



DELIVERING SUSTAINABLE INFRASTRUCTURE IN PUBLIC SPACES

PERSPECTIVES FROM THE UNITED
STATES AND CANADA

Municipal Engineering Foundation Victoria Study Tour

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FORWARD

This report has been made possible by the Municipal Engineering Foundation Victoria. Established in 1966, MEFV facilitates opportunities for local government engineers in Victoria to enhance their technical and managerial skills.

The Municipal Engineering Foundation Victoria enabled two Australian Local Government Engineers from Victoria to embark on a Study Tour to the United States and Canada in August 2022 to visit and learn from Local Authorities.

The MEFV and study tour awardees would like to acknowledge and thank all the host cities and organisations for their generosity and hospitality throughout the tour. Their willingness to share expertise, insights and experiences with our engineers has been invaluable, and we are grateful for the time they dedicated to making this study tour a success.

- American Public Works Association
- City Of Los Angeles, California
- City Of Charlotte, North Carolina
- Chicago Metropolitan Area, Illinois
- City Of Toronto, Ontario

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EXECUTIVE SUMMARY

The increasing demands on civil infrastructure due to urbanisation require sustainable and resilient solutions involving collaboration between various stakeholders. Integrating civil infrastructure into public open spaces is crucial for environmental benefits and urban adaptability. Victoria faces substantial population growth, necessitating a focus on public infrastructure to meet the rising demand. Climate change poses serious challenges, leading to extreme weather events and species loss, emphasising the importance of sustainability and resilience in public infrastructure. Public spaces are essential for social interaction and community well-being. They encompass streets, open spaces, and public facilities, serving as hubs for local communities. Balancing urbanisation, sustainability, and social equity is challenging. Leveraging public spaces for sustainable infrastructure is a crucial strategy, and studying successful projects in the USA and Canada can provide valuable insights.

ROLE OF POLICY IN ACHIEVING SUSTAINABLE OUTCOMES

Government policies shape civil works projects, but their effectiveness varies. Policies set standards for sustainable infrastructure design and can drive innovation. Local governments can exceed state requirements, but policies must be enforced for effective project delivery.

- The developers of the Lucas Museum in Los Angeles met the strict low impact development (LID) requirements by using many innovative water treatment techniques.
- Charlotte North Carolina's Unified Development Ordinance integrates green spaces, sustainability goals, and tree canopy enhancements. The city has a Climate Action Plan and regional partnerships.
- Toronto's Net Zero 2040 plan targets a carbon-neutral city by 2040. It involves infrastructure transformation, energy-efficient buildings, sustainable transportation, and increased green spaces to offset emissions.

INTEGRATED SUSTAINABLE DESIGN FRAMEWORKS

Municipalities often overlook sustainability in infrastructure due to cost and design constraints. This can result in negative impacts like increased emissions and loss of biodiversity. Project managers face challenges in balancing quality, budget, and sustainability. Access to tools, education, and certifications can help. Inspiring a commitment to sustainability in project managers can set a standard for future developments.

- Toronto's Green Streets initiative introduces green infrastructure to streetscapes, improving water quality, urban tree growth, and stormwater management.
- The Michelle and Barack Obama Sports Complex exceeded sustainability standards through California's Green Building Standards Code and achieved LEED Gold certification.

- Los Angeles' Asphalt Plant No. 1 underwent an upgrade and received Envision certification, considering social, economic, and environmental aspects.

DELIVERING SUSTAINABLE PUBLIC SPACES

Expanding public open spaces is a challenge that requires innovative solutions, especially in the face of urbanisation and climate change. It can be difficult and expensive to address past infrastructure decisions retrospectively. To tackle these issues, a multifaceted approach is necessary, which includes both proactive solutions and public amenities that can drive economic growth.

- The LA River Revitalisation Masterplan aims to transform an 82km concrete river channel in Los Angeles into a vibrant, biodiverse linear park. It addresses flood risk, and promotes open space,
- Toronto waterfront project looks to naturalising rivers and create a flood barrier, while also opening open land for redevelopment. It includes 25 hectares of green space and mixed-use development,

COMMUNITY PROJECTS

Municipalities can face constraints in delivering infrastructure projects due to limited resources and public space. Private-public partnerships, grants, and community involvement can help overcome these challenges, allowing municipalities to meet their sustainability goals.

- The City of Charlotte's Placemaking Program engages with various city departments and also community groups to create vibrant, accessible public spaces that foster community interaction and sustainable design.
- The Downers Grove Bioswale Program manages stormwater runoff, enhances water quality, and educates the community about sustainable stormwater practices.
- The City of Toronto's Eco-Roof Incentive Program encourages building owners to install green roofs. Green roofs offer energy savings, insulation, air pollution reduction, and habitat creation.
- The MWRD partners with agencies to fund and support green infrastructure projects on private property that manage stormwater effectively, such as through rain gardens, bioswales, and permeable pavements.

PROFESSIONALS IN PUBLIC WORKS

Engineers play a crucial role in delivering innovative infrastructure projects. They design, plan, and execute projects within budget, ensure technical feasibility and sustainability through innovation and testing, and contribute to superior results that positively impact the broader community.

- Individuals must not only obtain a bachelor's degree, but also 2 to 5 years of supervised work experience and pass two exams in order to call themselves an engineer.
- Continuing education involves completing continuing education units (CEUs) or professional development hours (PDHs) over time.

- The American Public Works Association (APWA) Public Works Expo (PWX) offers a valuable platform for engineers to earn CEUs and PDHs, enabling them to learn about the latest technologies and network with industry professionals. The event is crucial for professional development, providing insights into new techniques and trends, and fostering collaboration.

Based on the observations and findings gathered during this study tour, a total of 13 recommendations have been developed for local governments to enhance the integration of sustainable outcomes into their infrastructure projects. These recommendations have been thoroughly detailed in the report and are succinctly outlined in the conclusion section.

BACKGROUND

As the demands on civil infrastructure continue to increase with urbanisation and growth, the need for sustainable and resilient infrastructure is becoming more critical. Municipalities are challenged to find innovative ways to meet the needs of today while also considering the needs of future generations. This requires a multi-disciplinary approach that considers both engineering and design and social and environmental factors. Collaboration between government, industry, and community stakeholders is essential to implement projects effectively and efficiently.

Integrating civil infrastructure into public open spaces is critical to creating sustainable and resilient infrastructure. Open space provides opportunities for physical activity, social interaction, and relaxation, and integrating civil infrastructure with open space can help to minimise negative impacts on the environment and public health. It can also serve as natural infrastructure, providing ecosystem services such as flood control and temperature regulation, and creating a more adaptive urban system.

URBAN GROWTH

Victoria's population increased by an estimated 98,600 people between 2019 and 2020, bringing the total population to approximately 6.7 million. The Victorian Planning Authority (VPA) has predicted that around 70% of the new housing in Victoria will be provided through infill development increasing Melbourne's population density.



FIGURE 1 MELBOURNE URBAN GROWTH, SOURCE: CITY OF MELBOURNE

The VPA has also set a target of accommodating 1.6 million people in Melbourne's existing metropolitan area by 2051, which will require the construction of approximately 1.5 million new dwellings expanding Melbourne's urban sprawl (Figure 1). This level of urbanisation and growth poses a challenge for municipalities to provide public infrastructure to meet the increasing demand.

