Rebuilding for Resilience and Functionality in the Green Mountain National Forest

*Kelley Stand Road, Sunderland, Vermont*

*Presented by Robert Wildey*

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Project Overview

Kelley Stand Road
- Town of Sunderland - Town Highway No. 3
- U.S. Forest Service – Forest Access Highway No. 6
- Connects between Sunderland and Stratton
- Open seasonally but also popular snow mobile trail

Roaring Brook
- Tributary to Batten Kill River
- Flows from major tributary “South Fork”
- Steep, confined valley
TOWN OF SUnderland
County Of Bennington
Kelley Stand Road
Rehabilitation
Town Highway No. 3
Forest Highway No. 6

Project Location: Located in Sunderland, VT, T.H. J (Kelley Stand Road) branches off from Kansas Road approximately 575 ft east of the U.S. Route 7 overpass.

Project Description: Work to be performed under this project includes roadway repairs and reconstruction, streambank armoring, bridge rehabilitation, and bridge removal and replacement.

Length of Roadway: 4.52 miles
Length of Bridge 16: 75 feet
Length of Bridge 17: 63 feet
Length of Project: 4.55 miles
Tropical Storm Irene

- August 27-28, 2011
- 5.16 inches of rain recorded during event at Sunderland rain gage (located downstream)
- Between a 10 and 25-yr storm event for this area
- Watershed Areas:
  - 9.3 square miles upstream
  - 19.3 square miles downstream
- Resultant stream flows
  - 1,000 cfs upstream
  - 2,000 cfs downstream
Post-Irene Investigation and Design

- Downstream reaches cleared following storm
- Majority of roadway remained closed
- 32 locations where treatments required
- Stream cross-sections and measurements
- Geotechnical investigation
- Bridge analysis and design
- Ledge outcrops and decision to blast
- Stormwater management
Design Criteria and Construction Planning

- Relocate road where feasible and pull back to unerodable section for road bed
- Stacked boulder detail with pinned and grouted boulders to make vertical banks (6 to 8 feet high in some locations)
- Provide stable foundation for roadway, stable streambank for future events, flood bench where feasible
- Provide additional material for construction
- Crusher on-site to process in-place
- Brought-in crushed aggregate for roadway
- Woody debris added into site for grubbing materials – woody debris left in place
Idealized Cross Sections

- Typical Roadway Repair Section
- Typical Ledge Cut Section
As-Built Cross Section

NOTE:
REVIZIONS TO FULL WIDTH ROADWAY REPAIR TYPICAL SECTION WITH LEDGE REMOVAL WERE APPLIED AT THE FOLLOWING PROJECT LOCATIONS
SITE 11 - STA. 143+95 TO STA. 145+85
SITE 14 - STA. 163+00 TO STA. 168+25

SOLID ROCK EXCAVATION MAY BE REQUIRED TO ESTABLISH FULL KEYWAY DIMENSIONS
Pinned Boulder Detail

EXISTING GROUND

0"-6" AGGREGATE, SURFACE COURSE

1"-0" SUBBASE OF GRAVEL

10'-0" TRAVEL LANE

3%

20'-0"

10'-0" TRAVEL LANE

3%

PROPOSED GRADE

4'-0" STONE FILL, TYPE IV

12" GRUBBING MATERIAL

VARES

1.5 MIN

DRILL AND GROUT 3" # HOLE WITH # 8 BAR

BOULDER APPROXIMATELY 6' TO 8' DIAMETER. SEE ROCK SIZING DETAIL. PAYMENT UNDER ITEM 613.15 "RIPRAP HEAVY TYPE"

2'-0" STONE FILL, TYPE I

2'-0" STONE FILL, TYPE II

PROPOSED LEDGE FACE

CONCRETE, CLASS D BEU

#8 BAR EMBEDDED 4'-0" MIN INTO LEDGE SUBBASE

QHW
SEE STRUCTURE TABLES FOR HORIZONTAL AND VERTICAL COORDINATES ASSOCIATED WITH LABELED STONES ("A" - "E")

EXCAVATED SCOUR POOL DIMENSIONS SHALL BE APPROXIMATELY 2' DEEP X 15' WIDE X 20' LONG OR AS DETERMINED BY THE ENGINEER

WHERE THE VANE ARM TIES INTO WITH THE PROPOSED ROADWAY SLOPE, KEYSONE SHALL BE SELECTED AND PLACED TO FIT SNUGLY WITH THE PROPOSED TYPE IV STONE FILL AS DIRECTED BY THE ENGINEER

THE BOTTOM OF THE 2ND TIER OF FOOTER ROCKS SET A MINIMUM OF 2' BELOW BOTTOM OF SCOUR POOL

BOTTOM OF SCOUR POOL A MINIMUM OF 2' BELOW TOP OF HEADSTONE AND AS DIRECTED BY THE ENGINEER

BACKFILL A MINIMUM OF 3' UPSTREAM OF EACH TIER OF BOULDERS USING IN-PLACE COBBLE/GRAVEL MATERIAL AS SPECIFIED AND DIRECTED BY THE ENGINEER
Construction

- Contractor had limited experience with in-stream work but was open to receiving direction; such collaboration was an important part of construction success
- Operators needed time to come up to speed
- Known at outset and planned for, senior geomorphologist spent a week in field with training
- Some structures were taken down and rebuilt following inspection
- Overburden removal didn’t always reveal stable rock face that was anticipated
- Challenging site conditions within and adjacent to active channel
Acknowledgements

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