MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

# Non-Destructive Evaluation – MDOT SHA Process and Experience

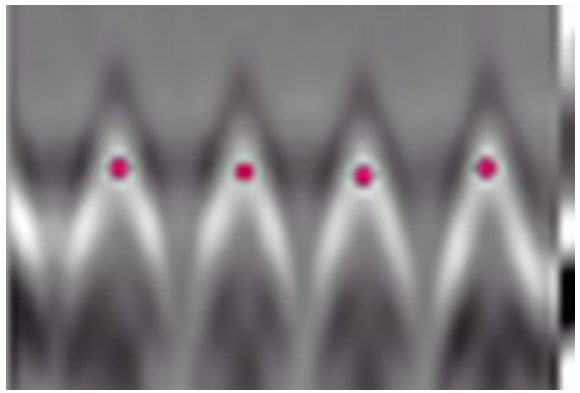
April 29, 2025

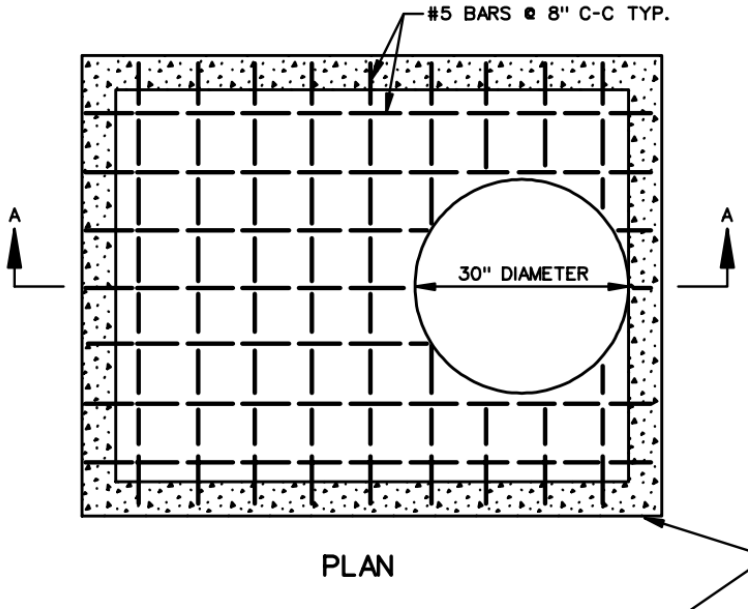
# NDE Methods at MDOT SHA

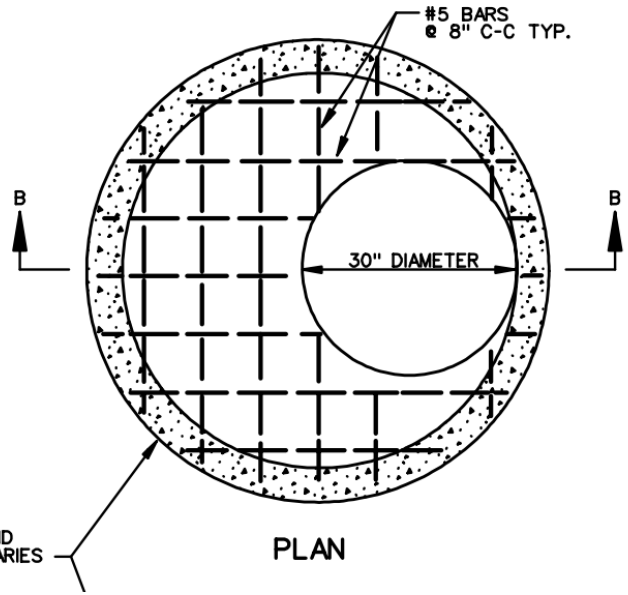
- **Ground Penetrating Radar Inspection of Precast Concrete Structures**
- MDOT SHA (Maryland Department of Transportation State Highway Administration) Concrete Technology Division employs GPR as a part of its Non-Destructive Evaluation (NDE) toolkit to investigate precast concrete structures. GPR provides information about rebar location, void detection, crack identification, and other structural assessments. These methods help us assess that the infrastructure while avoiding physical damage to the concrete.

