citygreen™
URBAN LANDSCAPE SOLUTIONS

SPECIFIER UPDATE

ISSUE 20

Trees planted in Stratavault System at Wichita, Kansas, United States

CASE STUDIES

WHITE PAPER

Creating Winnipeg's first 'Woonerf' at John Hirsch Place

The design — based on the Dutch 'Woonerf' (living street) model — flips the traditional approach on its head. Instead, traffic yields to pedestrian activity.

As part of the City of Winnipeg's Northeast Exchange District Renewals project, WSP Canada Group Limited chose to redevelop John Hirsch Placeas a shared space roadway.

One clear feature of Woonerfs is the significant landscaping. At John Hirsch Place, this consists of raised community gardens for annuals, additional trees along the north and south side of the roadway, climbing ivys placed on fences and screens, and perennials in strategic planting areas.

However, this change demanded an under-roadway soil retention system to prevent soil compaction and provide root growth space for vegetation.

The Stormwater enters the systems along the roadway through a series of catch basins to reduce loading on a combined sewer while providing water for the tree roots.

Stratacell: space to grow and strength to support

In collaboration, transportation engineers, land drainage engineers, and landscape architects chose Stratacell.

They calculated the cells would be able to withstanding vehicular traffic and pavement loads and could be placed under the roadway to bolster existing trees' ability to obtain nutrients, air and water without compromising the structural strength of areas beneath the roadway.

And, buried underground, the cells would not limit right of way for road users —a project key goal given the natural space constraints of the location.

How Stratacell works

Perforated drainage pipe runs throughout the Stratacell matrix. Water enters the system through a series of catch basins and saturates the soil beneath the road. Air circulates into the system through small vents distributedthrough the matrix that rise to the surface.

Geotextile fabric prevents soil from escaping and surrounding material from entering (and clogging) the system. Drainable material is used as a base. This enables water to flow through into the subdrain when necessary.

Stormwater enters the systems along the roadway through a series of catch basins to reduce loading on a combined sewer while providing water for the tree roots.

Space for 20 trees and 600 perennials

Stratacell were placed beneath 20% of the roadway pavement — and approximately 45% of the total area of public right of way. This created space (and soil volume) capable of supporting around 600 perennials, as well as 20 new and existing trees.

During excavation, engineers discovered that the roots of existing trees were unable to grow into the road due to the roadbase and pavement. This limited their growth potential.

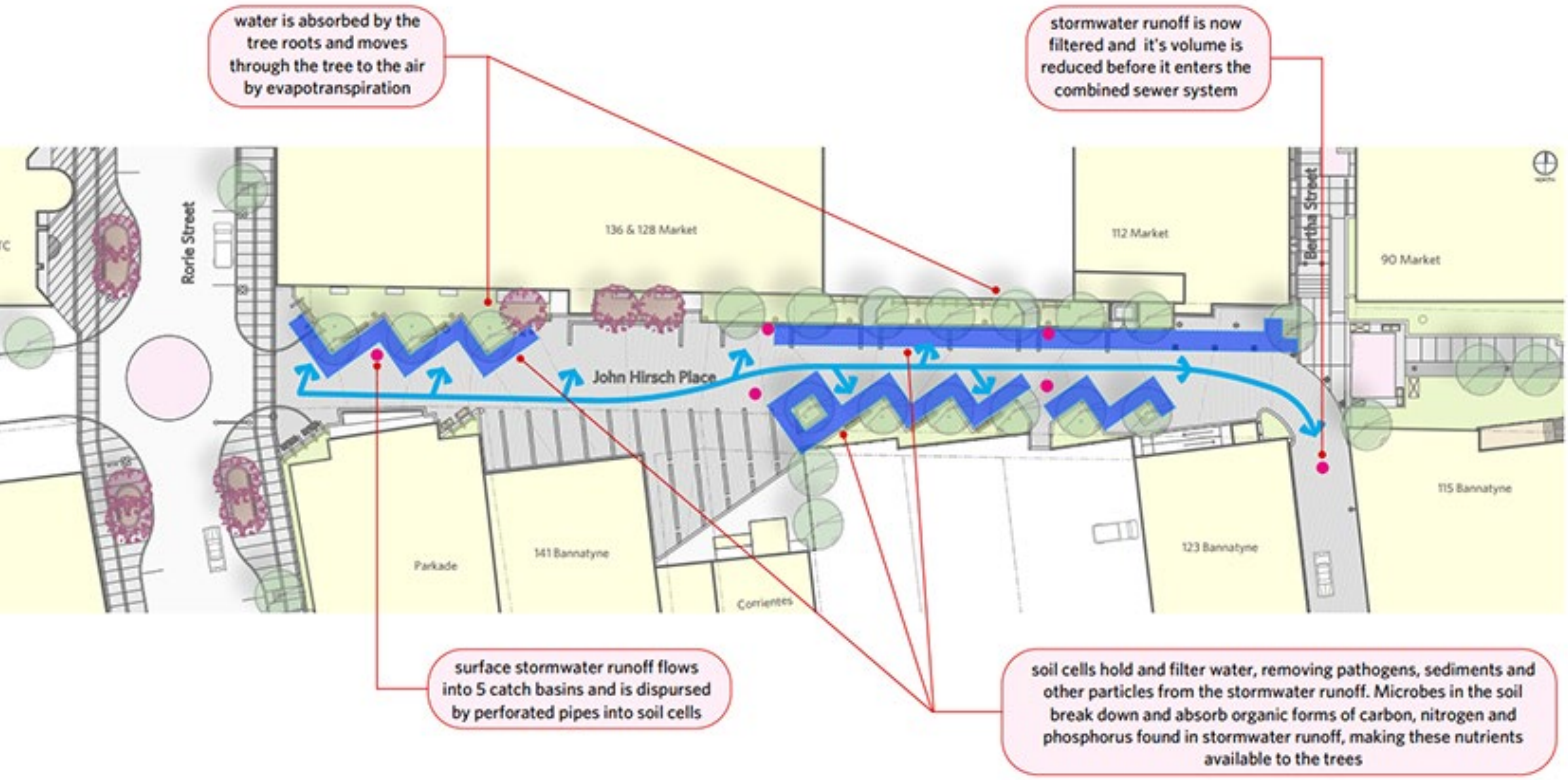
To counteract this, they placed the Stratacells close to trees as possible. Roots were pruned to allow for the cells to be placed closer and maximize system effectiveness. For new tree locations, cells were placed around the tree base with an opening positioned for the root ball.

