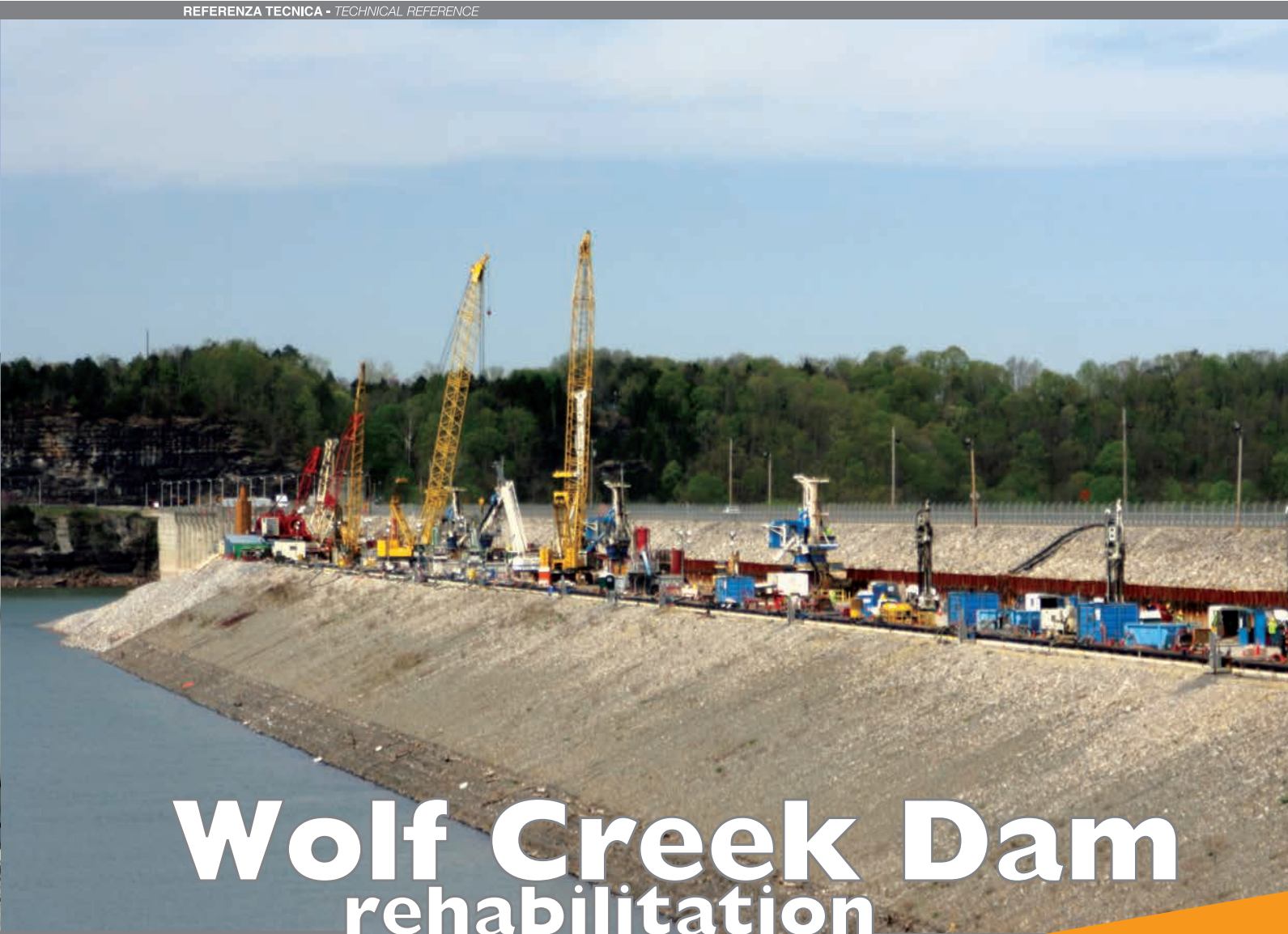


worldwide leader in the foundation engineering field



REFERENZA TECNICA - TECHNICAL REFERENCE



Wolf Creek Dam rehabilitation

Kentucky, USA



US Army Corps
of Engineers.

