
Moving Bristol Forward
A low-cost tram solution
tracks to a GREEN future
The answer to air pollution, connectivity,
congestion, regeneration etc.,

WHY DO WE NEED A MASSIVE IMPROVEMENT IN PUBLIC TRANSPORT?

The key problem is dominance of private car travel which causes

- **Pollution**
  - a threat to global health - the health of the planet
  - a threat to public health - poor air quality in and near travel corridors
- **Congestion**
- inefficient travel patterns and
- discourages healthy, active travel by cycling and walking

There are solutions - alternatives to mass car travel to deal with these problems are

- improved bus services – a partial solution
- introduction of a tram network supplemented by substantially improved bus services
- Integrated transport system with the Tram as Core & Spine
- Buses as feeders then upgraded to a tram route

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Why do we need a drastic improvement in public transport ?

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1. **POLLUTION:** – **a two-dimensional challenge**

- **global health** - consumption of fossil fuel generates greenhouse gases causing climate change - has to be minimized to meet Bristol's aim of becoming a carbon neutral city

- **public health** - toxic emissions produce poor air quality in transport corridors which causes illness/premature deaths - have to be minimized if Bristol is to protect the health of its citizens

    - tail pipe emissions from petrol/diesel combustion engines
    - non - exhaust emissions – NEES - polluting particulate dust from the wear of tyres, tarmac and brakes wear/tarmac wear/ brake wear

Why do we need a drastic improvement in public transport ?

CONGESTION

- Increases fuel consumption and air pollution - traffic jams, stop-start at busy junctions
- Increases journey times
    - **cars** - economic cost of unproductive time behind the wheel especially during journeys to work
    - Provision of parking space expensive
    - Pavement parking, a hazard for pedestrians, blind and disabled, pushchairs, prams etc.,
    - Clog up a city's arteries
    - Socially selfish allocation of road space
    - Significant illness, loss of production and multiple deaths particularly amongst the young old and those with underlying health issues

WHY CAN'T WE SIMPLY NOT IMPROVE ROAD NETWORKS FOR MODERNISED (EV) CARS AND (EV) BUSES?

ROAD NETWORK INVESTMENT?

Build new roads and widen existing roads to increase network capacity? this has been done since the mechanization of vehicles and hasn't worked, there is no more land being made

Electric cars on improved road networks will reduce carbon & Tail-pipe emissions per journey but increases exponentially the Non-Exhaust Emissions *(NEE)

***NEE is produced by all rubber tyred vehicles/road interface abrasions which contain extremely toxic pollutions such as fine particulates 2.5 PM > and a significant amount of Micro Plastics**

- **Road generated Micro Plastics pollutants second only to that created by the Clothing Industry.**
- **Affects roadside buildings inside up to 25 miles**
- **Road Dust Suspension and downwind plume not included in pollution figures**
- **Reduction in car journey times is relatively short lived - conventional road network improvement increases car use and inefficient travel patterns**

A busy road with 25,000 vehicles travelling on it each day will generate around nine kilograms of tyre dust/particulates/micro plastics alone per kilometre.

- **We cannot build our way out of these problems, the solution is modal switch out of the habit of excessive use of cars by better, sustainable public transport, steel on steel where possible**

Why do we need a drastic improvement in public transport?

INEFFICIENT TRAVEL PATTERNS AND USE OF URBAN SPACE

Cars

- 1 or 2 person per car journey compared to xx persons per bus
- Costs of space needed for car parking

  Off-street - expensive urban sites could be better used - e.g., for combination of housing and green spaces

  On street – dangerous for pedestrians and cyclists

INVESTMENT IN MODERNISING BUS FLEETS

- **Electricity powered buses** will reduce Co2 emissions and tail pipe emission substantially

- Non-Exhaust Emissions (NEE) from a bus is on par with a LGV and is above the minimum published by WHO? However, according to WHO, there is no safe minimum level!
- The working life of a city bus is generally between 8 – 13 years before scrapping, modern continental tram systems are celebrating 140 years +
- Buses should be seen as an interim mode (pending tramline construction, where appropriate) and as feeders into the core tram corridor
- E-Buses need electricity from renewable sources and various options exist and can be shared with trams
- Creating bus priority routes will improve the reliability and frequency of bus services and make buses more attractive for car user and fore runners of possible tram routes later.
- Low modal switch, the highest figure is circa 9% with a very intense frequency which was not sustainable due to the high number of vehicles required and other bus congestion issues
- Limited applicability in the form of busways with a maximum of 7000-8000 passengers per hours
- Bus services have limited reliability - not popular can lead to transport poverty - seen as a failure, bus patronage indicates a failing mode since WW2

NEES pollution will continue unabated

WHY SHOULD WE INVEST IN 'STEEL ON STEEL' TRAM SERVICES?