# NDE Methods at MDOT SHA using Ground Penetrating Radar

- Assists with Providing Traceability reports for Field Quality Assurance Visits
- Rebar location and mapping-3D
- Steel Depth and Spacing
- Determine the actual thickness of precast concrete structures, design verification
- Void detection





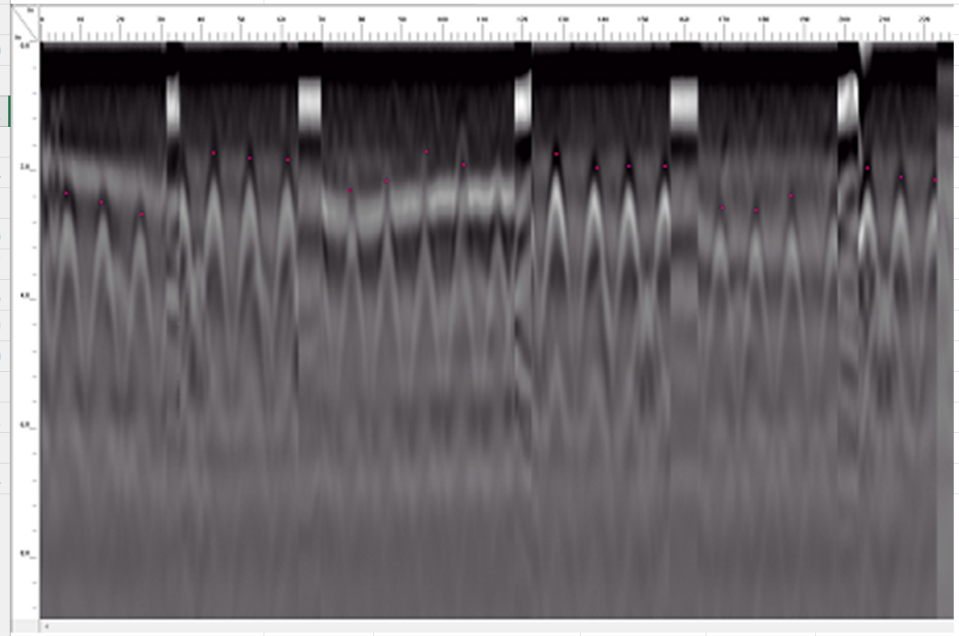




MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

# From Field Scan to Reports


## Ground Penetrating Radar Investigation Report

| | |
|---|---|
| **File Name:** | FILE__005.DZT |
| **Scan Name:** | 3-D File |
| **Date/Time:** | Dec, 26 2024, 11:41:26 |
| **Comment:** | 8-10" spacing shown for this inlet. **REQUIRED SPACING =6"This spacing does not meet drawing requirements for STD 374.70** |



| | | | |
|---|---|---|---|
| **Project Name:** | 5- I-02B 11/04/2024 | **Customer:** | MDTA |
| **Location:** | Belvedere Road @I95 | **Object:** | Check of steel spacing |
| **User:** | D. Rosen | | |

| Dist.(in) | Target Picks Depth(in) | Spacing (in) | Scan Direction |
|---|---|---|---|
| 6.5 | 2.35 | | Horiz |
| 15.2 | 2.5 | 8.7 | |
| 25.3 | 2.68 | 10.1 | |
| 43.1 | 1.73 | | Vertical |
| 52.1 | 1.81 | 9 | |
| 61.6 | 1.83 | 9.5 | |
| 77.1 | 2.31 | | Horiz |
| 86.1 | 2.17 | 9 | |
| 96.1 | 1.71 | 10 | |
| 105.3 | 1.92 | 9.2 | |
| 128.4 | 1.75 | | Vertical |
| 138.5 | 1.96 | 10.1 | |
| 146.4 | 1.94 | 7.9 | |
| 155.4 | 1.94 | 9 | |
| 169.6 | 2.58 | | Horiz |
| 178.1 | 2.62 | 8.5 | |
| 186.8 | 2.39 | 8.7 | |
| 205.7 | 1.96 | | |
| 214.1 | 2.1 | 8.4 | Vertical |
| 222.6 | 2.15 | 8.5 | |
| | | 8.45 | |

