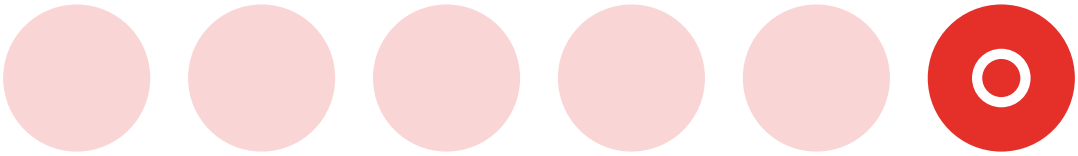
CIRCULAR ECONOMY IN CITIES



OPERATING AND MAINTAINING URBAN MOBILITY ASSETS FOR EFFECTIVE PERFORMANCE

ELLEN MACARTHUR FOUNDATION

ARUP

The operation and maintenance of urban mobility assets can be improved significantly for greater efficiencies and to minimise negative impacts. Vehicles, roads, and street lights can often be operated and managed better. Simple solutions and new technologies can help cities to get more out of their mobility assets (for example through reducing energy use or material use in repairs), while new business models can help overcome financing barriers and create positive incentives. While future operation and maintenance costs need to be planned for and minimised in the design phase, circular economy actions for existing assets will remain important.

CASE FOR CHANGE

Urban transport accounts for **20–50%** of urban final energy consumption (excluding industry); scenarios forecast that it is this consumption that will experience the highest growth[1]

Urban transport is currently the largest single source of global transport-related CO^2 emissions and the largest local source of urban air pollution[2]

An average local UK authority spends around **GBP 20 million** a year on road maintenance[3]

In India, street lighting electricity and maintenance costs can make up **5–10%** of municipal budgets in large cities and up to **20%** in smaller cities[4]

EXAMPLES OF CIRCULAR ECONOMY OPPORTUNITIES

Minimising trip length, duration, and operational energy use with digital solutions

Responsive route planning software can enable users (such as public transport passengers, freight companies or taxis) to optimise routes according to real-time traffic data, as well as the required stops and pick-up needs, in order to reduce transport time and energy consumption.

Mobility assets operated and maintained in new business models

Procuring mobility assets (such as street lights, bikes, vehicles) through new, performance-based, business models that allow the operator to pay for the use of the asset rather than having to procure the product outright, incentivises improvements to the overall operation and maintenance of the asset. Through such a model, the provider is incentivised to provide products and assets that are a combination of durable, adaptable and readily able to be repaired or refurbished, as well as being energy- and resource-efficient. The Philips pay-per-lux model is an example of this approach.[5]

Refurbishing and repairing vehicles to extend material cycles

By refurbishing and repairing vehicles, depreciation and obsolescence of the vehicles and their parts can be slowed down and performance optimised. Prolonging asset life can also reduce the need to produce new mobility assets, which often is more resource- and carbon-intense than maintenance.[6]

New techniques for infrastructure operation and maintenance

When urban mobility infrastructure, such as roads and street lights, need to be upgraded and refurbished, there are a range of measures that can minimise cost while increasing resource- and energy-efficiency. For example, in-situ recycling of old road surfaces is a well-established practice in public road maintenance. Building information modelling (BIM), sensors, and digital twins can also be used to predict maintenance needs and improve overall performance.[7]

RELEVANT CASE EXAMPLES

Nature-inspired route planning to reduce delivery times and costs

Routific has developed a route optimisation software for delivery companies using an algorithm based on how bees discover the shortest route between flowers. Companies using this solution can cut delivery routes by up to 40% according to the company, saving both time and fuel.[8]

Refurbishing public street lights for improved energy performance

In Guadalajara, Mexico, street lighting represented approximately 18% of electricity consumption. To improve the service and operation, and minimise the maintenance costs, Guadalajara entered into a public-private partnership to retrofit LED public lighting into its system through a lease-to-own delivery model with private company financing repaid over 10 years. Expected energy savings will be around 50–55%, equating to a cost saving of USD 500,000 per month.[9]

