Minnesota Department of Transportation

Bridge Foundation Memorandum

Bridge Office
3485 Hadley Avenue North
Oakdale, MN 55128

Tel. No.: 651-366-4563
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DATE : August 24th, 2016

TO : Keith Molnau, P.E.
Bridge Office – Preliminary Design

FROM : Paul Pilarski, P.E.
Bridge Office Metro Region Construction Engineer

The Third Avenue Bridge #2440 was constructed from 1915 to 1918 and spans the Mississippi River near St. Anthony Falls in Minneapolis. The bridge went through a major rehabilitation in 1979 which included new abutments, a new deck, new spandrel columns, refurbished traffic rail, and better pedestrian railings all which accompanied the raising of the deck 5'. In 2004, a bridge preservation project including joint replacement and deck patching occurred.

Due to the timeframe and deterioration of the bridge structure since the last major rehabilitation, MnDOT is proceeding with hiring a Consultant (referred herein as Consultant) to evaluate this bridge and provide rehabilitation recommendations, plans, and specifications.

Work evaluated and completed by others and provided to Consultant:

Geotechnical Evaluation

MnDOT has evaluated the geotechnical conditions and certifies that no geotechnical resistance concerns exist for the river pier soil or rock bearing stresses. This is distinguished from concrete elements and piling which would be subject to designer review and assessment for re-use. The North approach footings are founded on geotechnically competent material and are determined adequate for current loading plus increases less than 15%.

If the proposed rehabilitation by the Consultant includes significant increases (Greater than 15%) in pier footing pressures, then the geotechnical resistance certification statement above shall be evaluated by the Consultant.

Inspection of Pier Footings and Substructure below Waterline
(Footings up to ≈ Waterline Portion)

MnDOT will provide detailed inspection of river piers to the consultant sufficient for evaluation of substructure defects. The inspection is programmed to occur as a supplement to the 2016 underwater routine inspection. Details of the requirements tasked for underwater

inspection are shown in the Attachment A.

Work to be completed by this Consultant:

Substructure (Structure portion below Normal Pool or Waterline - See Figure 1)

This Consultant is also required to review and address findings of the Bridge pier and footing inspection information provided to them. The Consultant is tasked with evaluation of structural resistance of the footing given the inspection documents, plans and historical documentation available. In addition, the consultant is tasked with evaluating any current defects that would compromise the structural integrity of the footing in a 50-year life extension.

The Consultant will present defects and corresponding proposed remediation for MnDOT concurrence. Repairs of defects insignificant to the structural integrity, but whose escalation cannot be predicted to for integrity impacts beyond 20 years' timeframe, will be scheduled for monitoring in lieu of repairs with MnDOT owned risk based on the Consultant's characterization of the defect risk to structural integrity. The consultant shall propose corrective repairs to any defects MnDOT deems an unacceptable structural integrity risk, as determined in consultation with the Consultant.