Diaframmi
Barrier wall

Pali secanti
Secant wall

Perfor. direzionate
Directional drilling

Perforazioni e Iniezioni
Drilling & Grouting

Cliente :
Owner:

U.S Army Corps of Engineers

Contrattista principale :
Main Contractor :

Treviicos - Soletanche JV (Treviicos - Trevi Group - Managing Partner)

Durata dei lavori :
Duration of work :

2008 - 2014

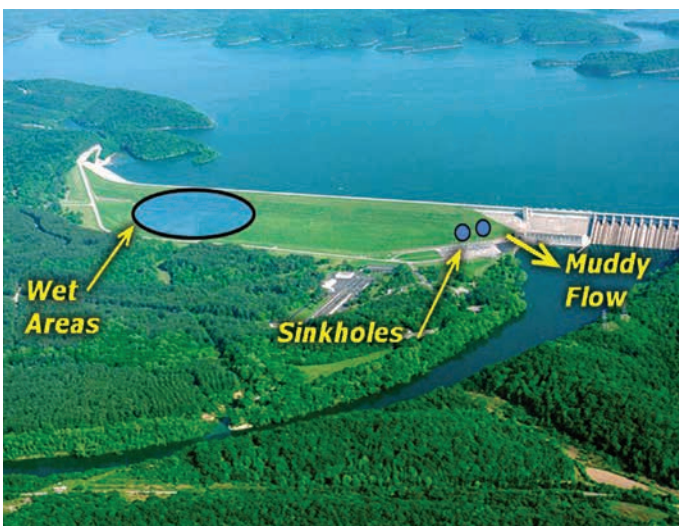


Evidence of solutioning at the karstic foundation of the dam

Introduction

The **Wolf Creek Dam** is vital to southern Kentucky and northern Tennessee, preventing the periodic flooding that once plagued the cities and towns along the 1,100 km long Cumberland River.

Designed and constructed during the period 1938-1952, **the 1,750 m long dam has a maximum height of 79 m above founding level.** Lake Cumberland, created by the dam, impounds 7.5 billion m³ and it is the largest reservoir east of the Mississippi River and the ninth largest in the US. The dam and its adjacent reservoir reside upon a heavily karstic bedrock foundation. In late January 2007, the USACE designated the dam as “high risk” for failure and launched a major, ambitious remediation program to bring the dam to full operating condition. This major rehabilitation program was awarded in 2008 to the Treviicos-led joint venture.

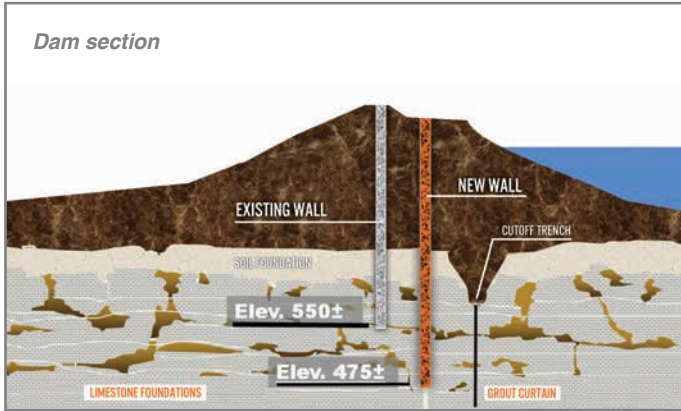


The project

Treviicos-Soletanche JV, for the construction of a 91,000 m² concrete barrier. A 0.6 m wide concrete barrier wall was successfully built to depths up to 85 m, in rock with strengths up to 250 MPa, under quality control measures that by far exceed the industry standards.

Undoubtedly, the complexity of the task and the unprecedented stringency of the contract's performance requirements make the Wolf Creek Dam Foundation Remediation Project the most extensive and complex dam foundation project ever executed in the world.

