

STRUCTURAL ASSESSMENT OF THE CONSOLIDATION JAIL PROJECT

1400 ST. ANTONIE
DETROIT, MICHIGAN 48226



NOVEMBER 16, 2016

PREPARED FOR:
WAYNE COUNTY BUILDING AUTHORITY
500 GRISWOLD
DETROIT, MICHIGAN 48226



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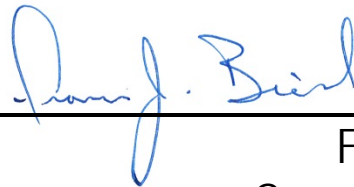
NOVEMBER 16, 2016

PREPARED BY:



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November 16, 2016

Karla Henderson
CC: Steve Ohm
Wayne County Building Authority
500 Griswold
Detroit, Michigan 48226

RE: Structural Assessment of the Consolidation Jail Project
1400 St. Antonie
Detroit, Michigan 48226
MSG Project No: W2470001

Dear Karla Henderson:

We have completed our structural assessment for the proposed continuation of the Wayne County Jail Project in Detroit, Michigan. Based on the results of our evaluations, we have developed recommendations for proceeding with further construction. Our investigation, evaluation and recommendations are detailed in the attached report.

We trust that this report addresses your project needs. We appreciate the opportunity to work with you on this very important project and look forward to providing additional services in the future. Please contact us if you have any questions or if we can be of further assistance.

Sincerely,
The Mannik & Smith Group, Inc.

Felicia Koch
Project Engineer

Francis J. Biehl, P.E.
Senior Project Manager

Enclosures

Submitted: One (1) Electronic Copy via email
File

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EXECUTIVE SUMMARY

The Mannik & Smith Group, Inc., (MSG) was retained by the Wayne County Building Authority to conduct a structural assessment and conditions report for the Wayne County Authority Consolidated Jail Project in Detroit, Michigan. A summary of the findings and recommendations are presented below:

- Our field investigation consisted of observing the entire site and assessing it in building sections. The daily field reports and photo log are divided into these sections referring to the original building plans (Area A, Area B, etc.). Our assessment presented in this report is broken into construction material sections (Structural Steel, Masonry, and Concrete) and methods of assessment (Survey and Sewer Assessment). A survey of the first and second floor slabs was completed to obtain as-built elevations to inspect for any deviations from the specifications. All elevation deviations found were due to concrete slab finishing and are all within tolerance of the project and ACI specifications.
- MSG inspectors performed a visual inspection of the steel by scraping or brushing the layer of oxidation off and looking for any signs of damage or section loss. MSG inspected every member for section loss and anything that would impact structural integrity, to which they found none. MSG suggests the oxidation on structural steel members and cast-in-place (C.I.P.) steel plates where welding will take place to be sandblasted or removed by hand and power tools or by another method before continuing construction. Galvanized structural steel and pan decking on-site was in excellent condition and does not require any further cleaning or inspection before construction continues.
- A visual inspection was performed on completed and partially completed CMU walls. Inspectors looked for any cracks or bulges and checked for alignment and for any signs of movement. This assessment found no evidence of movement or structural integrity concerns with the masonry walls; however, there was some efflorescence present on the CMU walls. The efflorescence present does not appear to have caused any structural issues with the CMU walls. MSG suggests the efflorescence be cleaned off the surfaces before continuing construction and to further prevent efflorescence from occurring.
- Hairline cracking can be seen throughout the concrete on-site; however, no major cracking due to deflection, flexural, or settlement. Hairline cracking is normal to a certain extent in concrete. The joints throughout the site appear to be excellent condition. There are some expansion cracks present in the C.I.P. concrete walls and slabs and in the CMU walls throughout the site, which is expected of any new construction. The cracking throughout the site is of no structural concern.
- There appears to be no issue with internal corrosion or degrading of the steel reinforcement. There is only oxidation present where the steel reinforcement has been exposed to the elements for the length of time that construction on the site has been idle. Any rust "bleeding" seen on sight is from the oxidation on the exposed reinforcement at uncompleted cold joints and not from inside the completed slabs, walls, and columns. There is surface discoloration on the tops and running down the sides of the unfinished columns, due to the oxidation on the exposed rebar at the top and when it rained and snowed, the rust-colored water ran down the sides of the column and left the rust color on the columns. This is only visually on the surface and has not compromised the strength of the concrete.
- Installed and uninstalled jail cell units on-site and the cells at International Precast Solution location are in good condition.
- A video inspection was completed of the installed storm and sanitary sewer pipelines on site. The results of this investigation revealed no issues (i.e. cracking, leaking joints, etc.) with the installed sanitary and storm sewer pipelines.

