B R A N C H L I N E R

How do we solve a problem like the Flows?

FINAL REPORT

May 2016

HITRANS

THE HIGHLANDS AND ISLANDS TRANSPORT PARTNERSHIP

Co-funded by:
Strategic Timber Transport Fund
Forestry Commission Scotland
HITRANS

Contents

SECTION 1

Introduction & Background, Summary of Conclusions & Next Steps

Introduction & Background

THE BRANCHLINER project started out in September 2014 as an outcome of the Highland Timber Transport Group Flow Country Strategy and followed on from two earlier HITRANS reports: *Upsticks* - modelling timber flows to the main mills in the Inner Moray Firth and *Lifting the Spirit* - analysing whisky industry haulage movements and reporting on a rail demonstrator project.

It also followed two previous Strategic Timber Transport Scheme (STTS) projects Roundwood by Rail in 2011 and Strathrail in 2012.

The initial Branchliner proposal was for a demonstrator project similar in concept to Lifting the Spirit, but proposing a common-user timber-by-rail service from Georgemas in Caithness to Inverness, picking up part of the load by railside loading at Kinbrace. It proposed to shift 20,000t of timber over 10 weeks, with the operational and transport costs subsidised by STTS to be no more costly than road transport. Branchliner would be delivered in two phases, an initial study to determine realistic logistics and costs, followed by the actual demonstrator.

Given the high cost of the demonstrator, STTS was awarded for the study project element only, following resubmission in December 2014.

HITRANS with support from Confor, UK Forest Products Association (UKFPA), Forestry Commission Scotland (FCS) and Highland Timber Transport Group (HTTG), engaged separate consultants to cover the following Work Packages:

- WP1 Civil engineering: terminal design, improvements.
- WP2 Rail operations: procurement, wagons, haulage, pathing and possessions.
- WP3 Road logistics: trip to and from terminals, roadspace allocation.
- WP4 Product supply: harvesting, loading to rail, off loading.
- WP5 Facilitation: promoting and establishing the alliance.
- WP6 Economic case: establishing the value of timber to the Highland economy.
- WP7 Environmental assessment: impact of mode shift.

Summary of Conclusions

Key Study Outcomes

- The Branchliner Reports have demonstrated the viability of a rail solution to the challenges of timber transport in the Flow Country.
- Up to 140,000 tonnes per annum of timber can be delivered from the railhead to the market with significant economic and environmental benefits.
- The Reports have focussed primarily on quantitative outcomes but it is acknowledged that there is a range of qualitative environmental benefits arising from the non-abandonment of the timber resource.

WP1: Civil Engineering: terminal design, improvements (Douglas Binns Ltd)

The ability to move a significant volume of timber by rail from the Flow Country to Inverness and beyond is dependent on the provision of an efficient means of transferring loads from road to rail. The site at Kinbrace was chosen by the project team as the preferred transfer site.

Options were considered for both lineside loading and fixed sidings, with the fixed siding option being developed as the preferred option. The site was previously used for lineside loading – direct loading from the adjacent hardstanding onto trains occupying the main railway line.

The proposed layout entails a south facing connection onto the main railway line with two 440 metre sidings and a run round facility. This arrangement allows a train to be loaded in one siding and an empty train to be brought in on the other siding. The run round allows the locomotive to take the train of empty wagons into the siding, detach and transfer to the opposite end of the loaded wagons before heading south.

The overall terminal would have an area of approximately 30 000 square metres with a width suitable to allow the three rail lines, one through road, one loading road and a stacking area. Significant earthworks will be required in order to achieve a terminal area that is level with the adjacent railway, with reasonable longitudinal gradient.

Road access would be via the existing access point on the B871 south of Kinbrace.

The estimated cost for the civil and track engineering works is £3.6 million for works within the yard but excluding the connection to the main line

WP2: Rail Operations: procurement, wagons, haulage, pathing, possessions (Deltix Transport Consulting)

The volume of c.100,000tpa or more of timber traffic over 10 to 15 years from the Flow Country to Inverness justifies a bespoke rail terminal in the Kinbrace area, serviced by a cost-effective regular train service.

The train service will be dependent on long trains with substantial payloads, and a rail terminal design which minimises the time which the locomotive and driver are required to wait before returning to Inverness, so that the round trip can be achieved in a single driver shift.

The longest trains with the largest payloads will be those which are permitted by Network Rail to operate at lengths greater than those of the line's crossing loops. In such a scenario, depending on the class of locomotive and type of wagon utilised, timber payloads range from c.624t to c.1,080t, equating to 100,000tpa or more over a 40-week season, based on four trains per week.

In the case of lineside loading – the terminal type with the lowest capital cost, but highest operating cost – the maximum possible train payload would be c.364t to c.480t, equating to 73,000tpa and 100,000tpa respectively over a 40-week season, based on five trains per week. In light of the above and other forest and rail industry concerns about the cost, complexity and inflexibility of lineside loading, this type of terminal has been rejected as a core option – although it may be required as a sub-optimal interim solution should NICS not secure approval.

The preferred Flow Country terminal option from 2017 or 2018 onwards is the provision of bespoke sidings at Kinbrace, connected permanently to the main line by a conventional set of points controlled by a ground-frame – the terminal type with the highest capital cost but lowest operating cost and greatest operational flexibility.

In the interim period (2016-2017/18) the preferred option is the 'semi-permanent' Non-Intrusive Crossover System (NICS), which would involve medium capital cost, medium operating cost and flexibility – and crucially, the potential for short-to-medium term implementation.

NICS, however, will require Type Approval or a derogation with a site-specific Safety Plan to facilitate innovation at Kinbrace. The prospects for securing derogation from Network Rail should be enhanced by Transport Scotland's enthusiasm for innovation set out in its Rail Freight Strategy.

The length of terminal loading sidings is likely to be in the range 374m to 437m, with two double-ended sidings and a parallel run-round loop within the terminal maximising wagon productivity and simplifying on-site shunting. Longer sidings will provide long-term flexibility in train size and wagon type. The detail will become clearer once a preferred rail haulier has been appointed.

In the case of an Inverness railhead, the preferred option will rest on whether a conventional or intermodal wagon option is chosen, and in the former case, on alternative accommodation being found for current Network Rail technical train berthing and equipment.

The choice of conventional or intermodal will depend on the preferences of the rail haulier, and also on the capacity and capability of each method for the Kinbrace-Inverness flow, notably payload, rail-to-road handling and delivery cost, and timescale for availability. Provision of a private siding at the Norbord mill at Dalcross would tend to push the decision towards conventional wagons.

WP3: Road Logistics: trip to and from terminals, roadspace allocation (Arvikaconsult Ltd)

There is the potential to deliver between approximately 112,000 tonnes and 140,000 tonnes of timber annually to Kinbrace during a 40 week year.

In providing this tonnage the anticipated timber traffic volume is:

A897 Forsinain – Kinbrace: 7 loads per day an increase of 1 load on the present restriction.

A897 Kildonan – Kinbrace: 7 loads per day an increase of 1 load on the present restriction.

B871/873 South of Syre – Kinbrace: 13 loads per day: an increase of 3 loads per day (based on 10 loads per day)

It is anticipated that the B871/873 will incur significant structural damage and THC will require additional monitoring to be carried out and additional funding to be invested in the road.

The timber will be delivered to Kinbrace using low impact timber trucks fitted and operating tyre pressure control systems with on-board cranes enabling the timber to be loaded directly onto the train.

Alternative vehicles for timber haulage were Investigated; however, at this time these were discounted due to the potential damage they may cause, and general availability.

Little if any timber will be stockpiled at the rail terminal with the industry preferring to store in the wood as part of normal harvesting operations to cut down on the costly double handling of timber.

7 trucks will be required to service the haulage operation and as the operation is working above the current load restriction no additional timber will leave the area and it is anticipated that the timber vehicles will be based in Kinbrace. Managing the haulage operation and exact road space allocation will be best handled by a cooperative of the forest owners. In effect this has started with a group of owners agreeing the road space allocation for 2016.

The recent improvement and maintenance works carried out on the roads within the area by THC has a design life of 5 years and additional funding for investment for infrastructure improvement and maintenance will be required. A figure of £1.50 per tonne may be sufficient.

Roadscanners have produced a proposal for future monitoring and assessment of the road which would specifically focus on just in time repairs and targeted infrastructure improvements. This proposal will supplement THC existing monitoring system. It is anticipated that Roadscanners will work with and for the forest owners to advise on investment and maintenance.

There is the option that in partnership with THC and Roadscanners the forest owners accept responsibility for the management of the public roads within the project area. This has been done previously for the B871 in a partnership between FES and THC.

A traffic monitoring and permit system is desirable but not essential and may be explored further if it adds value to the operation.

WP4: Product Supply: harvesting, loading to rail, off-loading and WP5 Facilitation: promoting and establishing the alliance (C J Piper and Co)

The forecast for future timber production from the project area over the next 5 years indicates that only 40% of this production could be accommodated by the local road network serving the Project area.

However the indications are likely further financial and physical limitations being placed on this road infrastructure will make even this level of production unsustainable with resultant highly damaging economic and environmental impacts on this area of the Highlands and investment returns on commercial forestry, all placing a renewed imperative on establishing a feasible and complementary solution to timber transport using the rail network via a centralised "hub" at Kinbrace.

There is a need for a "paradigm" shift in the level of mutual co-operation between the various Project area forest owners / managers, timber haulage contractors, the Highland Council and rail transport operators in order to co-ordinate and optimize future timber transport to enable owners to realize their current, and justify future, investment into commercial forestry within this area of Scotland

Also needed is a modal shift in the method by which growers, harvesting and haulage contractors and market outlets measure harvested timber as a means of mitigating the historical issues associated with weight loss between harvesting site and end user.

WP6: Economic case: establishing the value of timber to the Highland economy (Bob Stubbs Consulting)

For each stage in the movement of the timber the economic impact has been analysed on both the HITRANS area and Scotland in terms of business turnover; employment (expressed in Full-Time Equivalent (FTE) jobs); income-i.e. gross annual wages excluding employer's contributions; and Gross Value Added (GVA).

The assessment encompasses three types of impact: direct (the activity of workers involved in moving the timber-e.g. harvesters, train drivers); indirect (the increased purchases of goods and services required by the activities e.g. fuel, sub-contractors); and induced (the expenditure in the wider economy, shops, restaurants etc. of the wages of those directly and indirectly employed as a result of the timber movements).

In addition the cost savings to mills and other timber purchasers in the HITRANS are included within the GVA impacts.

When added together these individual impacts produce *total* impacts. In addition there would be economic impacts from the physical works to create the rail freight facility at Kinbrace, and to upgrade the roads in the Kinbrace area to allow haulage of the timber from the forests to the railhead.

Not all of the 100,000 tonnes of timber are solely attributable to the Branchliner project. In its absence 50,000 tonnes would still be moved by road from the Kinbrace area to the mills. Thus, Branchliner would result in the harvesting of an additional 50,000 tonnes per annum-and it is this activity that is the basis of this impact assessment.

Within the HITRANS area the total direct, indirect and induced impacts would be approximately:

- £3.8 million of business turnover.
- 18 full-time equivalent jobs.
- £0.6 million employee income.
- £2.0 million GVA.

For Scotland the impacts would be around:

- £4.6 million of business turnover.
- 22 full-time equivalent jobs.
- £0.7 million employee income.
- £2.4 million GVA.

The majority (over 70%) of total impacts come from harvesting, road haulage, etc. The £400,000 GVA impact for HITRANS timber purchasers would represent an additional economic impact, along with the construction impacts of the project.

WP7: Environmental assessment: impact of mode shift (TRI Napier)

This Work Package has analysed the environmental and social impact of moving timber by rail from the Flow Country to Inverness and beyond. It has outlined some of the environmental issues, described the methodology used by the Department for Transport to calculate the benefits of modal switch from road to rail in general and then used this methodology to actually calculate the marginal social benefits to society.

The conclusions are quite clear that there are substantial benefits from this modal switch, both in terms of pure environmental benefits in the reduction of CO_2 and the wider social benefits. The headline figures are that for each round trip lorry load displaced by rail, approximately 0.234 tonne of CO_2 is saved and maximum £140 of marginal social benefits accrue. Thus, over a year, this would amount to 532 tonnes of CO_2 and £317,584 of marginal social benefits.

***

Next Steps

BRANCHLINER has proved to be an iterative project, reflecting the immense difficulty of energising the forest industries to embrace mode shift to rail. Importantly, the Report has not identified any compelling obstacles to further progress. Originally planned as a single project it can now be taken forward in a phased manner. The completion of Branchliner 2 will determine if a demonstrator project and/or siding construction is viable. This is a cautious, step-by-step approach, but is surely fully justified given potentially immense strategic and environmental benefits associated with a successful outcome.

Phase 1
An investigative study to establish the logistical, cost and infrastructure barriers to providing a viable on going service for timber, with particular application to the Far North Line but also to inform the development of other rail services in Scotland. **(Completed)**

Phase 2
A logical continuation of Phase 1 to tease out the more complex outstanding issues and costs.

Phase 3
A demonstrator project to prove costs and logistics prior to commissioning major capital expenditure.

Phase 2 could consider:

(1) Establishing realistic costs of sidings at Kinbrace taking into account local fill and ballast availability This will require an opening of formal engagement with Network Rail, with associated costs.

(2) An analysis of existing information on road deterioration rates and the review and installation of appropriate monitoring systems as identified in Branchliner 1 and as necessary for enforcement of existing agreed traffic limits

(3) Continued effort to establish an alliance of owners and /or purchasers to manage a longer term operation.

(4) The logistics of a demonstration project, partnership arrangements and costs.

(5) An assessment of alternative systems of management and equipment if the rail option is unable to proceed.

Suggested Work Packages (WP)

WP1	Terminal design / construction costs
WP2a	Road monitoring strategy
WP2b	Installation of equipment
WP3	Alliance negotiations
WP4	Demonstrator project review
WP5	Review of alternatives

SECTION

2

Work Programme 1

Civil Engineering & Signalling

Douglas Binns
&
Douglas Kirk MIRSE
Rosskirk Scot Limited

2.1 Introduction

Douglas Binns Limited was employed by HITRANS on the Branchliner project to examine the civil and track engineering requirements of providing a rail head for the transfer of timber from road to rail at Kinbrace. The aim of the study was to produce a costed suitable layout of yard. The facility was to allow for the stacking of timber brought from local forests together with a suitable fixed infrastructure for transferring the timber onto trains.

The rail head will require to accommodate trains which will both arrive from and depart to the rail network south of Kinbrace. The site had previously been utilised for lineside loading and the overall project team would examine whether this methodology or a larger fixed sidings facility would be the preferred proposal.

2.2 Site Location and Current Layout

The proposed site for the sidings is immediately south of Kinbrace Station with road access from the B871 road. The railway mileage is approximately 118 miles (Ordnance Survey grid reference 862 313). The proposed location is the currently disused lineside loading area.

The railway is single track, running south to north. The line is rising on a 1:160 gradient running south past the proposed sidings. The main line is positioned on sidelong ground, sloping downhill from east to west.

A level crossing (automatic open level crossing plus barrier) is situated immediately north of the station.

The existing loading area is owned by Highland Council with the land to the west and south being owned by Achentoul Estate. Timber loading was previously carried out at the site utilising lineside loading during railway possession, generally at night.

A topographical survey has been carried out of the proposed area, limited at the south end of the site due to access issues.

2.3 Proposed Layout Option

Options have been considered for the layout of the loading facility, all of which are based on the current loading area. The options considered are:

(1) A connection facing the south (Down) direction of traffic located on an existing straight or potentially the transition out of a right hand curve heading north. Two sidings of c.440 metres would be provided, with a run round and headshunt facility.

(2) As Option 1 with a single siding of 440 metres.

(3) Lineside loading with no siding.

Option (1) above has been chosen for development for reasons discussed under the chapter on rail operations.

The sidings will be located in the area of ground to the west of the line and to the south of the existing connection to the B871 road. The current lineside loading facility is too short to accommodate the proposed facility and will require to be extended both west and south.

The gradient of the sidings will require to be confirmed and for the purposes of this report have been assumed to follow the gradient of the main line. This will mean that they will remain level with the main line and will fall towards the buffers. The sidings would be connected to the main line via a turnout with trap points. The trap points and ground frame controlled turnout would be within Network Rail property and control. Signalling and telecomms issues associated with the provision of the connection are covered in Section 2.7 below.

An extension to the existing hard standing of approximately 43 metres width and 680 metres length will be required. The hard stand would be a minimum of 17 metres width on the west side of the sidings to allow for a loading road, a delivery road and a timber stack.

Additional land may be required for extra storage hardstanding and buildings. This has been excluded from this report.

Road access will be provided from the existing access point.

Both sidings would be loaded from the adjacent hardstanding to the west. A robust fence would be required between the run round and the main line. For loading of timber it will be necessary to position the loading plant such that it is "failsafe", i.e. in the event of failure the jib or load cannot fall on or about the main line. Extension and slue limiters may be required to enable this.

There will be significant visual, traffic and noise impacts from the proposal and advice should be sought from the planning authority on any likely mitigations that may be required.

2.4 Earthworks

No ground investigations have been carried out for this report. It has been assumed that the existing hardstanding is suitable for use or for building upon. For areas outwith the existing hardstanding it has been assumed that one metre depth of material will need to be removed before building up in suitable material to the required level.

The existing ground level in the proposed siding area is below that of the main line and will require to be built up by up to five metres.

The hard standing extension would be located on land that appears to be currently moorland rough grazing. The topsoil and any soft material beneath would require to be stripped and the level brought up to that of the existing hardstanding in suitable granular fill. A ground investigation would be required to determine the existing ground conditions and the extent of the material to be removed.

It has been assumed that a minimum of 0.75 metre of existing material will require to be removed throughout the proposed area; however this will need to be verified by survey and ground investigation.

The quantity of earthworks has been estimated as per Table WP1.1 (below) and is based on the proposed drawing.

Table WP1.1 : Earthworks Quantities

Item	Quantity	Comment
Soil strip	30,000m^2	680x43m area
Excavation depth	0.75m	
Quantity of excavated material	22,000m^3	
Quantity of fill material	61,500m^3	Based on average 2.1m depth

The surface of the hardstanding would be envisaged to be compacted Type 1 material or similar. Concrete loading areas may be beneficial if the area is to be heavily used, but this would have cost implications.

There may be a benefit in using geotextile strengthening materials within the track solum and hardstanding in order to reduce the specification of the fill material and future maintenance.

2.5 Drainage

There are two existing cross site culverts which pass beneath the hardstanding. These will require to be extended. There are also a number of minor watercourses in the vicinity of the proposed south extension which will need to be piped.

Any diversion or culverting of the existing watercourses will require to be agreed with the Scottish Environmental Protection Agency (SEPA). Any positive site drainage will be subject to Highland Council approval for quantity.

With the hardstanding area proposed to be constructed from granular fill, positive drainage of the track bed, roads and hardstanding areas may not be required, although this will definitely be required if concrete hardstanding is provided. This will be determined at the design stage following ground investigation.

Contamination of the watercourses will require to be avoided. With no positive drainage of the site currently proposed this should not be a major risk, although ground investigation will determine the permeability of the existing ground.

2.6 Permanent Way Works

The connection from the main line is proposed to be from straight track although this may potentially be on the transition out of a right hand curve heading north. The topographical survey carried out did not obtain track alignment details for the southern end of the proposed site.

The connection to the main line and the trap points would be a CV 9.25 (or similar) turn out. The turn outs which are outwith Network Rail control are proposed to be BV8. All turn outs would be controlled by ground frames. The sidings would be positioned adjacent to the hardstanding, with the run round adjacent to the main line. The layout of the sidings, run round and headshunt will be able to be optimised once the detailed requirements of the freight operating company are known.

In accordance with Network Rail Standard NR/L2/TRK/2049 *"Track Design Handbook"*, the vertical alignment within sidings should ideally be level, with a gradient of 1:500 being acceptable. It should be noted that the sidings will not be under Network Rail control, however Network Rail will be required to accept the risks associated with new sidings being connected to their infrastructure. It should be acceptable to incorporate a gradient in the sidings to match the main line gradient but this will require a full risk assessment and agreement with both Network Rail and freight operating companies.

It is proposed that the track would consist of serviceable materials. There can be a wide variation in costs and availability of serviceable materials, particularly switches and crossings. Consideration of the advantages and disadvantages of timber versus concrete bearers should be made. The design life of the track will be largely dependent on the quality of the serviceable materials used.

Bottom ballast would be provided to a depth of 200 millimetres below the sleeper.

2.7 Electrical and Services Requirements

Depending on the usage of the sidings and the requirement for any buildings, there is likely to be a requirement for electrical, water, foul water and telephone services to the site. Lighting would be required where operations are to be carried out at night. The provision of these services has not been investigated in this report or included in the estimate.

2.8 Signalling and Telecommunications

Kinbrace Station is located on the Inverness to Wick / Thurso route between Helmsdale and Forsinard. The station is situated immediately south of the AOCL+B * level crossing for the B871 road. The level crossing datum is at 118 Miles, 550 Yards. The Strike in Point (SIP) for initiating the Level Crossing warning / barrier lower sequence for north bound trains is positioned 415 metres south of the level crossing. It is important that the proposed connection for the new freight facility is located clear of and to the south of this SIP as this will avoid added complications to the operation of the Level Crossing. The new connection should therefore be to the south of 118 Mile Post on the single line.

The lines north of Inverness to Kyle of Lochalsh, Wick and Thurso are controlled from Inverness Signalling Centre (ISC) using Radio Electronic Token Block (RETB). The lines are all single with short sections of double line (passing places) positioned at strategic points to allow trains to pass. ISC controls trains by issuing (and retrieving) 'electronic' Tokens to a train / locomotive Cab Display Unit (CDU) which authorises drivers to enter a single line section.

Kinbrace is located within the Helmsdale to Forsinard Token Section. A new connection for a freight facility would be controlled by a 3 lever Ground Frame (GF) and would be capable of allowing trains to shut in. The GF is normally securely locked and can only be released by a special 'Castell' key which is 'connected' to the train / loco CDU.

There is a strict procedure for trains arriving and shunting into the siding / returning the 'electronic' token to clear the single line section. A similar strict procedure is also used for loaded trains departing from the siding when an 'electronic' token is issued to the train to allow release of the GF and access to the single line. The GF must be fully restored before the 'Castell' key can be returned to the CDU and the train can proceed to Helmsdale. Trap Points will be provided to give protection to the single line from the freight facility.

