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Artikel: Shed against stone fall to protect railroad (Japan)
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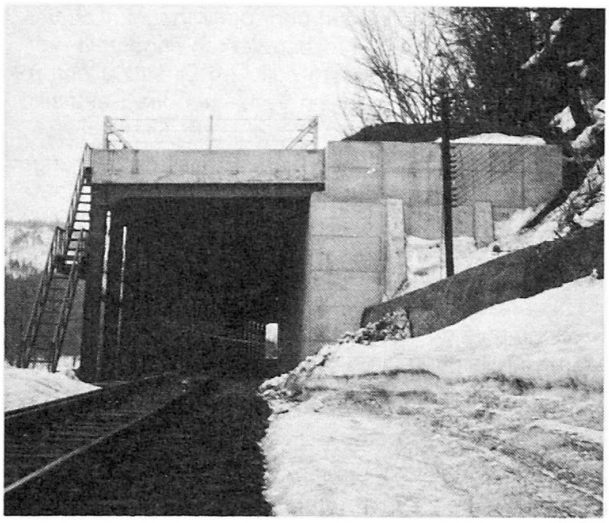
10. Shed against Stone Fall to protect Railroad (Japan)

Owner: *Japanese National Railways (JNR)*
Design and Construction: *JNR, Asahikawa Division*
Work's duration: *4 months*
Service Date: *1985*



Dimensions:

Structure: length 87.3 m, width 6.6 m, height 7.15 m
Railway Curve: R=301 m and transition curve

Concrete of Retaining wall: 5.0 m^3/m
Concrete of Upper Slab: 1.2 m^3/m
Concrete of Foundation: 1.4 m^3/m
Steel Protective Frame: 1220 kgf/m^3

Introduction

This area, situated in the center of Hokkaido, the northernmost island of Japan, suffers from severe cold weather with annual snowfall totaling more than 13 m. Blizzard and avalanche caused by snow cornice sometimes bring heavy damages. In the midst of winter, temperature lingers below zero and early spring climate brings repeats of thawing and breezing.

This stone shed is constructed on the railroad connecting Asahikawa and Abashiri, having been under construction from 1915 to 1923.

Frequent stone fall and avalanche occur at the construction site of the railroad along the river on the skirts of Mt. Daisetu. The mountain slope is barren and ruined. The dimensions of the slope is 50 degrees in gradient, 40 m in length and 30 m in height.

Design

This stone shed was designed with reference to the JNR Manual for Preventative structures against stonefall. This structure is composed of reinforced concrete retaining wall and steel protective frame. The stability and strength of each section of the wall were checked against the composed force of the dead load, the earth pressure of the backfill, the lateral force of earthquake, snow weight, and load of falling stones.

The load of falling stones, assumed to affect the wall through the backfill, was calculated as of 20.1 tf for vertical load and 28.7 tf for lateral load, considering the slope gradient, the length of the slope and the estimated stone weight.

The steel frame of H-beam (H390×300 ×10×16) with 3 m pitch was also designed against the same falling stone load.

The joint of the frame at the concrete base and the top of retaining wall was designed as a pin support.

Construction of Structure

Retaining Wall

Mountain side of the slope was excavated firstly, followed by the setting of the base concrete and wall concrete with designed compressive strength of 210 kgf/cm^2.

Human guards and alarm devices assured the safety of the construction executed on and near the railroad.

Earthwork

Temporary railroad crossing made the transport of the backfill material possible. The backfill was well compacted.

Steel Protective Frame

Factory fabricated members were assembled by the use of truck crane. Special care was taken in designing the joints of the frame with the base and the wall to ensure easy construction. The frame was painted once in shop and twice on site.

Covering Upper Slab

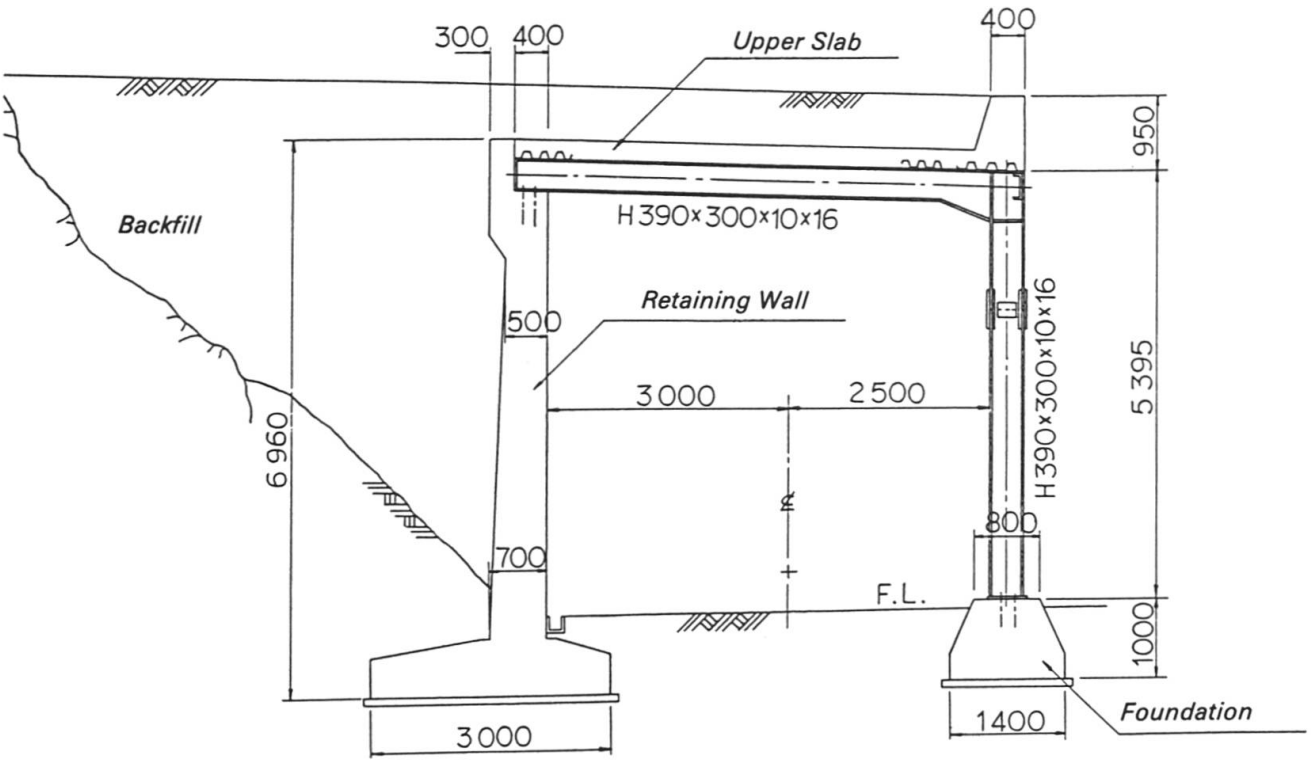
Wave shaped steel plate was placed, followed by the concrete placement, the setting of expansion joints and water stop. Watertight seat was spread over the covering upper slab. Finally surcharge cushion fill was placed.

Drainage Works

Drainage pipes were set for the sake of drain of backfill.

(JNR)

Reference: «Manual for Preventative Structures against Stonefall» 1978.3 JNR


300
400
Upper Slab
400
950
Backfill
H 390×300×10×16
Retaining Wall
500
3 000
2 500
5 395
H 390×300×10×16
6 960
800
700
F.L.
1000
3 000
1400
Foundation