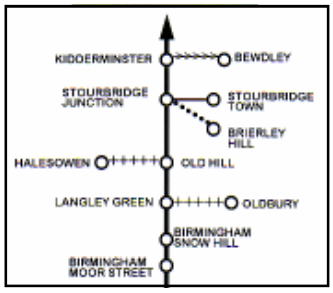

The Lightweight Rail Connection

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AFFORDABLE TRANSPORT WITH LOW ENVIRONMENTAL IMPACT

THE LIGHTWEIGHT RAILWAY presents a new start for local public transport. This technology offers a series of benefits provides an affordable, environmentally-friendly means to expand attractive public transport and bring about modal shift away from the private car.

It is well-recognised that people are prepared to leave their cars at home if offered the option of trains or modern trams. However, the cost of expanding these modes has become prohibitive. Lightweight rail, on the other hand, offers the attractiveness of modern, electrified systems for lower capital and operating costs.

Substantial savings are achieved by the inherent characteristics of the lightweight rail mode compared to conventional heavy rail:

- *One-third the capital cost;*
- *One-fifth the carbon emissions;*
- *Higher productivity;*
- *Proven reliability;*
- *Reduced infrastructure maintenance.*

The societal and environmental benefits of this new mode match the aspirations of governments and transport industries to reduce emissions of carbon dioxide while maintaining the essential function of transport within the wider economy.

Lightweight rail enables local transport that is both attractive and affordable. This creates the opportunity for restoring passenger services to corridors that long ago saw their last trains. Not only does it make local journeys easier, but it makes it possible to drive less and make trips to distant destinations by connecting to the main line.

Also In This Issue...

LIGHTWEIGHT RAIL IN ACTION

Scenes from the 12-month trial service at Stourbridge Town branch in 2006

A nine-decade absence of regular Sunday rail services between Stourbridge Junction and Stourbridge Town was broken in December 2005 with the introduction of a year-long experimental service. A Parry People Movers PPM 50 lightweight railcar operated by Pre Metro Operations Ltd ran over 4,000 passenger services from 11th December 2005 until 17th December 2006.

Following the initial two shorter operating days, each Sunday saw 82 public services run, 41 in each direction, with a 15-minute interval between departures. In the period while the services were operated, punctuality and reliability averaged 99%. More than 11,000 passenger journeys were made on the railcar; bicycles, prams and wheelchairs were carried with ease, and the service attained a high degree of acceptance by passengers of all ages.

The 10:00 departure from Stourbridge Junction gets a last-minute rush of cycling passengers

Setting off down the branch with a mixed load of passengers

The customer service officer checking tickets

Some passengers take an interest in the journey, others occupy their time en route to Stourbridge Town

At the Town station, the first passenger to board for the return trip settles down for a quiet read

Although seats are still available, some passengers choose to stand, either strap-hanging or leaning casually against the bulkhead

15 minutes later, and back at Stourbridge Town, more passengers prepare to board the railcar

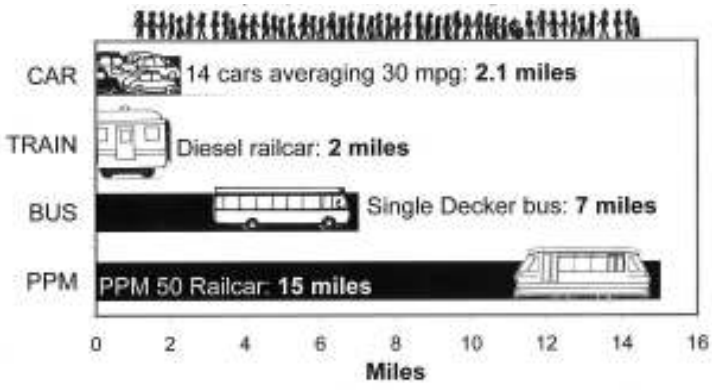
LIGHTWEIGHT RAIL FACTS AND FIGURES

How much road space is saved by public transport?