A Facing Point Lock (FPL) is provided on the single line connection. A Stop Board will be required at the exit from the siding just before the trap points. Train Protection Warning System (TPWS) will be required at this Stop Board. This will require a lineside apparatus case with radio / signalling equipment.

** Automatic Open Crossing Locally Monitored with Half Barriers.*

A Trackside Radio Control Module (TRCM) will be required. The TRCM's are now obsolete, however a number of spares have been transferred from Suffolk and Cambrian RETB sites to Scotland. Network Rail would have to authorise release of a TRCM for this project.

Since radio communication is used for train control, it is essential that the radio signal is adequate in the Kinbrace area. A recent Network Rail radio survey report has highlighted a short section with a weak signal just to the north of Kinbrace station. This may not affect the proposed freight facility but this must be verified as the project develops.

The provision of a new siding between Helmsdale and Forsinard at Kinbrace will require a software data change at ISC which will add the Kinbrace Freight Siding GF to the signaller Screen Displays and the Solid State Interlocking (SSI).

It will also add Token Sections from Helmsdale to Kinbrace and Kinbrace to Forsinard as well as the existing section token from Helmsdale to Forsinard and vice versa. TPWS controls will also have to be included. This work is carried out by a specialist contractor.

Network Rail has a current project to upgrade the RETB radio system and alter ISC SSI (split the SSI & screen displays) for the RETB Lines with a planned implementation circa June 2016. There may be an opportunity for this project to include the Kinbrace Siding in the ISC software as part of this work. This will eliminate any timescale risk with engagement of the specialist contractor and is likely to have a financial benefit.

The inclusion of software changes for the Kinbrace Siding GF at an early stage will have no impact on how the internal layout of the facility is developed. The inclusion of the software at an early stage will include the new Kinbrace Ground on the Signallers Screen Display at ISC. The exact datum for the GF is not shown on the screen display so it can be included before the final position of the GF is determined. There does not need to be any physical works carried out on the line side at this stage.

Signallers will be issued with a local instruction notifying them that the Kinbrace Ground Frame has not yet been installed and tokens to / from it shall not to be issued.

The exact datum point for the GF will be included on an updated RETB overview (emergency) wall plan when the GF is formally commissioned.

2.9 Cost Estimate

The estimate for the construction costs of the yard are set out in Table WP1.2 and are +/- 50%.

Table WP1.2: Costs for Yard

Item	Cost (£K)
P. Way	870
Culverts	70
Earthworks	2,660
Fencing	20
TOTAL	**3,620**

Exclusions:

- Connection costs to mainline, all disciplines.
- Project Management costs (by NR and/or others).
- Design and ground investigation costs.
- Power supply.
- Site accommodation and lighting.
- Remedial works to east side access, if required.
- Land and legal costs.

Assumptions:

- Reasonable ground conditions requiring average excavation of 750mm across site.
- Two culverts to be extended across site. Other water courses assumed to be small diameter pipes.
- Excavated material cannot be re-used but can be disposed of on site.
- Serviceable rail, S&C and sleepers used.
- Type 1 granular fill has been costed. There may be an opportunity to obtain local material at a reduced cost.
- Yard levels to match adjacent main line. There may be a cost benefit in lowering the yard to reduce fill costs.
- Project management and design costs may be of the order of an additional 20% of the total in Table WP1.2, and ground investigation may cost an additional circa £40k.

***

May 2016

SECTION 3

Work Programme 2
Rail Operations

David Spaven
David Prescott
Deltix Transport Consulting

3.1 Brief, Methodology & Report Structure

In August 2015 HITRANS commissioned Deltix to undertake – as part of the Branchliner Plus Project– *Work Package 2: Rail Operations*, encompassing procurement, wagons, haulage, pathing and possessions required for rail movement of timber from the Flow Country to Inverness and beyond.

The requirement was to provide technical expertise, to liaise with freight operators, to assess wagon type etc, to optimise the current terminal, and to investigate new ways of working, including three alternative types of railhead – lineside loading, semi-permanent sidings connection using the Non-Intrusive Crossover System (NICS), and permanent sidings using conventional connection.

Our approach has been based on the following guiding principles:

- Identifying options for short-term, medium-term and long-term application – and the extent of potential synergy / conflict across different timescales.
- Working closely with the consultants undertaking the other six work packages, in particular Work Package 1 (civil engineering) as the design of terminal will have a critical impact on rail operations.

The study has been both desk and field-based, the latter element comprising (i) a site visit to Kinbrace and Forsinard, (ii) a meeting with the client and the other consultants, and (iii) two meetings with Network Rail in Glasgow. A detailed project update and questionnaire was also distributed to five rail hauliers, preceded and followed by supporting email correspondence.

Discussions held with Network Rail and with rail hauliers on the scope for optimisation of terminal and train operations are summarised in Sections 5 and 6 of this report, with overall project conclusions synthesised in Section 7.

In order to best reflect the chronology of analysis and the iterative process of identifying preferred operational options, the remainder of this report is structured under the following headings:

- **Demand & Wider Context**
- **Rail Terminal Concept Options**
- **Rail Route Haulage Constraints & Opportunities**
- **Selection of Preferred Terminal Option(S)**
- **Discussions with Rail Hauliers**
- **Conclusions & Next Steps in Project Development**

3.2 Demand & Wider Context

Total potential rail **volume** figures over the anticipated 10-15 year project across the core Helmsdale-Kinbrace-Georgemas rail corridor catchment continue to be evaluated and refined by forest industry consultants. However, at an early stage of the current study it was agreed with HITRANS and Highland Timber Transport Group (HTTG) that for the purposes of informing discussions with rail hauliers on rail operational resourcing, a rail target for the core Kinbrace / Forsinard catchment of around 100,000tpa over a 40-week year would be adopted – a relatively conservative figure in light of some recent total demand projections.

Potential rail demand from the supplementary / supporting Altnabreac / Georgemas catchment (see below) is less certain, as the market can be serviced via acceptable roads and, for some markets, shipping via Scrabster, but total demand from this catchment may be in the range c.67,000tpa-c,200,000tpa.

While there are likely to be significant road capability constraints on the volume of timber which could be moved by road from the core catchment to Inverness and beyond, the rail industry will need to deliver a **price** and service package which eliminates or at least minimises the operational on-cost of rail haulage (and thereby the requirement for ongoing Mode Shift Revenue Subsidy from Scottish Government). In this context, forest industry sources have advised a road benchmark of £15 per tonne delivered from Flow Country forest to Norbord mill at Dalcross.

There are a number of detailed aspects of rail **service** quality requirements which will need to be evaluated in greater detail as the project develops and direct discussions begin between the ultimate rail customer (probably an alliance or joint venture of forestry interests) and the rail industry. However, at an early stage of the current study it was agreed with HITRANS and HTTG that for the purposes of informing discussions with rail hauliers on rail operational resourcing, a base assumption would be that the client will want an inclusive rail/road price from Kinbrace terminal (or other terminals) via Inverness terminal to delivered at customer premises (largely Norboard Dalcross, but some smaller volumes to one or two other premises also east of Inverness, and possibly even Central Scotland).

The core Kinbrace / Forsinard catchment projected volume of around 100,000tpa over a 40-week year equates broadly to a **train frequency** of four or five trains a week. Based on advice from HITRANS and HTTG about current working week practices within the forest industry, a train service on four days pw, as opposed to five, could be acceptable if that helped rail haulage economics.

While there are some particular location-specific issues around the concept of handling timber by rail from Kinbrace, a key aspect of the **wider context** is that despite an annual Scottish harvest of seven million tonnes, no round wood (as opposed to board product) is currently carried by rail in Scotland. The development of a Kinbrace Timber Terminal could therefore create a precedent with much wider implications, at a time when the rail industry is seeking new markets to help replace the rapid and substantial decline in coal traffic.

Just as the mooted concept of an alliance or joint venture of forestry interests to take forward the rail project represents a departure from standard practice, so also will the rail industry need to show flexibility, in line with Transport Scotland's (TS) observations in its recent Rail Freight Strategy consultation document[1] that:

- "Innovation will be the key to unlocking transportation of timber by rail" (para 18)
- "[We are] keen for the industry to come forward with proposals for pilot initiatives" (para 35)
- "We also want to work with the industry to broaden the scope of potential investment beyond the traditional towards the innovative, seeking out best value" (para 55).
- Grant aid from Transport Scotland is potentially available in respect of:
  - Up to 50%-75% of the cost of capital equipment such as terminal facilities, rail works, wagons and containers.
  - On-going revenue subsidy through the Mode Shift Revenue Support grant.

In both cases, award of grant aid is subject (a) to meeting strictly defined environmental benefit and financial criteria, and (b) budget availability.

3.3 Rail Terminal Concept Options

From the outset it has been recognised that terminal type, location, length and design will be a critical element of the rail haulage specification – in terms of train length / capacity, train crew resources etc. A key project objective is to facilitate highly efficient train working in order to achieve the lowest possible rail rate per tonne, as well as safe train operation and safe terminal operation.

Therefore the identification of the most appropriate terminal option(s) for the short, medium and long terms – and the extent of potential synergy / conflict across different timescales – is a key analytical task.

The three basic types of terminal / terminal connection outlined below involve different trade-offs between capital cost and operational cost (terminal handling and rail haulage). The choice of the most appropriate option(s) will therefore partly depend on the relative availability of, on the one hand, one-off capital funding and capital grant aid (Freight Facilities Grant), and, on the other hand, ability / willingness to pay haulage charges and attract on-going revenue subsidy (Mode Shift Revenue Support grant).

The most efficient form of train working is likely to be 'slip' working where there are two sets of wagons circulating and the terminal at Kinbrace is configured to permit the arrival of empty wagons straight into a loading siding, the engine would then be released from this train, running round to the other end attaching to the pre-loaded wagons ready for departure. This minimises the driver and locomotive time wasted in the terminal and also ensures the minimum of propelling and shunting movements, thus reducing staff risk. For this type of operation bespoke sidings and a connection to the main line are required.

The core task in this area has been to consider the strengths and weaknesses of three basic concept options for the **Kinbrace** rail terminal type:

- Lineside loading – ie loading a train while it is standing on the main line, so no sidings are required.
- Bespoke sidings connected to the main line by means of a 'semi-permanent' Non-Intrusive Crossover System (NICS) connection (explained in more detail in Sections 3.7-3.9 below).
- Bespoke sidings connected permanently to the main line by a conventional set of points controlled by a ground-frame.

The key theoretical attributes of the three different types of rail terminal are as follows:

Lineside loading

- Low capital cost.
- Short lead-time for implementation.
- Low operational flexibility – generally requiring a whole night shift to complete the operation, with cost and safety implications.

[1] http://www.transportscotland.gov.uk/news/transport-minister-calls-support-deliver-rail-freight-growth

- Increased rail haulage costs – as the locomotive and train driver have to remain on site for the duration of loading an economic train payload (potentially four hours or more) – and additional competent railway staff required to ensure safe working.
- Double-handling of timber stockpiled on site over the previous day(s).

NICS connection

- Medium capital cost (through avoidance of signalling costs).
- Potential short-to-medium term lead-time for implementation.
- Medium operational flexibility – day-time working possible on lightly-trafficked routes where single-track section time periods of up to 60 minutes are available for NICS to be utilised.
- Minimisation of rail haulage costs – as, with 'slip working' of empty and loaded wagon sets, the loco and train driver are detained on site for less than an hour.
- Some increased terminal operating costs (compared to conventional connection), through the need for mobile staff to move NICS into position, and after the train operation at the siding, to move it back out of use and to verify the integrity of the line on behalf of the remote Network Rail signaller controlling the line.
- No double-handling of timber, since wagons are pre-loaded in the siding over the day(s) prior to the train arrival.
- good fit with timber harvesting, and other sectors with short-to-medium term, temporary or trial traffic demands – since the NICS kit is portable and readily transferable to other locations after months or years of use.

Conventional connection

- High capital cost.
- Long lead-time for implementation, due to signalling work required.
- Maximum operational flexibility – and lowest long-term operating cost.
- Minimisation of rail haulage costs – as, with 'slip working' of empty and loaded wagon sets, the loco and train driver are detained on site for less than an hour.
- No double-handling of timber, since wagons are pre-loaded on the siding over the day(s) prior to the train arrival.

The relative importance of these generic attributes to local circumstances and timber project needs at Kinbrace is discussed in Section 3.5.

The innovative **Non-Intrusive Crossover System (NICS)** concept was developed by Glasgow-based NICS Ltd in 2004, and provides a novel lower-cost means of connecting an existing main-line track and a planned freight siding. It allows the movement of a train from a main-line track onto a siding without cutting into existing rails**.** An approaching train travels over 'temporary' rails on plates raised 50mm above the height of the existing rails (taking the wheel flange over rather than through the rail) and then reaches the physically separate 'permanent' siding. The physical elements of NICS are essentially hinged temporary rail switches and crossings, and are manually controlled. NICS can accommodate rolling stock of the heaviest axleloads (25.5 tonnes) at speeds of up to 15 mph.

Once the necessary hardware has been installed on site (within a single shift) and hinged back into the non-operational mode (and locked out of use), trains can continue to run as normal on the main line, but with relatively short notice, arrangements can be made for rail staff to move NICS into position, within modified railway operational rules in a 'possession environment'. See http://nicsrail.com.

NICS has been successfully deployed on engineering possessions on the WCML (installed / removed during blockade), extensively on the Nexus Tyne & Wear Metro, and has now secured approval from London Underground, reducing maintenance and renewal costs. The NICS kit has been endorsed by Network Rail engineers, but its deployment on the network (including the Kinbrace opportunity) will require type approval or – potentially – a pro-active derogation with a site-specific Safety Plan to facilitate innovation at Kinbrace.

The project also requires identification of a suitable **Inverness railhead**, since none of the currently identified timber processors who are potential markets for the Flow Country timber has its own private rail siding. The study requirement was to consider short / medium / long-term options and associated unloading methods / final delivery arrangements.

Due to the extensive rail siding infrastructure in the Inverness area, it was assumed, in the case of both conventional wagons or intermodal wagons (each selected by two of the four rail hauliers), that a suitable site would be identified where sidings are already connected permanently to the main line, either directly by a conventional signalled ground-frame connection or indirectly via hand points within a 'yard working' environment. However, key bespoke requirements for any site are:

- Suitable siding length to minimise rail shunting requirements
- Sufficient area of adjacent hard standing to facilitate efficient rail-to-road transfer
- Acceptable quality of road access for lorries.

The intelligence gathered and analysis undertaken on practical opportunities for terminals at both Kinbrace and Inverness – and different determining locational factors for the latter in the case of conventional or intermodal wagons – are set out in Section 3.5 below.

3.4 Rail Route Haulage Constraints & Opportunities

This section sets out the principal physical characteristics of the Far North Line and the associated **capacity and capability** constraints and opportunities for timber traffic from Kinbrace and other potential rail loading points. It also sets out the key theoretical attributes of the two generic types of wagon which could be used for this traffic – namely 'conventional' or 'intermodal'.

Two meetings were held with Network Rail, in accordance with the project work plan. The first was on 12th August 2015 where David Prescott of the Deltix team met with Audrey Laidlaw (Senior Route Planner, Scotland) and Anne Mackenzie (Scotland Freight Manager). This was an introductory meeting to inform Network Rail of the study, outline the study objectives and seek their support and assistance. Network Rail was supportive of the project.

Three areas emerged as key issues to focus on:

(1) The train plan (discussed in 4.4 below);'

(2) The use of NICS (discussed in Section 5 below), and

(3) The terminal arrangements at Inverness (discussed in Section 5 below).

In terms of **capacity**, the key characteristic of the Far North Line is that it is a single-track route with 11 intermediate crossing loops (with Britain's longest single-track block section, 24 miles, between Helmsdale and Forsinard). The expansion of Inverness area commuter services over the last decade (and a fourth daily train to and from Caithness) mean that there are only a limited number of potential daytime paths available for freight services.

Given the performance of the Far North train service at present and the fragility of the infrastructure, Network Rail are not prepared to volunteer any reduction in the period available for engineering access.

Night operations are constrained by engineering possessions between Inverness and Muir of Ord from 23.40 FSX to 04.30 MSX and 01.50 to 04.30 SO, and between Helmsdale and Forsinard from 21.45 WFSX to 07.20 ThSSunX and 02.00 to 07:20 ThSO. This would therefore require the timber trains to run during the afternoon and evening if the slip working concept is to work. An initial examination of the timetable by the Deltix team suggests that there may be paths – one based on 15.20 departure from Inverness with an arrival back into Inverness at around midnight (requiring a slight erosion of the engineering time at the south end), and another at 13.20 taking longer northbound due to crossing more passenger trains, so getting back to Inverness around 22.30. The 13.20 timing would only leave the morning to discharge the train in Inverness, which might import additional costs into the unloading and road delivery.

These specific points will have to be explored in more detail by prospective rail hauliers, who will need to find a train plan that can meet all parties' requirements. This is a company-specific issue, as the different possible hauliers have partly differing concepts of train working, traction and wagon types – each of which may have a differential impact on the optimum train plan.

Train payloads are limited by a **Gross Trailing Load** (GTL) limit southbound of 1,230t for a standard Class 66-hauled train. For a Class 56 and a Class 37, the limits are 1,150t and 905t respectively; the limit for double-headed Class 37s is 1,810t. The practical payload for timber will depend on the tare weight of the wagon and whether or not container wagons (with the additional tare weight of the containers) are used.

The maximum permitted **train length** is 50 SLUs (c.320m) for normal operation of trains which are required to cross other trains en route – restricting loads to less than those achievable with the GTL limits above. However longer trains, such as the pipe trains to Georgemas, are permitted to operate over-length (within GTL limits) on specific designated paths which do not disrupt normal passenger services.

The maximum payload will be determined by the type of wagon used and the loadability of product within the loading space available. In the case of the nearest crossing loop to Kinbrace, at Forsinard, its ability to act as a key element of the operation is constrained by a loop length of just 40 SLUs (c.256m) and by a public level crossing interface with the loop.

(This reinforces the case for constructing a terminal at Kinbrace, where the train length will not be constrained by the limited loop length at Forsinard.)

The **axle load** limits along the line potentially have an impact in terms of both (a) permitted maximum locomotive and wagon weights at normal line speed and (b) dispensations for otherwise-barred higher 'route availability' vehicles to operate over specific sections of the line subject to speed restrictions. The normal Route Availability over the line is RA8 from Inverness to Invergordon (axle weight up to 22.5t for four-axle vehicles) – although this section is currently being operated as RA5 under the Short Term Network Change procedure – and RA5 from Invergordon to Georgemas (axle weight up to 19t for four-axle vehicles).

Locomotives and wagons above RA5 can operate over the line subject to speed restrictions, but the latter will of course have an impact on the number of potential freight paths available and possibly create a requirement for an extra driver. In practice, as detailed in 4.12 below, the most likely timber-carrying wagon options involve axle loads within RA5 – therefore only the locomotive (depending on class) will involve axle loads higher than RA5, but this will still trigger speed restrictions on a timber train. Utilisation of single, or more likely double-headed Class 37s (to secure the maximum payload), would avoid these speed restrictions and extended journey times – but there would be a trade-off against some extra operating costs (including fuel) and a performance risk associated with these 50-year old locos (albeit they are still used on a variety of services by two rail hauliers).

The **loading gauge** of the route – determining maximum height and width of rail vehicle – would only be a potential constraining factor in the case of using intermodal wagons, where the square profile and the height of the container could conflict with the round profile of overbridges (there are no tunnels on the Far North Line). The loading gauge throughout the Far North Line is W8, permitting containers 8'6" high to be carried on standard-height container flat wagons. It is not envisaged that this will be a determining factor in the design of the rail offer.

The initial exploration of options with the five potential rail hauliers (see Section 6) confirmed that two generic types of **rail wagon** could potentially be used for this traffic flow – namely conventional or intermodal. The key theoretical attributes of the two different types are as follows:

[2] Short Term Network Change can be reversed in a published timescale if there is a customer demand

Conventional

- Higher payload potential (since no container tare weight is involved, and there is minimal 'dead' space at wagon-ends).
- Optimum load-carrying method in terms of payload as and when the final traffic destination is directly rail-connected.
- Virtually no loading gauge restriction throughout the British network.
- Higher operating costs and more time required for rail-road handling.
- Higher unit costs for road deliveries through use of lorries with trailer-mounted HIAB cranes (unless an independent crane is used).
- Bespoke timber carriers may – partly rail haulier dependent - require conversion of existing wagons (with time and cost implications).
- Bespoke timber carriers less readily redeployed in the event of traffic down-turns / seasonality.

Intermodal

- Poorer payload potential (due to container tare weight / height, and additional 'dead' space at wagon-ends reducing the productive utilisation of the train's overall length).
- As a consequence of the above, there is a requirement for longer trains in order to deliver a payload similar to that which can be accommodated on conventional wagons - and hence a requirement for longer terminal sidings.
- Loading gauge restrictions for certain types of container / wagon combination (but very unlikely to be a constraint in this project).
- Lower operating costs and less time required for rail-to-road handling.
- Standard container wagons and timber-suited containers readily available for purchase / lease / hire.
- Standard container wagons readily redeployed in the event of traffic down-turns / seasonality (timber-suited containers less so).
- Potentially the ability to retain the integrity of each container load in storage areas at the destination mill.

The relative importance of these generic attributes to timber traffic at and between Kinbrace and Inverness is discussed in Section 5.

The key dimensions and timber carrying capacities etc of the most likely wagon options – based on bespoke sidings and a rounding loop at Kinbrace, Class 66 haulage and NR agreeing over-length train operation – are set out in Table WP2.1 (overleaf)

Table WP2.1

	Generic wagon type		
	Conventional		*Intermodal*
Wagon model	KFA	KSA	IKA Megafret twin
Timber payload per wagon	c.40t	c.45t	c.52t
Wagon tare weight	26t	28t	39t
Containers (2) tare weight	-	-	8t
Total wagon weight	c.66t	c.73t	c.99t
WAGON WEIGHT PER AXLE	*(RA4)* c.16.5t	*(RA5)* c.18.25t	*(RA3)* c.12.41t
Wagon length*	20.76m	23m	36.44m
PAYLOAD PER METRE	c.1.9t	c.2t	c.1.4t
Maximum no. of wagons within 1,230t GTL	18	16	12
Total train length (excluding loco)	374m	368m	437m
TOTAL TRAIN PAYLOAD	c.720t	c.720t	c.624t
ANNUAL THROUGHPUT (4 trains pw, 40 weeks pa)	c.115,200t	c.115,200t	c.99,840t

** Buffer to buffer length (loading length is less)*

3.5 Selection of Preferred Terminal Option

As noted in Section 3, from the outset it has been recognised that terminal type, location, length and design will be a critical element of the rail haulage specification. A key project objective is to facilitate highly efficient train working in order to achieve the lowest possible rail rate per tonne, and therefore the identification of the most appropriate terminal option(s) for the short, medium and long terms - and the extent of potential synergy / conflict across different timescales - has been a key analytical task.