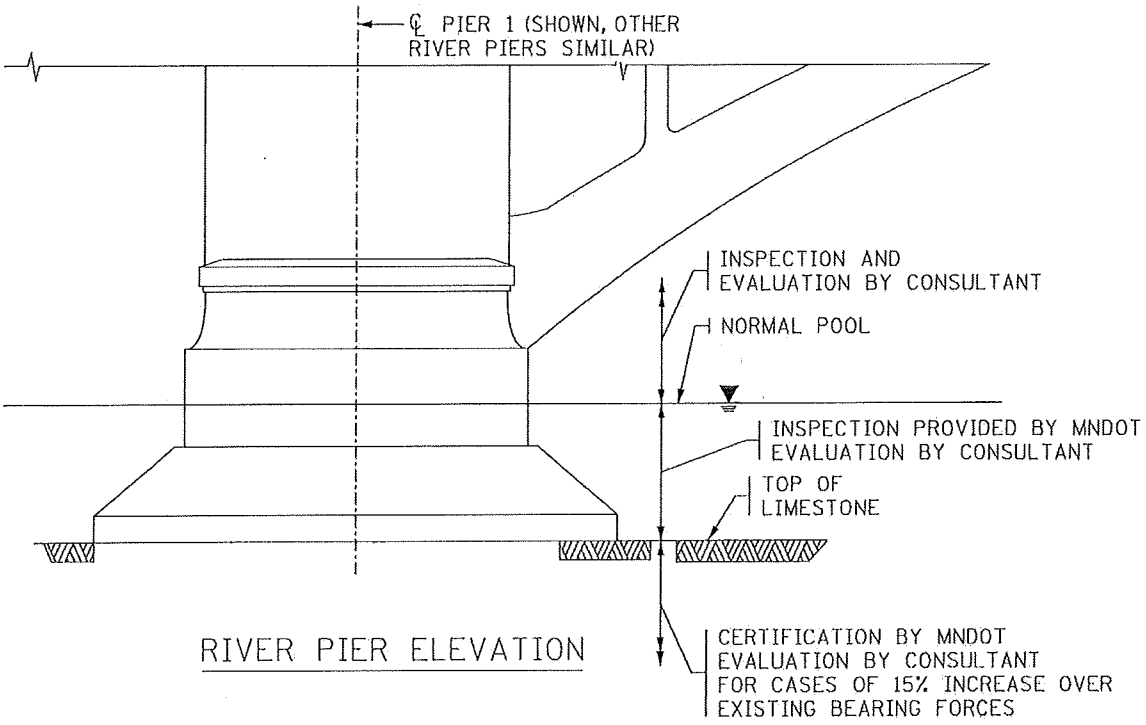


Figure 1: Illustration showing division of work and responsibilities

Substructure, Superstructure, Deck (Structure portion above Normal Pool Waterline)

The Consultant will be required to perform, review, and evaluate all inspection work for the portion of the bridge structure above the water line which includes the substructure not provided to them, the superstructure, the deck, barriers, railings, and lighting. A detailed work scope is defined elsewhere in the contract.

Work items for Consultant to complete:

1. Review 1968 Engineering Report
2. Review historical borings
3. Evaluate LRFD resistance of piled foundations assuming design bearing achieved.
4. Transfer historical borings and new borings into standard CADD format
5. Review historical dive inspection records
6. Review 2014 and 2015 structural repair plans. Review post-installation dive inspection of Pier 1 and 5 footing undercutting repairs.
7. Evaluate adequacy of inplace footings for proposed rehabilitation. Actual concrete strength has not been confirmed by MnDOT for all locations but may be in historical documents. Consultant shall address if there is a need to determine actual concrete strengths at piers and perform supplemental cores and concrete strength breaks as mutually agreed between the Consultant and MnDOT.

Paul Pilarski, Metro Region Bridge Construction Engineer

Rich Lamb, Foundations Engineer

Attachments:

Attachment A: Detailed underwater inspection scope as contracted by MnDOT with underwater bridge inspection firm

