Forestry Commission Scotland

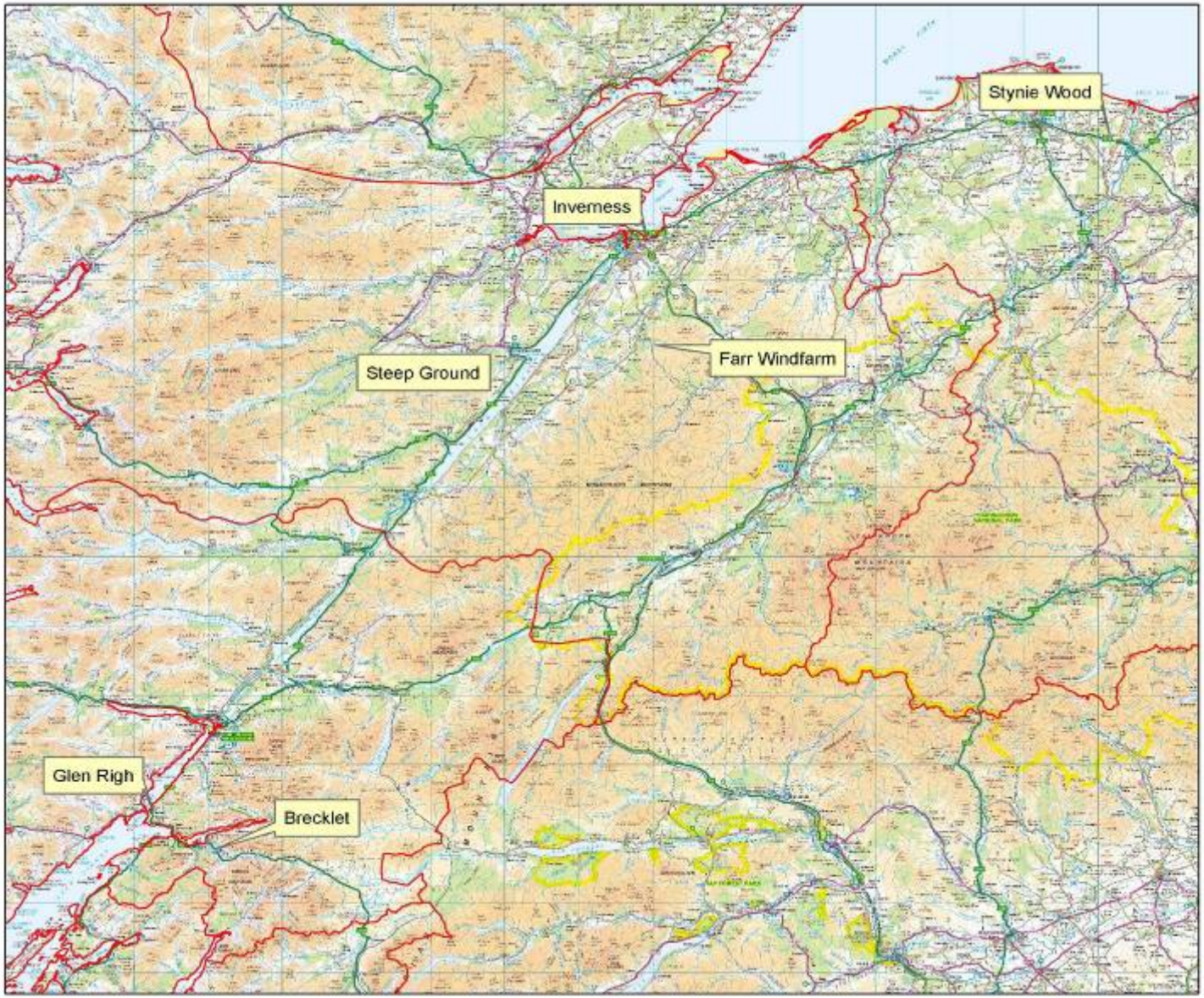
Välkommen till Skottland

Swedish Forestry Engineers April 2011

Frank MacCulloch
Director Forestry Business Units
Forestry Commission

Skissera av besök

- 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



Location Plan

Swedish Visit 17-21 April

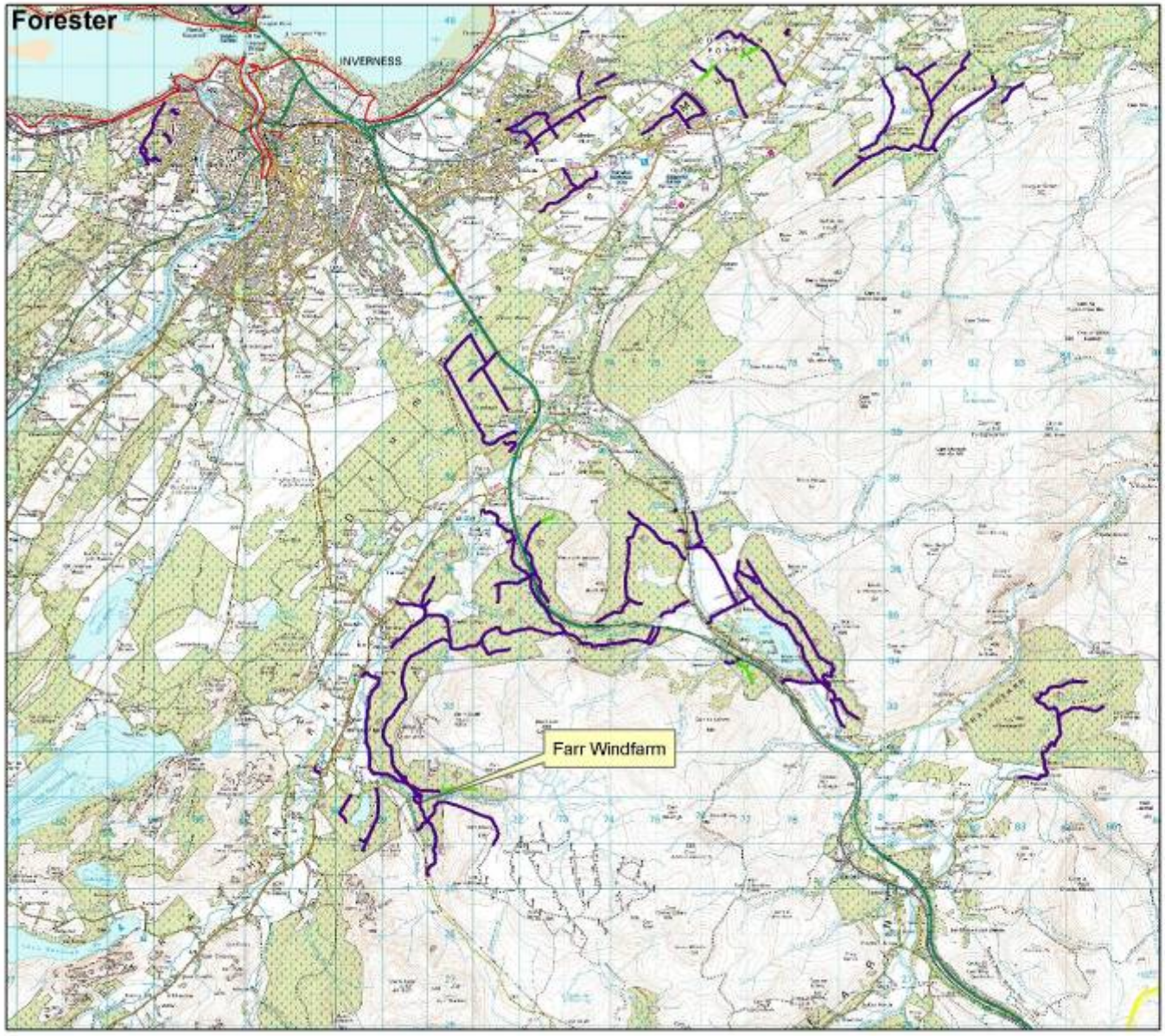
N
W E
S

Forestry Commission
Scotland

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

Map Scale : 1:700,000

Monday



Location Plan

Farr Windfarm

OS Map Ref. NH 702 312

N
W E
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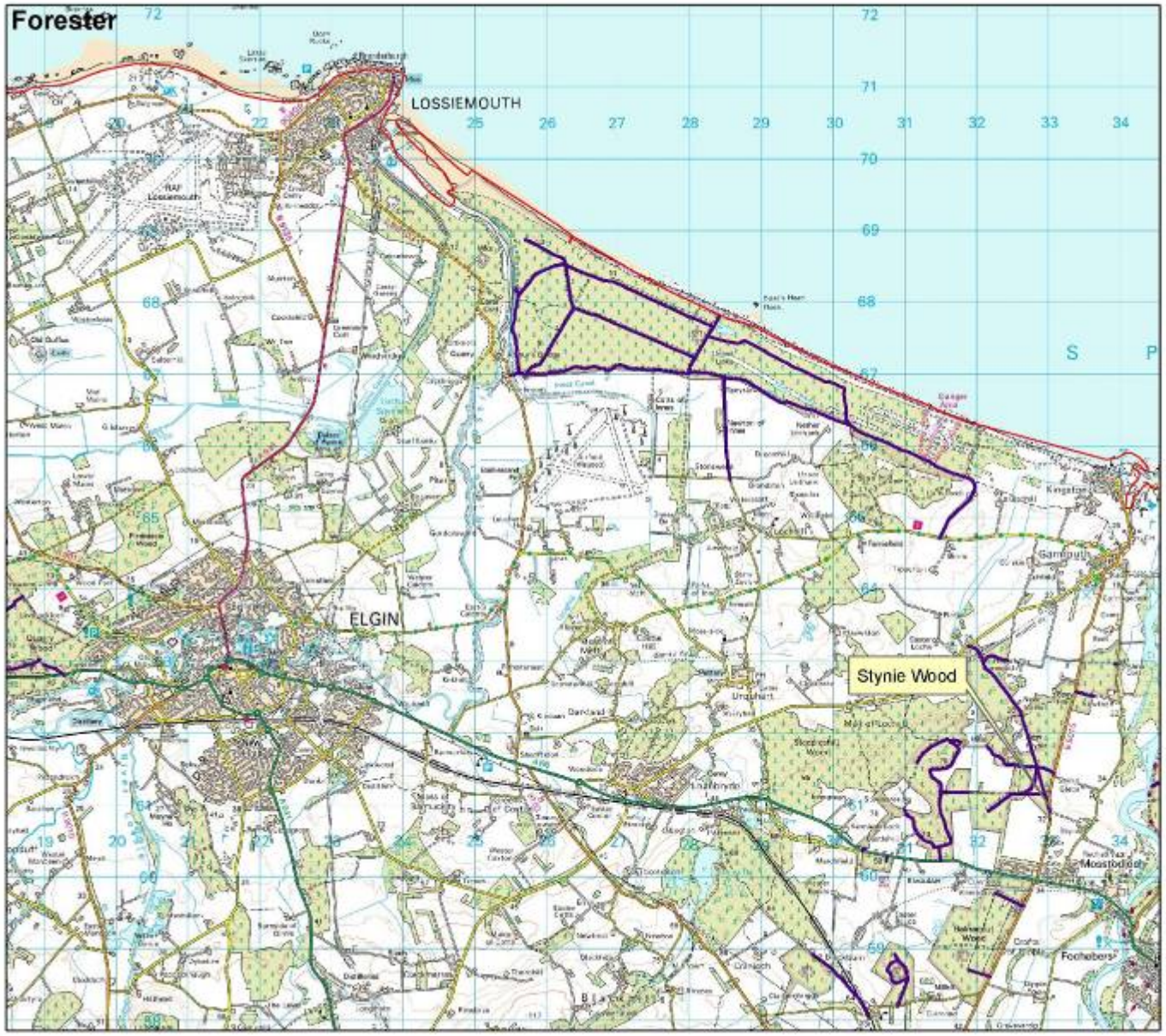
Tuesday