75 people can be carried in 60 cars or on a single public transport vehicle

(Source: Union Internationale des Transports Publics)

How far can 50 people ride using 1 gallon of fuel?



What is the difference in annual cost in operating a rail branch by heavy or lightweight rail equipment?

	Heavy (£'000)	Lightweight (£'000)
Capital charges	135	70
Labour	480	187
Fuel	30	10
Total	**645**	**267**

How many passengers can be carried on a lightweight rail system?

Hourly line capacity related to headways

Time interval between services (minutes)

Capacity of trains Number of passengers	15	10	5	4	3	2
50	200	300	600	750	1000	1500
100	400	600	1200	1500	2000	3000
150	600	900	1800	2250	3000	4500
200	800	1200	2400	3000	4000	6000

Number of passengers per direction, per hour

A PEOPLE-FRIENDLY TRANSPORT SYSTEM

LIGHTWEIGHT RAIL is easy, convenient and pleasant to use. It provides a friendly travelling environment and enhances the communities and countryside through which it passes.

Flexible railcars

Railcars are specifically designed for short-distance local services. The picture below shows the interior of the railcar used for public operation on the Stourbridge Town branch in the West Midlands, fitted out for the short journey on this line, but flexibility is built into the concept so that railcars can be adapted to suit local circumstances.

As lightweight rail operations will often be over short distances, it is envisaged that many passengers will prefer to stand during their journeys, while space will also be available for prams, wheelchairs or bicycles.

Level access demonstrated by Mrs M Parsons

Ease of access

Railcars are designed to be fully compliant with the accessibility regulations, but exceed even these requirements by giving completely level access from platforms. People with wheelchairs, prams or heavy luggage can easily use the transport system.

Benefits for all

The hybrid traction system brings about further passenger benefits. The lightweight railway does not require electrification but still runs as quietly and cleanly as an electric tram system. Passengers are not subjected to the noise and pollution of diesel trains, while people living and working near the line do not suffer from noise, and unsightly overhead equipment does not clutter the city scene.

Lightweight operation on double track. With a line for each direction, services can operate every two minutes

Local pride in local transport

Attractive public transport is a source of pride — a tradition dating back to the tramways of a century and more ago and now seen in cities benefiting from light rail. Lightweight rail gives the opportunity to spread this to more communities, at the same time as providing attractive, affordable transport to the local population.

Interior of PPM 50 railcar

Civic pride: on 5th February 2006, Lynda Waltho, MP for Stourbridge, waves the green flag at the official launch of the experimental service

BRANCH RAILWAY RE-OPENINGS: THE KEY TO CARBON REDUCTION IN THE TRANSPORT SECTOR

An environmentalist's dream — in 1952 Britain had a comprehensive network of railway lines and over a hundred urban tram systems: most people once lived within walking or cycling distances of rail-based public transport

THE FIRST DECADES following World War II were a bad period for fixed track public transport. Almost all British tramways were closed (in the 1950s) and numerous railway lines and local stations followed (in the 1960s and '70s).

The age of ignorance

The prevailing assumption was that railways would continue a process of decline. For trams the duck was already seen as dead. The voices speaking against all these closures created an incoherent mix of arguments, bewailing the loss of the magnificent spectacle of express steam locomotives alongside worrying about the long-term impact of withdrawing easy access to the rail network by closing thousands of miles of branch lines. Most, but not all, tram preservationists felt the need to rush to prevent the loss of the beautiful workmanship which had gone into elegant double-deck British trams.

What was destroyed at the same time by the ripping-up of the old systems was something far bigger and more valuable: swift, clean, quiet and frequent public transport which could provide a constancy and reliability of journeys which would make modern day bus passengers gasp with envy.

