Biodiversity & Natural Capital Design Tool

South west Pilot – Nationwide

Kier Highways / Treeconomics / National Highways

BIG Biodiversity Challenge Award Category: *Innovation Award*

Project overview

Kier Highways and partners have created a Biodiversity & Natural Capital Design Tool that captures before and after biodiversity units and vital ecosystem service values (ESVs). It holistically delivers a picture of environmental impacts and benefits in a monetised way, used to inform decision making and design, demonstrating true value for money.

What were the biodiversity conditions on site, prior to the enhancement?

The tool goes beyond normal business practice capturing both before values (biodiversity units and financial ESVs of existing vegetation within a scheme footprint) and after values (generated by new planting once the scheme is complete).

A designer can plot a polygon to cover the scheme footprint. Once the landscape design has been inputted, the tool will calculate the current ESVs and use them along with the species of tree, geographical and climatological data to model the ESVs into the future to create the "natural capital breakeven point" i.e. the year at which the new planting will replace the values lost.

What were the reasons behind this project ?

Until the creation of this tool, natural capital was not factored into decisions or scheme design. The importance of the highway verge as an asset, it's ability to mitigate impacts of climate change, offset carbon emissions and improve biodiversity has only recently been recognised. capturing these values and feeding them into decisions and designs help maximise these benefits.

National Highways has a target for no net loss of biodiversity by 2025 and net gain by 2040. Natural capital (the total of all the ecosystem service values), is considered just as important and is helping to achieve their performance measures.

Biodiversity & Natural Capital Design Tool landing page

Habitat type, planting plan and pre & post biodiversity units modelled in the tool in table format

What were the biodiversity measures taken?

Using a grid reference or postcode, designers can navigate to a scheme location in the tool and plot polygons to cover the scheme footprint. Once the landscape design has been inputted, the tool will calculate the current Biodiversity units, ESVs and create the "natural capital breakeven point", which is then displayed in a graph, making the collection of data much easier. The designer can effortlessly alter the number and species of plant in the tool to increase the ESVs and reducing the breakeven point.

For the first time, designers can understand what true impact their scheme will have on these vital services and can amend the design to create both a biodiversity and natural capital net gain.

This tool, currently being used on the strategic road network, could be mainstreamed, and used across any road in the country. A version of this tool could be used to capture BNG, ESVs and replicating a "natural capital breakeven point" on any construction site (big or small) that involves the removal of vegetation.

Training was provided to design teams on how to use the tool & a user guide produced.

During the design of a Green Bridge on the A38 in Devon, the tool was used to calculate before and after biodiversity units and ESVs to identify a "natural capital breakeven point" of 28 years. The scheme footprint and planting plans were then "tweaked" within the tool until a "natural capital breakeven point" of just 19 years was achieved. The design was revised and the scheme footprint extended to the whole central reservation, an extra 13,281 M^2 of heathland creation, (see polygons plotted and BNG graph from the tool above). The habitat type, due to be recreated on the site compound, was changed from coniferous to broadleaf woodland boosting both biodiversity units and ESVs.

A38 Haldon Green Bridge: Plotted polygons in the tool for different habitat types.
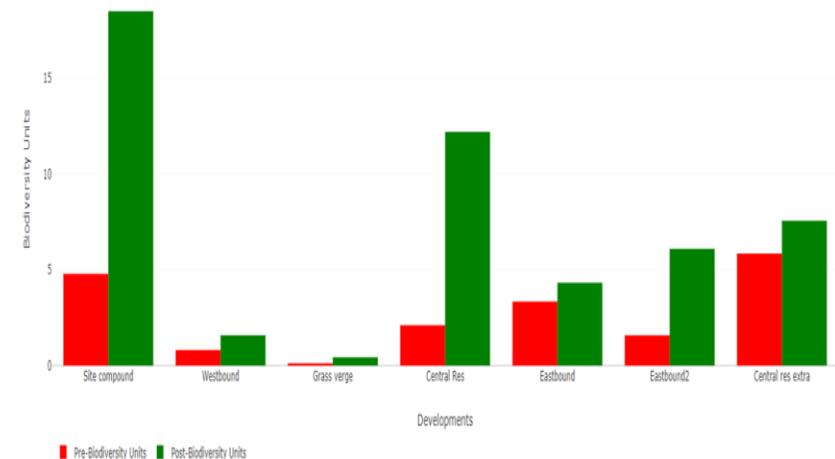
A38 Haldon Green Bridge: Pre & Post biodiversity units for each polygon (habitat type) mapped and modelled in the tool

Further information

Our Biodiversity & Natural Capital Design Tool captures biodiversity units (calculated using Natural England's Biodiversity Metric which is built into the tool), and ecosystem service values (ESVs), such as carbon sequestration and storage, storm water attenuation - flood avoidance and air pollution removal (calculated using iTree Design). Following research and development by a team consisting of environmentalists, arboriculturists and economists from Kier Highways, Treeconomics and Davey (based in the USA), we piloted the new tool on Strategic Road Network (SRN) schemes across southwest England throughout 2021-22.