There is no alternative to having a 21st century integrated, accessible and sustainable public transport system with a tram network as a major component - needed to deal with pollution, congestion and inefficient travel patterns and encourage active, healthy travel.

- Bring more measurable benefits to passengers including cleaner air, improved connectivity, regeneration, employment opportunities etc.,
- Achieving wider economic and social objectives of regeneration, employment, inclusion, and accessibility in the communities served by tram rails;
- Tram stops generates linear growth rather than station only growth as experienced with Underground, Heavy Metros and Classic Rail
- Trams can take the rails more cheaply (VFM) than underground or classic railways especially to new P+R sites adjacent to Motorways and have a greater passenger catchment.
- Active travel is encouraged by the general nearness of tram stops enables penetration into the retail/city centre/entertainment facilities
- Tram stops can provide where suitable Bike + Ride facilities
- Evidence shows that retail foot fall can increase by 36% (Kassel) and develops the night-time economy and lengthens the retail availability, good examples can be found in Manchester and Nottingham
- Contributes to a reduction in drink related car accidents
- Helps reduce "Transport Poverty" e.g., unreliable bus services drive fixed income passengers on to taxis and eventually into unaffordable car ownership
- Increases the street scene ambience especially in pedestrianised areas such as street cafes, planters etc.,
- Ensuring that all steel-on-steel rail especially street running contributes to a sustainable development across the common transport corridors

Infrastructure costs

• Feasibility from development to operation including design, QS, engineering, manufacturing, sustainable and autonomous operation, ticketing, customer service and maintenance

Budget guidelines
(estimated) for tramcars are dependant on operational specifications.

- Rail costs (estimated)

- £800k per km for ballasted rail

- £1m per km for slab track • £1m per km for Waybeam relocatable track
- Vehicle costs are determined by route and operational requirements
- A ground sweep radar survey will determine location of Utilities
- Cost of moving utilities if required to be negotiated with their owners

Light Rail (UK).


City Class


City Class

West Thurrock


Croydon

Light Rail (UK).

Nottingham

Hydrogen
Dubai

Lisbon

Manchester

ULRP BioUltra

Why Trams?

The Hydrogen/BioMethane Tramcar Doha Qatar.