This Executive Summary articulates selective findings and recommendations and is provided solely for the purposes of overview and should not be counted upon to provide details in its entirety for the feasibility evaluation of the proposed project.

1.0 PROJECT DESCRIPTION

The purpose of this investigation was to perform an on-site assessment and produce a condition report for the Wayne County Building Authority on the current condition of the Wayne County Authority Consolidated Jail Project, located at 1400 St. Antoine in Detroit, Michigan. Construction at the Site was discontinued on or about June 10, 2013. This assessment is to verify that the installed improvements are suitable for continuation of construction work.

2.0 INVESTIGATION PROCEDURES

Our investigation consisted of a visual and physical inspection by a team of MSG inspectors. MSG inspectors that performed the assessment on-site have years of experience on inspecting structural steel, concrete, and masonry construction. MSG's team of inspectors was led by David K. Wehner, a Senior Construction Engineer, who has more than 29 years in the construction engineering field and is a licensed professional engineer in Michigan and Ohio and a licensed residential builder in Michigan.

3.0 FIELD EXPLORATION

Our field investigation consisted of observing the entire site and assessed in sections. The daily field reports and photo log are divided into these sections referring to the original building plans (Area A, Area B, etc.). Our assessment presented in this report is broken into construction material sections (Structural Steel, Masonry, and Concrete) and methods of assessment (Survey and Sewer Assessment). Throughout this report and photo log, the Area zones (A, B, C, etc.) from the original plans are referenced. A copy of these plans for the sub-basement, basement, first and second floors is presented in Appendix A.

3.1 Structural Steel Assessment

Our investigation of the structural steel followed AISC (American Institute of Steel Construction) 303-10 *Code of Standard Practice for Steel Buildings and Bridges* in procedure and inspection. MSG inspectors performed a visual inspection of the steel by scraping or brushing the layer of oxidation off and looking for any signs of damage or section loss. Area G contains a partially completed structural steel building exposed to the elements, as can be seen in *Figure 1*. MSG inspected every member for section loss and anything that would cause structural integrity, to which they found none.



Figure 1: Area G Structural Steel Building (Photo log Image #180)

In the sub-basement, due to heavy rain fall and two of the permanent in-place sump pumps losing power there had been approximately 22 inches of water collected in the sub-basement at one point in time (depth measured from the water line marks left on the walls). All the water since has been removed after the sump pump intakes were cleaned and power restored. This rain water caused the oxidation at the base of the structural columns, as can be seen in *Figure 2*. After scraping and brushing the oxidation off, MSG inspected visually for any section loss or corrosion issues. There appeared to be no damage to the steel besides the oxidation that occurred on the surface.



Figure 2: Area G Basement Column Oxidation (Photo log Image #214)

MSG suggests the oxidation on structural steel members and cast-in-place (C.I.P.) steel plates where welding will take place to be sandblasted or removed by hand and power tools or by another method before continuing construction in accordance to ISO (International Organization of Standardization) 8501 *Preparation of Steel Substrates before Application of Paints and Related Products*. MSG is uncertain of the state of the structural steel after installation; if it will be painted or coated with fire protection, further cleaning maybe necessary. After the oxidation has been removed, MSG highly advises to further inspect the steel members for pitting or corrosion that would further compromise the strength of the steel.

Galvanized structural steel and pan decking on-site was in excellent condition and does not require any further inspection before construction continues.

