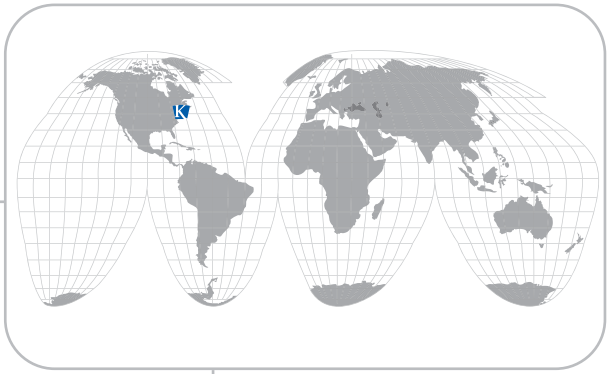
KEYSTONE® RETAINING WALL SYSTEMS
A CONTECH COMPANY

Retaining Excellence™

CASE STUDY

Manchester Boston Regional Airport

Manchester, New Hampshire



The Manchester Boston Regional Airport, located 50 miles north of Boston in New Hampshire, has experienced an increase of more than two million passengers throughout the last few years. Its growing significance as a New England Airport prompted the Manchester Boston Regional Airport to expand and enhance its facility with several construction projects.

Keystone Compac Unit walls were built throughout a three-phased project involving bridge veneering, runway expansion and road reconstruction. Phases I and III, the largest projects, were the most challenging because of unique site conditions and wall designs and time constraints. The Keystone Compac Unit was the preferred product for all three phases because it provided the best structural, installation efficiency and aesthetic appeal for the highly traveled and visible structures.

Project:	*Manchester Boston Regional Airport*
Location:	*Manchester, New Hampshire*
Keystone Product:	*Keystone Compac Unit, Series I & II*
Keystone Manufacturer:	*A. Jandris & Sons, Inc.*
Wall Area:	*107,000 total square feet*
Installer:	*Vermont Lumber & Stoneworks, Inc.*
Engineer:	*Keystone Retaining Wall Systems, Inc.*

CASE STUDY

LAND MANAGEMENT

Phase I: Bridge Veneer Application at Main Entrance Overpass (52,000 sq. ft.)

Phase I included building Keystone Compac Unit walls to serve as a bridge facing for the airport's main entrance overpass. The terraced walls wrap around, through and underneath the bridge. A strict construction deadline and unique site conditions increased the complexity of Phase I.

The time constraint came into effect because steel girders needed to be set before the bridge could be poured into place. The girders' weight required the walls be backfilled at least 60%. The entire bridge construction would have been delayed if the walls were not installed in the allotted time.

"The bridge abutment application was a critical part of the whole project. The Keystone Compac Unit provides better stability and is just easier to work with which is especially needed with more complex installations," said Yves Joyal, Keystone Northeast.

The portion of the wall that wraps underneath the bridge serves as a veneer. This portion of the wall is mechanically attached versus the grid reinforcement used for the wall portion that wraps around the bridge. The veneer wall is mechanically attached with rebar. Apoxy filled vials were inserted in holes drilled into the concrete abutments. Rebar was punched through the vials, bent at a 90° angle and core grouted with concrete.

A high water table further complicated Phase I. The proposed walls were to reach in excess of 25' below existing ground level. The water table was at approximately four feet below existing ground level. The high water table required a major dewatering process. Dewatering included placing wells underground to pump water out from the area needed for the proposed wall and grid.

The wells were constantly lowered throughout the dewatering to achieve a lower ground water level.

An intricate pipe system provides drainage for the wall. The pipe system is located at approximately 20-30' below existing ground level and ties into the city's drainage systems. The system features a six inch pipe rather than the more regularly used four inch pipe. The more rigid, larger pipe results in a labor and time intensive application. The drainage issues also affected the wall's design. According to Al Cheney of Keystone Engineering, an in-depth hydrostatic analysis was conducted to ensure the wall would stand even if the drainage system failed.

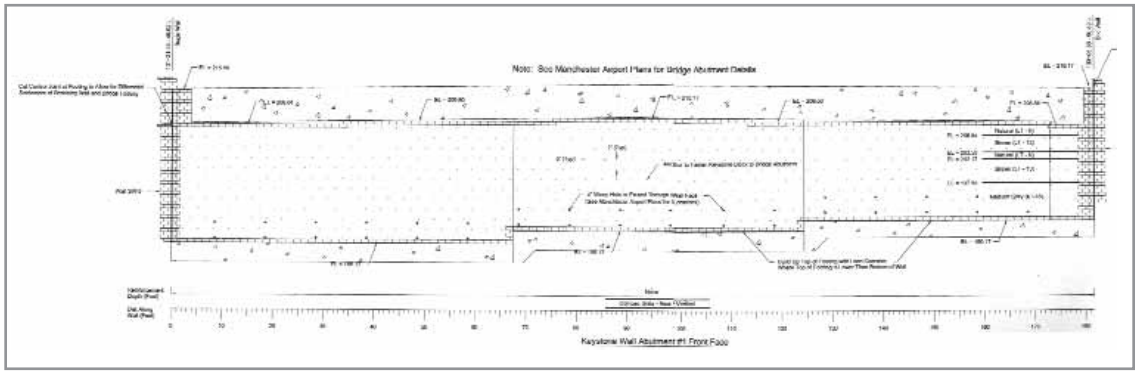
Phase III: Runway Expansion (41,000 sq. ft.)

Phase III included building a 28' sectioned wall along an expanded runway. One end of the wall has two 14' tiers that meet up with a third tier at the middle portion of the wall. All three tiers come together at the other end of the wall.

"Phase III walls spread apart and then come back together. This design results in constantly changing leadings and is not necessarily the most economical to build. To ensure they got the most wall for their money, extensive analysis was conducted on every couple hundred feet of the wall," said Al Cheney.

The Manchester Boston Regional Airport presented unique site conditions and unique wall designs that required an installation efficient, structurally sound and aesthetic solution. The Keystone Compac Unit provided the best solution for both the construction and engineering challenges.

For more information on the Keystone Compac Unit or other innovative Keystone products, please call 800-747-8971 or visit our website at www.keystonewalls.com. Keystone Retaining Wall Systems, Inc. is a subsidiary of CONTECH Earth Stabilization Solutions (ESS) Inc. (www.contechess.com).



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