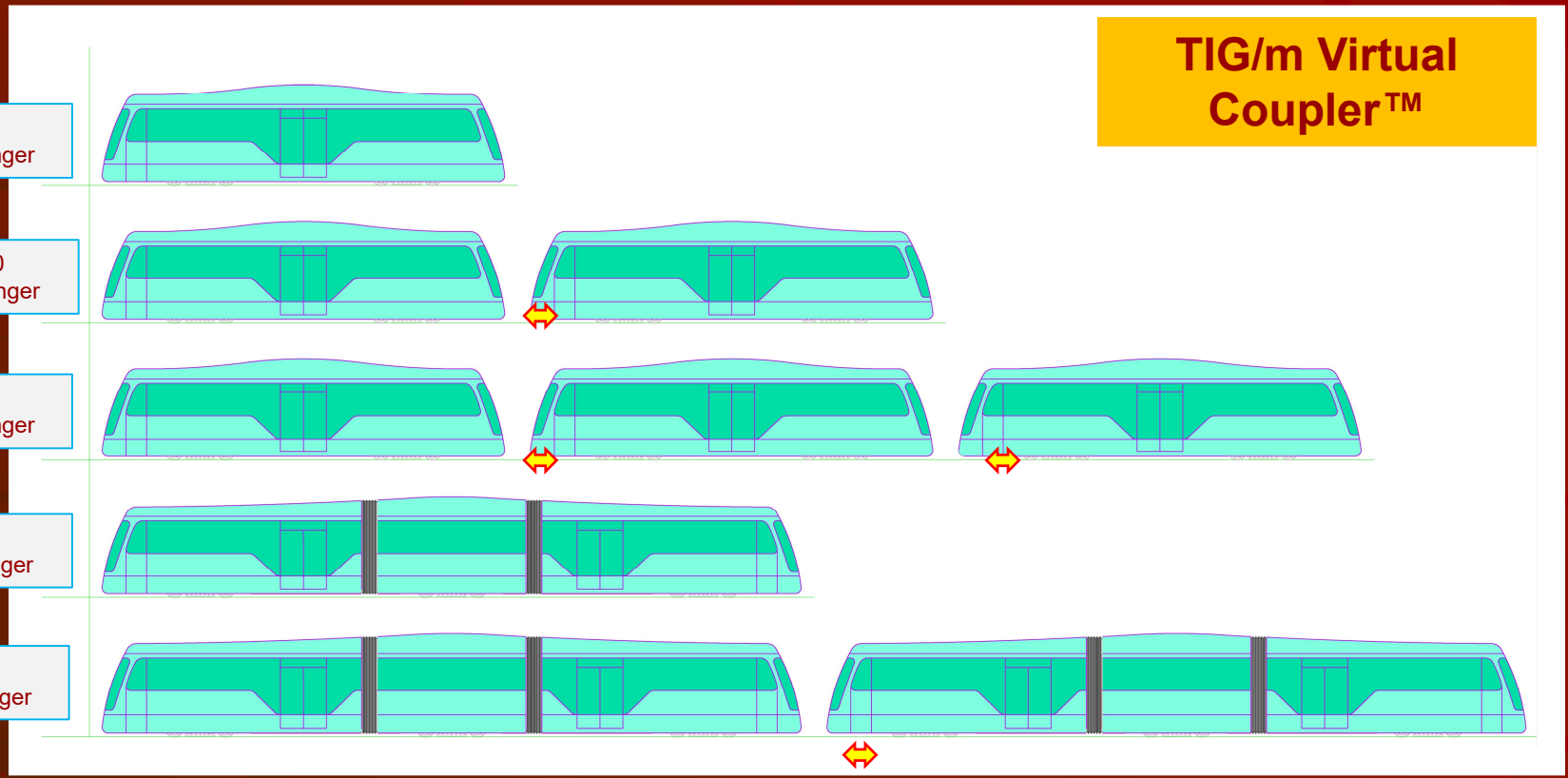
In the typical light rail project, up to 50% of the capital cost of infrastructure construction is spent on power distribution systems.

Furthermore, up to 60% of the life cost of system maintenance is spent on maintenance of wayside power systems;
all of theses costs are eliminated from the project with this system
From £8-£12 Million per track kilometre

https://www.youtube.com/watch?v=v5wgxJA_d0I

Why Trams?

VIRTUAL COUPLER



- Scalable Tram Size
- Non-mechanical vehicle coupling at the push of a button
- Trams can be sized to reflect demands during Peak and Off-Peak hours
- Reduces excessive driver costs
- Eliminates deadheading empty seats

Why Trams ?

The Tram Network will:-

Be fully accessible to all residents and visitors including those with reduced mobility to all Tram and shared Bus stops, Public Transport Pathways (PTP)

Be mindful that we have an ageing population and the network will be fully accessible, easy to understand and use

Successfully uses the flexibility of the car by supplying the last/first mile door to door connectivity from Park + Ride sites

Why Trams ?

The Tram Network will :-

- A Political Statement of Permanence
- Encourages of Inward Investment
- A belief in the Greater Bristol Area
- Provide a greater service frequency i.e., 4-8 trams per hour,
- Improve non car access and connectivity to the Transport Corridors
- Relieve pressure on the "Road corridors" thus providing significant savings on maintenance etc.,
- Provide a low-cost car flexible "Rail" corridor initiative between all points of Greater Bristol

Why Trams ?

The Tram Network will :-

- Demonstrate belief in the Greater Bristol Area
- Show case Inward Investment
- Encourage Inward Investment from overseas
- Act as a catalyst for organic growth
- Engender a sense of citizenship

Why Trams ?

The Tram Network eventually will provide access to :-

- Employment including industrial and logistics sites
- New housing developments including denser housing without parking spaces.
- Provision of cleaner air to schools and hospitals
- Sports & leisure including several stadia
- Heritage and tourism.
- A " Rochdale Pattern" of transit behaviour, "Hop on, Hop Off"
- Future proof against further pandemics enabling for home working and the development of the 15-minute neighbourhood.