'How can they have been so stupid?' must go through the minds of older folk on seeing the much celebrated modern tram systems in Croydon, Nottingham and Dublin — reintroduced at a total cost of over £1 billion to streets where 50 years earlier the planners decided to scrap something essentially similar. But they didn't know what we know now.

Angels go by rail

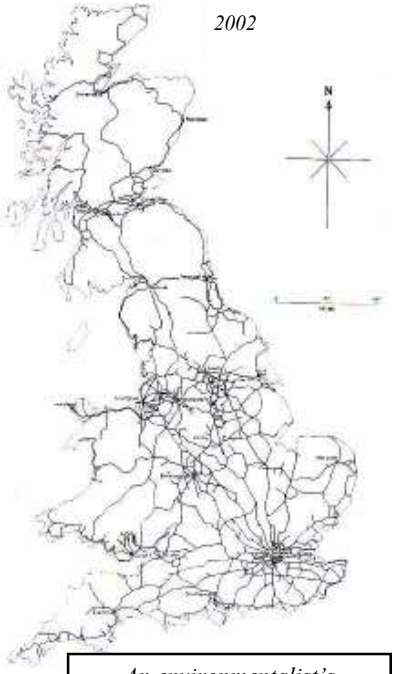
Various estimates of the 'carbon footprint' of different forms of transport agree that travelling by rail is on the side of the angels. Compared with flying, or even using efficient hybrid petrol-electric cars, a journey by surface public transport consumes a fraction of the energy. While people travelling through central London can be bludgeoned out of their cars and put onto a 'bendy bus' by Mayor Livingstone's congestion charges (soon to be felt in a city near you), install a modern tram system — or build or upgrade a suburban railway line — and commuters will take to public transport *by choice.* After all, who is daft enough to relish enduring the jams, threats and conflicts of modern urban roads when there is the alternative of a tram or train to take the strain?

According to Professor Sir Nicholas Stern's Review, we are to expect massive damage to the world's economy if our energy habits don't change.

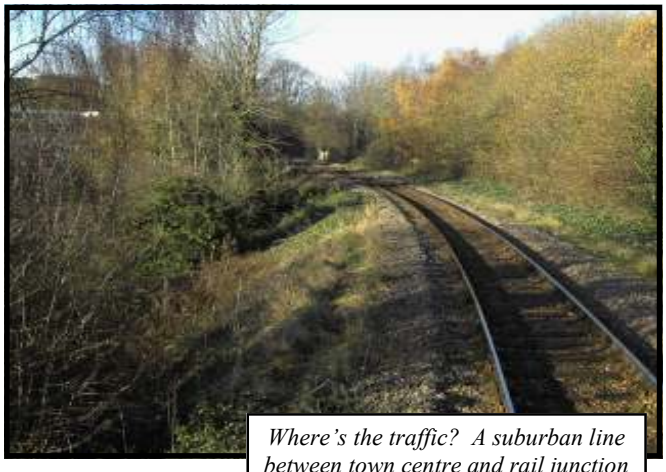
Challenge to civilisation

So the call to reduce energy use, described by Sir David King, the Government Chief Scientist, as 'the biggest collective challenge that civilisation has ever faced', strongly suggests that we should be planning a major expansion of rail-based public transport, beginning with the re-opening of local railways — but not as we know them!

Despite the consequences of British Railways' 1963 'Reshaping Report', Britain's present-day network (right) still has 2,500 stations scattered over the length and breadth of the land. But compared to the 1952 map, it has many 'deserts', such as in North Devon and Somerset, West Wales, East Anglia and Cumbria. The list of towns and villages which lost local connection to the railway is substantial, and meanwhile major conurbations not only lost their tram systems but now have entire districts where local stations, which used to be within easy walking or cycling distance of millions of homes, are long gone. Herein is a paradox: while rail travel has actually recovered to late-1950s peak levels, so many local boarding places have disappeared that a million or more new car journeys, morning and evening, are necessary for rail travellers to drive their cars miles to stations where they park. Fifty-five million people now live *more* than half a mile from a railway station! In order to gain access to an environmentally *benign* means of travel, the railway, most people are more or less forced to incur repeat journeys, some quite long, using an environmentally *damaging* mode, the private car.