CLIMATE CHANGE

The Earth's average temperature has increased by 1.1 degrees Celsius (2 degrees Fahrenheit) since the Industrial era began. This warming trend is expected to continue increasing and will have various effects on our climate system, such as increased frequency and intensity of heatwaves, droughts, hurricanes, and wildfires, which have increased in many parts of the world.

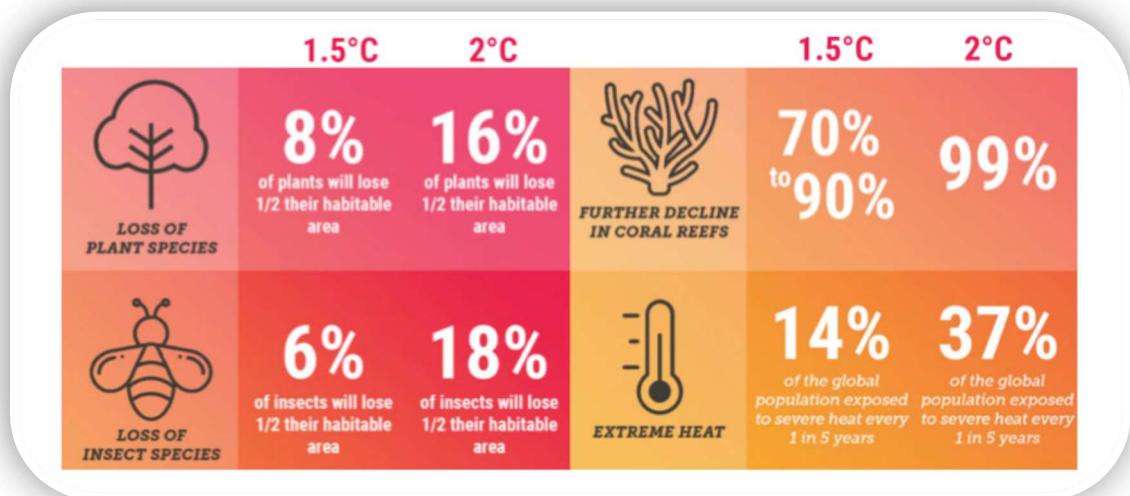


FIGURE 2 CLIMATE CHANGE FACTS, SOURCE CLIMATE COUNCIL

According to "The State of the Climate 2020" report by the Bureau of Meteorology and CSIRO, Australia has experienced an increase in the frequency and intensity of heavy rainfall events over the past century. The report noted that the intensity of extreme rainfall events has increased by around 10% for every 1 degree Celsius of warming.

The number of extreme heat days in Australia has increased by 60% in the last 50 years, leading to a rise in heat-related deaths and illnesses, with the average temperature increasing by 1.52 degrees Celsius since 1961. The 2019 Commonwealth Scientific and Industrial Research Organization estimated that climate change would increase the rate of species losses in Australia by about five times more in the next 20 years. The loss of species has critical impacts on ecosystems and the environment. Figure 2 also shows just how much biodiversity loss and severe weather such small increases in average temperature can have.

The state and local governments have been incorporating sustainability and resilience requirements into public infrastructure to contribute to more urban cooling, storm flood risk management, and providing habitats to local flora and fauna. However, due to limited space and increasing complexity, public infrastructure needs to be creative to deliver sustainable and resilient outcomes.

PUBLIC SPACES

Public spaces are crucial in creating dynamic and sustainable communities and cities. These spaces offer essential benefits in social interaction, environmental sustainability, and economic development. They provide opportunities for recreational activities, cultural and artistic expression, and foster a healthy and vibrant community.

Figure 3 illustrates the fundamental attributes and measurable elements that make up a good public space.

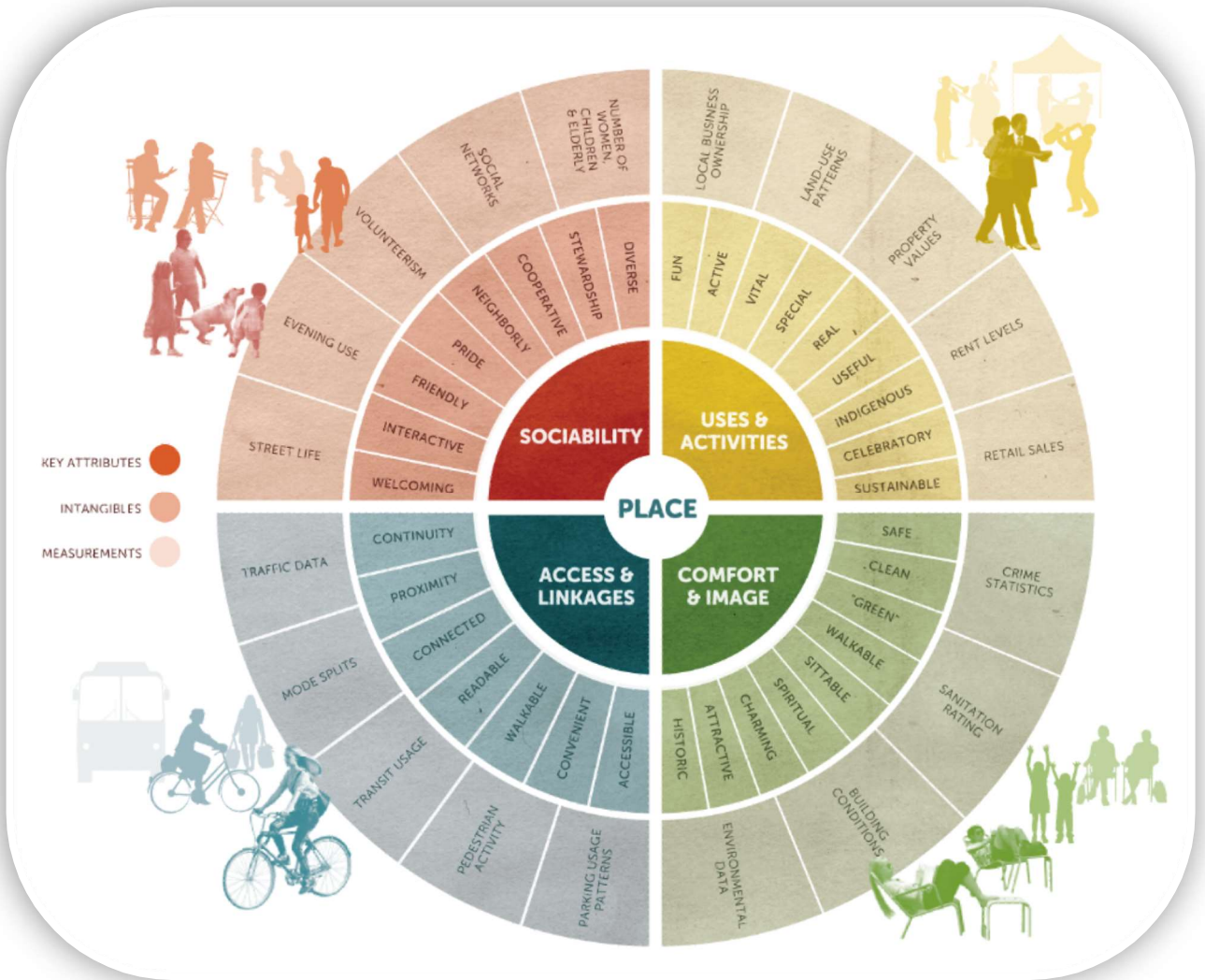


FIGURE 3 WHAT MAKES PUBLIC SPACE GREAT, SOURCE PROJECT FOR PUBLIC SPACES PPS.ORG

Public spaces comprise of:

- Streets, which are thoroughfares for walking, running, and cycling, as well as outdoor dining areas that provide opportunities for social interaction and generate income for local businesses.
- Open spaces, such as parks, playgrounds, and sports fields, contribute to our sense of community and the health and wellbeing of the community.
- Public facilities, including libraries, recreation facilities, community centres, and spaces for government workers, are places for people to meet, collaborate, learn, and share ideas. As our cities expand and the world becomes more connected, public facilities are the local hub of our communities.