Stratacell Soil Retention

To accommodate the significant landscape and limited right-of-way within John Hirsch Place, a key component of the design was the incorporation of the Stratacell soil retention system beneath the roadway. The successful application of the soil retention system allows for the trees and shrubs to have sufficient soil volume to facilitate grow and development, while maximizing the available right-of-way for all road users.

The system provides additional benefit by significantly reducing stormwater loading into the combined sewer system to create a more sustainable drainage for stormwater by supplying the tree roots. Stormwater enters the Stratacell system and is absorbed and filtered by the soil. Once the soil becomes saturated, remaining stormwater then flows into the sewer from the sub drain located beneath the system. The City of Winnipeg is exploring options to reduce flow and loading within its aging combined sewer network. Stormwater relief through a soil retention system such as the Stratacell system allows for heavy loading from stormwater to be significantly reduced.

Trees require an abundance of soil for roots to obtain nutrients, oxygen, and water. Conventional methods of providing uncompacted soil require space within the sidewalk either through alternative soil retention systems or traditional sodded boulevards. Where boulevard or sidewalk space for uncompacted soil is unavailable, the Stratacell system can be used to utilize space underneath a roadway to provide additional soil volume for trees to obtain nutrients, air, and water, while still providing the structural strength as a subbase for the roadway. During excavation of the roadway, it was found that tree roots did not grow into the road due to the base and pavement, limiting the growth of the trees. The Stratacells are placed as close to trees as possible to allow for roots to easily enter the system. The existing trees' roots were pruned where possible to allow for the cells to be placed closer to the tree and maximize the effectiveness of the system. Cell location was not finalized until during construction due to the unknown extent of the root system for each tree. For new tree locations, cells were placed all around the base of the tree with an opening located where the root ball was to be placed.



Providing stormwater relief

The system allows for trees in developed urban areas to grow by providing water and air to the system. Perforated drainage pipe runs throughout the Stratacell matrix so that water can enter the system through a series of catch basins and saturate the soil beneath the road. Air circulates into the system through a series of air vents that are spread out through the matrix with vent covers at the surface. The system is protected by geotextile fabric to prevent soil from escaping or from surrounding material from entering the system. Drainable material is used as a base for the Stratacells to be placed on to allow for water to enter the subdrain if necessary. The cells interlock with one another to provide the strength needed to support the pavement structure and vehicular loading and can be stacked atop one another to increase soil volume.

Conclusion

Overall the implementation of Winnipeg's first Woonerf created a shared space that promotes pedestrian activity within the right of way with enhanced pedestrian facilities and safety while maintaining limited vehicle access and parking. The roadway was designed for pedestrians first to encourage pedestrian traffic in the area and create a destination through pedestrian areas with benches and site furnishings, improved

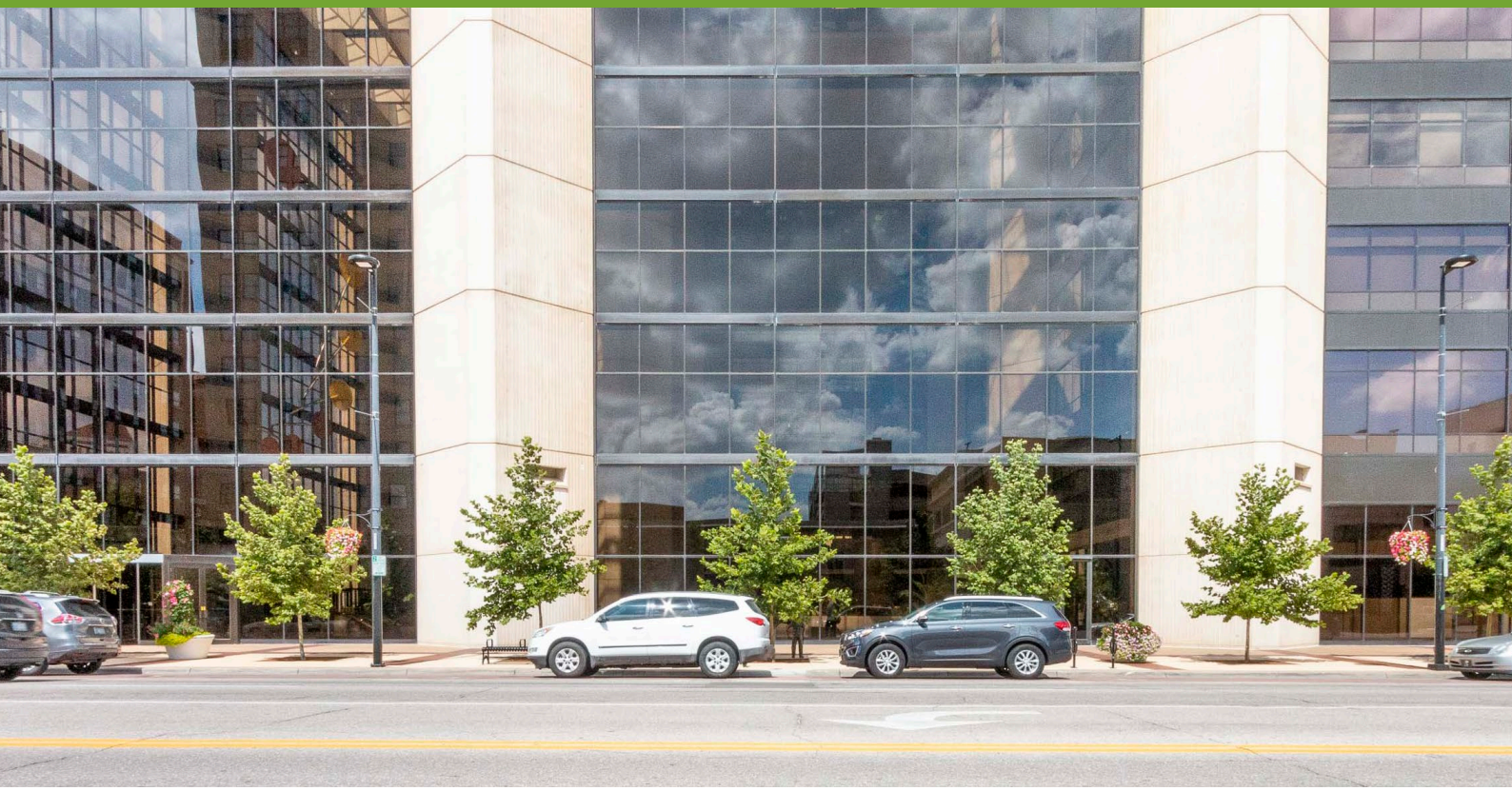
lighting, accessibility within the project area as well as connectivity to the existing pedestrian network. Safety was improved through traffic calming measures and fixtures such as bollards to prevent vehicles from entering pedestrian spaces and provide guidance through the area.