At an early phase of the research, informal advice from Transport Scotland's freight grants team suggested that availability of ongoing revenue subsidy (through the Mode Shift Revenue Support grant) was likely to be relatively more constrained than availability of capital support through Freight Facilities Grant. For a project of perhaps 10 to 15 years duration, it would in any event clearly be preferable to minimise exposure to annual budgetary constraints, particularly where a greater emphasis on up-front capital expenditure (with grant aid support) can be an alternative.

This intelligence – pointing towards **terminal type** options which would minimise (a) terminal handling costs at Kinbrace and (b) overall rail-road movement costs – was reinforced during site visits and discussions among the consultancy team and client on 27th / 28th August at Kinbrace, Forsinard and Inverness.

Concerns were expressed about the potential difficulties of interface between the rail and forest industries in the event of lineside loading (and associated night-time working) being the core chosen option.

Network Rail's engineering possession requirements (as set out in 4.4 above) – as well as the passenger service timetable (which is, however, much less frequent on Sundays than Mondays to Saturdays) – constrain the hours when a timber train can be operated from Inverness to Kinbrace and return. However, it would be feasible in theory for lineside loading to take place at Kinbrace even while engineering work was being undertaken elsewhere in that section, subject to appropriate management of the work sites. Lineside loading is therefore theoretically feasible as follows:

- Three nights a week from approximately 21.45 (Mondays, Tuesdays and Thursdays) to 07.20 (Tuesdays, Wednesdays and Fridays).
- Two nights a week – when the pipe train is timetabled to run from Inverness to Georgemas – from 02.00 to 07.20 (Thursdays and Saturdays).
- From 21.45 Saturday to 13.00 Sunday, ie partly during daylight hours.
- From 13.45 to 20.30 Sunday, ie partly during daylight hours
- From 21.10 Sunday to 07.20 Monday.

There would therefore be enough time to load a train every night, but with the double-handling costs associated will all lineside loading and the lighting and other costs associated with night-time working. In addition to these extra operating costs, maximum train length would be constrained (and unit haulage costs per tonne thereby increased) through the locomotive having to round the train at Forsinard loop (256m length) prior to returning to Inverness. The significantly lower payload implications – to be compared with Table WP2.1 above are, in summary:

- c. 480t / 495t train payload using conventional KFA/KSA wagons
- c. 364t payload with intermodal IKA Megafret wagons.

Based on five nights pw train operation, the conventional wagon options could convey up to 100,000 tpa of timber over a 40-week season, while intermodal would give just 73,000 tpa – but both requiring the operation of 200 trains per season, compared to just 160 trains handling 100,000tpa or more in the case of a terminal with bespoke sidings.

In both the wagon sub-options within lineside loading, higher costs per tonne would be involved than with a bespoke sidings arrangement – and therefore, in the case of lineside loading being used only as a fall-back interim arrangement, there would be a period of perhaps a year during which possibly substantially greater dependence on the Scottish Government's Mode Shift Revenue Support grant would be involved.

Sunday (day-time) working would have handling cost implications, over and above the double handling involved in all lineside loading options. A once-weekly train would involve very poor locomotive and wagon utilisation – unless complementary uses could be found during the week – and even greater dependence on the Scottish Government's Mode Shift Revenue Support grant would be involved.

Later responses from some rail hauliers (who incorrectly assumed a lineside loading requirement) confirmed that very heavy train crew and support staff resourcing would be required, since the wagons cannot be pre-loaded and a period of four hours or more would be required to load a commercially acceptable size of train – making the key operational aim of round-trip working from Inverness within one driver shift untenable

Concern was also expressed that use of lineside loading as a short to medium term option could obstruct construction of bespoke sidings and a longer-term handling area (since these would have overlapping footprints with the lineside loading area), unless these works could be conveniently fitted into the 12-week winter 'off-season' envisaged for the timber contract. This would not however be a good time to carry out significant civil engineering works at a high and exposed location.

In light of all the above, lineside loading was dropped as a core option, with the proviso that should NICS not secure approval from NR for commencement of operations at Kinbrace in 2016 (see 5.11 below), then an interim (albeit sub-optimal) arrangement for limited lineside loading for a period of around a year would need to be identified.

However, in any event, lineside loading could be deployed as a possible niche add-on for a limited number of suitable sites north of Helmsdale throughout the project period, ie not as a full train operation, but loading a few wagons to the core train.

A terminal of 10-15 years' life will require a medium to long term requirement for a permanent connection, based on a conventional set of points controlled by a ground-frame – but with relatively lengthy lead-times for installation (2018, or at best 2017, as advised by NR) conflicting with a forest industry wish to begin moving timber by rail in 2016, the need arises for a short-to-medium term connectional solution, as potentially provided by NICS. This is discussed in some detail below.

The core **terminal location at Kinbrace** was endorsed by timber interests at an early stage, due to its nodal position close to the key intersecting roads (A897 and B871) serving the wider timber catchment, as was the rejection of Forsinard loop as a core part of the operation, due to (i) its short loop length (40 SLUs or 256m) and the consequent inability to round trains of acceptable commercial payload / length, and (ii) likely operational complications arising from the A897 road level crossing of the loop. However, the need for a (limited) spread of terminals to ensure continuity of volume, and the opportunity to reduce lorry impacts on the A897 between Forsinard and Kinbrace, points to (possibly early) use of Forsinard's existing siding (c.50m length), potentially extended to c.75m, to load two or three wagons as an add-on to the core Kinbrace volumes, with the loco making a short 'trip' from Kinbrace to Forsinard and back (c. 1 hour), then aggregating the wagons into a single big trainload from Kinbrace to Inverness.

Other potential secondary (and later) locations could be Altnabreac (between Forsinard and Georgemas) and Torrish Forest / Kildonan (between Helmsdale and Kinbrace) – both lineside loading – with possibilities of conventional loading at the existing Georgemas (east end) site, which could be switched on very quickly. On any one train service operation, probably no more than two / three locations would be served (although running beyond Kinbrace / Forsinard could trigger resourcing beyond a single out-and-back from Inverness train driver).

A second meeting was held with NR on 27th October where Anne Mackenzie met with David Prescott, Frank Roach, Douglas Binns (engineering consultant) and Dougie Kirk (signalling consultant) to discuss the technical issues regarding the proposed loading facility at Kinbrace, unloading at Inverness and train pathing. Details of the work that Network Rail had carried out in the period between the two meetings were provided. NR did not dismiss lineside loading as a possible method of working in the short term, subject to the practical problems being satisfactorily resolved.

NR was supportive of the project and provided some initial indicative costings and timescale for the provision of a new ground frame and connection at Kinbrace. This is NR's preferred solution and is not seen as particularly complex, although a lot of technical issues need to be resolved before a sidings connection is operational. An indicative estimate of £1.6m plus 'optimism bias' was suggested for the connection and associated signalling alterations (not including the internal track work in the terminal). NR is prepared to consider either full delivery by NR or the 'Asset Protection' option where delivery would be by an approved Third Party.

As noted earlier (in Section 3), a key project objective is to facilitate highly efficient train working, and an important component of that efficiency (over and above round-trip working from Inverness within one driver shift, and 'slip' working) will be maximising the length of train and thereby cutting the cost per tonne of movement. The optimum **terminal length** in terms of loading sidings will therefore be one which matches the length of train – without any requirement to split and shunt trains – thereby avoiding potential safety risks and extra in-terminal time for the locomotive and driver.

Based on wagon choice indications given by rail hauliers (see Section 6) – and assuming that over-length running will be feasible, within the constraints of the line's GTL limits – the maximum loading siding length can be identified as follows for the two core options of conventional wagon or intermodal wagon on a Class 66-hauled train:

- Conventional wagon (KFA/KSA): 368m-374m (720t train payload).
- Intermodal wagon (IKA Megafret): 437m (624t train payload).

With utilisation of a single Class 56 or single Class 37 loco, marginally and significantly shorter train / siding lengths respectively than the above would be involved. Utilisation of double-headed Class 37s is more likely than single, for payload and performance reasons – and in theory this would allow a train of up 560m conventional wagons length to be operated (1,080t payload). However, this is considered to be an unlikely scenario due to capital costs and the concentration of volumes into just two to three trains pw and hence the reduced productivity of wagons; perhaps more likely with utilisation of double-headed Class 37s would be an intermediate scenario, with maximum siding lengths of between 374m (720t) and 560m (1,080t) – and the additional train payload capability used for peaks of traffic and add-on locations such as Forsinard or Georgemas.

It should be noted that the intermodal solution proposed only involves the container leaving the rail wagon at the Inverness end of the transit. At Kinbrace, timber would be brought by road from forest to the terminal in conventional timber lorries (with or without HIAB crane) and the timber would then be loaded direct into container on rail wagon.

Given the relative complexity of the core project from Kinbrace rail terminal to delivery to customer near Inverness, it was concluded that the additional terminal capital cost, terminal handling equipment cost and in-forest operational ramifications of transferring the containers from rail to road at Kinbrace and then taking these into the forest for loading would be too great.

A number of other key elements of **terminal design** arise from the need for efficiency of train working:

- Two loading / stabling sidings required in order to allow 'slip' working of wagons (ie one siding for pre-loading wagons, the other siding for arriving empty wagons) – the sidings are used alternately.
- These sidings to be double-ended to simplify on-site shunting – and to be paralleled by a run-round loop to allow the loco to be released from the front of the arriving empty train and move to the front of the loaded train for departure.
- The site will be geared to day-time loading of wagons (with cost and safety benefits) and therefore lighting and other requirements associated with night loading should be capable of reduction / elimination.

As noted in 5.9 above, lineside loading has been dropped as a core option for **terminal type**. Given (i) the forest industry's need to begin moving timber by train in 2016, and (ii) Network Rail's initial estimate of 2018 (or at best 2017) for completion of a conventional connection to sidings at Kinbrace, this underlines the importance of finding an interim NICS solution which will offer synergies with the long-term connection.

The **Non-Intrusive Crossover System (NICS)** kit has been extensively deployed on engineering works on the Nexus Tyne & Wear Metro and now has similar approval for use on London Underground. NICS has been endorsed by Network Rail engineers (following its use within NR engineering 'blockades'), but its deployment on an open running line on the national network (including the Kinbrace opportunity) will require 'Type Approval' or, potentially, a pro-active derogation with a site-specific Safety Plan to facilitate innovation at Kinbrace.

The opportunity / requirement to innovate at Kinbrace is timely, as Transport Scotland's observes in its current Rail Freight Strategy consultation document[3] that:

[3] http://www.transportscotland.gov.uk/news/transport-minister-calls-support-deliver-rail-freight-growth

- "innovation will be the key to unlocking transportation of timber by rail" (para 18)
- "[we are] keen for the industry to come forward with proposals for pilot initiatives" (para 35)
- "we also want to work with the industry to broaden the scope of potential investment beyond the traditional towards the innovative, seeking out best value" (para 55).

The key benefit of NICS for the Kinbrace project is that it offers much shorter lead-times for completion than for conventional connection. In terms of precedent, it also has a very good fit with the wider potential for timber by rail in Scotland in its ability to be easily re-located to emerging harvesting areas. A shortlist of up to 22 potential NICS timber railhead locations across Scotland was identified in the 2006 Potential Timber Transport Applications of the Non-Intrusive Rail Crossover report by Deltix / IBI for Scottish Enterprise – the majority on single-track 'peripheral' routes where the typical 45-60 minutes of section occupation time could be accommodated during day-time hours without any disruption to scheduled train services.

Successful deployment at Kinbrace would also represent a commercial trial of the cost-saving potential for use of NICS on (i) non-blockade engineering works, and (ii) other non-timber freight flow opportunities, such as short-notice / temporary flows, seasonal flows and trial flows to test rail freight's capabilities.

At various times since 2004, NICS has moved close to type approval from NR, but changes in key NR staff and its organisational structure have to date prevented a trial being undertaken on the national network. Some NR operators are understood to be nervous about perceived safety implications – despite NICS always being deployed in a 'possession environment' and being securely locked out of use once the possession has been given up. To restart and progress the Type Approval process (or a site-specific derogation process), it would appear to be crucial to bring key NR managers face-to-face, at an early date, with (a) a working example of the NICS kit and (b) NICS Ltd managers, engineers and operators, in order to discuss and allay NR concerns about its operational deployment at Kinbrace. A working NICS demonstration can readily be arranged at Cambuslang or Acton (London).

As noted in 3.10 and 3.11 above, the project also requires identification of a suitable **Inverness railhead**, with sufficient siding length, hardstanding and acceptable road access.

The optimum railhead identified for a ***conventional wagon scenario*** is a Network Rail pad in the former Up Millburn Yard which has sidings to both the north and south sides. These were formerly used for handling Safeway containers (with reach-stacker) and timber loading (with lorry-mounted HIAB cranes), and their upgrade was part-funded by Freight Facilities Grant provided by the Scottish Executive in 1998, as part of the successful initiative to transfer Safeway supermarket traffic from road to rail. The sidings are immediately south of the Lafarge cement terminal and immediately north of the Network Rail office and yards area – and are identified collectively as 'timber loading' on Quail maps, with the south siding called 'ballast road Z' or 'ballast road B', depending on the Quail edition, and the north siding extending into the south face of the Needlefield Warehousing.

There appears to be scope to lengthen the pad eastwards, by removing an unused secure material compound, to increase accessible wagon standage on both sidings. NR has been unable to supply exact lengths of sidings / hard standing, but the combined length of the sidings length appear to equate to circa 12 x KFA wagons (c. 250m) – and therefore significantly less than the maximum length of train envisaged, ie 18 x KFA (c. 375m). However, there appears to be scope – but this will need to be established through NR – to extend the accessible length of each siding by several KFA lengths.

Road access is available, but NR concerns re impact on its own road access / operations etc would need to be addressed. Some relocation of minor NR storage activities would be required, plus alternative stabling location for NR technical trains.

Network Rail's clear preference is to re-open part of the currently out-of-use former Millburn Yard and to provide a bespoke timber facility on the north side of the Lafarge cement terminal. This would minimise any impact on their own activity, although all timber delivery lorries would still need to use the same final road access that Network Rail staff currently use. There would also be capital cost and timescale implications for the project, likely to be significantly greater than those arising from enhancement and re-use of the former timber loading pad as above.

There are a number of options here, which again will require the input of the preferred rail haulier before a final decision is taken. The haulier will need to consider access and egress by the train as well as the unloading arrangements (in conjunction with the chosen road deliver haulier) and other operational details such as wagon maintenance arrangements, locomotive fuelling and inspection, train crew and staff facilities.

The discussion above has focussed on a conventional wagon scenario. In terms of an ***intermodal wagon***

scenario, the greater length, tonne for tonne, of an intermodal train, and the more onerous load-bearing requirements for the hard standing area (to accommodate container transfer equipment), suggest that the optimum solution would be to utilise the nearby existing John G Russell / DRS intermodal railhead. Its two sidings have sufficient length to accommodate the maximum achievable intermodal timber train length of 12 x KFA Megafret twin wagons – but capacity would be time-constrained to a night-time to mid-morning slot, i.e. during those hours not required for the core activity of unloading / loading the daily Stobart / Tesco train from/to Grangemouth.

In summary, therefore, the preferred option(s) for the key elements of a core northern rail terminal are:

1) **Type:** in the short to medium term, bespoke sidings connected to the main line by means of a 'semi-permanent' NICS connection; in the medium to long term, bespoke sidings connected permanently to the main line by a conventional set of points controlled by a ground-frame.
2) **Location:** south of Kinbrace station, to the west of the railway, in the vicinity of the plot used in the 2002 lineside loading campaign.
3) **Length:** on the assumption that over-length train working will be permitted on the Far North Line, and dependent on the ultimate choice of conventional or intermodal wagons, loading sidings probably in the range 368m-437m long.
4) **Design:** two double-ended loading / stabling sidings of full train length, and a parallel run-round loop (but with just a single connection from the terminal to the main line (to the south of the terminal); design geared to day-time loading of wagons.

In summary, in the case of an **Inverness railhead**, the preferred option will rest on (a) whether a conventional or intermodal wagon option is chosen, and (b) in the former case, on alternative accommodation being found for current Network Rail technical train berthing and equipment. In any event, NR plans to review the provision and utilisation of all its infrastructure in Inverness.

Finally, with regard to the **project development process** – incorporating Kinbrace and Inverness sites, and train planning – NR's strong recommendation was to prepare a Client Remit for the project so that NR could allocate appropriate resources to resolving the details as soon as possible. This will require funding. The scope of the Client Remit will need carefully consideration, and NR suggested a need to specify the delivery route – either NR to deliver, or 'Asset Protection' delivery. It is suggested that this is an area where it will be important to keep options open as it may be a rail haulier's preference to do some or all of the work itself. It is suggested that initially – ie before a preferred rail haulier is chosen – the work be carried out up to GRIP3 (Option Selection) with an option to go to GRIP4 (Detailed Design).

3.6 Discussions with Rail Hauliers

At an early stage of the project, all five major British rail hauliers (Colas, DB Schenker, Direct Rail Services, Freightliner Heavy Haul and GB Railfreight) were invited to express 'in principle' interest. All five did so, and following the clarification (and, in part, simplification) of the envisaged rail specification arising from the site visits and consultancy team / client discussions on 27th / 28th August, a Project Update & Questionnaire was sent to the five hauliers, seeking further intelligence on their experience, expertise, and likely capacity and capability to handle this relatively unusual flow – involving both a client new to rail and a 'peripheral' location. In light of (a) the fact that no single potential customer for rail yet exists, and (b) unresolved issues around the terminal capabilities etc., it was decided not to request any indicative rail prices at this stage.

The following specific questions were posed:

1) The type of operation /method of working you envisage using and the resources which would be required to serve Kinbrace.
2) The resourcing implications of train working beyond Kinbrace.
3) The resourcing / cost implications of the Kinbrace sidings / run-round being less than 50 SLU or the 1,230t GTL equivalent (topographic survey of up to 375m length will not be completed until late September).
4) Wagon supply options.
5) Relevant experience in 'similar' customer / commodity / geographical circumstances.
6) Potential synergy / fit with other existing / planned rail operations.
7) Confirmation that you would be able to offer an inclusive rail/road price from Kinbrace terminal (or other terminals) via Inverness terminal to delivered at customer premises (largely Norbord Dalcross, but smaller volumes to one or two other premises also east of Inverness).
8) Broad scope of project management input that you would provide to embrace project development with a client new to rail and at a 'peripheral' location.
9) Capability – subject to NR / engineering issues being resolved – to commence train service in

Spring 2016 (March is suggested, but this will depend on the weather), possibly with short-term use of lineside loading at Kinbrace if NICS / conventional connection cannot be achieved within that timescale. Any payload / resourcing cost etc impacts of short-term use of lineside loading at Kinbrace should be flagged up.

Responses were received from all five hauliers. In evaluating these responses, the Deltix team adopted a simple scoring system based around four groups of 'scoring questions', together with an additional line of entry for 'understanding of brief'. Two 'entry questions' (ie without a positive response on these, hauliers would essentially fail two key tests) were not labelled as such in the questionnaire, but in practice were:

- Capability of commencing train service (not necessarily the full long-term service envisaged) in Spring 2016.
- Willingness to provide a package rail/road price (rail wagons already loaded by forest industry customer) from Kinbrace terminal to delivered Norbord and other road destinations east of Inverness.

The remaining grouped scoring questions covered the following topics:

- Resourcing
- Rail wagon provision
- 'Fit' in terms of experience / existing operations in Inverness area
- Envisaged project management input
- Understanding of brief.

For the five 'scoring questions', the Deltix team awarded marks out of 5 in four groups and marks out of 10 in the key 'resourcing' group of questions. The results of the team's assessment are summarised in Table WP2.2 below:

Table WP2.2:

	Haulier A	Haulier B	Haulier C	Haulier D	Haulier E
Entry questions					
Timescale capability Q9	Yes	Yes	Yes (but not for lineside loading)	Yes	No, not addressed
Rail/road package Q7	No*	Yes	Yes	Yes	No specific commitment
Scoring questions					
Resourcing Q1,2,3	7/10	7/10	7/10	6½/10	3/10
Wagon supply Q4	4/5	4/5	3½ 5	3½/5	3/5
'Fit' Q5,6	5/5	3/5	3½/5	3/5	2/5
Project management Q8	3/5	3½ /5	½/5	4/5	0/5
Understanding of brief	2½ /5	2/5	3½/5	2/5	1½/5
TOTAL	**21½/30**	**19½/30**	**18/30**	**19/30**	**9½/30**

** Not their customer experience with other timber flows, but would look to partner if required.*

It can be seen that there was a clear distinction between a group of four hauliers scoring at broadly the same level – well above 'pass' marks – and the fifth haulier scoring at around half that level, and well below 'pass' marks.

With regard to the detail of the individual submissions, in order to protect commercial interests these are not identified to individual companies within this report. In terms of key topics within the answers provided, it can firstly be noted that two of the four 'pass mark' hauliers explicitly suggested use of the standard Class 66 freight **locomotive**, providing a maximum Gross Trailing Load (wagon tare weight plus payload) of 1,230 tonnes on the Far North Line. The third haulier did not explicitly mention locomotive type, but the number and type of wagons advocated implied this was based on Class 66 haulage. The fourth haulier suggested using a Class 56 or (implied) pairs of Class 37s – the former gives a slightly poorer train payload (by around 80t) than Class 66, and the latter potentially significantly better – but this haulier left open the possibility of higher powered locos and other wagon fleet options in return for long-term commitment.

Current rail timber flows in England & Wales utilise **conventional wagons**, converted from covered vans to timber carriers. In their Kinbrace questionnaire responses, two of the four 'pass mark' hauliers nominated conventional wagon use, one indicating that they already had potential availability of part of the Kinbrace 2016 requirement within their wagon fleet.