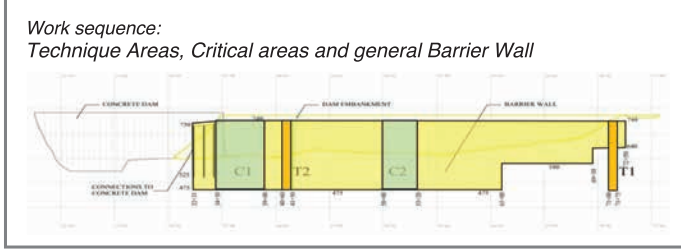
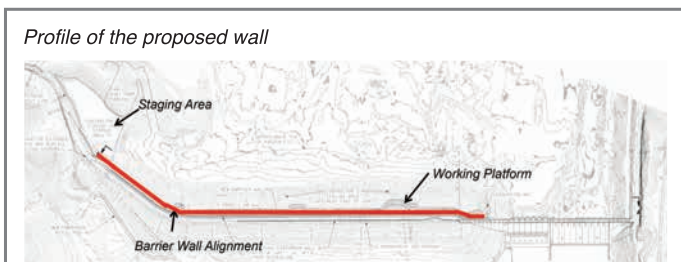
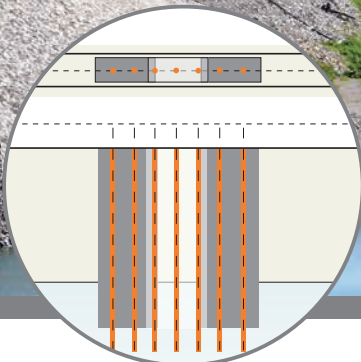
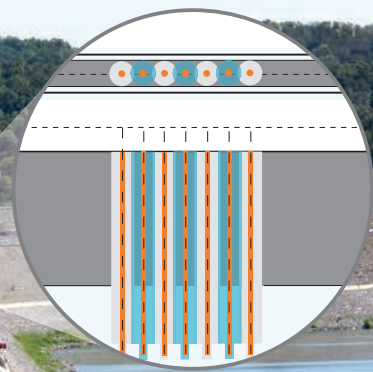
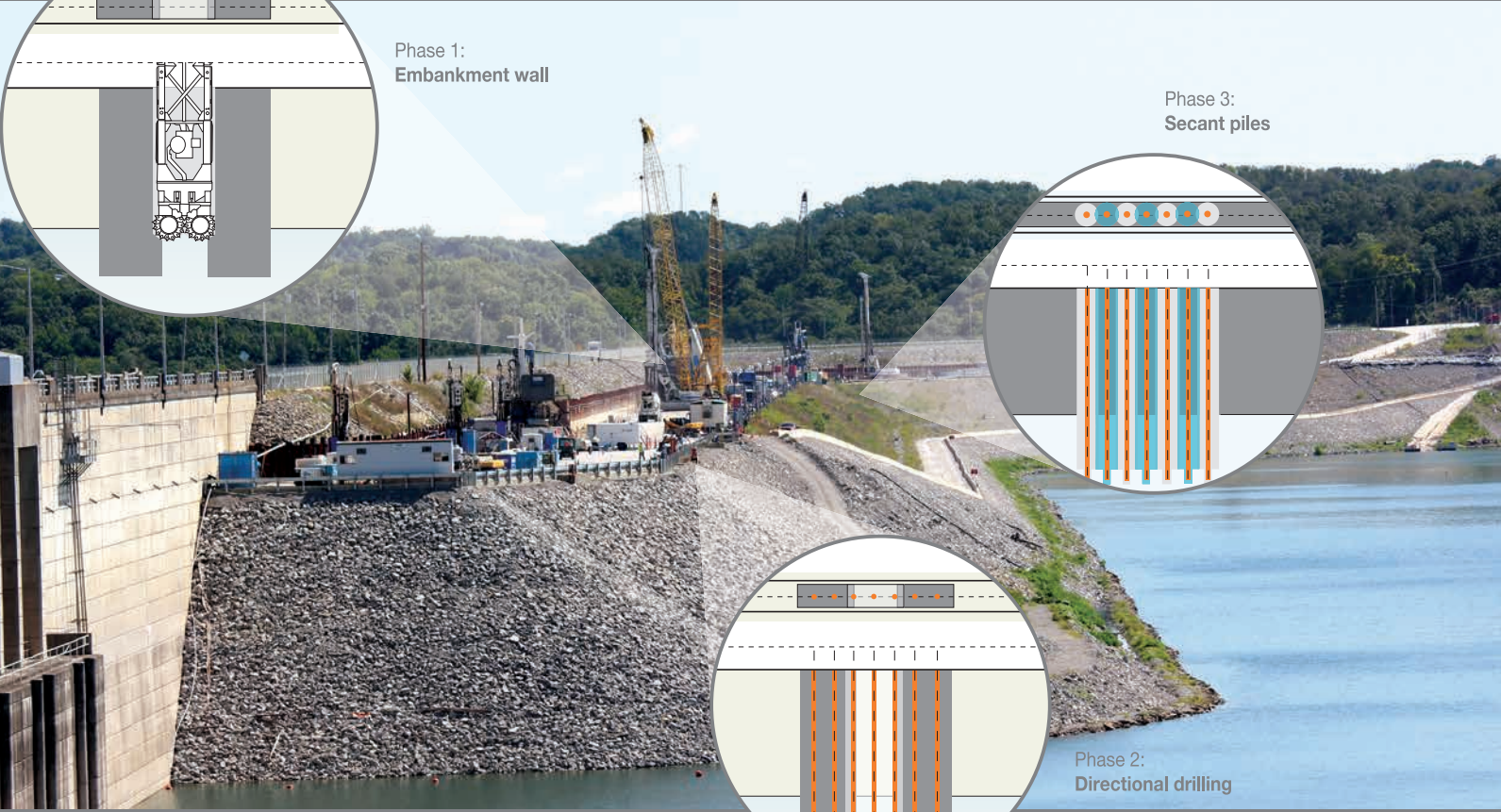
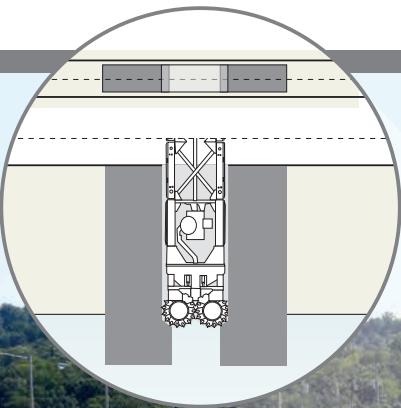
In order to safely protect the existing dam body during the subsequent pile installation, a 1.80 m wide Protective Concrete Embankment Wall (PCEW) was installed in the dam's embankment and into the foundation rock using a hydromill cutter. The concept of the PCEW has been introduced to the industry by the JV in this project and is now being considered for, and used in, other high risk dam remediation projects in USA.