CONCLUSION

The challenges of delivering infrastructure that meets the goals of urbanisation and population growth while also being sustainable and socially equitable are significant. The increasing demand for services, limited budgets, and complex regulatory requirements make balancing competing demands and priorities difficult.

Public spaces appear to be a perfect place for municipalities to not only provide amenities to the public but also integrate sustainable and resilient infrastructure to combat the effects of climate change and deliver services to meet the demand from urban growth.

Travelling to the USA and Canada to look at successful infrastructure projects and find how they successfully integrated these multifaceted goals to achieve these integrated public spaces.

THE ROLE OF POLICY IN ACHIEVING SUSTAINABLE OUTCOMES

Civil works are often driven by different levels of government policies that dictate the direction and requirements of such projects. The USA and Canada generally have similar levels of government to Australia, which are Federal, State, and Local. Typically, in Australia, The Federal and state governments set the overarching policies, and the local Municipalities follow suit.

Unlike Australia, municipalities in the USA and Canada are generally larger. A large city and the surrounding suburbs are often under the same organisation. They undertake more responsibility and deliver more services, from utilities like sewer and energy, to emergency response like police and fire. Municipalities can also have responsibilities shared with overlapping authorities like counties and speciality district boards.

In the United States and Canada, policies and requirements for civil works differ significantly from state to state. Municipalities have a wider berth to determine their own requirements and internal policies. However, the effectiveness of these policies and frameworks in achieving sustainable outcomes is often debated. While policies can provide guidance and direction, without ways to enforce their use, they can also become mere documents without any real impact.

CASE STUDY - LUCAS MUSEUM OF NARRATIVE ART



FIGURE 4 LUCAS MUSEUM CONCEPT RENDERS SOURCE LUCAS MUSEUM

The Lucas Museum of Narrative Art is a forthcoming museum created by George Lucas, the renowned filmmaker. The museum will house a diverse range of visual storytelling forms, including photography, painting, illustration, sculpture, performance, comic art, and video. The structure is being constructed at Exposition Park in Los Angeles, California. The grand opening is expected to occur in 2025. The museum's massive, five-level structure will comprise 10,000 square meters of dedicated gallery space, a library, specific learning studios, two theatres, a restaurant, a café, an event area, and 11 acres of landscaped areas on top of underground car space.

The Lucas Museum of Narrative Art worked closely with the city of Los Angeles to ensure compliance with low impact development (LID) requirements. The museum's sustainability initiatives included extensive green roof and car park landscaping. One of the architectural requirements for the project was “no repeating lines or patterns,” which created a challenge for the engineers to meet their structural and sustainability goals.

Low Impact Development, is a federal policy that imposes strict requirements from the highest level of government, allowing cities to enforce requirements without having to defend them. It manages stormwater runoff using natural processes such as infiltration and evapotranspiration and is part of green infrastructure. This infrastructure protects natural areas that provide habitat, flood protection, cleaner air, and cleaner water. The approach emphasises the conservation and use of on-site natural features like permeable pavements, and rain gardens. The Lucas has used multiple landscaped areas (figure 5) to provide more infiltrations and slow the flow of water generated by the site.



FIGURE 5 LANDSCAPED AREAS ON TOP OF A MULTI-LEVEL CARPARK

The implementation of LID practices has multiple benefits and builds city resilience. It reduces the impacts of urbanisation on the natural hydrologic cycle, mitigates flooding, improves water quality, enhances air quality, increases biodiversity, and improves human health and well-being. As LID is a highly regulated process, the city of Los Angeles rigorously checks designs to ensure that they comply with the runoff requirements. Once constructed, the stormwater systems must be inspected and certified for their function, which must be submitted annually.

The green roofs and landscaping were made possible using expanded polystyrene foam (XPS) shown in figure 6. One of the significant advantages of using XPS foam is its lightweight nature, which means it can be easily transported, handled, and installed by construction workers, saving time and effort. Additionally, XPS foam is known for its ability to support heavy loads, making it ideal for use in weight-bearing projects such as retaining walls and foundations. XPS foam is also porous, allowing for good drainage, which is especially important in landscaping projects. Furthermore, it is highly durable and resistant to water, chemicals, and pests, making it a reliable choice for construction landscaping.



FIGURE 6 GEOFOAM FORMS A LIGHT SUBBASE FOR LANDSCAPE AREAS AND

The museum also implemented a rainwater management system that involved diverting 95% of impervious surfaces into dry wells for long soakage, using rain gardens to reduce runoff by 41%, and installing underground rainwater tanks for irrigation and toilet flushing.

CASE STUDY – SUSTAINABLE CHARLOTTE



FIGURE 7 THE CITY OF CHARLOTTE

The city of Charlotte, North Carolina, is one of the fastest-growing cities in the United States. From 2010 to 2020 the population of Charlotte increased by over 17%. Charlotte is now the second-largest financial centre in the United States, behind only New York City. Charlotte has become a more diverse and progressive city in a predominantly conservative state. Due to political and ideological differences with the state government, Charlotte has faced significant challenges in implementing sustainable and climate change policies.

With significant growth and demographic changes, Charlotte has recognised the importance of sustainable practices and environmental stewardship. In 2011, the city adopted its first sustainability plan, "Envision Charlotte," which aimed to reduce energy usage in uptown Charlotte by 20% within five years. The initiative achieved its goal ahead of schedule and has since expanded to include more ambitious targets, such as achieving carbon neutrality by 2050.



FIGURE 8 IDEAL STREET DESIGN FROM THE UNIFIED DEVELOPMENT ORDINANCES

To ensure that Charlotte's growth is sustainable and that the character of established neighbourhoods is preserved while encouraging high-quality development that enhances the city's liveability and economic vitality, the City of Charlotte passed the "Unified Development Ordinance" (UDO). The UDO is a comprehensive set of regulations that govern land use, zoning, and development in the city. It provides a clear framework for developers, property owners, and community members to understand the rules and regulations that apply to their projects, and it establishes clear processes for the review and approval of development proposals. The UDO is regularly updated to reflect the changing needs and priorities of the city and its residents, making it an essential tool for managing growth and development in Charlotte.

The UDO promotes the integration of various infrastructure goals related to:

- Transportation
- Emissions
- Energy
- Street frontages
- Water treatment elements,

Additionally, the UDO brings about significant requirements, including more green space, and enhancing tree canopy.

However, implementing sustainable policies and initiatives in Charlotte has been complicated due to the conservative policies and attitudes of the state government. The state has been reluctant to address climate change, a former Governor even dismissed concerns about climate change as "scientific speculation." This tension between the city's progressive values and the conservative policies of the state government remains an ongoing challenge for Charlotte's sustainability efforts. The lack of support from policymaking and state regulations and the absence of funding for sustainability projects have further hindered the city's efforts to achieve its sustainability goals.



