PRECAST CONCRETE UNDERGROUND UTILITY VAULTS
OUTLINE

• Purpose
• Precast Advantage
• Purpose of Utility Vaults
• Uses of Utility Vaults
• Applicable Standards
• Structural Design
• Materials
• Production
• Installation
• NPCA Plant Certification
PURPOSE

• Provide current and accurate technical information as it relates to the design, production and installation of precast concrete utility vaults.
PRECAST ADVANTAGE

• Available nationwide
• Environmentally friendly
• Non-combustible
• Long life span and durability
• Delivered and set by manufacturer
• Less maintenance than CMU
• Easily designed to withstand traffic or aircraft loading
• Mass
• Faster installation – large structures easily designed
• Produced in a controlled environment
• Cost effective
PURPOSE

• Provide easy access to equipment for maintenance.

• Provide structurally sound enclosure.

• Provide a secure enclosure for costly equipment.
PURPOSE of UTILITY VAULT

- Protect vital underground connections and controls for utility distribution.
APPLICATION
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USES of UTILITY VAULTS

- Communications
- Electricity
- Gas
- Steam
APPLICABLE STANDARDS

• ASTM C 857
  ▪ Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

• ASTM C 858
  ▪ Specification for Underground Precast Concrete Utility Structures

• ASTM C 891
  ▪ Practice for Installation of Underground Precast Concrete Utility Structures
APPLICABLE STANDARDS

- ASTM C 1037
  - Practice for Inspection of Underground Precast Concrete Utility Structures
APPLICABLE STANDARDS

• ACI 318
  ▪ Building Code Requirements for Structural Concrete

• AASHTO
  ▪ Specification for Highway Bridges

• Project Specific Requirements
REFERENCES

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• NPCA Quality Control Manual for Precast Plants

• Local Codes and Regulations
STRUCTURAL DESIGN

• Loading Conditions
  - Surface surcharge
  - Concentrated wheel loads
  - Lateral loads
  - Presumptive soil bearing capacity
  - Buoyant forces
  - Connections and penetrations
  - Point loads
  - Live loads
  - Dead loads
STRUCTURAL DESIGN

• Concrete Thickness
  ▪ Sufficient to meet minimum reinforcement cover and withstand design loading conditions.

• Concrete Mix Design
  ▪ Concrete Compressive Strength – Minimum 4,000 psi strength at 28 days.
  ▪ $w/c < .45$ (water/cementitious ratio).
  ▪ Quality materials using well-graded aggregates.
  ▪ Air entrained in accordance with ACI 318.

• Reinforcement
  ▪ Reinforcement design by structural calculations as required by code or as proven by testing.
MATERIALS

• Cement

The majority of cement used in the manufactured concrete products industry is governed by ASTM C 150 “Standard Specification for Portland Cement.”
MATERIALS

• Aggregates

MATERIALS

• Water

MATERIALS

• Admixtures & Supplementary Cementitious Materials (SCMs)

Admixtures and SCMs allow the manufacturer to fine-tune and enhance the properties of the concrete mix.

- Air entraining admixtures per ASTM C 260 improve freeze-thaw properties while SCMs per ASTM C595 and C618 have impacts upon the water content and can lead to significant improvements in the physical properties of the concrete.

• Today, precast concrete is the high-tech material of choice.
MATERIALS

• Reinforcement
  - Reinforcement of concrete is required and must be provided and designed to meet structural loading and handling conditions of the structure.
MATERIALS

• Reinforcement
  ▪ Reinforcement types can vary from WWM to conventional rebar to fibers – all reinforcement must comply with applicable standards.
PRODUCTION

• Pre-pour Inspection
  ▪ Trained and qualified plant personnel perform inspection before each pour to verify form cleanliness, proper amount of release agent, and reinforcing steel placement and configuration.

• Post-pour Inspection
  ▪ As an essential part of the production process, the post-pour inspection verifies product conformance to project specifications.
PRODUCTION

- Final Inspection
  - Validation of Quality
INSTALLATION

• Proper installation is absolutely critical for maintaining the inherent quality of plant-manufactured concrete utility structures, and considerations include:
  ▪ Proper connections
  ▪ Planning for site conditions
  ▪ Excavation and bedding
INSTALLATION

- Vault placement
- Proper sealing methods
- Installation of access risers and entry
- Penetrations
- Backfilling procedures
NPCA PLANT CERTIFICATION

• Quality Control Manual to ensure the production of quality precast products

• Plant Inspections conducted by third-party consultants