Kingfisher Technical Solutions

Automated Parking Systems Sustainability Report

Preface

This independent report has been researched and compiled by:

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Ben is the Managing Director of Mainer Associates, leading a team of experts in delivering sustainable development across various sectors.

Colin is the Managing Director of Kingfisher Technical Solutions, an independent specialist consultancy with global expertise in all types of Automated Parking Systems.

Introduction

This report highlights the real sustainability benefits that Automated Parking Systems can bring when compared to a conventional car park.

Key findings include:

- ✓ Significant energy efficiency improvements
- ✓ Reduced running costs
- ✓ Reduction in the amount of space required
- ✓ Improved BREEAM, LEED and Green Star credit scoring

Data

Data used to form the basis of the review:

- ✓ Quantity of Vehicles based on surveys of similar sized operating car parks
- ✓ Background energy consumptions for electrical systems
- ✓ Operating energy consumptions for electrical systems
- ✓ Vehicle emissions including CO_2 NO_x and PM_{10}
- ✓ Energy emissions in CO_2
- ✓ Embodied Energy for construction

NOTE: All data marked with an asterisk in this report*, including calculations and survey data, is taken from Waterman Building Services (2009) 'Independent Environmental Review' technical report.

Report Structure

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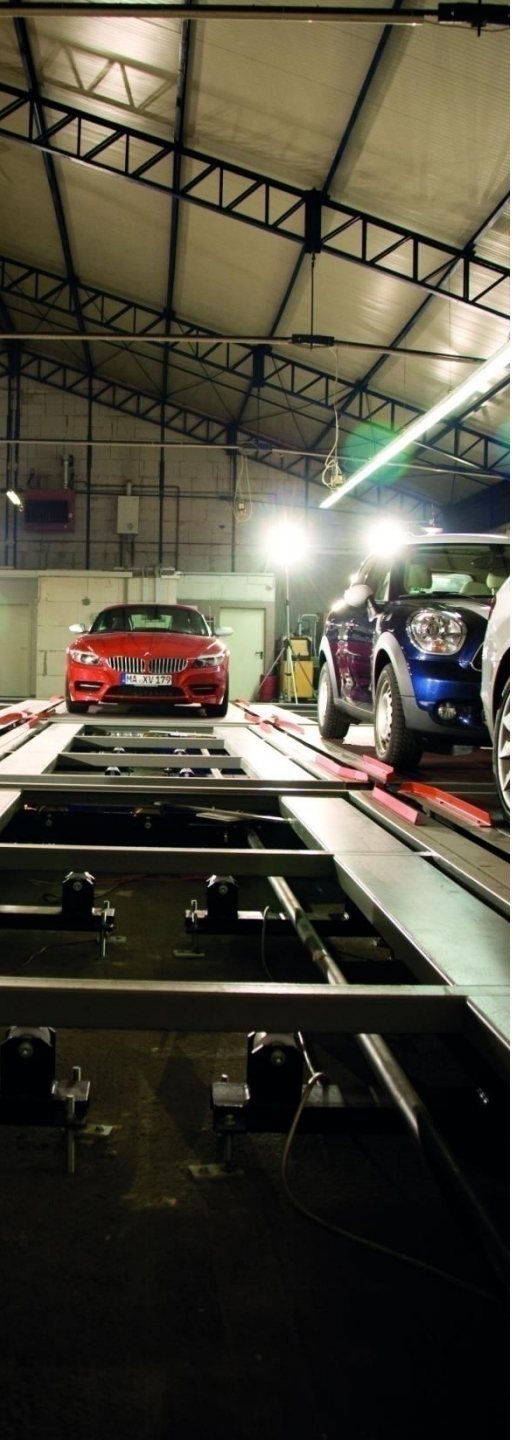
The report is structured in two key sections:

