STRAND ASSOCIATES®
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February 18, 2025

Ms. Rebecca Ewald, Village Manager
Village of Shorewood
3930 North Murray Avenue
Shorewood, WI 53211

Re: Department of Public Works (DPW) Warehouse Building Condition Assessment
Village of Shorewood, Wisconsin

Dear Rebecca,

Enclosed is the final DPW Warehouse Building Condition Assessment.

Please call 414-271-0771 with questions.

Sincerely,

STRAND ASSOCIATES, INC.®

Christopher T. Bolle, P.E.

Enclosure: Report

c/enc: Phil Bzdusek, Strand Associates, Inc.®

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Report for

Village of Shorewood, Wisconsin

Department of Public Works Warehouse Building Condition Assessment

Prepared by:

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February 2025

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Strand Associates, Inc.® (Strand) conducted a series of site visits to review the condition of the existing Warehouse Building at the Village of Shorewood, Wisconsin (Village) Department of Public Works (DPW) site located at 3801 North Morris Boulevard, Shorewood, WI 53211. The first site visit conducted on August 29, 2024, reviewed the observable interior and exterior portions of the existing building and included interviews with Village staff to understand the historical and current use of the building. Based upon observations made during this initial visit, it was determined that repairs are needed to restore the building to prevent further degradation of the concrete and masonry load bearing systems.

A follow-up visit conducted on October 3, 2024, included Tom Holton of Holton Brothers, Inc. to review repairs needed to restore the building and provide an opinion of probable construction cost (OPCC) for various repairs. Holton Brothers, Inc. is a masonry contractor that has completed past repair projects at the DPW site. The following report describes the existing conditions, anticipated repairs, and an OPCC to complete the repairs. As requested by the Village, the focus of the report is structural conditions and repairs. However, ancillary items observed during on-site visits and noted by Village staff have also been included in the following report for completeness.

The observations noted in the following report shall be considered general in nature and are limited to visual observations made from floor and grade levels that were accessible at the time that visits were conducted. The use of high lift aerial equipment, destructive investigations, selective demolition, x-ray equipment, ground penetrating radar, coring, material sampling, or other similar techniques were not included. The scope of services for this report did not include a building code review nor a structural analysis to determine whether the building design is in conformance with current building code prescribed design loads. Rather, this report compares the existing observed conditions with the original building construction intent (as shown on the original construction drawings) and provides recommendations for repairs based on the observed conditions.

EXISTING DOCUMENTATION

The Warehouse Building is located on the west side of the DPW site, as shown in Figure 1. Overall exterior building elevation views are shown in Figures 2 through 7. The Village provided available existing drawings for the original construction of the building to assist with this investigation. The drawings provided appear to be a select portion of the original drawings for construction of the building but do not constitute the full set of original construction drawings. The existing available drawings applicable to this report that were reviewed include the foundation plans, sections and elevations, roof framing, and overall layout drawings. All drawings are dated the year 1936.

Aerial Source: Google Earth

Figure 1 Warehouse Building Site Location

Figure 2 South Elevation

Figure 3 East Elevation, South End

Figure 4 East Elevation, North End

Figure 5 North Elevation

Figure 6 West Elevation, South End

Figure 7 West Elevation, North End

The Warehouse Building includes approximately 4,000 square feet (sf) of single-story, enclosed space and an approximately 700-sf continuous platform located on the west side of the building. The drawings indicate the original use of the interior spaces include storage space, electrical storage, and landscape materials storage. The platform located on the west side of the building is labeled as a shipping platform. The roof framing consists of 2- by 6-inch wood planking on steel purlins. The purlins span between steel trusses. The steel trusses clear span approximately 37 feet and are supported by the perimeter masonry walls.