3.2 Masonry Assessment

Our inspection of the masonry conditions on-site followed the ACI (American Concrete Institute) 530-02/ASCE (American Society of Civil Engineers) 5-02/TMS (The Masonry Society) 402-02 *Building Code Requirements for Masonry Structures* and ACI 530.1-02/ASCE6-02/TMS 602-02 *Specification for Masonry Structures*. There are several completed and partially completed Concrete Masonry Unit (CMU) walls throughout the site, including the Southwest wall in Area A in *Figure 3*. A visual inspection was performed on completed and partially completed CMU walls.



Figure 3: Area A Southwest Exterior Wall (Photo log Image #6)

Inspectors looked for any cracks or bulges and checked for alignment and for any signs of movement. This assessment found no evidence of movement or structural integrity concerns with the masonry walls; however, there was some efflorescence present on the CMU walls, as seen in *Figure 4*. Efflorescence is due to excess moisture, and in this case from being exposed to the elements since construction on the site became idle. The efflorescence present does not appear to have caused any structural issues with the CMU

walls. MSG suggests the efflorescence be cleaned off the surfaces before continuing construction and to further prevent efflorescence from occurring in accordance with ASTM (American Society for Testing and Materials) C1400 *Standard Guide for Reduction of Efflorescence Potential in New Masonry Walls*.



Figure 4: Area A Partial CMU wall (Photo log Image #5)

3.3 Concrete Assessment

Our investigation followed the ACI 201.1R-92 *Guide for Making a Condition Survey of Concrete in Service* and ACI 364.1R-94 *Guide for Evaluation of Concrete Structures Prior to Rehabilitation* for the concrete C.I.P. slabs, walls, and columns. The terminology used in this report to describe the condition of the concrete is in accordance with these ACI standards. Surface mapping, crack survey, and nondestructive testing were performed in accordance with ACI 207.3R-94 *Practices for Evaluation of Concrete in Existing Massive Structures for Service Conditions*, ACI 228.2R-98 *Nondestructive Test Methods for Evaluation of Concrete in Structures*, and ACI 437R-91 *Strength Evaluation of Existing Concrete Buildings*. A sounding hammering or "echoing" technique was used to test the condition of the concrete around cracks, especially where efflorescence was present.

From the first floor looking at the bottom of the second floor slab a shadow effect can be seen of the layout of the rebar. This shows there is very little cover for the rebar. There is no discoloration in the concrete or rust bleeding present; therefore, this shadow effect is of no structural concern, just cosmetic. This shadow effect can be seen in *Figure 5* as the grid of the rebar can be seen ever so slightly. Review of the original construction plans and in reference to ACI 318-02/318R-02 (*Building Code Requirements for Structural Concrete*) for the concrete protection for reinforcement, the bottom reinforcement coverage in the second floor slab meets requirements and design.



Figure 5: Area F/F1, Re-steel Reflection (Photo log Image #175)

Hairline cracking can be seen throughout the concrete on-site; however, no major cracking due to deflection, flexural, or settlement. Hairline cracking is normal to a certain extent in concrete. The joints throughout the site appear to be excellent condition. There are some expansion cracks present in the C.I.P. concrete walls and slabs and in the CMU walls throughout the site, which is expected of any new construction. The cracking throughout the site is of no structural concern. Maps of the hairline cracks can be found in Appendix D. There was a large crack (dimensions of this crack have not been confirmed and possibly cannot be due to the location) that is of some concern in Area D on the Southern side of the area at a column aligned with one of the basement openings, as can be seen in the *Figure 6* and *Figure 7* below. We recommend repair of this crack in accordance with ACI 224.1R *Causes, Evaluation, and Repair of Cracks in Concrete Structures* prior to the upcoming 2016-2017 Winter Season.



Figure 6: South Open Area to Small Basement Chamber (Photo log Image #80)



Figure 7: South Open Area to Small Basement Chamber, Crack Close-Up

Our investigation of the steel reinforcement followed the ACI 222R-01 *Protection of Metals in Concrete Against Corrosion*, ASTM A615/A615M *Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement* and ACI 318-02/318R-02 *Building Code Requirements for Structural Concrete*. There appears to be no issue with internal corrosion or degrading of the steel reinforcement. There is only oxidation present where the steel reinforcement has been exposed to the elements for the length of time that construction on the site has been idle. Any rust “bleeding” seen on sight is from the oxidation on the exposed reinforcement at uncompleted cold joints and not from inside the completed slabs, walls, and columns. Straightening of bent rebar, as depicted in several photographs in Appendix C, should occur in accordance with ACI 318 *Building Code Requirements for Structural Concrete and Commentary*.