An environmentalist's nightmare — by 2002, the railway network had been savagely pruned. Most passengers now have to employ a car to get to a station



Where's the traffic? A suburban line between town centre and rail junction

What is the chance of reinstating the capillaries? For many years very few railway re-opening schemes have been contemplated and urban tram projects are moving forward at a trickle, not the flood anticipated in the Government's original Ten Year Plan.

Sir Rod Eddington's Transport Study identified congestion in urban areas and their catchments as one of the principal areas of concern for transport, and attractive suburban rail systems would clearly contribute in a major way.

The outcome of the one-year trial of the lightweight railcar at Stourbridge, now reported in detail to Network Rail, could turn on its head the assumption that most previously closed suburban railways, which stopped operations due to lack of economic levels of patronage, must remain closed. Similarly the Department for Transport's bold statement that 'Light rail is expensive' (the reason for it being rarely favoured nowadays over bus-based schemes) assumes that the popular but rarely-affordable features of clean, quiet urban transit always require electrification. This also has been disproved by the exemplary environmental performance of the railcar at Stourbridge, while 99% reliability and 99% punctuality has meant that probably none of the 11,000 passengers missed their connecting trains.

New lightweight railway systems meld the methods and benefits of heavy and light rail, with the potential for operating costs halved compared with current franchising expectations.

Stations could run themselves

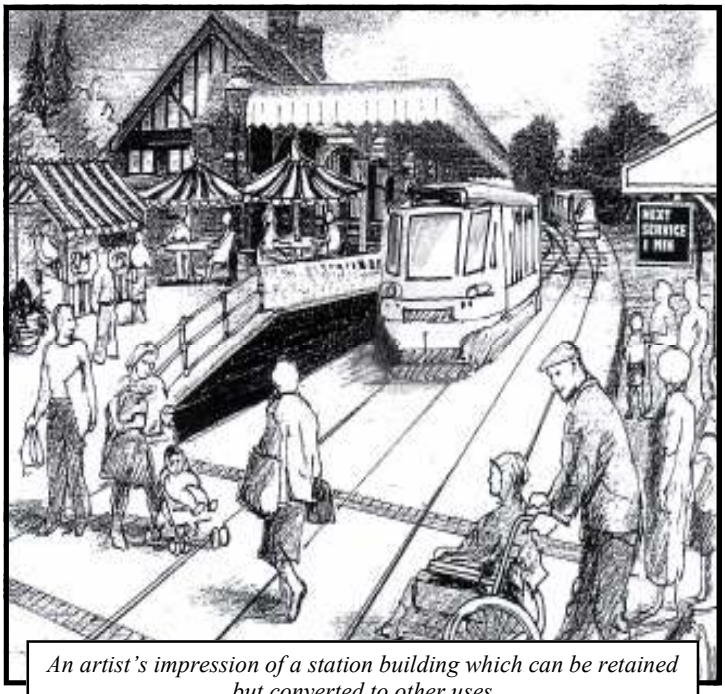
Construction costs can be greatly reduced by taking advantage of the tram-type performance attributes which remove the requirement for full segregation. Instead of having single-function stations handling train movements, stopping places can be integrated with other activities — retail, leisure, hospitality, education and health — removing the need for staffing by the train operator. Not only does the network gain a useful, well-populated stopping place with virtually no operating costs to cover, as landowner it has the prospect of rent-paying tenants! And many miles of trackside fencing do not need to be constructed or maintained. Instead of level crossings, lightweight railways will have traffic-light style crossings and, wherever possible, system control will be without conventional signalling. Such are the benefits of lightweighting on relatively slow speed branch lines.

