

# Rebuilding Lives and Villages

After the Great Sichuan Earthquake destroyed many villages and homes in China, survey crews set out to begin the rebuilding process.



▲ HBSM survey teams before leaving on the 1,243-mile journey to Sichuan Province.



▲ Team members survey among the rubble of a village.

Surveying in the aftermath of a local disaster demands perseverance, patience, compassion, and a dedicated, experienced survey team. On May 12, 2008, the earth beneath the Sichuan Province of western China shifted, generating a massive magnitude 8.0 earthquake. Although the three-minute earthquake was felt throughout China and Southeast Asia, the Sichuan Province was hardest hit.

The earthquake, aftershocks, and landslides reduced millions of business, homes, and schools to rubble. Nearly 80,000 residents lost their lives, and 360,000 were severely injured. Millions of residents lost everything, including their homes, families, and hope.

To rebuild the lost cities and villages of PingWu County in Sichuan Province, the Chinese government turned to the Hebei Bureau of Surveying and Mapping (HBSM) and its array of GNSS equipment for assistance. Less than two months after the earthquake, two teams from HBSM traveled to the disaster area to re-establish crucial boundaries and control points lost in six villages. These six villages included PingTong, DouKou, GuCheng, ShuiJing, GauCun and BaZi. Once these boundaries and control points were established, the process of rebuilding the villages could proceed.

Zhuang Quincun and Huang Hau, engineers from Sokkia China, led the HBSM teams on the 2,000-kilometer (1,243-mile) journey across China to reach PingWu County. It took survey teams two days of driving in three jeeps and one van to cross the country and penetrate the mountainous terrain of western China to reach the villages. Transportation lines to and from Sichuan Province had been severed by the earthquake but had been rebuilt to allow immediate relief efforts to proceed.

“The earthquake can destroy our homeland and harm our lives, but it cannot destroy the determination and confidence we have for our homeland,” Tian Zhi, director of the HBSM technical department says. “Now the phrase ‘let’s help the people in need and rebuild our homeland’ is our new duty and mission.”

## Overwhelmed by the Destruction

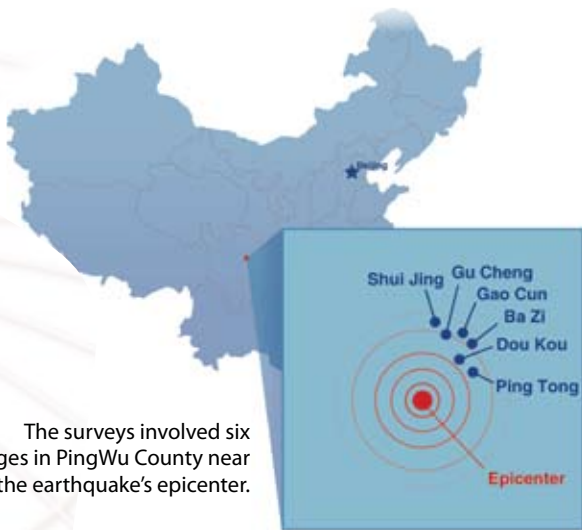
Once the HBSM survey teams arrived at the villages, each team member was overwhelmed at the magnitude of destruction. “We were all shocked by the disaster. Most of the buildings were broken down in the quake. Even though we all had seen the images of the earthquake destruction in the newspapers, nothing could have prepared us for the destruction we saw when we arrived in Sichuan Province,” Zhi recalls.

Before surveying could proceed, the survey teams were required to meet four criteria set by HBSM. HBSM teams selected Sokkia GSR2700 ISX GNSS receivers and the GSR2700 RSX GNSS Reference Station and Mobile Reference Station, combined with the SDR+ data collector:

1) *Surveys must be completed using the local coordinate system.*

For the surveys performed in Sichuan province, the reference location was in the center of PingWu County. PingWu County was one of the hardest hit by the earthquake in Sichuan Province, and the six villages to be surveyed were located there. The PingWu County’s coordinate system would require a specialized local system.

The SDR+ Coordinate System Manager converts data in various datum and coordinate systems, including accepted user-defined projections. They created a user-defined system,



The surveys involved six villages in PingWu County near the earthquake's epicenter.

based on the Transverse Mercator projection to meet the required local coordinate system. The team used the reference datum WGS84 and the Bursa Wolf transformation method for accurate coordinate transformation.

