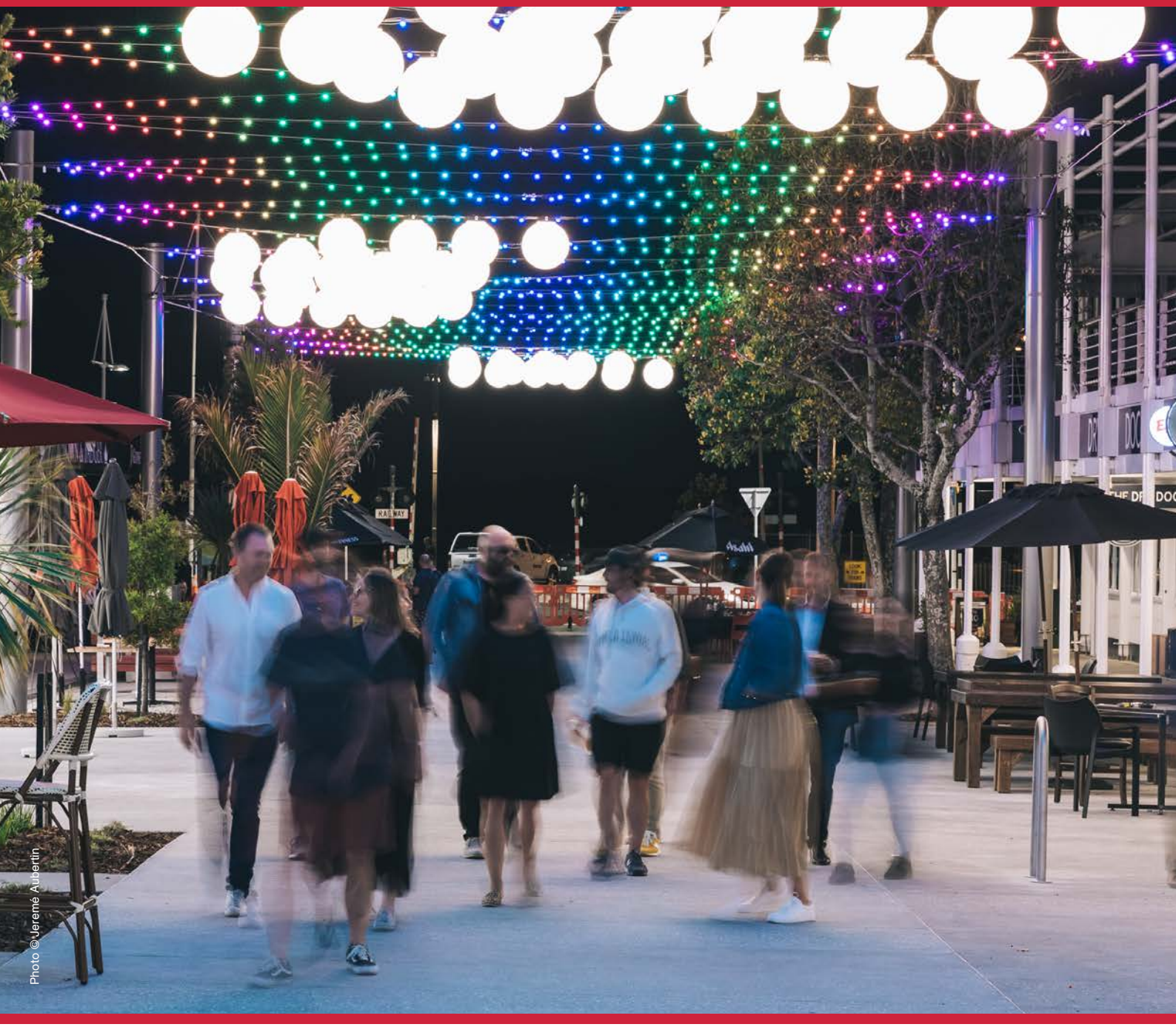
Lighting the urban night

How catenary lighting systems enliven public spaces and maximise their use and return



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Introduction

The design of public lighting is critical as it transforms public spaces, going beyond illumination to improve the quality of life for humans. Good lighting provides night-time visibility, increases pedestrian safety, reinforces community boundaries and draws attention to the uniqueness of an area.