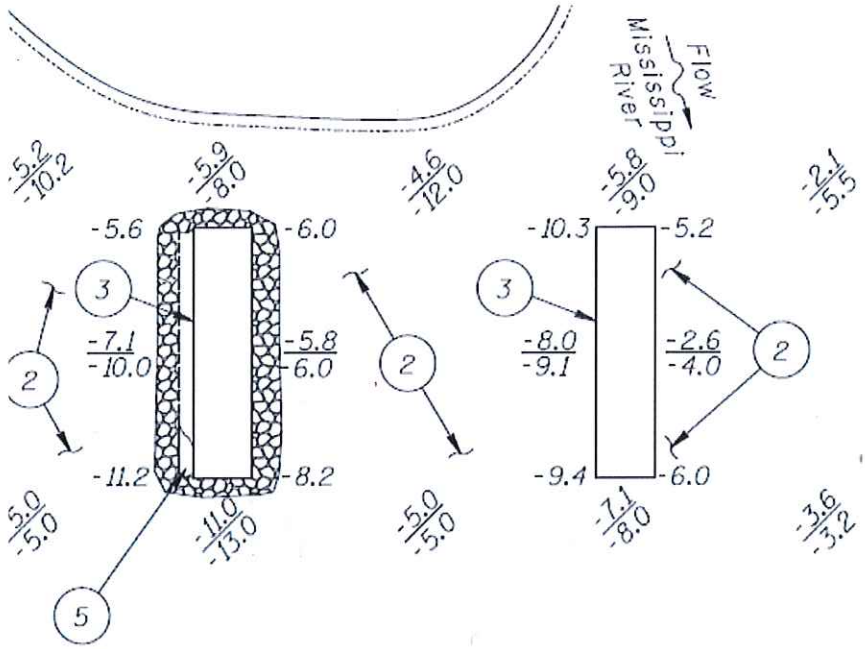
cc: Kevin Western, State Bridge Engineer
Arielle Ehrlich, Bridge Design Engineer
Amber Blanchard, Bridge Planning and Hydraulics Engineer
Duane Green, Metro Bridge Operations and Maintenance Engineer
Andrea Hendrickson, Bridge Hydraulics Engineer
Jennifer Zink, Bridge Inspection Engineer

Attachment A: In-depth Underwater Inspection Requirements

Bridge 2440 In-depth inspection

Bridge 2440 is the 3rd Avenue Bridge in Minneapolis. Repairs to underwater footings were completed in 2014 at river Piers 1, 2 and 5. A bridge rehabilitation is being planned for 2020-2022 timeframe. The rehabilitation should address any deficiencies and this in-depth inspection should identify any deficient areas that may escalate to an unacceptable level in the next 20 years. The river foundations should be documented for to a level of detail sufficient for rehabilitation plan preparation. This includes:

1. Researching historic plans and clipping plan views of footing details. Where no suitable plan view is found, develop a scaled plan view of footing for photo and defect logging. Include river-side inspection of Arch Pier 8. See example.
2. Documentation of the repairs at Piers 1 and 5 have been completed following construction in 2015. The documentation should be reviewed prior to the dive and updated to note any new deficiencies. In particular, note any undermining at boundary 2014 repairs.
3. Photographic evidence with location logging. Photograph each face with 12 MP minimum resolution at one photo per 10 LF perimeter. Edit digital photos by providing plan view caption with location. This is required at all river piers.
4. Develop elevation views as necessary for logging defects at all river piers. MnDOT will provide microstation plans for recent work at piers 1 and 5 to utilize, but modification will be necessary for mapping sketches.
5. Maps of any defects around the circumference of the footing to a level at the arch springline.
6. Quantity any concrete penetrations in increments of 3" (eg, 3" penetration for 4 LF, 3" to 6" penetration for 5LF, etc)
7. Characterize the size orientation and length of any concrete cracks over 0.025". Sketch on gridlined paper. Where frequency is closer than 3 feet, circle area on elevation view, characterize frequency (map cracking at 1 ft on center each direction) and indicate average crack opening for the corresponding area.
8. Document scour condition void depth, width and length as to enable scour mitigation volume calculations.
9. Provide dive assistance for underwater scanning at Piers 2, 5, and 6: Include an item for a quote to provide diving assistance time to MnDOT Hydraulics staff to perform a Bluview underwater scan of the pier footings. Assist in positioning and holding MnDOT provided Blueview 3D scanner at river piers at up to 8 locations per pier. Scan time is approximately 45 minutes per location. MnDOT to provide scanning technicians and hardware. Underwater inspection team to provide positioning of Blueview scanner at up to multiple and means of stabilizing MnDOT boat through pier anchorage or tie-offs. The Blueview scanner is mounted on a 60-lb weight with hoisting hook or a factory standard underwater tripod.
10. A couple examples of such a mapping and report are attached. We would expect labeled photographs to accompany any sketched defects such as those found in attachment "Pier5Defects-labeled.pdf".



Pier 4 *Pier 3*

SOUNDING PLAN

Example of general underwater inspection, but detail is insufficient for preparing contract plans.

