Chris Shelow
Structural
Advisor: M. Kevin Parfitt
Koshland Integrated Natural Science Center
11/21/05
AE 481W

Structural Technical Report 3

Lateral System Analysis and Confirmation Design

Executive Summary

The purpose of this report is to provide a detailed analysis of the existing design for the lateral force resisting system of the Koshland Integrated Natural Science Center, located at Haverford, PA. The first portion of this report includes the development and distribution of the seismic and wind loadings acting on the KINSC. The second portion of this report contains a detailed description of the lateral supporting system found in the KINSC. This section will provide an explanation of the lateral supporting elements that were used in the analysis. The next section of the report contains the analysis results concerning the lateral load resisting systems of the building. To obtain accurate results, the use of ETABS, an analysis and design software package, was incorporated. In ETABS, the building was modeled, lateral loads were applied, and the lateral forces on each lateral supporting element were outputted. Base shear, torsion, and overturning moments were found with the use of the program. A spot check of a typical shear wall was also conducted to ensure that the design of the shear walls is sufficient.

The existing structural framing system of the KINSC is predominately precast concrete. Some steel was incorporated in the roof framing. The lateral force resisting system is also precast concrete. It consists of a number of precast shear walls, with a few CMU block shear walls. The existence of two expansion joints separates the building into three sub-structures, able to be analyzed independently for lateral loads. The report that follows describes the analysis procedure of obtaining the lateral loads from ASCE7-02 and applying them to the structure. Though much of the derivation of the lateral loads is referenced from Technical Report 1, some factors and values have changed due to further investigation of the building. Also, in the report, the distribution of the lateral loads to the lateral resisting members was calculated using relative stiffnesses of each shear wall. Then, analysis results were obtained from both, the ETABS output data as well as hand calculations. The two results were compared; however, the values were significantly different. The reason for the discrepancies is uncertain. However the result values obtained seemed reasonable and were used to design the reinforcement in a typical shear wall for shear and flexure, as well as overturning. Minimum reinforcement was typically sufficient for both shear and flexure strength.