During the pilot of the Tool, we ironed out glitches and identified improvements that were then fed back to the developer iTree. By summer 2021, we had an intuitive, functional design tool that adds real value to scheme design. As a mandatory part of our Environmental Assessment, the tool is now completed on every scheme, across all our contracts. An environmental specialist liaises with the designer to assess both biodiversity and ESVs and then amends the design (if required) to increase values and bring the breakeven point down.

Besides biodiversity, two of the key ESVs captured by the tool are carbon sequestration & carbon storage. By capturing and maximising these values within scheme design we can help the decarbonisation the transport system, using the highways verge as a carbon sink and as a means of mitigating the impacts of climate change. This is reflected in the National Highways target to plant 3 million trees on its soft estate by 2030 to offset its carbon emissions.

Project Team - Kier Highways / Treeconomics / National Highways / Davey

What was the motivation for carrying out the enhancement?

Only recently has the true value of the natural environment filtered through to sectors such as construction and transport. Before a highway scheme is approved, it is measured and scored using traditional economic measures generating a Benefit Cost Ratio (BCR). There is a blind spot when it comes to the natural environment. The solution is a more holistic scoring model that values biodiversity and natural capital and places it front and centre, alongside these more traditional measures.

Break-even Estimation:

(You can Go Back to modify your project and re-run your project.)

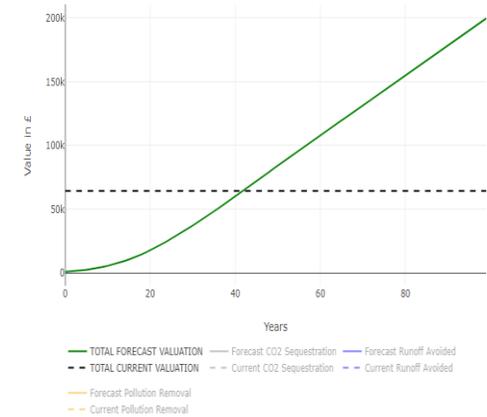At right is the break-even estimate for your tree plantings.

Your project will break even in 42 years.

Current total value: £64,344.61
- CO_2 Sequestration: 62,219.67 kg
- Avoided Runoff: 952.91 m^3
- Air Pollution Removal: 1,172.04 kg

Projected project break-even value: £64,914.04
- CO_2 Sequestration: 39,615.44 kg
- Avoided Runoff: 20,677.13 m^3
- Air Pollution Removal: 4,621.47 kg

Natural Capital Breakeven Point modelled in the tool and breakdown of Ecosystem service £ values

Break-even Estimation:

(You can Go Back to modify your project and re-run your project.)

At right is the break-even estimate for your tree plantings; grasslands are not included due to data limitations. As you can see, your project will break even after 2 years.
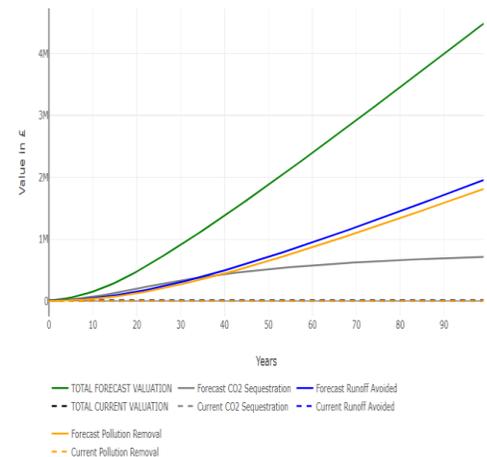
Click legend items to toggle their visibility.

Current total value: £15,364.75
- CO_2 Sequestration: 13,041.2 kg
- Avoided Runoff: 1,088.51 m^3
- Air Pollution Removed: 13,041.2 kg

Projected project break-even value: £20,581.59
- CO_2 Sequestration: 8,272.76 kg
- Avoided Runoff: 7,211.78 m^3
- Air Pollution Removal: 5,097.04 kg

Natural Capital Breakeven Point split by individual ecosystem service i.e. pollution removal, carbon sequestration etc.