In the past, public lighting design has lacked imagination and coordination, resulting in the reliance on conventional solutions that detract from the functionality and aesthetics of our urban environments. Over-illumination and light pollution are particular concerns, with excessive or poor use of artificial outdoor light disrupting natural habitats, obscuring the stars in the night sky, and causing a nuisance to neighbouring residents. In addition, the light poles and fixtures characteristic of traditional street lighting often intrude on public spaces and are difficult to match with the overall aesthetic of the surrounding area.

As local governments look for ways to revitalise neighbourhoods, the renewed appreciation of usable urban spaces provides an opportunity for architects and designers. Due to pressures of increasing urban density, such spaces are under constant scrutiny in terms of their effective use and return. Good lighting design can extend the return on an expensive public asset – the space itself – through greater usage of the asset during the evening.

The challenge is to enable the cost-efficient adaptation of public spaces while enhancing their functionality, ambience and character, something which conventional lighting solutions often fail to achieve. Of the lighting solutions available, catenary lighting is probably not the first that comes to mind, but it is gaining popularity due to its unique benefits. Suspending luminaires from cables allows designers to focus light on specific areas while leaving others in darkness, creating elegant lighting arrangements with a minimal space and energy footprint.

In this whitepaper, we look at the growing importance of public lighting, the emergence of catenary lighting as an effective solution for public lighting, and the key considerations when planning and designing a catenary lighting system.

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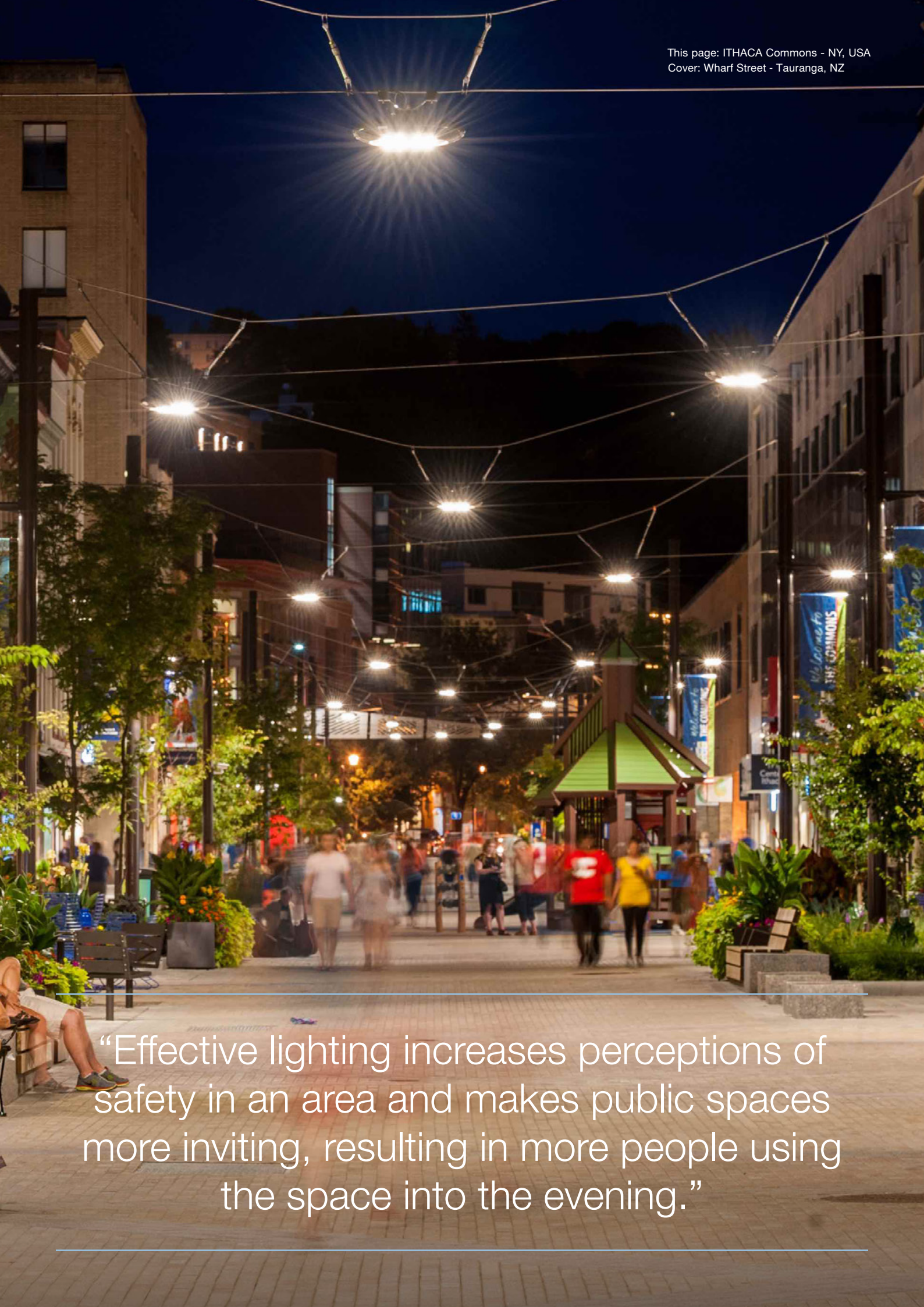


