



**Environmental Surveys and
Ground Investigations
Information for Landowners**



FORTHREPLACEMENTCROSSING

www.forthreplacementcrossing.info

INTRODUCTION

The Forth Replacement Crossing is a major infrastructure project for Scotland. In December 2007 the Scottish Government confirmed its intention to build a multi-modal cable stay bridge to the west of the existing Forth Road Bridge, which despite significant investment and maintenance over its lifetime is now showing signs of deterioration. The replacement bridge will maintain this vital link in the transport network, safeguarding the future of cross-Forth travel and the Scottish economy.

Environmental surveys are carried out at an early stage on major infrastructure projects and continue throughout the development of the scheme. A wide range of surveys is necessary to give a full picture of the features of the landscape and the wildlife, flora and fauna that inhabit it. The information is used to assess the potential impacts of the scheme on the environment, including communities, and allow mitigation measures to be put in place which reduce these impacts.

Ground investigations reveal the soil and rock strata that exist in the vicinity of the proposed scheme. As the Forth Replacement Crossing crosses a sizeable body of water, these works will include marine investigations as well as on-land investigations. Some preliminary ground investigations have been carried out in the Forth area in the past and more detailed investigations are now required to supplement and update those findings. The results of ground investigations are used by engineers to inform decisions on the alignment of the road, the location of structures such as bridges and cuttings, and the materials to be used in construction.

Wherever possible environmental surveys and ground investigations will be carried out within public land, however it is often necessary to carry out work on private land. Landowners will receive formal notification in advance of any works and wherever possible Transport Scotland will seek to arrange for access to take place at a mutually convenient time.

This document has been prepared to give landowners an overview of the kinds of surveys and investigations that may be necessary and what they entail.



ENVIRONMENTAL SURVEYS

Environmental surveys are carried out in order to gather information for Environmental Impact Assessment (EIA). The results of the assessment process will be reported in an Environmental Statement which is published at the same time as the draft orders for the scheme and is a publicly available document.

The type of surveys which are expected to be required on the Forth Replacement Crossing include:

I. ECOLOGY

Ecology surveys involve observing and recording the different habitats and species, both protected and non-protected, within the proposed development area. The surveys will consist of visual inspections and sampling of the different habitats and species, and will be carried out by ecological specialists.

The ecology surveys include:

Extended Phase I Habitat Survey

A Phase I Habitat Survey identifies and maps out the main habitat types in an area and is a system of habitat classification designed for use in rural and urban environments. It involves recording the nature and extent of semi-natural and man-made plant communities. Bryological (moss) species and important invertebrate habitats will be included in the survey.

National Vegetation Classification (NVC)

National Vegetation Classification (NVC) surveys will be undertaken on all sites which have been identified for their notable botanical features and plant life. The survey consists of observing and noting the plants that are present in the areas concerned.

Otters

The otter surveys will aim to identify all areas of known otter habitat and otter populations within the survey area and will also consider areas into which otters may spread. All watercourses or other water features within the survey area will be surveyed for signs of the presence of otters.

If found to be necessary, repeat surveys may be implemented to account for seasonal variations in otter activity and to identify expanding populations at watercourses where the presence of otters is not confirmed by the first survey or where potential breeding holts have been identified.

Water vole and water shrew

All river banks, watercourses, wetlands and standing water bodies within the vicinity of the proposed development will be surveyed for water voles and water shrew. Where further investigation is found to be appropriate, watercourses and ponds will be surveyed from within the channel or pond, where practical, to give the best view of bank habitat and increase the probability of detecting signs of water vole presence. Wetlands, such as areas of peat bog or grazing marsh, will be searched for signs of water voles by systematically surveying

along all drainage ditches, the edges of all significant standing water bodies and along a series of parallel tracks.

Birds

Breeding and wintering bird surveys will be undertaken for a variety of terrestrial habitats throughout the study area. Ecologists will identify discrete higher value habitats to be surveyed, together with a sample of lower value habitats. Breeding surveys will be undertaken from early to mid-morning in late March to mid-June 2008. Wintering bird surveys will be undertaken during daylight hours from October 2008 to March 2009.

Incidental sightings of priority bird species will also be recorded during the other ecological surveys to provide additional information on the presence of species within the survey corridor.