Urban Transport Corridor Pollution

AIR QUALITY EXPERT GROUP

Non-Exhaust Emissions (NEE) from Road Traffic

Prepared for:

Department for Environment, Food and Rural Affairs;

Scottish Government; Welsh Government;

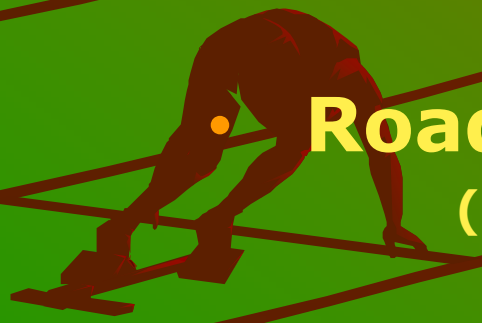
Department of the Environment in Northern Ireland

July 2019

Why Trams?

There are two main Transport Corridor Pollutants (UTC).

- **Tailpipe emissions**



- **Road, Tyre & Brake Dust (NEE)**

(Often Known as the "Oslo Effect)

Why Trams?

Non-Exhaust Emissions (NEE)

Each time a tyre rotates, it loses a layer of rubber about a billionth of a metre thick.

This works out to about four million million, million carbon atoms lost with each rotation.

A busy road with 25,000 vehicles travelling on it each day will generate around nine kilograms of tyre dust alone per kilometre.

Why Trams?

Non-Exhaust Emissions (NEE)

Vehicle tyres, brakes, air suspensions and road surface wear are now bigger contributor to particulate matter (PM's) in the air than vehicle exhaust systems

NEE PM10 have increased from 29% in 2000 to 73% in 2016, (2.75% per annum)

NEE PM2.5 have increased from 26% in 2000 to 60% in 2016 (2.125% per annum)

NEE PMs Road Dust Suspension and downwind plume not included

Affects roadside buildings inside up to 25 miles

There are no minimum safe amounts

Data from the UK national Atmospheric Emissions Inventory (NAEI)

Why Trams?

mg PM_{10} / km		Tyre	Brake
Cars	Urban	8.7	11.7
	Rural	6.8	5.5
	Motorway	5.8	1.4
LGVs	Urban	13.8	18.2
	Rural	10.7	8.6
	Motorway	9.2	2.1
Rigid HGVs	Urban	20.7	51.0
	Rural	17.4	27.1
	Motorway	14.0	8.4
Artic HGVs	Urban	47.1	51.0
	Rural	38.2	27.1
	Motorway	31.5	8.4
Buses	Urban	21.2	53.6
	Rural	17.4	27.1
	Motorway	14.0	8.4
Motorcycles	Urban	3.7	5.8
	Rural	2.9	2.8
	Motorway	2.5	0.7

+

mg PM_{10} / km	Road abrasion
Cars	7.5
LGVs	7.5
HGVs	38.0
Buses	38.0
Motorcycles	3.0

+

Vehicle Aggregate types	Total urban PM10/Kms
Cars (urban)	27.9
Trucks	127.1
Buses	112.8
M/cycle	12.5

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There are no minimum safe amounts

Why Trams?

Non-Exhaust Emissions (NEE)

Health Costs

153,000 respiratory deaths, mainly young & old *British Thoracic Report*

Figures show between 25% - 40% of deaths due to "Tail Pipe emissions" (38,250 – 61,100 deaths) UK Government

Trams & TramTrain will help prevent
Death on the Pavement
"Oslo Effect"

To burn carbon and road grind is to pollute. Is this where it will all end?

Why Trams?

Non-Exhaust Emissions (NEE)

Because of the high dust detritus with animal transport,
many first generation tramways had a nocturnal "Water Tram".
This washed away the suspension material created into the sewers
Part of a Public Health Program

A future low cost method of containing NEE, Fine Particulates, 2.5pm, Micro Plastics

There are no minimum safe amounts!

Why Trams?

No tail pipe emissions
Reduces the immediate pollution

Reduces death on the pavement, No "Oslo Effect"

Year on year savings to health costs

Release funding for other health projects etc.,

Increases the ambience of the city streets

Why Trams?

Improves liveability of the immediate & surrounding area

*Improving air quality is estimated to provide a £7 million benefit to the local economy

*Fewer premature deaths 60 deaths

*Fewer sickness days almost 16,000 days

* Extract from CBI Economic: Breathing Life into the UK Economy. Sept 2020

Attracts 26% + retail plus footfalls

Why Trams?