This page: ITHACA Commons - NY, USA
Cover: Wharf Street - Tauranga, NZ

"Effective lighting increases perceptions of safety in an area and makes public spaces more inviting, resulting in more people using the space into the evening."

Photo © Jonnu Singleton

Left: Avenida Houston – TX, USA
Right: Lakeside Joondalup - WA, AUS

"Catenary lighting utilises tensioned cables to span wide public spaces positioning light exactly where it is needed along the way without need for intrusive columns, posts or poles. "

Why public lighting is more essential than ever

Public space is that which is shared by other people. It is the glue that holds cities and neighbourhoods together; a space for community to take place. If public spaces are successful, they benefit the health and wellbeing of the community, provide a sense of civic identity and culture, and have the ability to drive economic growth.

In Australia, governments are recognising the importance of public space and investing significantly into open space strategies and infrastructure. The most successful cities around the world place a high priority on their public realm, transforming wasted space into meaningful public amenity. Accordingly, it is the duty of architects and designers to not only make public spaces attractive and welcoming, but also to activate them and make them accessible.

Effective lighting increases perceptions of safety in an area and makes public spaces more inviting, resulting in more people using the space into the evening. A positive night-time experience allows users to enjoy spaces for longer periods for activities such as exercise, commuting and socialising, rather than only for transient use. Well-considered lighting can also highlight the design, culture and history of an area, creating spaces that users will return to again and again. These factors establish the conditions for a prosperous night-time economy and a stronger sense of place and community.

Considered lighting design meets the needs of communities in a sustainable and environmentally-sensitive manner. This is where traditional street lighting often falls short: through inadequate lighting or the use of powerful light beams that flood the area and result in excess light pollution and energy consumption. The effects of light pollution are well documented, including impacts on the reproductive cycle of wildlife and disturbing human sleep patterns.[1] Public lighting can also be a major contributor to energy costs and carbon emissions. In Australia alone, the annual energy cost of public lighting exceeds $125 million, making it the single largest source of carbon emissions from local government, typically accounting for 30 to 60% of their total emissions.[2]

What you need to know about catenary lighting

When designing lighting for public spaces, designers are presented with a multitude of options relating to lumens, colour, temperature, power and mounting. Despite its relatively short history, catenary lighting is a functional and versatile solution all designers should consider when maximum reuse of a public space is a key objective.