Two of the four referred to potential **intermodal wagon** solutions, partly as a means of delivering a wagon fleet more quickly than conversion of vans into timber carriers – since standard types of intermodal wagon are readily available for hire / lease. In all cases the containers would remain on rail wagons (and be loaded directly with timber) at Kinbrace, only being used intermodally at the Inverness end. The lead-time for construction / modification of suitable wagons underscores the importance of moving towards an identified forest industry customer (or 'shadow' customer) as soon as possible, if timescales for the start of movement of timber by train are to be met. That said, there will be options for temporary arrangements for wagons, provided that the forest industry customer and the chosen haulier can agree that initial arrangements may be sub-optimal in terms of operational efficiency and unit costs.

In consultation with the client, the team concluded that these four hauliers should be invited to take forward the dialogue with HITRANS. The full text of the pro forma letter sent to them on 4th November 2015 is shown in the Appendices. This recorded, *inter alia*, that discussions were ongoing with forestry owners in the Kinbrace area on the creation of an alliance or joint venture to permit a single customer interface with the rail industry. In the meantime, HITRANS would continue to fulfil the role of 'virtual customer', taking the dialogue and analysis forward towards a formal tendering process. The letter also recorded that the aspiration was to operate the longest possible daily trains within the line's gross trailing load limits, and additionally flagged up key NR issues, including NICS approval and the timescale challenges.

It can be anticipated that the rail hauliers will soon be looking for a greater degree of definition to the prospective business, beyond the current status of an open-ended dialogue (involving management time and effort) with a party who will not be the ultimate customer. To keep the hauliers on board during this intermediate phase between 'pre-qualification' and tendering, good progress is required towards a position where they are given (a) more definition about the capacity and design of the two key rail terminals at Kinbrace and Inverness (and an associated plan for capital funding, grant aid, etc), and (b) an identifiable path and indicative timeline leading towards the emergence of a defined customer (and his committed long-term volumes) for the rail hauliers to engage with. It is important that impetus be maintained and that the hauliers do not lose interest or find other projects to pursue – and in the case of one of the four hauliers, possibly find alternative uses for their currently spare conventional timber wagons.

3.7 Conclusions & Next Steps in Project Development

3.7.1 Conclusions

Although the business case (based on capex, opex, revenues and grant aid) will not be determined until a later phase of the project, the likely volume (target c.100,000tpa or more) and duration of timber traffic (10 to 15 years) from the Flow Country to Inverness represent *prima facie* grounds for anticipating a supporting case for a bespoke rail terminal in the Kinbrace area, serviced by a cost-effective regular train service.

A cost-effective train service – reducing dependence on ongoing Mode Shift Revenue Support grant from Transport Scotland – will be critically dependent on (a) operating long trains with substantial payloads, and (b) a rail terminal design which minimises the time which the locomotive and driver are required to wait before returning to Inverness, so that the round trip can be achieved in a single driver shift.

The lengthiest trains (with the largest payloads) will be those which are permitted by Network Rail to operate at lengths greater than those of the line's crossing loops. In such a scenario, depending on the class of locomotive and type of wagon utilised, likely timber payloads range from c.624t to c.1,080t, equating to 100,000tpa or more over a 40-week season (based on four trains per week).

In the case of lineside loading – the terminal type with the lowest capital cost, but highest operating cost – the maximum possible train payload would be in the range c.364t to c.480t, equating to 73,000tpa and 100,000 tpa respectively over a 40-week season, based on five trains per week). In light of the above and a range of other forest industry and rail industry concerns about the cost, complexity and inflexibility of lineside loading, this type of terminal has been rejected as a core option – although it may be required as a sub-optimal interim solution should NICS (see (vi) below) not secure approval.

The preferred Flow Country terminal option in the medium-to-long term (i.e. from 2017 or 2018 onwards) is the provision of bespoke sidings at Kinbrace, connected permanently to the main line by a conventional set of points controlled by a ground-frame – the terminal type with the highest capital cost but lowest operating cost and greatest operational flexibility.

In the interim period (2016-2017/18) the preferred option is the 'semi-permanent' Non-Intrusive Crossover System (NICS), which would involve medium capital cost, medium operating cost and flexibility – and crucially, the potential for short-to-medium term implementation.

NICS, however, will require 'Type Approval' or, potentially, a pro-active derogation with a site-specific Safety Plan to facilitate innovation at Kinbrace. The prospects for securing derogation from Network Rail should be enhanced by Transport Scotland's enthusiasm for innovation set out in its current Rail Freight Strategy consultation document, notably the observation that "innovation will be the key to unlocking transportation of timber by rail".

The length of terminal loading sidings required in the medium to long term at the site to the south of Kinbrace station and to the west of the railway, is likely to be in the range 374m to 437m, with two double-ended sidings and a parallel run-round loop within the terminal maximising wagon productivity and simplifying on-site shunting. Lengthier sidings will provide long-term flexibility in train size and wagon type. The detail will become clearer once a preferred rail haulier has been appointed.

In the case of an Inverness railhead, the preferred option will rest on (a) whether a conventional or intermodal wagon option is chosen, and (b) in the former case, on alternative accommodation being found for current Network Rail technical train berthing and equipment.

The choice of conventional or intermodal will in part depend on the preferences and existing resources of the chosen rail haulier, but also more widely on the capacity and capability of each load-carrying method for the specific circumstances of the Kinbrace-Inverness flow, notably payload, rail-to-road handling and delivery cost, and timescale for availability. Provision of a private siding at the Norboard mill at Dalcross would tend to push the decision towards conventional wagons.

The WP2 work package has robustly filtered down the list of potential hauliers from five to four, and this exercise has improved understanding of the key issues – so that the preparation, in due course, of a formal tender for rail haulage will be both better informed and better framed.

3.7.2 Next steps in project development

It is suggested that HITRANS undertake the following actions:

(1) Continues to facilitate early creation of an alliance or joint venture of forestry interests to take the project forward and enter formal negotiations with rail hauliers.

(2) Provide the four hauliers selected for on-going dialogue with HITRANS with (a) greater definition about the proposed capacity and design of the two key rail terminals at Kinbrace and Inverness (and an associated plan for capital funding, grant aid, etc), and (b) an identifiable path and indicative timeline leading towards the emergence of a defined customer (and his committed long-term volumes) for the rail hauliers to engage with.

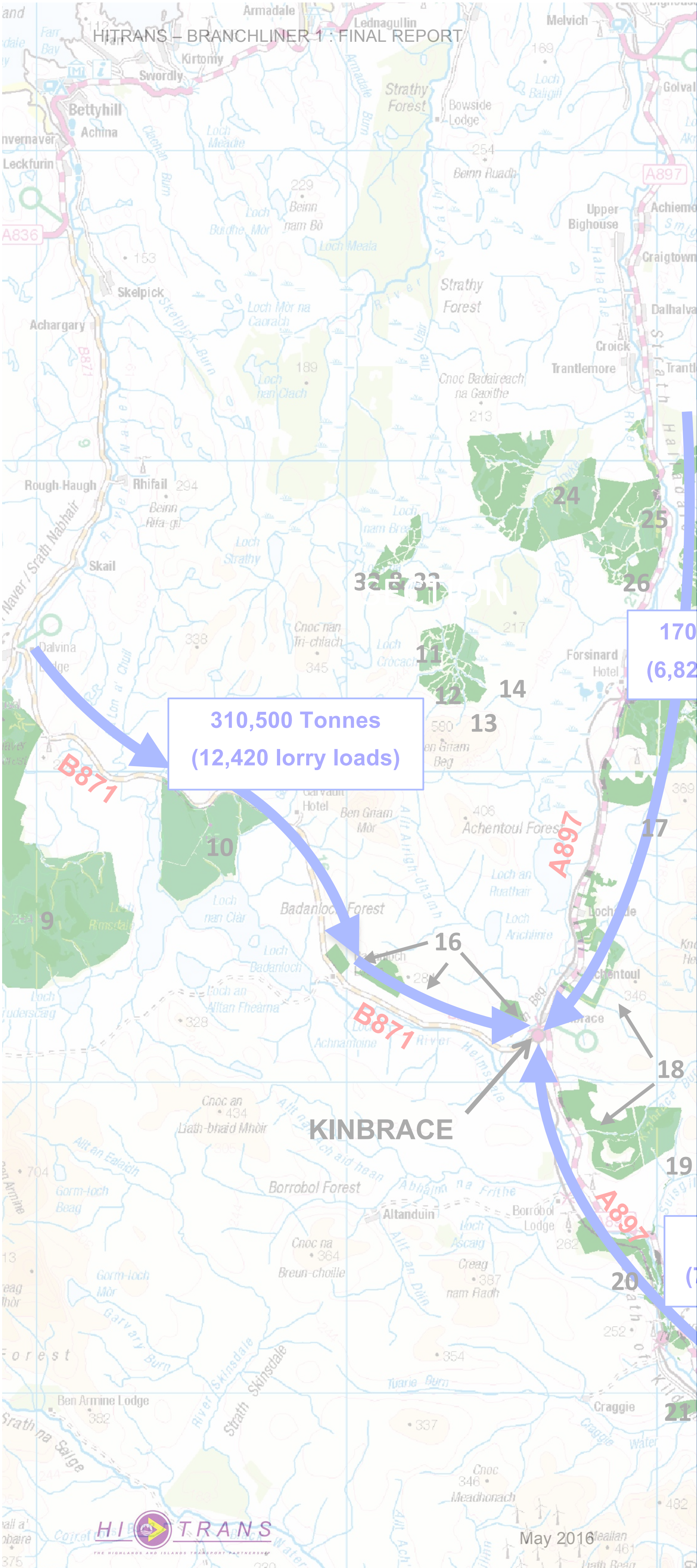
(3) Prepare a Client Remit for the project so that Network Rail (NR) can allocate appropriate resources to resolving the details of the proposed Kinbrace terminal as soon as possible, moving through the appropriate stages of the GRIP process.

(4) Seek further clarification from NR on terminal options at Inverness.

(5) Facilitate bringing key NR managers face-to-face, at an early date, with (a) a working example of the NICS kit and (b) NICS Ltd managers, engineers and operators' in order to discuss and allay NR concerns about its operational deployment at Kinbrace.

(6) Given (a) the importance of securing Network Rail approval for use of NICS at Kinbrace, and (b) Transport Scotland's current interest in the strategic national opportunities for timber by rail and the specific opportunities for innovation, as well as its core role in funding Freight Facilities Grant and Mode Shift Revenue Support grant for this project, it is suggested that the relevant Transport Scotland departments be kept appraised of progress and key issues arising.

***



4

Work Programme 3
Road Logistics

Frank MacCulloch C.Eng FICE
Arvikaconsult Ltd

4.1 Work Programme Scope

The scope of WP4 involved the following:

- Consultation with sample of key industry players (owners / agents / representative bodies (eg ConFor, UKFPA) to gauge issues / positions. ***[Note this task was shared with CJ Piper and Co, Chartered Foresters]***
- Overview of The Highland Council's (THC) condition assessment of the roads in the area.
- Discussion with THC on potential timber traffic limits and road sections of concern.
- Consultation with THC on future methods of road condition assessment.
- Work with other Branchliner partners to determine potential volumes and timings of material arriving at Terminal.
- Review of the current road transport situation (e.g. in light of possible weight limit imposition) and potential economic and other impacts and risks.
- Overview of alternative road transportation methods.
- Provision of options for road space allocation which following discussion with THC, suppliers and haulier.
- Desk review of available traffic permits systems/methods of allocating road space.
- Options for monitoring subsequent road haulage.
- Provision of recommendations and next steps for implementation.

4.2 Desk Review of Key Issues

The historical context of the Branchliner project is set out in the introduction to this Report. At this time there is an ongoing issue relating the number of 44 tonne timber trucks required to meet the needs of the timber industry with the Highland Councils (THC) assessment of the capacity of the public road network in the area.

For clarity the public roads within the Branchliner Project are:

- A897 Helmsdale to Bettyhill
- B871 Kinbrace to Syre
- B873 Syre to North of Altnaharra

At this time there is a daily restriction on the number of 44 tonne low impact timber trucks travelling on the A897 which is 4 no timber trucks travelling north from Forsinain and 6 timber trucks travelling south from Kinbrace, a total of 10 trucks per day.

This equates to an approximately 50,000 tonnes of timber per annum. (Note: A Low Impact Truck is one referred to in the "Tread Softly " document as having a truck wear factor of 1, fitted with a Tyre Pressure Control System. The use of trucks with a greater truck wear factor subsequently reduces the number of truck permitted on the road). At this time the A897 restriction impacts on the B871 however THC permitted up to 10 loads per day during the previous rail operation in 2002 and will consider raising this level if improved monitoring and funding provided.

The A897 and B871 have benefited from a total investment of £1.7 million since 2007 including 7 awards from the Scottish Timber Transport Fund (STTF) for structural investment and repairs.

The details of the awards follow:

- 2007 A897 Partnership Project £409 707 (STTS £327 771) 2011
- Extreme Winter Repairs £50 000 (STTS 25 000)
- 2011 B871 Passing Places £29 400 (STTS £14 700)
- 2012 A897 Melvich to Forsinain £19 320 (STTS £9660)
- 2012 A897 Drainage Improvements £50 000 (STTS £25 000)
- 2013 B871 Bridges £52 000 (STTS £26 000)
- 2014 Flow Country Timber Links £1095 694 (STTS £805 694)

(NB: the additional awards for studies and strategy reports have not been included in the above awards.)

The B871 has also benefited from a Forest Enterprise Scotland/Highland Council partnership which contributed approximately £600k over a 10 year period into innovative bridge replacement works and road maintenance techniques which until 2007 were monitored and reported by the ROADEX Project see www.roadex.org

The additional expenditure out with the above amounts spent by the Highland Council in maintaining these roads since 2002 is at this time not available.

The works carried out all included an element of structural improvement of both the A897 and the B871 however this has not delivered the structural improvements required to remove the vehicle restriction and in essence keeps the status quo. It is THC's view that the latest work carried out on these roads will have a design life of 5 years and a similar or greater amount to that already spent may be required to facilitate the continuing extraction of timber beyond 2020.

The B873 has had little or no monies spent on structural improvement and any costs spent to date have been as a result of reactive maintenance. At this time is unlikely timber haulage beyond 10 kms south of Syre Bridge on the B873 will be approved by THC. However if the rail siding does proceed then THC are committed to re-visiting this option to permit timber from North Loch Naver Forests access the rail siding.

THC are still considering applying a weight restriction on the A897 which, if introduced will apply also to the B871/B873.

4.3 Potential Volumes of Timber:

The potential timber movements has been assessed by the Branchliner consultants and the 5 year timber lorry movement shown on the Map in appendix 1. For clarity these figures by route are replicated below:

- Forsinain - Kinbrace (A897): 6820 lorry loads over a 5 year period/1364 per annum;
- Kildonan - Kinbrace (A897): 7460 lorry loads over a 5 year period/1492 per annum;
- Syre South - Syre Bridge – Kinbrace (B873 + B871): 12420 lorry loads over a 5-year period/2484 per annum.

Thought was given to meeting the annual timber output provided by the forest owners and their agents however experience has shown that this information can be subject to a number of vagaries and unlikely to be achievable. The Branchliner group agreed that an average annual figure based on train capacity is a more realistic option, providing forest owners a level of consistency to plan budgets and resources.

4.4 Potential Traffic Volume

Based on the potential timber volumes obtained by C J Piper & Co Chartered Foresters through Work Programme 4, there is the potential to deliver 133,500 tonnes per annum over a 5-year period to Kinbrace.

The DELTIX: Branchliner Rail Timber Project recommends that the optimum freight train suitable for Kinbrace is a train with a 720 tonne capacity working 4 days per week over a 40-week period. This arrangement will haul approximately 115,000 tonnes of timber year and would extend the proposed 5-year timber extraction programme to 6 years. In discussion with both the rail and timber industry a four day week appears to be the preferred operating option and the exact detail as to how the extraction matches the train output will form part of the detailed discussion between the rail freight operator and the timber industry.

A potential solution to deliver 140,000 tonnes of timber over 5 days per week for 40 weeks and 112,000 tonnes over 4 days to Kinbrace is provided in Table WP3.1 (below) with indicative lorry loads/tonnages and anticipated lorry numbers. In the example the load numbers and average tonnages have been rounded up or down to provide complete lorry journeys and a load is assumed to be 25 tonnes. The delivery of timber to Kinbrace will result in no spare road capacity for timber extraction or lorry movement and it is anticipated that the trucks will be based at an operating centre in Kinbrace.

Table WP 3.1

Road Number / Location	Lorry loads required to meet 140K tonnes/per annum	Lorry Loads required to meet 112K tonnes/per annum.	Potential number of lorries required to deliver timber to Kinbrace.
A897: Forsinain - Kinbrace	1,388 loads per annum which equates to approximately 7 loads per day. (5 day week, 40 week year, annual figure of 35,000 tonnes).	1,120 loads per annum which equates to approximately 7 loads per day. (4 day week, 40 week year, annual figure 28,000 tonnes)	2.0 trucks/per day.
A897: Kildonan - Kinbrace	1,388 loads per annum which equates to approximately 8 loads per day. (5-day week, 40 week year, annual figure 40,000 tonnes).	1,080 loads per annum which equates to approximately 7 loads per day. (4-day week, 40 week year, annual figure 32,000)	2.0 trucks/per day.
B871/B873: Syre - Kinbrace	2,674 loads per annum which equates to approximately 13 loads per day. (5 day week, 40-week year, annual figure of 65,000 tonnes).	2,080 loads per annum which equates to 12 loads per day. (4 day week, 40-week year, annual figure of 52,000 tonnes).	3.0 trucks/per day.

The forest industry is of the view that the most cost effective method of loading the train carriages is not to double handle the timber and load direct from lorry to train. Timber stockpiles may be required in the case of harvester/forwarder breakdowns but these should be located within each forest as part of the harvesting operation and not at the rail terminal. This will require each truck to have an on-board crane which effectively reduces the payload to about 23.5 tonnes; however, 25 tonne is considered the industry norm and used for calculating load numbers.

There are several permutations of the above example and all will utilise the limits of the current lorry number restriction on these roads albeit on specific sections. THC has given a commitment that working at this level is acceptable provided that the increase is associated with the rail operation. It should be noted that as the roads in the area will be operating above the limit of the restriction, structural road damage is to be expected. The potential for damage will be highest on the B871 and B873 due to the poor structural integrity of the road and for large lengths is over deep peat. THC will require additional monitoring and funding to support the increase in traffic volume.

4.5 Existing Road Condition Monitoring

Public roads in Scotland are monitored using sophisticated vehicles driven over the roads, picking up a range of features and defects with the results used nationally to compare the performance of roads in different local authorities. The results of the monitoring of arterial routes in Sutherland are best described in a discussion document presented to the Timber Transport Group by Colin MacKenzie (dated 18/12/15) HTTG Consultant and annexed to this Report.

Unfortunately this monitoring does not provide the detailed analysis of the road structure require to carry out structural improvements and unable to provide specific solutions for areas or advise on the sensitivity of sections of road that appear to be failing.

4.6 Future Road Condition Monitoring

During the ROADEX project (1998 – 2012) THC and Forest Enterprise Scotland (FES) were actively involved with Roadscanners Oy in the monitoring and assessment of the public roads in the project area. There is a wealth of information available but unfortunately the partnership with Roadscanners dissolved due to budget cuts and FES selling their interest in the area. THC are keen to involve Roadscanners in future road assessment and monitoring to supplement their existing road condition monitoring however it is unlikely that a budget will be available to facilitate this. There is interest from some of the forest owners to be actively involved in the road assessment and monitoring of the roads within the project area and Roadscanners have prepared the following proposal.

4.6.1 Introduction

Roadscanners Oy is a consulting company specialized in developing tools and services for traffic infrastructure condition monitoring and management. Roadscanners Oy was established in 1997 and its main office is located in Rovaniemi, Finland.

The company also has consulting offices in Tampere and Helsinki, Finland. Currently, the group also has subsidiaries, Roadscanners Sweden AB, in Sweden, Roadscanners Norway A/S in Norway, Roadscanners central Europe s.r.o. in Czech Republic and Roadscanners USA inc in USA. In Scotland Roadscanners has been working since 2000 in different types of project related to Highland Council road and forest road condition management. Roadscanners Oy is now interested in participating public private partnership with a goal to ensure adequate timber transport route from local forests to Kinbrace railway siding during the time period of 10 years. In this work Roadscanners will use latest road condition monitoring and analysis techniques, strengthening design and proactive maintenance guidance to ensure most economical, sustainable and safe timber transport solutions among the selected roads in Kinbrace area.

The detailed proposal follows:

4.6.2 Roads and Study Methods

The roads, their respective lengths and previously collected material in this study are:

- A897 Kinbrace to Forsinain, length 26 km - GPR, FWD, video (risk analysis) data from 2011 by Roadscanners;
- A897 Kinbrace to Kildonan Lodge (10 km) - GPR, FWD, video (risk analysis) data from 2009 by Roadscanners;
- B871 Kinbrace to Syre (26 km) - Initial survey with GPR, FWD, video (risk analysis) data from 2000 by Roadscanners, revisited 2001, 2006 and 2008 with similar data collected B873 South from Syre (10 km) - Initial survey with GPR, FWD, video (risk analysis) data from 2000 by Roadscanners

For the study 2016 onwards the collected data in the first year will include ground penetrating radar surveys for pavement and unbound layer thicknesses and moisture analysis; video for visual evaluation; laser scanner for rutting; drainage and deformations and falling weight “deflectometer” for bearing capacity and pavement fatigue. With Road Doctor software, all collected data will be used to produce a full evaluation and risk analysis of current condition of the road. It can be used as a base for lifetime prediction under the estimated truck loads. The data will be used also to design correct strengthening measures on each, precisely focused road section.

For following years, annual survey would include laser scanner survey to follow any changes in the road surface. This would give clear indication if the conducted measures have been strong enough.

In 5th year of the project, another round of falling weight deflectometer surveys is needed. After several years of heavy traffic, road fatigue and stress have changed the road bearing capacity. At the same time, ground penetrating radar survey is recommended.