Location Plan

Stynie Wood

OS Map Ref. NJ328 614

N
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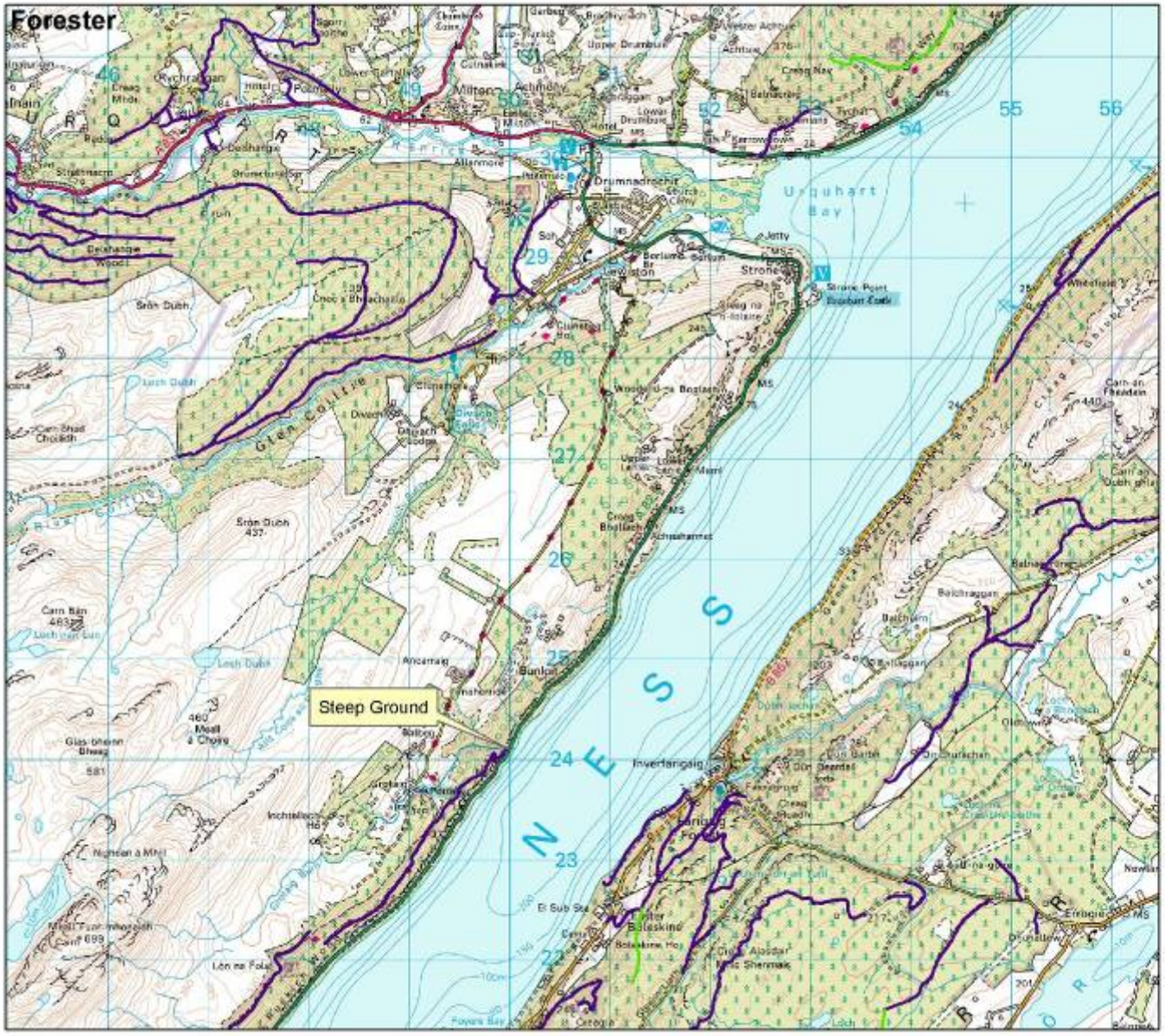
Map Scale : 1:70,000

Wednesday



Location Plan

Steep Ground Site

OS Map Ref. NH 499 241.

Forestry Commission Scotland

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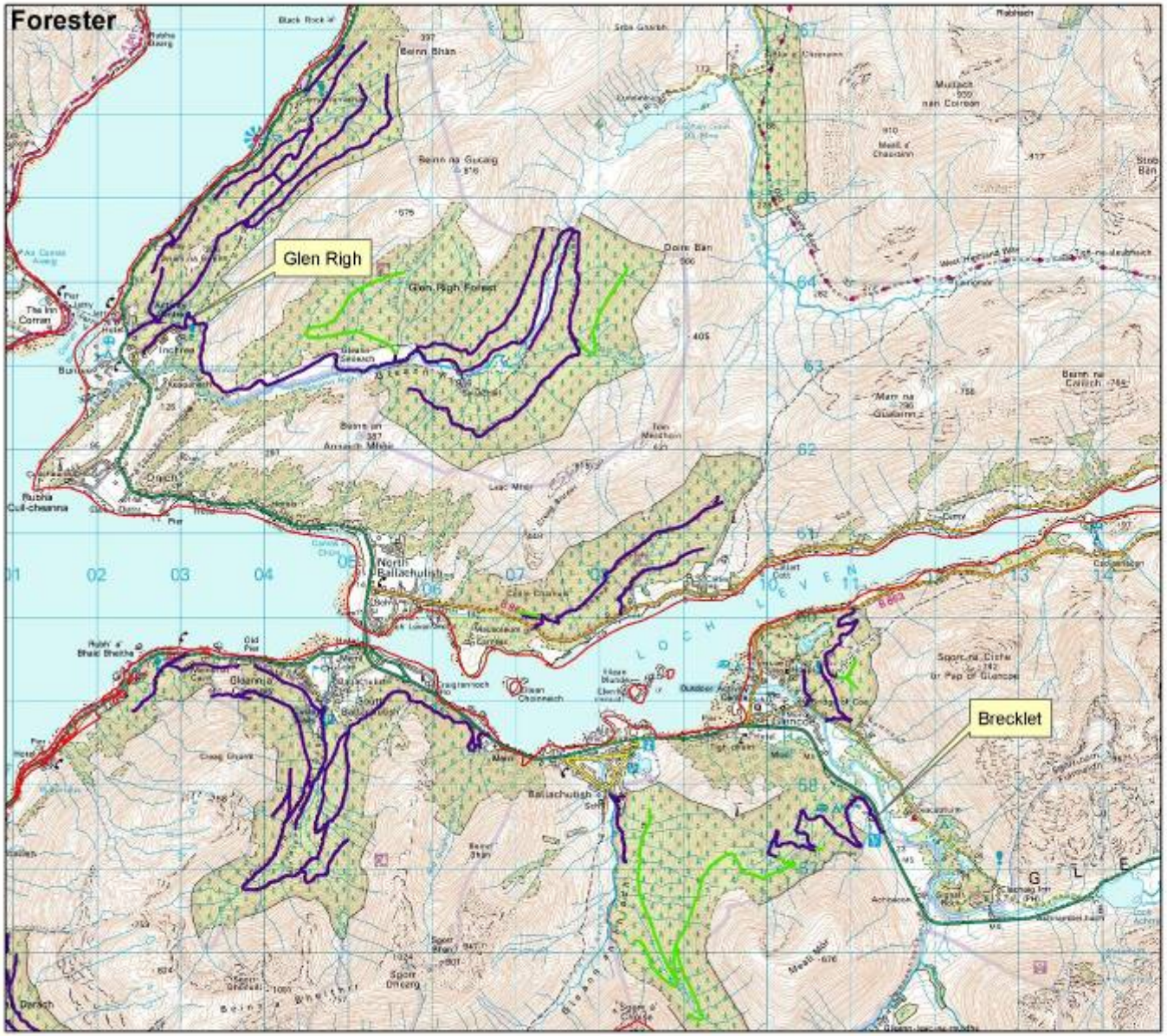
Wednesday


Forester
Glen Righ
Glen Righ Forest
Brecklet
Location Plan
Glen Righ & Brecklet
OS Map Ref. NN 051 597.
N
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Forestry Commission
Scotland
Forestry Civil Engineering
1 Highlander Way
Inverness Business & Retail Park
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Fax. 01463 714978
Map Scale : 1:60,000
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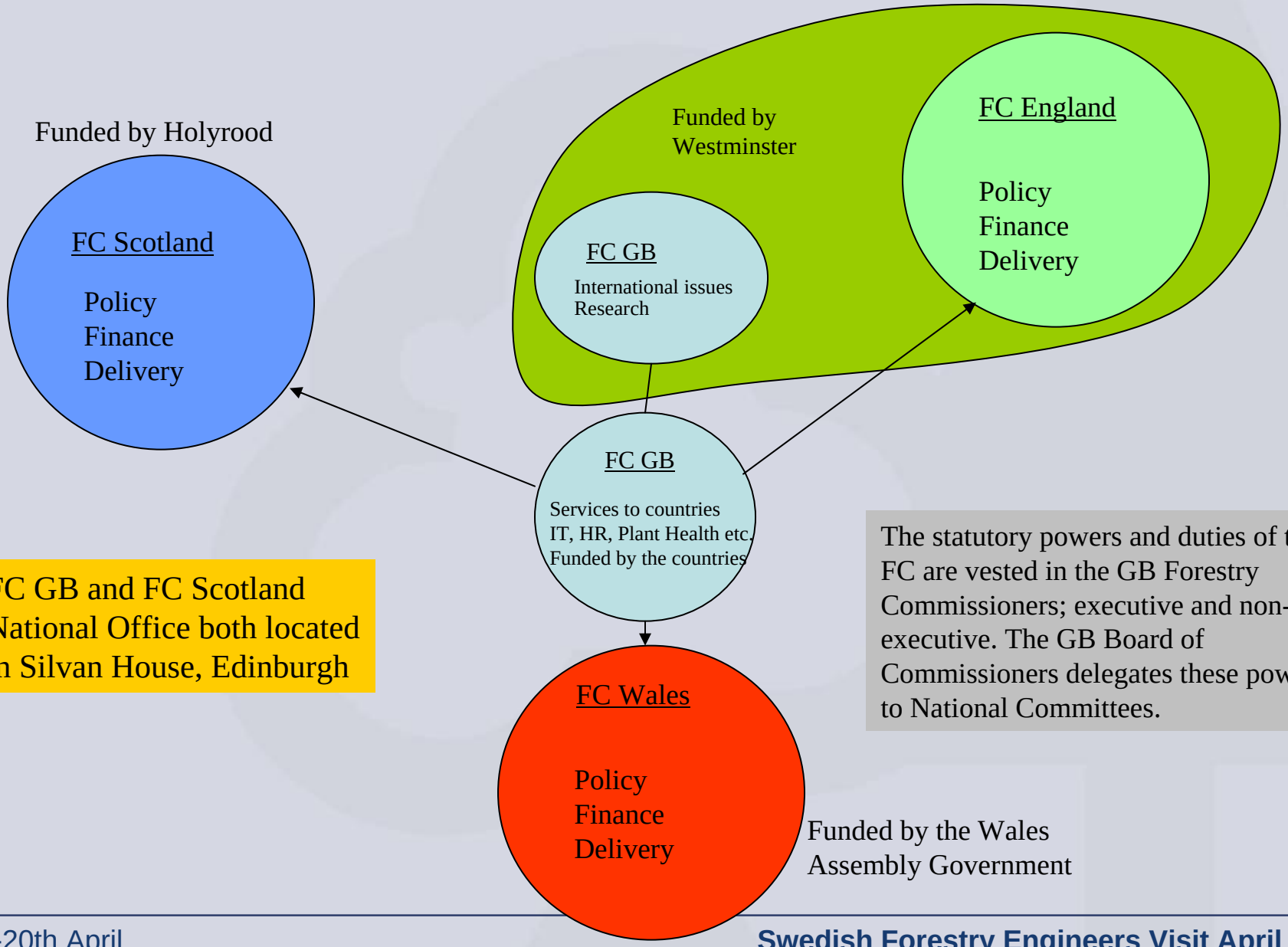
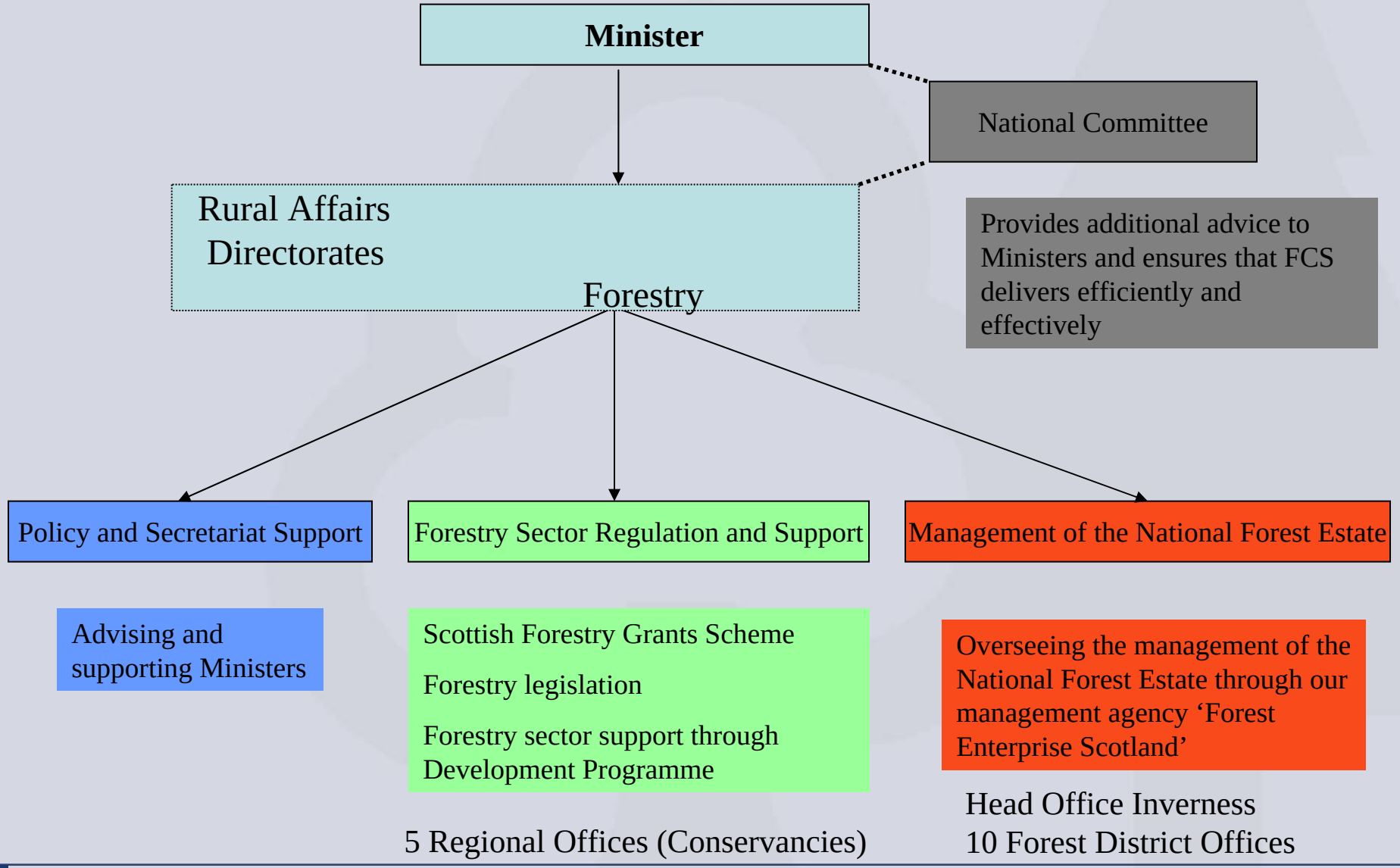
Forestry is a Devolved Subject Delivered by a Cross Border Public Body