FIGURE 9 LITTLE SUGAR CREEK GREENWAY, REVITALISED AS PART OF DEVELOPMENT ORDINANCES

Despite these challenges, Charlotte residents continued to advocate for more sustainability and resilience in its planning efforts. The city has developed a Climate Action Plan that outlines strategies for reducing greenhouse gas emissions, improving energy efficiency, and increasing renewable energy use. Additionally, Charlotte has partnered with other cities and organisations to advocate for progressive policies and address climate change at the regional and national levels.

CASE STUDY – TRANSFORMTO (TORONTO) NET ZERO STRATEGY



FIGURE 10 TORONTO WATERFRONT SKYLINE

Canada is well-known for its commitment to sustainability and climate change. Cities within Canada consistently appear on "most sustainable cities" lists in engineering and environmental journals. Toronto, which is often considered one of the most sustainable cities in North America, is recognised for its green spaces, low carbon emissions, and sustainable transportation.

Net Zero 2040 plan is an ambitious strategy by the City of Toronto to transition the city to a net-zero carbon community by 2040, ten years earlier than originally planned. The plan is based on a comprehensive analysis of Toronto's sustainability and outlines a strategy to reduce or offset emissions across all sectors of the city, including buildings, infrastructure, transportation, waste management, and energy generation.

The Net Zero 2040 plan in Toronto is closely connected to the city's sustainable and green infrastructure initiatives as it aims to mitigate the impacts of climate change. To achieve the plan's goals, there must be a significant transformation of the city's infrastructure, including the construction of energy-efficient buildings, the implementation of sustainable transportation, and the creation of more green spaces. Green spaces, such as parks, green roofs, and streets, can help absorb carbon dioxide and pollutants from the atmosphere, thus reducing the impact of urbanisation and offsetting emissions.

The plan leads directly to actions in the following documents:

- Toronto green standard – Standards for sustainable site and building designs that address air quality, resiliency and energy efficiency, water quality and efficiency, ecology and solid waste.
- Complete Streets -provide an expanded toolbox to ensure infrastructure projects within Toronto’s streetscape.
- Portland’s redevelopment 400 hectare redevelopment

The Toronto Net Zero 2040 plan represents a significant leap forward in the city's efforts to tackle climate change and build more sustainable and liveable communities. By prioritising sustainable and green infrastructure initiatives, the city is taking a proactive approach to lower its greenhouse gas emissions and create a more resilient and environmentally responsible future.

OBSERVATIONS

When it comes to sustainable outcomes in development, if there is no formal requirement to do so, both private and public developments may not make efforts in their design to adopt sustainable and green infrastructure practices. This is often due to budget constraints and pressure to deliver infrastructure.

Federal policies that set strict sustainability requirements at the highest level of government can have a profound impact on the outcomes of sustainable infrastructure projects. The developers knew they had to meet stringent standards, so they worked closely with the city and successfully developed innovative solutions that would meet the requirements set out in the policy. As a result, amicable relationships between developers and cities have been observed, with developers often proud to showcase their innovative approaches. By pushing developers to be more innovative in meeting sustainability standards, we can create more sustainable infrastructure projects that benefit both the environment and provide public amenities and open spaces.

When governments set policy and requirements at the highest level, it allows municipalities authority to enact these sustainability features in all development. When it is known that strict approvals and compliance need to take place, these projects often will consider these objectives up front and find innovative solutions.

Where federal and state policy do not exist, Councils can develop their own policy and documents to exceed minimum state requirements, when it is seen that higher levels of government are lagging.

However, Policies need to lead into action plans, guidelines, frameworks, and enforcement, to ensure all the careful planning is followed through with the delivery of projects.

RECOMMENDATIONS

1. Councils should develop strong policies to ensure development projects within their municipalities deliver sustainable outcomes.
2. Councils should establish clear and ridged sustainability targets to encourage innovation in the project development.
3. Where higher levels of government are failing in good environmental policy development, Local Government can step in and become a leader in its own policy development and influence other levels of government.

FRAMEWORKS FOR INTEGRATED SUSTAINABLE DESIGN

Municipalities play a crucial role in developing and maintaining critical infrastructure and facilities essential for communities' well-being. However, in their eagerness to deliver these facilities, municipalities often need to pay more attention to the potential impact of sustainable requirements on the design and budget.

Sustainable design involves integrating environmental, social, and economic considerations into the planning and implementation of infrastructure projects. This includes:

- reducing carbon emissions
- conserving natural resources,
- promoting biodiversity,
- improving air and water quality,
- and enhancing resilience to climate change.

Sustainable design can lead to long-term cost savings and benefits, but it can also increase the upfront costs and complexity of infrastructure projects.

Unfortunately, municipalities may be overly focused on delivering minimal infrastructure at the lowest possible cost, which can result in cutting corners and compromising on sustainability. This can lead to negative consequences such as increased greenhouse gas emissions, loss of biodiversity, and reduced resilience to climate change.

Engineers delivering projects need frameworks and tools to aid in scoping and designing sustainable infrastructure.

CASE STUDY – TORONTO GREEN STREETS

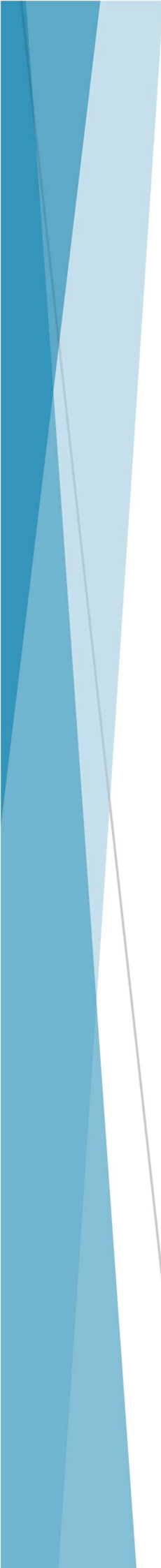


FIGURE 11 GREEN STREET PROJECT IN TORONTO

Toronto's Green Streets program is an initiative that seeks to introduce more green infrastructure into the city's streetscapes and is a significant part of its Complete Streets Guidelines.

Green Streets are an innovative approach to managing the impact of wet weather events. They act as a natural filter that cleans the water before it enters local waterways and provides numerous social, economic, and environmental benefits. These streets help improve urban tree growth, mitigate the urban heat island effect, and manage stormwater runoff to improve water quality and reduce the impact of extreme storms. Additionally, they promote infiltration to sustain groundwater systems, enhance air quality, and improve biodiversity.

Traditionally, streets in Toronto were designed primarily for transportation, with water runoff discharged directly into storm sewer systems as quickly as possible, which often discharge contaminants such as dirt, oil, and grease directly into waterways. This approach not only impacts water quality but also harms the environment that relies on those waterways.



Toronto's Green Streets program recognised early on that engaging and educating both internal and external stakeholders was essential to the successful implementation of green infrastructure. This involved educating city officials, planners, engineers, and contractors on the benefits and requirements of green infrastructure, as well as working closely with local communities to gain their support and buy-in.

To achieve this, the program developed a comprehensive outreach and education strategy that included public meetings, workshops, and other events to promote the benefits of green infrastructure. They also developed training programs and resources for city officials, planners, and engineers to help them better understand the requirements and importance of incorporating green infrastructure into their projects.