The perimeter walls are approximately 13 inches thick above the floor level and approximately 17 inches thick below the floor level. The existing drawings indicate these walls were constructed using solid mass brick construction methods, and no wall insulation or drainage cavities were included in the original construction. The approximately 17-inch-thick perimeter foundation walls support the upper perimeter walls of the building, the interior concrete slab, and the platform slab on the west side of the building. The typical wall construction from the 1936 drawings is shown on Figure 8.

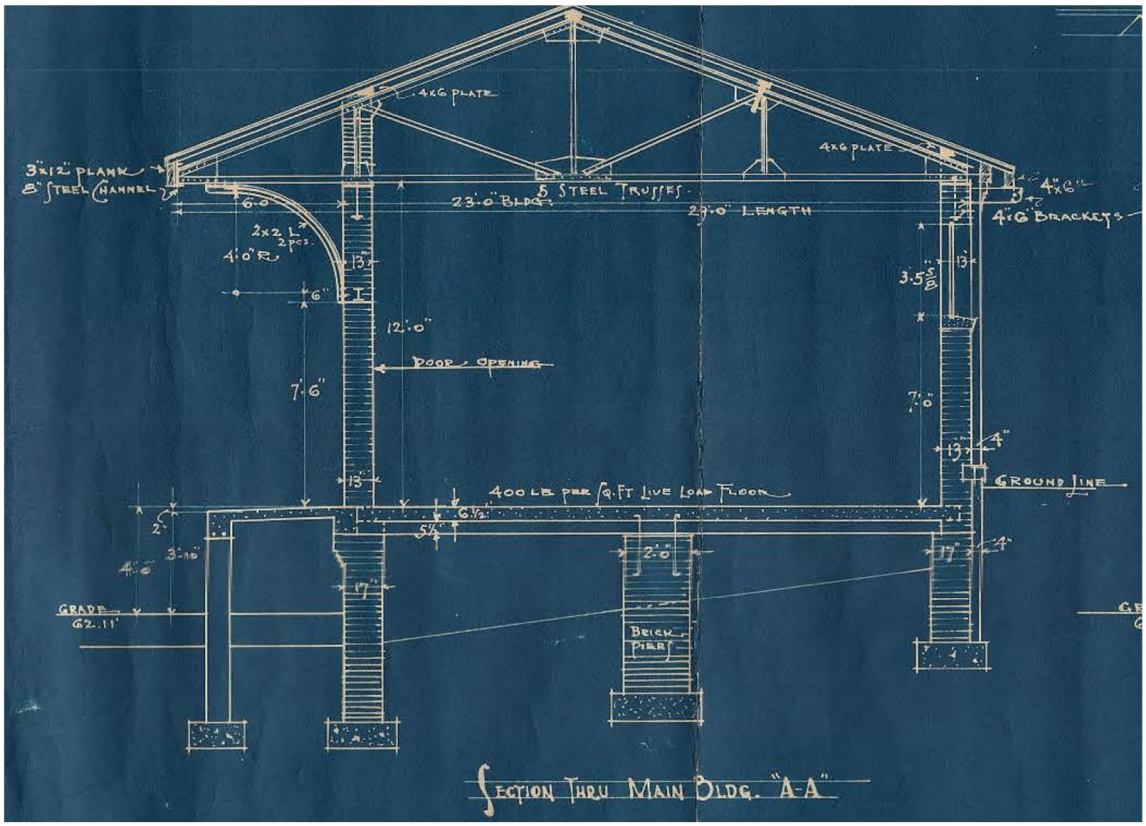

Figure 8 Building Section from 1936 Drawings

The floor system consists of an elevated concrete slab that spans between perimeter walls and is supported at midspan on piers located below the slab at an approximately 10-foot spacing. Similarly, the elevated platform along the west side the building is constructed of an elevated concrete slab system supported on a building wall foundation system on the east side of the platform and a series of piers located at approximately 10 feet on center on the west side of the platform.