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

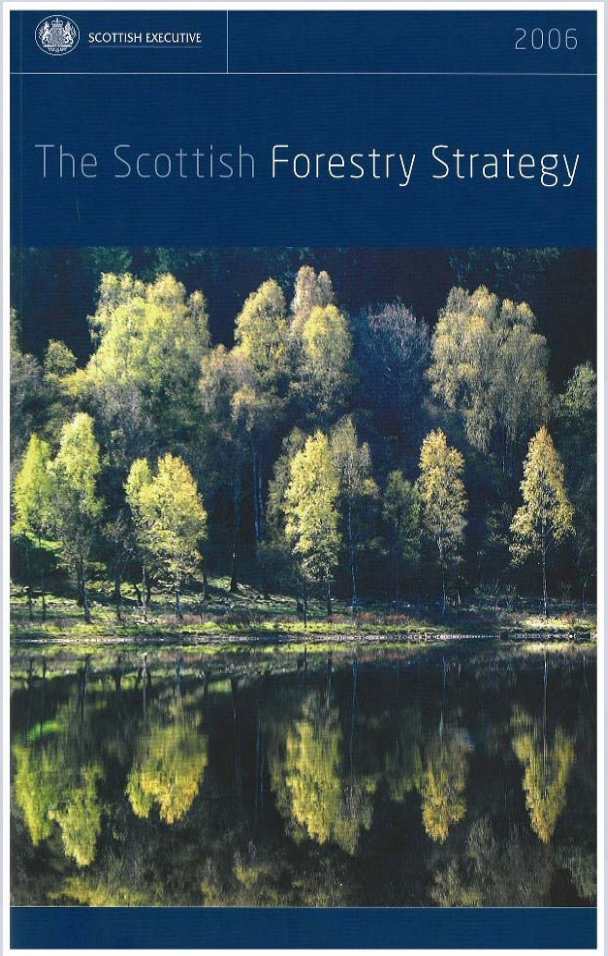
The statutory powers and duties of the FC are vested in the GB Forestry Commissioners; executive and non-executive. The GB Board of Commissioners delegates these powers to National Committees.

Role of FCS


Minister
National Committee
Rural Affairs Directorates
Forestry
Provides additional advice to Ministers and ensures that FCS delivers efficiently and effectively
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

Forests

Activities & Outputs

Timber and other Forest Products

Recreational facilities

Conservation of important sites, species and habitats

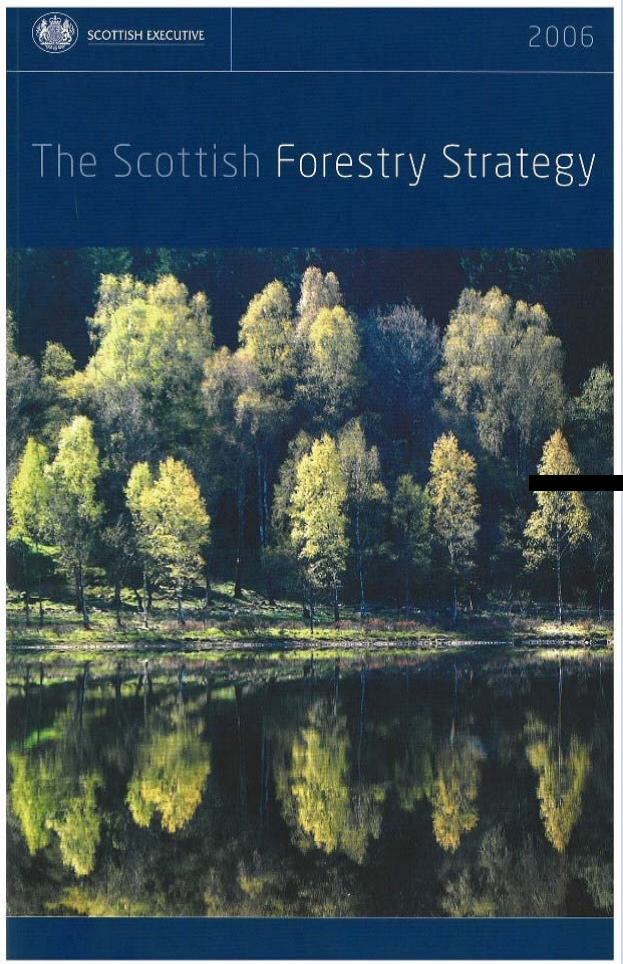
Outcomes

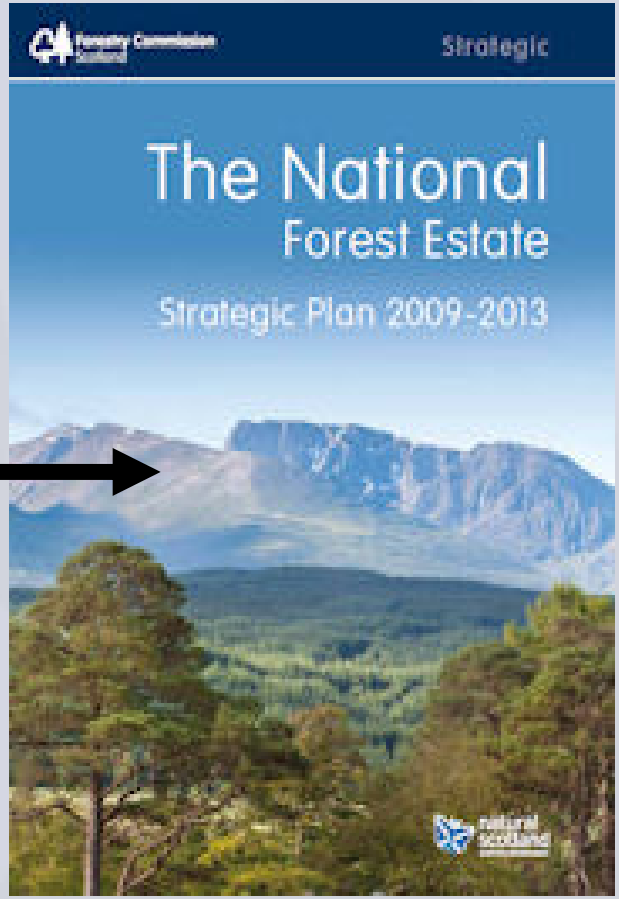
Competitive and innovative businesses contributing to the growth of the Scottish Economy

Improved health & well-being of people and their communities

High quality, robust and adaptable environment

Where Does FES Get Its Lead From?





FCS Policies

Plus a few more for good measure!!

Front-line focus

Responding to priorities

FCS wants more:

new planting

renewables

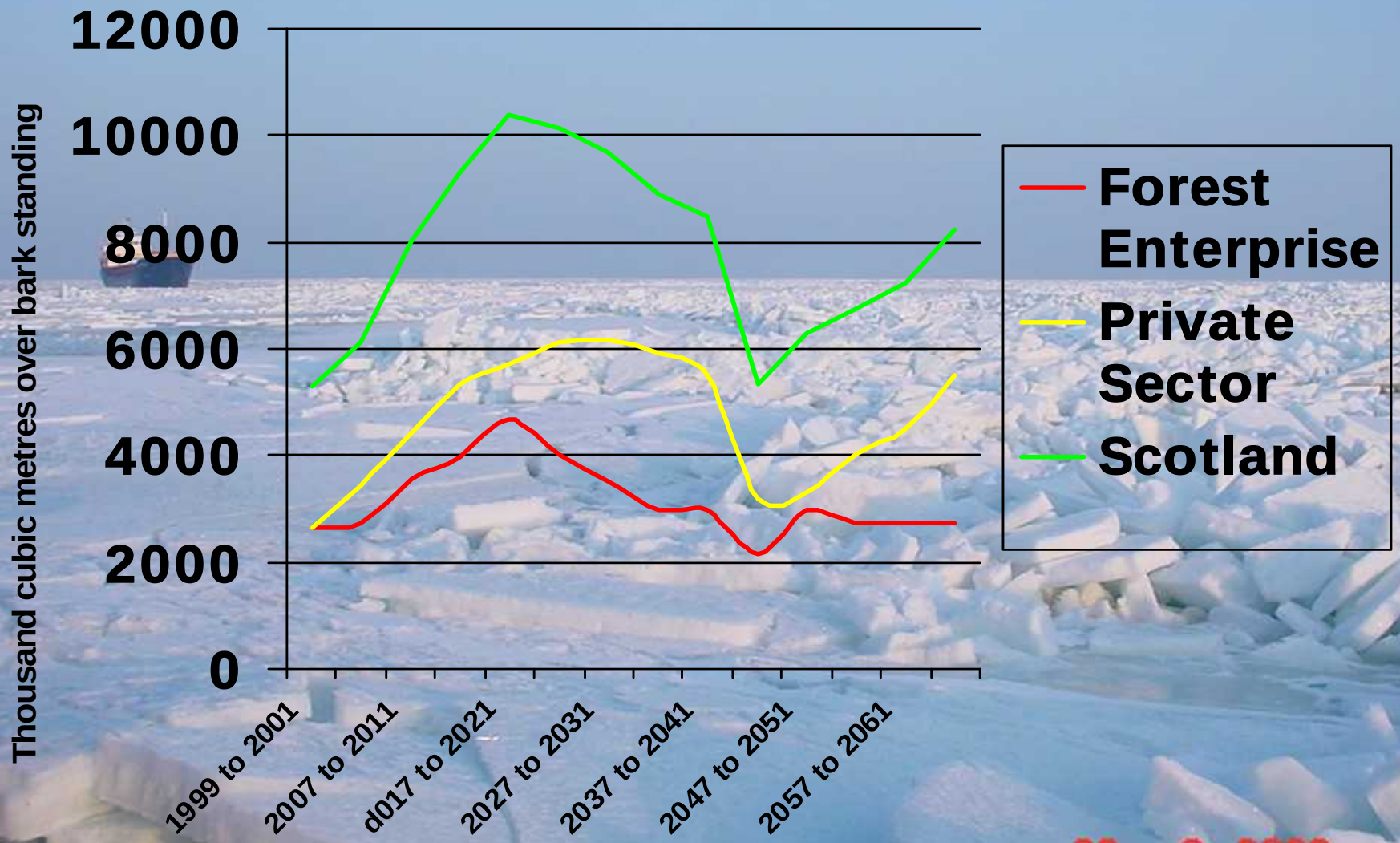
WIAT

priority biodiversity

sector skills

Forestry Commission Scotland

Combined FES and Private Sector



Planning

Planning

Roads

Pavement Design

Soil Description	CBR	Pavement Thickness mm.	
		Crushed Rock	Rock as raised
Soft Clays	2	700	900
Poorly drained silty clay or badly drained sandy clay	4	475	600
Well drained silty clay and good mineral soils	6	350	450
Poorly drained granular materials	10	250	325
Well drained granular materials and rock	15	200	250

