

ICE insights into the use of low- or no-build solutions in strategic infrastructure planning

November 2024

Overview

Low- or no-build solutions are increasingly being used as an alternative approach to delivering much-needed infrastructure services. Presented as practical solutions for reusing or maximising the existing infrastructure asset base, they offer benefits to 'protect, conserve, restore, sustainably use and manage' ecosystems while supporting human and environmental benefits.¹

While many examples of low- and no-build solutions have been identified at the project level, incorporating them into a wider programme to deliver services at a national scale remains a key challenge. For example, the ICE has identified at least six ways low- and no-build solutions can provide tangible benefits, such as purifying water, increasing the capacity of roads, or boosting the functionality of buildings. However, scaling these solutions up to support service delivery at the national scale is less certain.² Thinking critically about infrastructure services as part of the wider strategic system and identifying how they can be delivered as part of a programmatic approach to infrastructure planning can unlock wide-ranging benefits in the infrastructure system.

A public consultation run by the ICE-led Enabling Better Infrastructure (EBI) programme revealed that a more systematic approach to identifying all infrastructure service needs upfront could unlock low- or no-build solutions later in the infrastructure life cycle.³ However, limited information on how to map out different service needs in practice, including how to appraise low- or no-build solutions, remains a key policy challenge. Finding the right policy mechanisms to initiate this approach requires further exploration.

To better understand the value of low- and no-build solutions and how they can help governments deliver on their infrastructure service needs, the ICE has embarked on a study to understand how countries have used low- and no-build solutions to identify and deliver infrastructure services. This includes how national governments and other influential stakeholders have incorporated them into wider planning initiatives to ensure countries gain the most from their infrastructure systems.

Purpose of this paper

This paper provides insight into what low- or no-build solutions are and how they have been used in strategic infrastructure planning to unlock benefits for people and the planet. By way of examples, the paper sets out policy mechanisms to identify infrastructure needs and how they can be met through a wider range of infrastructure solutions, including low- and no-build options.

The paper combines insights from global experts who have used low- and no-build solutions first-hand or incorporated them into policy, including government officials, private-sector stakeholders and non-profit organisations. The paper also incorporates findings from ICE President Anusha Shah's presidential year and a policy-specific ICE roundtable event that outlined how governments can integrate nature-based solutions into their infrastructure systems.⁴

¹ ICE (2024) [Presidential Roundtable summary: How can governments incorporate nature-based solutions in their infrastructure systems?](#)

² ICE (2024) [6 types of nature-based solutions to consider for your next project](#)

³ ICE (2023) [EBI: Driving purpose, certainty and pace in strategic infrastructure planning](#)

⁴ ICE (2024) [Presidential Roundtable summary: How can governments incorporate nature-based solutions in their infrastructure systems?](#)

The paper's findings will enhance the Enabling Better Infrastructure (EBI) guidance, strengthening the evidence base for two of its eight principles.⁵ While links have already been made to EBI Principles 2 and 3 as outlined below, finding tangible examples of where low- or no-build solutions have been used in strategic planning for government and other influential stakeholders will only substantiate and reinforce them.⁶

- Principle 2 acknowledges the need to use the UN Sustainable Development Goals as a baseline to deliver on infrastructural, economic, social and environmental needs.
- Principle 3 identifies the need to consider a wide range of infrastructure options for delivering on needs.

What are low- or no-build solutions?

'Low- or no-build solutions' is a catch-all term for infrastructure solutions that involve the limited physical construction of new assets using concrete. While 'low- or no-build' implies two neat categories, in practice, it comprises a range of infrastructure solutions that deliver one or more infrastructure services across sectors (Table 1). These solutions can include: where infrastructural services such as water attenuation and purification are provided by nature (nature-based, green infrastructure, or blue-green infrastructure); where repurposing can extend the life of infrastructure through targeted monitoring (repurposing); where leasing can reduce the need to build new infrastructure (shared assets); and where patterns of use can streamline how services are provided (changing user behaviours). Some solutions also offer services to support mental health and well-being (nature-based, green infrastructure, or blue-green infrastructure).

