

Translink Infrastructure Division

Survey Report

Coleraine to Derry Track Relay

Methodology

Health and Safety

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Methodology

Geodetic Surveying

A key element of this project was the survey control and formation of a survey grid for future engineering works. The survey grid for this project was designed taking into consideration the overall length of the project and also be suitable to facilitate future survey extensions within the network allowing for continuity and survey cost savings.

The fundamental control was derived from a GPS Network working from the "whole to the part". Forward / backward compatibility between mapping grids is critical to the success of the control network.

Personnel

Basil Irwin.....Survey Manager
Roy Sinclair.....Project Surveyor
Stephen McKendry.....Senior Surveyor
Davin Cavalleros.....Surveyor
Laura McCool.....Surveyor

Equipment / Software Used

4 No. Leica Dual Frequency GPS Receivers
1 No. Leica Digital Level / Bar Code Staff
Leica Geo Office (LGO) Processing Software
LSS /CAD Processing Software

Reconnaissance/PGM Installation

Reconnaissance to position and install the 9 No. Primary Control Markers was carried out during the first week of the programme. These markers were placed in accessible locations – utilising overbridges, station platforms and level crossings to best effect. The installation and GPS observations of these Primary Stations was carried out without the need for track access.

Control requiring track access:

238 No. Secondary Control Markers were installed within the cess at 200/250m intervals along the full length of the project. These markers were installed at a safe working distance from the nearest active rail and were intervisible.

The Control Markers were a combination of road pins in hard surfaces / roads and Feno Earth Anchors in all other areas.

Primary and Secondary Control Stations

Horizontal Control (easting and northing)

Leica SR530 / 1200 dual frequency GPS receivers were used for the coordination of the Primary and Secondary Control Stations.

Primary Control Stations (9No)

The Primary Control Stations were observed for a minimum period of 4 hours at one second epoch using a minimum of three GPS receivers recording simultaneously. The Primary Control Station coordinates were held fixed as control for the Secondary Stations.

Secondary Control Stations (238No)

The Secondary Control Stations were observed in static mode only using two GPS Receivers "leap frogging" each other between adjacent stations with a minimum of one hour observation at each station. During the observation period one receiver remained static at all times. During these observations two Primary Control Stations were also occupied and one second data recorded for the duration of each days activity giving a minimum of two vectors at each Control Station location.

All Control Stations were tied to the National Grid using the OSNI Active Stations located near Kilrea and Omagh.

All GPS observations were processed using Leica GeoOffice (LGO) software.

The WGS84 coordinates derived through Leica GeoOffice were transformed to National Grid (ING) Eastings/Northings using the Ordnance Survey Grid Inquest Software.

During the topographic data capture an important check was carried out on the final control coordinates derived from the GPS observations. The straight line horizontal distance between each Secondary Control Station was observed using Total Station and checked against the computed GPS derived distances. All checks indicated that the distances were within the Contract specified tolerances.

These distance scale checks on survey control are mandatory within the process described and intrinsic to the Company's ISO 9001:2000 system.

Vertical Control (Height)

The Primary Control Stations were tied OS Datum (Belfast) using GPS observations. The orthometric levels (Belfast Datum) for the Primary Stations were derived from the GPS observations and Grid Inquest and were then held fixed.

All Secondary Control Stations were spirit levelled using a Leica Digital Level and bar code staff holding the GPS derived heights for the Primary Stations fixed.

All residuals between the Primary Control Stations were found to be within the Contract Specification.

Survey Grid /Transformation Parameters

The Primary and Secondary Control Stations for the project were initially computed in WGS 84 and transformed to National Grid (ING) coordinates and Belfast Datum using OSNI Grid Inquest software.

As National Grid coordinates contain a scale factor we agreed with Translink that the final mapping coordinates should be a **True To Scale (TTS)** grid system based on the National Grid with the scale factor removed.

After discussions with the client we agreed to use a False Origin (FO) at the 10km grid intersection south and west of the site and a **weighted mean** scale factor selected at the middle of the project, this scale factor was also reduced to mean sea level. This single transformation system can easily be used to convert coordinates back to National Grid (ING) should this be required

The Transformation Parameters for the Project were:

National Grid (East) - 240000m (FO) = Local Grid (East)
1.000089 (LSF)

National Grid (North) - 410000m (FO) = Local Grid (North)
1.000089 (LSF)

Note: the coordinates for the Survey Control Stations (PGMs) have been supplied in both National and Local Grid with the survey in Local Grid only.

Ground Survey

A detailed ground survey was carried out along the entire length of the project, approximately 54 kms using both the Primary and Secondary Stations as control. All work was carried using a combination of Leica TCA 1100/ 1200 Total Stations.

The primary objective of the track and topographic survey was to accurately survey the track including switches and crossovers (S&C) and associated cable ducts etc.

The running edge of both rails was surveyed using a Rail Shoe to ensure that the specified accuracies are achieved through the project length.

The data required at structures was surveyed using a Leica 1200 Reflectorless Total Station.

The survey included:

- 2 No. Railway Stations, Coleraine and Derry.
- 2 No. Tunnels, Castlerock and Downhill
- 42 No. User Worked Crossings (UWCs)
- 16 No. level crossings
- 24 No. Bridge / culvert surveys

The existing railway was surveyed fence to fence or 5m from nearest rail in areas of dense vegetation with a 7/8 point cross section observed at intervals of 10m on straights and 5m at platforms.

