



# The Roads of Pemba

*A surveyor's journey to a distant and different land.*

Just off the east coast of Africa, the island of Pemba is part of the Zanzibar archipelago of the nation of Tanzania. In 2009, the regional government initiated an US\$11 million (€8.2 million) project to rehabilitate roughly 45 km (28 mi) of rural roads to improve safety and maintainability. As part of the project, the Swiss company GRG Ingenieure AG was hired to develop post-construction information on the roadways. GRG assigned surveying engineer Adrian Holzer to conduct the field surveys on Pemba.

Before traveling to Pemba, Holzer completed initial planning for the work. Faced with limited information on the roads and conditions, he scoured numerous sources to find information about the project. But compared to other projects he had worked on, many details were still uncertain. With only one month to plan and prepare for the work, Holzer needed to rely on his experience and flexibility to get the job done. "Part of the road construction was not even finished," he said. "Although there was a lack of basic information, there were many ideas floating around. In my discussions with other surveyors, some approaches began to take shape."

Holzer's route to Pemba took him through Dar es Salaam on the Tanzania mainland. He was not traveling light. Because of the short time frame, he carried his equipment as baggage. His "luggage" included two Trimble R8 GNSS receivers, a TSC2 controller, a laptop computer, a base radio for RTK and a generous assortment of cables, chargers and accessories. Holzer said that the waiting room in the Dar es Salaam airport brought back memories. "Twenty years ago I sat in the same room while traveling with my father," he said. "He worked as a physician in Tanzania and made regular trips to Zanzibar. Flight delays were

common and I was a very impatient child. My father paid me 100 Schillings for every 15 minutes in which I sat still and was quiet during the seven hours we had to wait. If you asked me today, I would never do that again for so little pay."

When he arrived in Pemba, Holzer rechecked his equipment to make sure everything was in good order. Then it was off to the neighboring island of Zanzibar, where he met the project leader from Switzerland. Armed with a letter of reference from the Ministry of Transport, the two went to the office of the Minister for Surveys and Mapping, where Holzer began to learn about how things work on the islands. "The Minister was away," Holzer recalled, "and no one in the office knew how to find the data we needed. We were steered to several different offices. Eventually we happened to meet a man from Finland who explained how land surveying is organized in Pemba and Zanzibar."

Finally, Holzer's task was defined. He returned to Pemba and the next day got down to work. He was to map more than 40 km (25 mi) of road, developing information on horizontal alignments, longitudinal profiles and civil structures such as bridges, culverts and drainage structures. He also needed to capture locations and data on distinctive objects such as mosques, power lines and antennas. He would use RTK for all of the surveying. Holzer was now on his own—a one-person crew, functioning far removed from the familiar terrain and culture of his home in Switzerland.

An unexpected challenge quickly emerged: eating. There is a large Muslim community on Pemba and Holzer had arrived in the month of Ramadan. During the day, food is not available

and he needed to persuade the cook to give him some basic items to sustain him. "Eating was only possible in the car," he said. "Anything else would be considered impolite." Holzer also needed to plan his work to come near a mosque at mid-day, allowing his driver to participate in noon prayers.

With a routine established, Holzer began to make progress, measuring sections of road each day while dealing with the rural region's high temperatures and dust. Because he carried a low-power radio for his RTK base station, Holzer frequently moved the base station as the survey progressed. His work frequently attracted onlookers, including crowds of children. When working in forested areas he changed position often, lifting the receiver and looking towards the sky while waiting for a signal. "I thought the people watching me must be thinking I had lost my mind," he said, "but I was mistaken. In talking with the spectators, I found most of them knew what a GPS receiver is. They even asked me precise questions about the accuracy of the instrument."

In order to put his own survey into the national coordinate system, Holzer needed to measure some permanently marked control points. He obtained documentation for the control, which was in surprisingly good condition. However, using the documentation was not an easy task. Holzer hired a local surveyor, who easily navigated to the control points.

Holzer said he and the surveyor quickly developed a bond as they found and measured the needed control. Even after Holzer had collected sufficient data, the surveyor insisted on visiting more control points that lay in scenic locations. Convinced by the gleam in his counterpart's eye, Holzer agreed to go along and see the other points. They were, he recalled, "exceptionally beautiful places."

After a month on Pemba, Holzer had completed his fieldwork. His data included roughly 4,000 individual points on about 40 km (25 mi) of Pemba roads. He captured centerlines; culverts, ditches and bridges; electric facilities, radio and cellular antennas; and stone gabions. He also collected the location of the mosques along the roads.

While on Pemba, Holzer used Trimble Business Center to analyze each day's data. With a return visit out of the question, Holzer needed to be sure everything was in good order before leaving the island. Using a local coordinate system, he confirmed that his work was accurate and complete. Final processing and adjustment to the national coordinate system would wait until he returned to Switzerland.

With the work complete, Holzer flew to Zanzibar, where the celebration marking the end of Ramadan was underway. He filled his mind, and stomach, with the colorful scenery and festive food. It was a happy end to a successful journey.

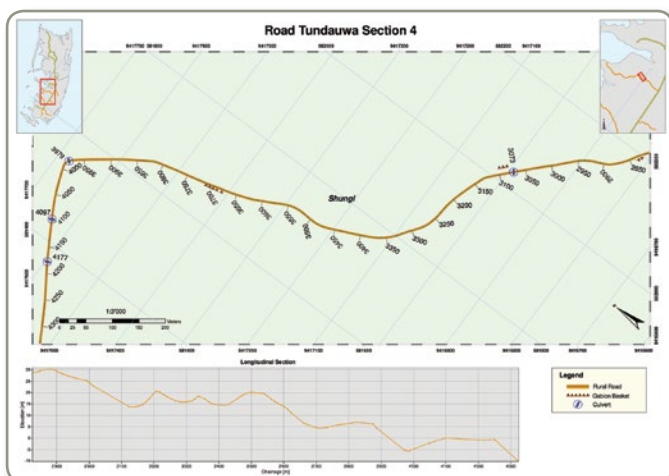
See the original article in *The American Surveyor*, Aug. 2014: [www.amerisurv.com](http://www.amerisurv.com)



*Pemba residents pose with surveyor Adrian Holzer. Holzer's work often attracted curious onlookers.*



*After sunset, Holzer could dine with his local colleagues.*



*A typical deliverable from Holzer's survey included plan and profile views of a Pemba roadway.*