There is surface discoloration on the tops and running down the sides of the unfinished columns, due to the oxidation on the exposed rebar at the top and when it rained and snowed, the rust-colored water ran down the sides of the column and left the rust color on the columns. This is only visually on the surface and has

not compromised the strength of the concrete, as can be seen in *Figure 8*. The same has occurred where rebar is exposed at cold joints, as in *Figure 9* at a column base on the second floor slab.



Figure 8: Oxidation on Top of Unfinished Columns (Photo log Image #127)



Figure 9: Oxidation at Base of Column on Second Floor Slab (Photo log Image #126)

In accordance with ACI 318-02, steel reinforcement with rust, mill scale, or a combination of both shall be considered satisfactory, providing the minimum dimensions and weight of a hand-wire-brushed test specimen comply with ASTM A615 *Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement*. "Tight" rust on reinforcing bars does not inhibit the bond between the reinforcement and the concrete; however, rust that flakes or can be brushed off is excessive and can inhibit the bond. MSG recommends the excessive rust on the steel reinforcement be sandblasted or removed by another method before continuing with concrete. The same should be done with any in place dowels and other embedment materials.

There was ponding water on the first and second floor slabs during our investigation. The issue was further investigated by survey for surface elevation. There are no structural issues with these ponding areas; it is just a result of the finish grade of the concrete being low in these areas.

3.4 Elevator Shafts and Stair Towers

An assessment was completed of the elevator shafts and stair towers installed on-site. The elevator shafts and stair towers in Area E and D are constructed of C.I.P. concrete, and the elevator shafts and stair towers in Area G are constructed of CMU. All elevator shafts and stair towers were well constructed and are currently in excellent condition. There is no evidence of unexpected cracking, displacement, or any damage

from being exposed to the elements for the set amount of time since construction on the site became idle. There is no structural concern with these shafts and towers.

3.5 Jail Cell Units Assessment

An assessment was completed for all installed and stored jail cell units on-site and for the cells stored at International Precast Solution (I.P.S.) location. MSG counted 120 installed and 14 uninstalled units on-site. At the I.P.S. site, MSG counted 109 jail cell units. All units were in good condition, with the exception of a unit at the I.P.S. location which was damaged beyond repair and which appeared to be a demo or test unit being used by electrical and mechanical contractors to determine suitable arrangement of mechanical and electrical features on the backside of the cell. There were two other units, one on-site and one off-site each with minor cosmetic damage (e.g. eight-inch diameter chip). The minor cosmetic damage can be repaired in accordance with the manufacturer's recommendations (which is likely to be in accordance with ACI 546 *Concrete Repair Guide*).

3.6 Survey Assessment

A survey of the structure was conducted to check that the partially cantilevered slab sections supported by scaffolding and other slabs have not experienced any deflection over time. New survey control points were first set for this assessment and possibly for further construction as the original survey control points set in support of the original construction could not be located. The survey data is provided in Appendix E. These as-built elevations show that on the first floor there is no more than a tenth deviation from the design elevation (that is 0.1 feet or 1.2 inches) and no more than two tenths deviation from the design elevation on the second floor. These deviations are due to finishing of the slab and not from deflection. The current elevation of the partially cantilevered slab supported by scaffolding was of high priority and the greatest deviation present there was 0.11 feet. There is no evidence in cracking that this partially cantilevered slab is deflecting; these deviations are most likely due to concrete finishing. These deviations throughout the first and second floor slabs all fall within the tolerance presented in the project specifications in reference to ACI 117 *Specification for Tolerances for Concrete Construction and Materials*.