The interior concrete slab is indicated to be 6.5 inches thick with 5/8-inch-diameter reinforcing bars spanning the north-south direction and welded wire mesh reinforcing near the top of the slab. The slab is supported on thickened concrete girders spanning the east-west direction at approximately 10 feet on center. The concrete girders are 5.5 inches deeper than the typical slab, are 2 feet 5 inches wide, and were constructed with steel reinforcing bars of various sizes and arrangements, as shown on the existing drawings. The existing drawings indicate the interior concrete slab was originally designed for a 400-pound-per-square-foot live load, which is a typical design loading for heavy storage and vehicle traffic.

The exterior shipping platform concrete slab is indicated to be 5.5 inches thick with 1/2-inch-diameter reinforcing bars spanning the east-west direction and welded wire mesh reinforcing near the top of the slab. The slab is supported at the west edge by a thickened concrete spandrel beam that is 10 inches wide and 8 inches deep reinforced with 1/2-inch-diameter reinforcing bars spanning the north-south direction.

The building foundation systems consists of solid mass brick construction for foundation walls below the building perimeter walls and similarly constructed 2- by 2-foot brick piers below the interior building slab. The brick piers are supported on concrete spread footings located approximately 5 feet below grade. The 1936 plan view foundation drawing is shown on Figure 9. Typical brick construction foundation walls and interior slab support piers are shown on Figures 10 and 11.