What can they do for Growth & Regeneration?

- Tram systems does increase the amount of development in an area and makes the linear development much more effective.
- We have identified areas including Brownfield sites that the Trams will open up and access land
- Areas along the line of route lend themselves to high density housing, offering a mix of commercial and residential uses.
- Gives developers the chance to build efficiently with fewer parking spaces needed moving 'car-free development.'

Why Trams?

Why a Hydrogen/BioMethane Tramcar?

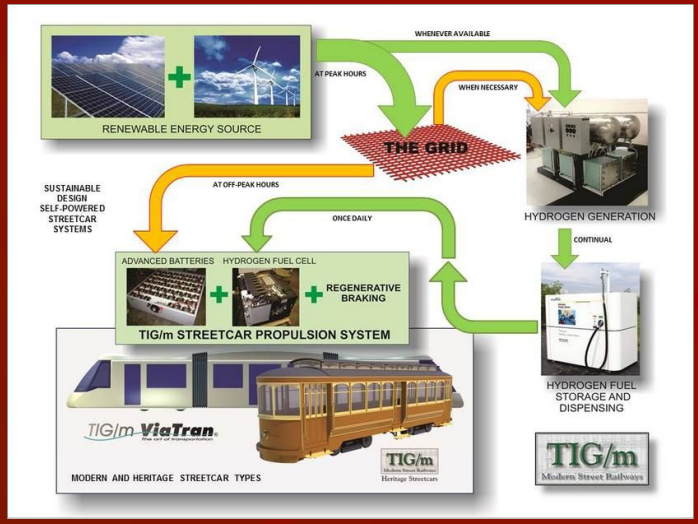
On-site hydrogen generation.
Hydrogen compression and storage.

BioMethane Supplies local in Somerset

Hydrogen fuel dispensing, trams & trucks

On-board fuel cell generators that charge the batteries while the streetcar is in passenger service.

Energy required for up to a full 20hr. service day is carried on-board each vehicle



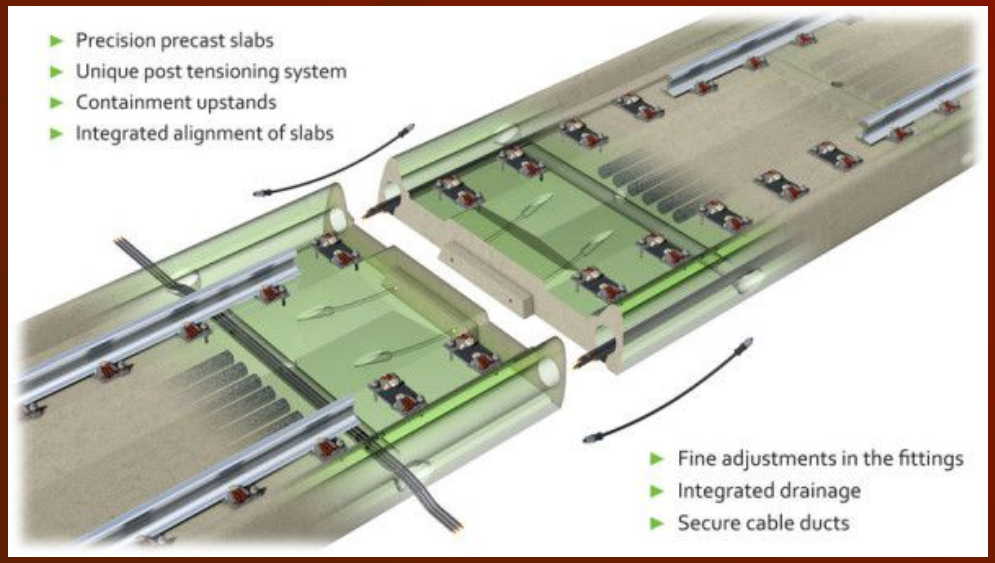
Urban Trams, Corridor Solution

https://www.tig-m.com/videos.html

Why Trams?

Track - keep it simple and quick

PCAT (Pre Cast Advanced Track)



Most utilities left in situ

Will Tramcar use in City and Town

Urban Transport in the near future make this a Sunrise or a Sunset for Tramways and Urban living?

Doing Nothing is not an Option !

Getting it wrong is unforgiveable.

– its your world!

Apollo June 1996

Trams - your flexible fixed track method of travel

Pedestrian Friendly.

All weather service.