Winnipeg's first street to incorporate Stratacells allowed for the necessary soil volume to be available for the significant landscaping in the area while also not limiting the right of way for road users, which was a key goal of the project due to the space constraints in the urban environment. Overall, the soil retention system and planting areas make up approximately 45% of the public right of way and provide the soil volume necessary for the growth of approximately 600 perennials and 20 new and mature trees. The soil retention system

provides additional benefit in stormwater relief for an old combined sewer system, where reducing loading was another key goal of the project in order to reduce costly sewer maintenance work. Stormwater enters into the soil retention system and only enters the combined sewer if the soil becomes saturated and the additional water enters the subdrain, connected to the combined sewer.

The project utilized new innovative roadway design concepts and tools to improve the pedestrian environment while maintaining vehicle requirements; innovative drainage to reduce sewer stormwater loads and facilitate tree growth; and significant streetscaping and landscaping to create a complex shared space that benefits all road users. The project shows the success of a multidisciplinary team working together and expanding their expertise through innovation and collaboration to meet client needs for a broad and unique project and encourage the future construction of shared streets in Winnipeg.

This is an article written by WSP Global



Stratavault replaces ineffective tree pits in downtown Wichita, Kansas

Focused on enhancing various elements of the streetscape, including build-outs, transit bus shelters, planter pots and an assessment of the tree corridor.

Located on the Arkansas River, Wichita is the largest city in the U.S. state of Kansas. It is also the city's cultural centre and home to many musical, sporting and arts events – many of which take place in the popular Douglas Avenue district.

In 2017, Citygreen was engaged to assist in a revitalisation of this high-traffic area. The project focused on enhancing various elements of the streetscape, including build-outs, transit bus shelters and planter pots. It also included an assessment of the tree corridor, with a view to finding a more effective way to grow healthy, mature trees.

Project goals

A major goal for this project was to find a suitable tree pit system to supersede the existing system, in turn overcoming issues around stunted growth. As William Wells from LK Architecture explained,

Tree wells in the downtown Wichita area are typically a four-foot square opening in the sidewalk. The existing soil is not removed and replaced with good backfill. Trees tend to last around seven years and only reach 60% of their mature size.

The City wanted to try a tree well system for comparison to the traditional method. With this project, trees being replaced had over-excavated tree wells with soil replacement to 3-feet. We were asked to select an alternative to the typical city installation.

Project solutions

As the first test site for the City, a suspended pavement system was recommended to ensure optimum results. Citygreen's Stratavault soil cell system was chosen specifically for its ability to provide ample soil volume and structure.

Two layers of Stratavault were installed in a total of 11 tree pits with a matrix area of 4.35m x 5.85m. London Planetree (Platanus x Acerifolia 'Morton Circle') was the species of choice, selected for its moderate growth rate, attractive foliage and tolerance to harsh urban conditions.

Choosing the right system for this project was critical to ensure a fair comparison to the City's previous tree pits. According to William from LK Architecture, Citygreen were outstanding throughout the selection process, providing technical support and friendly service.

William said,

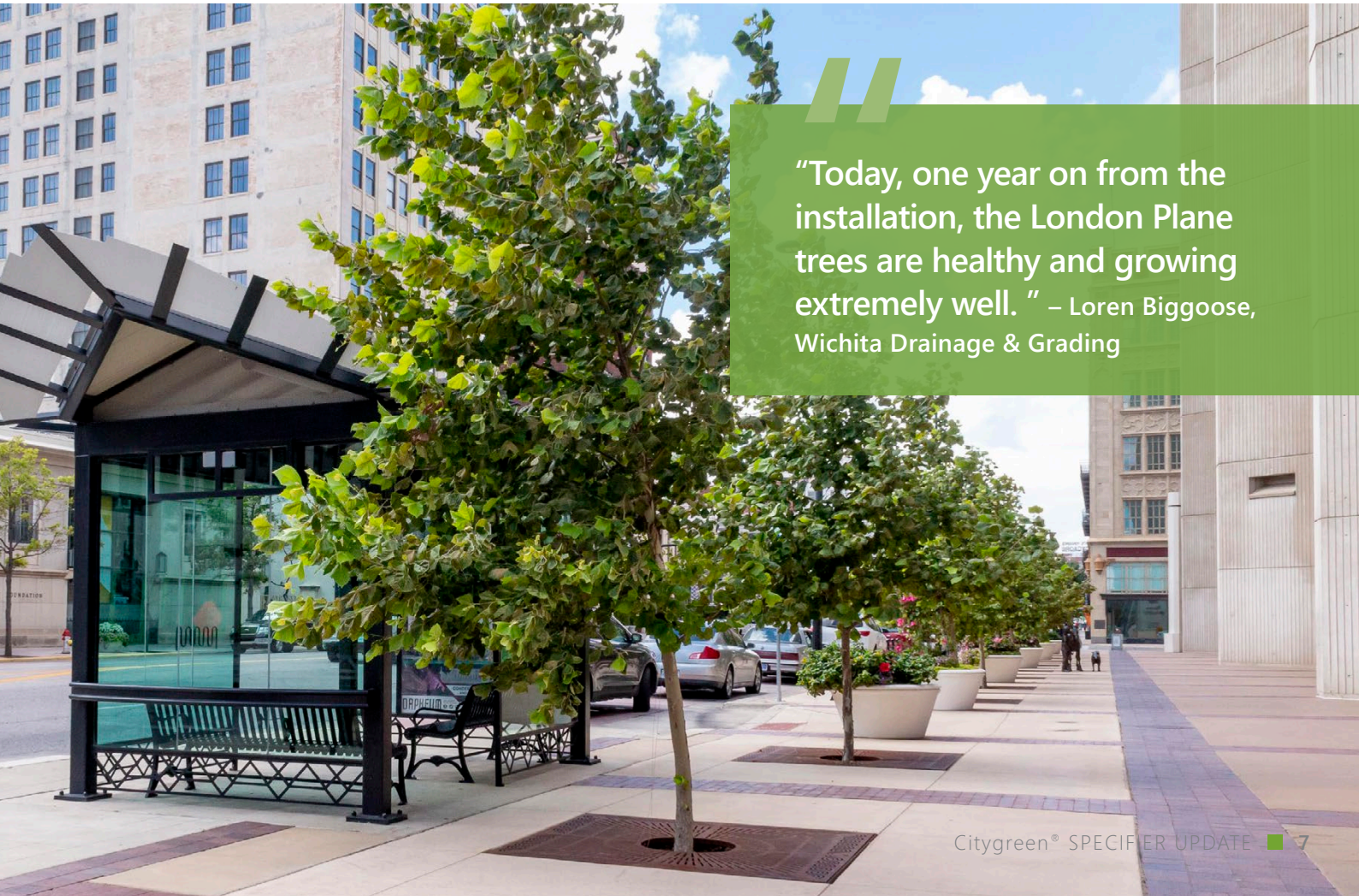
> ***"It was easy to reach a person to talk with. The sales representative was exceptionally helpful in providing all the materials to understand the system, determine soil volumes, and produce construction details."***