What is catenary lighting?

A 'catenary' is a curve formed by a wire, rope or chain that hangs between two points. As its name suggests, catenary lighting utilises tensioned cables to span wide public spaces positioning light exactly where it is needed along the way without need for intrusive columns, posts or poles.

Catenary lighting is based on the 'less-is-more' ideology. Suspending luminaires from cables allows light to be focused in areas that need it, leaving other places in darkness, while the space below is unencumbered by any supporting structures. By freeing up the space at ground level, catenary lighting allows greater flexibility and usage of the asset into the evenings.

Benefits of catenary lighting

Precision lighting

The accuracy of the positioning of catenary lighting allows designers to use light and shadow to define a space, whether the objective is to establish a comfortable atmosphere, provide directional lighting or achieve more dramatic lighting effects. For example, specific areas can be targeted with bright light to encourage pedestrian movement, or with softer light for a more peaceful transition between light and dark.

Space optimisation

As it eliminates the need for poles or walls to mount luminaires, a catenary lighting system improves the flow of the area both during the day and at night. It also frees up overhead space, giving designers the opportunity to incorporate decorative features or create spectacular overhead designs that can give the space a unique identity.

Increased public space use

The versatility of catenary lighting systems allows areas that could not be previously lit via conventional means to be reclaimed for public use in the evenings. A common example of this are narrow alleyways in which traditional street lighting could not be used due to space limitations.

Improved safety and security

Increased lighting quality and accurate illumination create a perception of safety and security in a given space. This increases night-time use of the asset while improving accessibility through better wayfinding and easier navigation.

Beautification

Catenary lighting provides the opportunity to amplify the beauty of public spaces. At a minimum, unsightly poles that distract from the space itself can be minimised. Catenary lighting can be positioned to highlight landmarks and create a beautiful ambience that complements the hustle and bustle of night-time activity. Decorative elements, including unique luminaire designs, lanterns, seasonal decorations and more, can be incorporated to create more visually-engaging installations.

Visual interest

Catenary lighting does not need to be static. Advancements in LED technologies and automation systems allow designers to play with lighting effects and patterns to create dynamic light installations that help draw people to the public space or create spaces for entertaining. Individually-controllable lights across the catenary platform can be programmed with an almost limitless range of colours and sequences, from waves of light cascading down a street to dramatic overhead light shows. Some new LED technologies are even interactive, opening the door for truly immersive experiences that are controllable by the public.

Economic benefits

Catenary lighting is cost-effective as the capital expenditure for supporting structures and installation are minimised or avoided entirely. In addition, the accuracy and control provided by a catenary lighting system can help designers control the intensity of lighting in a specific area, thus reducing light pollution, light spill and energy consumption.

Design flexibility

Catenary lighting is a flexible solution that can be used for small, confined spaces (e.g. narrow laneways and alleyways), large expanses and everything in between – all with minimal structural supports. It is a practical solution for effective illumination, or it can play a dual role as an element in unique and beautiful public art installations.

Rundle Mall - SA, AUS

Planning and design

Initial considerations
A high degree of technical competence and experience is required to create a successful catenary lighting system. Like any lightweight structure, the simple form of the cable hides the complexity and high forces. It is advised to engage with a catenary lighting specialist with expertise in the end-to-end delivery of a catenary lighting system and tensile design and construction. A specialist can assist in balancing functionality, aesthetics and performance with cost, quality, maintenance and energy efficiency as well as facilitate the complex structural design needs.

In addition, it is important to have a detailed understanding of how people will use the space. Consultation with the community and other stakeholders will help determine the expectations for the space and how lighting can enhance its use and accessibility. The impact of potential light spill on surrounding wildlife and residents should also be considered.