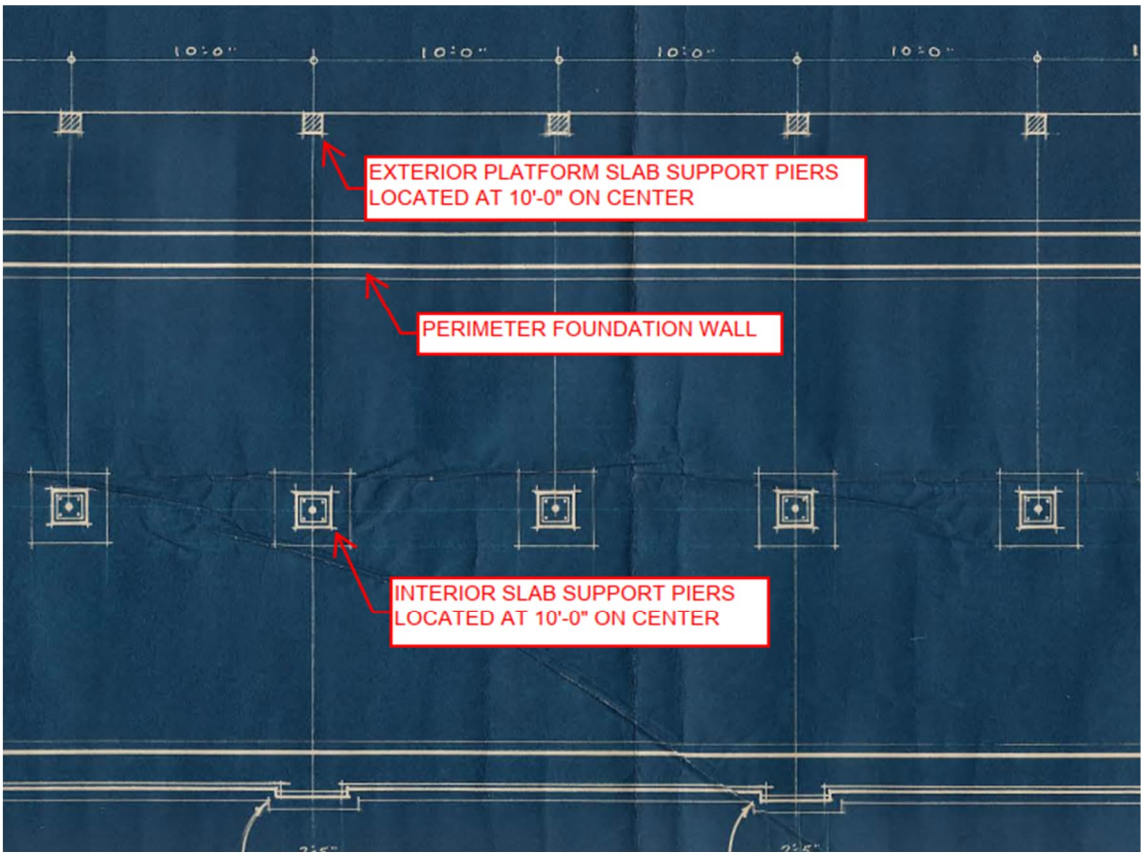

Figure 9 Plan View of 1936 Foundation Drawings

Figure 10 Typical Brick Perimeter Foundation Wall

Figure 11 Typical Brick Interior Slab Support Pier

The 1936 drawings indicate the west edge of the shipping platform was to be supported on 10- by 12-inch rectangular piers, as shown on Figure 12. However, it was observed on-site that the west edge of this platform is currently supported on approximately 12-inch-diameter concrete piers, as shown on Figure 13. This indicates the original support piers in these locations were likely replaced with circular concrete piers at some time in the past.

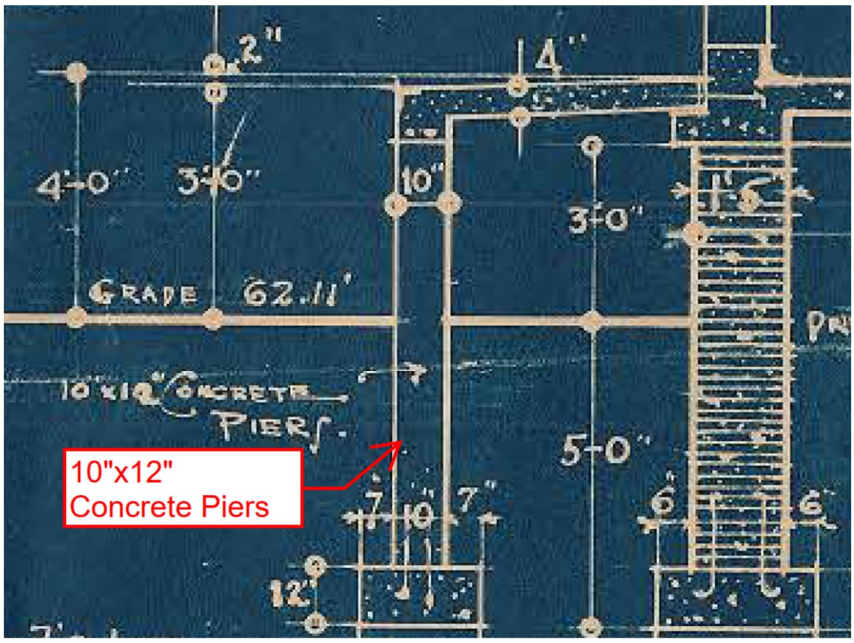

Figure 12 Section View of West Shipping Platform Piers on 1936 Drawings

Figure 13 Current Circular Concrete Piers at West Shipping Platform

OBSERVATIONS AND RECOMMENDATIONS

A. Roof

The roof framing system was observed from the floor level inside the building. The following observations are considered general in nature as in-depth inspections (including the use of aerial lifts to provide detailed observations) were not included. The steel roof trusses and steel joists generally appear to be in fair condition, with localized areas of corrosion visible on the steel. Significant portions of the original wood planking roof system have been replaced since original construction, as shown in Figure 14. The current system appears to be in fair condition. It is recommended that localized corrosion present on areas of the steel framing systems be prepared and recoated with an epoxy paint system to prevent further corrosion and deterioration. The wood plank roof system should continue to be monitored and routine maintenance and deteriorated wood replacement be performed.

Figure 14 Steel Framing and Wood Plank Roof System

The Village has indicated that the existing asphalt shingle roofing system is approximately 20 to 30 years old. The asphalt shingle roof is at the end of its useful life and should be replaced.