Bridges

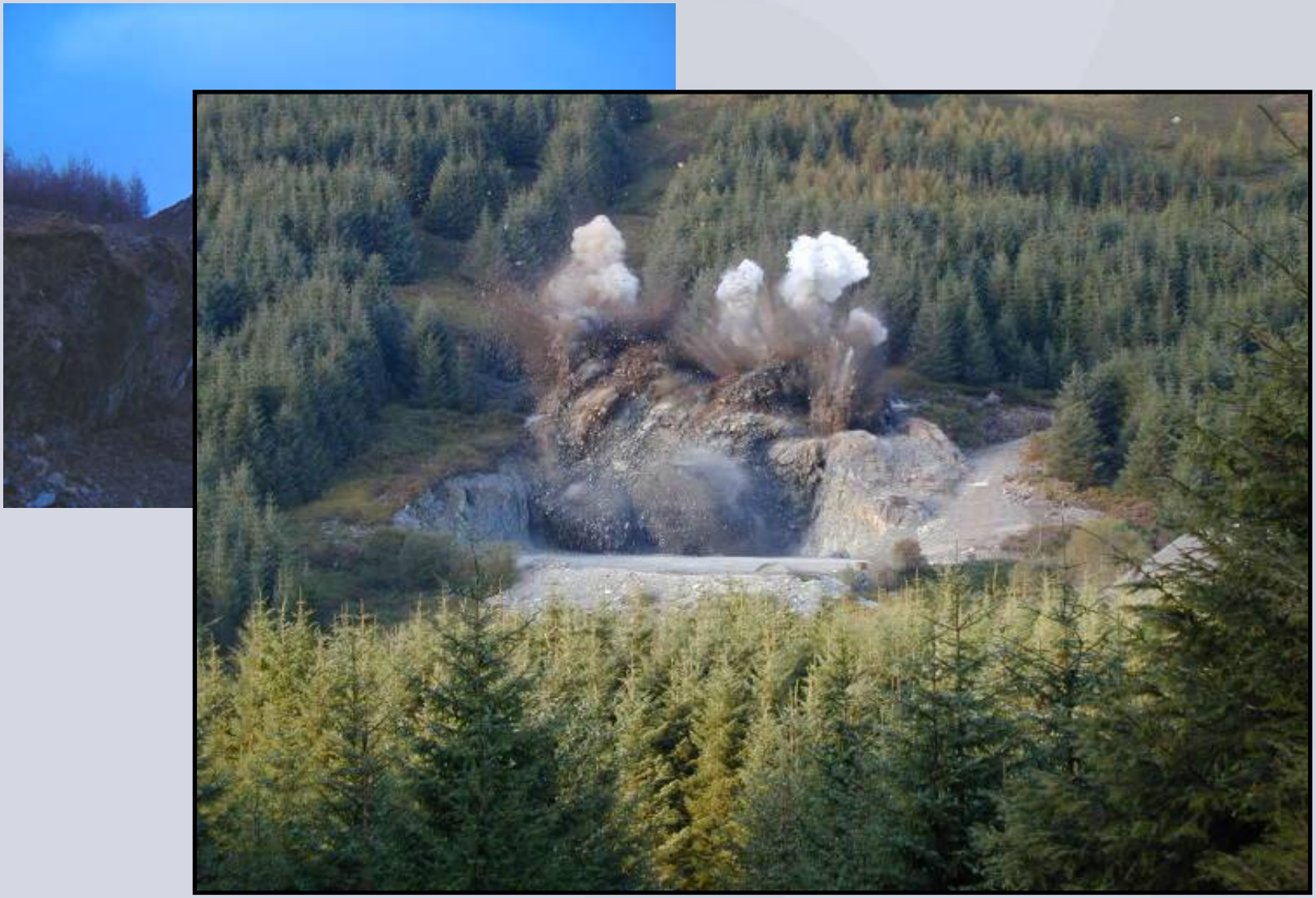
Build and Maintain Bridges

Maintenance & Repairs

Carry out Maintenance & Repairs

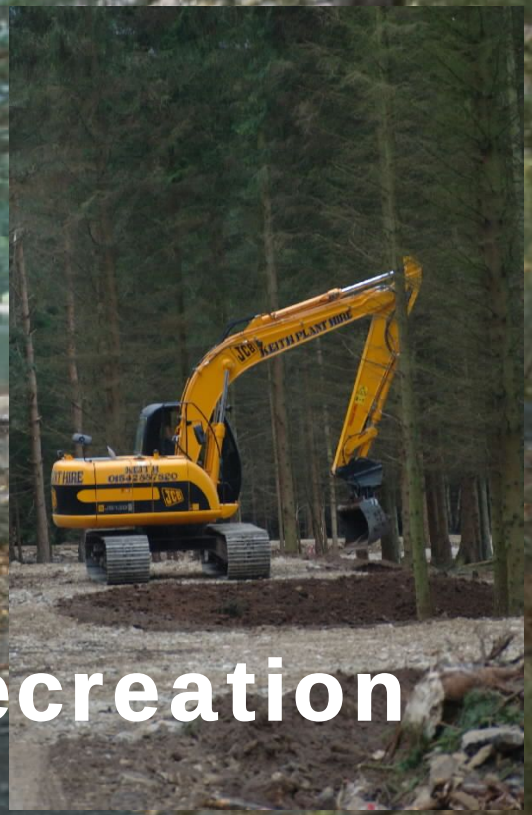
Quarries

Producing materials



Getting the right mix!

