



Stabilizing the I-4 Maitland Boulevard Interchange Sinkhole

Interview by Jim Martin, Global-5 Communications

In December 2008, the Florida Department of Transportation (FDOT) began the construction effort required to stabilize a sinkhole located within the Interstate 4 and Maitland Boulevard interchange. Crews are doing the work now to prepare the interchange for the future widening of I-4, which will be accompanied by a reconfigured interchange. To stabilize the sinkhole, workers are injecting cement grout into the ground under high pressure to depths greater than 350 feet. The I-4 Maitland Boulevard Sinkhole stabilization is one of the largest sinkhole grouting projects ever undertaken in the United States.

Jim Martin recently conducted the following interview about the Interstate 4 and Maitland Boulevard interchange project with Engineers Gary Kuhns and Kathy Gray.

MARTIN: How big is the I-4 Maitland Boulevard Sinkhole compared to other sinkholes?

KUHNS: Sinkholes come in all sizes, from three feet in diameter to more than 300 feet in diameter. When you fly in a plane over Central Florida, the numerous ponds, lakes and wetlands you see were mostly created by the sinkhole formation process. The I-4 and Maitland Boulevard sinkhole is about 325 feet in diameter, which is very large compared to most sinkholes. The largest Central Florida sinkhole formed in recent times is the Winter Park Sinkhole, which occurred in 1981, and it also has a diameter of about 325 feet.

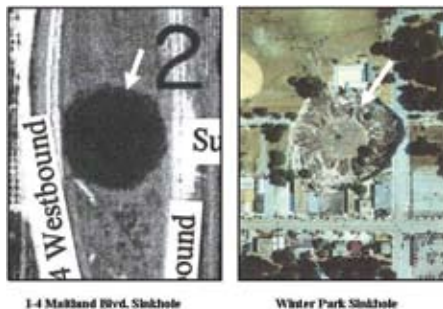


Figure 1. Comparison of I-4 and Maitland Boulevard Sinkhole with the Winter Park Sinkhole.

MARTIN: What does the ground below the I-4 and Maitland Boulevard Sinkhole look like?

KUHNS: The soil profile around the sinkhole is comprised of a surface sand layer that extends to a depth of about 40 feet and is underlain by clay. Limestone (rock) is usually present under the clay at a depth of about 75 feet. However, within the center of the sinkhole the limestone is about 300 feet

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Kathy Gray, PE is the District Geotechnical Engineer and supervisor of the Florida Department of Transportation (FDOT) District 5 Geotechnical

Office. She is responsible for the Department's geotechnical activities in nine Central Florida counties. Her office provides geotechnical support for the design, construction and maintenance of FDOT facilities.



Gary Kuhns, PE is President of Geotechnical and Environmental Consultants Inc. (GEC), based in Orlando and Kissimmee. Gary received the 2007 GMEC Award in recognition of his

outstanding service to the geotechnical and materials engineering profession. In 2004, GEC was honored with the FICE Grand Award for Engineering Excellence for Gary's work on the Pine Hills Sinkhole (Orange County).

Stabilizing the I-4 Maitland Boulevard Interchange Sinkhole Continued deep. Above the limestone, the sinkhole is filled with layers of very soft, weak soil as shown on Figure 2.

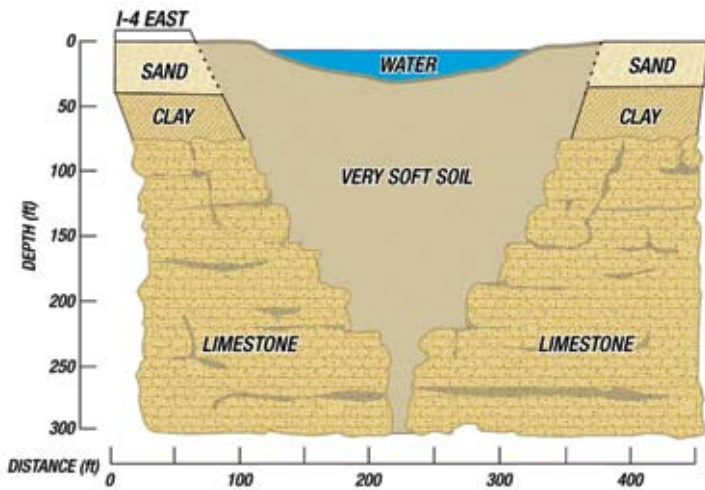


Figure 2. Profile of the ground beneath the I-4 and Maitland Boulevard sinkhole.

MARTIN: Why does the sinkhole need to be stabilized before I-4 is widened over the sinkhole?

GRAY: There are two reasons that the sinkhole must be stabilized prior to construction: 1) to help prevent a re-occurrence of the sinkhole and 2) to strengthen the soft soils within the sinkhole so that they can support the future highway. Although the risk of sinkhole re-occurrence is low, the FDOT is taking the precautionary step of plugging the hole, or holes, in the top of the limestone. The weak soils within the sinkhole are the primary concern, since if left untreated they could cause excessive settlement of the highway over time.