3.7 Storm, Sanitary, and Combined Sewer Assessment

As depicted in the "Utility Plan", Sheet Number CU-00-01, a copy of which is included in Appendix A, storm, sanitary and combined sewers were proposed along the eastern and western edges of the Site. Advanced Underground Services LLC (AUS) was on-site October 25, 2016 and November 1, 2016 to perform a video inspection of the storm, sanitary and combined sewer installed on the east side of the site (the proposed storm, sanitary and combined sewer on the west side of the site has not been installed).

During the initial inspection AUS confirmed that the a majority of the sewer system could not be video inspected due to the pipes and manhole structures being filled with water, debris and sediment likely due to the discharge of the sub-basement water into Manhole 3B and to a lesser extent there being a 3 to 4 inch opening or gap in the cover at Manhole 11. In addition, the video inspection could not be completed since three of the manhole structures were not visible (i.e. were buried). The exact locations of the structures were determined with a Schonstedt metal detector. The structure lids or covers were then exposed using hand tools (shovel and pick) in in order for the video inspection to continue.

MSG attained a fire hydrant water usage permit from the City of Detroit for water-jet washing and vacuuming of the sewer pipes before video inspection could continue. The cleaning of the sewers and video inspection was then performed on November 1, 2016. The results of this investigation revealed no issues (i.e. cracking, leaking joints, etc.) with the installed sanitary and storm sewer pipelines. Copies of the video inspection reports are contained in Appendix F. The videos are being provided under separate cover. Please note that additional cleaning may be required due to subsequent future discharges to Manhole 3B or due to removal of manhole lids.

4.0 SUMMARY OF ASSESSMENT

The table below provides a summary of the issues that should to be addressed before continuing construction. While not a structural concern, there are multiple locations with exposed, unsealed electrical conduit ends or termination points which likely are holding water. The water should be removed (by appropriate measures such as vacuuming) and the conduit ends sealed (e.g. use of a sealing agent such as Polywater FST Duct Seal or other suitable, industry standard measures).

Table 1: Summary of Issues

Issue	Area of Problem	Notes	Example Photos
Exposed re-bar	<ul style="list-style-type: none"> Throughout the site 	<ul style="list-style-type: none"> Sandblasted before continuing with concrete Bent re-bar and dowels need to be corrected or replaced 	#56-57, #88, #91, #126, #130, #137, #144, #149, #151, #152
Efflorescence ¹	<ul style="list-style-type: none"> Area A Area D Area E 	<ul style="list-style-type: none"> No structural concern Clean off before continuing Present in cracks on bottom of second floor, no structural concern 	#5, #18, #20, #86-87, #89, #153, #162-163, #167
Oxidization ²	<ul style="list-style-type: none"> Throughout the site 	<ul style="list-style-type: none"> Exposed anchor bolts, dowels, and rebar are oxidized and need to be sandblasted before continuing with concrete Structural steel need to be sandblasted where welding will take place 	#22, #134-135, #157, #178-186, #189-201, #203-207
Watermarks	<ul style="list-style-type: none"> Basement Sub-basement 	<ul style="list-style-type: none"> 22" waterline on sub-basement wall No structural concern, just visual 	#210, #212, #213, #221-223
Cracks in slabs	<ul style="list-style-type: none"> Throughout site 	<ul style="list-style-type: none"> Hairline cracks³ in slabs Concerns where larger cracks in thicker slabs 	#29, #63-65, #82-84, #85-87, #89, #104-107, #133, #153, #162-164, #167-168, #183, #184
Cracks in walls	<ul style="list-style-type: none"> Area D 	<ul style="list-style-type: none"> Minor diagonal cracks⁴ and vertical cracking in C.I.P. walls, stress cracking is expected 	#77, 80

¹*Efflorescence* is a deposit of salts, usually white, formed on a surface, the substance having emerged in solution from within either concrete or masonry and subsequently been precipitated by evaporation (ACI 201.1R-92).

²*Oxidation* is corrosion; rusting; rust; chemically, the combining with oxygen (Allen 2009).

³*Hairline cracks* are cracks in an exposed concrete surface having widths so small as to be barely perceptible (ACI 201.1R-92).

⁴*Diagonal cracks* in a flexural member, an inclined crack caused by shear stress, usually at about 45 degree to the axis; or a crack in a slab, not parallel to either the lateral or longitudinal directions (ACI 201.1R-92).