- ✓ Sustainability Benefits
  - CO_2 Emissions
  - Embodied Carbon ECO_2
  - NO_x and PM_{10} Emissions
  - Energy Costs
  - Space
  - Electric Car Charging
- ✓ Building Assessment Methodologies
  - BREEAM Credits
  - LEED Credits
  - Green Star Credits



Sustainability Benefits - CO_2 Emissions

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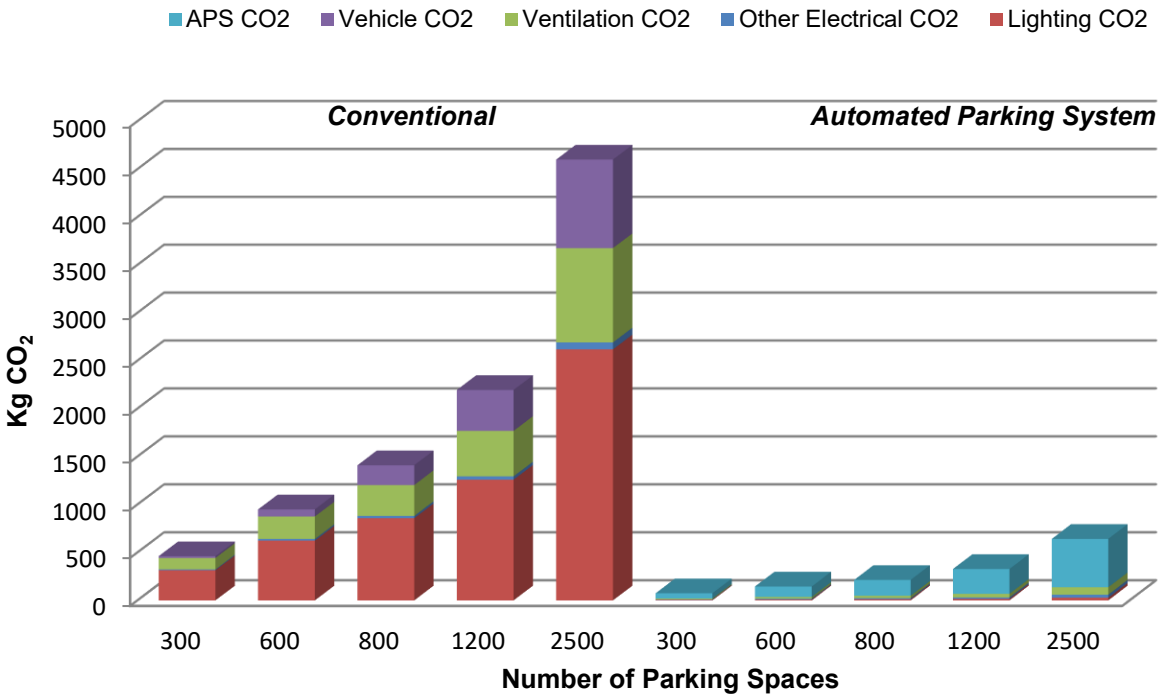
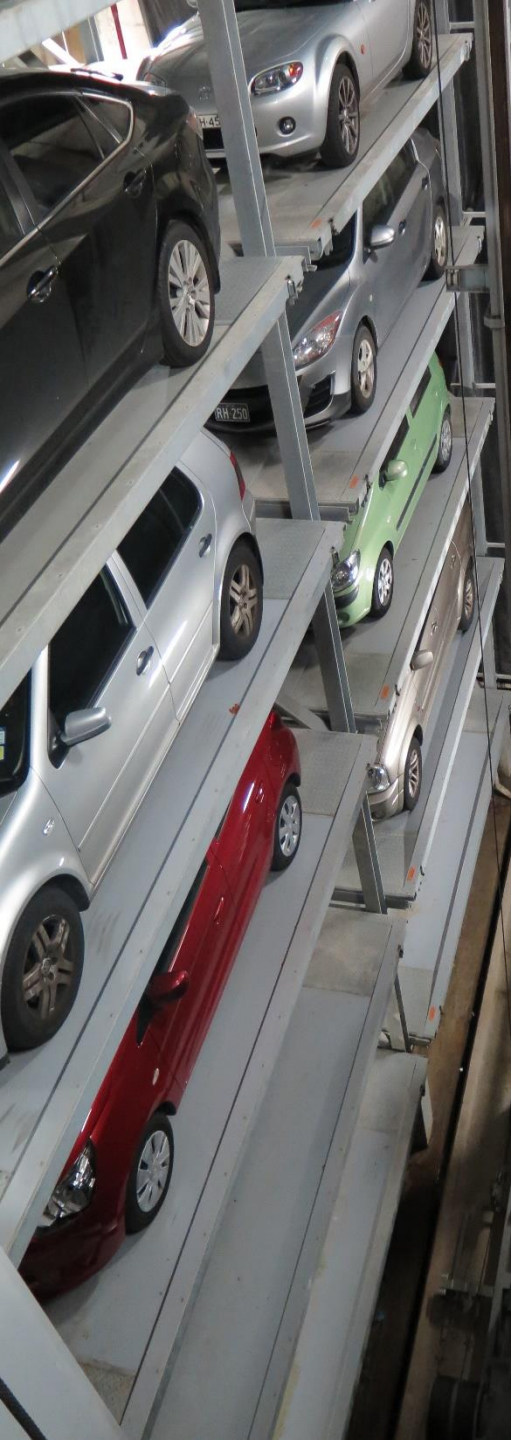