4.6.3 Project Output

One of the main outputs for the project will be locating the weakest road sections that need special strengthening, and also making proposal for these strengthening measures. Sections needing special maintenance, drainage monitoring, seasonal change monitoring etc. will also be located. The road diagnostics and analysis will consist the following:

Existing information about the road condition

The road diagnostics survey will be started by collecting available existing information, such as the maintenance history of the different road sections, results and data from the earlier surveys and risk analyses performed as well as the existing information of soil types e.g. from geological maps. An important source of road condition information will also be the local maintenance masters and crews that have years of experience concerning problem spots on the road.

Road dimensions, geometry and topography

The basic information about the critical road dimensions (road width, pavement width) and geometry (sharp curves and steep hills) will be made based on the mobile laser scanning data collected from the road. Topography classification to define the proposed strengthening solution will also be made based on ROADEX guidelines.

Structures and subgrade soils

Certain variables and factors need to be known in order to make a realistic diagnosis of the impact of the increased heavy haulage on the low traffic volume road. In this work ROADEX diagnostics terminology and methodology will be followed. The following variables will be examined:

- Road structures and subgrade soil quality
- Pavement and bound layer thickness and quality
- Unbound layer thickness and material quality of subgrade soils and their quality
- Permanent deformation and seasonal changes
- Material properties when dry, wet and after freeze/thaw (risk of Mode 1 rutting)
- Drainage condition and its effect on road performance
- Road sections with critical to poor drainage
- Potential geotechnical problems
- Weak road sections built on peat
- Other compressive soils

Based on the analyses the road will be divided into sections with different risk class for failures. In this classification the main type of deformation problems will also be estimated if possible. Proposals for strengthening measures will also be made.

At first stage the role of Roadscanners will be to carry out the data analysis and provide guidance on the planning of annual maintenance. However, heavy truck impact analysis will also be required. Calculations and evaluations on the effect of different loading options on the stresses and strains in the road structure, and to the risk of different types of permanent deformation problems, can be performed after the road structures and subgrade soils and their properties are known. Many techniques can be used for these evaluations.

Another main output for the project will be providing tools for proactive road maintenance practices. The idea is to react before there are visible damages on the road surface. In order to maximize the pavement lifetime a new overlay should be made early enough, before the old layer is damaged. Potential savings in paving costs from this practice are significant. The project will also provide digital systems (tablets) to maintenance crews so that they know to focus exactly on correct places with their maintenance operations.

The findings and key results from this project will be reported annually.

4.6.4 Resources and Staff

The Roadscanners crew has a long history of similar projects from previous years. First tests in B871 in the Highlands were already made by Roadscanners in 2000 so Roadscanners has a long history of the performance monitoring of low volume roads in Scotland. Related to public private partnership projects Roadscanners has started with Finnish Transport Agency a 10-year project focusing especially on the use of modern technologies in guiding proactive maintenance on paved roads. This PEHKO project has started in Finland in 2015 and is covering nearly 2000 km of paved road network. In 2011, a 150 km long mining road in northern Sweden was evaluated before heavy transport was launched with methods described in chapter 2 and 3. Laser scanner monitoring was used to follow up the behaviour of certain road sections in following years. Roadscanners will co-operate with Forestry Commission for data collection. The falling weight deflectometer surveys in the first year will be conducted by Aecom URS UK.

4.6.5 Prices

The approximate price of the first year for the complete surveys, analysis and preparing preliminary proposals for the strengthening work is 35.000 € (VAT 0%).

The prices for the monitoring with laser scanner and reporting of the changes in road condition and proposing new measures in the coming years will be around €8.000.

4.7 Road Design Life and Ongoing Maintenance

THC maintains that the current design life of the road with the present restriction on lorry numbers will be approximately 5 years, allowing extraction up to 2020. The proposal to fully utilise the road capacity in delivering timber to Kinbrace may require a further investment of £1 million pounds in 2020 to maintain the status quo and permit a further 5 years of haulage. This equates to an approximate subsidy of £1.51 per tonne based on a total of 665,000 tonnes of timber being extracted over the 5 years. The figure of £1 million is based on the recent works carried out by THC and the award from the Scottish Timber Transport Fund.

Roadscanners assessment and monitoring may be able to reduce this subsidy by targeting just in time repairs and focused structural improvements however it is clear that further significant investment is required.

THC is quite clear that further investment is unlikely due to ongoing budget constraints and staff reductions.

FES and THC with Roadscanners worked on an innovative approach to assessing and maintaining the B871 during the extraction of timber from Rossal Forest and this may be a possible model for a partnership of the current forest owners to review and take forward.

The partnership working with Roadscanners and in partnership with THC could look to take on the responsibility for managing haulage, inspection, monitoring and maintaining the public roads in the partnership area.

Several owners have expressed an interest in a partnership to manage the public roads but funding is a concern and those interested in funding wished to control the budget and repairs. The industry suggested three potential funding suggestions which are to be explored further:

- Base the lorries in Kinbrace and run on red diesel. As an example for this project a lorry will use 14.2 litres of diesel for an average return journey of 22 miles (Environmental Benefit Report). This may provide a potential saving of £7.00 per load based on the present tax regime and oil prices.
- Add a premium to the timber price which will go directly to the "owner's partnership".
- Direct contribution from the owners based on the tonnage being hauled that year.

4.8 Alternative Road Haulage Vehicles

The forest industry is actively looking at alternative vehicles to carry greater loads to reduce road damage, road maintenance and cost. In the UK there are a number of specialist vehicles which are available and in use which operate on internal forest roads and/or remote minor public roads. The option to use similar vehicles in the delivery of timber to Kinbrace was not supported by the industry for a variety of reasons including the large number of vehicles required, a high capital investment and the general availability of the vehicles.

Metsähallitus and Roadscanners in Finland and Trafikverket, Sweden were contacted to discuss the large capacity Lorries used in Timber Transport which range from 64 tonne GVW to 102 tonne GVW and all are permitted to use public roads. The axle loadings of these trucks are below 10 tonne however the lengths vary up to a maximum of 34 metres. The debate on possible road damage from these high capacity trucks is ongoing in Finland and Sweden with Roadscanners producing a report for the roads authorities which in essence urges caution on using these trucks on thin bituminous pavements. All the public roads within the scope of the Branchliner Project have such thin pavements and at this time without further assessment of the public road network these large capacity trucks cannot be recommended for use on the public network. (Reference: ROADEX NETWORK "Effect of Axle and Tyre Configurations on pavement durability – a pre-study" 2014.)

4.9 Traffic Permit Systems/Traffic Monitoring

The desk study indicated that there are various high tech solution to traffic monitoring, most of which are geared to high volume traffic and as such in the Kinbrace scenario are overly technical and not required. THC at present operates a simple permit system on roads which are weight restricted and is relatively simple to use. The system involves contacting the local office and registration number etc. are recorded prior to approval.

In the Kinbrace scenario there may be 7 trucks all based and operating from Kinbrace and it is anticipated that registering these trucks on the THC system will be a simple operation. Placing a card in the windscreen stating the forest that the lorry is hauling from may be all that is required. In other areas of Highland, tipper trucks working on wind farms operate a similar system which is working successfully.

There are GPS systems and data logging systems available to monitor lorry location and tyre pressures. The GPS systems are product specific and the data only available to the fleet owner. There are data logging systems to record tyre pressure systems which are internet based allowing both the road authority and the lorry owner to monitor location and tyre pressure but at this time it is not available in the UK. There is general interest for this product in the industry but until there is a specific requirement by a local authority or others it is unlikely to be implemented.

4.10 Summary

There is the potential to deliver between approximately 112,000 tonnes and 140,000 tonnes of timber annually to Kinbrace during a 40 week year.

In providing this tonnage the anticipated timber traffic volume is:

1) A897 Forsinain – Kinbrace: 7 loads per day an increase of 1 load on the present restriction
2) A897 Kildonan – Kinbrace: 7 loads per day an increase of 1 load on the present restriction
3) B871/873 South of Syre – Kinbrace: 13 loads per day: an increase of 3 loads per day (based on 10 loads per day) (It is anticipated that the B871/873 will incur significant structural damage and THC will require additional monitoring to be carried out and additional funding to be invested in the road.)

The timber will be delivered to Kinbrace using low impact timber trucks fitted and operating tyre pressure control systems with on-board cranes (Truck wear factor 1 or below, ref: Tread Softly) enabling the timber to be loaded directly onto the train. Alternative vehicles for timber haulage were investigated however at this time discounted due to the potential damage they may cause and general availability.

Little if any timber will be stockpiled at the rail terminal with the industry preferring to store in the wood as part of normal harvesting operations to cut down on the costly double handling of timber.

It is anticipated that 7 trucks will be required to service the haulage operation and as the operation is working above the current load restriction no additional timber will leave the area and it is anticipated that the timber vehicles will be based in Kinbrace.

Managing the haulage operation and exact road space allocation will be best be handled by a cooperative of the forest owners. In effect this has started with a group of owners agreeing the road space allocation for 2016.

The recent improvement and maintenance works carried out on the roads within the area by THC has a design life of 5 years and additional funding for investment for infrastructure improvement and maintenance will be required. It is suggested that a figure of £1.50 per tonne may be sufficient however further assessment will be required to justify this figure. There are options how to obtain this necessary funding such as operating the trucks on red diesel however obtaining the funding solution is outside the scope of this work package and is to be explored further.

Roadscanners have produced a proposal for future monitoring and assessment of the road which would specifically focus on just in time repairs and targeted infrastructure improvements. This proposal will supplement THC existing monitoring system. It is anticipated that Roadscanners will work with and for the forest owners to advise on investment and maintenance. The estimate for the initial survey and report is 35,000 euros and 8000 euros for the subsequent annual monitoring.

There is the option that in partnership with THC and Roadscanners the forest owners accept responsibility for the management of the public roads within the project area. This has been done previously for the B871 in a partnership between FES and THC. Further discussion will be necessary with THC however due to THC cut backs on staff and budgets it is anticipated that the forest owners cooperative would be required to accept the responsibility for providing the necessary funding and managing the infrastructure investment and maintenance with THC as a partner on the group.

At this time a traffic monitoring and permit system is desirable but not essential and may be explored further if it adds value to the operation.

***

SECTION 5

Work Programmes 4 & 5 Timber Supply & Facilitation

Chris Piper FICFor
C J Piper & Co
Chartered Foresters

Acknowledgments

The C J Piper & Co Consultant Team gratefully acknowledges to the forest industry and other colleagues who assisted with this element of the Branchliner Study by providing woodland-related data and other information, including:

Fountains; RSPB; Highfield Forestry Ltd; John Risby (Conservator Forestry Commission Scotland (Highland and Islands);
Forestry; Tilhill Forestry; Andrew Leslie (Summerleaze);
Cameron Ross (Crosscut Forestry); John Clegg & Co;
Dr Rodger Thomas; Scottish Woodlands;
Frank MacCullouch (Avrika Consult); Colin MacKenzie (Consultant to the Highland Timber Transport Group);
Mike Thompson (Munro Harvesting).

5.1 Introduction

This Report comprises the outputs from "Work Programmes 4 and 5" (WP4/ WP5) of the wider "Branchliner Plus Investigative Study", commissioned by HITRANS and carried out by C J Piper & Co Chartered Foresters.

The headline aims of WP 4/5 were to provide the most up to date predictions of timber output volumes data from the commercial forests within the Project catchment area in the context of current public road network and other constraints and to explore the scope for enhancing cross-sector coordination of future timber transport logistics with particular emphasis on the re-introduction of rail transport from Kinbrace.

WP4 and WP5 were carried out by a Consultant Team comprising Chris Piper FICFor, Richard Ogilvy FICFor and Sandy Hogg, working under the umbrella of C J Piper & Co Chartered Foresters and also in collaboration with Avika Consult given the close linkage with Work Programme 3.

The wider historical, political and strategic contexts of the Branchliner Plus Project are set out in the overall Project Report that draws together the outputs of the other Work Programmes.

The specific context for WP4 and WP5, however, is given by the fact that over the next 10-15 years timber growers will be looking to harvest and transport several million tonnes of timber from their forestry investments within the "Flow Country" catchment to markets outwith the area. This will continue to be severely constrained by the fragility of the local public road network and its limited carrying capacity with the resultant significant implications for forestry owners in the area looking to realise an economic return from long term commercial forestry investments, plus associated environmental factors and impacts on local communities.

Furthermore, lack of a concerted approach to better coordination of timber harvesting logistics between forest owners, hauliers and the Highland Council in terms of road usage continues to exacerbate an already precarious situation with regard to the future sustainability of the forestry sector and its contribution to the Highland economy.

The Highland Timber Transport Group's Flow Country Strategy 2014-16 highlighted the still unrealised potential for rail to play a significant part in mitigating the above constraints on the public road network.

Using data and the analyses derived from this and the other Study Work Programmes, therefore, the outputs of the Branchliner Plus Project will facilitate a demonstrator project that will trial timber deliveries by rail as a key element of a longer term solution to timber transport within the Flow Country catchment.

5.2 Background and Historical Context

Encouraged by Government policy, since 1980 some 11,000 hectares of commercial forestry plantations have been established in this area of northern Scotland (which has become known colloquially as the ***"Flow Country") representing an inward investment by forest owners*** of around £22million.

Notwithstanding the environmental benefits, the value of the standing timber from this part of Sutherland when delivered to Highland sawmills and small roundwood outlets is now in the order of £75million. If there were no restrictions on usage of the local rural road network for transporting timber to these markets, of the order of 150,000 tonnes of timber would be harvested annually in perpetuity amounting to a annual delivered value of over £5million.

Assuming only 60% of the felled woodland was to be re-stocked using commercial conifers using current UK Forestry Standard (UKFS) guidelines, the site improvement from the pioneer crop and the use of genetically improved spruce could maintain annual production at over 100,000 tonnes, valued on delivery at £4million.

Although the value of this resource to the Highland economy has long been recognized, the strictures on local authority budgets for maintaining the rural road network have been severely constraining timber harvesting and onward transport to markets over the past two decades. The increased road use resulting from the creation of the forest resource has led to road damage and restrictions being placed on timber traffic, typically a limit of 10 articulated lorry-loads a day (equating to 250 tonnes of freshly felled timber) with a minimum of 20 minutes between each load.

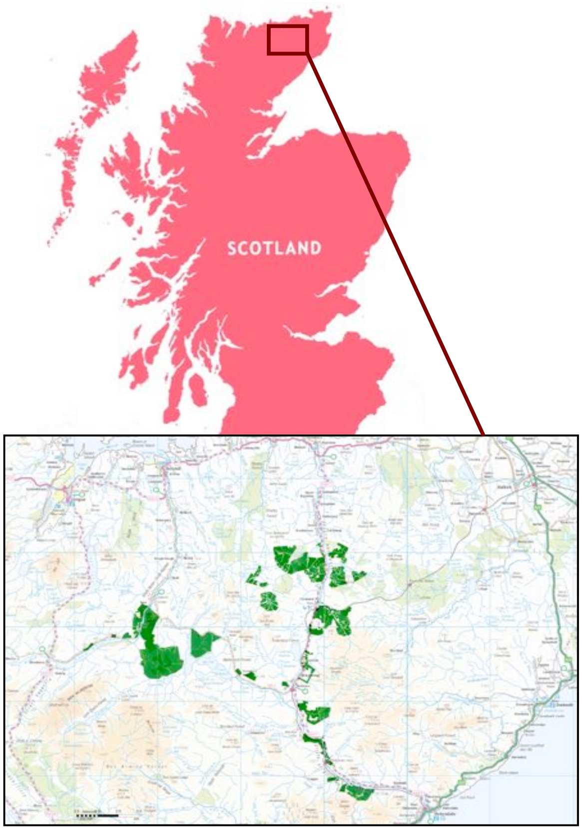
The situation has been further exacerbated (a) by storm damage giving rise to the need to harvest considerable areas of forest before their scheduled felling dates and (b) shortfalls in logistical co-ordination and co-operation between resource owners and managers, hauliers all of whom are vying for priority in allocation of the road usage restrictions and in the process causing difficulties in the management and deployment of minimal financial resources to maintain the roads by the Highland Council.

5.3 Work Programme Scope

Whilst clearly there was overlap of scope between the various Work Programmes requiring close collaboration with the other Project consultants, the specific scope for WP4 and WP5 was to:

- Provide an overview of key forest industry players and woodland ownerships the within Project Area
- Through electronic and face-to-face communication with the relevant forest owners / managers, collect and collate the most current information available on predicted timber production within the Project catchment area, including windblown timber.
- Consult with a sample of key industry players (owners / agents / representative bodies (eg ConFor, UKFPA) to gauge issues / positions. [Note this task was shared with Arvikaconsult Ltd] Identify possible short and longer term strategy(s) for maintaining harvesting streams, including any "modal shifts" in approach to harvesting, marketing and timber transport within the Project Area, together with closer partnership working.
- Provide outline recommendations and next steps for setting up a centralized and independent mechanism or "alliance" to co-ordinate / facilitate implementation of shorter and longer terms solutions for future transportation of timber from the Project Area.

Map 1 - Branchliner Plus Project Area



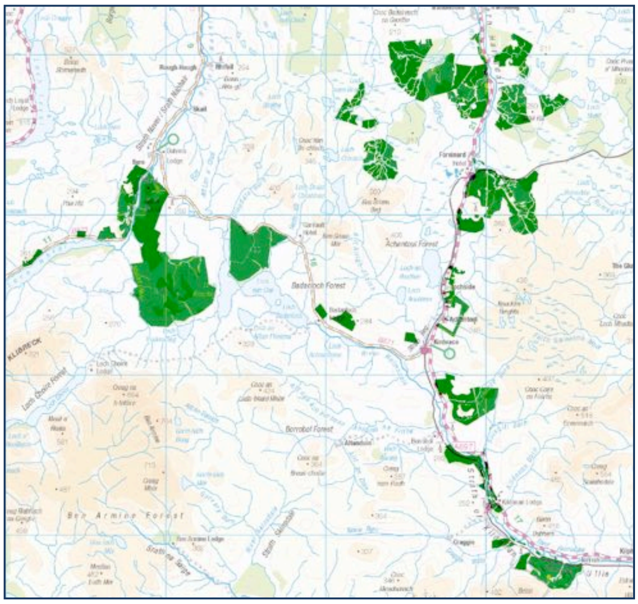
5.4 Project Catchment Area

The Study area was defined by an area termed the "Flow Country Timber Catchment Area", situated in Caithness bounded approximately by the B873 to the west and the A897 to the east - see Map 1 across.

5.5 Woodland Distribution, Ownership & Management within the Project Area

The Project area encompasses approximately 8,000 hectares of commercial conifer woodland (mostly planted in the 1980s) that are, or will become, actively productive over the next 10 years see Map 2 below. Other woodland within the Project area has been excluded for the purposes of this Study.

Map 2 - Branchliner Plus Catchment Area
Commercially Productive Forests *(next 5 years)*



There are 12 different ownerships / management companies involved in the management of this commercial woodland area as shown in Map 3 overleaf.

5.6 Forecasting Future Timber Production

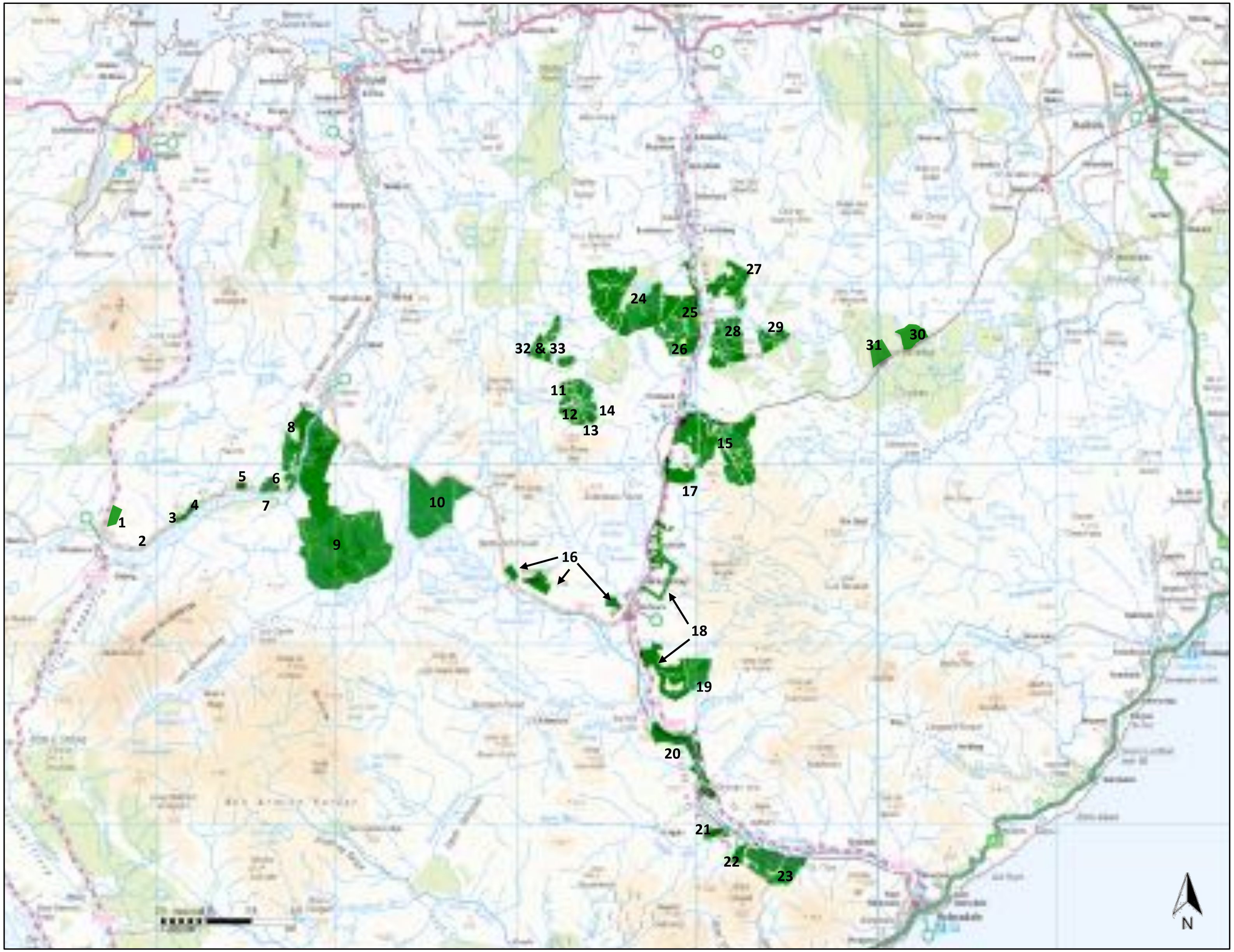
5.6.1 Methodology

The methodology for the review of predicted timber outputs from the Flow Country Report area over the next five period was based on a combination of the following:

(a) Design and electronic circulation to all forest owners / managing agents of a timber outputs Excel spreadsheet for entry of data and return to the Consultant Team.