The PPML railcar leaves Stourbridge Junction, heading for the town centre

Costs down — CO_2 even more so

Cost savings will then arise out of maintaining the rail vehicles at each individual branch, avoiding the need for empty stock movements through the network to reach the main maintenance depots. Regarding the cost of operating the rolling stock, history has repeated itself. The light German-style four-wheel railbuses introduced in the 1950s cost only 3 shillings a mile to run compared with a longer bogie unit's cost of 5 shillings and 6 pence a mile: a saving of 45%.

Waiting at a railway level crossing (upper picture) could involve five minutes' delay, while a traffic-light controlled tram-style crossing (below) only takes 30 seconds



An artist's impression of a station building which can be retained but converted to other uses

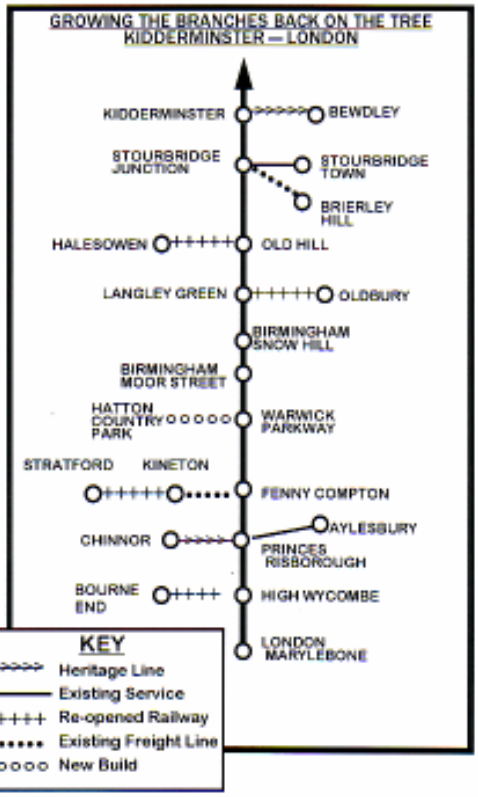
A similar 45% saving in running costs is *also* being recorded for lightweight rail. In the 1950s, the new railbuses then had their branch lines closed under their wheels before the financially-based authors of the Reshaping Report caught on to the fact that infrastructure maintenance costs would have been far lower with only a light vehicle running, which is also the case with the PPML railcar.

All in all, 'second tier' local railways with highly-desirable tramway-style characteristics seem to be within reach, costing half as much to run as a conventional suburban line.

And the environment: in operation at Stourbridge the PPML railcar recorded a saving in carbon dioxide emissions of around 80% of that of the smallest heavy rail equivalent.

So, ladies and gentlemen, what are we waiting for?

Below: with lightweight rail, the railway route between Marylebone and Kidderminster could have eight new branch line feeder services



DEVELOPMENT OF THE PARRY LIGHTWEIGHT RAILCAR

THE PARRY PEOPLE MOVERS approach to rail vehicle design and construction generates savings in cost, material use and environmental impact — both in construction and in service. By making full use of available 'off the shelf' components, but bringing them together in an innovative arrangement and combining them in a minimum-weight finished product, the result is efficient across its whole life-cycle.

Vehicle technology

A hybrid driveline with flywheel energy storage is at the heart of the lightweight rail vehicle. The flywheel makes possible two important improvements: a much smaller engine than would otherwise be needed, and regenerative braking. By using energy stored in the flywheel to boost acceleration, there is no need for the engine to provide high power outputs, bringing down the size, weight and fuel consumption of the powertrain. By recovering energy that would normally be dissipated as heat during braking, the railcar saves both energy and the effects of brake wear.

The principal components of the PPM 50 railcar, pictured before final assembly at Parry Associates' Cradley Heath workshops. The flywheel casing can be seen in the centre of the main chassis

External and internal design are fully flexible, enabling vehicles to be adapted to local conditions for each application, but retaining the basic operating systems for maximum interchangeability. Floor levels can be altered too, so that the same approach can be used for a street tram as for a railcar running on a converted branch line.

