



# Ultra Light Rail

Smart Intermediate Mode Passenger Transport

Associate Professor Beverley Nielsen

IDEA Institute, Institute of Design & Economic Acceleration, Birmingham City University

Chair, Ultra Light Rail Partners Ltd

Collaborating with Parry People Movers and Premetro Operations – designers, producers and operators of the STOURBRIDGE SHUTTLE



# What has been the Stourbridge Branch Line Service Performance Record?

- **10 years in operation**
- **5 million**, safe, reliable passenger journeys
- **Highest passenger satisfaction levels** and reliability levels of any operator in UK
- Much appreciated, even loved, by the people of Stourbridge
- **£5 million saving** to the Public Purse as private investors made it happen
- **Highly commended** in two consecutive years International Light Rail Industry awards



# Are lightweight railcars now in service?

Innovative technologies deliver **best passenger service and reliability** records through



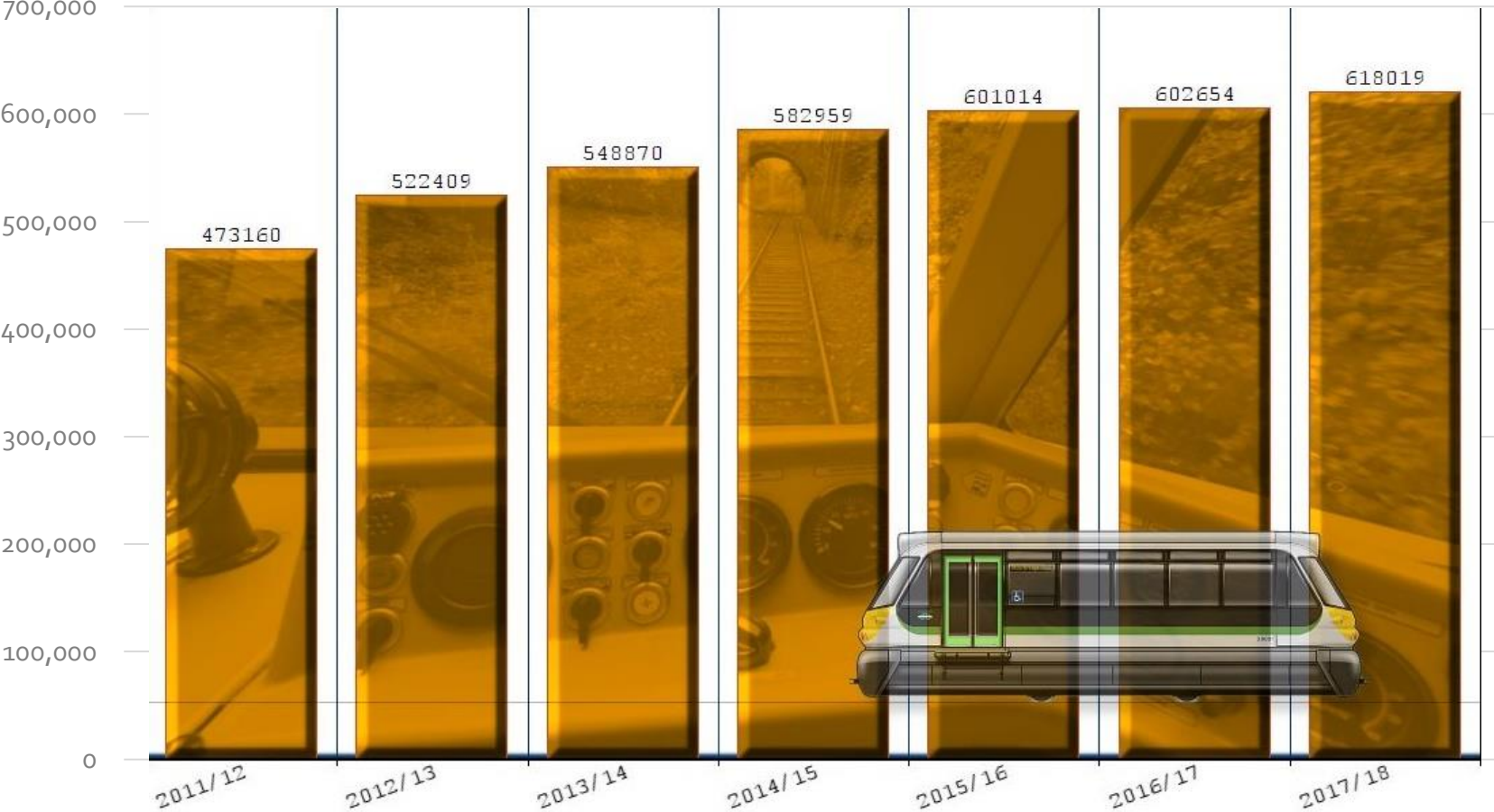
- **Flywheel energy with 2.3l Propane (LPG - C<sub>3</sub>H<sub>8</sub>) engine powertrain**, providing a breakthrough in hybrid technology
- **184 miles drivetime** without refuelling (@20mph)
- **110 miles drivetime** without refuelling (@45mph)
- Delivering major cost savings for operators leading to viability and **business sustainability**
- Delivering **congenial and reliable journeys** for passengers