Bird surveys will also be undertaken for a variety of estuarine and coastal habitats including open water, mudflats and saltmarshes, and in adjacent fields and other areas. These surveys will mainly look for qualifying species of the Firth of Forth Special Protection Area (SPA) but will also include additional relevant species. Surveys will be undertaken from vantage points during daylight hours from October 2008 to March 2009.

Badgers

All areas of woodland, scrub, fields, hedgerows, stone walls, paths and other features within the survey area will be studied in order to locate badger setts, paths, evidence of foraging and dung pits.

A bait marking study will be undertaken where necessary to establish the territorial boundaries of specific social groups. This will mean that setts which require relocation can be moved within the existing territorial boundaries and specific habitat mitigation can be put in place.

Bats

Desk-based research and walkover surveys will be undertaken to identify potential roost sites, foraging habitat and linear features such as tree lines, hedgerows, or watercourses, and to predict potential bat commuting routes. Detailed habitat assessments, emergence counts and activity surveys will be carried out in the day time, evening, night time and at dawn. Visual observations are used for daytime and dawn surveys and small bat-detecting devices may be installed in some locations within the survey area to detect bat activity at night.

Where initial surveys indicate that bats may be present in buildings, follow-up surveys will be arranged directly with the landowner.

Great Crested Newts

Surveys for Great Crested Newts will aim to identify all areas of known or potential habitat and populations within the study area. Consultation will be undertaken with local statutory bodies and biological record centres to identify known populations within a 500m radius of any water bodies within the study area.

Water bodies in the local area will be reviewed to identify known habitats likely to support great crested newts, and

also other areas to which the species may disperse. All ponds and other water bodies within an agreed study area will be assessed, and if considered suitable, surveyed for great crested newts. Repeat survey visits will be undertaken to confirm the presence or absence of great crested newts to subsequently determine population status.

River Habitat Surveys

River habitat surveys will be carried out by accredited surveyors and will take place during early summer. The assessment involves surveying lengths of watercourses to establish the physical characteristics of the watercourse. These surveys may also be extended to modified water channels, such as field drains, if judged to be necessary by the surveyors.

Estuarine Fish

Fish communities will be assessed in line with the Water Framework Directive (WFD) monitoring requirements. Fish surveys will be conducted twice annually on a number of sites upstream and downstream of the proposed crossing. In addition to the fish surveys, water quality data will be collected at each site using techniques including dissolved oxygen, pH, temperature and conductivity tests.

Estuarine Benthos

Estuarine benthos (organisms which live on, in, or close to the estuary bed) can be affected by disturbance and the benthic habitats of the Forth in the vicinity of the proposed crossing will therefore be monitored twice annually in spring and autumn. This will include both intertidal (between low and high tides) and subtidal (submerged) habitats.

Baseline conditions will be determined prior to commencement of construction work with subsequent monitoring undertaken throughout the construction phase. A walkover survey will be conducted to assess the physical characteristics of the intertidal habitats. Subsequently, a monitoring programme will be devised with sampling techniques adopted suitable to the characteristics of the habitats found.

Freshwater Invertebrates

All watercourses in the survey area will be considered for invertebrate sampling. Watercourses will be assessed during the walkover surveys for their ability to support established invertebrate communities, such as might be found in ephemeral water bodies.

The survey involves searching for surface dwelling species, followed by sampling using a Freshwater Biological Association (FBA) mesh sampling net. In addition to the collection of macroinvertebrate samples, simple water quality measurements (dissolved oxygen, pH, temperature and conductivity) may be taken using field probes.

Other Species

During the course of surveying the proposed development area, ecologists will note any incidental sightings of other species not listed above, for example, hare or deer. Such sightings may therefore lead to further survey work.

2. LANDSCAPE AND VISUAL IMPACT ASSESSMENT

A detailed landscape and visual impact assessment is carried out to consider how the proposed development might impact on the appearance of the landscape.

The assessments involve walking through the area, noting landscape features and assessing the views. The work is non-intrusive and will not involve any plant, machinery or equipment other than cameras, which are used to provide a record of views, landform and land use in the area.

These surveys inform the assessment process, including the development of appropriate mitigation such as landscaping and planting as well as the design of the bridge crossing itself.

3. GEOMORPHOLOGY SURVEY (RIVERS AND BURNS)

Geomorphology is the study of landforms and the processes that form them. With regard to the Forth Replacement Crossing this has a bearing on the ecological quality of the Forth and surrounding rivers and burns. The aims of the survey are to establish what, if any, impact the scheme proposals may have on the make-up of watercourses in the area.