B. Masonry Walls

Interior brick walls are generally in fair condition with select areas in poor condition. There are areas of step cracking at openings and mortar bed deterioration at doors, as shown on Figures 15 and 16. There is significant wall cracking at the northeast corner of the building, as shown on Figure 17. This damage appears to have been caused by settlement of the foundation system in this corner of the building, and previous repairs to the walls and lintels over the door openings were observed. It is unclear whether the settlement is continuing or if it has stopped. See the Overall Site and General Observations subsection for additional commentary regarding this area of the building.

It is recommended the interior portions of the masonry walls be tuckpointed to repair all cracks and deteriorated mortar joints. Additionally, it is recommended the northeast corner of the building have crack gauges installed to monitor whether or not the building is still settling or moving in this corner.

Figure 15 Typical Masonry Step Cracking at Openings

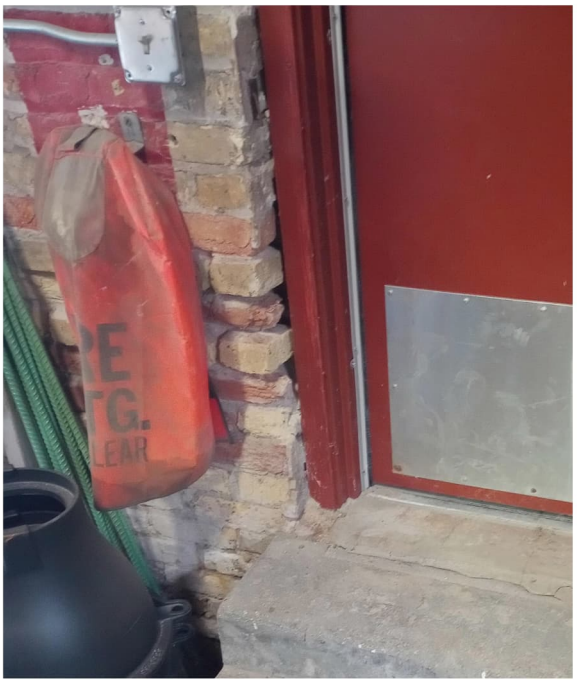

Figure 16 Typical Masonry Deterioration at Door Openings

Figure 17 Significant Wall Cracking Observed at Northeast Building Corner

The exterior brick walls are generally in fair condition with select areas in poor condition. As previously noted, the northeast corner of the building has undergone settlement and has previously been repaired, as shown on Figure 18. However, portions of the repairs were completed using caulk, which is an inappropriate repair material and method for masonry. Original door and window openings located on the west side of the building have previously been infilled with masonry. Additionally, portions of the west wall have undergone significant deterioration of the brick and mortar joints, as show on Figure 19.

It is recommended the exterior portions of the masonry walls be tuckpointed to repair all cracks and deteriorated mortar joints. Additionally, deteriorated and broken brick should be removed and replaced with new brick throughout. All previous repairs that were completed using caulking materials should have caulk removed and the joints repaired with mortar materials.

Figure 18 Previous Exterior Repairs at Northeast Building Corner

Figure 19 West Wall: Original Openings Infilled with Masonry and Significant Deterioration of Brick and Mortar Joints

C. Interior Concrete Slabs

The interior concrete slab located along the main east-west long axis of the building is in fair condition with minor hairline cracking, as show on Figure 20. This type of cracking is typical of concrete construction and does not represent a significant structural concern. The interior concrete slab located in the northeast extension of the building is in poor condition, as show on Figure 21. It is recommended that this area of the interior slab have concrete repair work performed to restore the concrete. While this area of the interior concrete slab was originally designed as an elevated slab with a void space below according to the original 1936 drawings, it is unclear whether this area has been replaced in the past with a concrete slab on grade over fill materials. Additional investigation will be required, such as concrete coring, in order to determine the existing construction conditions and appropriate repair methods developed.

