Transport Sustainability Case study

Carbon positive commuter car parks

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Sustainability focus areas



Respond to climate change



Improve environmental outcomes



Respect culture and heritage



Empower customers to make sustainable choices

Transport for NSW strategies

Sustainability Plan 2021

NSW Future Energy Strategy/Action Plan (2020)

NSW Government Electric Vehicle Strategy (2021)

Environment & Sustainability Policy

NSW Climate Change Policy Framework



Transport for NSW has designed two multistorey car parks at Leppington and Edmondson Park (South) to achieve a carbon positive outcome.

Highlights

The Commuter Car Park program is delivering infrastructure to make public transport more accessible. Considering whole of life emissions, including during construction, the design approach of the car parks has reduced embodied carbon emissions by an estimated 18 per cent. This equates to 3866 tonnes of carbon dioxide equivalent (CO2-e) avoided. The remaining embodied carbon emissions will be more than offset through the operational carbon emission savings over their 50-year operational life, reflecting our strong commitment to transform the Transport sector to net-zero emissions by 2050.



Achieved a joint Infrastructure Sustainability (IS) 'Excellent' Design rating.

More information

Visit our <u>Leppington</u> and <u>Edmondson Park (South)</u> project pages for more information on how we are making public transport more accessible.

Check out our sustainability commitments and achievements on the sustainability website.

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As part of the <u>Commuter Car Park program</u>, Transport is delivering 4000 new commuter spaces at 13 locations.

Sustainability outcomes

Located in South-West Sydney, the five story Leppington and six story Edmondson Park (South) car parks provide commuters with more than 1000 parking spaces at each location. The two car parks have reduced energy related emissions by 153 per cent against a reference building, courtesy of considered, sustainable and functional design, complete with future-proofing key design elements.



Respond to climate change

Key resilience and climate change adaption measures

The roof level of both car parks is covered with steel roofing to support solar panels, which have been sized to cover the entire roof. The sizing of the rooftop solar photovoltaic (PV) system was informed by a detailed Whole of Life Cost analysis, which included an analysis on PV sizing options, EV charging technology and the integration of battery energy storage. Following the outcome of the study, it was decided the PV system was to be maximised for both car parks, providing the most benefit from the available roof space. The rooftop solar structures provide refuge from direct sunlight and extreme temperatures, delivering additional shade for commuters and parked cars.



Figure 1: Over 1300 solar panels on the roof of Leppington car park

Ground floor of the Leppington car park is raised above the one percent Annual Exceedance Probability (AEP) Flood Zone, and the access points are outside the flood area, to ensure the car park is operational during high rainfall events. Water-sensitive urban design features have been installed, such as a dual rainwater capture and on-site detention system. The on-site detention tanks filter stormwater from vehicle impurities and help mitigate localised flooding. Across both car parks, rainwater compartments can store a total of 600KL. This captured water will be reused for cleaning and landscape irrigation purposes reducing an estimated 30 per cent of total demand for potable water.

Designed to reduce embodied carbon emissions

A range of initiatives were undertaken to reduce the material impact of the two car parks. The structural design optimised the use of concrete and reinforced steel, and reduced quantities required of both components.

The concrete mix employed is designed with an average of 37 per cent recycled material in place of Portland cement. For the ISC Mat-1 credit, the material savings from supplementary cementitious material (SCM) replacement in concrete were quantified and resulted in an 18 per cent reduction in the material impacts across the construction and operation of the car parks alone.

Smaller stair cores resulted in a reduction in concrete walls and at Edmondson Park (South), the existing ground slab sub-grade was reused. Concrete upstand was replaced with proprietary steel crash barriers, resulting in a reduction in overall building weight and concrete footings; and enabling the slab to act as cantilever, removing the need for external columns.

Reinforced steel with an estimated 65-80 per cent recycled scrap content and Environmental Product Declarations, which demonstrate lower embodied carbon, was procured for the build. The use of post-tensioned slabs reduced the amount of steel reinforcement required.

A range of design modifications enabled less structural material and thus concrete required than traditional designs including:

- Modified ramp design increases the number of car spaces per total floor area, resulting in less structural material required per car space.
- Optimising column spacing reduced the overall number of columns required to provide structural support to the upper levels.
- Rearrangement of band beam orientation to an East-West direction reduced overall band beam length and the number of columns.
- Optimising the foundation design, adopting larger piles, and founding on rock with more skin friction, resulted in a 50 percent reduction in piles and deletion of pile caps.
- Smaller stair cores resulted in a reduction in concrete walls.

