CASE STUDY: Highways Agency - A421 Improvement

SECTOR TYPE: Infrastructure - roads
LOCATION: Bedford
CLIENT: Highways Agency
PRINCIPAL DESIGNER: Scott Wilson
PRINCIPAL ENGINEER: Jacobs
PRINCIPAL CONTRACTOR: Balfour Beatty
CONTRACT VALUE: £202 million
CONTRACT DURATION: 26 months

The Project

The A421 improvement scheme was an Early Contractor Involvement (ECI) project for a new 13km section of dual carriageway from Junction 13 of the M1 towards Bedford.

ECI benefits the Highways Agency by allowing the principal contractor, Balfour Beatty, to work with other project partners 6 months before construction work begins to identify design and other project improvements. This time allows alternatives and project innovations to be explored and implemented, reducing costs and enhancing the delivery of the scheme.

Environmental innovations and the use of alternative materials were key to meeting the project’s requirements for 2 million m$^3$ of fill material and 400,000m$^2$ of surfacing in a cost effective way.

The Highways Agency’s carbon calculator was used to estimate the project’s carbon footprint, particularly the embodied energy associated with materials used. Reducing costs goes hand in hand with delivering reductions in the project’s carbon footprint.

As well as using recycled aggregates and pulverised fuel ash to replace traditional fill materials, the project pioneered the first application of car tyres for lightweight fill on a major road scheme in the UK.
The Benefits

The project approach delivered significant environmental, community and financial benefits.

- **Reduced carbon and waste** – 77,000 tonnes of embodied carbon was avoided through design changes and material substitution.
- **Recycled materials** – 400,000 car tyres were put to beneficial reuse as lightweight fill for embankments on the project and 30,000 tonnes of glass sand (from recycled bottles) was used as bedding media for the drainage trenches, avoiding the need for traditional quarried sand for this application. Also, 450,000 tonnes of recycled aggregates were used in the build, including the asphalt surface, avoiding the need for traditional quarried materials.
- **Recycled materials** – 400,000 tonnes of pulverised fuel ash (a by-product from power stations) was diverted from landfill for use as an alternative lightweight and fill material on embankments.
- **Recycled materials** – the completion of the road provided a major community and road safety benefit to local residents by diverting traffic away from built up areas.
- **Recycled materials** – the material changes reduced the project costs by £3.8 million.

The Process

The key processes underpinning the project:

- The project team used the Highways Agency’s carbon calculator, developed by Parsons Brinckerhoff, to establish the scheme’s carbon footprint and quantify the carbon benefits of design changes and material substitutions.
- Designing out the need for certain structures avoids the embodied impacts of materials such as concrete, aggregates and steel.
- Replacing virgin aggregates and traditional fill materials with recycled aggregates and secondary materials or the by-products of other industries also reduces the embodied carbon impacts of the scheme.

Key Learning Points

- This project demonstrated the value of ECI in creating the time and impetus to identify design changes, material substitutions and other innovations to deliver a lower cost project with reduced environmental impacts.
- The use of a project carbon calculator helped the project team link carbon with material cost.

Learn more

www.highways.gov.uk/roads/road-projects/a421-bedford-to-m1-junction-13/
www.bbcel.co.uk/capabilities/roads/136_a421-improvements-m1-j13-to-bedford

For more information on
The Green Construction Board
visit www.greenconstructionboard.org
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