The field survey will consist of a visual inspection of the channels and bank-side vegetation on watercourses within the route corridor and immediately up and down the stream. More detailed data will be collected around the Firth of Forth by undertaking shoreline walkover surveys and small boat surveys of the saltmarshes and intertidal flats. A Global Positioning System (GPS) recording tool is used to record coordinates for the survey location. In addition, photographs will be taken of the watercourses to provide a visual record of current conditions in the area.

4. HYDROLOGY SURVEYS

The purpose of hydrology surveys is to provide information on how watercourses actually flow and involve setting up equipment in watercourses to measure the flow velocity. Measurements are also taken to determine the watercourse topography.

The equipment used is called an impeller and does not generate any noise. Depending on the size of the burn and whether there is a bridge nearby that can be used for the survey, watercourses are normally entered wearing waders.



Photographs of each survey location will be taken to provide a visual record of current conditions in the area.

5. NOISE MONITORING SURVEYS

Noise monitoring is carried out to measure the current noise levels in a given area and assess what impact the scheme proposals may have on these noise levels. Monitoring equipment simply records the level of noise, rather than the noise itself.

• Short Term Noise Monitoring Survey

The short term monitoring survey involves setting up the equipment and monitoring the noise levels for approximately 30 minutes, removing the equipment and then revisiting the site a number of times during the same day. The equipment is not left unattended at any time.



• Long Term Noise Monitoring Survey



The long term monitoring survey involves setting up the monitoring equipment, which takes 30 – 40 minutes, and is then left for 14 days to monitor the noise levels before being removed. The equipment is battery operated and will be secured to a fixed object such as a fence post or lamp post.

The findings of the noise surveys are used to assess the noise effect of the scheme proposals which inform decisions on noise mitigation.

6. AIR QUALITY

The air quality assessment is used to consider the effect that the scheme proposals may have on the air quality in the existing environment. There are two possible types of air quality monitoring - automatic and passive surveys.

An automatic survey involves the use of continuous air quality monitors which would be placed in appropriate locations and monitor relevant traffic-related air pollutants such as nitrogen dioxide (NO₂) and fine particulate matter (PM₁₀). Data would be collected on a continuous basis and downloaded from a remote location.



Passive air quality surveying involves the use of small tubes which monitor nitrogen dioxide (NO₂) and are attached to a drainpipe, lamppost or fence post, as shown in the photograph. The device would be left for up to 12 months. Every 3-5 weeks the tube would be removed, sent to a laboratory for analysis and be replaced with a fresh one.

7. AGRICULTURAL IMPACT ASSESSMENT

The agricultural assessment considers the likely effects of the road on agricultural activity. This requires evaluation of current agricultural activities, including a Land Capability Assessment (LCA). The LCA allows soils to be graded according to their suitability for growing various crops. In order to complete the LCA, inspection of the soil and land gradient is made. A hand auger is used to complete the soil assessment (no soil is removed) and a clinometer is used to measure gradient. Access to the sample locations will be by car and on foot.

Site visits are made to agricultural land interests to consult with the landowner and evaluate current activities. This involves completing a questionnaire to collect data on the extent of property holdings and land ownership, land use, management and performance levels attained, labour and machinery resources, other business interests and existing land-based grants. Additionally the extent of land-take and the impacts of severance are also assessed. We will also consider accommodation works which may be required for access, to protect water supply, or to ensure adequate drainage.

With specific regard to agricultural impact assessments where site visits and consultations with landowners are required, the survey team will contact the landowner to arrange a suitable time, date and location to meet at their convenience.

8. CULTURAL HERITAGE SURVEY

A detailed cultural heritage assessment is undertaken to gather information on sites of potential archaeological significance in the vicinity. The survey includes consideration of archaeological features and listed buildings and consists of a visual inspection of the area, with no equipment used other than cameras. Areas of interest will be photographed to provide a visual record of the current features on the site.

GROUND INVESTIGATIONS & SURVEYS

Ground investigations, topographical surveys and marine investigations are an essential part of the design process for any major infrastructure development. They reveal information about the ground conditions in any given area and indicate whether the location can support a major structure. The findings of these surveys not only inform the alignment of the scheme but also construction techniques.

As in environmental surveys, ground investigations and topographical surveys will be carried out on public land wherever possible, however it is inevitable that some work will be required in areas of private land.

