

Innovation in Scottish Timber Haulage Tyre Pressure Control Systems (TPCS)

Case Study



**Companies
Involved:**

A & F Grant Ballindalloch Ltd
Forestry Commission Scotland
Ferguson Transport (Spean Bridge) Ltd
James Jones and Sons Ltd
James Munro General Engineering Services
John Miller Ltd
Munroconsult Ltd
Scottish Woodlands



Department for
Transport

Acknowledgements

This case study was funded by the Department for Transport (DfT) and the Scottish Government, and was compiled with assistance from:

- ➡ A & F Grant Ballindalloch Ltd
- ➡ Forestry Commission Scotland
- ➡ Ferguson Transport (Spean Bridge) Ltd
- ➡ James Jones and Sons Ltd
- ➡ James Munro General Engineering Services
- ➡ John Miller Ltd
- ➡ Munroconsult Ltd
- ➡ Scottish Woodlands

Introduction

The Challenge

The timber industry is extremely valuable to the Scottish economy. The nature of the industry means that heavy vehicles travel on rural roads, many of which are not entirely suitable for this type of traffic. The issue for Local Authorities is the damage that can take place to the road surface. The issues for operators are the limitations of these roads and their effect on the operational efficiency and the competitiveness of the industry.

Previous studies into this technology include Task B2

of the ROADDEX III project, funded by INTERREG IIIB Northern Periphery Programme, a technical

trans-national cooperation project between the Highland Council, Forestry Commission Scotland and partners in Scandinavia. The report summarises the requirement for 'Tyre Pressure Control System' (TPCS), demonstrates the technical operation of the system on the vehicles, and includes inputs from other field tests in Scotland, Sweden and Canada.

This publication concludes with case studies from operators who have employed the technology in Scotland including discussion on the performance obtained from the perspective of the client, vehicle operators and drivers.

Meeting the Challenge

The timber industry across the world faces similar challenges, and one of the ways being investigated,

is to use 'road-friendly' vehicles with variable tyre pressures that reduce stresses on weak roads. By reducing air pressure in tyres the loaded area on the road surface can be increased, and the load distribution within the road structure improved. This technology is designed to reduce the deterioration of the road and minimise the need for temporary load restrictions. It is commonly referred to as 'Tyre Pressure Control'.

The Potential Benefits

- ➔ On tarmac roads TPCS is said to offer **improved vehicle responses** at speed when operating at lower tyre pressures
- ➔ Operating off road the flexible tyres and longer footprint help to **reduce tyre slip** and negotiate difficult surfaces without damaging tyres
- ➔ **Cost saving through extended tyre life** - as the tyre pressure is being constantly monitored they remain at their optimum inflation pressure resulting in more even tread wear, less tread damage with fewer blowouts due to overheating
- ➔ **Ride quality** - reduced vibration in the vehicle should result in fewer mechanical breakages which result in additional workshop time
- ➔ **Driver health and safety** - the system reduces vibration felt in the cab by the driver, which can cause stress and fatigue
- ➔ **Reduction in 'boggling down'** of vehicles has reduced the number of recoveries where drivers and machinery are most at risk
- ➔ Has the potential to **reduce fuel consumption** in some cases, especially as tyres are always returned to optimal pressure

The Potential Issues

- ➔ The lifetime repair costs for TPCS are estimated at between 0.01€ / km (ROADDEX Project) and 0.02€ / km (Vägverket – Swedish Road Authority)
- ➔ TPCS can be retro-fitted to second and third generation vehicles, saving on buying price and improving the return on investment



What Is Tyre Pressure Control?

A 'Tyre Pressure Control System' (TPCS) is an onboard system that electronically controls tyre pressures from the cab of the vehicle whilst in motion. It is used as a mechanism for optimising load, speed and air pressure in tyres. It is particularly useful on those vehicles which are involved in heavy haulage operations that travel over different road types, such as the non-metalled forest tracks used in timber transport. TPCS is sometimes called 'Central Tyre Inflation' (CTI).

Having the correct pressure in tyres can improve the management of the tyres on a vehicle, increase the traction through the tyre and reduce the consequent damage to roads. By November 2008, there were twelve vehicles fitted with TPCS equipment in Scotland, all have been fitted following INTERREG trials as operators and local authorities see the commercial benefits of the system.

