Välkommen till Skottland

Swedish Forestry Engineers April 2011

Frank MacCulloch
Director Forestry Business Units
Forestry Commission
• Presentations
• Visit Farr Wind farm access road
• Ground Penetrating Radar
• Bridge Construction
• Roads Over Peat
• ROADEX Trial Site
• Tyre Pressure Control Vehicles
• Steep Ground Working
• Road and Bridge Construction
Swedish Forestry Engineers Visit April 2011

Location Plan

Swedish Visit 17-21 April

Forestry Civil Engineering
1 Highlander Way
Inverness Business & Retail Park
Inverness IV2 7GB
Tel: 01463 232811
Fax: 01463 714578

Map Scale: 1:700,000

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Monday

Location Plan

Farr Windfarm

OS Map Ref. NH 702 312

Farr Windfarm

Map Scale: 1:110,000

Forestry Civil Engineering
1 Highlander Way
Inverness Business & Retail Park
Inverness IV2 7GB
Tel. 01463 232811
Fax. 01463 714978

18-20th April
2011

Swedish Forestry Engineers Visit April 2011
Tuesday

Location Plan

Stynie Wood

OS Map Ref. NJ328 614

Map Scale: 1:70,000

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Forestry Commission Scotland

Forestry Civil Engineering
1 Highlander Way
Inverness Business & Retail Park
Inverness IV2 7GS
Tel. 01463 222211
Fax. 01463 714979

Swedish Forestry Engineers Visit April 2011

29/04/2011
Wednesday

Location Plan

Glen Righ & Brecklet

OS Map Ref. NN 051 597.

Map Scale: 1:60,000

Forestry Civil Engineering
1 Highlander Way
Inverness Business & Retail Park
Inverness IV2 7GB
Tel. 01463 232811
Fax. 01463 714978

Swedish Forestry Engineers Visit April 2011
Forestry is a Devolved Subject Delivered by a Cross Border Public Body

FC Scotland
Policy
Finance
Delivery

FC GB
International issues
Research

FC GB
Services to countries
IT, HR, Plant Health etc.
Funded by the countries

FC England
Policy
Finance
Delivery

FC Wales
Policy
Finance
Delivery

Funded by Holyrood

Funded by Westminster

Funded by Westminster

Funded by Holyrood

The statutory powers and duties of the FC are vested in the GB Forestry Commissioners; executive and non-executive. The GB Board of Commissioners delegates these powers to National Committees.

FC GB and FC Scotland
National Office both located in Silvan House, Edinburgh

Funded by the Wales Assembly Government
Role of FCS

Minister

National Committee

Provides additional advice to Ministers and ensures that FCS delivers efficiently and effectively

Forestry

Rural Affairs Directorates

Policy and Secretariat Support

Forestry Sector Regulation and Support

Management of the National Forest Estate

Advising and supporting Ministers

Scottish Forestry Grants Scheme

Forestry legislation

Forestry sector support through Development Programme

Overseeing the management of the National Forest Estate through our management agency ‘Forest Enterprise Scotland’

5 Regional Offices (Conservancies)

Head Office Inverness

10 Forest District Offices
The Vision for Scottish Forestry

By the second half of this century, people are benefiting widely from Scotland’s trees, woodlands and forests, actively engaging with them and looking after them for the use and enjoyment of generations to come. The forestry resource has become a central part of our culture, economy and environment.

- Larger woodland area
- More woodlands in active management
- More of the desired outcomes being produced
- More people benefiting
Forests are a Means to an End

**Input**

**Activities & Outputs**

- Timber and other Forest Products
- Recreational facilities
- Conservation of important sites, species and habitats

**Outcomes**

- Competitive and innovative businesses contributing to the growth of the Scottish Economy
- Improved health & well-being of people and their communities
- High quality, robust and adaptable environment
Where Does FES Get Its Lead From?