5.0 SUMMARY OF STOCKPILES

There are multiple stockpiles with various supplies and materials throughout the site. It was made clear to MSG that a thorough inventory has already been taken of all the stockpiled supplies and materials on-site and taking inventory was not part of our assessment. We did take note of where the stockpiles are located and in what condition they appear to be in. Designated use of these materials would be between the County and future Contractor working on-site. The table below summarizes the condition of the materials and location of these stockpiles. In general, additional material storage protection measures (use of tarps, relocation of stored materials from open, unprotected areas to more protected areas, etc.) will be beneficial for those materials still potentially usable that are at least

partially exposed (e.g. stockpiles of materials that are under roof cover but placed on an unpaved surface and/or exposed to the elements due to no side walls).

Table 2: Summary of Stockpiles

Location	Materials	Example Photos
Area A	<ul style="list-style-type: none"> • CMU block - usable • 3" Owens corning Styrofoam - usable • Mortar and cement – not usable • Type N mortar, covered – usable • Nuts and bolts - unusable 	#1, #3, #4, #7, #8, #10, #11, #12-14, #27-28
Area B	<ul style="list-style-type: none"> • CMU block – usable 	#58
Area C	<ul style="list-style-type: none"> • Structural steel – possibly usable after sandblasting 	#71-72
Area D	<ul style="list-style-type: none"> • Electrical Conduit in basement– majority usable 	#96, #99
Area E	<ul style="list-style-type: none"> • Structural steel – possibly usable after sandblasting • Cells – majority in good condition, check for damages before using • Stored material, dowels, J-hooks, etc. - usable 	#103, #140-143, #147, #154-156
Area F	<ul style="list-style-type: none"> • Electrical conduit and materials – in good condition and usable • Sprinkler and plumbing piping – usable • CMU ties - usable 	#176-177
Area G	<ul style="list-style-type: none"> • Structural steel – possibly usable after sandblasting • CMU block - usable 	#186
I.P.S. Site	<ul style="list-style-type: none"> • Cells in good condition, inspect individual units before using 	#225-237

6.0 REFERENCES

1. *ACI Manual of Concrete Practices*, Vol. 1-6, American Concrete Institute International, Farmington Hills, MI, 2003.
 - a. ACI 117, Specification for Tolerances for Concrete Construction and Materials
 - b. ACI 201.1R-92, Guide for Making a Condition Survey of Concrete in Service
 - c. ACI 207.3R-94, Practices for Evaluation of Concrete in Existing Massive Structures for Service Conditions
 - d. ACI 222R-01, Protection of Metals in Concrete Against Corrosion
 - e. ACI 228.2R-98, Nondestructive Test Methods for Evaluation of Concrete in Structures
 - f. ACI 318-02/318R-02, Building Code Requirements for Structural Concrete
 - g. ACI 364.1R-94, Guide for Evaluation of Concrete Structures Prior to Rehabilitation
 - h. ACI 437R-91, Strength Evaluation of Existing Concrete Buildings
 - i. ACI 530-02/ASCE 5-02/TMS 402-02, Building Code Requirements for Masonry Structures
 - j. ACI 530.1-02/ASCE6-02/TMS 602-02, Specification for Masonry Structures
2. AISC 303-10, Code of Standard Practice for Steel Buildings and Bridges, American Institute of Steel Construction, Chicago, IL, 2010.
3. ASTM Standards, American Society of Testing and Materials, West Conshohocken, PA, 2003.
 - a. ASTM A615/A615M Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - b. ASTM A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 - c. ASTM C1400-98, Standard Guide for Reduction of Efflorescence Potential in New Masonry Walls
4. Allen, Edward and Joseph Iano, *Fundamentals of Building Construction Materials and Methods*, John Wiley & Sons, Hoboken, NJ, 2009.
5. ISO 8501 Preparation of Steel Substrates before Application of Paints and Related Products, ISO/TC 35 SC 12, Ed. 2, International Standardization Organization, ISO Central Secretariat, CH – 1211 Genève 20, Switzerland, 2007.