Figure 20 Typical Interior Concrete Slab in Main East-West Portion of the Building

Figure 21 Interior Concrete Slab at Northeast Extension

D. Exterior Concrete Slab: West Shipping Platform

The exterior concrete platform is in poor condition and requires significant concrete and reinforcing repairs. The concrete has undergone significant cracking, spalling, delamination, and deterioration. The steel reinforcing bars that were embedded in the concrete during original construction have become exposed in numerous locations, have experienced significant corrosion, and have completely corroded away in some locations. See Figures 22 through 31 for typical deterioration of these areas.

It is recommended that all loose and delaminated concrete be removed down to sound concrete. Existing exposed steel reinforcing bars that are still intact should be cleaned and prepared for embedment in newly placed concrete repair materials. Where reinforcing bars have completed corroded away, they should be replaced with new reinforcing bars doweled into existing sound concrete with epoxy adhesive or mechanically spliced onto the ends of existing reinforcing. All reinforcing steel should then be embedded in new concrete repair materials installed throughout the platform areas on both the top side and underside. The intention of repair work is to restore the platform to its original construction conditions.

Currently, the Village is using the platform for storage of various materials including pallets of bricks. Due to the compromised nature of the existing platform and concrete and steel reinforcing deterioration that has occurred, it is recommended that the Village remove all storage materials from the platform until repairs are completed.

Figure 22 Exterior Platform Slab Deterioration–1

Figure 23 Exterior Platform Slab Deterioration–2

Figure 24 Exterior Platform Slab Deterioration–3

Figure 25 Exterior Platform Slab Deterioration–4

Figure 26 Exterior Platform Slab Deterioration–5

Figure 27 Exterior Platform Slab Deterioration–6

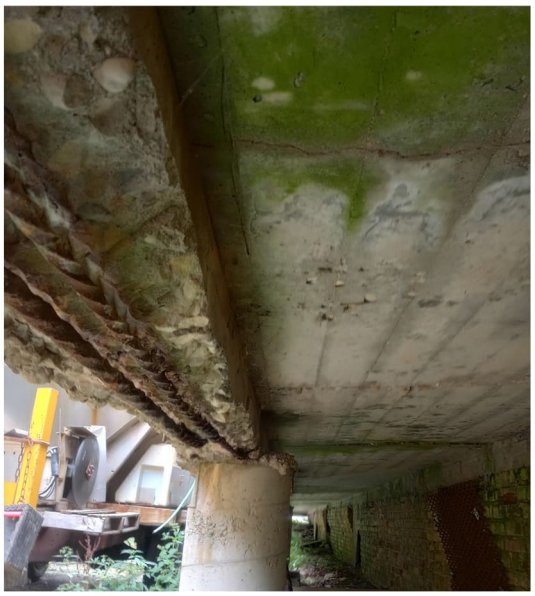

Figure 28 Exterior Platform Slab Deterioration–7

Figure 29 Exterior Platform Slab Deterioration–8

Figure 30 Exterior Platform Slab Deterioration–9

Figure 31 Exterior Platform Slab Deterioration–10

E. Exterior Concrete Slab: Underside of Building Slab

Along the west foundation wall, there are access openings in the brick foundation wall below the platform slab that allow access to the crawl space located below the elevated concrete building slab. The northernmost opening allowed for visual observation of the interior brick foundation piers as well as the underside of the building slab and concrete girders. The underside of these concrete elements were observed to be in poor-to-fair condition. Concrete spalling has occurred, exposing the steel reinforcing bars that were originally embedded in concrete. The exposed reinforcing bars have undergone corrosion. The steel beam lintel that frames the access opening in the brick foundation wall has also experienced significant corrosion. See Figures 32 and 33 for typical deterioration of these areas.