The Scottish Forestry Strategy

Corporate Plan 2008-2011

The National Forest Estate
Strategic Plan 2009-2013
Plus a few more for good measure!!
Front-line focus

Swedish Forestry Engineers Visit April 2011
FCS wants more: new planting

renewables

WIAT

priority biodiversity

sector skills
Swedish Forestry Engineers Visit April 2011

Combined FES and Private Sector

- Forest Enterprise
- Private Sector
- Scotland

Thousand cubic metres over bark standing

1999 to 2001
2007 to 2011
2017 to 2021
2027 to 2031
2037 to 2041
2047 to 2051
2057 to 2061
Planning

Planning
Build Roads
## Pavement Design

<table>
<thead>
<tr>
<th>Soil Description</th>
<th>CBR</th>
<th>Pavement Thickness mm.</th>
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<tr>
<td></td>
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<td>Soft Clays</td>
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<td>Well drained silty clay and good mineral soils</td>
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<tr>
<td>Poorly drained granular materials</td>
<td>10</td>
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<td>325</td>
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<tr>
<td>Well drained granular materials and rock</td>
<td>15</td>
<td>200</td>
<td>250</td>
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Bridges

Build and Maintain Bridges
Carry out Maintenance & Repairs
Quarries

Manage Quarries
Producing materials
Getting the right mix!
Recreation Facilities

Construct and Maintain Recreation Facilities

Swedish Forestry Engineers Visit April 2011
Road Use
Road Condition Surveys Programme

Road Condition Surveys

18-20th April
2011

Swedish Forestry Engineers Visit April 2011
Example of Weak Public Road
Communication; Timber Transport Groups

Argyll
Ayrshire
Scottish
Borders
Dumfries &
Galloway
Grampian
Highland
Stirling and
Tayside
Tayside
Wales
Northern
England

PROJECT MANAGER
Objectives

To collect and maintain information relating to current and future timber traffic

To review the existing timber transport infrastructure and identify priorities for maintenance, upgrades and new investments

To explore and promote the potential for increased use of rail and water modes

To develop and maintain a system of agreed timber transport routes

To work through partnerships to resolve timber transport problems and avoid new ones arising.

To share information and methodologies with other Regional Timber Transport Groups
• **Agreed Routes** Those routes that can be used for timber haulage without restriction as regulated by the Road Traffic Act 1988

• **Consultation Routes** Those routes that are recognised as being key to timber extraction but which are not up to Agreed Route standard. Consultation with Local Authority is required and may be necessary to agree limits of timing, allowable tonnage etc. before the route can be used.

• **Severely Restricted Routes** Those routes that should not normally be used for timber transport in their present condition. These routes are close to being Excluded Routes. Consultation with the Local Authority is required to achieve an agreed management regime to avoid land locking of timber.

• **Excluded Routes** Those routes that should not be used for timber transport in their present condition under any circumstances. These routes are either formally restricted, or are close to being formally restricted, to protect the network. Consultation with the Local Authority is essential.
Class A road; 2970km; Strategically Important

Class B road; 3145km; Strategically less important and may have limited strength

Class C road; 1962km; Not strategically important
Typical Road Cross - Sectional Details

- 2.5 m minimum preferred
- 75 mm minimum curb or over half width
- Lip to be rounded
- Cut off ditch if required
- Side slopes must be cut to a safe angle.
- Small ledges on cut will assist vegetation growth.

'Carriageway' means running surface width. There should be sufficient 'structural' width to ensure adequate lateral support to the carriageway.

Cross Fall up to 20 Degrees

- Excavated material to be side cast away from the cutting, landscaped, used in construction or carted away.
- Do not obstruct harvesting routes.
- Brush can be placed at the bottom of the slope for short-term stability or as a safety barrier.

As far as possible, formation to be on undisturbed suitable material.