A number of TPCS systems are available worldwide, but the system trialled by operators in Scottish operations is the "TIREBOSS" system manufactured by Tire Pressure Control International Ltd of Edmonton, Canada and fitted in Scotland by General Engineering Services, Rafford, Near Forres.

TPCS Operation

TPCS takes compressed air from the vehicle's onboard compressor and routes it through hoses, under control, to inflate the vehicle's tyres. Similarly, when pressures are required to be lowered rather than raised, valves located on the wheels are opened, again under control, to permit air to be released to deflate the tyre.

The result of this is that when the dashboard-mounted control panel is operated by the driver to lower (or raise) the pressure in a radial tyre, the contact area on the road increases (or reduces) and this has the effect of changing the tyre's contact length, or "footprint", on the road surface.



This difference in the footprint created is an important feature for heavy haulage vehicles as a longer tyre footprint and increased number of tread blocks in contact with the road distributes the weight of the truck over a larger surface area. This, and the increased number of edges from the tread blocks in contact with the road, can offer increased traction and mobility for the vehicle whilst reducing the damage to the road surface.

Another useful feature of variable tyre pressure on twin tyre systems is that the tyre pressures are equalised across the tyre pairs, giving rise to a better distribution of load between the tyres and equal contact patterns on the road when travelling over rough ground, as shown below in Figure 1.

When operating on soft ground 'road crowning' produces unequal load sharing across twin tyre assemblies (in red) that results in unequal tyre pressure between the tyres resulting in irregular tyre wear and increased stresses on the road. With TPCS, the controlled tyres have balanced pressures and equal loads, regardless of the shape of the road, and this creates better conditions for even tyre wear.

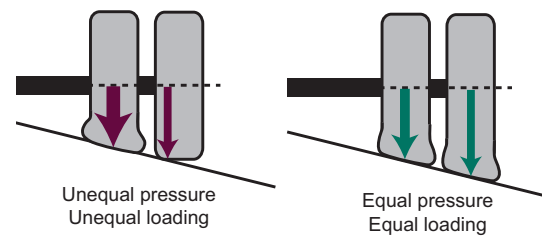
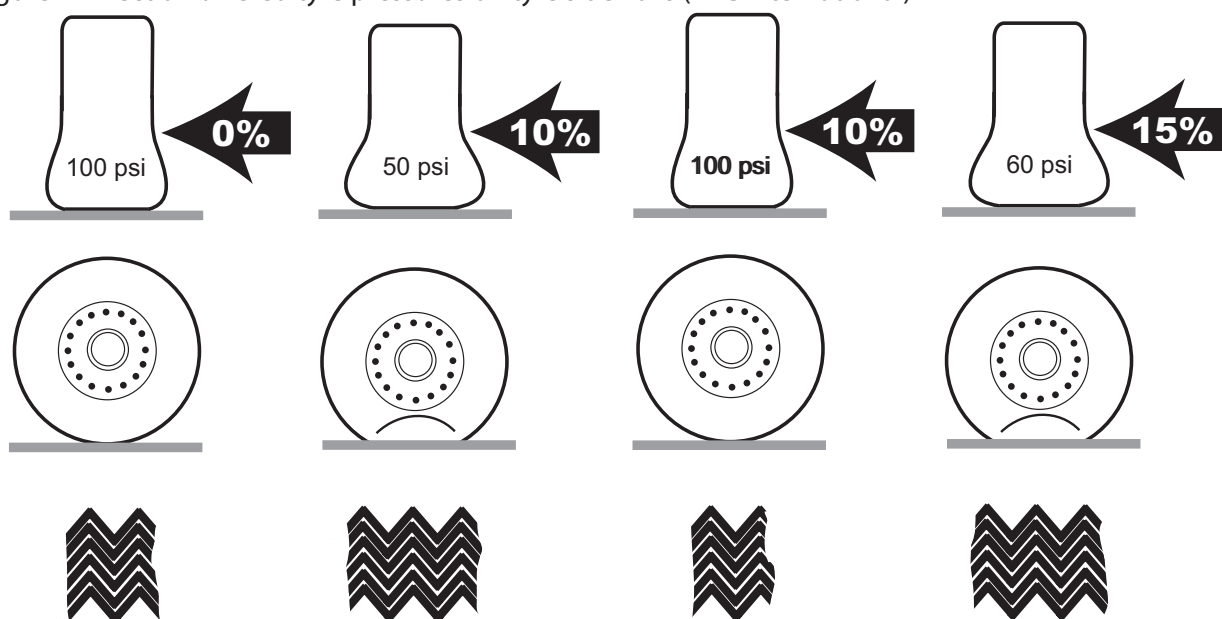