# Ultra light rail partners

- Feasibility to development to operation including design, QS, Engineering, manufacturing, sustainable and autonomous operation, ticketing and customer service, maintenance
- **Budget guidelines (Est) for light rail**
  - **Rail costs (est)**
    - £800k per km for ballasted rail
    - £1m per km for slab track
    - £1m per km for waybeam relocatable track
  - **Railcar costs (est depending on specification)**
    - 60 person railcar @ £1m each
    - 90-120 person railcar @1.8m-£2m each
  - **Operating costs (Stourbridge)**
    - £2,000 per day per railcar (incl. margin)
  - **Operating 1300 journeys a week 7-days a week**
  - **Pax cost (Stourbridge)**
    - £3 per 4km journey ; £5 return fare

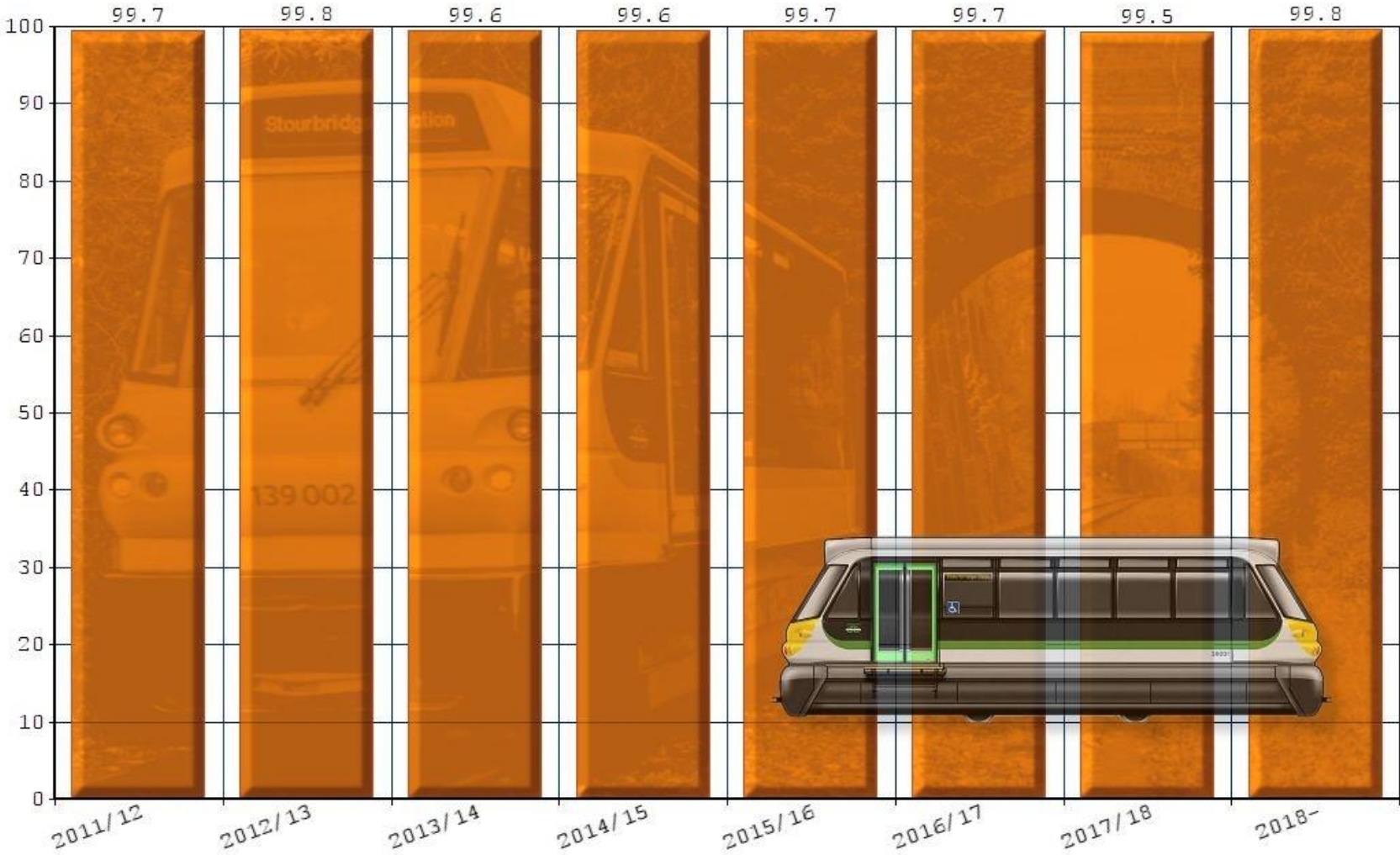
# PMOL's Operating Record at Stourbridge