250 mm curb or over half formation width.
Supporting the trade develop CTI & LGPV Systems
ROADEX III Task B2 Report

Tyre Pressure Control on Timber Haulage Vehicles
Some observations on a trial in Sutherland, Scotland

Ron Munro, Frank MacCulloch
Introducing Low Ground Pressure to FC

- Aim to specify specific routes or areas to be restricted to low ground pressure vehicles or lorries fitted with Tyre Pressure Control Technology
- Roads fall into two categories
- Class A – suitable for conventional 44t GVW lorries
- Class A® - Restricted Use – to be used by LGP/ TPC lorries only
Criteria for route selection

- Geological catchment of poor stone quality for road building / maintenance.
- Areas / roads with high associated maintenance costs.
- Areas / roads that can be managed exclusively and would not be compromised by the requirement of third parties to use conventional lorries.
- Forest blocks serviced by public roads which the local authority regards as weak and have been classified on the Agreed Routes Map (AGM) as restricted or consultation routes.
- In-forest haulage routes specifically linked to other transport terminals e.g. sea and rail.
- Forest blocks with either exceptionally long off-road access routes, or alternatively, very long in forest haulage routes where a bespoke vehicle system
The process

Stage 1 Initial Assessment
Stage 2 Benchmarking review
Stage 3 Update GIS layer
Stage 4 Identify area specific solutions
Stage 5 Cost benefit analysis
Stage 6 Discussion with trade
Stage 7 Implementation
Results
Terragator Vehicle
Bridge Management

FES manage 1560 bridges

Database provides construction details of all bridges and inspection dates

Principle Inspections; 6 year interval

Visual Inspections; 2 year interval

Inspectors assessed and graded

Migrating to GIS
Swedish Forestry Engineers Visit April 2011

Principal Inspections of Bridges
Agreed Strategy for UK

Four actions are necessary so that Principal Inspections can be scheduled over a 6-year running programme based on a priority matrix starting 1st April 2011.

1. An electronic query is required for the database to help pick out the old, at risk, special bridges, temporary bridges, new footbridges, class of road etc. All of these items identify bridges which need Principal Inspections most urgently.

2. Add access requirements to the record of each bridge. Also note any other special procedures or preparations before Principal Inspections (cleaning).

3. Grade, train and test Principal Inspections and certify who is qualified to inspect which category of bridge. This will depend on complexity of structure.

4. Make up more detailed checklists for the observations which are necessary in a Principal Inspection (special inspection forms). This will ensure that Principal Inspections do not become 'special' visual inspections.

1. Screen and others involved with (BIS database) will look into building a query to pick out:
   - Bridges over 56 years old
   - Bridges over 12m span
   - Any which had a 4 or 5 for severity in the last report
   - Bailey Bridges
   - Public roads
   - Suspension bridges
   - Spanning buildings
   - Hard wearing or active arterial routes

2. The database query will pick out the second category which will consist of small, less complex, less needed bridges and will follow the first, in terms of programmeing, the time of Principal Inspections. It will, normally, contain the PSC bridge which is in great condition on a spur road with no plans to increase the harvesting traffic for some time.

3. There will be a third category of simple bridges which can be Principally Inspected by less experienced engineers. This category will contain most footbridges and some very short span road bridges.

All field engineers will report their problem bridges to the Supervising Engineer to allow an urgency list to be drawn up from the priority list.

2. Bridge with a sill less that 2m above the river bed can be reached by hand for close inspection and tapping with a hammer. Bridges with sills between 2m and 3.5m will be accessed from the ground using a special hammer, telescope and fibre optic viewer. Bridges with sills over 3.5m will be accessed in a number of ways. The first being by a ladder properly secured at the top and bottom and used only by an engineer who has been trained.

Each bridge will be risk assessed on its own merits and if PC personnel cannot inspect a bridge safely the inspection will be contracted out. The contractor will choose between above, scaffold, cherry picker or another. Access down the bank, pollution, wildlife, environmental etc will all be risk assessed in accordance with a specific schedule attached to the bridge inspection suite of forms.