INSPECTION NOTES:

1. *The channel bottom consisted of sand, allowing probe rod penetration of 1 to 2 inches, around Piers 1 and 2, and along the east face of Pier 3.*

2. *Channel bottom consisted of 6 inch to 4 foot diameter riprap.*

3. *Piers 1 through 4 exhibited moderate to heavy deterioration of mortar joints (up to 75% of mortar loss), with 4 inch typical and 6 inch maximum penetrations, from the stone pier collar at the base of the arch to approximately 1.5 footbelow the waterline. Below the first submerged horizontal joint to the pier foundation or channel bottom, the joints were in good condition. There was some minor deterioration of the limestone blocks with cracks, which extended to 1 to 2 feet below the waterline.*

4. *Concrete section loss with 3 to 9 inches of penetration and exposed reinforcing steel was noted on the top of the pier encasements along the downstream nose and east face of Piers 5 through 7, extending up to 1.5 foot below the waterline.*

Attachment A: In-depth Underwater Inspection Reporting (By others)

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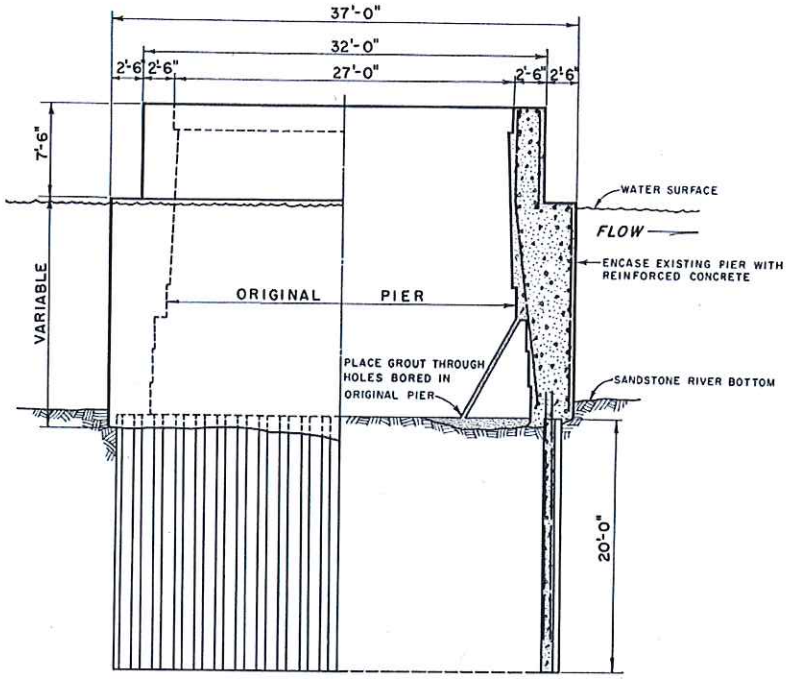
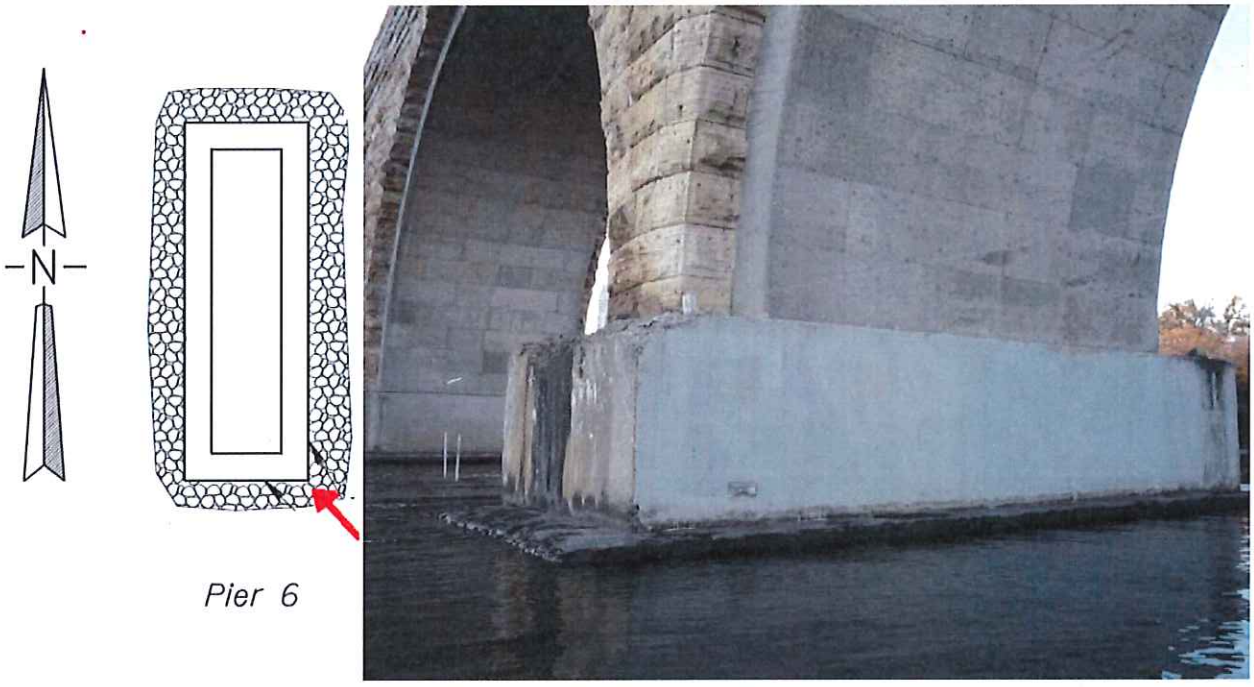
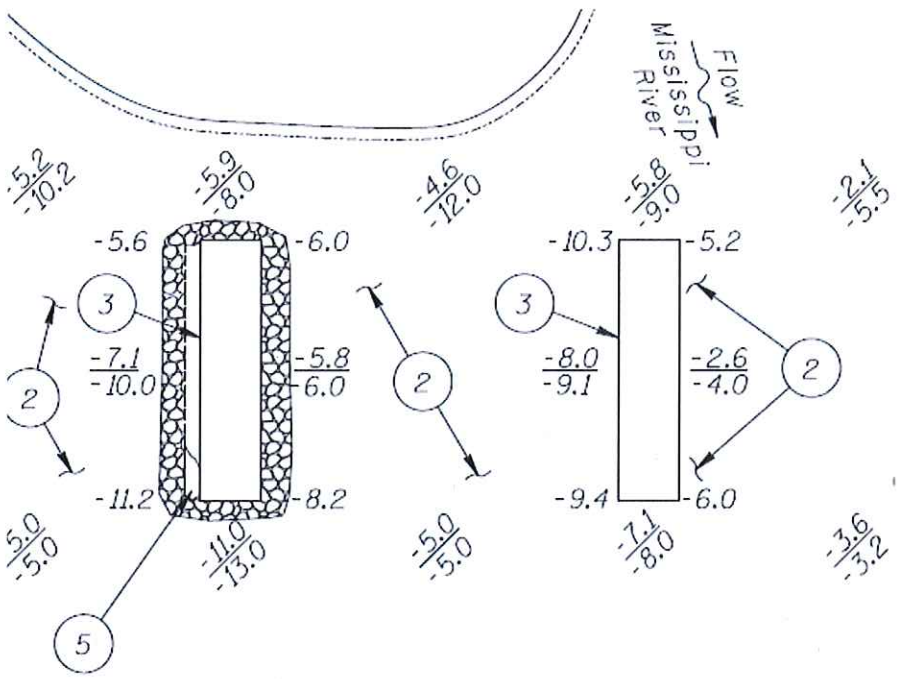


