Alamodome Expansion – Retaining and Load Bearing Wall

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Abstract

A wall requires to be designed for the bunker to carry loads and resist soil and water pressure. A retaining wall is designed to resist lateral pressure coming from earth or water or a combination of both. A load bearing wall is designed to carry gravity loads such as human occupancy. The wall is required to retain surcharge load, soil pressure, and water pressure. In addition, gravity loads from structural members and live load from the floor above is to be supported by the wall. As per ACI 318-11, the wall was designed to use main reinforcement of no. 6 at 12 inches, spaced on center and shrinkage and temperature bars of no. 6 at 15 inches, spaced on center.

Introduction

The Alamodome is a multipurpose facility that holds big events such as college football, tradeshows, etc. The facility is operated by City of San Antonio. Opened on May 15, 1993, the construction cost was at $186 million. The Alamodome features column-free spans for unobstructed viewing and curtain wall system for configuration flexibility. This year (2015), the structural engineers at Intelligent Engineering Services are designing an expansion for the Alamodome. The expansion includes the addition of a bunker in the northern plaza area and the expansion of the concourse for spacious concessions area and new terrace club.

Objectives

Design the reinforcements for a 16 inch retaining and load bearing wall for the bunker addition in the Alamodome. In addition to the load bearing components of the wall, inclusion of lateral pressure of surface charge loads, soil pressure, and water pressure at a depth of 17.5 feet was considered.

Methodology

Evaluation of the effects of lateral forces was done separately from the axial loads. For solving the minimum requirements needed to support the axial loads, the method used followed the design requirements of bearing wall using the empirical design method stated in ACI 318-11 Chapter 14.

The ultimate moment due to lateral forces was solved. Similar to the design of one way floor slab, the reinforcement was solved by evaluating a one foot strip of wall and therefore factoring the pressure per foot. Once the required area was known by utilizing the ultimate moment, spacing was found by using proportionality method. For this evaluation, ultimate shear due to the lateral forces was also checked if the shear capacity of the concrete was sufficient. The shrinkage and temperature bars were designed in the similar manner these bars are designed in one way slabs

Then, the bearing strength of the wall was designed. In this step, the capacity of the wall is designed to be sufficient for carrying the ultimate axial load. The ultimate axial load is composed of the loads carried on top of the wall. Collection of data from the original structural plans were vital. This includes the sizes of beams, thickness of slabs, and other superimposed dead load. Data from geotechnical engineers were also gathered as there were soil properties needed for solving the soil pressure and surface charge load.

Results

The results varied between the two requirements, bearing strength and moment strength capacity.

For the moment strength capacity, the final design was to use main reinforcements of no. 6 at 12 inches and no.6 at 15 inches for its shrinkage and temperature bars.

For the bearing strength design, no. 6 at 18 inches was assigned for the vertical reinforcement and no. 6 at 11 inches was assigned for the horizontal reinforcement.

After consulting these solutions to the project engineer, it was decided to use the reinforcements solved for the moment strength design. This was due to the fact that the area of steel provided for the moment strength capacity was greater than the area of steel provided by the bearing strength design.

Conclusions

The wall that will be in the addition of the bunker in Alamodome is designed to have main reinforcement of no. 6 at 12 inches, spaced on center and shrinkage and temperature bars of no. 6 at 15 inches, spaced on center. The wall will work as a retaining wall and as a load bearing wall.

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