Recreation Facilities



Construct and Maintain Recreation Facilities

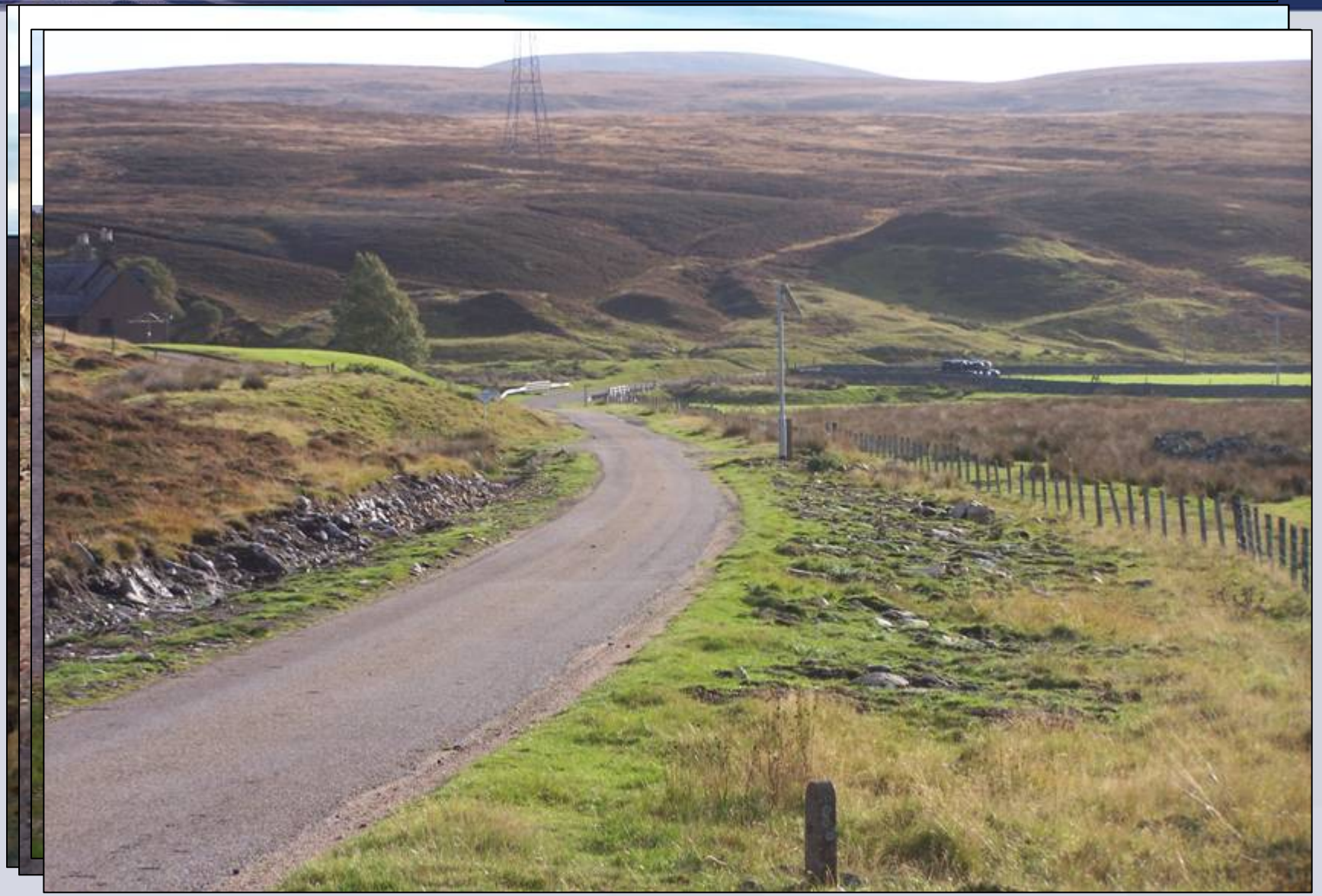
Road Use


HANKOOK
TOYOTA
David
BOGIE
HANKOOK
OAKBANK SERVICES
XLZ 6889

Road Condition Surveys

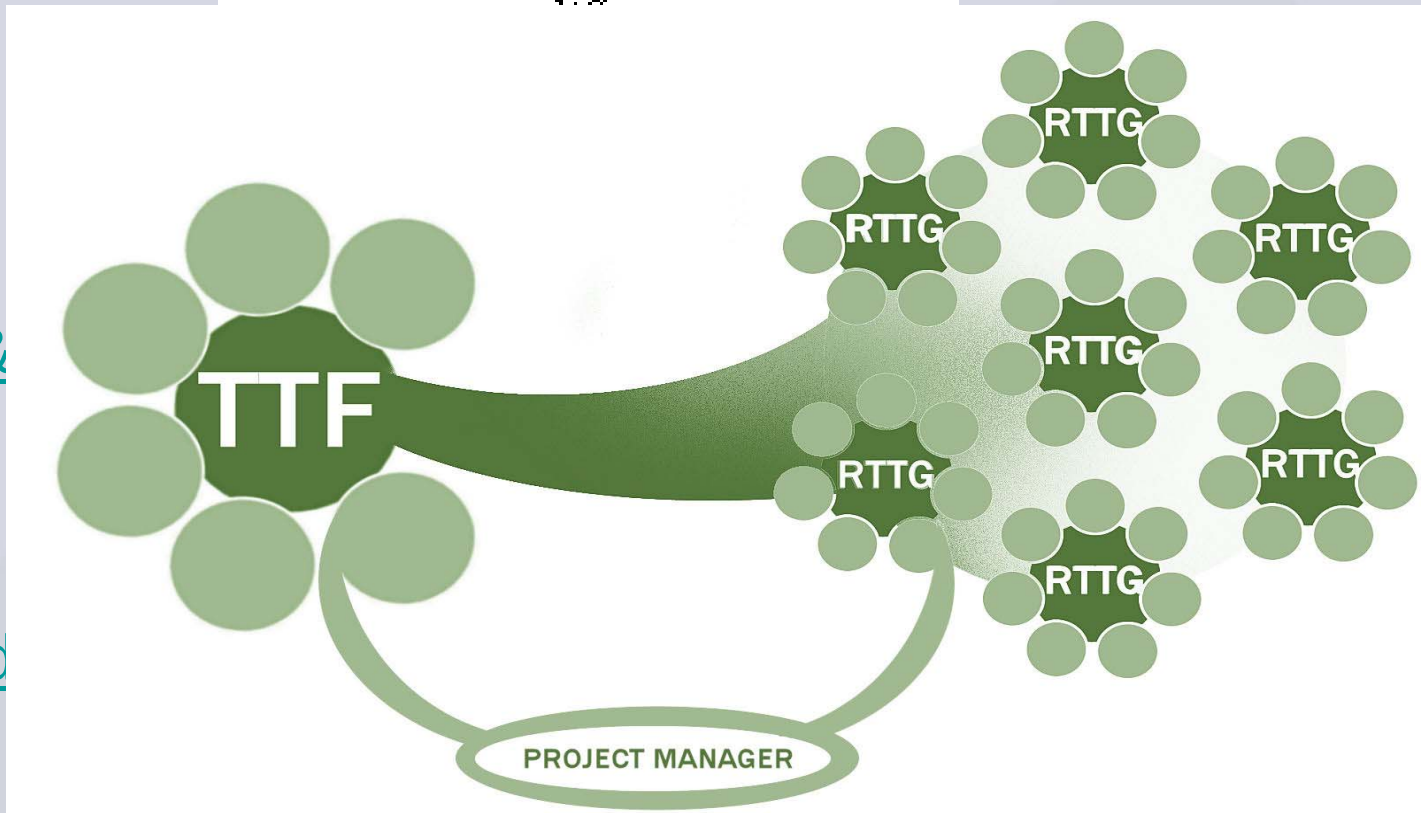
Road Condition Surveys Programme

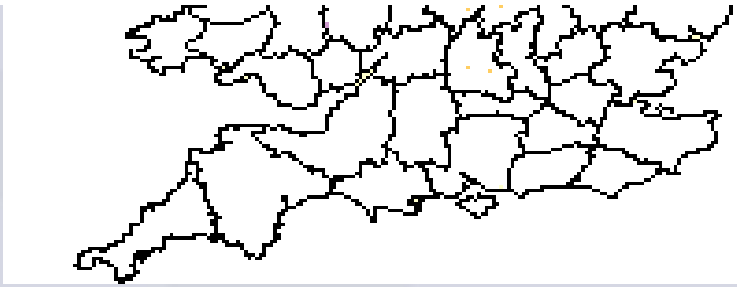
Example of Weak Public Road



Communication; Timber Transport Groups

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





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

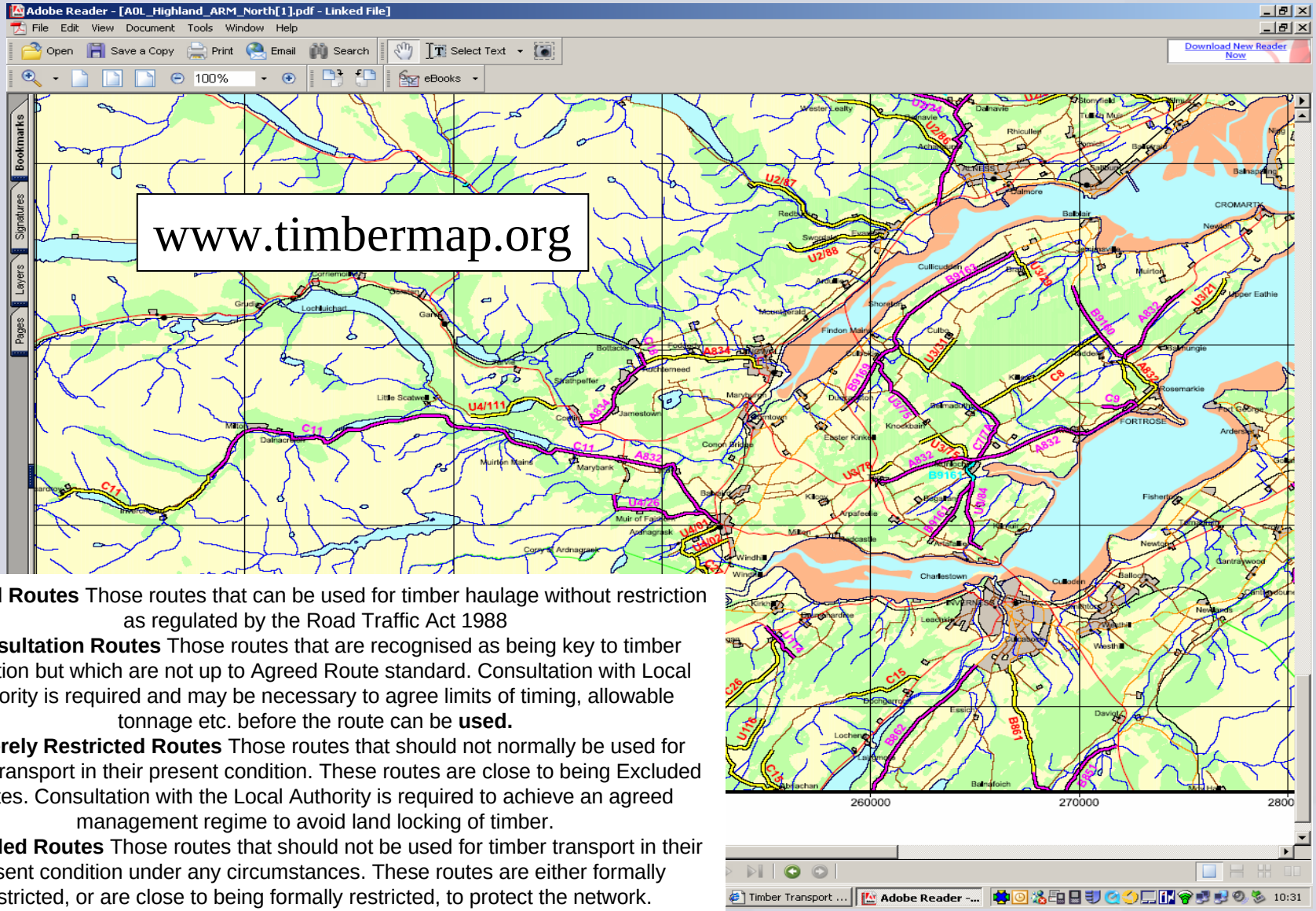
To explore and promote the potential for increased use of rail and water modes

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.

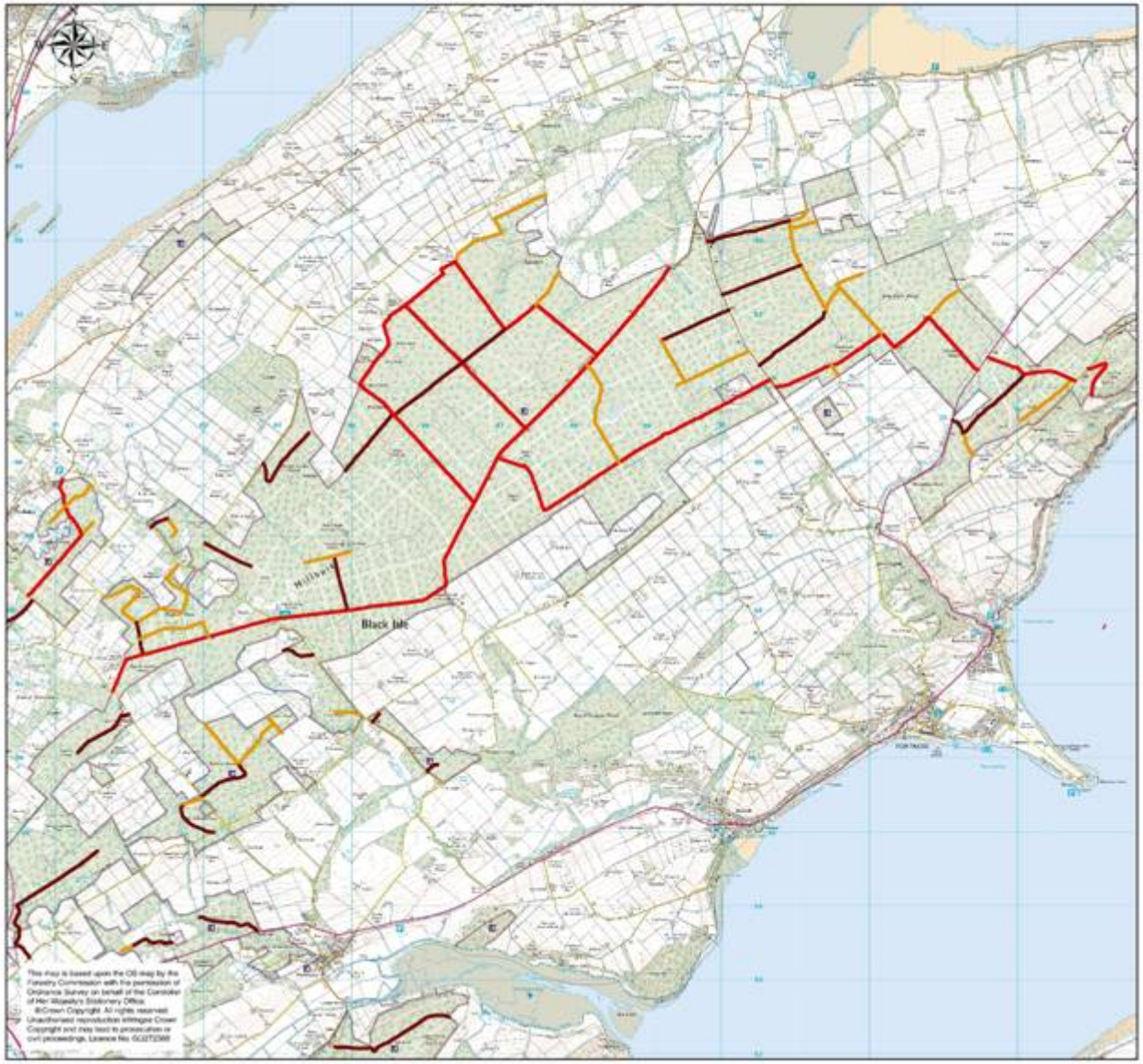
To share information and methodologies with other Regional Timber Transport Groups

Agreed Timber Transport Routes



- **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

Forest Road Network



Title

Millbuie - Black Isle

Information

Road Classification

- Class A
- Class B
- Class C

1 centimeter equals 500.00 meters

Author	D. Straube	Date	27/02/07
Checked by		Date	
Scale	1 : 50000	Filename	Millbuie.jpg

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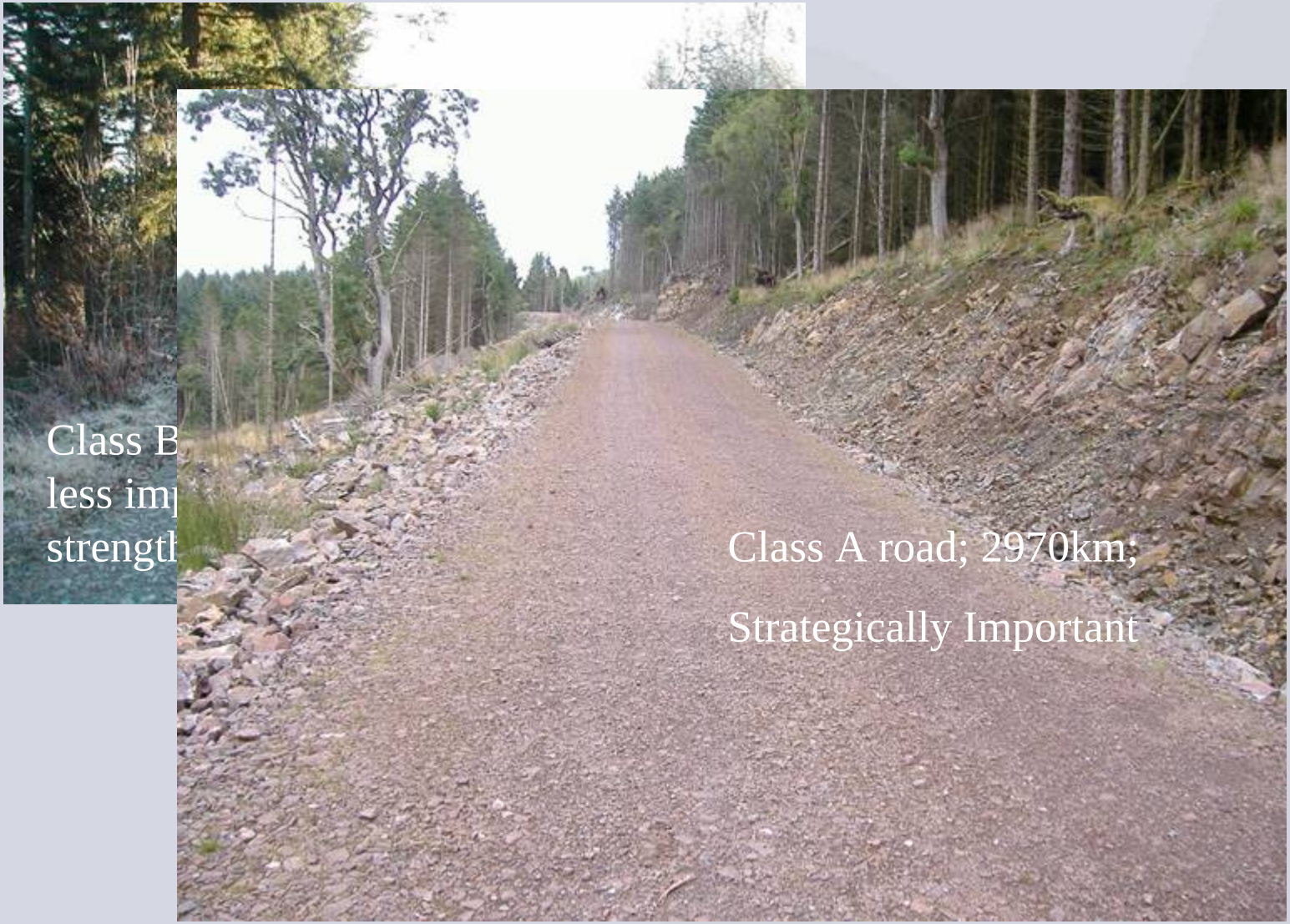
Frank MacCulloch
Area Civil Engineer