Once the PCEW was completed in one area, several technologies were utilized in an unprecedented sequence to install the barrier wall itself. Some of these technologies were designed and developed by the Trevi Group specifically for this project, and then become breakthroughs in the foundation industry.

These new technologies are:

- **Directional Drilling**, used to guide the secant piles, which are installed with Reverse Circulation Drilling. These holes are drilled with an maximum deviation of 7 cm a depth of 85 m;
- **Slot Pile System** (known as the *Arapuni System*), which allows the sequential installation of several secant piles that are concreted in one operation, thereby increasing productivity and quality by eliminating the vertical cold joints usually required between secant piles.



As a result of this extraordinary technical and management effort, the secant piles section of the barrier wall had 1,196 joints totaling about 85,000 linear meter. Only one pile required replacement because it was not within tolerance specifications. This pile was required in the technique areas while the techniques were being developed. The extraordinary quality of the barrier wall is attributable to the techniques pioneered on this job for installing, steering, and measuring the positioning of wall elements in real time.

A distinctive feature of the QA/QC system at Wolf Creek Dam Project was the implementation of a 3-D data management system, which allowed for the processing of large amounts of information on a daily basis, and also simplified the final evaluation of the barrier wall quality before its final acceptance. As a result of the exhaustive QC system, the JV was able to considerably and consistently exceed the client's performance requirements and measurement of the barrier wall. The USACE Nashville District team was able to conduct a comprehensive technical evaluation, which provided analyses and documentation that typically would have taken several labor-months to be prepared.

It was concluded that our team built a high quality wall, which met or exceeded depth and length requirements necessary to remediate the seepage issue. The meeting, held in March of 2013, just six days after the completion of the barrier wall, was successfully concluded with an agreement to start raising the Wolf Creek pool.

The JV set a tremendous safety open record with 1.35 million hours, i.e. more than 1,000 days, without any lost time incident.

The USACE has stated that the Wolf Creek Dam project is a “model” for future dam remediation projects. This project has been awarded the Deep Foundation Institute’s 2013 Outstanding Project of the Year Award and the Association of State Dam Safety Officials’ (ASDSO) National Dam Rehabilitation of the Year Award for 2013.



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