Figure 1 Effect of equal pressure in twin tyres on a crowned road (TPC International)

Increased deflection in the sidewall of the tyre may also prevent foreign objects from becoming trapped between the twin tyres.

A consequence of TPCS is that lower inflation pressures tend to reduce damage to tyres on rough roads, both in the tread and sidewall, and the increased tyre sidewall flex of lower tyre pressures dampen vibration and create a smoother ride for drivers, and reduce maintenance costs on public access and forest roads.

Figure 2 Effect of lowered tyre pressures on tyre sidewalls (TPC International)



Unloaded tyre deflection

Loaded tyre deflection



James Jones & Sons Ltd

Operation

James Jones & Sons Ltd is one of the largest suppliers of British Timber in the UK today. Following a five month trial investigation using Tyre Pressure Control working in conjunction with the ROADDEX project in 2006 (a project part-funded by The European Union, European Regional Development Fund) and a subcontractor, James Jones and Sons started to retrofit their own eight vehicle fleet with TPCS in 2007.

- ➔ Area of operation - Highlands and Grampian
- ➔ Number of vehicles in fleet with TPCS - Seven, including Foden, Scania and Volvo artics operating tri-axle Dennison and SDC timber trailers with onboard cranes
- ➔ TPCS fitted - The first two of James Jones' own vehicles were installed in July 2007, with the remaining five fitted throughout 2008, and the final vehicle in 2009
- ➔ Maxi-single tyres on tri-axle trailers which give 30% more footprint than Super-singles to reduce ground impact at 44 tonnes

- ➔ Cost - Initially £13,000 supplied and fitted, but the buying and installation costs have dropped to approximately £10,000 as a result of fitting more TPCS units

- ➔ Estimated payback period - 3–4 years

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“I have more confidence with the vehicles to do the job ... advantages are a reduction in tyre replacement and maintenance costs.”

Jonathan Ritchie, Harvesting and Transport Manager, James Jones & Sons Ltd

Benefits

Fleet management in James Jones and Sons Ltd has shown other benefits such as:

- ➔ Effective tyre management with constant air supply keeps slow punctures inflated until replacements can be scheduled on route
- ➔ There is an increase in productivity of each vehicle due to higher road speeds as drivers can have more confidence in the vehicles and travel faster
- ➔ Fitting TPCS shows a fuel saving of 3–4% per year at 44 tonnes

- TPCS has a 15 year life span allowing re-fitting of second and third generations of vehicles
- It can be fitted to a 6x2 tag-axle vehicle which are lighter, more fuel efficient and carry higher payloads than a standard 6x4 unit
- Reduced tyre damage estimated at £600 per annum per vehicle
- Reduced vibrations saving approximately £480 per annum in labour per vehicle
- Fuel saving of tag-axle over double drive is worth about 0.21 km / litre
- Following installation, the TPCS components running off the vehicle's main pneumatic air supply are serviced at the same intervals as the rest of the vehicle's braking system

Drivers had expressed concerned over snagging the air pipes on road-side objects, but this proved to be unfounded, with the system proving to be robust in the field.

“With the Maxi tyres and TPCS you can run over soft ground with a full load then stand on the road behind the trailer and your footprint will sink deeper into the mud than the tyre tread.”

Steven Marnoch, Driver, James Jones & Sons Ltd

Scottish Woodlands' Partners

Operations

Three companies working closely with forest owner Scottish Woodlands and Local Authority

partners have invested in TPCS allowing their vehicles to access forest sites with sensitive road surfaces.