Project Outcomes

Today, one year on from the installation, the London Planetrees are healthy and growing extremely well. Loren Biggoose from Wichita Drainage and Grading explained that 10 of the 11 trees planted have been successful – and that the one tree that is stressed is due to staying materials, not the Citygreen Stratavault system.

Loren also echoed comments from William at LK Architecture regarding Citygreen's superior service, saying,

> ***"Personal service and follow up is fantastic. And I'm now a believer in the system."***



> **"Today, one year on from the installation, the London Plane trees are healthy and growing extremely well. " – Loren Biggoose, Wichita Drainage & Grading**

Stratavault™ system paved the way for the revitalisation of Downtown Ennis

A 'Green Streets' approach was taken for the design of infrastructure and making Dallas Street more accessible and beneficial to downtown's residents and tourists alike.

Downtown Ennis, located 25 minutes south of Dallas, is known for its 19th-century historic architecture and iconic brick streets.

It was once a bustling urban hub for the agricultural economy until the construction of the I-45 bypass combined with changes to the agriculture industry shifted development and commercial activities away from the region.

> ***"The construction of the I-45 bypass resulted in a decline in population and economic vitality. Despite this shift, Ennis retained much of its downtown fabric."***

said David Newman, from MESA Design Group.

With its current population of over 20,000, the city was now looking to cultivate its residential growth again. In fact, the demand for work, leisure and mixed-use spaces was starting to increase – making investors interested in Downtown Ennis once more.

Ashley Colunga, Marketing and Communications Director of the City of Ennis, said,

> ***"In anticipation of this future growth, the City developed a Downtown Master Plan, serving as a guide for future development and economic revitalisation."***

This included redesigning their own streetscape.

Through Citygreen's Stratavault™ system, the project commenced at Dallas Street to make it more attractive, accessible and beneficial to downtown's residents and tourists alike.

Project goals

The overall objective of the Downtown Master Plan centred around establishing more investment opportunities for existing and new local businesses to nurture economic growth for the city.

In order to achieve this, the following project goals were set:

- Beautify the downtown area to make it a tourist and entertainment destination
- Mitigate physical barriers that restrict movement
- Ensure that the pedestrian experience is enhanced, without ruining the historical and cultural heritage
- Heighten the safety, serviceability and comfort of the downtown's streetscape
- Make the city's urban environment conducive for the growth of large, long-living trees

Drawing from these goals, the design focused on creating a modern, active and dynamic downtown that prioritised the pedestrian experience, celebrating the rich history and cultural heritage of downtown, while accommodating vehicular needs.

The redesigned downtown streetscape environment was also designed to encourage visitors to have authentic and unique experiences, distinguishing itself from the commodity-based retail environment of the nearby I-45 corridor.

Project methodology

From the start, the city faced several constraints including a limited budget and a tight construction schedule. They also had to take into account the existing cast iron and historic brick threshold that had to be preserved, all while creating an accessible and barrier-free streetscape.

Keeping these challenges and project goals in mind, they opted to utilise the Green Streets approach.

A 'Green Streets' approach was taken for the design of infrastructure and pedestrian improvements, in response to the goals of increasing safety, serviceability, comfort and beauty.

This meant replacing the impermeable curb and gutter section with a suspended paving system – that is, Citygreen's Stratavault™ system.

> ***"The project evaluated the pros and cons of the typical approach with structural soil and suspended paving. It was determined that the best value would be the suspended paving system. We then compared the products on the market and chose the Stratavault™ system based on reviews, input for construction economy and cost," David said.***

To implement Phase I (design and construction) of the project, MESA Design Group and the City of Ennis also collaborated with the team from Gresham Smith headed by Engineer, Tim O'Brien.

According to Tim,

> ***"It's a true team effort. MESA provided the landscape design for Phase I of the master plan implementation, while we supported their efforts by providing water, wastewater and stormwater utility design as well as civil and site design."***

MESA also enlisted the help of Construction Ecoservices and Fain Construction to equip the city's trees with adequate soil volume to address concerns regarding pavement heaving and underground utilities.

Led by Construction Ecoservices distributor, Anthony Kendrick and Fain Construction's installer, Noel Sanchez, permeable pavers were installed on top of soil cells to capture sheet flow from the buildings before entering the storm drain.

The system created an organised utility infrastructure corridor that facilitated repairs and maintenance, and provided a structural system supporting a

> **"We compared the products on the market and chose the Stratavault™ system based on reviews, input for construction economy and cost," – David Newman, from MESA Design Group.**

permeable paver section, capable of supporting heavy duty vehicular loading. The soil mix specified as part of this system provided a high percentage of void space, optimising the growing environment for street trees and understory plantings. It also provided stormwater filtration, groundwater recharge and detention.

Project solutions

The Stratavault™ system from Citygreen, with its affordability and eco-friendly attributes, served as a perfect solution for the requirements of Downtown Ennis. The streetscape design provided preserved and highlighted the historic beauty of the city.

The sustainable features of the system also optimised the growth of urban trees and developed the city's stormwater detention ability.

In total, there are now over 45 different plant species throughout the downtown, all of which are native or adaptive to the region.

> ***"An alley of Princeton American Elm trees in the Stratavault™ system line the street, providing a cathedral-like corridor of cool, dappled shade in the hot summer months, and allowing warm sunlight through in the cool winter months."***

David said.

Decorated in holiday lighting, the trees will serve as a grand sculptural lighting display during the annual 'Lights of Ennis' holiday festival,

Downtown Ennis' 19th-century vintage charm, together with the benefits delivered by the 21st-century green infrastructure of Citygreen, has now been consistently attracting more visitors and investors into the city. This influx is expected to continuously support the area's variety of retail, restaurant, entertainment and residential businesses, making the local economy thrive in the process.