*This graph demonstrates significant reductions in total CO_2 emissions associated with both vehicle output and output from operating the building, when you compare a Conventional car park with an Automated Parking System**



Sustainability Benefits
- Embodied Carbon ECO_2

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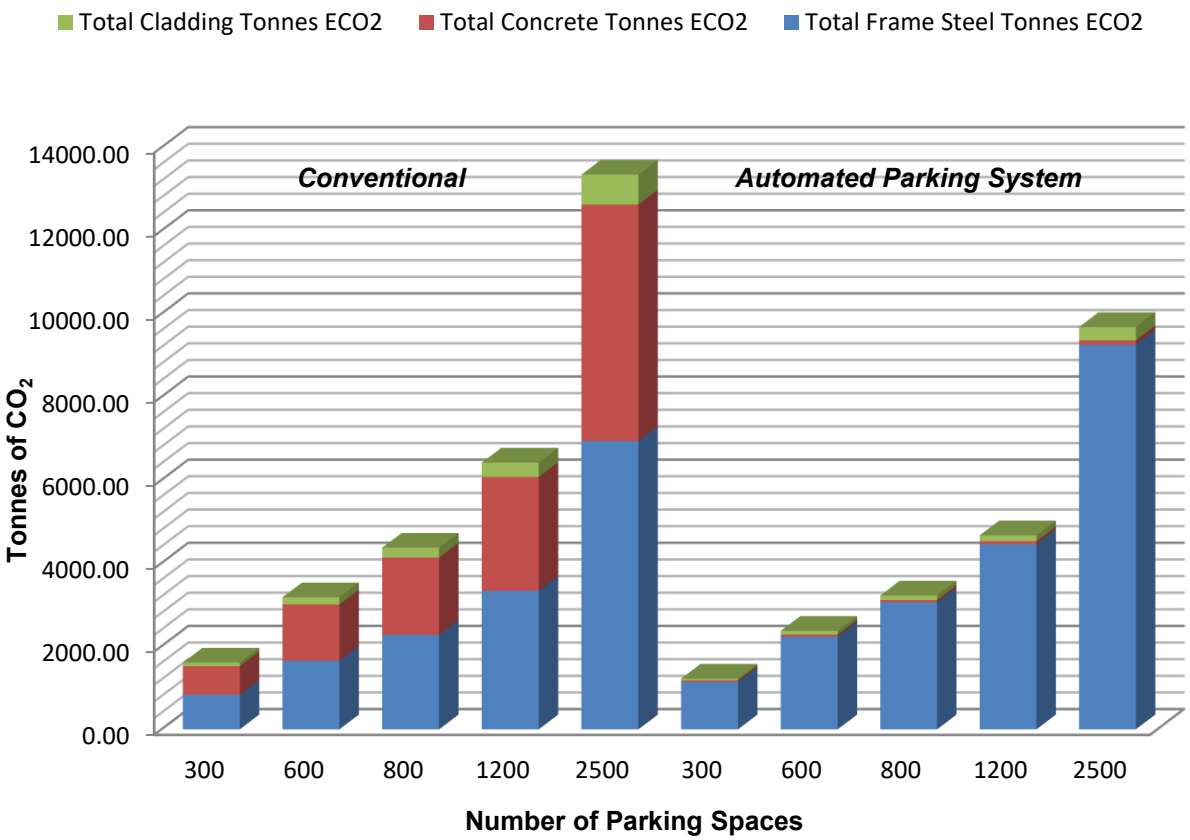

