Bridges Survey in the South-West of UK

By Reinaldo Alvarez Cabrera

During my recent visit to one of our partners in the UK, I was invited to attend a survey in Weymouth, Dorset. The client requesting the survey was a rather large construction company, which by the appearance of the town, were everywhere. My colleague explained to me that the reason for such massive construction work was the fast approaching 2012 Olympics in the UK and Weymouth is supposed to host some of the water sports events. Everything has to be nice and tidy by then.

The engineer in charge from Interserve Plc didn't have much previous exposure to GPR technology. This led to a short introduction at their local warehouse and showing him how to find and correctly identify a utility. The short survey went very well and soon enough we were able to find a pipe crossing one of the gravel roads in the storage yard at approximately 350mm depth. This was enough evidence for him of the suitability of the GPR for this kind of jobs. In a few minutes we were on our way to the real construction site were the actual survey would take place.

Fig. 1 Getting ready for the Survey.

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Due to safety regulations in the UK all of us were requested to wear protective shoes, reflecting vest, gloves and a helmet, of course. This was a little bit strange considering that the survey site was on a public street with many people walking around totally unprotected, but one has to follow the local regulations, that's just the way it is.

Fig. 2 Safety always comes first, even when slightly exaggerated.

Always follow the local regulations for safety and health protection. Consult with the local authorities whether or not a GPR survey can be conducted in the area without any potential hazards for the operator or the people involved in the survey as well.

I started by measuring the approximate attainable penetration in this area with the equipment we had at hand, a GCB-400 with as its name suggests 400MHz center frequency and approximately 118% bandwidth.
The useful data with good penetration turned out to be roughly 2 meters, but for our purposes that was

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more than enough. I also made a short survey for calibrating the RDP (relative dielectric permittivity) of the area in order to obtain correct values for the depth information. The engineer explained to us in general what they needed to find or establish and after making all the necessary adjustments to the collection software of the main control unit, an Akula 9000B, we were starting the survey.

Fig. 3 The first bridge to survey.

When looking for utilities try to keep the traces/unit reasonable high. Also beware of the excessive use of stacking. Preferable collect the profiles with the minimum length of two depths you wish to achieve. If you are careless about these options the data you collect will be hard to interpret or even missing targets that otherwise should be present.

In the first survey we were supposed to find out whether or not a bridge over a small creek had reinforcing bars in it or not. We were also required to find out the extend of these re-bar mesh, if it existed, and any weak point there might be in it. We went from the place where we had left the car doing a survey of the road to the bridge, over it and a little bit further. The re-bar mesh on the bridge was easily identified on the resulting profile, but it was bent down, sort of like hanging down. This, of course couldn't be right, and to my great personal surprise the engineer from Interserve Plc accompanying us pointed out the correct reason for that! The bridge had a slight mound over it so the actual depth to the

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re-bar mesh was constantly changing while walking with the survey cart over it. (Fig. 4 and 5)