It was recognised that some approaches resonated more easily with specific sub-disciplines within the engineering and built environment professions. For example, civil engineers tend to implement a bioswale, while landscape architects are more inclined to use an artificial wetland. Despite these preferences, insights gathered from global experts interviewed for this paper indicated:

1. Solutions are context-specific and need to be designed with this in mind.
2. Low- or no-build solutions can provide more than one service, e.g. an artificial wetland can attenuate or purify water while providing a habitat for wildlife.

What are the benefits of using low- or no-build solutions to deliver services?

Low- or no-build solutions provide a range of benefits for people and the planet. Most include reducing carbon emissions, among other key benefits. This was identified across all of the types presented in Table 1, but is particularly associated with repurposing. Other advantages, such as social and environmental benefits, were identified across nature-based, green infrastructure, or blue-green infrastructure, and changing user behaviours.

Benefits for people

Delivering on multiple stakeholder needs

The use of nature-based, green infrastructure, or blue-green infrastructure, can benefit stakeholder groups differently. For example, governments can deliver both infrastructure and recreation services through one intervention, ensuring fiscal resources are well spent. Benefits to immediate communities include receiving flood attenuation or water purification services, while wider community values include creating green space or a park. Examples of this are noted in South Africa, where an artificial wetland was used as part of a flood relief scheme in a community in Atlasville, Gauteng, and renaturalised rivers were built in Norwood and Bruma Lake, Johannesburg.⁷ In both cases, a river was re-instated where there was previously a concrete canal. The benefit was that spaces were used for recreation, with supporting biodiversity outcomes.

⁵ ICE (2024) [EBI: Driving purpose, certainty and pace in strategic infrastructure planning](#)

⁶ ICE (2024) [How policy can unlock the potential of nature-positive infrastructure](#)

⁷ Kerry Bobbins (2021) [Legacies, uncertainties and ownership: Green infrastructure as practice in Johannesburg, South Africa](#)

Table 1: Types of low- and no-build solutions

Category	Solution type	Description	Examples
Low-build	Nature-based, green infrastructure, or blue-green infrastructure	Solutions that utilise natural features and processes to deliver infrastructure services and tackle global challenges, such as climate change and extreme weather events. The International Union for the Conservation of Nature (IUCN) has devised a global standard for verifying and designing these kinds of solutions. ⁸	<ul style="list-style-type: none"> • Use of artificial wetlands, bioswales and river renaturation schemes.⁹ • Built environment interventions, e.g. green roofs or porous paving.
	Sharing assets	Solutions to share infrastructure assets can enhance utility and minimise operational costs. A robust lease agreement is needed between participating stakeholders. ¹⁰	<ul style="list-style-type: none"> • Fixed electronic communications infrastructure, e.g. in the telecoms industry.¹¹
No-build	Repurposing	Interventions help to reduce waste and maximise existing infrastructure assets and available resources to accelerate sustainable development. When applied to infrastructure, this involves extending the life of infrastructure to combat the need to build new assets, including opportunities to recycle materials. ¹²	<ul style="list-style-type: none"> • Repurposing roads for cycling and walking infrastructure, as done during the COVID-19 pandemic.¹³
	Changing user behaviours	Encourages citizens to rethink their approaches to using resources, which helps to drive a collective push for behavioural change over the long term. Interventions can include supporting policy to guide or incentivise changes made by the public or involving communities more closely in decision-making processes.	<ul style="list-style-type: none"> • Changing behaviours to support net zero initiatives.¹⁴ • Redesigning airports to encourage behavioural changes to maximise existing infrastructure.¹⁵

Getting the most out of infrastructure investments

For governments, cost-effectiveness is one of the key benefits of adopting a low- or no-build approach to long-term planning. While building new assets involves a large initial investment in building materials and equipment, solutions that challenge user behaviour and repurpose existing assets require a minimal financial commitment. Furthermore, the cost of