Purpose

Is the system required to perform a specific function, or is it purely decorative in nature? Some systems are designed to be the focal point of a space, while others are designed to blend seamlessly into the environment. If any special features are required for the system to fulfill a specific function, these should be raised as early as possible.

Lighting requirements
The next consideration is determining the intent of lighting in the space and how the catenary lighting system can meet those requirements. This includes specifying where the light needs to fall, how and to what extent specific areas need to be illuminated, and where shadows can be used to enhance mood and atmosphere. These factors will determine how the layout and catenary cable net geometry is designed, where luminaires need to be suspended, the types of luminaires required, mounting points, power requirements and so on.

Engineering and structural design
Catenary lighting systems can range in complexity. Single cable catenaries are often used for short spans. Linear grid catenaries, with their net-like geometry and extensive attachment point options, are used for larger open spaces with scope for the integration of decorations. Central spine catenary systems comprise a central chord that spans the full length of a long street, dining strip or alleyway, often resulting in an elegant, sculptural form. A random central ring catenary is used for areas where connections may be spaced irregularly around the perimeter.

As catenary systems are tensile structures, it is important to ensure that the cable net design can resist deflection and hold to the required geometry. The reactions that the cables/nets will impart at the mating structures have to be identified. These can be determined through careful analysis of expected loads and winds on the proposed structure and this information can be used to determine the appropriate cable size, strength and construction. Leading catenary specialists utilise 3D computer modelling to determine the most efficient structural sizing to keep cable deflections within acceptable limits and ensure long-life and performance.

Maintenance
During the design stage, consideration should be made for access for cleaning or replacement of lights and general maintenance. During seasonal celebrations or other events, there may be a requirement to change lighting themes or add decorations. This capability should be factored into the design of the system.