### Passenger Numbers



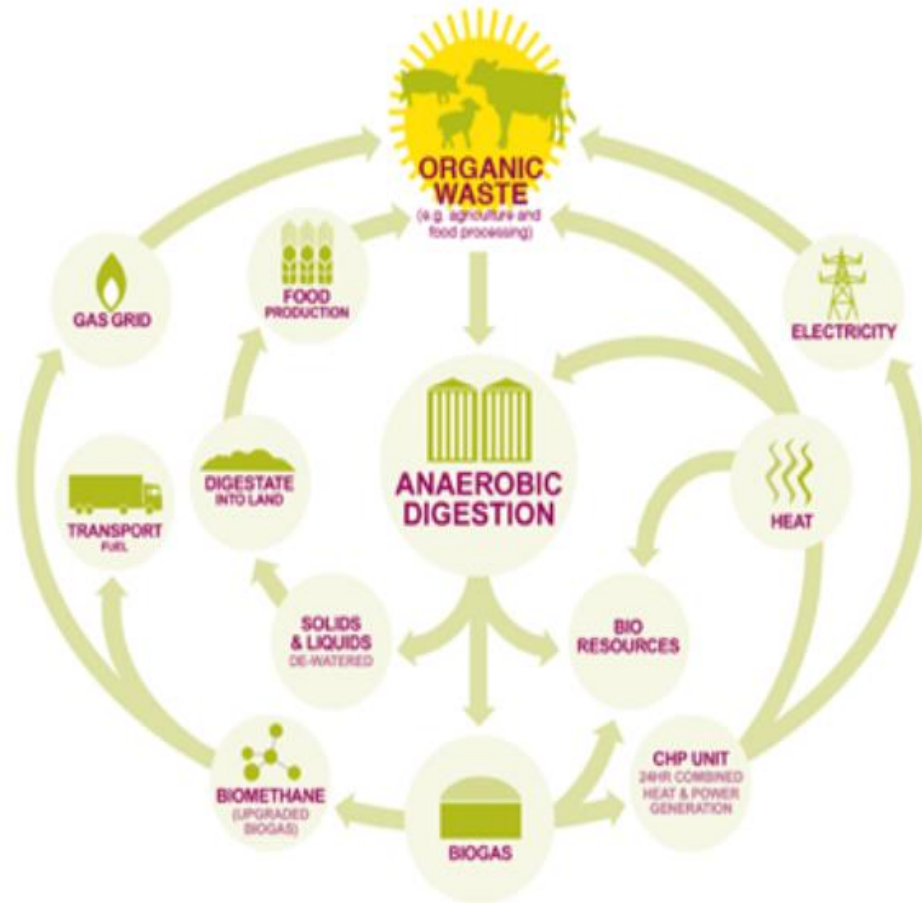
**99% +**  
**RELIABILITY**

# PMOL's Operating Record at Stourbridge



**99% +**  
**RELIABILITY**

# Ultra light rail partners – the green fuel solution



*Multiple products of anaerobic digestion (Modified from ADBA with permission)*

## Circular Economy Solution

Gas accounts 40% UK energy supply. Around three quarters of gas could be sourced from the green gas, biomethane.

## Biomethane – CH<sub>4</sub>

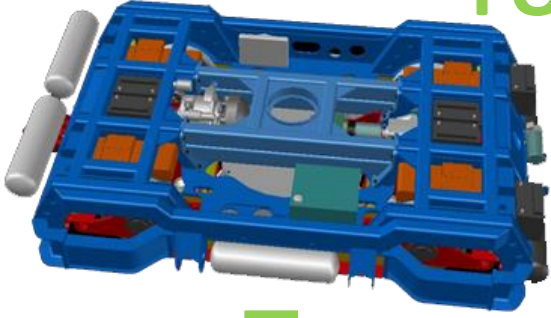
Clean biogas, 98% methane.

Features:

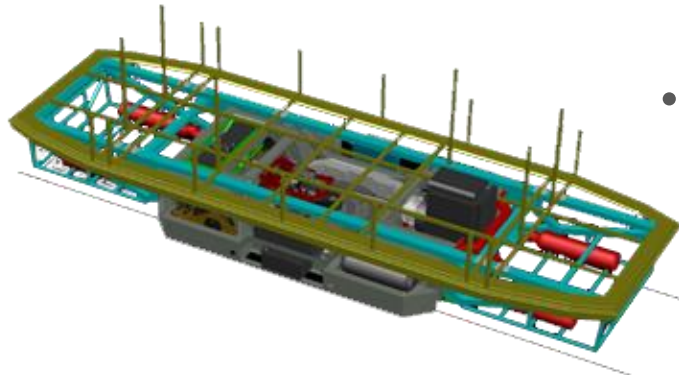
- Eliminates methane emissions
- Interchangeability with existing natural gas
- Use for electricity generation, water heating, space heating, cooking, fuelling vehicles
- Economic opportunity for regional areas
- Produce biomethane from sewage sludge, food and plant and organic waste, red-meat processing waste, poultry and cattle manure.
- Generation of skilled jobs in planning, engineering, operating and maintenance of biogas and biomethane plants.

