Emergency Slope Repair using Reinforced Soil
Gill, Massachusetts

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Presentation Overview

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Photo Provided by Northern Construction Services
Extreme Weather in Massachusetts

2.76 inches of rain in 3 hours per NOAA

Gill, Massachusetts Police Facebook Page
Project Location
- Route 2/Mohawk Trail in Gill, Massachusetts, located adjacent to the Turner Falls Dam and Turner Falls-Gill Bridge
- Route 2 is a major integral trade route that runs East and West across Massachusetts

Project Team
- Contractor - Northern Construction Services
- Engineer – Geosciences Testing and Research, Inc. (GTR)
- Owner – Massachusetts Department of Transportation (MassDOT)
Initial Drone Survey

- Drone Survey using LiDar
- Slope cross sections developed from drone survey
- Survey compared to previous recent surveys of existing slope
- Slope failure approximately 75 foot height in elevation
Temporary Roadway Support

Required for:

• Stop and reduce risk of further undermining roadway due further erosion at slope failure
• Reduce soil and roadway/traffic surcharge at top of remaining slope that would cause further slope failure
• Location of SOE allowed for traffic barrier and 2 way traffic along Route 2 at the completion of the SOE
Temporary Roadway Support Analysis:

- Soils assumed for analysis based on field observations of failed slope and based on location
- Considered reduced passive resistance due to remaining slope in front of support
- Considered HS-20 loading and construction surcharges for traffic above SOE
- Rock not modeled – unknown depth below micropile location
Temporary Roadway Support

- Single lane traffic during SOE installation
- Rock was encountered shallower than expected and micropiles were drilled a minimum of 5 feet into rock for further support
- Geotechnical Information Gathered during Drilling
  - Depth to rock
  - Soil types and density approximated from drilling action and spoils

Photo Provided by Phoenix Foundation Co., Inc.
Temporary Roadway Support

Photo Provided by Phoenix Foundation Co., Inc.
Geotechnical Information

- Drilling action/returns
- Visible soil observations used to confirm soil parameters used in design
- Temporary Roadway Support Performance
Geotechnical Information also reviewed from recent Bridge Project
Bridge No. G-04-003 Route 2 over Fall River - Gill-Greenfield, MA
Reinforced Slope Design

Initial Reinforced Slope Concept

- Rock Slope placed on backfilled gravel borrow backfill (Armor Stone down to 1.5"-crushed stone)
- Shear pins used to pin slope boulder toe (if required)
Final Reinforced Slope Concept

- Boulder Fill Base
- Shear pins used to pin slope boulder toe (if required)
- Reinforce soil slope above boulder fill base
- Drainage to implemented behind reinforce soil slope
Global Stability Analyses using Slope Reinforcement and Boulder Fill at base
(Normal Conditions – Left. Seismic Condition – Right)
Reinforced Slope Design

Slope Repair Limits – Plan View
Reinforced Slope Design

- Final slope design consisted of Boulder Fill ranging in size from 500 lb to 8 tons topped by a 2 foot thick 1.5”- crushed stone mat
- Reinforced slope above boulder fill consisted of MassDOT Gravel Borrow with Miragrid 2XT
- Reinforce slope was wrapped in Modified Rock Fill
- The bottom of slope elevation was required to be Elevation +150 ft based on discussions with MassDOT due to environmental constraints
Reinforced Slope Construction
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Reinforced Slope Construction

Materials Amounts Used

- 3,000 cubic yards of muck and earth excavation
- 5,000 tons of boulders
- 2,300 square yards of Mechanically stabilized earth
- 5,300 cubic yards of gravel borrow
- 1200 tons of armored riprap protection – native rock used to promote vegetation
Automated Monitoring
Project Timeline

Timeline

- **July 21, 2023**
  - Major Rain Event Causing Slope Failure
  - Roadway Closed

- **July 22-24, 2023**
  - Northern Construction and GTR immediately in emergency discussions with MassDOT

- **July 25-30, 2023**
  - Temporary Roadway Support Designed.
  - Initial slope concepts presented to MassDOT

- **July 31-August 20, 2023**
  - Temporary Roadway Support Installed and implemented to re-open roadway

- **August 22,2023-October 26, 2023**
  - Slope Repair Commenced

Photo Provided by Northern Construction Services
Completion of Construction
THANKS FOR WATCHING

QUESTIONS?