Ronstan Tensile Architecture
World leaders in catenary lighting

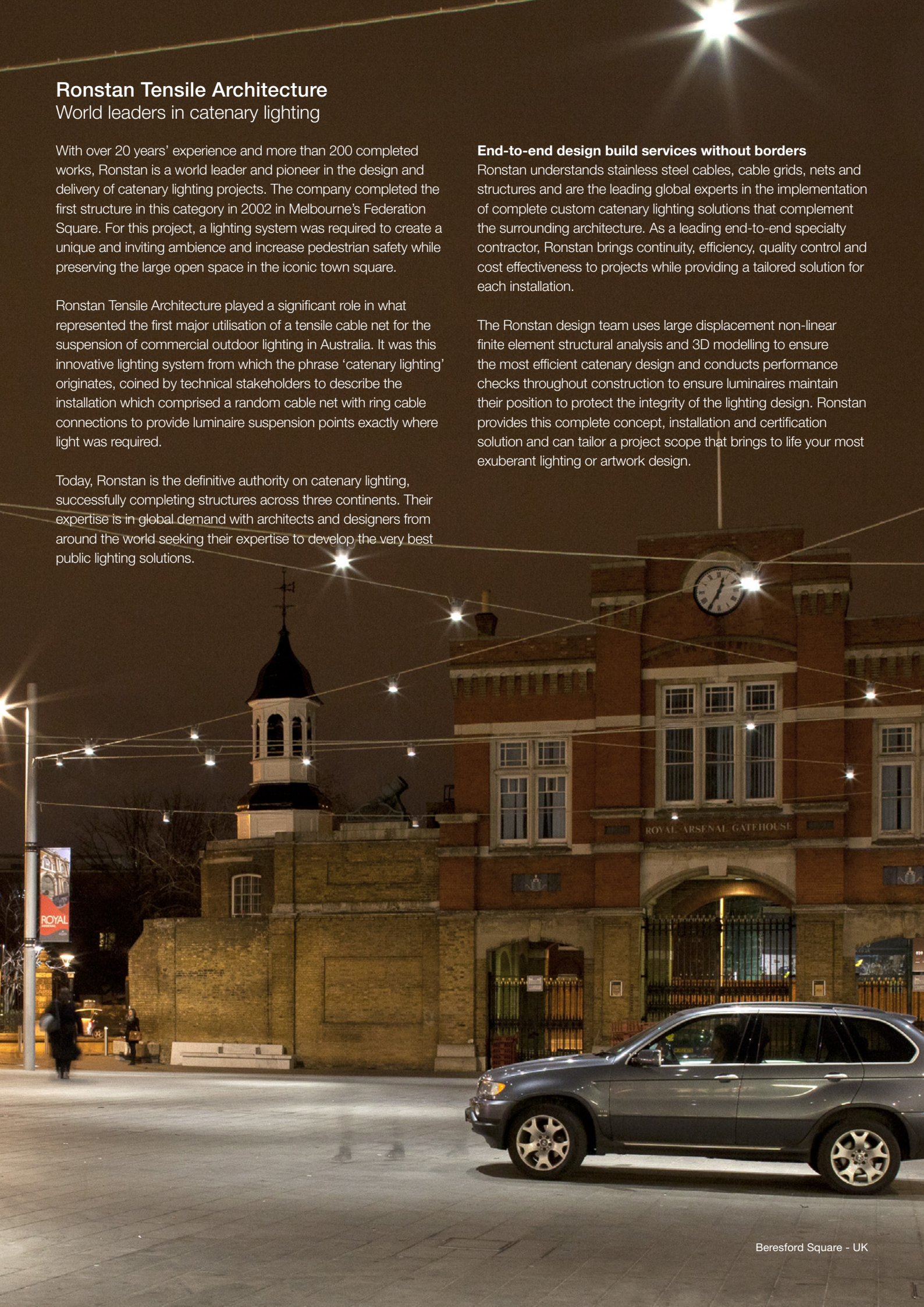
With over 20 years' experience and more than 200 completed works, Ronstan is a world leader and pioneer in the design and delivery of catenary lighting projects. The company completed the first structure in this category in 2002 in Melbourne's Federation Square. For this project, a lighting system was required to create a unique and inviting ambience and increase pedestrian safety while preserving the large open space in the iconic town square.

Ronstan Tensile Architecture played a significant role in what represented the first major utilisation of a tensile cable net for the suspension of commercial outdoor lighting in Australia. It was this innovative lighting system from which the phrase 'catenary lighting' originates, coined by technical stakeholders to describe the installation which comprised a random cable net with ring cable connections to provide luminaire suspension points exactly where light was required.

Today, Ronstan is the definitive authority on catenary lighting, successfully completing structures across three continents. Their expertise is in global demand with architects and designers from around the world seeking their expertise to develop the very best public lighting solutions.

End-to-end design build services without borders
Ronstan understands stainless steel cables, cable grids, nets and structures and are the leading global experts in the implementation of complete custom catenary lighting solutions that complement the surrounding architecture. As a leading end-to-end specialty contractor, Ronstan brings continuity, efficiency, quality control and cost effectiveness to projects while providing a tailored solution for each installation.

The Ronstan design team uses large displacement non-linear finite element structural analysis and 3D modelling to ensure the most efficient catenary design and conducts performance checks throughout construction to ensure luminaires maintain their position to protect the integrity of the lighting design. Ronstan provides this complete concept, installation and certification solution and can tailor a project scope that brings to life your most exuberant lighting or artwork design.



Beresford Square - UK

Aurora at Subi Strand - WA, AUS

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1 Dutfield, Scott. “Light pollution: Environmental impact, health risks and facts.” Live Science. https://www.livescience.com/light-pollution (accessed 6 July 2022).

2 Commonwealth of Australia. “Street and Public Lighting.” Energy Rating. https://www.energyrating.gov.au/products/lighting/street (accessed 6 July 2022).

All information provided correct as of August 2022

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