*This graph demonstrates a significant reduction in total ECO_2 when you compare a Conventional car park with an Automated Parking System**

Sustainability Benefits – NO_x and PM_{10} Emissions

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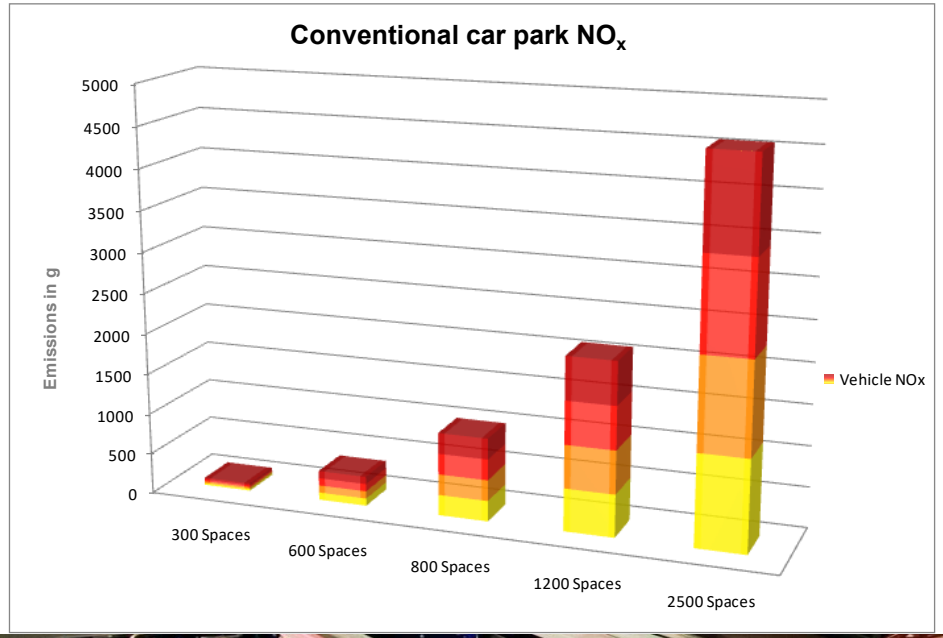
