Sustainable Transportation Retaining Walls

Denver RTD West Corridor

By Warren Harrison

Fig. 1(a): Jefferson County Government station under construction. Full depth—33 feet (10 m)—supporting adjacent highway with permanent soil nails and shotcrete (Photo courtesy of Harry Olsson)

Fig. 1(b): Wall under construction showing carved shotcrete facing, which is also structural member of final permanent wall structure (Photo courtesy of Harry Olsson)

Sustainability, to me, is the stingy use of scarce resources (money) and the inherent long life of a well-designed structure. This thereby minimizes capital expenditures and increases the economic life of the facility, minimizing maintenance costs.

The use in the last 40 years of geotechnical designed structures is a good example of sustainability. The use of the inherent strength of in-place rock and soil to build a structure is an excellent example of sustainable construction practices.

The original as-bid design of the new light rail station at the Jefferson County Justice Center had a 33 ft (10 m) high retaining wall supported with a double row of large-diameter drilled concrete caissons. The wall had to support the nearby US Highway 6 and also contend with drainage from snow removal on the highway.

As an alternate design, with the help of Bill Zietlow, we proposed a soil nail wall solution with a carved shotcrete facing. To ensure that the design was feasible, we invested in three additional soil borings and performed triaxial testing to determine our design assumptions.

The idea of a carved wall came from a site visit during the ACI Convention in San Diego, CA, to the California Coastal Line Station near San Diego. The carved shotcrete was very impressive and made a very inviting station atmosphere.

The final station walls consisted of approximately 22,000 ft^2 (2040 m^2) of soil nail and shotcrete walls and 12,000 ft^2 (1110 m^2) of carved shotcrete walls, which were shot and finished by Boulderscape of California. The non-carved shotcrete was in the tunnel section of the station.

The carving and architectural effect was the main reason the design change was approved

Fig. 1(c): Extent of shotcrete station wall before backfill of drainage and rail bedding (Photo courtesy of Harry Olsson)

Fig. 2(b): Light rail station east section retaining wall showing support for adjacent bridge abutment

Fig. 2(a): Jefferson County Government/Golden light rail station in operation, showing adjacent US Highway 6

Fig. 2(c): Light rail station showing shotcrete and soil nail support for tunnel out of station

by the local boards of Jefferson County and Golden, CO. The foresight of the general contractor, Transit Construction Group (DTCG)—a joint venture combining Herzog Contracting Corp. of St. Joseph, MO; Stacy Witbeck Inc. of Alameda, CA; and RTD, the owner—made this a great solution for the project. This innovative technique in building retaining walls also earned this project the "Award of Excellence" in 2011 from the Rocky Mountain Chapter – ACI, awarded at the chapter's 43rd Annual Concrete Awards Program.

***Warren Harrison**, PE, is the President of WLH Construction Company in Denver, CO, specializing in shotcrete, soil nailing, grouting, and concrete repair. He is currently serving as a member of ACI Committee 506, Shotcrete, and is a past Board member of ASA. A graduate of the Colorado School of Mines with an MBA from the University of Colorado at Denver, Harrison has worked on projects from Kodiak, AK, to Tiberius, Israel, and many places in between.*