Refurbishing ambulances to extend lifetime

DLL – a global provider of asset-based financial solutions – introduced the concept of modularity in the refurbishment stage of ambulances through an innovative remounting process. The remounting process involves refurbishing the box body of a used vehicle to an 'as-new' standard. The box is a module which is then fitted to a brand new chassis, providing reliability and efficiency as well as extending its useful life by 5–7 years and reducing investment costs for the end customer by more than 20%.[10]

100% road material recycling in Hamburg

When one of the main roads in Hamburg needed to be refurbished and resurfaced, the city decided to include a 100% recycling and reuse requirement in the procurement tender, ensuring that all the old road material was reused in the same road. The road was laid in 36 hours and provided a 30% cost saving compared to conventional road resurfacing, and it still had the same properties and durability as new asphalt. Other benefits included reduced energy consumption and CO^2 emissions, as well as minimised noise and traffic disruption.[11]

EXAMPLES OF WHAT URBAN POLICYMAKERS CAN DO

Taking a circular economy approach to **asset management** of mobility infrastructure and vehicles can improve operations and reduce maintenance costs (for example with predictive maintenance technology or in-situ pavement recycling). When replacing and renovating mobility infrastructure, city governments can integrate circular economy criteria in **public procurement** tenders to incentivise circular economy solutions.

To explore further see **Policy Levers**

EXAMPLES OF LINKS TO OTHER SYSTEMS AND PHASES

Mobility: Designing Operation and maintenance costs can be planned for or minimised in the design phase, for example increasing durability or by ensuring easy disassembly.

EXAMPLES OF BENEFITS

ECONOMIC PRODUCTIVITY

Saving travelling time

Anonymised transport data released to the public by Transport for London (TfL), enables third-party organisations to create real-time journey planners. This helps public transport users save time to the economic value of between GBP 15 million and GBP 58 million per year. It also unlocks new revenue and savings opportunities for TfL, and a GBP 20 million increase from bus usage, as customers are more aware of service opportunities.[12]

Reducing freight kilometres

Dynamic delivery route-planning software can cut delivery routes by up to 40%.[13]

Reducing street light operation and maintenance costs

In the US alone, replacing outdoor lighting with LED lighting can save USD 6 billion annually through reduced energy use, as well as reduced operations and maintenance costs because LED luminaires last at least four times longer than traditional bulbs.[14]

Reducing traffic disruption

In-situ recycling for road maintenance can reduce the duration of traffic disruption by around 50%.[15]

HEALTH AND ENVIRONMENT

Reducing light energy CO^2 emissions

Replacing outdoor lighting in the US with LED lighting can reduce carbon emissions by the equivalent of taking 8.5 million cars off the roads for a year.[16]

Increasing worker safety

Use of some in-situ recycling processes reduces workers' exposure to Hand Arm Vibration Syndrome, which is a health concern that arises from regular paving processes.[17]

RESOURCE USE

Minimising embodied energy

Across individual case studies, refurbishment of vehicle parts, industrial digital printers, and heavy-duty truck and off-roading (HDOR) equipment parts saved 57–87% of process energy and 80–99% of embodied material energy; repair saved 93–99% embodied material energy.[18]

Enabling easier repairs

Additive manufacturing or 3D printing of machine components can enable faster repairs since damaged parts can be 're-printed', supporting longer product lifetimes.[19]

Saving road material costs

The use of recycled materials for highway maintenance is often cost neutral, and in many cases can deliver good financial returns. In the UK, the Newport Southern Distributor Road Scheme saved GBP 1 million by using around 450,000 tonnes of recycled and secondary aggregates instead of purchasing primary materials. In-situ recycling techniques employed for Essex County Council in the UK gave direct cost savings of nearly GBP 200,000.[20]

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