The carbon positive approach adopted by these two projects is anticipated to avoid 115,188 tonnes of carbon dioxide equivalent (CO2-e) over the construction period and 50 years of operation. Transport is committed to radidly reducing our greenhouse gas emissions, transitioning to low-carbon options and building climate resilience across our network, as we strive to achieve net zero emissions by 2050.

Carbon dioxide equivalent, also known as CO2-e, is the universally adopted unit of measurement to indicate the global warming potential of each of the greenhouse gases.



Improve environmental outcomes

The installation of highly efficient LED lighting, with motion detection and daylight sensors for each fitting, has significantly reduced overall operational lighting demand.

A combined 1370 kWp of rooftop PV panels have been installed across both car parks. The panels are projected to produce at least 130 per cent above the annual operational energy requirements of the two car parks. The excess solar supply then feeds back to the grid, helping the community with sustainably sourced energy.

To encourage mode shift to low emission vehicles, electric vehicle charging stations have been installed in 10 car spaces in each of the car parks.



Figure 2: Electric vehicle charging spaces at Leppington multi-storey commuter car park

Future proofing through adaptable design

The Leppington and Edmondson Park (South) car parks have been designed for adaptability and disassembly, to consider the whole of life material use and future uses of the facilities.

The ground level of each car park has been designed so it can be converted into commercial, community or retail space. An increase in ground floor height – from a typical 3m to 4.5-6m – will enable future conversion into commercial space or other community use. Ramps accessing the upper levels have been designed to maintain access to the carpark while the ground floor is utilised for other purposes. Hydraulic services are included on the ground floor, so future spaces can be easily created without the need to demolish existing structures.

The structural design allows for up to two additional floors to be added if required, and the roof structure supporting the PV solar system has been designed to allow for detachment and reattachment if additional levels are required.

As the uptake of electric vehicle usage increases, cable route infrastructure has been installed to allow for electric vehicle chargers to service up to 15 per cent of all car spaces in the future.



Figure 3: Edmondson Park South commuter car park

The Leppington car park reached practical completion on 18 October 2021 and Edmondson Park (South) on 24 January 2022. The two car parks boast very similar structures and have both achieved a joint Infrastructure Sustainability (IS) 'Excellent' Design rating.



Respect culture and heritage

During the design phase of Leppington and Edmondson Park (South) car parks, ongoing engagement and consultation with the Tharawal Local Aboriginal Land Council explored collaboration opportunities. This developed into an Aboriginal led co-design process for the façades at both car parks. Future opportunities were identified around landscaping and a storyboard interpreting local Aboriginal heritage and context to the designs.

Indigenous participation in the design was conceptualised by Aboriginal Architect Michael Hromek-Yuin (Badawang) and managed by Josh Loyd (Wajarri Yamatji), providing Indigenous led and managed participation throughout the design process.

Shane Smithers artwork 'Where Sky Meets Earth' has been incorporated into the façade at Leppington car park, embedding cultural values and principles into the development.

Aboriginal artist Shane Smithers (Darug, Burraberongal) was engaged to assist with design and interpretation of artwork. In this artwork, Shane has horizontal lines representing Mother Earth and vertical lines representing Father Sky. The art piece reflects that Darug Country is a place where sky meets earth, and the generative forces of Wiari (Mother Earth) and Biari (Father Sky) come together to create all life.

For the Edmondson Park (South) façade, Shane produced a new artwork titled 'Ghost Trees and The Lost Woodland', which focuses on the destruction and degradation of the native Cumberland Plain Woodlands. The north, south and western façades show a pixilated form of the woodlands, resembling the remaining isolated trees and acknowledging the loss experienced.

The east façade shows a detailed representation of the woodlands among an urban backdrop of houses and rooflines, to provide hope for urban regeneration. The image details the tree roots in the soils and tree canopy in the sky, sharing Indigenous knowledge and connection to Mother Earth and Father Sky. This connection represents the coming together of the forces of birth, rebirth and regeneration.



Figure 4: Feature façade at Edmondson Park South commuter car park