⁸ IUCN (2020) [IUCN Global Standard for Nature-based Solutions](#)
⁹ Ibid.
¹⁰ Digital Regulation Platform (2022) [The infrastructure sharing imperative](#)
¹¹ ICE (2024) [To build or not to build, that is the question](#)
¹² Frontiers in Environmental Science (2021) [Nature-based solutions for urban sustainability](#)
¹³ Digital Regulation Platform (2022) [The infrastructure sharing imperative](#)
¹⁴ ICE and APPGI (2024) [APPGI and ICE policy paper: What are the public behavioural changes required to meet net zero?](#)
¹⁵ ICE (2024) [To build or not to build, that is the question](#)

maintaining nature-based solutions tends to be lower than that of traditional structures, although they have different requirements and skill sets when it comes to maintenance.¹⁶

To attract financing, delivering multiple benefits for the government and the public can ensure a return on investments made in infrastructure.¹⁷ Demonstrating these benefits upfront can boost investor confidence and increase the likelihood of infrastructure funding. The section on 'Risk and uncertainty' below will discuss this latter point in more detail.

Benefits for the planet

Low- or no-build solutions such as artificial wetlands, bioswales and river renaturation schemes can be designed to preserve natural ecosystems and enhance biodiversity, contributing to environmental conservation and habitat protection.¹⁸ National Highways and Cambridgeshire County Council are two authorities that now have biodiversity enhancement as a key part of their policy.

Extending the life of assets also helps limit the production of harmful emissions that contribute to climate change.

How have governments used low- or no-build approaches in strategic infrastructure planning?

Global experts interviewed for this paper identified how governments around the world have been able to actively incorporate the benefits of low- or no-build into strategic planning. The following four activities were identified as best practices in this area.

1. Use no-build as a baseline

In Wales, a no-build approach is part of the country's approach to infrastructure delivery, which is rooted in the Well-being of Future Generations Act 2015.¹⁹ The Act incentivises long-term resilience, enhanced equality and greater accountability for achieving global sustainability targets, which are key milestones for sustainable development.

In alignment with the Well-being of Future Generations Act, an independent panel appointed by the Welsh Government submitted a report with 51 recommendations for Wales's long-term road strategy. The report highlighted the importance of considering a no-build approach to road planning. Specifically, it encouraged policymakers to consider investing in new road schemes for only four purposes:²⁰

- developing sustainable transport for reducing carbon emissions
- reducing driving-related casualties through small-scale changes
- adapting roads to the impact of climate change
- supporting prosperity by improving access to development sites that will achieve high sustainable transport mode share.

This report marks a step towards refining Wales's road strategy by setting clear boundaries for investment in new projects. The Welsh Government will now only consider the development of new roads if it supports achieving a modal shift to respond to climate change and to reduce congestion across the network.²¹

2. Outline 'do minimum' options

Extending the life of existing infrastructure can play a significant role in delivering infrastructure services on time and on budget. This is because it requires less investment, with quicker delivery times (if applicable). Gaining a clear picture of

¹⁶ ICE (2024) [Unblocking barriers to nature-positive solutions: a State of the Nation deep dive](#)

¹⁷ ICE (2024) [Unblocking barriers to nature-positive solutions: a State of the Nation deep dive](#)

¹⁸ ICE (2024) [Presidential Roundtable summary: How can governments incorporate nature-based solutions in their infrastructure systems?](#)

¹⁹ Welsh Government (2015) [Well-being of Future Generations \(Wales\) Act 2015](#)

²⁰ ICE (2024) [How Wales uses the UN SDGs to support long-term infrastructure planning](#)

²¹ Welsh Government (2023) [Welsh Government response to the Roads Review](#)

the capacity of the existing infrastructure base is critical to informing whether the infrastructure can be enhanced to deliver on much-needed services.

Frequently, decisions regarding whether an asset can be retained or reused are based on limited data, such as visual inspections, which may not give a good indication of actual capacity. If sufficient monitoring is put in place, existing assets can be used more effectively.