2) RTK was needed in an area of 45 kilometers (28 miles). A receiver capable of performing long baseline RTK was required.

To meet this requirement, the GSR2700 ISX and its AdVance RTK capability provided centimeter-level positioning, and the extended baseline range reached beyond 40 km.

3) The same RTK reference point would need to be accessed by several survey crews with different equipment.

The mobile reference station system was set up on the fly for the short-term needs of this survey for localized RTK coverage. RTK data was distributed in standard correction formats, supporting receivers from different manufacturers.

4) Because of the mountainous surroundings, a GPS receiver with excellent tracking ability was necessary.

To provide maximum satellite coverage in the mountainous and densely forested landscape of Sichuan Province, the receiver and its 72 universal GNSS channels supported all GPS and GLONASS signals. Having access to these additional satellites increased efficiency and coverage.

## Getting to Work

Once one of the receivers, positioned in PingWu County, had been established as a mobile reference station, team members could stream GNSS data from a receiver over a GPRS connection to the reference station in Wuhan, more than 900 kilometers (500 miles) from PingWu County.

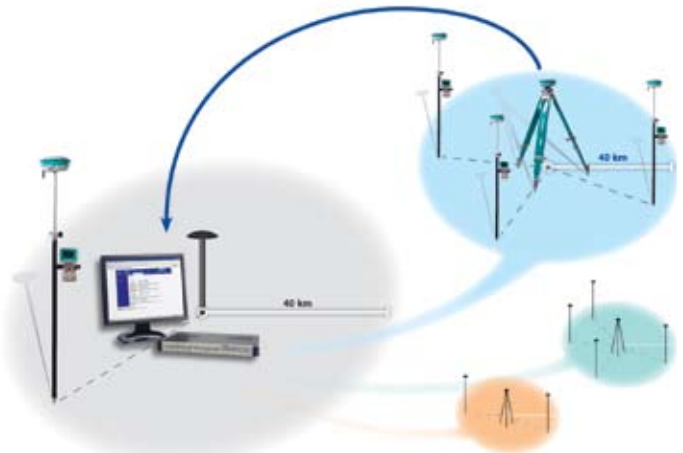
The reference station receiver, acting as a mainframe, then managed the data and distributed them to rovers within the 5,000-square-km working area of each reference station. Villages being surveyed were located in an 80-km area. Although any number of rovers can be supported by a reference station, the teams required four receivers for the job.

Many of the communication and electrical lines had been severed by the quake, and replacement of the lines was still being completed. Because of this, the reference station's ability to be used in areas without electrical hookups or internet access proved invaluable.

The Sichuan Province is far from the ideal location for performing a survey. Surrounded by the Himalayan Mountains to the west, the Qinling Range to the north, and the moun-



▲ Using a Sokkia GSR2700 ISX receiver as a rover to re-establish lost boundaries and control points.



▲ Surveyors used the receivers and reference station to create a mobile reference station.

tainous area of Yunnan Province to the south, the rocky terrain and isolated position of the villages presented daunting challenges. Mountains limit the number of satellites tracked, decreasing the accuracy of the data collected. However, the capability to track both GPS and GLONASS satellites, combined with RTK technology, delivered positioning performance that allowed the project to proceed. "The satellite geometry, for the most part, was not favorable," says Zhi. "With the receiver, we tracked an average of six to eight satellites. We were able to complete all surveys in just a week." He adds, "Even at a baseline of 43 kilometers, we could obtain an RTK solution in a reasonable time."

With the surveying complete, construction can begin on schedule to rebuild the businesses, schools, homes, and lives in Sichuan Province. Those involved in the future stages of the recovery process can be confident that the boundaries and control points established by the survey teams are accurate. Although many lives were lost in the quake, the surveyors were able to provide new beginnings for the millions of survivors. ♣

*ZHUANG QUINCUN and HUANG HAU are engineers with Sokkia Surveying Instruments Trading in Shanghai, China. ANGELA BOWMAN works for POINT, Inc., a firm in Olathe, Kansas that partners with Sokkia to develop positioning systems.*