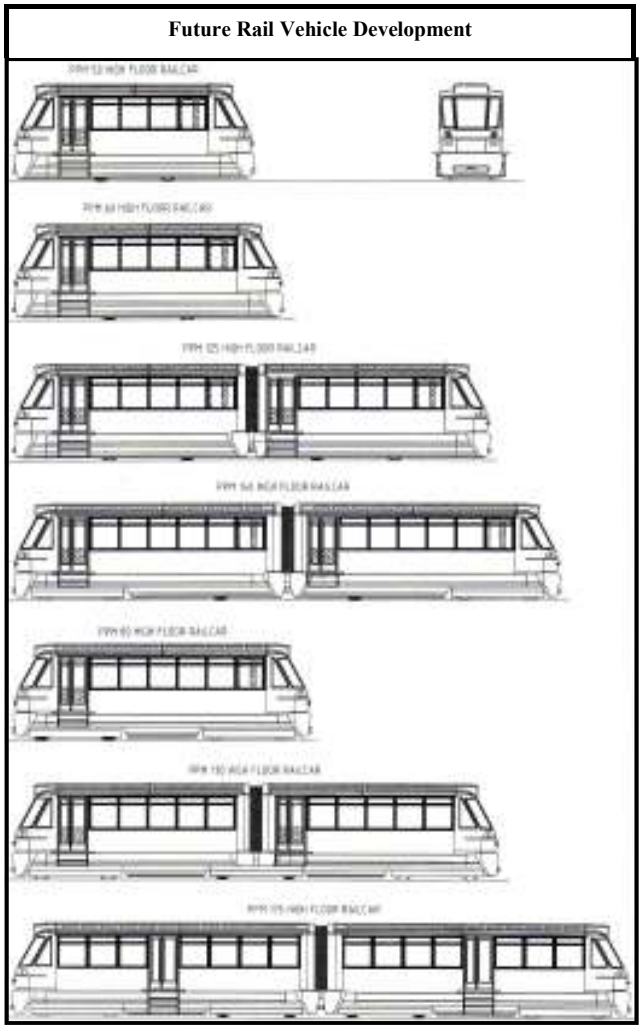
Driving a lightweight railcar is straightforward and easily learned. The necessary complexities of heavy rail technology are not necessary, but safety systems such as driver vigilance control and a 'dead man's handle' are installed as standard.

The passenger experiences a modern, bright and comfortable vehicle, matching expectations of public transport for today's age. This is achieved by the involvement of experienced bus and coach builders, combined with the confidence engendered by the rail infrastructure.

Railcar and tram development

Tens of thousands of passenger journeys have already been made in four-wheel Parry People Movers vehicles, in both high- and low-floor formats. These relatively small vehicles are suited to situations where capacity of around 50 passengers is required, often coupled to high service frequency.

Larger trams and railcars are under development, with a bogie design — incorporating the complete hybrid driveline — having reached the stage of patent publication. This will enable a new generation of vehicles to be brought to the market, offering passenger capacity up to 175. Nonetheless, the advantages of lightweight and minimal environmental impact will be maintained. Vehicles that run coupled together will have corridor connections, allowing people to walk from one car to the next, while low-floor tram types will complement railcars built for standard-height railway platforms.



Visions of the future: Models showing a lightweight vehicle with corridor connections (left) and a twin-car set (below). Both illustrate the potential for low-floor trams suited to street running

HOW LIGHTWEIGHT FORMS OF RAILWAY WILL BECOME A LEADING CLIMATE CHANGE PRODUCT

Energy used in operation and 'sunk' in heavy infrastructure is conserved by lightweight approach

ENVIRONMENTAL CONCERNS are driving changes in consumer demand, in government policy and in the private sector's offerings to the market. There is widespread understanding of the importance of reducing the carbon footprint of all kinds of activity, and transport is a particular case in point.