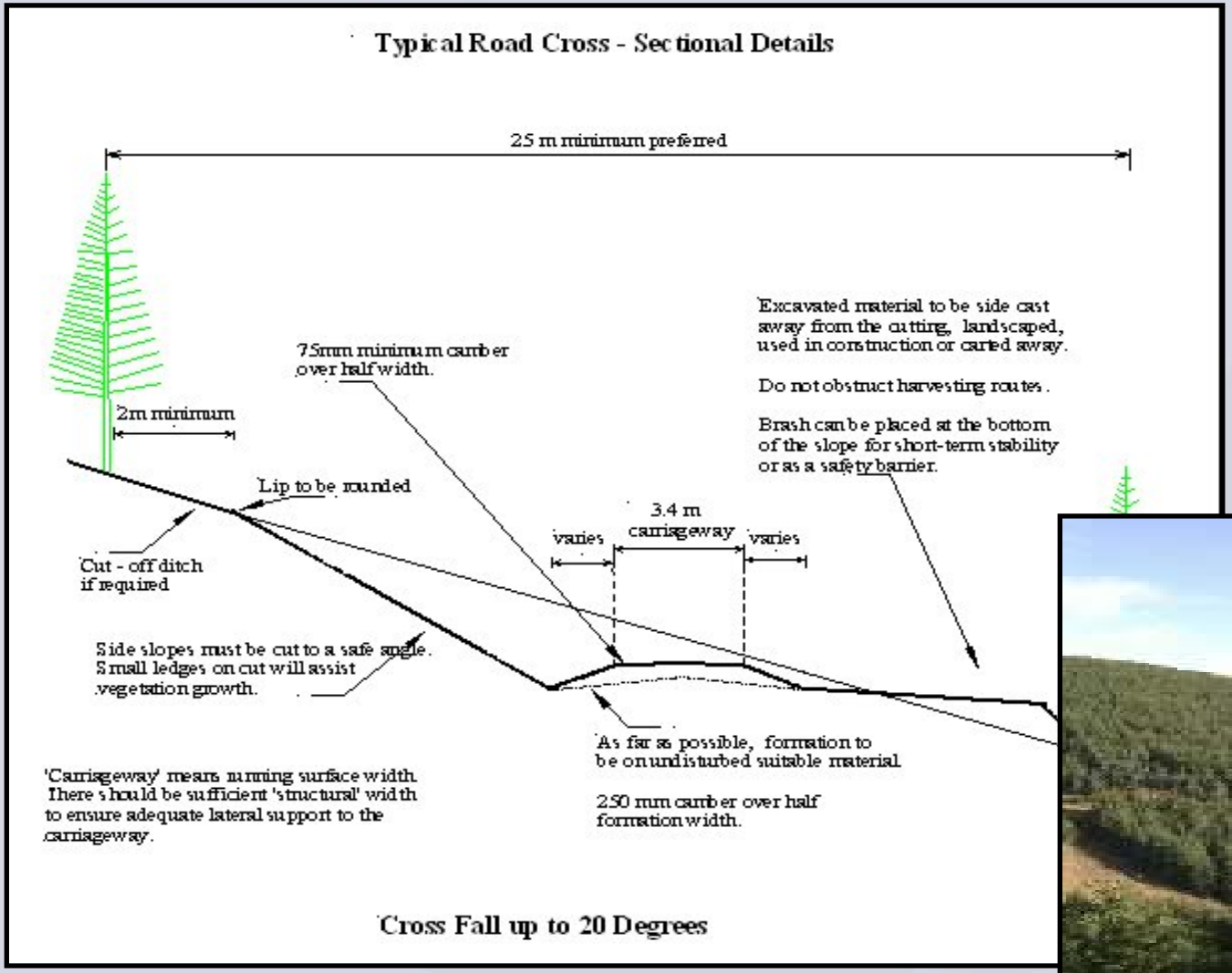
E-Mail:
frank.macculloch@forestry.gsi.gov.uk

Forestry Civil Engineering

Forest Road Classification



Road Cross Section



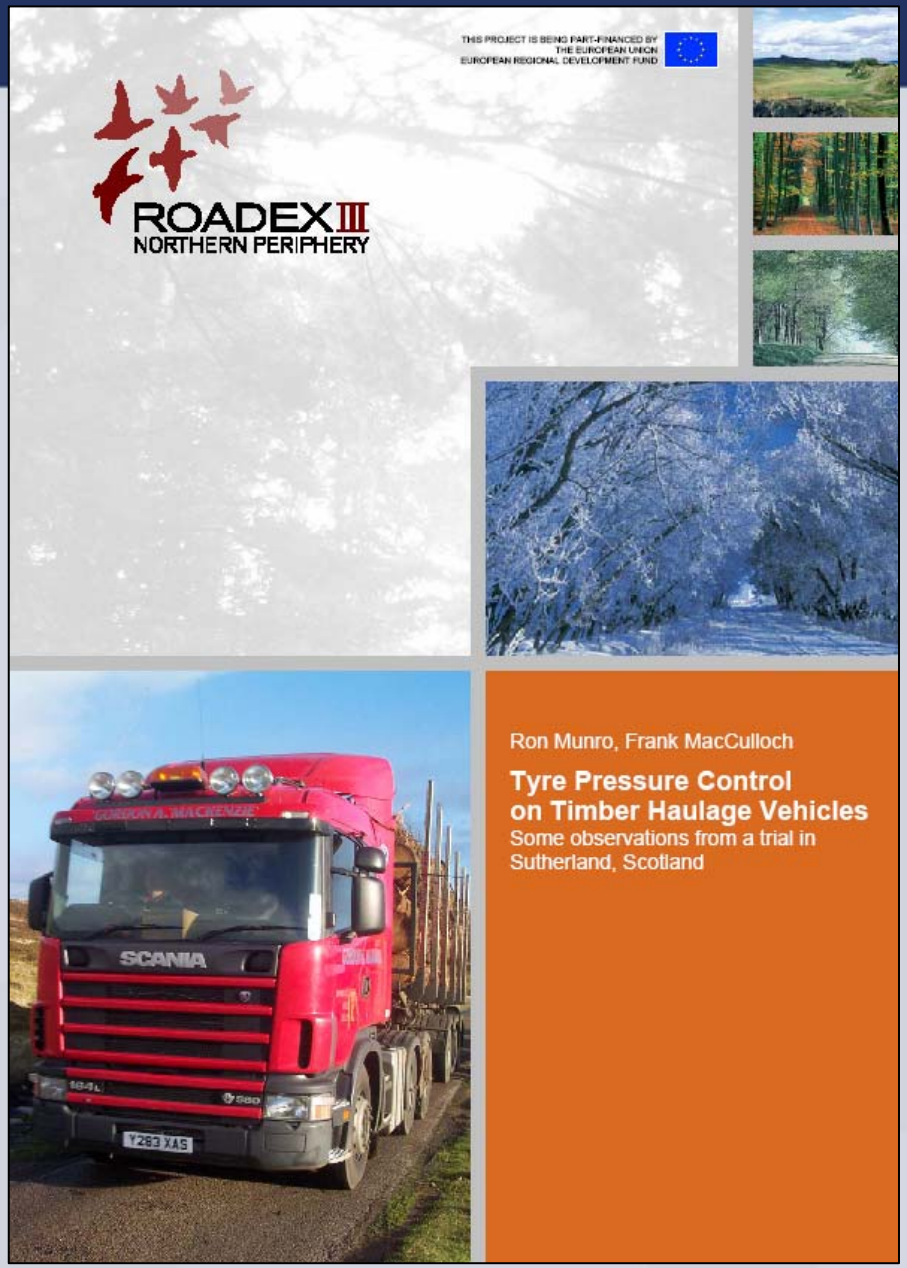
CTI & LGPV

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 Asessment

Stage 2 Benchmarking review

Stage 3 Update GIS layer

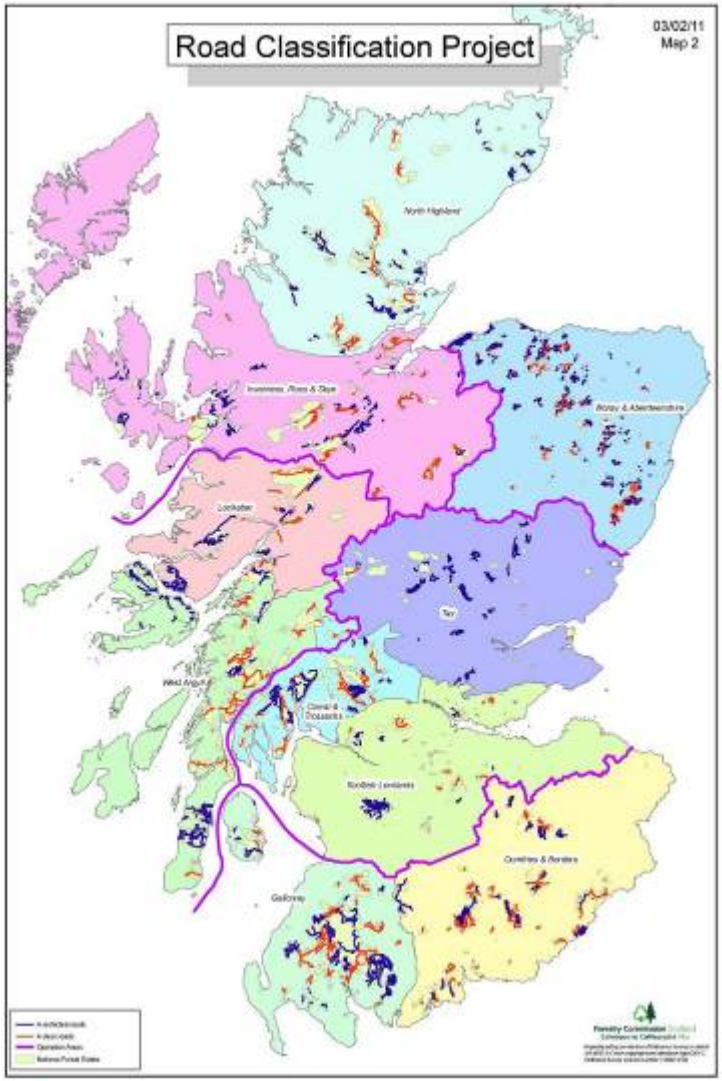
Stage 4 Identify area specific solutions