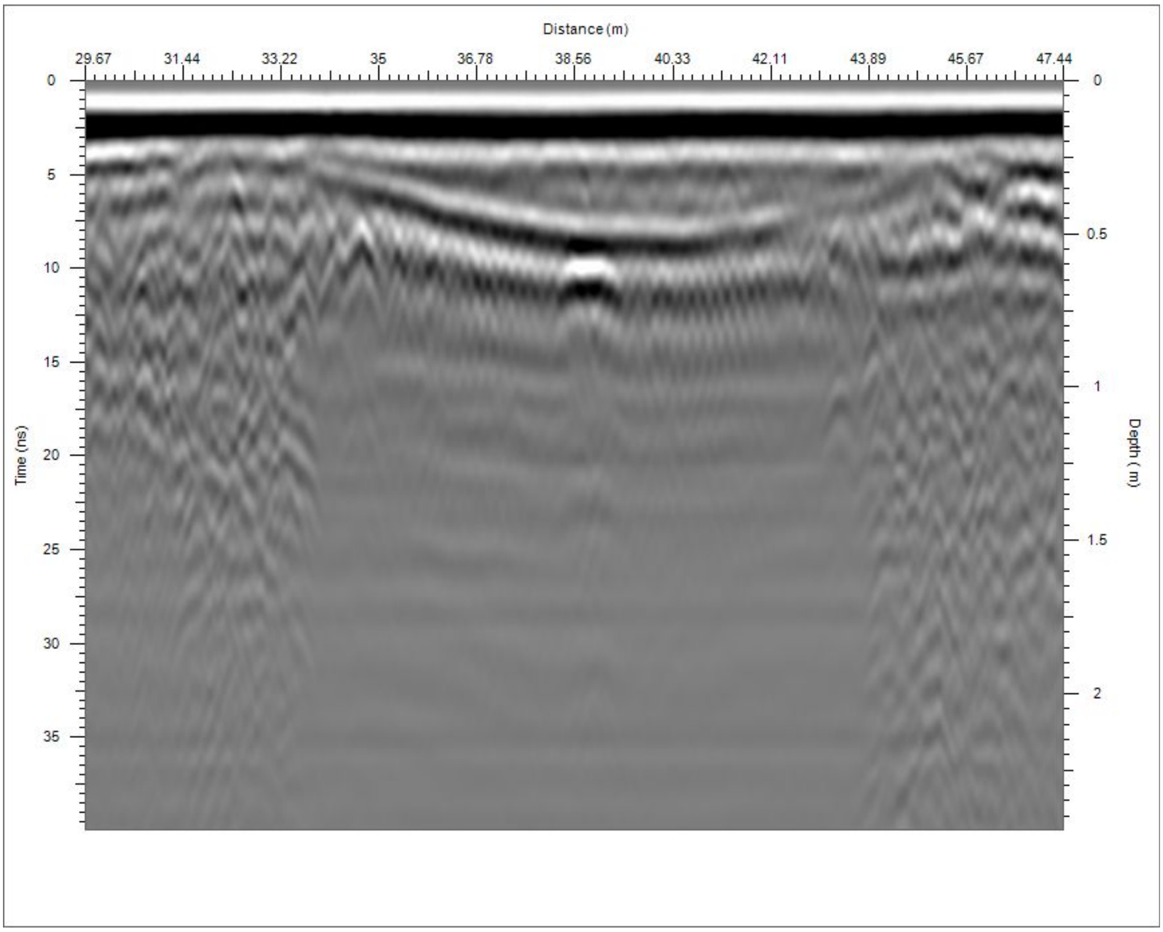

Fig. 4 The concrete slab with the re-bars “hanging” down.

The topography of the terrain under survey can significantly affect the results of the data collected. Try to make an assessment on whether or not extra surveys efforts should be employed. Sometimes the use of a simple GPS receiver with not so many bells and whistles can prove to be extremely useful later on when the collected data is to be processed.

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Fig. 5 Going downhill from the bridge.

None the less, the objective of the survey had been accomplished and we could identify that indeed there was a re-bar mesh there and that it had a couple of weak points, probably due to corrosion of the metal in the mesh or just moisture from the underlying creek. (Fig. 6)

I pointed out to the engineer in charge that the distortion of the visible re-bar mesh could be easily corrected in our post processing software GPRSoft PRO if we had the elevation information. Since we didn't actually had that information and the data was not collected using a proper GPS then I did the next best approximation. I used my phone GPS to sketch out an elevation profile of the survey area to be able to correct for the distortion of the re-bar mesh later on in the post-processing software. The approximation turned out to be pretty good and I got the profile of the road accounting for the elevation changes and an almost straight re-bar mesh. (Fig. 7)

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Fig. 6 The first bridge under survey.