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

# Report Non-Compliance Results to Producer

- Quality Assurance efficiency
- Explanation of deficiency
- Producers are compelled to improve their quality control to align with MDOT NDE Quality Assurance standards and maintain their certification.

# GPR FORMS

| GPR SCAN FORM-Structure Mini XT | | | | |
|---|---|---|---|---|
| SCAN # /DIRECTION | STRUCTURE # | STD. OR TYPE | DATE | PLANT # |
| HORIZONTAL / VERTICAL | | | | |
| | | | | |

## MARYLAND STATE HIGHWAY ADMINISTRATION
## GPR QUALITY ASSURANCE CHECKLIST

**Date:** _____ **Plant No.:** _____

**Type of Structure:** Manhole risers, 72" Manholes **Standard Detail/Drawing No.:** 384.05 and 384.01

**Target Element:** steel reinforcement **Inspected by:** _____ (Print/Sign)

☐ **Meets Design Tolerance** ☐ **Does Not Meet Design Tolerance**

| Yes | No | |
|---|---|---|
| ☐ | ☐ | Are all applicable drawings, details, and standards available at the Plant? |
| ☐ | ☐ | Is the structure free of damages and defects? |
| ☐ | ☐ | Does the structure meet design dimensions? |
| ☐ | ☐ | Are internal targets found within the structure? |
| ☐ | ☐ | Does the structure contain the correct number of target elements? |
| ☐ | ☐ | Is there sufficient center to center spacing between target elements? |
| ☐ | ☐ | Is there sufficient concrete cover around target elements? |

REMARKS: (Please explain in detail any items noted as non – compliant. Use additional pages as necessary.)

Plant QC Personnel: _____ (Print/Sign)

# Return on Investment

- **Cost Savings:** Detection of structural issues minimizes extensive repairs and replacements.
- **Increased Safety:** Timely evaluations help reduce the risk of failures. MDOT's use of advanced NDE methods, like GPR, sets a benchmark for quality and safety.
- **Time Saving:** A mass scan of structures may be performed after production when large numbers of structures are either at a production plant or jobsite.
- **Efficient Resource Allocation:** Evaluation methods allow for isolating areas for repair/damaged locations.
- **Increased Accountability:** Knowing that MDOT uses GPR to thoroughly inspect concrete components post-production, producers are more likely to ensure their products meet all specifications and quality standards to avoid rejection or costly repairs.

# Implementation Status and Challenges

**Status:** GPR is well-suited for precast concrete inspection.

**Challenges:**

- Interpretation of GPR data requires trained personnel although standard methods may be learned quickly.
- Certain conditions, such as high moisture content in concrete, dense steel configurations can interfere with radar signal clarity.
- Equipment cost and training time may initially be a barrier for broader adoption

# Future NDE plans / projects

- Upgrading GPR equipment for better resolution and faster data acquisition.


# Recommendation for states who are not adopting GPR NDE in their programs and projects

1. **Education and Advocacy:** Promotes awareness of NDE benefits through case studies showing cost savings and risk reduction.
2. **Federal and State Incentives:** Use available grants or funding programs to offset initial costs.
3. **Pilot Programs:** Review successes in pilot programs related to NDE
4. **Training Programs:** Develop training for engineers and technicians to build expertise in NDE techniques. Create SOP's
5. **Collaboration:** Partner with universities and research institutions to explore new innovations in other NDE programs.

# QUESTIONS?