MARTIN: How will the sinkhole be stabilized?

KUHNS: First, pipes will be drilled into the ground until they reach the top of the limestone layer, which will vary from about 75 to 300 feet below ground surface. Then a water, sand and cement mixture, called grout, will be pumped through the pipes to fill holes and cracks in the limestone surface as shown in Figure 3.

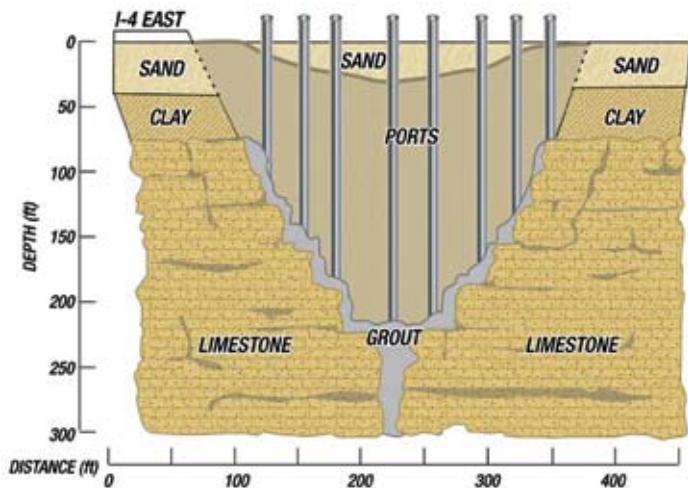


Figure 3 Injection of cement grout to seal limestone surface



Figure 4. Sinkhole grouting operation at the I-4 and Maitland Boulevard Interchange

After the top of the limestone has been sealed with grout, the pipes will be raised in 1 foot increments up to the ground surface. Grout will be pumped through the pipes into the ground as the pipes are raised to strengthen the very weak soils within the sinkhole. As a further step to strengthen the soils within the sinkhole, a mound of soil about 28 feet high will be placed over the sinkhole after the grouting is completed. This is called a “surcharge” and is shown in Figure 5.



Figure 5. Surcharge to strengthen weak soil remaining after grout injection

The weight of the soil surcharge will compress the underlying weak soils over time, making them strong enough to support the future highway. The settlement of the soft soil will be monitored during and after construction of the surcharge to determine when the soil within the sinkhole has been adequately compressed. At that time, the soil surcharge will be removed.

MARTIN: How do you know the sinkhole will be stabilized?

GRAY: The FDOT geotechnical engineers and their consultants have extensive experience in sinkhole stabilization and the methods that will be used to stabilize the I-4 Maitland Boulevard Sinkhole have been successful on many past projects. The FDOT is taking the appropriate precautionary steps to assure that future risks associated with the sinkhole will be minimal.

MARTIN: How much grout will be used?

KUHNS: It is anticipated that up to 35,000 cubic yards of cement grout will be used to stabilize the sinkhole, which is about 7 million gallons. That would be enough grout to fill 400 swimming pools.

MARTIN: What other construction work will be performed at the site?

GRAY: The eastbound lanes of I-4 will be temporarily shifted to the west to make room for the surcharge, and a wall about 28 feet high will be constructed along the east side of I-4 to separate the surcharge from the highway. Also, stormwater ponds and other drainage improvements will be constructed within the interchange as part of the project.

MARTIN: How long will construction last?

GRAY: The grouting process is expected to take six to nine months to complete. Construction of the soil surcharge and wall will require about 2 months. The entire construction should be completed in about 18 months. Settlement of the soil surcharge will be monitored for several years after construction is done.

MARTIN: How much will it cost?

GRAY: The overall cost of the project will be about \$9 million.

MARTIN: How does stabilization of the I-4 Maitland Blvd Sinkhole compare to other sinkhole stabilization projects?

GRAY: The I-4 Maitland Boulevard Sinkhole stabilization is one of the largest sinkhole grouting projects ever undertaken in the United States. In addition, surcharges in this area are usually not greater than about 10 feet high. The surcharge for the I-4 Maitland Boulevard Sinkhole will be more than twice as high as usual. As you can see, the FDOT has devoted considerable effort and resources to make the future I-4 a safe and reliable highway for Central Florida's citizens and visitors. ■

In addition to FDOT, members of the project team include the following:
GEC – Geotechnical Engineer,
Earth Tech – Grouting Contractor,
Hubbard Construction – General Contractor,
PB Americas – Design Engineer,
DRMP – Construction Engineering Inspection (CEI),
and Global 5 Communications – Public Information Consultant.

About the Author:



Jim Martin is a transportation planning, government and community relations manager with Global-5, Inc., a business that specializes in public relations, public involvement, marketing, multimedia and technology-based training. Since 2002, he has been the Public Information Officer for Interstate 4 construction projects totaling \$397.5 million. Martin's experience as the Supervisor for the Florida Department of Transportation District V Intergovernmental Liaison Office has given him a unique insight to community transportation concerns.

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