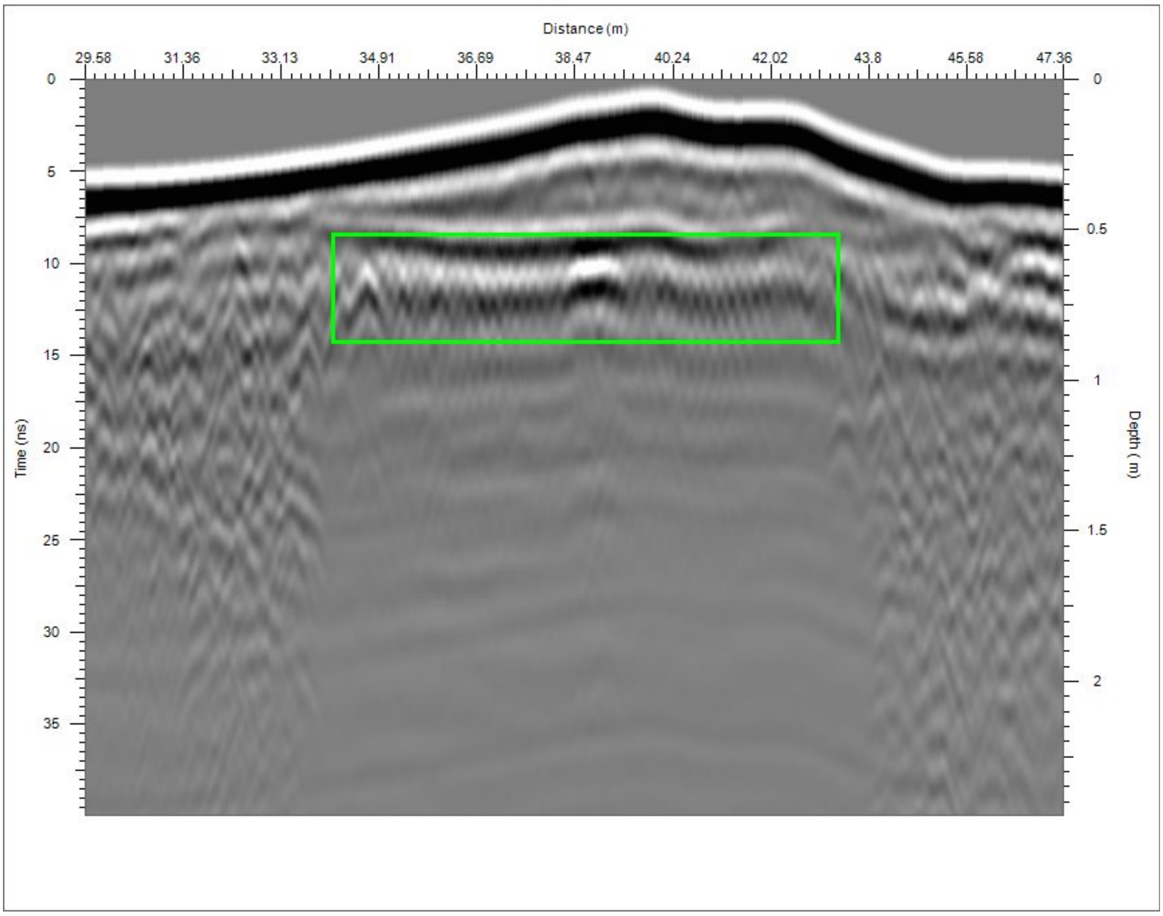

Fig. 7 The same data, but corrected for elevation.

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The next target was more of an exercise for our unit than an actual survey. The customer wanted to see what an arch of a bridge would look like in the radar profile. On the same track we had a high voltage line crossing the side walk and they wanted us to identify its location as well. Both of these tasks were completed successfully in a short period of time. (Fig. 8)