Similar to the concrete platform repairs, it is recommended that all loose and delaminated concrete be removed down to sound concrete. Existing exposed steel reinforcing bars that are still intact should be cleaned and prepared for embedment in newly placed concrete repair materials. Where reinforcing bars have completed corroded away, they should be replaced with new reinforcing bars doweled into existing sound concrete with epoxy adhesive or mechanically spliced onto the ends of existing reinforcing. All reinforcing steel should then be embedded in new concrete repair materials installed throughout the concrete deterioration areas. The intention of repair work is to restore the concrete and steel reinforcing bars to their original construction conditions. The corroded steel beam lintels should be prepared and coated with a new epoxy paint system.

Figure 32 Concrete Delamination and Reinforcing Bar Corrosion on Underside of Building Slab

Figure 33 Corroded Steel Beam Lintel Above Access Opening

F. Foundations

The observable brick foundation piers supporting the interior portions of the concrete building slab appear to be in fair condition, as shown on Figure 34. The brick foundation wall along the west side of the building was observable below the platform slab. Approximately 25 percent of this foundation wall is in poor condition with the remaining portions in fair condition, as shown on Figures 35 and 36. It is recommended the brick foundation wall be rebuilt in areas where it has collapsed and the entire wall system undergo tuckpointing to repair masonry joints and all broken or deteriorated brick be replaced.

Figure 34 Brick Pier Foundations Below Interior Building Slab

Figure 35 Collapsed Brick Foundation Wall Along West Wall

Figure 36 Collapsed Brick Foundation Wall at Northwest Corner

G. Overall Site and General Observations

While the focus of this report is a structural evaluation of the existing building, the following comments are provided for additional context regarding the overall performance and longevity of the building.

Vegetation is growing near the building, and vines are growing on exterior walls. In particular, the north wall is almost entirely covered with vines, which prevented observation of the exterior portions of the wall, and these vines have encroached upon the gutter and downspouts. It recommended that the vines and vegetation be removed from building surfaces and from the immediate area around the building. The current vegetation will trap moisture in and around the walls and will cause further deterioration of the structure.

It appears site grading is causing stormwater to be directed toward the building walls. In particular, there is a low point along the northeast side of the building where stormwater is directed to a drainage pipe. Based on discussions with Village staff, this pipe has backed up during rain events and the pipe's condition is unknown. The pipe was replaced by the Village in September 2024 and the condition of the pipe before removal was not observed. It is possible that the pipe had defects that allowed soil to enter it and cause settling of the northeast corner of the Warehouse Building as soils were washed into the pipe. It is recommended that this pipe be cleaned regularly and monitored to determine whether it has adequate capacity for most rainfall events.

The building is not heated and does not include insulating materials. As previously mentioned, the walls are constructed of solid mass brick construction. This is an antiquated construction method as any moisture that infiltrates into the brick wall construction could freeze during the winter, causing wall cracking and damage. It is recommended that the roof, gutter, and downspout systems be well maintained and repairs conducted as necessary to ensure water infiltration is mitigated into the building and walls.

Similarly, the building windows are beyond their expected typical life span, there are numerous broken panes, and sealant joints have failed around window and door frames. It is recommended that these elements be reviewed and replaced as necessary to prevent moisture infiltration into the wall systems and subsequent damage be prevented.

The building lighting and electrical systems may be nearing the end of their useful life and should be reviewed.

Village staff have noted issues with rodents and raccoons living in the crawl space below the building. It is recommended that pest control protocols be implemented and the access openings into the crawl space be closed with tight knit wire mesh or similar materials to prevent access by rodents or raccoons. A budgetary cost to have a contractor install tightknit wire mesh is approximately $2,000.

OPCC

OPCCs have been included for recommended improvements. The OPCCs were developed using 4th Quarter, 2024 cost information and do not include escalation or inflation considerations. The OPCCs have been prepared to a Class 5 estimating class (expected accuracy: -30 to +50 percent), as defined by the Association for the Advancement of Cost Engineering. OPCC information is being supplied for general guidance only. Strand has no control over competitive bidding or market conditions and cannot guarantee the accuracy of such opinions as compared to contract bids or actual costs to the Village. This information was developed based on past experience and contractor input from Holton Brothers, Inc. Table 1 includes items that require more immediate repairs that should be completed to maintain the building if the Village is planning to occupy the building for at least 5 years. Table 2 includes items that should be repaired if the Village plans to occupy the building for more than 5 years.