The ideal transport solution will make it attractive to individuals to pollute less and generate less carbon dioxide. At the same time, it must be affordable to the authorities who have to agree the spending, and the payers of fares and taxes who ultimately foot the bill.

Lightweight rolling stock

The new type of railcar fits into this category. Its development has been driven by three principal factors: as a transport mode it must attract passengers, as an operating system its environmental performance must be excellent, and as a transport option it must offer economic advantages.

By concentrating on efficiencies in design and operation, the originators of the Parry People Movers venture achieved high fuel-efficiency. On the Stourbridge Town branch, lightweight rail showed an 80% improvement in carbon dioxide emissions compared to the heavy rail alternative. This is achieved through weight minimisation, regenerative braking and hybrid powertrain efficiencies.

Not only that, but efficiencies are made — and carbon emissions cut — in every aspect of the operation. The use of standard automotive components ensures that lightweight rail borrows from established technologies rather than needing its own specialised supply chain. As these components are lighter than heavy rail equivalents, less energy is expended in maintaining them. Since the whole vehicle is light, it causes less damage to track, which in turn requires less maintenance and can be built using less energy-intensive methods.

Just as importantly, the passenger experience is equivalent to riding on a modern electric tramway — a mode shown to be effective at attracting people out of their cars and on to public transport.

And finally, lightweight rail makes financial sense. Benefiting from the efficiencies inherent in the concept, its capital and operating costs are lower than equivalent conventional train and tram systems.

Lightweight rail is a global product too. Its rolling stock engineering, based on universal automotive technology, means that it can be maintained and operated anywhere in the world. With some of the world's most acute transport challenges occurring in developing countries, where sophisticated transport systems necessitate expenditure of scarce skills and foreign exchange, lightweight rail offers a transport solution suited to local situations.

Infrastructure matters

The fact that traditional railways have tended to be very heavy is in part due to a 'vicious circle' dating back to the invention of the steam locomotive. Heavy axle-load vehicles inevitably impose heavy static and live loads on the track and over time the results show up in track damage. Faulty track gives a rough ride and so rolling stock designers have tended to produce vehicles that are tough and heavy enough to withstand all the shock.

Lighter rolling stock means lower forces on the track. The introduction of lightweight rail will bring about reductions in the necessary track maintenance, and will reduce loads and vibration effects on railway structures such as bridges and embankments. A *virtuous* circle can be introduced, with track maintained so as to provide a smooth ride, and lightweight vehicles which don't damage the track.

Section of track over a pedestrian tunnel damaged by the static weight of heavy rail vehicles

Maintenance

An important factor in railway operation is the provision of facilities for maintaining the vehicles. Lightweight rail presupposes that branch lines and tramways are operated separately from the rest of the rail network, and so accessing established depots and workshops is not possible. Instead, local maintenance is carried out, at facilities located on the individual lines.

Lightweight vehicles have lightweight components, so heavy lifting equipment of the type found in railway workshops is not necessary. Instead, a small fitted-out depot can be installed on the line itself, and staffed by technicians more used to automotive than railway engineering.

Railcar depot at Stourbridge Junction, built using lightweight methods

This approach not only avoids the need for lightweight rolling stock to traverse the heavy rail network, but also ensures that spare stock is retained on the lightweight route at all times, with resulting benefits in the event of railcar faults.

Depot construction

Building of the maintenance depot and platforms can be a further opportunity to introduce lightweight techniques which in themselves can conserve half the energy used in the manufacture of elements making up floors, walls and roof. The method used to build the floor and the platforms of the maintenance depot at Stourbridge saved as much as ten tonnes of the concrete which would normally have been used.