The design of Dallas Street now offers a mixture of intimate and casual public spaces, as well as a variety of outdoor dining and gathering spaces suitable for activities and events throughout the year, including festivals, street markets and musical and theatrical performances.

> ***"The key benefit that the Stratavault™ system offered was the opportunity to have mature canopy trees in the urban environment, while also offering green infrastructure components such as capturing stormwater on site. It was also reasonably easy for the contractor to understand how to install it too,"***

David said.

Citygreen is beyond grateful to be involved in such a significant project by the City of Ennis. In revitalising the beauty of Downtown Ennis, it has also been a privilege for us to work with MESA Design Group, Gresham Smith, Construction Eco Services and Fain Construction.

At Citygreen, we have a wide range of cutting-edge urban landscape products like the Stratavault™ system that can make your communities greener, healthier and more sustainable.

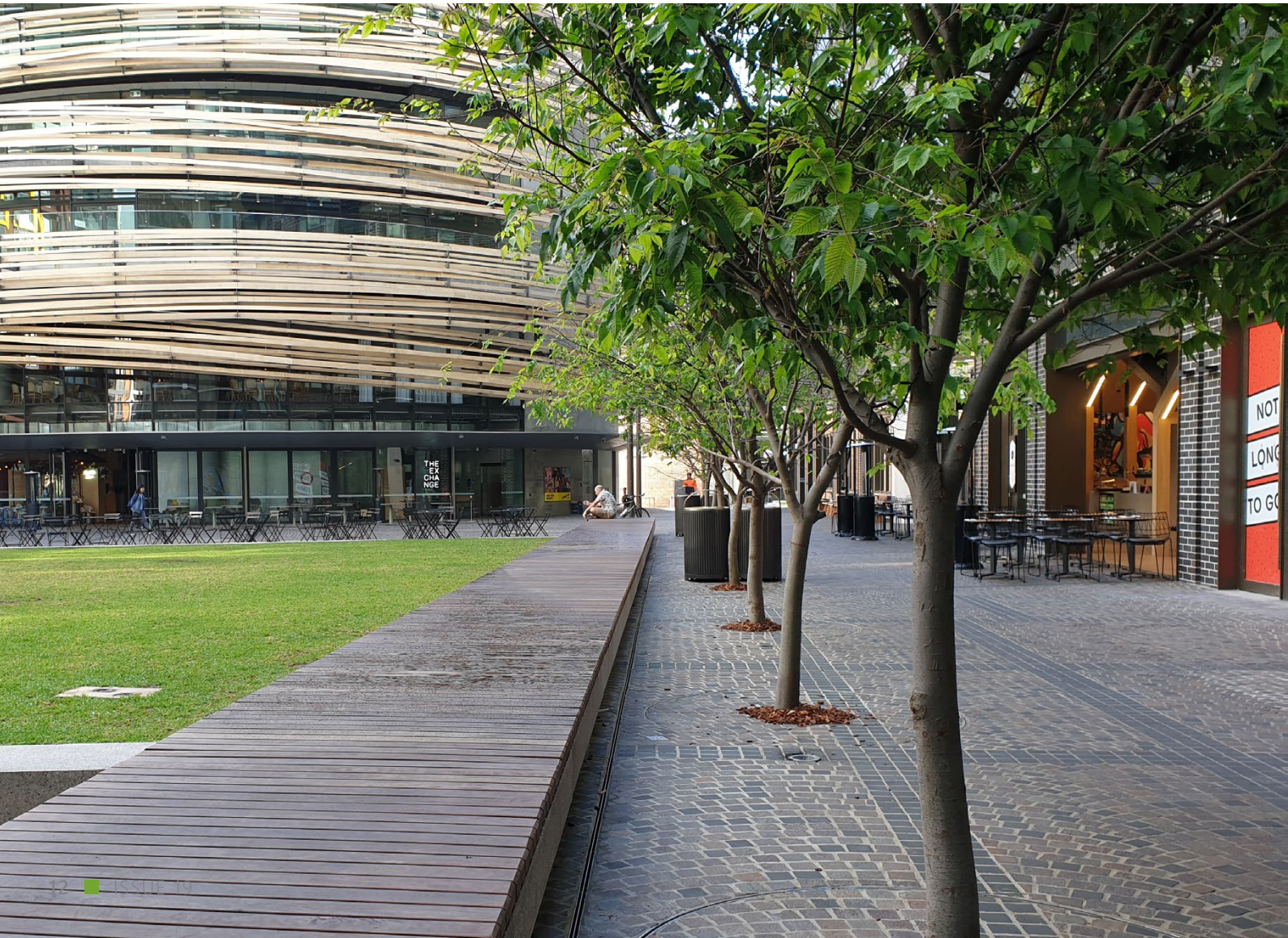
If your goal is to optimise your city's potential, speak to us today.

Stunning street trees shape the success of Sydney's Darling Square

Prior to the redevelopment and Citygreen's involvement, previous tree installations had failed. The heavily hardscaped conditions proved too challenging for trees, which failed to grow to their full potential despite several attempts.

Darling Square is a new public domain on the former site of Sydney's Entertainment Centre. Part of the NSW government's $3.4 billion transformation of Darling Harbour, this mixed-use precinct provides residential, commercial and entertainment opportunities in the heart of Sydney.

The Square was imagined by ASPECT Studios, a leading landscape architecture company who won a design competition by developer, Lendlease. The centrepiece of Darling Square is The Exchange – a spiralling, hive-shaped building designed to house a library, market hall, childcare facility and rooftop bar. Citygreen was engaged by ASPECT Studios and landscape contractor Regal Innovations, to help bring Darling Square to life with large street trees in front of The Exchange.



Project goals and challenges

Darling Square is situated in one of Australia's most visited public places. As such, the project goals centred firmly around people. As well as providing a 'wow' factor for first-time visitors, the project aimed to provide a strong sense of place for local workers and residents – particularly around The Exchange. Healthy street trees with large canopies were an important part of this vision.

Prior to the redevelopment and Citygreen's involvement, previous tree installations had failed. The heavily hardscaped conditions proved too challenging for trees, which failed to grow to their full potential despite several attempts. For Citygreen, the project goal was simple – to succeed where other solutions had failed. This meant providing the required soil volume for early establishment of the trees and their continued long-term growth.