The Supervising Engineer will investigate what other Authorities employ for safe access while trying to develop innovative ideas to assist remote dense inspection without having to work at height.

3. Principal Inspectors, according to the Inspection Manual, are assessed by the Supervising Engineer, as competent, and work under his/her supervision. The Supervising Engineer will be Chartered Civil or Structural and have appropriate experience in design, construction and maintenance of highway structures. He/she usually consults the Principal Inspectors to ensure correct competence. The fully experienced Principal Bridge Inspector must at least have:
   - Knowledge of safe working practices and methods of access required for inspection
   - Ability and experience to recognise and evaluate defects on highway structures
   - An understanding of the structural behaviour of highway structures and an understanding of assessment calculations
   - Knowledge of the construction methods and materials used in the construction of highway structures
   - Knowledge of causes of defects and suitable testing methods to identify, confirm or investigate these
   - Ability to record defects accurately and consistently
   - Sound health
   - Inspectors of limited experience should work under the supervision of experienced staff.
   - Knowledge and experience must be current - Professional Engineering Institutions state that practice and knowledge more than 5 years old is not acceptable as proof of competence unless further similar experience has been gained during that time to keep the knowledge valid.

Bridges vary in complexity and some simple structures could be inspected by a less experienced inspector. The above criteria will be balanced against the structure and the Supervising Engineer will decide on competence. All inspectors in PC have been given basic training so are covered in areas of negligence. Every inspector should complete a competance CV based on the above nine standard requirements. The Supervising Engineer can make a judgment based on which boxes are ticked or not ticked. In short we do not need our most qualified engineer to carry out a Principal Inspection of a 4m span footbridge. There will be multiple choice tests to help the Supervising
Engineer justify grades of inspector where some boxes in the CV are not ticked. Frank MacCallum will discuss and countersign all engineers’ grading.

4. The visual inspection report form is general and not sufficient for a Principal Inspection. Specific structure types operate in specific ways and suffer quite unique defects. All of these peculiar points were covered in the inspection courses a year ago and this knowledge must find its way into a Principal Inspection. I am in the process of making an individual inspection report form for different types of bridge so that I have checklists and do not miss common failures. Other inspectors must adopt a system to ensure that the Principal Inspection is thorough and not just an ‘in depth visual inspection’.

Conclusion
In forestry our inspectors would all be assessors who could calculate the load capacity of the bridge. This is necessary because many bridges will need assessed. The inspector must at least be able to tick all the measurements necessary for an assessment. These measurements are not all sizes - they can be measures of deterioration and crack assessment. In forestry we cannot always justify removing someone out after the Principal Inspector has inspected them. It is best all done at once. For a simple structure an inspector could take information and another do the calculation but not a complex one where lots of defects add up to lower safety factors which affect the load capacity.

By the end of 2010 every bridge record will have a Principal Inspection category identifying the grade of inspector needed and a date set for inspection. Every bridge will have had a risk assessment carried out which will ensure safe access down the bank, ‘hard’ cordon will all parts of the bridge offlit and no accidental pollution or wildlife disturbance.

Eventually all bridges will have a risk register stating its importance to the network, its relation to other bridges, and identifying alternative routes etc if the bridge failed. It will include an estimate of the remaining useful life. In this way old trunnion and temporary Bailey bridges will have their succession planned for. Each record will have dates set for the biennial visual inspection and 6 yearly Principal Inspection.