# Biomethane – the green gas circular economy solution

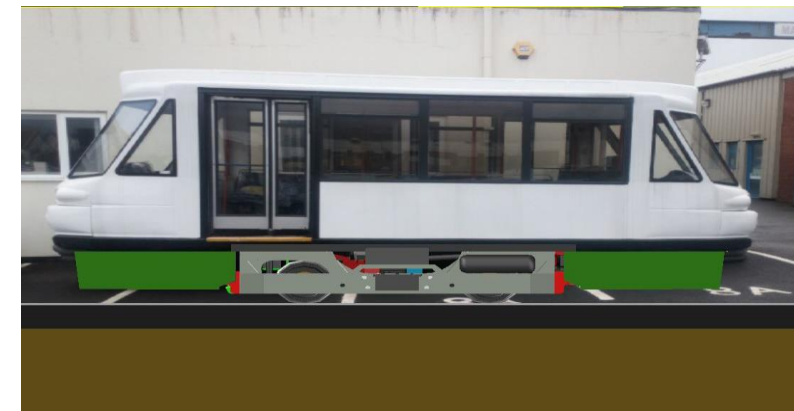
## FOAK Innovate UK and DfT funded project



- Integrated Bogie Frame with positioned green gas biomethane cylinders



- Integrated Bogie Frame with subframe attached

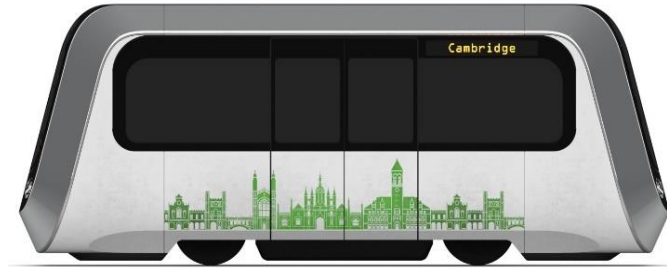


Final Railcar Design for Proof of Concept trialling in March- April 2020



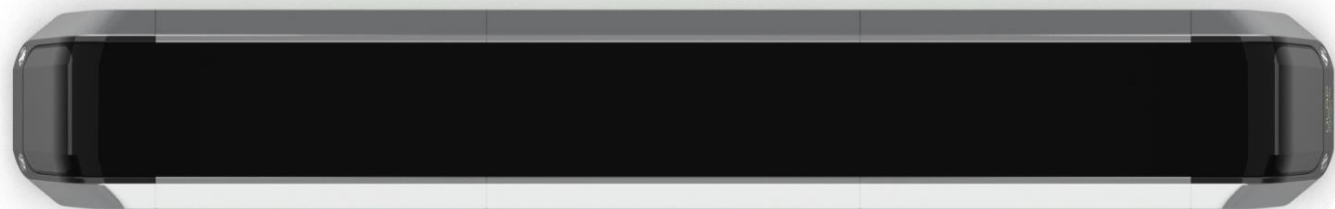
What innovations are planned for the rail version of the Smart Intermediate Mode?

