

Optimisation and Performance of a rigid Retaining Wall with Relief Shelves

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ABSTRACT

Reinforced concrete retaining wall are meant to support more height of earth mass. Earth pressure on a retaining wall decides the sectional dimensions of the wall and there have been several attempts in the literature to reduce the earth pressures on the retaining walls, by using techniques such as lightweight backfill and placement of compressible inclusions at the wall backfill interface, to name a few. Retaining wall with pressure relief shelves is one of the special types of retaining wall. High reinforced concrete retaining wall may be used as economically by providing relief shelves on the backfill side of wall. A parametric study is conducted to understand the influence of width and position of relief shelves on the contact base pressure below slab, deflection of top node of wall and lateral earth pressure.

Keywords: Retaining wall, Relief Shelf, Lateral Earth pressure.

INTRODUCTION

Engineers are continuously working on reducing the cost of construction with maintaining quality and serviceability of the structure. With increase in number of infrastructure project across the globe, retaining wall become the integral part of almost all infrastructure projects to protect backfill. The retained material exerts a push on structure and this tends to overturn and sliding of structure. The weight of retaining wall is considerable significance in maintaining stability of retaining wall. In many cases, you may require high retaining walls to resist huge lateral earth pressure. Rigid non yielding retaining walls are gravity walls which are bulky. Thus, it affects on economy of the project. One alternative to tackle this point is to reduce lateral earth pressure on wall. A continuous investigation and study is going on various types of retaining walls for achieving optimum economy, developing speedy and easy construction processes, reducing section of wall components and ultimately to get wall of maximum strength and durability. By reducing earth pressure sectional dimensions as well as cost can be reduced. One such technique, which is least practiced is retaining wall with relief shelf. Relief shelves are horizontal platforms which are perpendicular to wall, constructed on retaining side of wall and casted monolithically with wall. Number of shelves on wall depends on height and backfill intensity. A parametric study is conducted to understand the influence of width and position of relief shelves on deflection of shelves, deflection of top node of wall and lateral earth pressure.

MODELLING

A 7m high rigid non-yielding wall, retaining a dry cohesion less backfill chosen for study. Analysis and design is carried out by following stated properties. Model is designed by conventional method and dimensions for cantilever retaining wall are fixed on prevailing thumb rule.

MODEL DISCRIPTION

Height of backfill to be supported (H) = 7 m

Unit weight of soil (γ) = 20 kN / m³

Angle of internal friction = 30°

Coefficient of friction at base (0.5) = 0.5

Bearing Capacity of soil (qf) = 200 kN / m²

Unit weight of reinforced cement concrete = 25 kN / m³

Grade of concrete: M 25 and grade of steel: Fe 500

SECTION OF RETAINING WALL

Width of base slab (B) = 3.8 m (0.4 H to 0.7 H)

Thickness of stem at top of retaining wall (T0) = 0.40 m

(200 mm minimum, preferably 400 mm)

Thickness of stem at intersection of stem and base slab (Ts)

= 0.8 m (H/12 to H/8)

Thickness of base slab (Tb) = 0.8 m (H/12 to H/10)

Height of stem (h) = H – t b = 7.00 – 0.80 = 6.2 m

Projection of base slab towards toe = 1 m (0.20 B to 0.40 B)

Thickness of relief shelf = Base slab thickness / 2 = 0.80 / 2 = 0.4 m

These results are compared with results of model analysed in staad-pro software which are relatively found well.

RESULTS AND DISCUSSION

The validated numerical model is extended for modelling rigid retaining wall with relief shelf. In this study, retaining wall with single relief shelf at different heights with varying widths are chosen in combination. Then, retaining wall with multiple relief shelves are also analysed to study the behaviour of lateral earth pressure, total lateral thrust, deflection of top node of wall and deflection of relief shelves. The model is generated in staad-pro space structure and using four noded plate element.

Shelf width	Shelf Position				
	0.2h	0.4h	0.5h	0.6h	0.8h
0.25m	9.699	10.076	11.838	13.494	15.902
0.5m	9.390	9.806	11.278	12.995	15.480
0.75m	8.876	8.959	10.345	11.977	14.776
1m	11.156	7.773	9.038	10.651	13.792