Geoff Freedman
1st February 2010
**FORESTRY CIVIL ENGINEERING BRIDGE RECORD**

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<td>Date of Record</td>
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</table>

**NOTES**

1. This could refer to a forest block, river name, local area name etc.
2. OS survey reference: 2 letters, 4 digits.
3. Arch, RC slab, MSC beams and units infill, composite steel and concrete, tunnel, steel beam with timber deck, aerial mast, Bailey, large culvert, timber footbridge, suspension, etc.
4. This should refer to the current classification i.e.
5. A stream route: B spur Road: C other Road: D Footpath.
6. This refers to joint ownership or joint maintenance agreements or multiple users. Entry to show ID’s percentage liability and amount of participants.
7. Dimension in metres and fractions for shorter and millimetres for detailed record below. (Imprest units used where necessary for old sections).
8. Approximate dimension.
9. Average width, depth and downstream of bridge and an indication of flow characteristics: width, current, marshing, etc.
10. This will probably be the same as local capacity, for certain (possibly non-engineering) reasons, it may differ.
11. This should be total cost, i.e., construction plus overhead / design cost.
12. Electricity, water supply or other services attached to deck.
13. Construction and survey details if any.
14. Material to have base protection coating detailed under type, e.g., bitumen, structural sound etc.
15. Left and right bank looking downstream. US = upstream, DS = downstream.
17. Descriptions to accord with Tables 11 and 3.2 of RA 1667 i.e., as for MEXI assessment.
18. Further text or comments on structure or drawings of foundation, foundation sketch etc., such as: stone, clay, baulk etc.

**SKETCH AND OR PHOTOGRAPHS**
# Inspection Report

Inspection of the bridge conducted on [18-20th April 2011]

## Condition Rating

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<th>B</th>
<th>C</th>
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## Details of Maintenance Work Since Last Report

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## Maintenance Work Recommended

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</thead>
<tbody>
<tr>
<td>Work Authorized</td>
<td>Yes</td>
</tr>
</tbody>
</table>

1. **Notes**
   - This report refers to a fixed date, i.e. the last inspection.
   - This should refer to the current classification i.e.
     A: Access Track
     B: Spur Road
     C: Other Road
     D: Footpath
   - This refers to joint ownership or joint maintenance agreements or multiple entries. It is shown the percentage liability and names of parties.
   - The 'Condition Report' is the assessment of defects. The following system of coded descriptions must be used. Number 'Overall' box, and 'All other boxes as appropriate.'

2. **Overall & Severity**
   - A: Very good, no defects.
   - B: Good, minor defects of non-urgent nature.
   - C: Minor defects, requiring attention within 2-3 years.
   - D: Poor, defects of an unacceptable nature which should be included for attention within the next annual maintenance programme.
   - E: Urgent, severe defects where action is needed within the next financial year. (These should be reported immediately to the client.)

3. **Inspection Report**
   - Left after the report when looking down stream. U/S = upstream, D/S = downstream.
   - The inspection report for the bridge shall be obvious from the comments above. An estimated cost should be provided for the AEC.

4. **Inspection Report**
   - Unless another system is agreed. A copy of the report shall be sent to the ACE for authorisation. The following year's report shall show details of work carried out.

5. **Maintenance Work**
   - “Details of Defects”: Provides the description of the defect and severity beyond that in the beam. Photographs should be considered. The defect shall be noted from the “Condition Report” should always be used.

6. **Maintenance Category**
   - A: Minor
   - B: Moderate
   - C: Major

7. **Maintenance Category**
   - A: Minor
   - B: Moderate
   - C: Major

8. **Maintenance Category**
   - A: Urgent — 3 months
   - B: Medium term — 3 months
   - C: Long term — 3 months

9. **ACME's Comment**
   - ACE to agree or disapprove work recommended, and estimated costs. There may be other, non-structural reasons, why repairs are not to be carried out as recommended. To do, the ACE should report here.

10. **Work Authorization**
    - Yes: Work authorized

11. **Inspection Date**
    - Date: 18-20th April 2011

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**Swedish Forestry Engineers Visit April 2011**
This is a screenshot showing the many functions of our Microsoft Access Bridge Database, one of which is to manage our Inspection resumptions.
Over the past two years we have been working with our software developers ESRI to incorporate the contents of this database into our bespoke Forester GIS application.

Future development of this system aims to include our Quarries (approx 530), Dams, Reservoirs, & many other Structures.