Carriage Extension



Contemporary Styling

*The B.C. Bio*



# Heritage Tram Styling

## *The Malvern Mover*



# Flexible tram – train usage

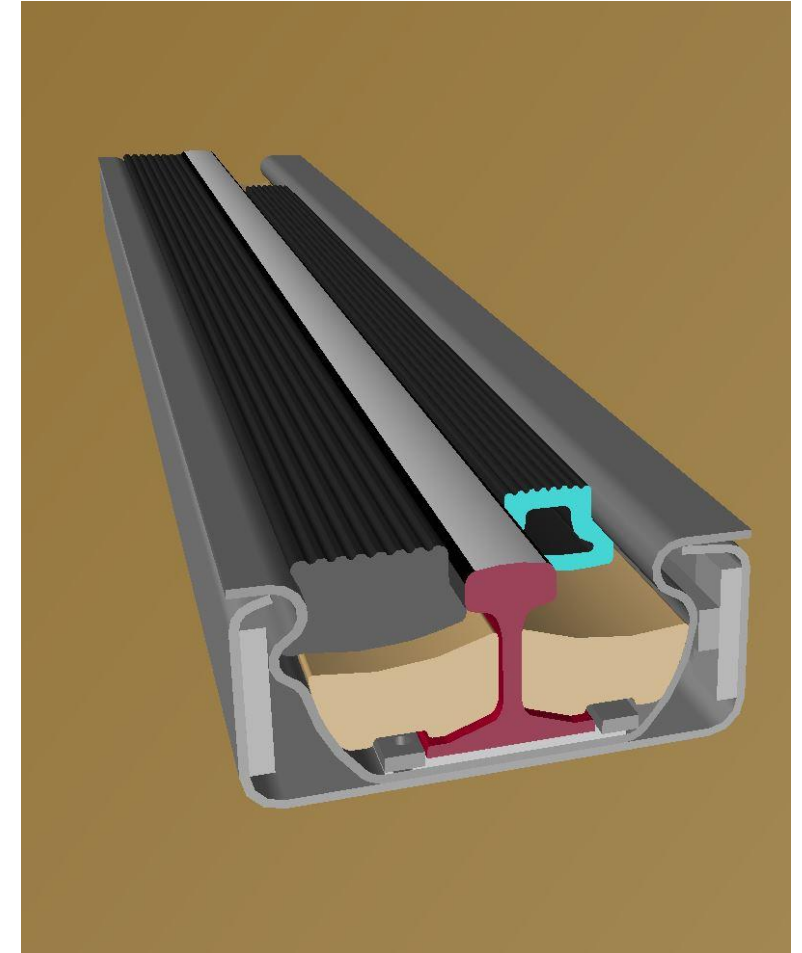
Intermediate Styling

*The Stourbridge  
Shuttle*



# Relocatable 'Waybeam' Track Development

- The **waybeam relocatable track, part of a carpet track concept**: developed to install a tramway through road-surface using dry technology solutions avoiding the need to create deep foundations, disturbing the road base and removing any utilities.
- **Carpet track**: introduced in the early 1990s. A precursor to the waybeam track, based on top of the road involving no disruption to the road surface laying the rail as a railway with ties on top of a series of precast concrete infilling elements.
- The **waybeam relocatable track**: for long-term installations, designed to be located in a slot cut into the road surface black top, enabling quick removal + providing access to statutory equipment and utilities. Rather than face the cost of disruption, utilities are left in place underneath the waybeam track.
- The waybeam approach and carpet track innovations **comprise the use of two single rails** installed separately but with provision for accurate gauging, making the handling and transportation of the precast track elements easier to perform.



patent pending ©

# Illustrations - Relocatable 'Waybeam' Track Developments



# Can new Routes be created across UK?

**Best technology solutions** for city region leadership to resolve

- Congestion
- Air Quality – delivering Clean Air Zones
- 14,100 premature deaths in UK from NOx emissions pollution