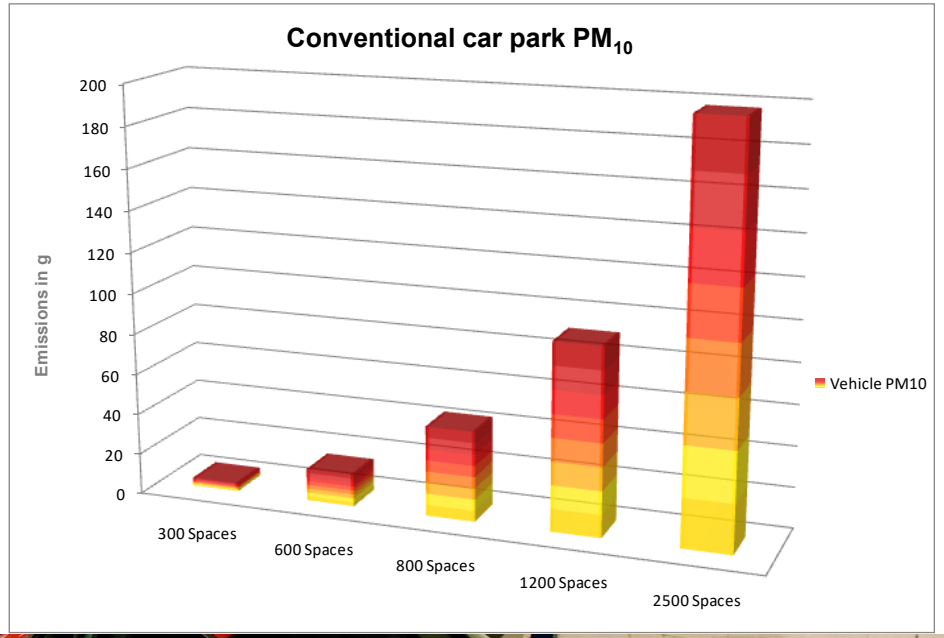
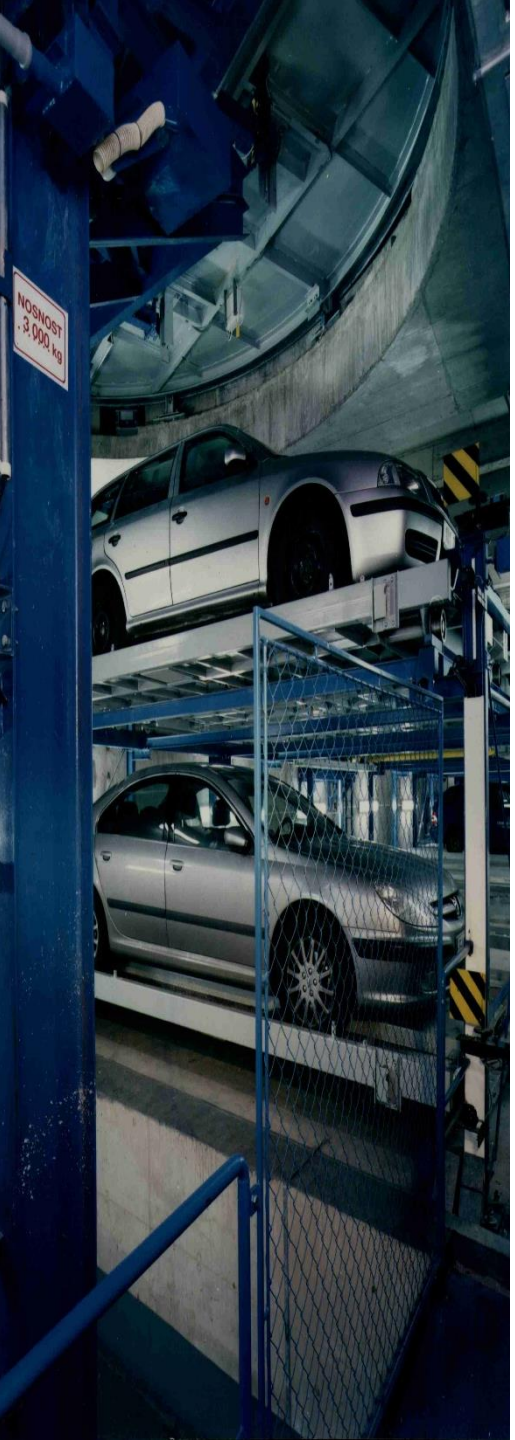
*There are no NOx or PM10 emissions associated with an Automated Parking System. The two graphs below show the NOx and PM10 emissions associated with a Conventional car park **