Stage 5 Cost benefit analysis

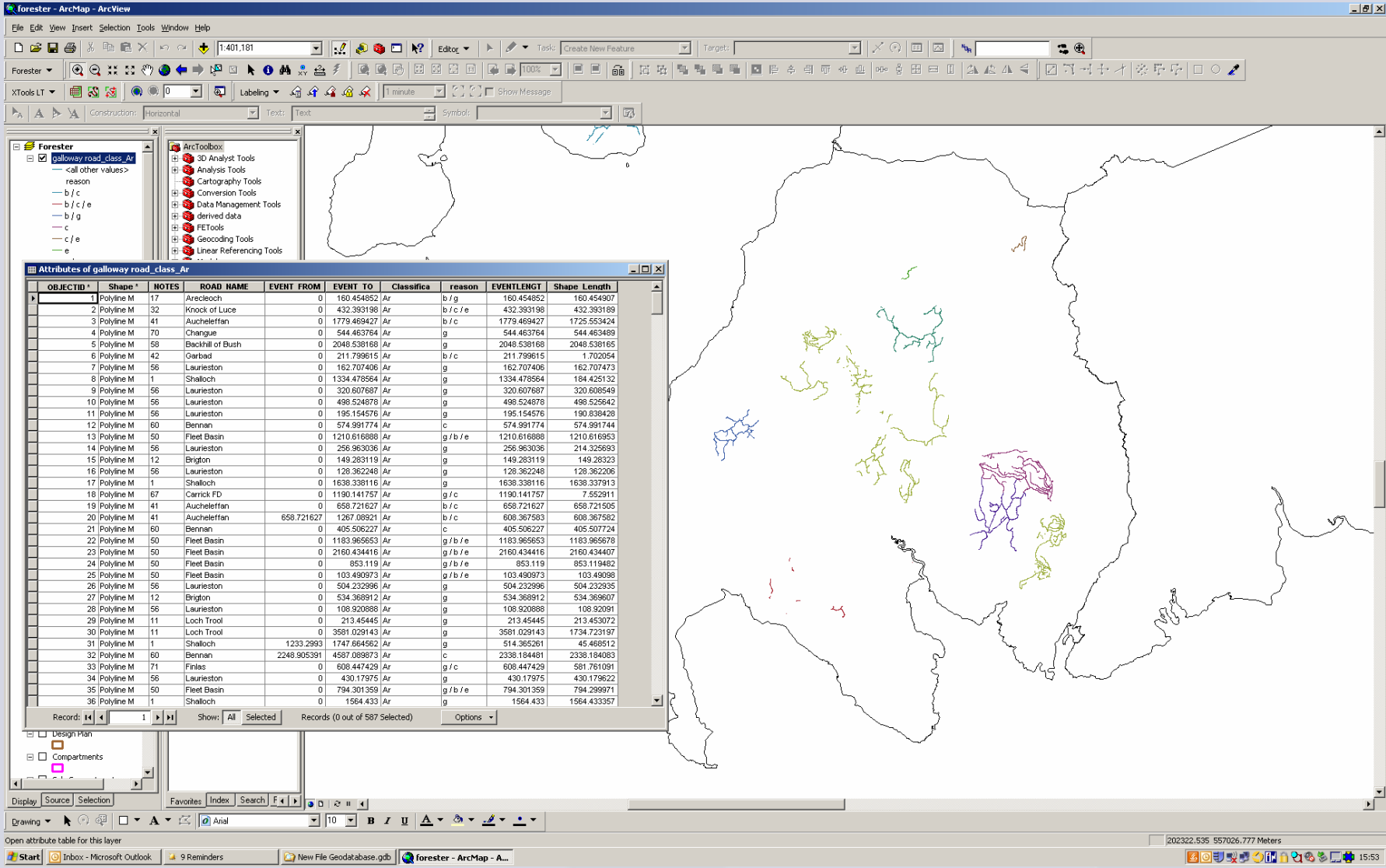
Stage 6 Discussion with trade

Stage 7 Implementation

Results



Area solutions



Terragator Vehicle

Truck Innovation

Trailer Innovation

TPC Vehicle


James Jones and Sons Ltd.
James Jones and Sons Ltd.
Larbert
01324 562241
Mosstodloch
01343 821421
SV08 GOX

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

Strategy

Principal Inspection 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 2010.

1. An electronic query is required for the database to help pick out the old, the long span, the special bridges, temporary bridges, restricted bridges, 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 Inspection (cleaning).
3. Grade, train and test Principal Inspectors 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 Inspection do not become 'special' visual inspections.

1. Helen (and others involved with GIS database) will look into building a query to pick out
    - Bridges over 50 years old
    - Bridges over 12m span
    - Any which had a 4 or 5 for severity in the last report
    - Bailey Bridges
    - Public road spans
    - Suspension bridges
    - Lorry bridges on active arterial routes

    There may be others but basically this is a list of criteria which would put a bridge in the first priority group and need a principal inspection as soon as possible. This group will contain the majority of FC bridges and their inspection is likely to span over a 3 or 4 year period. When these bridges have been picked out the strategy document below sets out how the inspections are carried out.

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

    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. Bridges with a soffit less that 2m above the river bed can be reaches by hand for close inspection and tapping with a hammer. Bridges with soffits between 2m and 3.5m will be accessed from the ground using a special hammer, telescope and fibre optic viewer. Bridges with soffits 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 FC personnel cannot inspect a bridge safely the inspection will be contracted out. The contractor will choose between abseil, scaffold, cherry picker or another. Access down the bank, pollution, wildlife, environmental factors 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 close 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 countersigns the Principal Inspections so must control 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 under load 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 FCE have been given basic training so are covered in terms of negligence. Every inspector should complete a competence CV based on the above nine standard requirements. The Supervising Engineer can make a judgement 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

Strategy

Engineer justify grades of inspector where some boxes in the CV are not ticked. Frank MacCulloch 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 out individual inspection report forms 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 preferable 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 take 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 sending someone out after the Principal Inspection to 'assess'. 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, 'hand' contact with all parts of the bridge soffit and no accidental pollution or wildlife disturbance..

Eventually all bridges will have a risk register stating its importance to the network, in 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 tramrails and temporary Bailey bridges will have their succession planned for. Each record will have dates set for the biannual visual inspection and 6 yearly Principal Inspection.

Geoff Freedman
1st February 2010

FORESTRY CIVIL ENGINEERING BRIDGE RECORD

FCE Area.....
Forest District.....
Location[1].....
OS Map Reference[2].....

Bridge No. & Name.....
Bridge Type[3].....
Road Category[4].....
Owners/Users[5].....

Clear Span(s)[6].....
Effective Span(s)[6].....
Height Deck to Bed (U/S)[7].....
Waterway Area.....
Catchment Area[8].....
Bed Gradient @ Bridge[9].....

Load Capacity.....
Weight Restriction[10].....
Completion Date.....
Cost[11].....
Services[12].....
Drawing Nos[13].....

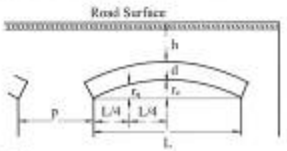
BEAM/SLAB SUPERSTRUCTURE

Main Beams.....No.
Type[14].....
Sizes.....
Diaphragm
Type[14].....
Size.....
Deck
Type[14].....
Thickness.....
O/A Width.....
Width for Traffic.....
Kerb Sizes.....
Abutments/Bank Seats[15]
Type.....L.....R
Height.....L.....R
Wing Walls[16]
Type.....
Length.....
Piers(s).....No.
Type.....

CULVERT/IRISH BRIDGE

Type[18].....
Diameter.....
Cover.....
Head Walls
Type.....
Height.....
Tail Walls
Type.....
Height.....

ARCH SUPERSTRUCTURE



Span(s)
L.....Show other Dims. Over.
Bridge O/A Width.....
Width for Traffic.....
Parapets
Type.....
Thickness.....
Height above Road.....
Material Types[17]
Arch Barrel.....
Arch Ring.....
Spandrel Walls.....
Wing Walls.....
Arch Fill.....
Wing Walls[16]
Length.....

FOUNDATIONS[18]

L Abut/Headwall.....
R Abut/Tailwall.....
Piers.....
Foundation
Subsoil.....

Date of Record.....

.....FCE Engineer

NOTES

1. This could refer to a forest block, river name, local area name etc.
2. OS survey reference: 2 letters, 6 digits.
3. Arch, RC slab, PSC beams and insitu infill, composite steel and concrete, trammil, steel beam with timber deck, aerial mast, Bailey, large culvert, timber footbridge, suspension, etc..
4. This should refer to the current classification i.e.
   A Arterial Route: **B** Spur Road :**C** Other Road: **D** Footpath
5. This refers to joint ownership or joint maintenance agreements or multiple users. Entry to show FE's percentage liability and names of partners.
6. Dimensions in metres and hectares for short record and millimetres for detailed record below. (Imperial units used where necessary for old sections.)
7. Approximate dimension.
8. Area and description of topography, vegetal cover etc.
9. Average within 50m up and downstream of bridge and an indication of flow characteristics – sluggish, torrent, meandering etc.
10. This will probably be the same as load capacity, but 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 drawings if any.
14. Metal members to have their protective coating detailed under type e.g. UB painted, trammil waxed etc.
15. Left and right bank looking downstream. U/S = upstream, D/S = downstream.
16. Where necessary, distinguish between L & R, U/S & D/S walls.
17. Descriptions to accord with Tables 3.1 and 3.2 of BA 16/97 i.e. as for MEXI assessment.
18. Depths required from fixed points on structure to underside of foundation. Foundation subsoil e.g. gravel, clay , bedrock etc.

SKETCH AND / OR PHOTOGRAPHS

FORESTRY CIVIL ENGINEERING BRIDGE INSPECTION REPORT

FCE Area.....
Forest District.....
Location[1].....
Map Reference.....

Bridge No. & Name.....
Road Identity[2].....
Owners / Users[3].....
Date of Inspection.....

Condition Report[4] Overall =		Extent A	B	C	Severity 1	2	3	4	5
1.	Foundations								
2.	Invert/Apron								
3.	Piers								
4.	Abutment Left[5]								
5.	Abutment Right[5]								
6.	Wing Wall Left U/S[5]								
7.	Wing Wall Right U/S[5]								
8.	Wing Wall Left D/S[5]								
9.	Wing Wall Right D/S[5]								
10.	Retaining/Revetment								
11.	Approach Embankments								
12.	Bearings								
13.	Main Beams								
14.	Transverse Beams								
15.	Diaphragms/Bracing								
16.	Concrete Slab								
17.	Kerbs								
18.	Metal Deck Plates								
19.	Deck Timbers								
20.	Arch Barrel								
21.	Arch Ring								
22.	Spandrels								
23.	Brick/Masonry Pointing								
24.	Tie Rods								
25.	Service Ducts								
26.	Expansion Joints								
27.	Parapets/ Handrails								
28.	Paintwork/Prot. Coating								
29.	Culvert/Pipe Arch								
30.	Scour Below Structure								
31.	Scour of Bed								
32.	Erosion of Banks								
33.									

Details of Maintenance Work Since Last Report

Details of Defects[9]

Weight[9] Restriction	Required ?	Yes/No				
	GVW Tonnes	3	7.5	17	38	41
	Signs up?	Yes/No				

Maintenance Work Recommended[6] | **Est. Cost**

ACE's Comments[10]

Maintenance Category[11] A / B / C
Next Inspection By[12] .....

Inspector[7].....
Date.....

Work Authorised:.....
Date.....