In addition, the Green Streets program worked closely with the city's various departments and educated green streets “champions” in each relevant department to develop a policy and framework that would ensure all projects included green infrastructure. This included developing guidelines and standards for green infrastructure, as well as incorporating green infrastructure requirements into the city's procurement and tendering processes.

As a result of these efforts, Toronto's Green Streets program has successfully implemented green infrastructure in numerous areas of the city, including streets, parks, and public spaces. This has not only helped to improve water quality, reduce stormwater runoff, and enhance the urban forest, but it has also provided numerous social and economic benefits to local communities.

CASE STUDY – MICHELLE AND BARACK OBAMA SPORTS COMPLEX



FIGURE 12 MICHELLE AND BARACK OBAMA SPORTS COMPLEX

The Michelle and Barack Obama Sports Complex is a recently completed multi-building sports complex located in Baldwin Hills, Los Angeles. The athletic centre is situated within a sprawling 24-acre parks and recreation site. The previous facility was built for the 1984 Olympics but badly needed updates and expansion to meet community demand.

One of the key requirements for any development to meet is the California Green Building Standards Code, also known as the CALGreen Code, which is a revolutionary building code that focuses on sustainable construction practices. Enacted in 2010, this code was part of the California Building Standards Code and was the first state-wide green building code in the US. Its purpose was to enhance the design and construction of buildings to improve public health, safety, and general welfare by promoting sustainable construction practices in various categories, including planning and design, energy efficiency, water efficiency and conservation, material conservation and resource efficiency, and environmental quality. Since the implementation of the CALGreen building code:

- carbon pollution has dropped 13% while the economy grew by 26%,
- per capita emissions are the lowest in the country, falling by 23%,
- California now produces twice as many goods and services for the same amount of greenhouse gas emissions as the rest of the nation.



FIGURE 13 BASKETBALL STADIUM

The Michelle and Barack Obama Sports Complex meets these standards and is a prime example of how sustainable construction can economically be delivered.

However, the scope of the project was ambitious, and the city aimed to exceed the CalGreen standard to become LEED certified. The 'Leadership in Energy and Environmental Design' (LEED) program, which is now used for green building certification worldwide, provides rating systems for the design, construction, operation, and maintenance of green buildings, homes, and neighbourhoods to encourage environmental responsibility and efficient resource usage.

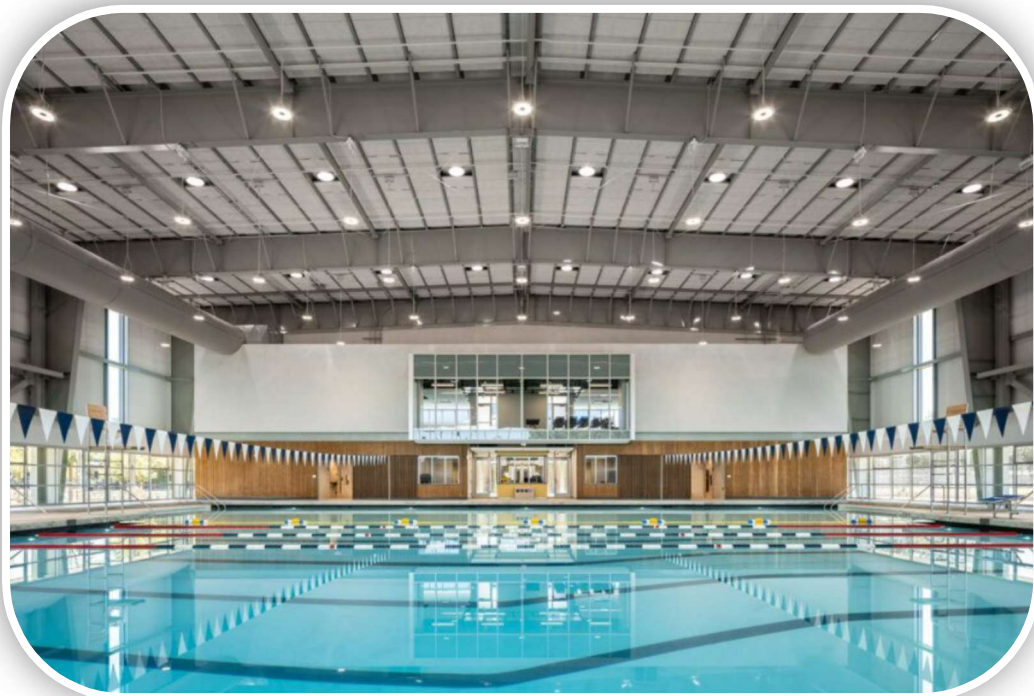


FIGURE 14 SWIMMING COMPLEX

LEED is the most widely used and well-recognized green building rating system worldwide. LEED certification is now used for practically all building types, whether commercial or residential and project types, from new construction and interior fit-outs to sustainable operations and maintenance upgrades. It signifies a certification that "creates healthy, highly efficient, cost-saving green buildings," improving environmental performance from carbon footprint to indoor environmental quality. Today, nearly 100,000 commercial buildings in 167 countries worldwide have been granted or are awaiting LEED certification.

The project has received LEED Gold certification through creative planning and design and has become the City of Los Angeles' first net-zero community centre.

CASE STUDY – LOS ANGELES ASPHALT PLANT NO. 1



FIGURE 15 ASPHALT PLANT #1

Asphalt Plant No. 1 has been operated by the City of Los Angeles since 1947. It can continuously produce asphalt at up to 400 tons per hour and 600,000 tons per year, utilising up to 50% recycled asphalt products. Recycled asphalt is a cost-effective and economically sustainable product that reduces natural resources and waste. It also has a lower carbon footprint while retaining its durability against harsh weather and heavy traffic. The asphalt plant has been wildly successful and was upgraded to keep up with the demand for recycled asphalt for all of Los Angeles' road resurfacing needs.

While undertaking the project to overhaul the existing plant, the scope was expanded to include a new state-of-the-art facility to house the road services and maintenance department for the City of Los Angeles. This new public building would also meet the Envision certification standard.



FIGURE 16 CONTROL ROOM

The Envision Standard is a set of guidelines and criteria developed by the Institute for Sustainable Infrastructure to assess the sustainability of infrastructure projects comprehensively. Over 200 cities, towns, counties, public agencies, and academic institutions across the USA and Canada, as well as more than 250 private-sector companies and industry associations around the world, have chosen to use Envision solutions.

It considers social, economic, and environmental aspects and project developers are required to engage with stakeholders throughout the development process, leading to better outcomes and greater community support. This guidance manual provides not only sustainability and resiliency criteria but also project assessment tools.

Envision score projects in the following categories.

- Quality of Life – Impacts on communities, from the health, wellbeing, and equity of individuals to that of the larger social fabric.
- Leadership – Communication, collaboration, teamwork, leadership, and commitment to sustainability, as well as stakeholder engagement and lifecycle economic evaluation.
- Resources – Materials, energy, and water quality are not only essential to construct the infrastructure but also to keep it running.

- Natural World – Conservation, ecology, and how projects affect the natural world and ecosystem services, minimising negative impacts, and protecting and restoring habitats.
- Climate & Resilience – Minimizing emissions, ensuring projects are resilient, and contributing to resilient communities.

Asphalt Plant No. 1 achieved a bronze certification of the Envision Standard. Using the framework that Envision provided, the project delivered a facility that set good standards for sustainability while also providing a service of sustainable building materials and recycling.