Project solutions

Despite working to a complex design, which included buried services, Citygreen worked with the design and installation team to deliver on the project goals.

Citygreen's engineered Stratavault system was chosen for its ability to provide the required soil volume for healthy tree root growth. Compared to structural soil, which provides around 10% soil volume, Stratavault provides over 90% of uncompacted soil volume. This allows trees to develop deep root systems, which lead to large canopy growth.

As well as enhancing root growth, Stratavault cells have large apertures which enable service pipes, aeration and watering systems to be seamlessly incorporated. This was particularly important for this project, as it was critical to maintain aeration through the heavily paved surface slabs.

The fact that Stratavault is made from 100% recycled polymers is also appealing to builders and developers with a corporate culture centred on sustainability. In addition to the obvious sustainability benefits and green building contribution, the Citygreen structural vault systems are subjected to the highest QA control in the industry. Compared to other systems, which use virgin materials and/or steel components, Stratavault has an array of advantages.

A total of 31 Eucalyptus Saligna and Zelkova Serrata trees were installed around The Exchange using Citygreen's Stratavault system. As well as contributing to the design process, Citygreen provided hands-on installation training and compliance support to the construction team.

The installation was completed efficiently, thanks to Stratavault's smart modular system, where units snap together quickly to form an integrated matrix.

Project outcomes

Since its completion in May 2019, Darling Square has been stunningly successful. It is frequented by thousands of residents, workers and visitors each week, providing a central link to popular locations like Ultimo, Haymarket and Chinatown. The trees are thriving in Stratavault, with lush green canopies adding colour and shade out the front of The Exchange.

The outstanding architecture and award-winning landscaping has done more than enhance the Darling Square precinct for locals and tourists. It has also contributed to a highly successful outcome for the developer, with The Exchange recently selling for a premium price of $70 million.

> **Since its completion in May 2019, Darling Square has been stunningly successful - The Exchange recently selling for a premium price of $70 million.**

High performance tree pits trialled successfully at Bulcock Street in Caloundra, Australia

Sunshine Coast Council trial planted the same species trees at the same time and in the same street - trees in structural vault system clearly outperforming trees planted with rock-soil 'structural soil' mix.

In 1917, Bulcock Street was established as the main street of sunny Caloundra on the Sunshine Coast. One hundred years later, competing against new urban centres, big box malls and online retail, the rundown street was in decline.

In a $12 million four-stage project, Sunshine Coast Council (SCC) transformed the tired main street into a vibrant and liveable community space through the Bulcock Street Revitalisation Project. This project is Australia's first smart city streetscape demonstration and testing facility, showcasing the latest smart city technologies.

Sian Crawford, Landscape Architect at SCC, said,

"With the Sunshine Coast Council's Landscape Architects acting in many roles; the client, the project manager, design lead, and project delivery, our challenge was to take the community and organisation on a journey to re-imagine the high street experience through a holistic place-making framework. As Landscape Architects, we listened, learned and shaped the streets cape forms, layout, infrastructure, selected materials and plants species, and collaborated with engineers and artists, as key participants in this process of collective leadership."

Newly planted tree in September 2011

Tree planted in rock-soil mix photo taken in July 2020

Scott Howarth, Landscape Architect at SCC, said,

> ***"The design responded to the community's desire for a green street with substantial tree planting and garden areas. To ensure success we instigated investment in underground tree health using Citygreen's Stratavault system, specialist soil mixes and tree grow-on contracts. Between 2016 and 2018, 35 Elaeocarpus Obovatus were installed in the Stratavault system. These trees were 700L when installed and were grown by council's nursery specifically for this is project."***

In total, the project saw a total of 105 extra trees planted in the street, though not all were installed in the Stratavault system. A few years down the track, this has provided an insightful comparison – with trees planted in stages 3 & 4 using Stratavault clearly outperforming those planted in stage 1 that didn't use any type of Stratavault or Strata-cell system.

Sian Crawford said,

> ***"Feedback from the community has been overwhelmingly positive. In terms of the physical outcome, Bulcock Street is now a vibrantly-green, comfortable place to be. Momentum following the streetscape has resulted in a community embracing innovation and activation, with an increased sense of identity and self-determination."***

Tree planted in Citygreen's structural soil vault system, photo taken in July 2020

Images above show the results from Council's initial trial – where the same species trees were planted at the same time, in the same street – with with rock-soil 'structural soil' mix, on the left and Citygreen structural vault system (on the right).

Eclectic in character, fun and colourful, the street has evolved into an 'alternative' retail experience that appeals to all ages and is uniquely 'Caloundra'. Retail outcomes support this, with Caloundra experiencing an increase in the total spending during the 2017/18 financial year of 8% above the 2016/17 results (equating to $39.3 million in extra trade). An overwhelming success, the project was nominated for the 2020 Queensland AILA Landscape Architecture Awards.

Stratavault brings world-class urban landscape to life at Tsim Sha Tsui waterfront, Hong Kong

The city garden was largely hidden from view and not a popular destination despite its close proximity to the Tsim Sha Tsui waterfront which is one of the world's most extraordinary urban sites.

The Tsim Sha Tsui waterfront is one of the world's most extraordinary urban sites, yet despite its dramatic setting, rich historic and cultural heritage, and popular appeal, its potential was largely unrealised. Although close to the heart of Kowloon, Hong Kong, the wide and busy Salisbury Road separated the waterfront from the city, making it difficult to access. While the existing waterfront drew large crowds for specific events such as the Symphony of Lights, Chinese New Year celebrations and Dragon Boat Races, extensive portions of the waterfront offered only minimal amenities.

The former garden design did not take advantage of the fantastic waterfront setting, instead focusing on a small central fountain and blocking views to the harbour with plant rooms and dense shrub planting. There was very little seating and limited shade for pedestrians as the tree planting comprised mainly palm trees and small trees incapable of providing adequate shade. The garden was largely hidden from view and not a popular destination despite its close proximity to the waterfront.