Sustainability Benefits
- Energy Costs

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*From the predicted total energy consumption for each type of car park, an assessment has been made regarding their respective energy costs for a year of operation. The graph shows the operating costs of different car park sizes for both Conventional and Automated Parking Systems. Additionally, both above and below ground scenarios are considered**

Sustainability Benefits – Space

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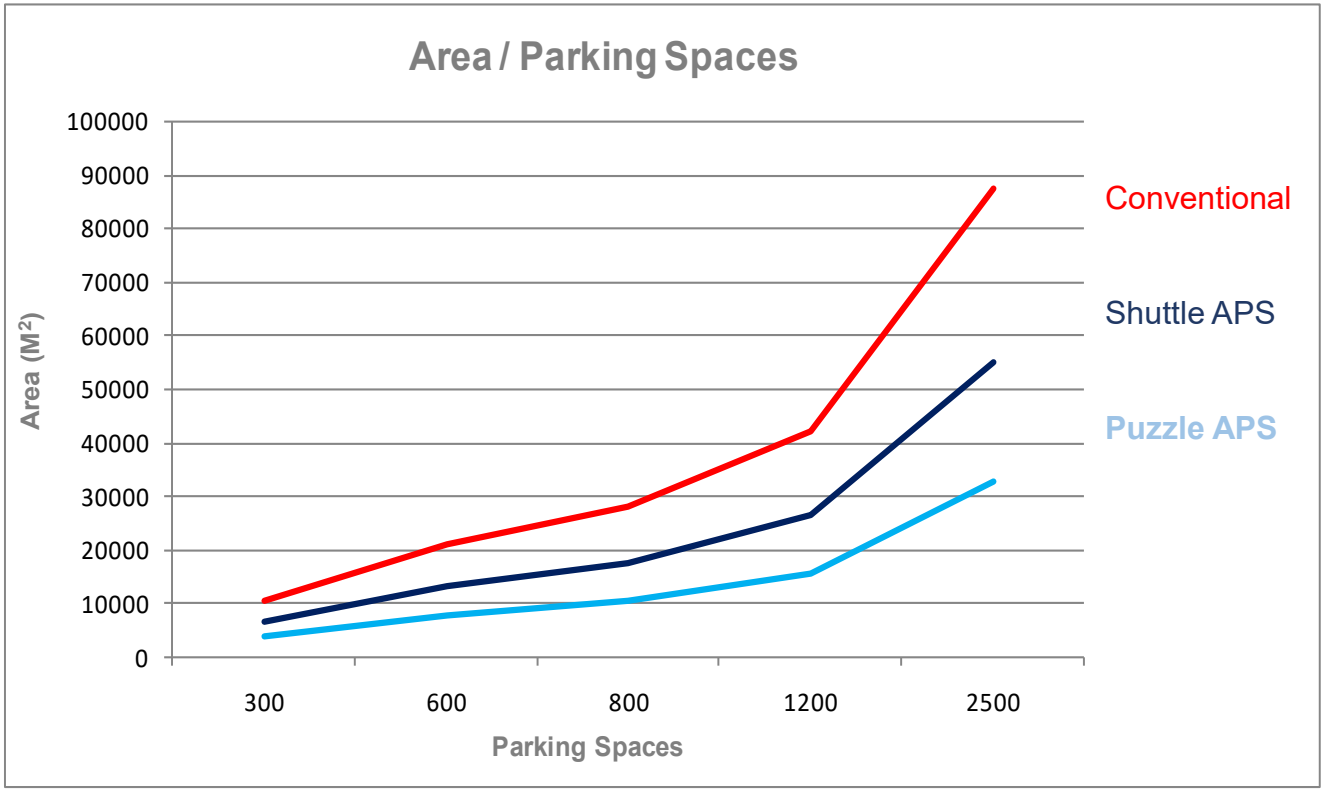

*This graph shows the greater space required for a Conventional car park compared to two types of Automated Parking Systems **

Sustainability Benefits
- Electric Car Charging

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With more electric cars coming onto the market, Electric Car Charging is clearly an area of growth, and one deemed by the Government and carbon reduction experts as being a way forward for the future of motoring. Hence, Government grant schemes have been brought in to help grow the market.