- 37,800 premature deaths from Particulate Matter (PMs) emissions from road, tyre and break wear
- First and last mile connectivity challenges

Why the **Smart Intermediate Mode** can help

- Much less expensive than heavy rail/Metro technologies but able to integrate with both of the mainline systems
- Much quicker and more flexible approach to planning and construction
- Predominantly utilising the skills, abilities and physical assets of Black Country firms and people supported by others in the West Midlands region.



# Can new Routes be created across UK?

## Best technology solutions for city region leadership

- **Circular Economy solution** – generating energy from waste through Anaerobic Digesters, producing compressed biomethane to power local tram fleet with no overhead wires
- **Air Quality** – delivering Clean Air Zones, cutting traffic, emissions and improving quality of life
  - 14,100 premature deaths in UK from NOx emissions pollution (BMJ, based on WHO, 2012)
  - 37,800 premature deaths from Particulate Matter (PM 2.5) emissions from road, tyre and break wear which is 1000 times more harmful than tailpipe emissions (BMJ and Emissions Analytics 2020 )
- **Linking local economy:** Fylde Coast connectivity for sustainable growth and opportunity

## Why the **Smart Intermediate Mode** can help

- **Value for Money:** Much less expensive than heavy rail/Metro technologies but able to integrate with both of the mainline systems
- **Proven Track Record:** 10 years operation and excellent reliability
- **UK Sourced:** Using the skills, and production capacity of people and businesses in West Midlands.