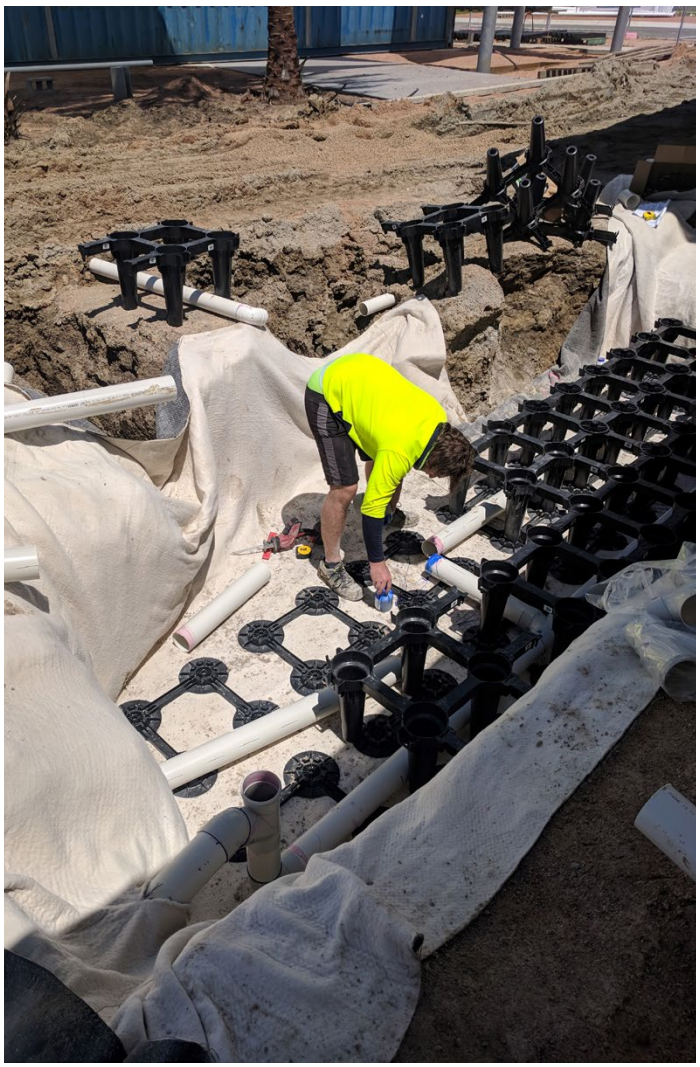
Project goals and challenges

With the goal of creating a vibrant public garden and open space landscape, URBIS Limited was engaged as the Executive Landscape Architect to work alongside James Corner Field Operation (JCFO) as the Project Leader and Design Landscape Architect and Pegasus Greenland Limited as contractor. In order to capitalise on the extraordinary potential of the site and establish a world-class setting, JCFO developed an ambitious design to connect, enhance and consequently revitalise the entire public realm of the waterfront. The plan sought to expand amenities, improve connections to adjacent areas and enhance public use by providing a higher-quality experience for all who visit the area. But, as with all urban areas, there were some unique challenges that needed to be overcome.

> **Given the typhoon prevalence in Hong Kong and the exposure of this site, good health and rapid establishment are important to limit the risk of future damage during the typhoon season.**

Firstly, the entire Salisbury Garden is built on top of an underground shopping mall making it challenging to provide a long-term planting solution for large established trees central to the design. In order to achieve this, a sizeable, interconnected planting pit was created using Citygreen's Stratavault structural root cell system with suspended pavement above. This successfully provided the trees with sufficient soil volume to grow and mature, providing much-needed shade for park users.

Another challenge was the site's exposure to extreme weather events including typhoons. Typhoon Mangkhut hit Hong Kong in September 2018 damaging the majority of trees in this project, some irrecoverably and requiring replacement. Given the typhoon prevalence in Hong Kong and the exposure of this site, good health and rapid establishment are important to limit the risk of future damage during the typhoon season.



Project solutions

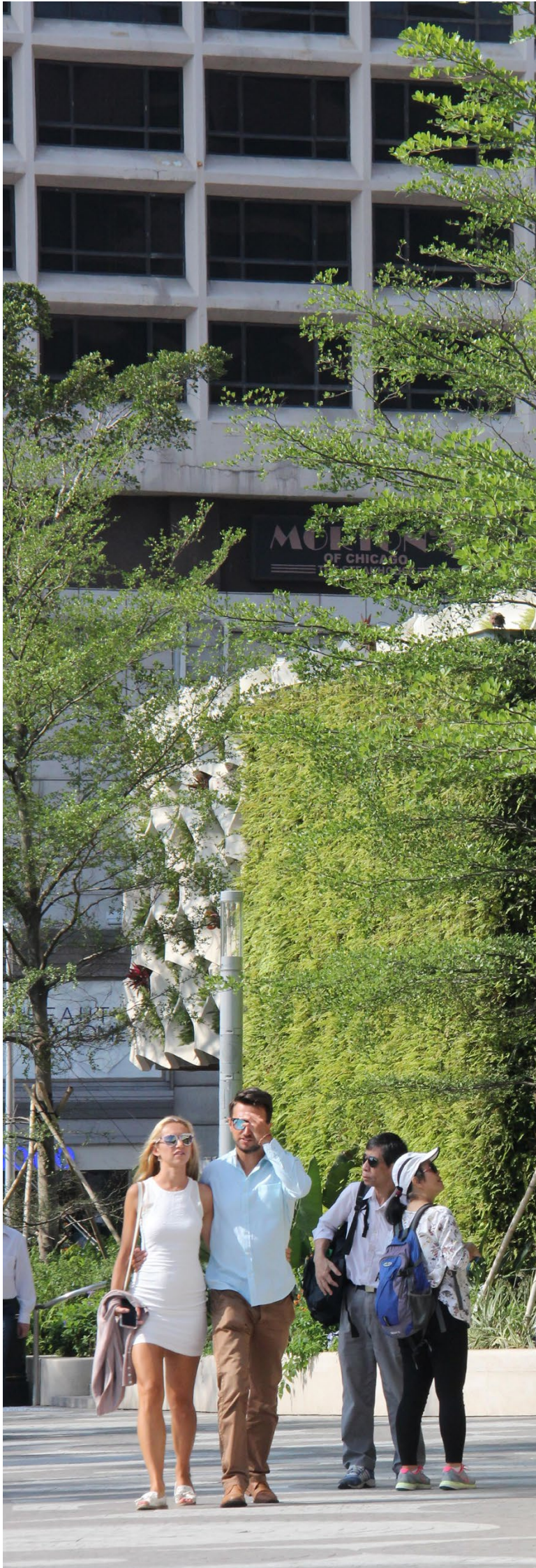
The Stratavault system in combination with high-quality soil and good management practices are key to the success and stability of the trees in this re-development and the long-term sustainability of the large trees at the site.

Re-opened in November 2017, today the waterfront has emerged as a fully integrated precinct for leisure, culture, recreation, education and tourism. The design is highly responsive to the site's complex technical constraints (relating largely to the underground mall beneath the garden) while striving toward a new standard of excellence in public realm design.