Australia's approach to identifying and analysing options for infrastructure development also incorporates low- and no-build options as part of a 'smarter' approach to delivering infrastructure. As part of stage 2 of its assessment framework for infrastructure projects, Infrastructure Australia encourages policymakers to consider different avenues to address infrastructure needs.²²

Alongside options to invest in building infrastructure, it proposes a list of ways to 'better use' existing infrastructure.²³ This includes implementing timetabling changes to balance passenger loading across services and better utilise existing capacity. It also draws on the value of changing user behaviours by encouraging policymakers to encourage people to work from home to minimise congestion and decrease transport-related carbon emissions.

In France, the value of repurposing infrastructure was evident throughout the COVID-19 pandemic. The French government created a €120 million set of financial incentives, known as the *coup de pouce vélo* (a helping hand), to address evolving infrastructure needs.²⁴ This was spent primarily on repurposing the existing road network by creating 'COVID cycle lanes'. This aimed to provide an alternative option to public transport, while also curbing car usage during the pandemic.²⁵

3. Set aside funding

Germany adopted a low-build approach using nature-based solutions to achieve its climate change goals. To do this, a €4 billion action plan was put together to mitigate the impact of climate change on communities, which was crucial in achieving its climate and biodiversity goals.²⁶ The action plan outlines how the climate crisis will affect Germany and what nature-based measures need to be taken to combat its negative impact.

Singapore also has nature-based solutions in its strategic infrastructure planning process. Several initiatives have been adopted into Singapore's long-term planning frameworks, including the Green Towns Programme, led by the Housing and Development Board.²⁷ The approach includes using 'natural, semi-natural and man-made green and blue features' alongside ecological engineering methods to reduce energy consumption, recycle rainwater and encourage urban cooling.²⁸

4. Strike mutually beneficial partnerships

Several telecom operators signed a cooperation protocol in Turkey in 2018 to share fixed electronic communication infrastructure via lease agreement.²⁹ This helped boost internet access in alignment with Turkey's National Broadband Strategy and Action Plan. Infrastructure assets in the energy and telecom sectors are most amenable to asset sharing.

²² Infrastructure Australia (2021) [Identifying and analysing options](#)

²³ ICE (2024) [Why Australia weighs costs and benefits differently to meet community needs](#)

²⁴ ICE (2024) [How can we plan infrastructure better in a post-Covid world?](#)

²⁵ The Urban Book Series (2023) [Cycling through the pandemic](#)

²⁶ Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (2022) [Short summary: Federal Action Plan on nature-based solutions for climate and biodiversity](#)

²⁷ Frontiers in Environmental Science (2021) [Nature-based solutions for urban sustainability](#)

²⁸ Ibid.

²⁹ Digital Regulation Platform (2022) [The infrastructure sharing imperative](#)

What barriers exist to incorporating low- or no-build solutions into strategic infrastructure planning?

While the value of low- and no-build solutions for people and the planet is apparent, mainstreaming them into policy and practice presents a range of barriers. Global experts interviewed for this paper outlined the following key barriers.

Risk and uncertainty

Uncertainty is a key challenge in integrating low- or no-build solutions in strategic planning. There is currently limited evidence of the impact of using these kinds of solutions nationally and globally. As a result, many policymakers prioritise solving problems by building new infrastructure in a similar way it has been done before. This omits the range of repurposing options, or nature-based solutions such as constructed wetlands or salt marshes that can be built to deliver services in a more sustainable way or through providing more than one service at any given time, e.g. water attenuation, recreation space and biodiversity benefits.

Furthermore, low- or no-build solutions may be overlooked due to the need for immediate impact in short-term budgeting or political cycles. Decision-makers often prioritise short-term economic considerations over long-term sustainability when resources such as time and funding are scarce. Not building any new infrastructure and repurposing what is already there can help to deliver impact with little to no investment. This, however, is only possible if the capacity and capability of the infrastructure system are well known.