Landowners whose land is required for ground investigations may be entitled to compensation, which is usually determined by the District Valuer, acting on behalf of the Scottish Government. Every effort is made to minimise disturbance, however, land which is disturbed will be reinstated to the satisfaction of the landowner and checked by comparing 'before' and 'after' photographs.

The ground investigation team is primarily made up of geotechnical engineers, geologists and drillers who are also

accompanied by an archaeologist and ecologist during the survey works. This is to ensure that archaeological and ecological features, such as historic ruins or protected species, are not disrupted or damaged during the works.

1. TOPOGRAPHIC SURVEY

The purpose of topographic surveys is to gain accurate details of the ground levels and features within the area of development and its immediate surroundings. Generally this is achieved through aerial surveys, supported by establishing 'control points' on the ground at certain locations.

Control points are markers that can be accurately surveyed to determine their precise geographical location and level. Wherever possible these control points will be placed in public areas, such as at the side of roads, but occasionally it may be necessary to place them within private land. They are installed by driving a metal post into the ground which permanently fixes the marker in position.

The presence of vegetation and planting in some areas can render aerial surveys less accurate and in these locations further ground survey work may be required. This typically involves the use of portable survey equipment by small survey teams.

We will work closely with landowners in advance of any topographical survey works to agree access to their land and identify with them potential locations for the control points which would cause the least disruption to their work.



Above: Example of control point marker.

2. MARINE INVESTIGATIONS

In the same way as ground investigations indicate the nature and depth of layers of soil and rock on land, marine investigations provide this information about materials underlying the sea bed.

Marine investigations will take place in the Firth of Forth along the line of the proposed bridge, particularly in the vicinity of the piers and pylons. The investigations will be carried out using drilling rigs or vessels from which boreholes will be drilled at key locations to identify material types and thicknesses below the seabed. Samples of soil and rock will also be collected and tested to assess the strength and suitability of the ground.

The findings are pivotal to the location and type of bridge foundations that will be put in place.

During the marine investigations soil and water samples will also be tested to identify any potential areas of contamination in the sea bed. This is to ensure that any contamination that is found is not disturbed or spread through bridge construction works.

Transport Scotland and their consultants will work closely with the port authority in advance of any works to ensure that mariners are given adequate notice of the likely presence of rigs in the Firth. Marine investigations will take place away from the main shipping channels and are unlikely to result in any disruption to usual ship movements.

3. GROUND INVESTIGATION

Ground investigations involve the use of drilling rigs to extract soil and rock samples. Detailed discussions will be entered into with landowners to seek agreement for access to their land and to reduce disruption as far as possible.

Three different activities are usually undertaken during ground investigation works:

Boring – used to recover soil samples

Rotary drilling – used to recover rock samples

Trial pits – used to recover soil samples

Boring and rotary drilling use drilling rigs which are usually towed behind four-wheel drive vehicles. Trial pits are dug using excavators.

In some locations it is necessary to monitor ground water movements over a period of a time, typically up to one year. To achieve this a small device called a Piezometer is installed in the ground and readings are taken from it at regular intervals. The Piezometer would usually be fenced off to avoid any accidental damage.

Where possible, some flexibility is available to modify the ground investigation proposals and make them more convenient to the landowner. The final arrangements will be agreed between the landowner and the ground investigations contractor and formalised in a written agreement which then becomes binding on all parties.



Above: Example of Piezometer insertion.



ABOUT THE SURVEY TEAM

Surveys and ground investigations will be carried out by fully qualified environmental and engineering consultants who have been appointed by Transport Scotland to undertake the work on their behalf.

A joint venture of Arup and Jacobs have been appointed as the main consultants for the Forth Replacement Crossing project, and other specialist contractors and consultants may be employed for particular elements of the work.

All consultants working on the ground will carry the necessary permits and will work to strict health and safety guidelines to maintain the safety of landowners and occupiers, the general public and the survey teams.

Current Government guidance on biosecurity risks will be strictly observed at all times. The team will keep abreast of any changes in this guidance and take appropriate measures to avoid the risk of contamination.

For more information about the Forth Replacement Crossing please contact the Transport Scotland Forth Replacement Crossing team on:

phone: **0141 272 7578**

email: **frcenquiries@transportscotland.gsi.gov.uk**

web: **www.forthreplacementcrossing.info**

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