If the Village plans to occupy the site for 3 years, Strand recommends that an annual review of the building be completed for additional or growing cracks, settling, concrete spalling, brick or masonry failure, roof leaks, and corroded steel. If the west concrete shipping platform is going to continue to be used for material storage, it should be repaired. Strand also recommends closing off the openings in the crawl space and having any raccoons or rodents removed. The cost for closing the openings is included in the line item for Masonry Foundation Wall and Pier Repairs.

Item	Unit of Measure	Quantity	Low End Unit Price	High End Unit Price	Low End Total Price	High End Total Price
Abovegrade Masonry Walls	LS	1	$40,000	$50,000	$40,000	$50,000
West Concrete Platform Repairs	LS	1	$40,000	$50,000	$40,000	$50,000
Masonry Foundation Wall and Pier Repairs	LS	1	$20,000	$40,000	$20,000	$40,000
Building Under Slab Repairs	LS	1	$10,000	$20,000	$10,000	$20,000
Building Concrete Slab Repairs	LS	1	$10,000	$20,000	$10,000	$20,000
Restoration	LS	1	$5,000	$10,000	$5,000	$10,000
Subtotal					$125,000	$190,000
Contractor’s General Conditions (12%)					$15,000	$23,000
Subtotal					$140,000	$213,000
Contingencies and Technical Services (40%)					$60,000	$90,000
Total Capital Costs					**$200,000**	**$300,000**

Note: Costs are provided in 4th Quarter 2024 dollars.
LS=lump sum

Table 1 Warehouse Building Rehabilitation OPCC (Near-Term Items)

Item	Unit of Measure	Quantity	Low End Unit Price	High End Unit Price	Low End Total Price	High End Total Price
Asphalt Shingle Roof Replacement	SF	5,500	$5.70	$6.00	$31,000	$33,000
Window Replacement	SF	250	$80.00	$120.00	$20,000	$30,000
Door Replacement	EA	6	$3,000	$5,000	$18,000	$30,000
Gutters and Downspouts	LF	400	$15	$20	$6,000	$8,000
Electrical	LS	1	$45,000	$60,000	$45,000	$60,000
Restoration	LS	1	$2,000	$4,000	$2,000	$4,000
Subtotal					$120,000	$170,000
Contractor's General Conditions (12%)					$14,400	$20,000
Subtotal					$134,400	$190,000
Contingencies and Technical Services (40%)					$50,000	$80,000
Total Capital Costs					**$180,000**	**$270,000**

Note: Costs are provided in 4th Quarter 2024 dollars.
SF=square feet
EA=each

Table 2 Warehouse Building Rehabilitation OPCC (Long-Term Items)

SUMMARY

Based upon review of the existing drawings and observations made during site visits if the Village is planning to occupy the building for up to 5 years, it is recommended that the Village repair masonry walls, concrete slabs, and foundation elements to perform as originally designed and intended in accordance with the original drawings. The OPCC for these repairs is $200,000 to $300,000. Other elements noted in this report such as window and door replacements, gutters and downspouts, roof rehabilitation, and lighting and electrical replacement should be performed if the Village intends to maintain and occupy the Warehouse Building for a period of 5 or more years. The OPCC for these repairs is $180,000 to $270,000.

If the Village is planning to occupy the building for 3 years or less, Strand recommends an annual review of the building be completed, the west concrete shipping platform be repaired (if it is continued to be used for storage [$60,000 to $80,000 total cost]), and any rodents or raccoons be removed from the crawl space and the crawl space closed off ($2,000 approximate cost).