(b) Face-to-face and other personal communication / consultations with the relevant woodland owners / managers within the Report area to assist with procurement, or clarification of, ownership areas and timber production data.

Map 3. Commercially Productive Areas by Ownership / Management



HI TRANS
THE HIGHLANDS AND ISLANDS TRANSPORT PARTNERSHIP

BRANCHLINER 1 PROJECT

Project Area Woodlands

LEGEND

Timber producing woodlands within Project Catchment Area

Map No	Woodland Name	Owner / Agent
1-6	North Strath Naver Cpts 1-6	John Clegg & Co
7	Creag Dubh, Loch Naver	Rodger Thomas
8	Syre	Fountains
9	Rosal -1	Tilhill
10	Rimsdale	Summerleaze
11	Dyke (Mackay & Tuath)	Brook Forestry
12	Gleann Nam Beist (Dyke)	Fountains
13	Gunn	Highfield Forestry
14	Abhain Beag	Highfield Forestry
15	Forsinard (Baledigle)	Brook Forestry
16	Badanloch Estate	John McGlade
17	Bealach	Mike Ashmole / Achentoul
18	Achentoul Estate	Cameron Ross
19	Suisgill - 2	Tilhill
20	Borrobol - 3	Tilhill
21	Craggie	Scottish Woodlands
22	Killearnan	Scottish Woodlands
23	Torrish	John Clegg & Co
24	Dyke	RSPB
25	Brig	Brook Forestry
26	The Dale	Highfield Forestry
27	Forsinain	RSPB
28	Forsinain	Highfield Forestry
29	Forsinain (Fasagh)	Brook Forestry
30	Catanach (Altnabreac)	Fountains
31	Station Hill (Altnabreac)	Fountains
32	Crocaich	Fountains
33	Coille Breac	Fountains

Date
Jan 2016

Approx Scale at A3
1:200,000

chartered foresters
C J PIPER & CO
Kinfauns
8 Pilmuir Road West
Forres
Moray
IV36 2HL
T: 01309 674374
M: 07802 833263
E: chrispiper@supanet.com

(c) Timber production data for each of 2016 and 2017 and for the ensuing 3 years 2018-2020 (so as to provide an aggregated 5 year period) was requested from the forest owners together with a best estimate of what proportion, if any, of this production was from windblown timber (as at the time of the Study).

5.6.2 *Results*

Table WP4.1 below summarises the headline results from the survey:

Table WP4.1. Timber Outputs 2016-20 (Tonnes overbark)

Category	Timber Production (Tonnes)			5 Year Totals
	2016	2017	2018-20	(Tonnes)
Windblow	75,000	92,000	n/a	167,000
Other	113,300	82,135	304,935	500,570
TOTALS	188,300	174,135	304,935	667,370

The data indicates that the quantity of marketable roundwood to be harvested over the next 5 years amounts to approximately **670,000 tonnes,** or an average of **134,000 tonnes per annum**.

Of this total timber production, some 167,000 tonnes (at the time of reporting) would be accounted for by the harvesting of windblown timber. Owners / managers have intimated that this harvesting would need to be prioritized over the next 1-2 years to avoid even greater deterioration in marketable value than it has already suffered as a result of loss of timber value through snap and attendant higher harvesting costs associated with windblown crops

It is important to note that the data gathered and presented for the purposes of this Project pertains specifically to the production plans of individual woodland owners / managers **as distinct from** an assessment of the potential productive capacity of (often referred to in national or other strategic level forest inventory / timber production forecasts as ***"availability"***) of the woodlands concerned.

The production figures are therefore "real time" estimates and present a "snapshot in time" in terms of the net 5-year period and are liable to change due to on-going timber transport and market constraints and other economic factors. Indeed individual forestry investments may be sold or be subject to changes in management in the interim which can typically affect timing of previously forecast timber production plans.

Please note that for the purposes of reporting, in the interests of commercial confidentiality production forecast data has not been attributed to individual forest ownerships but has been aggregated across particular areas within the Project catchment Area with a view to providing indicative timber traffic flows – see 6.3 below.

5.6.3 *Timber Flows*

Assuming an typical net maximum timber load of 25T for an articulated timber lorry, were the above timber production figures come to fruition, road transport equivalent to a total of **26,800 lorry loads** passing over the public road network within the BPA over the next 5 years – or an annual average of **5,360 lorry loads**- would be required.

Indicative flows of timber transport on the public road network to accommodate the above levels of production within the Project area are illustrated in Map 4 below, the implications of which are dealt with in detail in Work Programme 3 by Avrika Consult

5.7 Constraints & Opportunities

5.7.1 *The need for modal shifts*

Given the Highland Council's current limits on timber traffic of 10 lorry-loads per day (with a minimum of 20 minutes between each load), for the road network to accommodate the above forecasts of production this would require of the order of some 30 lorry-loads per day.

Under the road usage current constraints (with the possibility of further weight limits being imposed on the roads in question) the current road infrastructure could only cope with approximately 40% of actual production potential with the attendant negative impacts on the future viability – in terms of investment values - of the Flow Country forest resource.

This points unequivocally to the need for a modal shift to establish the feasibility of transferring the transport of very substantial quantities of timber from road to rail and associated logistics.

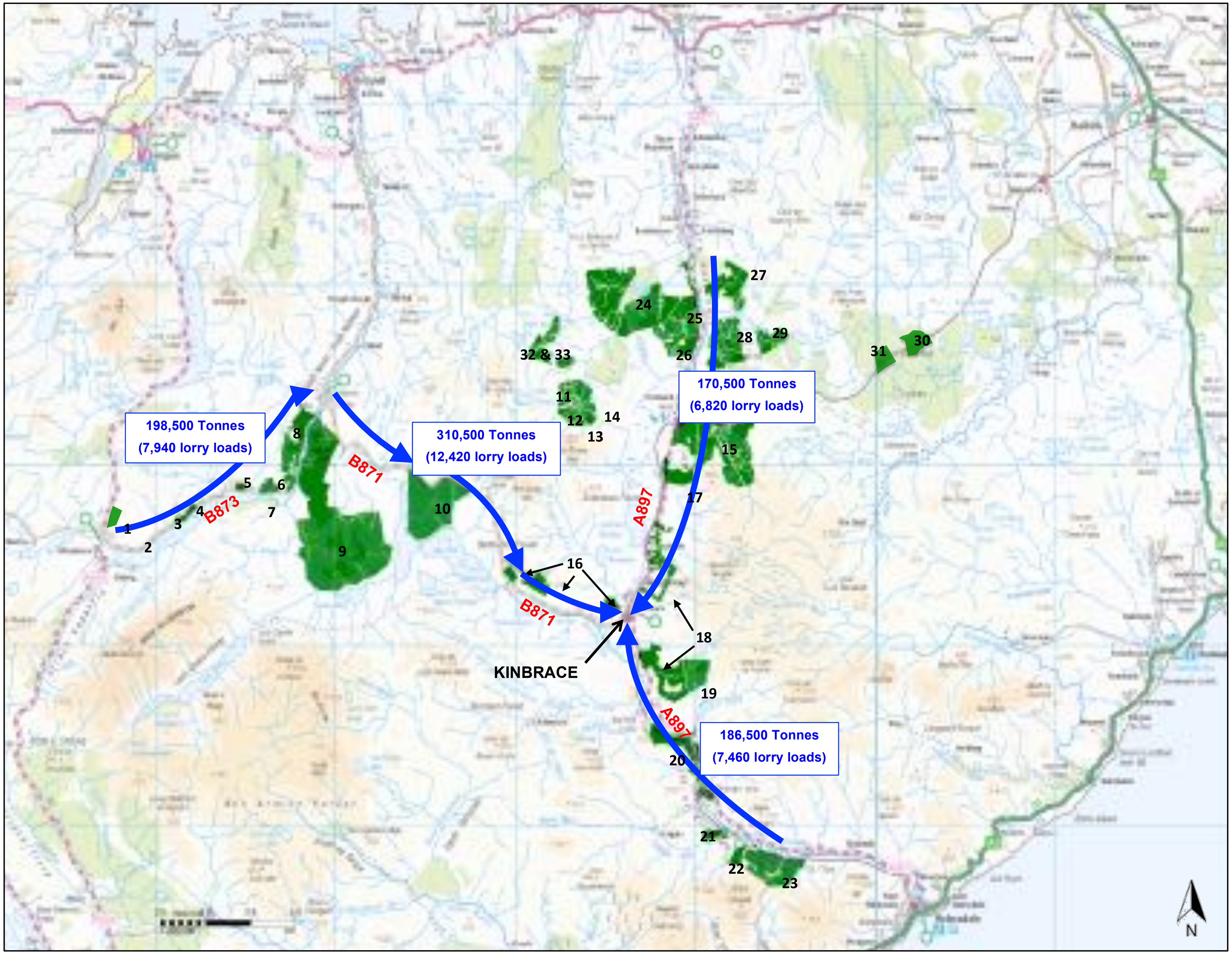
5.7.2 *Future quantification of timber for transport purposes*

Traditionally in UK forestry timber is either sold standing (when it is felled, extracted and hauled from the forest by the customer), or sold at roadside having been felled and extracted by the grower, typically using managing agents, harvesting and haulage contractors.

In both cases, payment for the timber, and for each step of the production process, tends to be almost exclusively based on the weight of timber carried to market, derived by each timber lorry load going over a weighbridge.

Regardless of the solution to the transport issues over inadequate roads, a fundamental issue is the haulage and sale of the water which can make up to 30% or more of the weight of freshly cut timber. The desire to maximize the weight by growers inevitably leads to prices being predicated on freshly cut timber with growers losing income from the drying of timber

Map 4. Indicative Timber Flows on the Project area road network 2016-20



BRANCHLINER PROJECT
Map 4
5 Year Timber Movements (2016-20)

LEGEND

Timber producing woodlands within Project Catchment Area

Direction of timber lorry flow

Map No	Woodland Name
1-6	North Strath Naver Cpts 1-6
7	Creag Dubh, Loch Naver
8	Syre
9	Rosal -1
10	Rimsdale
11	Dyke (Mackay & Tuath)
12	Gleann Nam Beist (Dyke)
13	Gunn
14	Abhain Beag
15	Forsinard (Baledigle)
16	Badanloch Estate
17	Bealach
18	Achentoul Estate
19	Suisgill - 2
20	Borrobol - 3
21	Craggie
22	Killearnan
23	Torrish
24	Dyke
25	Brig
26	The Dale
27	Forsinain
28	Forsinain
29	Forsinain (Fasagh)
30	Catanach (Altnabreac)
31	Station Hill (Altnabreac)
32	Crocaich
33	Coille Breac

Date Feb 2016

Approx Scale at A3 1:200,000

between the felling and delivery stages. This proved to be a fatal issue when trialling previous model for rail transport from Kinbrace some years back – with weight losses causing unsustainable economic losses to owners and harvesting contractors alike.

As buyers are interested in volume and fibre it is feasible to arrange to allow timber to dry (either stacked in the forest or other storage point) prior to onward transport to market with value being determined by using either:

(a) Measurement by volume (expressed in cubic metres) or

(b) By using agreed formulae for assessing moisture content to derive dry weight against the weighbridge measurements.

This could significantly reduce the amount of "dead weight" being hauled from forest on to the public road and/or onward to a railhead.

5.7.3 Future marketing of "Flow Country" timber

Assuming the above logistical and cost issues can be addressed, there is an imperative for timber delivered to the railhead to be measured and paid for at that point. Unless all measurements are made on a volume (per cubic metre) this would require a weighing mechanism at this point to provide the workable basis for sale.

In addition, there has to be an operator at the rail-head who takes ownership of the timber at that point, essentially a trader who buys timber and sells it on.

5.7.4 Possible marketing mechanisms

Possible operating mechanisms for the above could include a growers "business partnership", or an individual industry player or investor, who would operate the "terminal" and pay for timber delivered in and then invoicing for timber going to end-user.

If it was a grower's initiative - for example structured as limited partnership, an agreed percentage commission linked to timber quantities handled could be applied to cover running costs.

A grower's initiative to handle the transport of timber has a further advantage in that it could guarantee continuity of timber supply, which greatly enhances the commercial attraction for market outlets. Identifying a resource as standing timber is attractive to industry players but with no certainty as to when, or even if, it is coming to market end users are less willing to consider investing in facilities or committing to supply contracts.

For example, it is possible to visualize timber trains from the Flow Country going straight to the Norbord plant at Dalcross where the small roundwood (SRW) would be utilized at point of arrival and the logs onward transported on to a sawmill, reducing significantly the handling costs compared to unloading all and transporting by road from a railhead such as Inverness to Norbord.

Over the next few years the timber from the Project area will be largely lower end value small roundwood and it might make commercial sense to transport the sawlogs by road direct from the forest to the sawmill whilst using the railway purely for SRW direct to a plant.

A grower's cooperative, able to commit to long term production, thus has the potential to act as a catalyst for realizing the full financial potential locked up in the Flow Country timber resource.

Similarly, such a guarantee could help to attract the commitment from rail freight operators to support or invest in the required facilities.

5.8 Conclusions

The forecast for future timber production – as distinct from theoretical availability - from the project area over the next 5 years, information derived directly from the forest owners themselves, indicates that only 40% - at best - of this production could be accommodated by the local road network serving the Project area.

However the indications are likely further financial and physical limitations being placed on this road infrastructure will make even this level of production unsustainable with resultant highly damaging economic and environmental impacts on this area of the Highlands and investment returns on commercial forestry.

This places a renewed imperative on establishing a feasible and complementary solution to timber transport using the rail network via a centralised "hub" at Kinbrace.

There is a need for a "paradigm" shift in the level of mutual co-operation between the various Project area forest owners / managers, timber haulage contractors, the Highland Council and rail transport operators in order to co-ordinate and optimize future timber transport to enable owners to realize their current, and justify future, investment into commercial forestry within this area of Scotland

Also needed is a modal shift in the method by which growers, harvesting and haulage contractors and market outlets measure harvested timber as a means of mitigating the historical issues associated with weight loss between harvesting site and end user.

There is an imperative for an innovative and centralized mechanism for the co-ordination, timing and mode of transport of future timber production from the BPA to be put in place as a matter of priority.

***

SECTION 6

Work Programme 6

Economic Impact Analysis

Bob Stubbs
Bob Stubbs Consulting Ltd

6.1 Introduction, Approach & Method

This report sets out the potential economic impacts of the Branchliner Project.

Information, and related assumptions, on the activity from the forests in the Kinbrace railhead catchment to the mills was provided by HITRANS and consultants undertaking the other Work Packages. This information has been converted into economic impacts by using a number of secondary datasets.

For each stage in the movement of the timber we have endeavoured to measure the economic impact in terms of:

- Business turnover.
- Employment, expressed in Full-Time Equivalent (FTE) jobs.
- Income-i.e. gross annual wages excluding employer's contributions.
- Gross Value Added (GVA).

The impacts were calculated at two geographical levels:

- HITRANS area.
- Scotland.
- The assessment encompasses three types of impact:
- Direct. This relates to the activity of workers involved in moving the timber-e.g. harvesters, train drivers.
- Indirect. This arises from the increased purchases of goods and services required by the activities (e.g. fuel, sub-contractors).
- Induced. This arises from the expenditure in the wider economy (shops, restaurants, etc.) of the wages of those directly and indirectly employed as a result of the timber movements.

When added together these three individual impacts produce *total* impacts. In addition there would be economic impacts from the physical works to:

- Create the rail freight facility at Kinbrace.
- Upgrade the roads in the Kinbrace area to allow haulage of the timber from the forests to the railhead.

6.2 Input Information & Assumptions

6.2.1 Overview

Branchliner is expected to involve the movement of 100,000 tonnes of timber per annum.

This will be harvested in forests in the Kinbrace area. It will then be transported by road to a purpose built rail facility at Kinbrace and loaded directly onto a train.

The trains will then be driven to Inverness where the timber will be offloaded and forwarded on to mills by road haulage. For the purposes of the economic impact assessment it was assumed that the mills would be in a corridor between Inverness and Mosstodloch.

It is recognised that a rail siding may be established at the Norbord factory to the east of Inverness. This would allow the direct movement of timber by rail from the Kinbrace facility to the Norbord site. However, such a development is outside the scope of the current Branchliner project. Thus, for the purposes of this assessment is it is assumed that all timber is off-loaded from the train at Inverness and forwarded on by road to the mills.

Not all of the 100,000 tonnes of timber are solely attributable to the Branchliner project. In its absence 50,000 tonnes would still be moved by road from the Kinbrace area to the mills. Thus, Branchliner would result in the harvesting of an additional 50,000 tonnes per annum-and it is this activity that is the basis of this impact assessment.

However, it is expected that the additional 50,000 tonnes would displace sales by other Scottish timber growers-most likely ones in the HITRANS area.Thus, the ongoing annual economic impacts set out in this report are unlikely to represent additional economic activity within Scotland or the HITRANS area.

Nevertheless, in the absence of Branchliner the limited ability to move timber by road from the Kinbrace area risks the 50,000 tonnes per annum simply being left to rot. That would lead to degraded land value and attendant environmental issues.

6.2.2 Input Information

The following information was provided HITRANS and the consultants working on the other Work Packages.

(1) The net price achieved by the timber growers would lie between £2 and £10 per tonne. Those values exclude any subsequent costs for harvesting, road haulage. For the purposes of the assessment we have assumed a net price of £5 per tonne.

(2) The cost of harvesting and forwarding of 50,000 tonnes per annum would be £835,000. That comprises £595,000 for the former and £240,000 for the latter.

The work would require the equivalent of 5 full-time jobs per annum. Some 3.5 would be harvesters, the other 1.5 would be forwarders.

The income from this employment would be £200,000. That is, an average of £40,000 per full-time job.

The cost of road haulage from the forests to the Kinbrace facility and loading onto the train would be £7 per tonne. That would mean an annual payment of £350,000 to the haulier(s) concerned.

Assuming a distance of no more than 25 miles from forest to railhead, a lorry would move approximately 100 tonnes per working day. Thus, 500 working days per annum would be required to move the 50,000 tonnes. Based on a working year of 225 days this would result in c2.2 full time jobs per annum.

The additional 50,000 tonnes of timber would require 80 return train movements per year from Kinbrace to Inverness. The cost would be £10 per tonne.

Each return train would require a full shift's work by a driver and also by a shunter at Kinbrace. Gross wages per annum are £45,000 for a train driver and £30,000 for a shunter.

The cost of unloading the train at Inverness and road transport onto the mills is between £8 and £9 per tonne. The midpoint of this range has been used. That gives total turnover of £425,000 per annum to the haulier(s) involved.

In the absence of available information the employment from the Inverness-mills haulage was estimated by prorating the employment from haulage between the forests and the Kinbrace freightfacility. Thus, c2.2 full time equivalent jobs were multiplied by 425,000/350,000. This gives direct employment of 2.7 full-time equivalent jobs for the Inverness-mills haulage.

The capital cost of the construction of the rail freight facility at Kinbrace are taken as £4,384,000. It includes permanent way, culverts, earthworks and fencing. It also encompasses project management, design costs and ground investigation. That work is assumed to be split evenly between companies and staff members based in the HITRANS area and those based elsewhere in Scotland.

Some elements of the works have not been included in our calculation, as they have not yet been costed. Thus, the figure of c£4.4 million could be considered a conservative estimate.

The capital cost of the road upgrades would be £1,000,000. Given the scale and nature of the required works the design and project management elements are assumed to be undertaken by a company/companies based in the HITRANS area.

6.2.3 Secondary Economic Datasets

The input information was supplemented with secondary data to generate the economic impact estimates. They included GVA, employment and wages data from the most recent (2013) Annual Business Survey, and the 2012 Scottish Input-Output Tables.

The multipliers used to calculate indirect and induced impacts were taken from the Scottish Input-Output Tables. For impacts within the HITRANS area these national level multipliers had to be scaled down. This reflects that a proportion of goods and services would be purchased from businesses in parts of Scotland outside the HITRANS area.

Based on our experience of similar projects and our regular business surveys in the HITRANS area the following scaling factors were applied:

- Indirect: 50% of the Scottish level multiplier.
- Induced: 80% of the Scottish level multiplier.

6.3 On-going Annual Impacts

6.3.1 Sale of Timber

The annual **direct** sales (turnover) value of the additional 50,000 tonnes of timber is £250,000. It is estimated that the **direct** GVA element is £145,628.

As the timber has already been planted and grown there are no employment and income impacts attributable to the Branchliner project. Nor are there any attributable indirect and induced impacts for turnover and GVA.

6.3.2 Harvesting Turnover

The cost of harvesting and forwarding (i.e. the **direct** turnover generated by the companies providing these services) is £835,000 per annum. It is assumed that these companies would be based in the HITRANS area.

Once indirect and induced effects are included the **total** turnover impact is:

- HITRANS area: £1,071,740.
- Scotland: £1,243,835.

Employment

As shown earlier the harvesting and forwarding work would generate 5 **direct** full-time equivalent jobs per annum. Including indirect and induced employment effects the **total** employment impact would be:

- HITRANS area: 6.1 jobs.
- Scotland: 6.9 jobs.

Income

The **direct** wage income for the harvesters and forwarders would be £200,000. When the income of indirect and induced employees is included the **total** income impact would be:

- HITRANS area: £232,497.
- Scotland: £256,490.

GVA

The **direct** GVA would be £275,587. The **total** GVA impact would be:

- HITRANS area: £394,244.
- Scotland: £486,102.

6.3.3 Road Haulage to Kinbrace and loading onto train

Turnover

The annual cost is £350,000 per annum-which is the **direct** turnover of the road haulage business(es). Based on discussions with HITRANS the haulier(s) involved are assumed to be HITRANS area companies.

Once indirect and induced effects are included the **total** turnover impacts are:

- HITRANS area: £467,431.
- Scotland: £552,989.