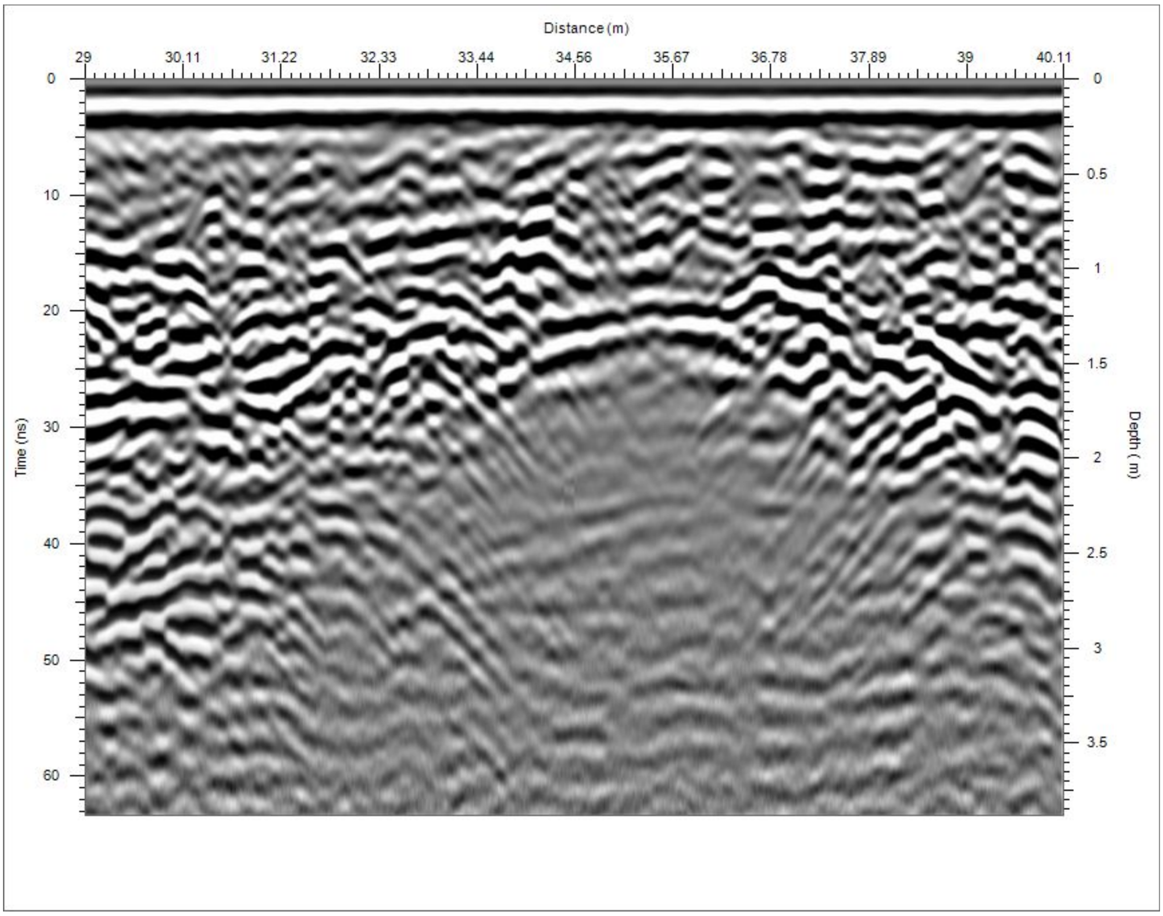

Fig. 8 The arch bridge data, it is not difficult to see where the arch is.

The third and final target was a small concrete bridge they needed to drill and were uncertain whether or not it had a re-bar mesh. This as in the first target site was an easy task for the equipment we had with us and promptly we were able to tell the customer not only the structure of the bridge, but also the thickness of the concrete slab. Because there were no re-bars on this particular small bridge we could “see” through it easily and the bottom of the small creek is beautifully delineated in the resulting profile. (Fig. 9)

I must point out here that although in all cases we were able to successfully conduct the survey and answer to all the questions asked by the customer, it is not recommended to use an antenna with 400MHz center frequency for doing these kind of surveys. The correct antenna for these tasks would have been the GCB-1000 with a center frequency of 1GHz. In that case we would have been able not only to tell the fact that there was or wasn't a re-bar mesh, but also the density of it and the re-bar diameter as well. Despite that, this shows how sometimes limited resources can be used to a great extend and can help to answer to a vast majority of questions coming from the customers side.

