



MAKING TRACKS IN FLEVOLAND

MODERN SURVEYING INSTRUMENTS AND PROCEDURES SPEARHEAD THE CREATION OF A NEW RAIL LINK IN THE NETHERLANDS

While the bicycle retains its popularity for urban journeys, many in The Netherlands are abandoning the roads and turning to the train for travel further afield. With nine out of 10 trains arriving on time, this mode of environmentally-friendly travel is enjoying a high and rising level of customer satisfaction. The result: an unprecedented 13 per cent increase in passenger numbers over the past three years [1].

Maintaining and improving an infrastructure that carries a million passengers and 80,000 tons of freight a day over 6,500 kilometres of track poses no small challenge for ProRail, an organisation that manages it on behalf of the Dutch government. [2]

Missing link

Although the national rail network as we see it today (Fig.1) was largely complete by 1900 [3], the more recent drainage of the Zuiderzee to create the province of Flevoland brought with it the need for a high speed line connecting its thriving capital, Lelystad, with the provinces of Gelderland and Overijssel to the north and east and where further economic development is regarded as of national importance.

To provide the missing link, construction of the *Hanzelijn*, a 50-kilometre route between Lelystad and Zwolle (Fig.2), commenced early last year and is scheduled for completion by the end of 2012 at a cost of a billion euros.

The task for ProRail is many and varied: public consultation, land acquisition, archaeological excavation, environmental and geological assessment – all prior to the awarding of contracts and the overseeing



FIGURE 1: (Top): Main line network with Hanzelijn route in blue

FIGURE 2: (Above): The route from Lelystad to Zwolle

HANZELIJN: KEY FACTS

- Overall length 50 km
- 1 km-long rail bridge over the River IJssel
- 800-metre rail tunnel under Lake Drontermeer
- Elevated road crossings and a new interchange for the A6 motorway
- 2 new intermediate railway stations
- Upgrading of existing main stations at Lelystad and Zwolle
- Construction involving 3.5 million m3 of sand
- 20 km of sound barriers
- 200 km/h services will cut journey times by 30 minutes

of construction activity. A pre-requisite to many aspects of the project... and one critical to their timely completion against *Hanzelijn's* ambitious timescale... is accurate site surveying.

Experienced team

Given this background, it is no accident that Nijkerk-based Prisma, one of the nation's most experienced surveying teams, was engaged by prime contractor BAM Civiel. Its task is twofold:

Perform a baseline survey for the 25 km stretch between Lelystad and Lake Drontermeer for which BAM is responsible under a design-and-build joint venture with Van Oord Nederland, and,

Conduct site surveys for all work involving traffic crossings and concrete construction.

One might imagine a small army of surveyors being deployed by Prisma but nothing could be further from the truth. "Tolerances are extremely tight, but thanks to the technology at our disposal, we've been able to perform the preliminary work with just one crew," notes the company's project manager Greg Burnett. Importantly, the activity is underpinned by quality procedures proven in earlier projects such as the HSL (High Speed Train) line between Amsterdam and Rotterdam and which are now central to Prisma's *modus operandi*.

Taking control

Establishing control networks for narrow but lengthy land corridors such as rail and

highways can be particularly challenging. Here, Burnett has employed Sokkia's advanced GPS/GLONASS receiver, the GSR2700 ISX, to obtain RTK measurements accurate to within 2cm.

"Achieving precision on a consistent basis in this preparatory phase is vital. Shortly, the bulk of the concrete construction will begin, requiring the support of our 35-strong workforce. The margin for error will then be wafer thin," he says, pointing to earlier delay in getting the *Hanzelijn* project underway that must be made good if it is to be completed on time.

Co-ordinates gathered by the all-in-one GSR2700 (receiver, antenna, Bluetooth technology, memory, batteries and internal data link - Fig.3) were initially relayed over its

GSM wireless link to a VRS subscription service for verification and error correction. This has since been superseded by use of Prisma's own reference station at its Nijkerk office and Sokkia Europe's 40km baseline RSX reference station at its European headquarters in Almere. This densification of the control network means that operators can obtain RTK-level accuracy along the entire project route, from Lelystad to Lake Drontermeer, at zero cost.

Productive working

With manpower at a premium and time of the essence, the baseline survey has made good use of another instrument from Sokkia, the SRX robotic Total Station (Fig. 4). Ideal for single-operator working, its auto-pointing,



FIGURE 3: Prisma's Greg Burnett (left) and Eelco Visser from MeetConsult discuss the finer points of the GSR2700 ISX GNSS receiver (Photos: Peter FitzGibbon)



FIGURE 4: The SRX robotic Total Station at work as a six-metre embankment takes shape near Dronen. In the background, fine sand dredged from the Zuiderzee is piped directly into a prepared profile. When settled, it will provide a firm track bed for Hanzelijn's double-deck trains. (Photo: Peter FitzGibbon)

auto-tracking features have proved invaluable in gathering highly accurate measurements at distances of up to 1,000 metres. Burnett makes the point: "Like a lot of companies, Prisma has to work as efficiently as possible and using instruments such as the one-man Station makes us much more productive without adding to headcount."

At shorter range and for day-to-day field work, Sokkia's SET330 Total Station has proved itself a versatile and reliable workhorse. This compact unit employs the same proprietary Red-tech phase comparison technology as its SRX stable mate to yield ultra-accurate reflectorless measurements at distances of up to 500 metres.

Collected data are downloaded at Prisma's office for use in AutoCAD, GBuilder (a

construction dimension tool from RAN Software), MOVE3 (a geodetic network adjustment correction package from Grontmij), the Spectrum Survey Suite from Sokkia (for GPS post processing), and other specialist software.

These are now being used by other surveying professionals to assist their own work on the project. For example, quantity surveyors have calculated the volume of material needed to construct the track bed. The latter utilises no more than fine sand dredged from the bottom of the Zuiderzee lagoon. This is pumped directly via a pipeline into prepared profiles (as per fig.4), eliminating the number of heavy truck movements that would otherwise be needed. Volumes are constantly monitored by GPS and everything

is being measured twice.

Helping hand

Fine sand, seawater and the rough terrain of construction sites inevitably take their toll on equipment, and with a large and growing inventory of Sokkia products in daily use, Prisma relies on a rapid repair and replacement service. Burnett has nothing but praise for MeetConsult in Almere, the exclusive Sokkia dealership in this part of The Netherlands and which is his first port of call when help is needed. Dedicated optical and electrical workshops located at Sokkia Europe's nearby office are an added bonus. It adds up to an efficient after-sales service that will help Hanzelijn stay on track – and provide the missing link in one of the world's busiest rail networks.

References:

- [1] Nederlandse Spoorwegen (NS) Annual Report 2007
- [2] ProRail figures
- [3] *Railways in the Netherlands, A Brief History, 1834-1994* by Augustus J. Veenendaal, Jr. 2001

Web Links:

- Sokkia Europe: www.sokkia.net
- Prisma: www.prisma-meten.nl
- MeetConsult: www.meetconsult.nl
- Netherlands Railway (Nederlandse Spoorwegen): www.ns.nl
- ProRail: www.prorail.nl
- BAM Civiël: www.bam.nl
- Van Oord Nederland: www.vanoord.com

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FIGURE 5: Artist's impression of the km-long replacement rail bridge to be built over the River IJssel near Zwolle (Photo: Welling/Zublin/Donges, ontwerp Quist Wintermans Architecten)