Employment

As shown earlier road haulage from the forest to the railhead at Kinbrace would generate c2.2 **direct** full time equivalent jobs per annum. Including indirect and induced effects the **total** employment impact would be:

- HITRANS area: 2.9 jobs.
- Scotland: 3.4 jobs.

Income

Based on secondary data, the **direct** wage income would be £65,985. Including the income of indirect and induced employees the **total** impact would be:

- HITRANS area: £86,432.
- Scotland: £101,949.

GVA

The **direct** GVA would be £157,542. The **total** GVA impact would be:

- HITRANS area: £218,323.
- Scotland: £261,717.

6.3.4 Rail Movement To Inverness

Turnover

The cost of the train move (i.e. the **direct** turnover generated by the rail operator) is £500,000 per annum. Once indirect and induced effects are included the **total** turnover impact is:

- HITRANS area: £753,658.
- Scotland: £967,970.

Employment

The work would require 80 driver shifts and 80 shunter shifts. Assuming that a shift equals one working day, and an annual working year of 225 days, the total of 160 shifts would generate 0.7 **direct** FTE of employment.

Including indirect and induced employment effects the **total** employment impact would be:

- HITRANS area: 1.2 FTE.
- Scotland: 1.6 FTE.

Income

The **direct** wage income from the 0.7 FTE would be £26,667. Once the income of indirect and induced employees is included the **total** income impact would be:

- HITRANS area: £39,515.
- Scotland: £50,605.

GVA

The **direct** GVA would be £142,796. The **total** GVA impact would be:

- HITRANS area: £266,709.
- Scotland: £376,348.

6.3.5 Road Haulage from Inverness to mills

Turnover

The annual cost is £425,000 per annum-i.e. the **direct** turnover to the road haulage business(es). Again, it is assumed that the haulier(s) are based in the HITRANS area.

Once the indirect and induced effects are included the **total** turnover impacts are:

- HITRANS area: £567,595.
- Scotland: £671,486.

Employment

As shown earlier road haulage from Inverness to the mills would generate 2.7 **direct** full-time equivalent jobs per annum. Including indirect and induced employment the **total** impact would be:

- HITRANS area: 3.5 jobs.
- Scotland: 4.1 jobs.

6.3.3 Income

The **direct** wage income would be £80,125**.** Once the income of indirect and induced employees is included the **total** impact would be:

- HITRANS area: £104,953.
- Scotland: £123,795.

6.3.4 GVA

The **direct** GVA would be £191,301. The **total** GVA impact would be:

- HITRANS area: £265,106
- Scotland: £317,799

6.4 Summary of On-going Annual Gross Impacts

Table WP6.1 below brings together the preceding analysis. It shows the Impacts that would occur in each year of the Branchliner project's operation.

Thus, the economic impacts set out in this section-from harvesting, road haulage, etc.-would still occur in Scotland in the absence of the Branchliner project and most likely would also still occur within the HITRANS area.

Table WP6.1. Summary of On-Going Annual Gross Impacts (Direct, Indirect and Induced)

Element/Geography	Turnover (£)		Employment (FTE)		Income (£)		GVA (£)	
	HITRANS	Scotland	HITRANS	Scotland	HITRANS	Scotland	HITRANS	Scotland
Sale of Timber	250,000	250,000	n/a	n/a	n/a	n/a	145,628	145,628
Harvesting	1,071,740	1,243,835	6.1	6.9	232,497	256,490	394,244	486,102
Road Haulage to Kinbrace and Loading	467,431	552,989	2.9	3.4	86,432	101,949	218,323	261,717
Rail Movement to Inverness	753,658	967,970	1.2	1.6	39,515	50,605	266,709	376,348
Road Haulage From Inverness to Mills	567,595	671,486	3.5	4.1	104,953	123,795	265,106	317,799
Total	**3,110,424**	**3,686,280**	**13.7**	**16.0**	**463,397**	**532,839**	**1,290,010**	**1,587,594**

Within the **HITRANS area** the total (direct, indirect and induced) impacts would be approximately:

- £3.1 million of business turnover.
- 14 full-time equivalent jobs.
- £464,000 of employee income, representing an average wage of over £33,500 per full-time equivalent job.
- £1.3 million GVA.

For **Scotland** the impacts are higher, reflecting the larger indirect and induced impacts over the wider geographical area. The total (direct, indirect and induced) impacts would be around:

- £3.7 million of business turnover.
- 16 full-time equivalent jobs.
- £533,000 of employee income, representing an average wage of over £33,000 per full-time equivalent job.
- £1.6 million GVA.

Within both geographies most of the employment and income impacts would come from harvesting and the road haulage from Inverness to the mills.

The employment would be relatively well paid. As noted above, the average figure is over £33,000 per full time equivalent job. This compares to the Scottish average (median) of £27,710 per full-time job *(Source: Annual Survey of Hours and Earnings 2015).*

. n/a= not applicable

6.5 Net Impacts

As noted earlier it is expected that the additional 50,000 tonnes would displace sales by other Scottish timber growers-most likely those in the HITRANS area.

6.6.1 Creation of Kinbrace Facility

Table WP6.2 sets out the total (direct, indirect and induced) impacts of building the rail freight facility at Kinbrace, based on an estimated capital cost of c£4.4 million.

Table WP6.2. Construction Impacts of Kinbrace Rail Freight Facility (Direct, Indirect and Induced)

Turnover (£)			
HITRANS Area		Scotland	
Total	FTE Basis	Total	FTE Basis
5,624,368	562,437	7,681,673	768,167
Employment (FTE)			
HITRANS Area		Scotland	
Job Years	FTE	Job Years	FTE
35.9	3.6	50.5	5.1
Income (£)			
HITRANS Area		Scotland	
Total	FTE Basis	Total	FTE Basis
1,078,220	107,822	1,511,607	151,161
GVA (£)			
HITRANS Area		Scotland	
Total	FTE Basis	Total	FTE Basis
2,483,529	248,353	3,514,503	351,450

The geographical distribution of impacts assumes that the:

- Physical works are led by a contractor based in the HITRANS area.
- Other elements (project management etc.) are split evenly between companies/staff based in the HITRANS area and those in other parts of Scotland.

The impacts are expressed, first, in terms of the total impacts during the construction phase, which is by definition time limited.

For example, in the HITRANS area there would be 35.9 job years with £1,078,000 of related employee income.

To allow direct comparison with the ongoing annual impacts shown at **section 2** the construction impacts have also been expressed in FTE terms: that is, using the convention that an FTE job lasts at least 10 years. On that basis, the HITRANS area employment impact is 3.6 FTE and £248,000 GVA.

The greater impacts at the Scottish level (e.g. 5.1 FTE jobs) reflects, first, that some of the design, etc. work will be undertaken by companies based in parts of Scotland outside the HITRANS area. Second, some of the goods and services required for the physical works will be provided by suppliers based elsewhere in Scotland.

6.6.2 Upgrading of Roads

Table WP6.3 shows the construction impacts of upgrading the roads in the Kinbrace area at a cost of £1 million.

Given their lower capital cost, the road upgrades generate lower economic Impacts than those for the rail freight facility.

A clear majority of the impacts would occur within the HITRANS area rather than in other parts of Scotland. They include £1.4 million turnover accruing to the area's businesses, generating nine job years of work (direct, indirect and induced).

Table WP6.3. Construction Impacts of Upgrading Roads (Direct, Indirect and Induced)

Turnover (£)			
HITRANS Area		Scotland	
Total	FTE Basis	Total	FTE Basis
1,405,123	140,512	1,752,206	175,221
Employment (FTE)			
HITRANS Area		Scotland	
Job Years	FTE	Job Years	FTE
9.0	0.9	11.5	1.2
Income (£)			
HITRANS Area		Scotland	
Total	FTE Basis	Total	FTE Basis
271,561	27,156	344,801	34,480
GVA (£)			
HITRANS Area		Scotland	
Total	FTE Basis	Total	FTE Basis
635,211	63,521	801,666	80,167

6.6.3 Total Construction Impacts

Table WP6.4 combines the results shown at Tables WP6.2 and WP6.3. Thus, it gives the total construction impacts of the Branchliner project.

The total direct construction spend of around £5.4 million generates a total turnover (direct, indirect induced) of £7.0 million in HITRANS area companies and over £9.4 million in businesses throughout Scotland. Within the HITRANS area the works generate 45 job years of employment at an average annual wage of around £30,000, with GVA of more than £3 million.

The impacts are higher at the Scottish level. They include 62 job years of work and over £4.3 million GVA.

Table WP6.4. Total Construction Impacts of Branchliner Project (Direct, Indirect and Induced)

Turnover (£)			
HITRANS Area		Scotland	
Total	FTE Basis	Total	FTE Basis
7,029,491	702,949	9,433,880	943,388
Employment (FTE)			
HITRANS Area		Scotland	
Job Years	FTE	Job Years	FTE
44.9	4.5	62.0	6.2
Income (£)			
HITRANS Area		Scotland	
Total	FTE Basis	Total	FTE Basis
1,349,781	134,978	1,856,408	185,641
GVA (£)			
HITRANS Area		Scotland	
Total	FTE Basis	Total	FTE Basis
3,118,740	311,874	4,316,169	431,617

6.7 Total Impacts

TableWP6. 5 shows the total impacts of the project within the HITRANS area and for Scotland as a whole. It combines the results shown at Table WP6.1 and Table WP6.4.

Within the HITRANS area the total (direct, indirect and induced) impacts wouldbe approximately:

- £3.8 million of business turnover.
- 18 full-time equivalent jobs.
- £0.6 million employee income.
- £1.6 million GVA.

For Scotland the impacts would be around:

- £4.6 million of business turnover.
- 22 full-time equivalent jobs.
- £0.7 million employee income.
- £2.0 million GVA.

The majority (over 70%) of total impacts come from the ongoing annual activity-harvesting, road haulage, etc. As noted earlier they are expected to be displaced from elsewhere in Scotland and most likely from elsewhere within the HITRANS area. As such, they would not constitute additional economic activity.

Table WP6.5. Total Construction Impacts of Branchliner

Element / Geography	Turnover (£)		Employment (FTE)		Income (£)		GVA (£)	
	HT	Scotland	HT	Scotland	HT	Scotland	HT	Scotland
Ongoing Annual Impacts	3,110,424	3,686,280	13.7	16.0	463,397	532,839	1,290,010	1,587,594
Construction Impacts	702,949	943,388	4.5	6.2	134,978	185,641	311,874	431,617
Total	3,813,373	4,629,668	18.2	22.2	598,375	718,480	1,601,884	2,019,211

SECTION 7

Work Programme 7
Environmental Impact Analysis

Dr Yuhong Wang
Senior Research Fellow
Transport Research Institute
Edinburgh Napier University

7.1 Introduction

The forestry industry is extremely valuable to the Scottish economy, contributing some £1bn in GVA and employing around 50,000 people.

The nature of the industry means that large number of heavy vehicles travel on rural and minor roads. Poor transport infrastructure has been identified as a major constraint to efficient management of existing areas of productive forestry and a barrier to expanding the resource by new planting to meet government targets (STTF, 2007).

Timber transport attracts significant attention from both the public and private sector. The former (e.g. mainly local authorities) shows great concern for the damage and maintenance of the road surface, while the latter (e.g. landowners, harvesters, freight operators etc.) are concerned about the limitations of these roads and their effect on the operational efficiency and the competitiveness of the industry. Furthermore other effects such as the need to clear significant volumes of windblow, have impacted on timber transport issues in many places in Scotland.

Currently there is no round timber moved by rail in Scotland despite a previously EWS run rail service between Kinbrace and Inverness from 2002 to 2005.

HITRANS is currently leading the proposal of Branchliner Plus which aims to find a viable solution for resurrecting rail haulage from the Flow Country where the volumes being harvested continue to increase and are well beyond the capacity of the fragile road network. The project aims to offer 100,000 tonnes per annum supplementary rail transport capacity to existing timber haulage between Kinbrace and Inverness. The target to be achieved by running rail service at a frequency of 4 trains per week, which equivalent to 2,273 road trips per year by the 44 tonne articulated HGVs at the maximum permitted loading capacity.

The aim of this Work Programme was therefore to analyse the potential environmental and social impacts of moving this projected volume of timber by rail from Kinbrace to Inverness, and thereby replacing traditional road haulage by 44 tonne articulated HGVs. It compares the marginal social benefits of using a combination of road and rail against the road only option.

The methodology used was the Department for Transport's (2009) Mode Shift Benefit analysis which is used for assessing mode shift grant schemes in the UK. The methodology is described below in more detail, but in summary, it is designed to assess the net social benefit of transferring freight from road to rail (or water).

This analysis takes into consideration the costs of congestion, accidents, noise, climate change, air pollution, infrastructure and other costs of both road vehicles (trucks) and other modes (rail and water). It then subtracts the costs of the latter from the costs of the former to give one **net** value. Although very general, this methodology is probably the best available at the time of writing and for the scope of this report.

7.2 Scope

Setting the boundaries in any assessment of impacts is always difficult. In this study, the boundaries are very tight. The study considers only the impacts of the operations between the harvest sites and the mills beyond the Inverness railhead (e.g. Dalcross, Dingwall, Nairn, Fochabers, etc.). It does not consider any impacts further than this. Additionally, it considers only the distribution of the round timber. It ignores the inputs to the process and any by-products produced. It is confined to a very small element of the total logistics chain. It also ignores all upstream impacts, for instance, the construction of the vehicles, loading and discharging equipment, rail lines etc.. It takes all these as givens. It also ignores the financial requirement of this proposal and the operational requirements of the mode switch, as these are the subject of a different report.

In measuring the environmental effects of logistics it is important to distinguish between different levels of impacts. The International Green House Gas Protocol Initiative has developed the following categorisation:

SCOPE 1 emissions – direct GHG emissions from sources owned or controlled by the entity, e.g. emissions from fossil fuels burned on site, in vehicles etc.

SCOPE 2 emissions – indirect GHG emissions resulting from the generation of electricity, heating or cooling or steam generated off-site but purchased by the entity and the transmission and distribution losses associated with some purchased utlilities (e.g chilled water, steam)

SCOPE 3 emissions – indirect GHG emissions from sources not owned or directly controlled by the entity but related to the entity's activities (e.g. travel and commuting by employees, solid waste disposal.

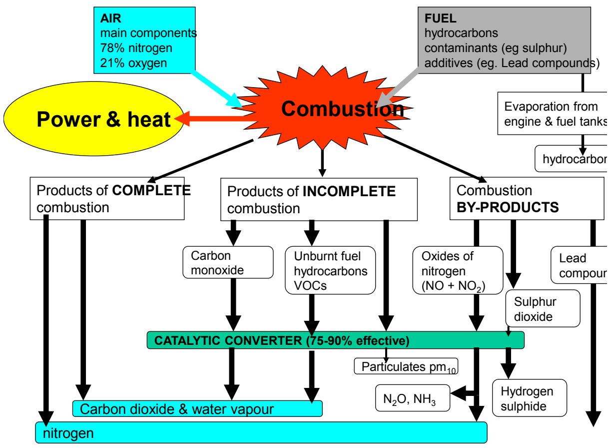
This report focuses solely on SCOPE 1 emissions from logistics operations, which could also be termed 'first order' impacts.

7.3 Environmental impacts of HGVs.

7.3.1 Emissions

Emissions from freight transport largely depend on the amount and type of fuel used. The main fuel used by trucks as well as conventional rail locomotives and ships continues to be diesel. Trucks emit pollution mainly because the combustion process in their engines is incomplete (see Figure 1). Diesel and petrol contain both hydrogen and carbon. If it were possible to achieve perfect combustion, 100% of the hydrogen would be converted to water and all the carbon into CO2. However, because combustion is not complete, tailpipe emissions of pollutants such as hydrocarbons, carbon monoxide and nitrogen oxides result – see Fig 1WP7 below:

Figure 1. Emissions and the combustion of fuel



According to the Inter-governmental Panel on Climate Change (IPCC, 2007) scientific evidence that human activity is the main cause of global warming is now 'unequivocal'. It explains that "greenhouse gases are the gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation emitted by the Earth's surface, the atmosphere itself, and by clouds"

The greenhouse effect arises because GHGs and some particles in the atmosphere allow more sunlight energy to filter through to the surface of the planet relative to the amount of radiant energy that they allow to escape back up to space.

The IPCC (1996) lists 27 greenhouse gases. These are combined into 6 categories in the Kyoto Protocol agreed in December 1997, namely:

- Carbon dioxide (CO_2)
- Methane (MH_4)
- Nitrous Oxides (NOx)
- Hydrofluorocarbons (HFC)
- Perfluorocarbons (PFC)
- Sulphur Hexafluoride (SF6)

Table WP7.1 below shows the emission factors of the main modes of freight transport.

Table WP7.1: Average emission factors for freight transport modes within Europe

		Energy Consumption (kj/tkm)	CO_2 (g/tkm)	NOX (mg/tkm)	SO_2 (mg/tkm)
Aircraft		9,876	656	3253	864
Truck >34-40-t	Euro 1	1,086	72	683	
	Euro 2	1,044	69	755	
	Euro 3	1,082	72	553	90
	Euro 4	1,050	70	353	
	Euro 5	996	66	205	
Train	Diesel	530	35	549	44
	Electric	456	18	32	64
Waterway	Upstream	727	49	839	82
	Downstream	438	29	506	49

Source: IFEU (2008)

Caution must be exercised, however, in interpreting comparative environmental data for freight transport modes (McKinnon, 2008). The relative environmental performance of a particular mode can be affected by:

- Differing assumptions about the utilisation of vehicle capacity
- Use of tonne-kms as the denominator, misrepresenting modes specialising in the movement of lower-density cargos
- Extrapolation of emissions data from one country to another with different transport and energy systems
- Allocation of emissions between freight and passenger traffic sharing the same vehicles (such as aircraft and ferries)
- Neglect of emissions associated with the construction and maintenance of infrastructure
- Restriction of the analysis to emissions at source rather than 'well-to-wheel' data.

Carbon dioxide (CO_2) accounts for by far the largest proportion of GHGs in the atmosphere (approximately 85%), which is why there is so much attention focused on this particular gas.

In the UK, transport accounts for 27% of total domestic GHG emissions, and freight transport is responsible for around 5% (DfT, 2013a). At a global level, the movement of freight accounts for roughly a third of all the energy consumed by transport (IPCC, 2007). In the UK in 2009 all modes of freight transport emitted a total of 122.2 million tonnes of CO_2 equivalent (Mt CO_2e[1]).

[1] Some gases have a greater impact on global warming potential than an equivalent amount of others, so GHG emissions are expressed in terms of the equivalent million tonnes of CO_2 (Mt CO_2 e).

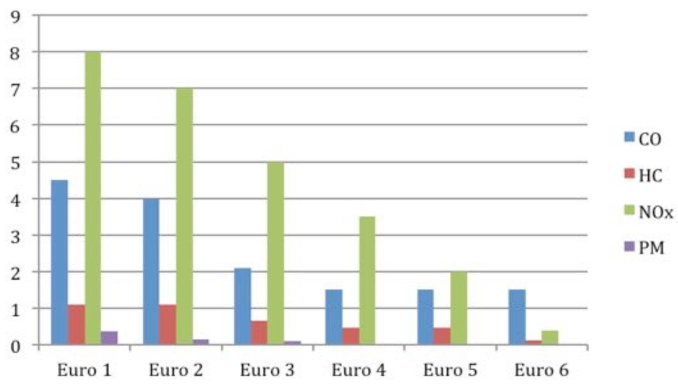
Road freight transport accounted for 92% of this total. HGVs accounted for 17.2% of UK domestic GHG emissions, with rail accounting for 1.8% and domestic shipping 1.3% (DfT, 2013a). Figure WP7.2 shows the proportions of work done and the GHG emitted by the main freight modes in the UK.

Since the early 1990s, emissions from diesel-engined HGVs have been strictly controlled by EU legislation. New HGVs have been the subject of progressively tightening environmental standards, known as EURO emission standards. The current legislation is that vehicles equipped with Euro V engines must be registered by 30th December 2013 and vehicles registered after this date must be Euro VI compliant. Emissions of nitrogen oxides and particulate matter have been particularly targeted and will be almost negligible after 2013, as can be seen in Table WP7.2 and Figure WP7.3.

Table WP7.2: Emission Standards for Heavy Duty Diesel Engines (g/kWh)

Tier	Implementation Date	CO	HC	NOx	PM
Euro 1	1992 (>85kw)	4.5	1.1	8.0	0.36
Euro 11	1998	4.0	1.1	7.0	0.15
Euro 111	2000	2.1	0.66	5.0	0.10
Euro 1V	2005	1.5	0.46	3.5	0.02
Euro V	2008	1.5	0.46	2.0	0.02
Euro V1	2013	1.5	0.13	0.4	0.01

Figure WP7.3 Euro Emissions standards for trucks (g/kWh)



Source: unece.org (2012)

Rail transport has also become considerably less environmentally damaging over the past couple of decades. In the UK, since privatisation took place, rail freight operators have invested heavily in Class 66 locomotives which are far more fuel efficient than their predecessors. According to Freightliner (2006), emissions of carbon monoxide are 95% lower, hydrocarbons 89% lower and nitrous oxides 38% lower. Generally, however, because pressure on the rail industry has been less than on the road freight industry, in particular a longer life of existing locomotives when compared to trucks, environmental improvements have been slower to be introduced.

7.3.2 Noise Pollution

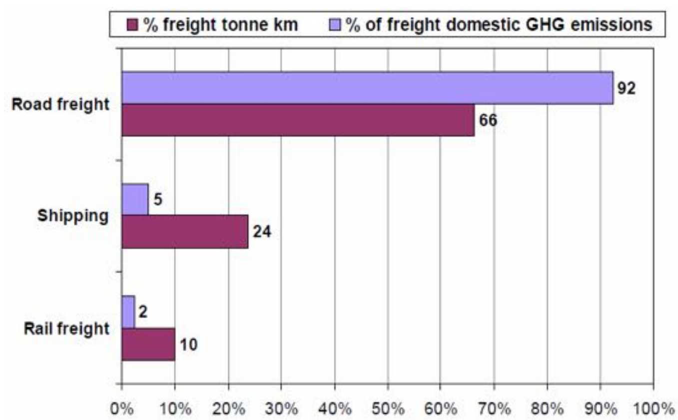
Road traffic is the main cause of environmental noise at the local level. The immediate adverse effects of noise disturbance include annoyance, communication difficulties, loss of sleep and impaired cognitive functioning resulting in loss of work productivity. Longer-term, physiological and psychological health issues may also arise. Currently, around 30 per cent of the European Union's population is exposed to road traffic noise and 10 per cent to rail noise levels above 55 dB(A).