Hollow formwork units and light steel reinforcement placed on the trackbed are seen being covered by a conventional concrete screed to create a level working floor for the depot

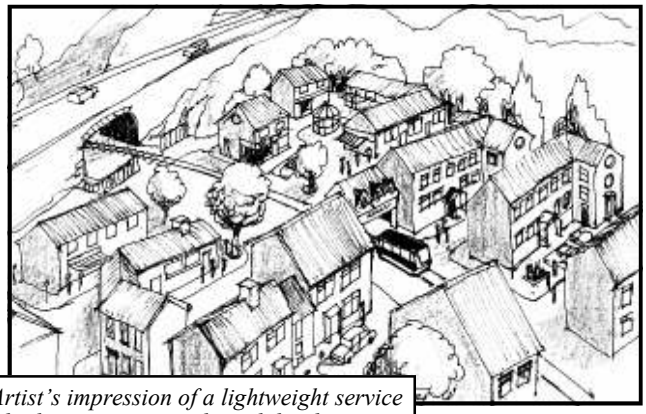
TRAVELLING LIGHT

Railcars integrate into mainline stations, residential areas, shopping centres and the countryside

THE LIGHTWEIGHT RAILWAY provides a direct link between communities, and a connection to the main line railway. It gives people an environmentally-friendly means of transport both in their local area and to nationwide destinations, by changing on to main line trains.

The experience of travelling by lightweight rail is different from existing branch line railways in respect of the vehicles, the stations and the ambience of the transport system.

Existing station buildings can be converted into leisure or catering amenities (see also page 5), with site management



Artist's impression of a lightweight service built into a new residential development

responsibilities often taken away from the transport system operator and transferred to organisations with a direct interest in ensuring a clean, safe and attractive vicinity.

The lightweight railway often has more of the character of a tramway, with safe interaction between pedestrians and railcars, and frequent stopping points at places where passengers want to board. In the case of a re-opened branch line, this entails the construction of new stops, built into residential, retail or other developments as shown — providing 'green transport' directly in the places that people need to get to and from.

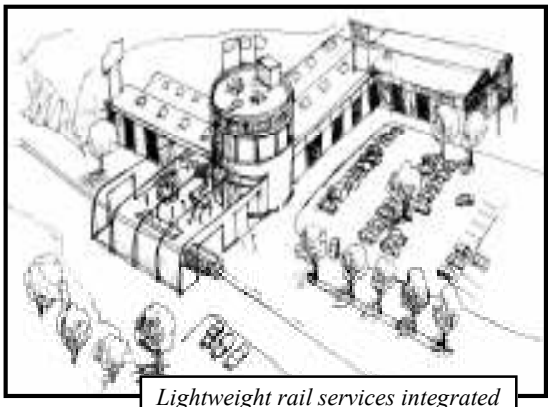
With its quiet, clean performance, the lightweight rail system fits into town and country alike. Neither the noise of diesel trains, nor the visual intrusiveness of overhead electrification equipment are involved in the operation of the lightweight railcars. Designed to interact with people and vehicles, the railcars do not automatically require fencing of the line or barriers at road crossings. The 'severance' effect of heavy rail — dividing communities rather than bringing them together — is avoided and the lightweight system enhances the areas through which it passes.

Through the countryside: the lightweight railcar fits into the rural scene

Stourbridge Town in July 2006: an example of a branch line station served by lightweight rail

With excellent acceleration and braking, the vehicles proceed on 'line-of-sight', eliminating the need for complex signalling in all but the busiest locations. Mobile communications keep the crew in contact with control centres and police for emergency situations.

Interchanging with main line rail services, the lightweight railway runs into the same station but, wherever possible, keeps to separate lines and platforms. Without the emissions from large diesel engines, the stopping point remains cleaner and quieter than on conventional railways . Vehicles have wide doors and access is entirely level so that those with limited mobility can board easily without assistance. The passenger alights from the railcar and steps directly to the train — continuing a pleasant, car-free journey.



Lightweight rail services integrated into a shopping centre

Little and large: a fully-integrated, cross platform connection between branch services and main line trains

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