Leading experts in the field have highlighted infrastructure growth as crucial to the expansion of this market. The Department for Transport is encouraging businesses and householders to install charge points, while companies such as Chargemaster have announced their intention to install thousands of points across the UK.

Some Automated Parking Systems have specific spaces with charging points built in so that electric cars can be charged whilst they are parked.

Building Assessment Methodologies

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Building Assessment Methodologies are used throughout the world as frameworks for measuring the environmental performance of a building. They are used to promote sustainable construction and to drive best practice in the sector.

The following information details some of the credits that an Automated Parking System can attract within the frameworks below:

- ✓ BREEAM
- ✓ LEED
- ✓ Green Star

There are other methodologies that would need to be considered such as MOHURD's Green Building Label of China and Estidama of Abu Dhabi, however, we have focused on the above three for the purposes of this report.

Building Assessment Methodologies - BREEAM Credits

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- ✓ Man 2 – Responsible Construction Practices
- ✓ Hea 2 – Indoor Air Quality
- ✓ Ene 1 - Reduction of CO_2 Emissions
- ✓ Ene 4 – Low & Zero Carbon Technologies
- ✓ Tra 3 – Cyclist Facilities
- ✓ Mat 1 – Life Cycle Impacts
- ✓ Mat 5 – Designing for Robustness
- ✓ Wst 1 – Construction Waste Management
- ✓ LE 1 – Site Selection
- ✓ Pol 3 – Surface Water Run-off
- ✓ Pol 4 – Reduction of Night Time Light Pollution
- ✓ Inn 1 – Innovation

BREEAM®

Building Assessment Methodologies - LEED Credits

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Sustainable sites
Prerequisite 1 - Construction Activity Pollution Prevention

- ✓ SS Credit 1 – Site Selection
- ✓ SS Credit 4.3 - Low-Emitting and Fuel-Efficient Vehicles
- ✓ SS Credit 4.4 - Parking Capacity
- ✓ SS Credit 5.2 - Maximize Open Space
- ✓ SS Credit 6.1 - Stormwater Design, Quantity Control
- ✓ SS Credit 6.1 - Stormwater Design, Quality Control
- ✓ SS Credit 8 - Light Pollution Reduction

Energy and atmosphere
Prerequisite 2 - Minimum Energy Performance

- ✓ EA Credit 1 – Optimize Energy Performance
- ✓ EA Credit 2 – On-site Renewable Energy

Materials and resources
Prerequisite 1 – Storage and Collection of Recyclables

- ✓ MR Credits 1.1 & 1.2 – Building Re-use
- ✓ MR Credit 2 – Construction Waste Management
- ✓ MR Credit 3 – Materials Re-use

Building Assessment Methodologies - Green Star Credits

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- ✓ Man 7 – Waste Management
- ✓ Ene – Conditional Requirement
- ✓ Ene 1 – Greenhouse Gas Emissions
- ✓ Ene 5 – Peak Energy Demand Reduction
- ✓ Tra 2 – Fuel Efficient Transport
- ✓ Tra 3 – Cyclist Facilities
- ✓ Mat 2 - Building Re-use
- ✓ Mat 9 – Design for Disassembly
- ✓ Eco – Conditional Requirement
- ✓ Eco 2 – Re-use of Land
- ✓ Emi 5 – Watercourse Pollution
- ✓ Emi 7 – Light Pollution
- ✓ Inn - Innovation

Conclusion

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There are numerous significant sustainability benefits in installing Automated Parking Systems over conventional car parks

- ✓ Significant energy efficiency improvements with reductions in:
  - CO_2
  - ECO_2
  - NO_x
  - PM_{10}
- ✓ Reduced running costs
- ✓ Reduction in the amount of space required
- ✓ Improved scoring in:
  - BREEAM
  - LEED
  - Green Star

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