Repurposing existing infrastructure can help to streamline the delivery of services both now and in the future, and can help to respond to a common challenge faced by governments around the world: the deterioration and decline of infrastructure assets.³⁰

Governments may also struggle to secure funding for low- and no-build options. Comparing proposed projects to past successes makes articulating the long-term economic benefits of building new infrastructure easier. What is needed is clear data on infrastructure asset condition, as well as robust monitoring and evaluation on how these assets are performing.³¹

Grasping the long-term risks and overcoming uncertainty is key to unlocking the systemic benefits of low- or no-build solutions, where financing and investments require a clear picture of short-term and long-term benefits.³² Examples of this include post-disaster reconstruction gains in New Orleans after Hurricane Katrina, where permeable paving, rain barrels and dry creeks can reduce stormwater run-off.³³

Scaling up

The full benefit of low- or no-build solutions is achieved through learning from the successes of previous projects. Gaining clarity on how and where different options can be used, however, is not straightforward.³⁴

For example, the City of Bristol has put in place regulatory measures to support the use of sustainable flood management in the city after implementing nature-based solutions such as soakaways, swales and water gardens.³⁵ Canada's Municipal Natural Assets Initiative supports municipalities in incorporating natural assets into their financial decision-making and asset management processes.³⁶ This municipal-wide intervention was based on previous successes of using natural assets to provide infrastructure services.

³⁰ ICE (2022) [ICE Green Paper: How can the UK's infrastructure be made more climate resilient?](#)

³¹ Ibid.

³² ICE (2024) [Unblocking barriers to nature-positive solutions: a State of the Nation deep dive](#)

³³ Global Center on Adaptation (2020) [This is how New Orleans is rebuilding to be more resilient](#)

³⁴ ICE (2024) [Presidential Roundtable summary: How can governments incorporate nature-based solutions in their infrastructure systems?](#)

³⁵ Dudley Saunders and John Martin (2022) [The role of green infrastructure in pluvial flood management and the legislation surrounding it: A case study in Bristol, UK](#)

³⁶ ICE (2024) [Unblocking barriers to nature-positive solutions: a State of the Nation deep dive](#)

Working differently

Using low- or no-build infrastructure often requires all stakeholders, including government, the private sector and non-profit organisations, to work together to implement effective policy mechanisms. That said, when using these mechanisms, stakeholders need to work in different ways to implement them, and this creates a challenge.

For example, the HM Treasury Green Book provides the right tools for assessing nature-based solutions in the United Kingdom. However, difficulties arise when government officials are required to change their working methods.³⁷

As low- or no-build solutions are often specific to the exact service need of an infrastructure programme or project, consideration needs to be given to how innovative approaches can be adapted to suit the specific project. Geography, maintenance structures, skills and politics all play a role in how low- or no-build solutions are used.

Technical capacity and maintenance requirements

Many governments around the world lack the technical capacity to incorporate low- or no-build solutions in strategic infrastructure planning. In many cases, new skills are required to facilitate the policies needed to design and implement low- and no-build solutions, and to maintain the infrastructure once it is built.

Because low- or no-build solutions are developed and function differently from the more traditional concrete-based infrastructure, they also often require a change of use or loading (repurposing), and different maintenance regimes (especially for nature-based, green infrastructure, or blue-green infrastructure). Understanding these different requirements and providing the skills needed for infrastructure maintenance is essential for delivering the anticipated service. To facilitate this, monitoring provides an opportunity to provide the data needed.

A key learning from ICE President Anusha Shah's presidential year is that civil engineers are creative problem-solvers, and this very 'inventiveness' can be used to develop the necessary technical capacity and maintenance regimes to support the use of low- and no-build solutions.³⁸

About the ICE

Established in 1818 and with over 97,000 members worldwide, the Institution of Civil Engineers exists to deliver insights on infrastructure for societal benefit, using the professional engineering knowledge of our global membership.

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³⁷ ICE (2024) [Presidential Roundtable summary: How can governments incorporate nature-based solutions in their infrastructure systems?](#)

³⁸ ICE (2024) [Unblocking barriers to nature-positive solutions: a State of the Nation deep dive](#)