DISCUSSION, OBSERVATIONS AND CHALLENGES

Project managers face numerous challenges when tasked with delivering high-quality public facilities that meet sustainability goals within set timelines and budgets. Often, they may be focused on delivering a core amenity to the public within a predetermined budget. This can make it challenging to ensure that all aspects of the project, including sustainability goals, are met.

One way to address these challenges is by implementing good frameworks and tools within the organisation. These tools can help manage project scope and expectations much earlier in the design process. Unfortunately, not all organisations have access to such tools.

For engineers, having access to tools and education can be instrumental in delivering successful projects. The best projects are often delivered when people are knowledgeable and well-educated in their respective fields. Additionally, third-party tools and certifications exist to aid in design.

It is also important for project managers to take pride in the facilities they deliver and the people who work there. By setting an example for future projects and private developments, they can inspire others to prioritise sustainability and quality in their work.

RECOMMENDATIONS

4. Councils should introduce sustainability guidelines into project management frameworks to ensure that environmental goals are achieved. Education, training and the use of champions are essential.
5. Councils use existing standards and tools such as LEED and Envision to assist in designing and delivering sustainable infrastructure
6. Councils should demonstrate leadership in all their projects and set a standard to promote integrated sustainable infrastructure in private developments.

DELIVERING SUSTAINABLE PUBLIC SPACES

Finding infrastructure projects to expand or contribute to open space, as well as projects to mitigate urbanisation and climate change, can be a difficult task.

It is not uncommon to face challenges when dealing with the infrastructure and planning decisions of the past, where the focus has been on delivering a single service and little has been done to address growth and the future. Growth has seen much of open space sold off for development, and what is left is often difficult to work with.

It can feel like it is too late to retrofit infrastructure as the complexity and cost of the problems can often lead to projects being overlooked and shelved.

CASE STUDY – LA RIVER REVITALISATION



FIGURE 17 LA RIVER PROJECT CONCEPT RENDER

The LA River is an 82km stretch of concrete channel that conveys a 2,140km² catchment through the heart of Los Angeles. After catastrophic flooding in 1938 the United States Army Corps of Engineers (USACE) was brought in to undertake the channelisation of the LA River due to constant flooding and property damage. Their sole focus was to reduce the risk of property damage and flooding.

The USACE is an engineering formation of the United States Army that focuses on providing vital public and military engineering services and reducing risks from disasters. For its time, the project was considered a success, freeing up a significant portion of flood-prone land for development. Formerly unstable floodplains are now prime areas for housing and industry.

However, the public's need for more green open space and biodiversity sparked the plan to revitalise the LA River and naturalise the concrete channels. The 2022 master plan addresses eight goals related to:

- Flood risk
- Parks
- Ecosystems
- Access
- Arts and Culture
- Housing, engagement, and education
- Water supply
- Water quality

Overall, the plan aims to decrease flood risk by preserving and increasing flood risk capacity, reducing the flow into the river, incorporating climate change research, and increasing emergency planning, public awareness, and management practices.



FIGURE 18 TAYLORS YARD PROJECT DESIGN

The final plan is to create an 82 km linear park with open space, an LA River Trail, public amenities, multi-use functionality, and promoting public safety. This requires significant engagement with federal and state agencies.

One key project is Taylor's Yard. The former railway station, classification, and headquarters of Southern Pacific Railroad were acquired by the City of Los Angeles in 2017 after community engagement revealed its potential.

The Taylor Yard River Park is a 42-acre site that was acquired by the city in 2017. The park is intended to provide recreational space, wetlands, and public amenities and is a key part of the ongoing initiative to restore an 18 km section of the river. The park is expected to be completed by 2028, in time for the 2028 Summer Olympics.

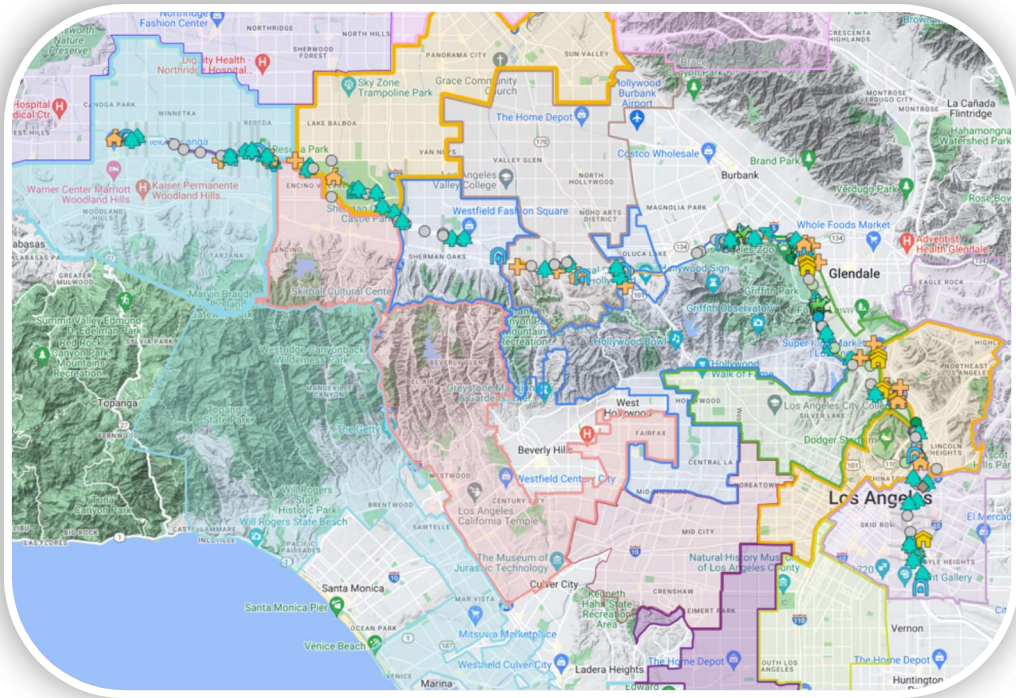


FIGURE 19 PROJECT PRECINCT PLAN

The master plan for the park was adopted in 2022. Along with the Taylor Yard River Park, other major projects include the Albion Riverside Park and the Los Angeles Recreation Zone. In total, there are 250 projects managed by different levels of government.

CASE STUDY – TORONTO PORTLANDS



FIGURE 20 TORONTO PORTLAND'S CONCEPT DESIGN

The Toronto waterfront is an important part of the city's history and economy. Its 46-kilometre stretch along Lake Ontario's shoreline has been a bustling port for trade and transportation, with a long history of industrialisation that has heavily relied on warehouses, factories, and commercial businesses.

To further develop the waterfront, land reclamation and landfill techniques were used over the years to increase its land area significantly. These methods, however, had significant environmental impacts. Natural wetlands were filled in, waterways were diverted, and crucial wildlife habitats and biodiversity were lost. These negative impacts have been worsened by the changing frequency and intensity of severe weather events and the development of upstream Toronto.

One area that has been affected by these issues is Toronto's Port Lands, located on the eastern side of the waterfront. Due to its low elevation, it has long been at high risk of flooding. When the area was originally developed, natural wetlands and creeks were filled in, resulting in an area that was lower than surrounding neighbourhoods and the rest of the city. As a result of its frequent flooding issues, the land remained mostly industrial and underutilised.