In addition all signals, existing surface utility features, culverts/outfalls, underbridge parapets were surveyed.

Final Data

The Final Data for the project was delivered in the following formats:

2d .dwg

3d .dwg

3d MX (Moss)

Health & Safety

F-BKS through established Health and Safety procedures within the company ensured that all surveyors fully complied with the agreed Health and Safety regulations.

F-BKS understand the requirement for Senior Surveyors, Surveyors and Assistant Surveyors to undertake work in areas on, or near to, railway lines or at railway stations and ensure that they can undertake these tasks safely whilst not presenting any risks to themselves, others working on that site or to the General Public.

All procedures were approved by our in house Health and Safety Officer (John Lennox).

The main hazards working on, or near to, railways relate to:

- safe place of work - overlap with Client activities;
- safe place of work - overlap with Contractor activities;
- being struck by passing train;
- electrocution;
- leaving items close to trackside;
- being struck by objects flung by passing trains;
- contact with poisonous plants such as Giant Hogweed, Foxglove, etc.

All surveyors were fully aware of the following:

- client site rules;
- Translink's standard risk minimisation policy;
- the Project Risk Assessment and Health and Safety Plan;
- requirements for Personal Track Safety (PTS) training;
- requirements to liaise with Client's TSC managing the trackside operations;
- approved points of access;
- designation of zones;
- availability of welfare facilities;
- correct Personal Protective Equipment (PPE) is worn at all times
- high visibility clothing (Orange in colour for trackside);
- safety boots;
- safety helmet when working in tunnels or under structures;
- gloves;
- ear defenders (if required).

The F-BKS Health and Safety Officer John Lennox worked closely with the appointed Project Health and Safety Officer from Translink and our Project Manager who was responsible for all site matters and client liaison.

John Lennox actively managed the following:

- that all Surveyors have current PTS certification and provided with the latest PPE;
- surveyors Railway working shifts are recorded and monitored inline with safety standards and Working Time Directive Legislation;
- every Surveyor is briefed on project risk assessments;
- every Surveyor is briefed on Method Statements or Work Package Plans and daily safety briefings and;
- safety issues are reviewed at regular office operations meetings.

Statement of Intent

From the viewpoint of safety at work, and in fulfilment of Section 2 of the *Health and Safety at Work etc. Act 1974 (UK)*, the *Safety, Health and Welfare at Work (Construction) Regulations, 2006* and the *Safety, Health and Welfare at Work Act 2005 (ROI)* and any future amendments, the policy of the Company is to safeguard, so far as is reasonably practicable, the Health, Safety and Welfare of all Employees.

This applies in particular to the provision of, and maintenance of, Safe Systems of Work (SSoW) and covers all work equipment and appliances used by Employees working on site.

The Company takes as much care as is reasonably possible to ensure the Health and Safety of other people who may be affected by our activities.

The Company considers that it is essential for this Policy to operate satisfactorily and to fulfil this aim it is very important to have the full co-operation of all the Employees of the Company. Therefore the Company gives every encouragement to its Employees to make suggestions and have discussions on any aspect of Health and Safety with the Manager with Responsibility for Health and Safety.

The allocation of duties for safety matters and particular arrangements, which are made to implement the Policy, are included in this Policy Document. Competent Health and Safety advice is provided by the group consultant. We would also ensure the suitability of contractors by accessing their Health and Safety Policies, Risk Assessments and other safety arrangements including consultation processes and agreed methodologies. The policy will be kept up to date, particularly if the business of the Company changes in nature and size. To ensure this, the Policy, and the way in which it has operated, will be reviewed as appropriate and at least every year.

Environmental Policy

F-BKS is a Fugro Group Company and has a committed environmental policy (Green Dragon Level 3). The Facilities Manager distributes all updates of the policy to the employees via e-mail and the notice boards situated around the office. Currently Fugro-BKS is working towards its ISO14001 Environmental Management Standard that will replace our Green Dragon Standard, this is expected to be awarded early in 2009. A copy of Fugro-BKS's environmental policy can be found below.

The Company creates geo-spatial information and provides services to the topographic and aerial photography industries. In delivering our service we are committed to continually improving our environmental performance.

- Comply with environmental legislation, regulations and orders and aim to minimise pollution from our activities;
- Prevent the risk of pollution and environmental impact and ensure that all relevant measures are in place to minimise the effect of accidents or mishaps;
- Reduce the consumption of natural resources and use recycled materials where possible;
- Recycle and reclaim whenever possible with regard to packaging and waste from our production processes;
- Encourage continual environmental performance through the setting and reviewing of objectives and targets;
- Ensure that documentary procedures have been implemented, maintained and made available to all staff.
- Ensure that the parent company's expert in the environmental field audits our procedures and site regularly and provides a report to the Board of Directors. He/she should also ensure that any changes in legislation are notified to the Company.
- Provide for the publication of the Environmental Policy internally by posting the document in the premises of the Company and externally to all interested parties on request.
- We will review this policy on an annual basis.
- Adhere to and strive to advance our Environmental Standards.