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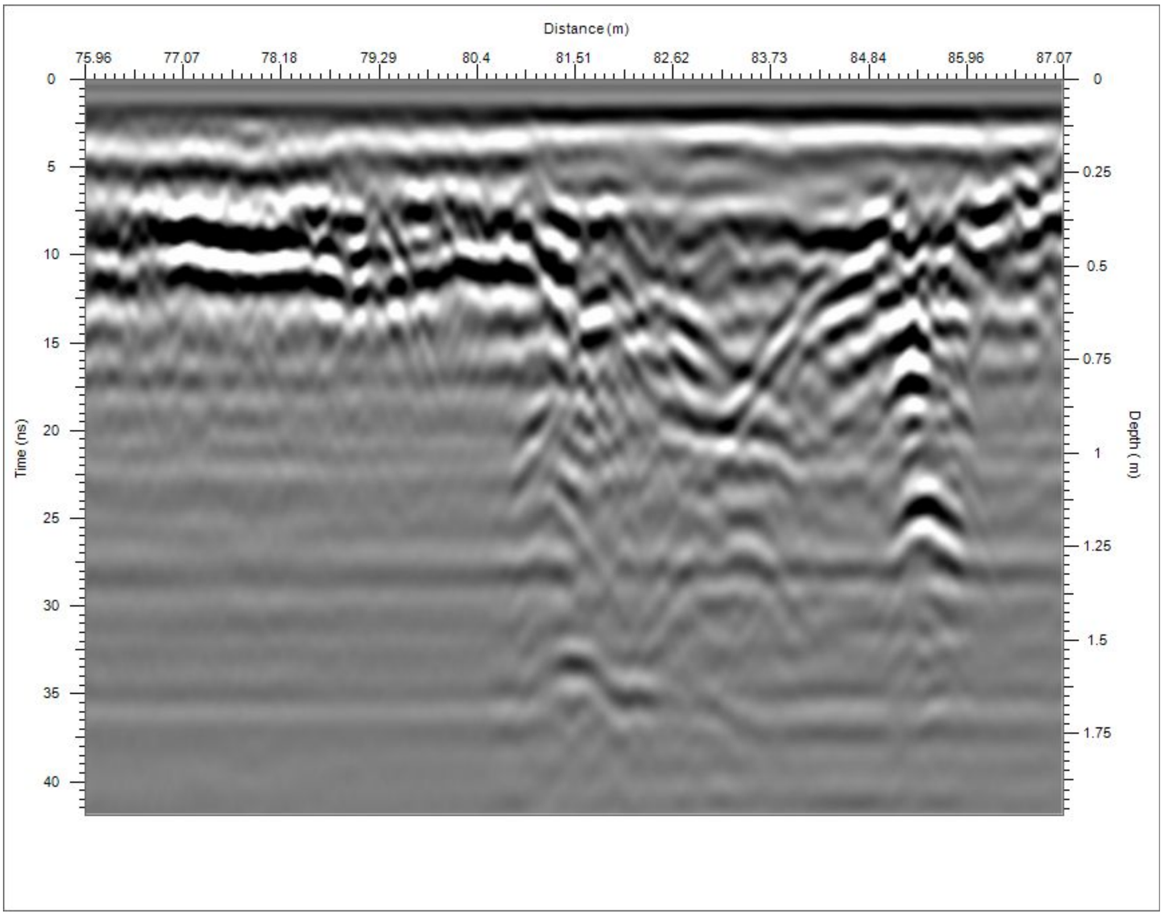

Fig. 9 The small bridge without re-bars.

I would like to thank the people from Phoenix Instruments Ltd in Yate, Bristol, for letting us to come along with them on this job. In particular to Adam Baker for listening to all my gibberish, during the long 4 hours drive to Weymouth and back. I also would like to thank our customers from Interserve Plc in the construction division for providing us with three men to conduct the survey.

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