FIGURE 21 CURRENT WORKS OF RIVER REDIRECTION AND FLOOD MITIGATION WORK

To mitigate the risk of flooding and address the environmental impacts, the city launched a revitalisation project for the Port Lands. This project includes naturalising and increasing the capacity of previously redirected rivers, as well as creating a flood barrier. By doing so, the project aims to not only reduce flooding in Toronto but also open a considerable amount of land for redevelopment in the Port Lands.

Additionally, the project includes the provision of 25 hectares of publicly accessible green space in a vibrant and sustainable mixed-use public space. This includes parks, walkways, and connectivity to the rest of Toronto's waterfront. The project is also projected to attract a significant return on mixed-use residential and commercial development, making it a win-win situation for both the environment and the economy.

Works started in 2018 and are on track to be finished in 2024, the development of the area will see a total reduction of 16,541 tonnes of CO₂ and save 300,000 GJ less energy per year in comparison to similarly developed areas in Toronto.

OBSERVATIONS

Addressing the challenges posed by urbanisation and climate change requires a multifaceted approach. While the issues are complex, it is essential to acknowledge that they cannot be ignored. It is necessary to take a proactive stance and seek out innovative solutions that address the challenges posed by urbanisation and climate change. By doing so, we can create a sustainable future for generations to come.

However, some projects demonstrate how redevelopment can encourage mixed-use and growth while addressing existing issues. These projects highlight the importance of finding solutions that not only fix problems but also create new outcomes and public amenities.

Infrastructure planning must account for future growth to avoid repeating the mistakes of the past. Additionally, it is crucial to consider how public amenities can lead to economic growth. By doing so, we can create sustainable and vibrant communities that are well-equipped to meet the challenges of the future.

RECOMMENDATIONS

7. Councils should prioritise revitalisation projects, even if they appear difficult. Ignoring sustainability and future planning can result in exponentially large-scale projects as the longer infrastructure needs are postponed.

8. Councils should engage with stakeholders, experts and authorities to identify gaps in public spaces and develop plans for their sustainability.

9. Once potential projects are identified, councils should conduct thorough investigations in order to integrate social, environmental, and economic benefits into large infrastructure projects. This ensures that these benefits are considered in the early stages of planning.

COMMUNITY PROJECTS

Municipalities can face limitations in delivering infrastructure projects due to constraints in space, resources, and staffing. With limited personnel, Councils can only scope and deliver a limited number of projects in a given financial year. In addition, limited public space poses a challenge to delivering infrastructure to improve water quality, promote urban cooling, and increase biodiversity.

To overcome these challenges, municipalities may need to explore innovative solutions and partnerships that leverage community involvement and effectively utilise limited resources. Private-public partnerships, in the form of community projects, grants, or incentives, may help municipalities meet their sustainability targets.

CASE STUDY – PLACE MAKING CHARLOTTE.



FIGURE 22 CHARLOTTE PLACEMAKING COMMUNITY PROJECT CONCEPT ART

The City of Charlotte's Placemaking Program aims to create more vibrant, welcoming, and accessible public spaces that encourage community interaction and collaboration. It is a diverse initiative that involves the collaboration of various city departments, including Planning, Design, and Development, Housing & Neighbourhood Services, and Engineering & Property Management.

The Urban Design Centre leads the Placemaking Program by developing its own projects and providing opportunities for neighbourhoods to participate in placemaking initiatives, such as the renovation of public spaces like parks and plazas, and the implementation of street enhancements. This enables individuals and businesses to define the character and identity of their communities while also providing opportunities for residents and business owners to better integrate public and private land for community use in Charlotte.

Many of these projects include urban greening and sustainable design. Part of the Placemaking Charlotte process is helping the community understand the

importance of providing green spaces in cities and how they can be maintained. Many grants lead to spaces that better 'activate' their public spaces and infrastructure to create a safer, more vibrant, and unique character in Charlotte's neighbourhoods.

The city is committed to completing 250 community placemaking projects, which range from:

- Activation of leftover or underutilised spaces
- Community Pocket Parks
- The Bus Stops revitalisations
- Community Gathering Places
- Streetscape improvements
- Art and beautification efforts

In 2022 16 projects were completed, and over \$200,000 in grants were awarded for community projects.

Overall, the City of Charlotte's Placemaking Program is an excellent example of how urban design and placemaking can transform underutilised public spaces into vibrant places for people. While also providing more green space and education on sustainability. Through collaboration and the sharing of resources, the city is creating more welcoming and accessible public spaces that promote community interaction and enhance the quality of life for residents.

CASE STUDY – DOWNER'S GROVE BIOSWALES

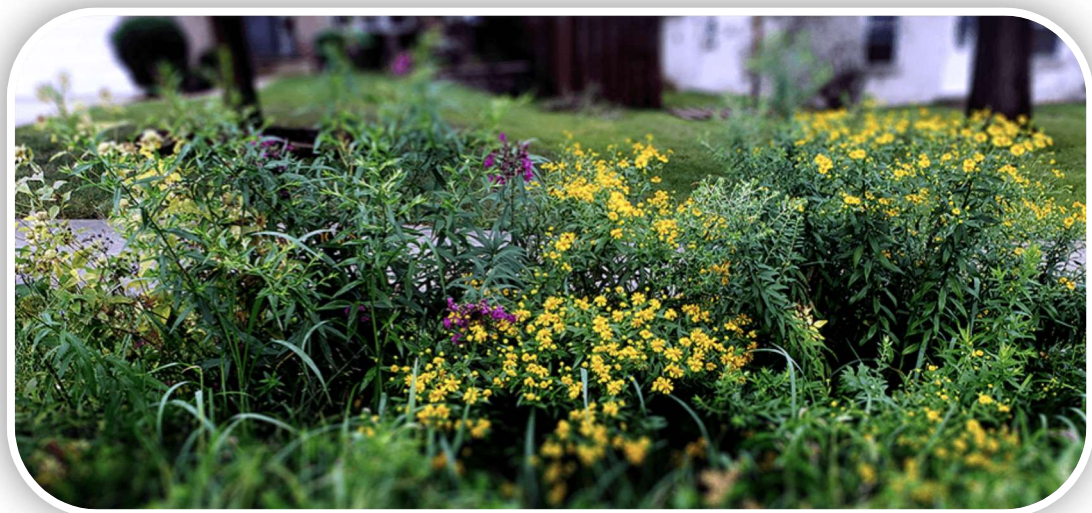
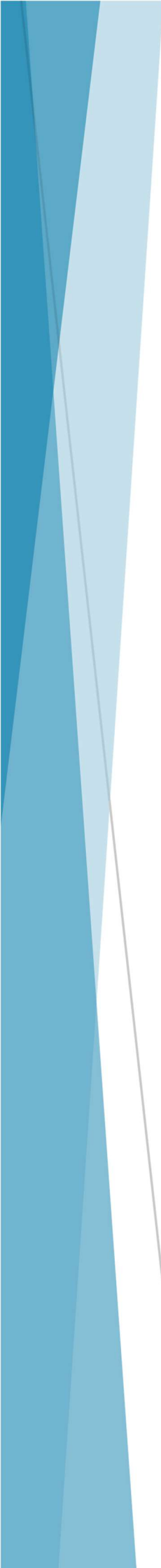


FIGURE 23 BIOSWALE COMPATIBLE NATIVE PLANTS

Downers Grove, a village located in DuPage County, Illinois, covers an area of 38.32 km and has a population of 50,247. The village is part of the Salt Creek Watershed, a large area that covers over 260 square kilometres in northeastern Illinois. Unfortunately, the Watershed has been designated as impaired due to high levels of bacteria and pollutants.