In the UK, 90 per cent of people hear road traffic noise while at home and 10 per cent of these regard this noise source as highly annoying (Watts et al. 2006).

Trucks generate road noise from three sources:

- Propulsion noise (power train / engine sources) which dominates at low speeds (less than 50kmph);
- Tyre / road contact noise, which is the main cause of noise at speeds above 50kmph; and
- Aerodynamic noise, which increases as the vehicle accelerates.

European vehicle noise standards for individual vehicles were introduced in the early 1970s (Directive 70/157/EEC), when the permitted noise emissions for trucks were set at 80dB(A). Noise standards have been tightened several times since then. Significant reductions in noise levels have been achieved by technical advances in engine design, tyres and the aerodynamic profiling of vehicles. Nevertheless, overall noise levels have not improved, as the growth and spread of traffic in space and time has largely offset both technological improvements and other abatement measures. The trend towards heavier and more powerful goods vehicles and the use of wider tyres has further exacerbated the problem.



Source: DfT (2013)

In 2001 the European Union launched regulations that limited the levels of noise generated by vehicle tyres (Directive 2001/43/EC). Tyre noise was targeted specifically for two reasons. First, tyre rolling noise is generally the main source of noise from trucks at medium and high speeds and second, as tyres are replaced more frequently than vehicles, implementing tyre noise standards was considered to be one of the fastest ways to achieve road noise reductions.

7.3.3 Accidents

Accidents cause personal injury and death for those involved, and general inconvenience for other road users. Overall, accidents involving HGVs by distance travelled are fewer than for cars, although there is a higher likelihood of an HGV being involved in a fatal accident. This is partly a reflection of the greater momentum of HGVs, and partly because of the relatively high proportion of time that they are driven on faster roads.

Table WP7.3 Casualties in reported accidents in Great Britain, involving HGVs, 2012

	Built-up roads	Non built-up roads	Motorways	A roads	B roads
Killed	81	144	46	175	22
Killed or seriously injured	511	641	196	800	137
All severities	3427	3322	1949	4722	718

Putting an economic value on road casualties is notoriously difficult. The values associated with the prevention of a casualty include the following elements of cost (DfT, 2013c, p2):

- Loss of output due to injury i.e. the present value of the expected loss of earnings, plus non-wage payments made by employers.
- Ambulance costs and the costs of hospital treatment.
- The human costs of casualties, based on a 'willingness to pay' to avoid pain grief and suffering to the casualty, relatives and friends as well as intrinsic loss of enjoyment of life in the case of fatalities.

The average value of prevention per reported casualty in GB is currently:

- Fatal - £1,703,822.
- Serious - £191,462.
- Slight - £14,760.
- Average for all severities - £50,698.

Of course, in an accident, there is likely to be more than one casualty, so the cost of an accident is higher than that of a casualty and also reflects the additional costs of

- Damage to vehicles and property.
- Police and administrative costs of accident insurance.

The average value of preventing an accident is thus:

- Fatal - £1,917,766.
- Serious - £219,043.
- Slight - 23,336.
- Average for all severities - £72,739.

7.3.4 Congestion

Congestion imposes many costs on society, mostly in terms of time wasted. When a HGV enters the traffic, it often slows the traffic, increasing the time it takes all road users to get to their destination. Additionally, slower speeds can lead to increased operating costs for other users and increased emissions, particularly in stop-start conditions.

On top of these obvious costs, congestion leads to increased journey time variability for all road users and road users must put aside more time for their journey than would be the case without congestion. In conditions where the speed limit for lorries on a particular stretch of road is lower than for other vehicles, particularly on single-carriageways where overtaking is difficult, the congestion costs will be higher.

Congestion costs are calculated on a 'value of time' basis. Each second wasted by every person affected by the congestion has an opportunity cost. Such costs are grossed up and multiplied by a standard 'value of time' calculated by the DfT. This explains why in the marginal social benefit (MSB) analysis, congestion costs account for such a high proportion of total marginal benefits.

7.3.5 Land-Take and visual intrusion

Logistics activities take up a substantial amount of land – whether this is for roads or warehouses / depots. McKinnon (2009) estimated that warehousing sites occupied 23,500 hectares of land in the UK alone, representing around 1% of non-agricultural and forestry land. On the urban fringes of most major cities can often be found several kilometres of warehousing and distribution facilities. This land take contributes to the degradation of eco-systems as well as causing considerable visual intrusion.

7.3.6 Resource sustainability

Fossil fuels such as diesel are by definition unsustainable, i.e. their availability is finite. In addition, many of the oil-producing countries are politically unstable and some use their power as oil producers in politically/economically dubious ways. The future of oil supplies is inherently unstable.

As a consequence, the price of fuel is also subject to considerable fluctuation and this is likely to be exacerbated in the future. Although alternative sources of fuel are being sought, none are yet as universally available as diesel.

7.4 Mode Shift Benefit Analysis.

Mode shift benefit (MSB) analysis is a method used by the Department for Transport in the allocation of mode shift grants. It looks at the benefit of removing 1 lorry mile of freight from road and transferring it to rail (or water). The costs included are congestion costs, accident costs, noise cost, climate change cost, air pollution cost, infrastructure costs and other costs. These costs, which are not direct financial costs borne by the operator, are termed external costs, or externalities.

The economic detail incorporated within MSB analysis is quite complicated. MSB analysis does not look at the total external costs imposed on society by road freight, rather it looks at the costs *additional* to those that are already covered by taxation (and which are therefore termed, internalised). In essence, it accepts that the costs imposed on society by lorries are higher than those covered by taxation and that therefore, there is a benefit to society if lorry miles are reduced and transferred to other, less damaging modes.

Thus, the net social benefit of transferring freight from road to rail consists of the difference between the net benefit of reducing the amount of freight on the road and the net cost of increasing the amount of freight on rail.
So:

$NSB = (MEC_{ro} – MT_{ro}) – (MEC_{ra} – MT_{ra})$

Where:

NSB = net social benefit of moving marginal amounts of freight from road to rail

MEC_{ro} = Marginal external cost of road freight

MT_{ro} = Marginal tax on road freight

MEC_{ra} = marginal external cost of rail freight

MT_{ra} = Marginal tax on rail freight

[I] In the DfT document, 'lorry' refers to an average articulated vehicle over 7.5T

7.4.1 The net costs of road freight (MECro – MTro)

The MEC_{ro} comprise the sum of the MEC of each of the individual elements of cost. Thus, *MEC – C* is the marginal external cost of congestion. This includes incident related and journey time variability as well as day-to-day variability. It includes the costs to other road users. MEC – C is the largest single component of MSB, accounting for over 60% of the total MSBs.

MEC – CC is the marginal external cost, climate change. In order to calculate this parameter, standard relationships are used. The impact on climate change is based on CO_2 output. Diesel has a specific carbon content (696.23 g per litre of diesel). The mass of carbon emitted can be translated into the mass of CO_2 by multiplying by 3.67 (equivalent to 44/12, the relative mass of carbon to CO_2). This means that one litre of diesel burns completely to produce 696g or 2.63 kg of CO_2. Thus by calculating the amount of fuel consumed by a lorry and then multiplying this by the carbon content of fuel, you arrive at an amount of carbon in grams and an amount of CO_2 produced. This is then multiplied by DECC's (2015) shadow price of carbon, which in 2015 was £20.79 per tonne of CO_2 equivalent at the high scenario.

The DfT has calculated that an average articulated lorry emits 935g of CO_2 per km. This is equivalent to an average fuel consumption of 7.7 mpg. Thus, using the train rather than a lorry for the trip between Kinbrace and Inverness (a round trip of approximately 250km) saves around 233,500g or approximately a quarter tonne of CO_2. A 44 tonne articulated lorry travelling 60,000 miles a year emits nearly 100 tonnes of CO_2. If it travels 80,000 miles per year it emits around 130 tonnes of CO_2.

MEC – N is the marginal external cost of noise. This accounts for approximately 4% of the total marginal external costs of HGVs.

MEC – A is the marginal external cost of accidents. Some of the cost of accidents is covered by insurance, so this element is not included. MEC – A covers the change in accident costs that is 'caused by the additional traffic but that is not factored into the operators decision to send freight by road.' Accident costs account for 3% of total marginal external costs of HGVs.

MEC – I is the marginal external cost of infrastructure. It accounts for 10% of total marginal external costs of HGVs.

MEC – P is the marginal external cost of pollution (e.g. NO_x, PM_{10}, VOCs, CO and SO_2). These are again calculated based on the emissions per tonne of fuel consumed combined with the damage cost values given by Defra.

MEC - O is the marginal external cost of other things. These include:

- Up and downstream processes
- Soil and water pollution

- Nature and landscape
- Driver frustration/stress
- Fear of accidents
- Community severance (restrictions on cycling and walking)
- Visual intrusion

The net costs of rail (MECra – MTra)

This element considers the marginal external cost of increasing the amount of freight transported by rail by 1 lorry load.

This is calculated at being around £13 per 1000 tonne km. It is assumed that the fuel consumption of the train (either conventional or inter-modal) is 4.8 litres per km. The DfT calculates that the carbon emissions of rail freight are equal to around 25% - 30% of the average road freight. Calculated using the same basis as for the road parameters, the resulting net costs of rail freight by component (pence per lorry mile) are shown in Table WP7.4.

Table WP7.4. Net costs of rail freight by component (pence per lorry mile)

Component	Cost
Noise	2.6
Pollution	2.2
Climate change	1.3
Other	1.2
Taxation	-1.7
Total	5.7

Source: DfT, 2009

The resulting MSB values (that is, the NET benefit of transferring goods from road to rail taking into account the costs of the additional rail trips) are shown in Table WP7.5

Table WP7.5. MSB values by road type and component (pence per lorry mile)

	Motorways		A	Other	Weight Average
	High	Low			
Accidents	0.5	0.5	5.6	5.5	2.7
Noise	9	7	8	14	8
Pollution	0.0	0.0	0.1	0.2	0.1
Greenhouse	6	6	7	9	7
Infrastructure	7	7	24	171	18
Other (roads)	6	6	6	6	6
Taxation	-31	-31	-32	-40	-32
Rail	-8	-8	-8	-8	-8
Total	89	12	82	235	58

Source: DfT, 2014

However it is not the case of some parts of peripheral north and west Scotland due to the unsuitability for HGV traffic on Single-Track A roads (with passing places). By following an informal consultation with DfT, it is suggested that single track A road sections should be treated as "other" roads for the purpose of calculating the environmental benefits. Removing a HGV mile would be valued at £0.82 per lorry mile, while the 'other' roads are valued at £2.35 per lorry mile. The final weighted average MSB values to be used in the calculations are shown in Table WP7.6 below.

Table WP7.6 MSB values (pence per lorry mile)

Road Type	Part of Journey	Distance	MSB Value
A Road	Kinbrace - Helmsdale	17 miles	2.35
Other Roads	Helmsdale - Inverness	68 miles	0.82

Source: DfT, 2014

7.5 The calculations

7.5.1 A simple illustrative example

Assume the road trip from the harvest site to the origin railhead = 15 miles on 'other' roads.

Assume the number of road miles displaced by the train is 85.

Assume that the road trip that rail displaces is combined by 68 miles A roads and 17 miles 'other' roads.

Assume there is a final leg road trip to the mills beyond the destination railhead = 15 miles on A roads.

Then, the MSB of the rail trip =

(68 x 0.82) + (17 x 2.35) = £95.71

The MSB of the road leg =

(15 x 2.35) + (15 x 0.82) = £47.55

The net social benefit of using rail = £95.71 - £47.55

= £48.16 each way per lorry or £96.32 per return trip.

As assumed, the aimed project capacity (i.e. 100,000 tpa) equivalent to the replacement of 2273 lorry trips per year, the MSB =

2273 x 96.32 = £218,935.36 per year.

7.5.2 A Practical Scenario

Table WP7.7 below lists the typical catchment sites and ultimate destinations of the projected rail service between Kinbrace and Inverness. For confidentiality purposes, the names of harvesters and mills have been anonymised in the information which follows. Harvested timber from Forsinain, Kildonan, Syre and other nearby sites will be delivered to Kinbrace terminal by road (e.g. A897 or B871), and then be loaded direct into container on rail wagon. Once reached Inverness, timber need to be off-loaded onto lorries to be transported to its final destinations mainly around Dingwall, Nairn, Boat of Garten, Fochabers, Invergordon, Dalcross etc..

Table WP7.7: Trip details with the connections of Kinbrace – Inverness rail service.

Gathering at Kinbrace			Final leg beyond Inverness		
Major origins	Road to Kinbrace	Miles to Kinbrace	Potential Destinations	Final leg road	Final leg miles
Forsinain	A897	11.5	Dingwall		15
			Nairn		17
Kildonan	A897	6	Boat of Garten		30
			Fochabers		47
Syre	B871	16	Invergordon		24
			Dalcross		6

The modal shift benefit (MSB) created by utilising projected rail service could be slightly different depend on the specification of traffic flows (i.e. road type and distance to both railheads). This study here runs three scenarios with different assumptions of the final legs: a) delivery is to Inverness only, b) final destination is Dalcross only, and c) the rest averaged. All roads connecting example origins to the railhead at Kinbrace are either Single-track A roads (A897) or B class road (B871), and therefore, all had been classified in the 'other' category and assumed in average distance when calculating MSB.

Results show that, as shown in Table 8, the total Modal Shift Benefit positioned in a range between £47.72 to £69.86 per one way lorry trip depending on the final destinations.

Table WP7.8. MSB per cost category, (£) per one way trip

Cost type	Cost per mile A roads (pence)	Cost per mile 'Other' roads (pence)	Costs to Kinbrace road miles (£)	Net MSB a (£)	Net MSB b (£)	Net MSB c (£)
Congestion	72	78	8.58	53.64	49.32	34.2
Accidents	5.6	5.5	0.605	4.138	3.802	2.626
Noise	8	14	1.54	6.28	5.8	4.12
Pollution	0.1	0.2	0.022	0.08	0.074	0.053
Climate Change	7	9	0.99	5.3	4.88	3.41
Infrastructure	24	171	18.81	26.58	25.14	20.1
Other	6	6	0.66	4.44	4.08	2.82
Taxation	-32	-40	-4.4	-24.16	-22.24	-15.52
Rail costs	-8	-8	-0.88	-5.92	-5.44	-3.76
Total	**82**	**235**	**25.85**	**69.86**	**64.94**	**47.72**

Table WP7.8 also illustrates that, as described in the earlier text, a very high proportion of the benefits arise as a result of the decrease in 'congestion', with infrastructure benefits being the second largest benefit category and pollution and climate change between them accounting for a very small percentage.

As mentioned at the beginning, the projected rail service aims to offer an 100,000 tpa supplementary capacity to existing timber haulage from the Flow Country to Inverness and beyond. This designed capacity equivalent to 2273 road trips per year by the 44 tonne articulated HGVs run at the maximum permitted loading capacity. According to the projected train frequency, each train service journey carries at least 11 lorry loads in order to achieve the target capacity. As a result, the maximum MSB would be £139.72 per lorry load per round trip, and the corresponding MSB per train would be £1,536.92. In total, the MSB over a year will be approximately £317,583.6 per year.

Table WP7.9. Social benefit saving under three scenarios

	Scenario 1	Scenario 2	Scenario 3
One way	69.86	64.94	47.72
Round Trip	139.72	129.88	95.44
Saving per Train	1,536.92	1,428.68	1,049.84
Annual Saving	317,583.6	295,217.2	216,935.1

7.6 Summary and Conclusions

This report has sought to analyse the environmental and social impact of moving timber by rail from the Flow Country to Inverness and beyond. It has outlined some of the environmental issues, described the methodology used by the Department for Transport to calculate the benefits of modal switch from road to rail in general and then used this methodology to actually calculate the marginal social benefits to society.

The conclusions are quite clear that there are substantial benefits from this modal switch, both in terms of pure environmental benefits in the reduction of CO_2 and the wider social benefits. The headline figures are that for each round trip lorry load displaced by rail, approximately 0.234 tonne of CO_2 is saved and maximum £140 of marginal social benefits accrue. Thus, over a year, this would amount to 532 tonnes of CO_2 and £317,584 of marginal social benefits.

***

Appendix I

Project Outline & Work Programme Briefs

Branchliner Outline

The storm on 8 January 2015 creates a new urgency for the supply of Flow Country timber with over 325k tonnes of windblow in addition to the regular movements.

To harvest this while it still has value, creates demand for up to 50 loaded trucks per day on the public road, up from the voluntary agreement of 6 per day south of Kinbrace, 4 north. The £1m SSTS award to Highland Council for improvements to the A897 will be insufficient to permit even a modest increase in traffic, but rather is designed to cope with the status quo. Rail is now not optional but has to be part of the solution.

A significant development occurred recently with the DfT decision to value the Mode Shift Benefit value of single-track A roads (with passing places), at £2.35 per lorry mile rather than the standard A road's £0.82 per lorry mile which are found in some parts of peripheral north and west Scotland. Timber moving by rail to Inverness from the Flow Country could attract £8 per tonne in support.

HITRANS believed that there was a need, within a short space of time, to create a viable rail project based on Kinbrace loading bank with lineside loading in the first instance, but exploring the costs and feasibility of :

- Developing the loading bank to permit more efficient stacking of material and therefore potentially longer trains.
- Establishing a more permanent solution with sidings connected to the mainline with a Non-Intrusive Crossover System (NICS) or a permanent connection to mainline.

In order to avoid a free for all for capacity on road and rail, an **alliance** could be formed of forest owners working with FCS, HTTG, UKFPA and Confor. Its role would be to act a single point of contact to:

- Lease the Kinbrace terminal from The Highland Council.
- Manage and operate the facility including loading.
- Contract with a rail haulier to provide wagons and a locomotive.
- Deliver timber to Inverness by rail for collection by mills.

Without co-operation there is a risk that no timber will get to market, and that there will be widespread environmental degradation and the loss of an asset of value to the Highland economy. Robust financial arrangements will need to be put in place to ensure that there is equality of access for each forestry owner.

HITRANS with support from Confor, UKFPA, FCS and HTTG, would engage separate consultants to cover the following Work Packages:

- WP1 Civil engineering: terminal design, improvements.
- WP2 Rail operations: procurement, wagons, haulage, pathing, possessions.
- WP3 Road logistics: trip to and from terminals, roadspace allocation.
- WP4 Product supply: harvesting, loading to rail, off loading.
- WP5 Facilitation: promoting and establishing the alliance.
- WP6 Economic case: establishing the value of timber to the Highland economy.
- WP7 Environmental assessment: impact of mode shift.

WP1 Civil engineering: terminal design, improvements - D Binns Ltd

This element of the report will be based on options for lineside loading and fixed sidings with reference to non-intrusive crossover system option. Options will be shown on plans which will be produced by overlaying layout on either topographic or ordnance survey plans. Requirements for road access, loading plant and stacking areas will be scoped.

Optimum land requirements with indicative earthworks will be established. Indicative methods of yard operation will be considered in conjunction with other consultants' input. A key output will be an initial estimate for construction costs. An updated topographic survey may be required.

WP2 Rail operations: procurement, wagons, haulage, pathing & possessions - Deltix

The requirement is to provide technical expertise, to liaise with freight operators, to assess wagon type etc, to optimise the current terminal, and to investigate new ways of working including alternative types of railhead.

Key outputs are required within five weeks of start of work, to help stakeholders decide the viability of the project. The key immediate demand context is over 325,000 tonnes of windblow timber, within a 10-15 year programme for movement of 4m tonnes of timber from the wider Flow Country to distant markets (Inverness and beyond).

On the supply side, consideration is to be given to three alternative types of railhead – lineside loading, semi-permanent sidings connection using the Non-Intrusive Crossover (NICS), and permanent sidings using conventional connection.

WP3 Road logistics: trip to and from terminals, roadspace allocation- Arvikaconsult

This will begin with a preliminary desk review of key issues.

An overview of The Highland Council's condition assessment of the roads in the area will be taken, and potential timber traffic limits and road sections of concern will be identified. Future methods of road condition assessment will be explored.

The current road transport situation (e.g. in light of possible weight limit imposition) and potential economic and other impacts and risks) will be assessed, alongside an overview on alternative road transportation methods.

Options for road space allocation will be identified which will require discussion with THC, suppliers and haulier following a desk review on available traffic permits systems/methods of allocating road space. Options for monitoring subsequent road haulage will considered.

WP4 & WP5 Product supply: harvesting, loading to rail, off-loading and WP5 Facilitation: promoting and establishing the alliance - C J Piper & Co, Chartered Foresters

WPs 4 and 5 will involve the following:

A preliminary desk review of issues, constraints and opportunities, the historical context and the strategic/key political context.

An overview of information on current and future timber availability/supply within the Project Area, including the position with windblown timber.

An overview of key industry players and woodland ownerships, within the Project Area (eg National Forest Estate v private, absentee v resident, area of forest on market, wind farm proposals etc.).

Consultation with a sample of key industry players (owners, agents and representative bodies including ConFor, UKFP, to gauge issues/positions.

Identification of possible short and longer term strategies for maintaining harvesting streams, including any modal shifts in approach to harvesting, marketing and timber transport within the Project Area, together with closer partnership working.

Assessment of the feasibility of achieving financial parity between on-road and on-rail timber transport options, including a review of the relative costs. Identify barriers and constraints and opportunities for mitigating /overcoming these.

Outline recommendations for setting up a centralized and independent mechanism to co-ordinate and strengthen alliances etc., to facilitate implementation of shorter and longer terms solutions.

Recommendations as to next steps in establishing and promoting the above alliance and gaining necessary support at political and industry levels.

WP6 Economic case: establishing the value of timber to the Highland economy- B Stubbs Consulting Ltd

Timber, standing and windblown, has a low value in the Flow Country but is a resource of great value when transported to the Inner Moray Firth for processing. This piece of work will consider the wider economic benefits to the area including the employment impacts of the supply chain.

WP7 Environmental assessment: impact of mode shift- TRI Napier

TRI Napier have been appointed to carry out an environmental assessment which will monetise the value of mode shift to rail for the product. This will be similar in format to the work carried out for Lifting the Spirit.