Actively programmed, carefully designed, and richly detailed, the new landscape responds to its unique setting and diverse use and provides places for people to sit, pathways to stroll, spaces for social gathering and a large open lawn for daily lounging as well as occasional celebrations and performances. New tree plantings offer shade around the edges of the space while lush ground-level and Garden Wall plantings are intended to engage and delight visitors. The new design capitalises on the magnificent views of the Hong Kong skyline while facilitating access and expanding appreciation of Victoria Harbour for public enjoyment. Pedestrian connections between the city and its waterfront have transformed Salisbury Garden into a lush and inviting landscaped garden, revitalising the Avenue of Stars Waterfront Promenade and establishing a world-class setting for Victoria Dockside.

The planting design by URBIS performs several important functional and aesthetic roles in the Salisbury Garden design. The trees play a key role in shaping and defining the different spaces within the garden, framing views towards the harbour and providing the shade that is so vital to the comfort of users in the hot summer months. The shrubs, groundcovers and Garden Walls provide the visual interest and detail to enliven the garden by use of flower colour and fragrance and leaf form, colour and texture.

From the outset, the garden design was configured



to retain as many trees as practical and where these could not be retained, they were either transplanted to a new location or replaced by better quality trees. 19 trees are retained in situ within the garden, including 2 large Ficus microcarpa (Chinese banyan). In addition, 12 trees have been transplanted to new locations within the garden, which now create an attractive welcome at the north-east entrance.

Project outcomes

46 new trees were planted throughout the garden. In the Central Bosque, a grove of 12 tall stately Terminalia mantaly (Madagascar almond) were planted to provide dappled shade for this gathering space in the hot summer months. Similarly, in the Western Bosque, a grove of 11 tall Bischofia javanica (autumn maple) provides cool shade for users to enjoy food and snacks from the nearby kiosk. Along the eastern side of the Central Lawn, a grove of transplanted Syagrus romanzoffiana (Queen palms) provide shade for picnicking or relaxing on the grass.

Despite the effects of Typhoon Mangkhut, this project has received awards from professional institutes recognising urban or landscape design related projects with outstanding performance and contributions in promoting excellence in design, including:

- A Gold Award (2018) with the Hong Kong Institute of Landscape Architect (HKILA)
- A Merit Design Award (2018) with the Hong Kong Institute of Urban Design (HKIUD)
- A Sustainability Award (2019), a Merit Award (2019) under A&A and Conversion Category with Building Surveying Division of the Hong Kong Institute of Surveyors
- A Finalist Award under the World Architecture Festival (2019)

Despite no previous experience installing the Stratavault structural root cell system in Hong Kong, the materials were delivered to site and installed with no delays. The hope is that this critically acclaimed precinct will be a useful site reference for future tree planting and the provision of better growing environments for the urban forest in Hong Kong.

Soil vaults return huge ROI in quantifiable results

The Burnley Method, a recognised tree appraisal approach developed by Dr Greg Moore at the Victorian College of Agriculture, was employed to determine a quantifiable value for each tree set at Foster carpark.

Located in the inner eastern suburbs of Perth, Foster Park plays hosts to a community centre and provides space for recreational activities to the City of Belmont's residents. With the design of the new centre's facilities, a new car park was also devised with parking bays and trees planted in traditional tree wells to provide shade coverage.

Encountering the same microclimate challenges facing many global cities today, The City has an ongoing commitment to their Urban Forest Strategy realising the benefits canopy coverage has on their City's liveability and sustainable population growth. In addition to the public health interests, The City have also recognised that the urban forest canopy is a tangible asset with a high propensity to deliver valuable ROI on their balance sheet if adequately managed.

With this vision in mind, following a review of the initial car park plans and the performance of trees planted conventionally in neighbouring sites, concerns were raised that within the standard tree pits (tree wells) sufficient soil volumes were not being provided. With both insufficient soil volume and compacted root space due to planting into carpark subgrade, trees were not growing to their full potential as intended within the landscape design. The traditional planting method was compromising tree health and therefore yielding a significant reduction in final shading area.

To address this, it was decided that the car park would be redesigned to include vaulted soil cells to increase available rooting volumes. After an initial trial installation and the direct comparison of results with nearby conventionally planted sites, the soil vaults have been adopted across three car parks and achieved not only momentous but quantifiable success.

Open ground planted trees circled in yellow, Stratacell trees circled in red. Note shade coverage.

Photo taken: February 2017.

Outcomes

Healthier trees growing at unprecedented rates were recorded deeming the root cells a resounding success and thus undertaken across all three car park sites.

Comparatively, a tree planted in a traditional tree well in a nearby site, now 15 years old, displayed ongoing stagnated growth and signs of health decline. (Refer page 6.)

To further illustrate the differing growth rates between methods, five soil vault trees were assessed and charted over a four year period against eight trees planted conventionally on the same site: The tree inspections were carried out on five separate occasions and measured for canopy cover and trunk diameter.

INSTALLATION METHOD TREE VALUATIONS

Soil Vault System | Tree Age: 4 years		Conventional Installation | Tree Age: 15 years	
INVESTMENT	ROI	INVESTMENT	ROI
Contractor & staff wages: $10,122 Trees: $3,010 Stratacells: $33,139 Soil: $4,136 Miscellaneous: $2,000 **Total cost per tree: AU$10,481.40** *(Civil costs not included)*	Canopy coverage: 50m2/538.20ft2 per tree Tree volume (cone): 150m3/5,297.20ft3 per tree **Monetary value per tree: AU$17,500** *(as at May 2017)*	Contractor and staff wages: $200 Trees: $250 Soil: $100 **Total cost per tree: AU$650** *(Estimates only. Civil costs not included)*	Canopy coverage: 7.5m2/80.73ft2 per tree Tree volume (cone): 11m3/388.46ft3 per tree **Monetary value per tree: AU$510** *(as at May 2017)*

Summary

Whilst the initial outlay was more expensive, the Stratacells have enabled the trees to thrive at unparalleled rates resulting in a huge return on investment for the City both financially and environmentally.

In only a short period of time, the combined value of these trees has far exceeded the installation costs of the cells and will continue to substantially increase in years to come. Conversely, the value of the trees in the traditional tree pits, when studied both four and 15 years on, cannot improve and will largely remain irrelevant.

Due the veritable success of the project, the City of Belmont plan to extend the Stratacell program and adopt the soil vaults as a pillar of their urban forestry strategy ongoing.

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