Ferguson Transport (Spean Bridge) Ltd and A & F Grant Ltd have been employed to extract timber from selected Scottish Woodlands sites in Lochaber and Sutherland. John Miller Ltd is the first to employ the system in the South working for Scottish Woodlands in Dumfries and Galloway.

All vehicles were part funded by clients Scottish Woodlands and partners at a cost of approximately £10,000–£12,000 per vehicle. The estimated payback period is 4–5 years. The vehicles are detailed overleaf in Table 1.

Benefits

The Ferguson vehicle has been in use one year and early signs show a good rate of productivity.

- Fuel consumption has increased by 0.3 MPG through low pressure low speed use, but this is stipulated by client and Local Authority to avoid damage to roads
- Tyre wear improved with much more even wear on drive axles
- Reduced maintenance on the vehicle caused by vibration
- Re-usable system that will be fitted on second generation vehicles

It is too early in the operation for A&F Grant and John Miller to calculate accurate cost savings, but early signs look very positive. Operators and drivers immediately felt the benefits of the vehicle with improvements in traction while in soft ground, smoother and more stable vehicle ride and less need for expensive recovery due to vehicles getting bogged down.

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“I’m very happy with it, we have less bogging down.”

Geordie Urquhart, Driver, A&F Grant Ltd

“We can go where we couldn’t work before, you have more confidence in the truck to get out.”

Martin Ross, Driver, A&F Grant Ltd

“It’s early days but the system looks good and the drivers like it.”

Iain Grant, Timber Haulage Manager, A&F Grant Ltd



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“In the recent snow the TPCS vehicle worked in the forest and met the rest of the fleet at the roadside, and that kept us moving when otherwise we’d be parked up.”

John Miller, Director, John Miller Ltd

“I was a little worried at first but it works great, I would not go back now. And it’s way more comfortable too.”

Norman Graham, Driver, John Miller Ltd



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“[TCPS] is good in the mud and never really gets stuck.”

Michael Oliver, Timber Transport Manager, Ferguson Transport Ltd

Table 1 Scottish Woodlands’ Partners vehicles fitted with TPCS

Partner	Area of Operation	No of Vehicles	Types of Vehicles	Dates TPCS Fitted
Ferguson Transport Ltd	Lochaber, Sutherland	1	Volvo FH12 6x4 Wagon and Drag plated at 44-tonnes	Nov 2007
A&F Grant Ltd	Lochaber, Sutherland	3	Renault Premium 6x2 Tag axle artics with tri-axle Dennison trailers	Aug / Sept 2008
John Miller Ltd	Dumfries and Galloway	1	Scania R480 6x4 Wagon and Drag plated at 44 tonnes	Nov 2008

Summary

Tyre Pressure Control Systems, despite their relatively short trial in the industry, has won favour with some of Scotland's most innovative timber hauliers. Adopting this technology has reduced maintenance and running costs of timber vehicles and helped to improve relations with clients and local authorities. TPCS allows the timber haulage industry to meet the demands of the client working from a safer platform through poor weather in conditions unsuitable for most road-going HGVs.

A proven system in North America and Scandinavia in timber and agricultural applications, early UK experience of TPCS shows:

- ➡ Fuel consumption improvement based on comparative figures
- ➡ Reduced tyre wear and vehicle maintenance
- ➡ Safer working environment as the vehicle has a higher proportion of tyre tread in contact with the road surface
- ➡ Less 'bogging down' and expensive recovery for timber vehicles
- ➡ A more flexible vehicle design allowing a longer haul season with extra operational days
- ➡ Reduction in driver fatigue as less vibrations happen on forest roads
- ➡ Improved client and local authority relations and less road repairs required

Apart from use in the timber and forestry industry further applications of this technology are worth investigating if your vehicle operation is in any of the following sectors:

- ➡ STGO Category Heavy Haulage
- ➡ Construction site / Quarry loading shovels, tipper and concrete vehicles
- ➡ Agricultural trucks that collect cereals, hay and beet crops at harvest time

- ➡ Waste Management and haulage of compactor trailers onto landfill sites
- ➡ Utility vehicles (fitted with air compression) which need to go off-road e.g. water, electricity and telecom vehicles

Further Information

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February 2010.

Printed in the UK on paper containing 100% recycled fibre.

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