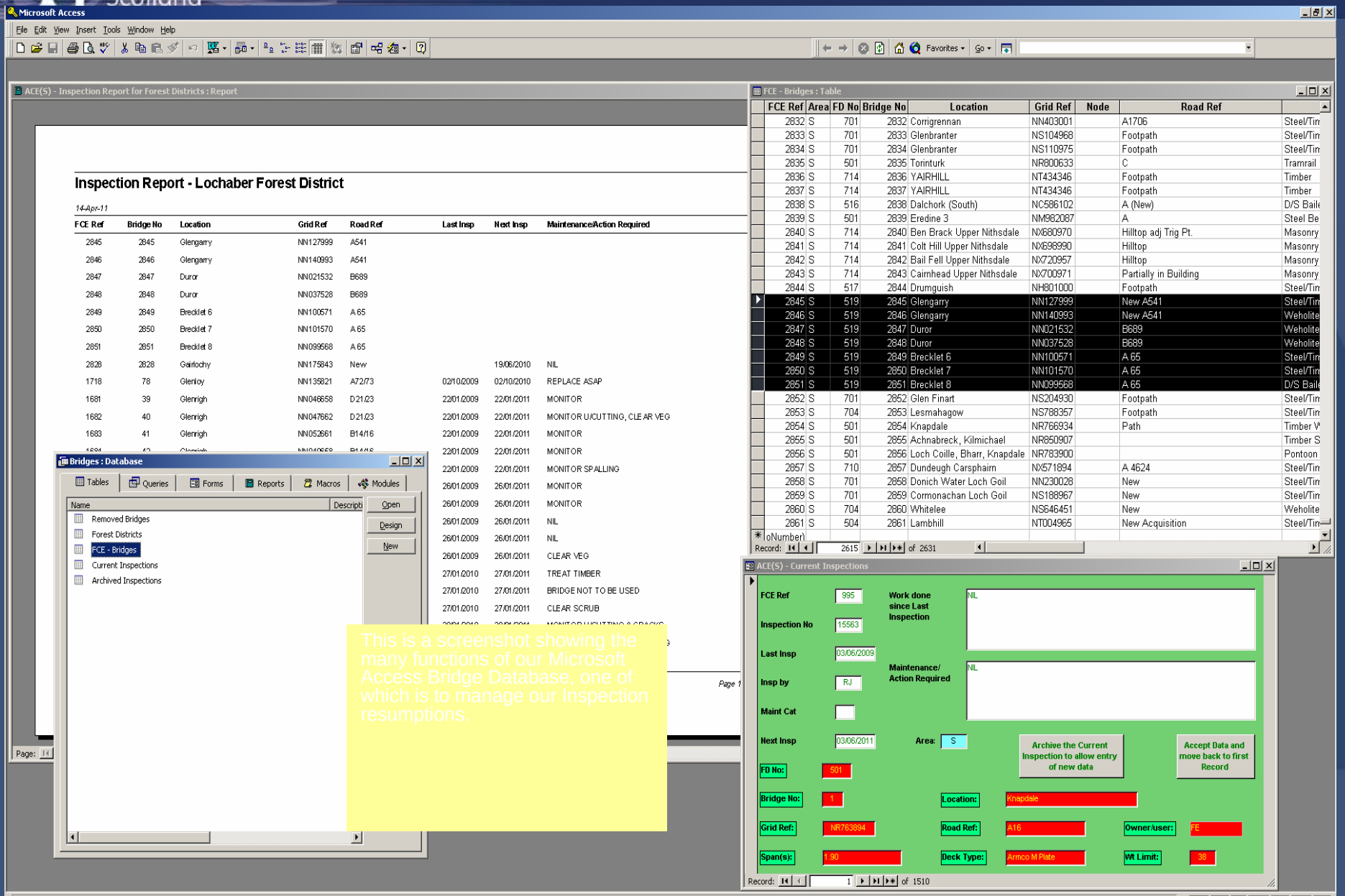
NOTES

1. This could refer to a forest block, river name, local area name etc..
2. This should refer to the current classification i.e.
   - **A** Arterial Route
   - **B** Spur Road
   - **C** Other Road
   - **D** Footpath
3. This refers to joint ownership or joint maintenance agreements or multiple users. Entry to show FE's percentage liability and names of partners.
4. The 'Condition Report' is the assessment of defects. The following system of scaled descriptions must be used. *Number 'Overall' box, and tick other boxes as appropriate.*

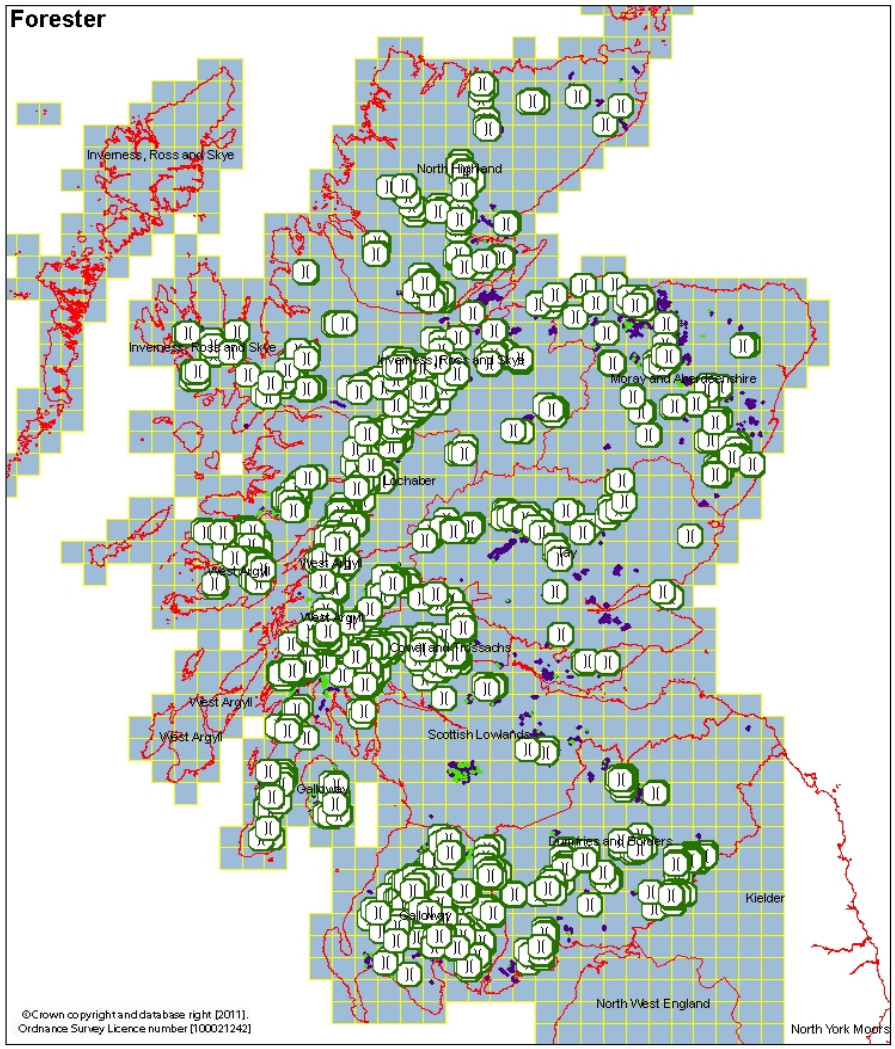
   Extent
   - **A** Slight, up to about 10% of area/length affected
   - **B** Moderate, 10% to about 50% affected
   - **C** Extensive, over 50%

   Overall & Severity
   - **1** Very good, no defects
   - **2** Good, minor defects of non-urgent nature.
   - **3** Minor defects, requiring attention within 2-3 years.
   - **4** Poor, defects of an unacceptable nature which should be included for attention within the next annual maintenance programme.
   - **5** Urgent, severe defects where action is needed within the present financial year. (These should be reported immediately to the client.)
5. Left and right bank when looking down stream. U/S = upstream, and D/S = downstream.
6. The requirement for the work should be obvious from the comments above. An estimated cost should be provided for the ACE.
7. Unless another system is agreed, a copy of the form should be sent to the ACE for authorisation. The following year's report will show details of work carried out.
8. 'Details of Defects': Provides for expansion of the description of the extent and severity beyond ticks in the boxes. Photographs should be considered. The defect number from the 'Condition Report' should always be used.
9. This refers to the current status of the bridge capacity.
10. 'ACE's Comments': ACE to agree or disagree work recommended, and estimated costs. There may be other, non engineering reasons, why repairs are not to be carried out as recommended. If so, the ACE should report here.
11. 'Maintenance Category': Allows for ACE to comment on the urgency / timescale of the proposed work
    - **A** Urgent – < 3 months
    - **B** Medium term – 3/6 months
    - **C** Long term - > 6 months
12. ACE to insert latest date for next inspection (maximum 3 years).

Forestry Commission Scotland — Microsoft Access Bridge Database



New GIS Bridge Database



Forest District : Scotland
Title : Forester GIS Bridge Layer
Author : David Straube
Scale : 1 : 2000000
Date : 14/04/2011

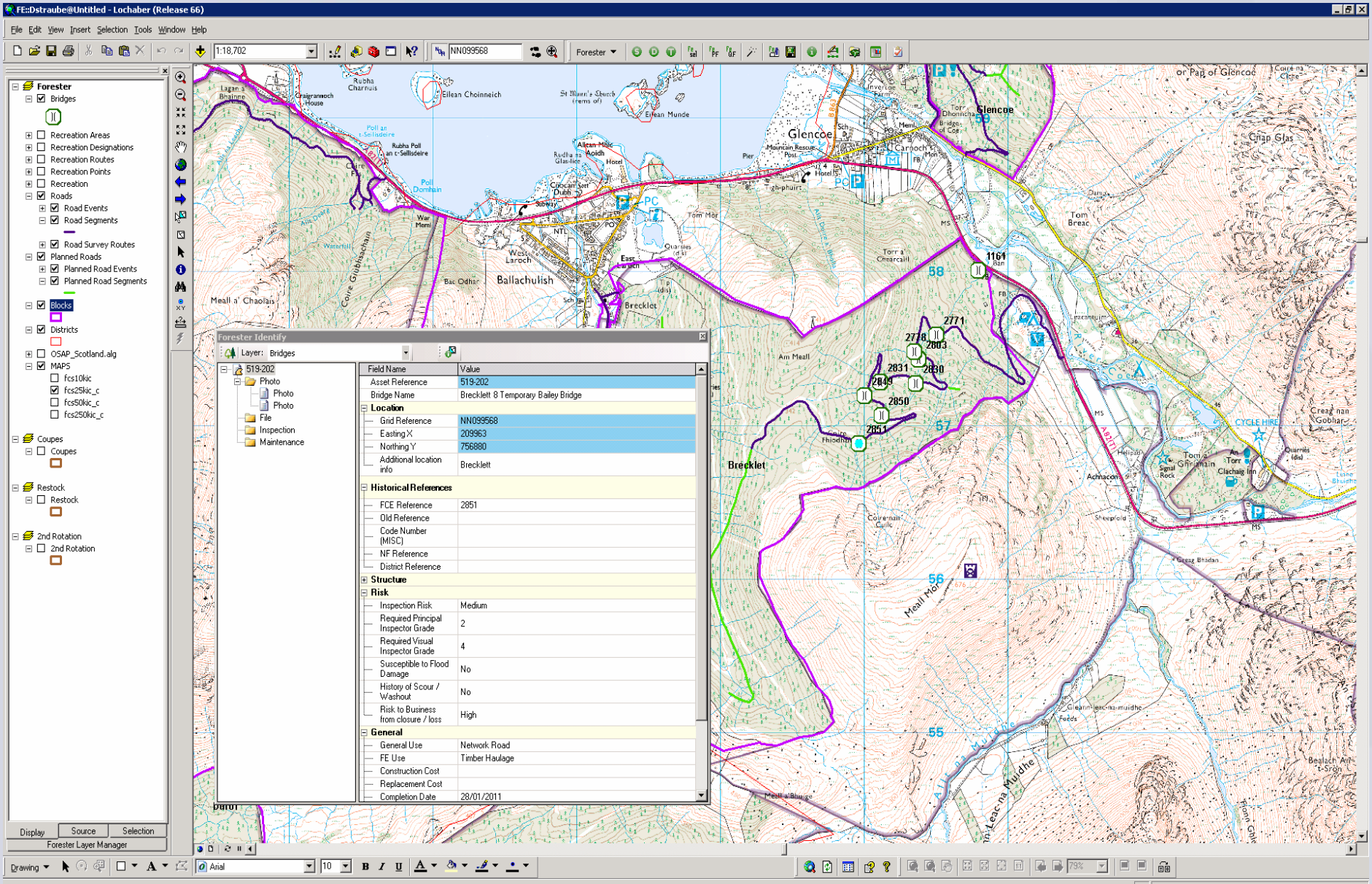
Legend

- Bridges
- Planned Road Segments
- Road Segments
- Districts

Forestry Commission Scotland

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


FE::Dstraube@Untitled - Lochaber (Release 66)
File Edit View Insert Selection Tools Window Help
Forester
Bridges
Recreation Areas
Recreation Designations
Recreation Routes
Recreation Points
Recreation
Roads
Road Events
Road Segments
Road Survey Routes
Planned Roads
Planned Road Events
Planned Road Segments
Blocks
Districts
OSAP_Scotland.alg
MAPS
fcs10kic
fcs25kic_c
fcs50kic_c
fcs250kic_c
Coupes
Coupes
Restock
Restock
2nd Rotation
2nd Rotation
Display
Source
Selection
Forester Layer Manager
Forester Identify
Layer: Bridges
519-202
Photo
Photo
Photo
File
Inspection
Maintenance
Field Name
Value
Asset Reference
519-202
Bridge Name
Brecklett 8 Temporary Bailey Bridge
Location
Grid Reference
NN099568
Easting X
209963
Northing Y
756880
Additional location info
Brecklett
Historical References
FCE Reference
2851
Old Reference
Code Number (MISC)
NF Reference
District Reference
Structure
Risk
Inspection Risk
Medium
Required Principal Inspector Grade
2
Required Visual Inspector Grade
4
Susceptible to Flood Damage
No
History of Scour / Washout
No
Risk to Business from closure / loss
High
General
General Use
Network Road
FE Use
Timber Haulage
Construction Cost
Replacement Cost
Completion Date
28/01/2011
Glencoe
Ballachulish
Brecklett
Achnacon
Tom Breac
Creag nan Gobhar
Chap Glas
CYCLE HIRE
Drawing
Arial
209963.381 759276.345 Meters
Start
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12:44

Forestry Commission Scotland — New GIS Bridge Database