VIEW A-A

Example general elevation



Example photo log



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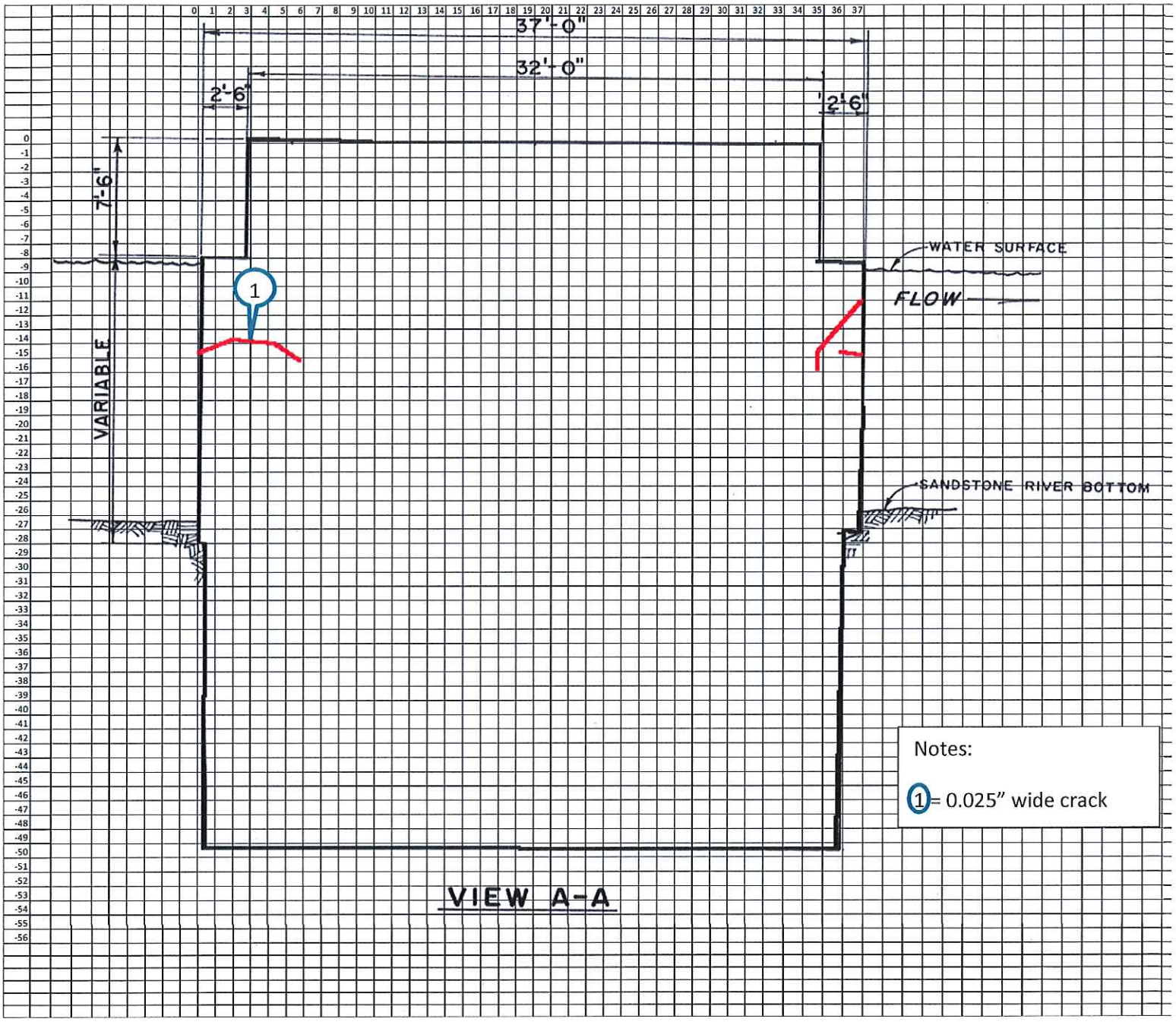
Example mapping of defects on 1' gridlined, scaled elevation views (Map each side, characterizing defect in type, size, depth and length):



Above image taken from historic plans on Edocs, edited in photoshop to make transparent, and superimposed in Excel.