The Downers Grove Bioswale Program is a local initiative in the village of Downers Grove Illinois, aimed at managing stormwater runoff and improving water quality in the community. Bioswales are a key component of the program, which is implemented by the Village's Public Works Department in partnership with the Environmental Concerns Commission.

These bioswales are vegetated shallow swales designed to capture, infiltrate, and treat stormwater runoff. They use soil and plant materials to filter out pollutants and reduce the volume and velocity of runoff, helping to prevent flooding and erosion.

The program focuses on installing bioswales in public rights-of-way in front of private or commercial properties at the request of the property owners. The program also aims to educate residents about the importance of stormwater management and the role that bioswales can play in improving water quality. The village provides information on their website about the benefits of bioswales, how they work, and how residents can install their own bioswales on private property. The maintenance of the site, such as mowing and weeding, is the responsibility of the Village for the first year. After the first year is established, the homeowner assumes all maintenance of the bioswale.

Overall, the Downers Grove Bioswale Program is a successful example of a local stormwater management initiative that is improving water quality and educating the community about the benefits of sustainable stormwater practices. The project launched in 2019 and delivered 40 bioswales in the program's first year.

CASE STUDY – TORONTO ECO ROOF PROGRAM



FIGURE 24 COMPLETED GREEN ROOF IN TORONTO

The City of Toronto launched the Eco-Roof Incentive Program in 2009 to support the uptake of eco-roofs by building owners, make buildings more sustainable, and promote the creation of green infrastructure. The program provides grant funding for building owners to install new green roofs with living plants that provide environmental benefits and improve climate resilience.

Green roofs provide cooling from the urban heat island effect during instances of extreme heat and significantly reduce the stormwater run-off entering Toronto's sewer systems after extreme rain events. Green roofs have become increasingly popular in urban areas to improve sustainability and mitigate some of the negative effects of urbanisation.

Green roofs offer various benefits. They help to decrease energy consumption for heating and cooling buildings, provide natural insulation and shade, absorb pollutants from the air, reduce the heat island effect in urban areas, absorb and filter rainwater, and provide habitats for plants and animals, which contribute to biodiversity. Green roofs can also provide public amenities as open spaces.

The Eco-Roof Incentive Program provides grants for the installation of green roofs depending on their size. This complements Toronto's Green Roof requirement for new buildings and is a key element of the 'Toronto's net zero 2040' strategy. Since the program started in 2009, program has supported a total of 112 projects, totalling 233,000 square metres, reducing energy consumption by an estimated 565 MWh, avoiding 106 tonnes of greenhouse gases, and diverting 8.7 million litres of stormwater annually.

CASE STUDY – GREEN INFRASTRUCTURE PARTNERSHIP OPPORTUNITY PROGRAM (MWRD)



FIGURE 25 WSUD PROJECT BEING COMPLETED IN ONE OF CHICAGO'S SCHOOLS

The Metropolitan Water Reclamation District of Greater Chicago (MWRD) is a governmental agency that provides wastewater treatment and stormwater management services for residents and businesses in Cook County, Illinois, USA. The MWRD manages the region's waterways to help prevent flooding and protect public health and the environment. The MWRD also works to promote sustainable practices and green infrastructure to help reduce the impact of stormwater runoff on local waterways.

Green infrastructure, includes a range of engineered installations that store, infiltrate, and/or evaporate stormwater, thereby mimicking the natural water cycle. The MWRD recognises that green infrastructure practices can be effective in reducing wet weather flows to combined sewer systems, reducing combined sewer overflows to local waterways, and reducing runoff volumes, as well as improving water quality in separate sewer service areas. The MWRD also recognises the vital role of local government in addressing flooding concerns through the innovative use of green infrastructure. However, there is limited space for this type of green infrastructure on land that the MWRD has access to.

In 2014, the MWRD established the Green Infrastructure Partnership Opportunity Program to increase the acceptance and investment of green infrastructure throughout the Chicago area. Since that time, the Green Infrastructure Partnership Opportunity Program has partnered with dozens of agencies to fund green infrastructure projects such as rain gardens, bioswales/bioretention areas, permeable pavement systems, and rainwater harvesting systems.

Starting in 2017, the MWRD began working with other governmental agencies within its jurisdiction for green infrastructure projects, such as municipalities,

townships, school districts, park districts, and grants for over 60 green infrastructure projects to help alleviate flooding.

So far, these projects have made better use of both public and private land and have saved 25 million litres of storage for stormwater runoff for over 3,700 benefiting structures with the use of rain gardens, bioswales, and permeable pavement in parking lots, alleys, and residential streets.

OBSERVATIONS

Private-public partnerships can provide the resources needed to deliver projects that might not have been possible otherwise. Through grants and incentives, municipalities can involve private partners in delivering public facilities and infrastructure. There is also a sense of city pride that comes with being involved in such partnerships. By working together, private and public organisations can create projects that benefit both the community and businesses.

Often residents, communities, and businesses want to contribute to open space and sustainability if they receive assistance and grants. The community can provide valuable local knowledge and expertise that can inform the design and development of public space infrastructure. Working with the community on such projects can strengthen community relationships, leading to greater social cohesion and a stronger sense of community.

Engaging neighbourhoods in the development and maintenance of open spaces can lead to greater sustainability and improved outcomes. Providing voluntary grants and programs can also help build momentum for projects as they provide more value to the community.

RECOMMENDATIONS

10. Develop programs to deliver public space infrastructure with community participation, as it can help educate the public, increase their engagement, and achieve results that the council might not be able to achieve alone.
11. Councils should invest in grants and rebate programs for green infrastructure, and engage with the community to improve environmental goals for public and private land.

PROFESSIONALS IN PUBLIC WORKS

Engineers play a critical role in delivering innovative infrastructure projects. These professionals bring their expertise in design, planning, and construction to ensure that projects are completed on time, within budget, and to the required specifications. They are responsible for overseeing every aspect of a project, from the initial concept to the final construction phase.

Engineers play a key role in ensuring that innovative infrastructure projects are technically feasible and sustainable. They use their knowledge to design and test new materials and systems, and to develop innovative solutions to complex problems. This requires a deep understanding of the latest technology, as well as a creative approach to problem-solving.

Engineers are also responsible for ensuring that all stakeholders are kept informed and engaged throughout the project lifecycle. In delivering innovative infrastructure, engineers are critical to the success of the project.

CASE STUDY – BECOMING AN ENGINEER.

To become a registered civil engineer in the USA, not only do you need to obtain a bachelor's degree but also to gain 2 to 5 years of work experience under the supervision of a licensed professional engineer and pass several exams.

Once civil engineers graduate, they are inducted into The Order of the Engineer in the United States or the Ritual of the Calling of an Engineer in Canada. Both these associations are for professional engineers that emphasise pride and responsibility in the engineering profession.

To become a licensed professional engineer, you need to pass 2 exams from the National Council of Examiners for Engineering and Surveying. The Fundamentals of Engineering (FE) exam, which covers the basic principles of engineering and then the Professional Engineering (PE) exam which tests the candidate's ability to apply engineering principles to real-world problems.

A licence must then be applied for as a professional engineer with the state board of engineering. The requirements for licensure vary by state but typically include a combination of education, work experience, and passing the FE and PE exams. And passing any exams for engineering specialisations. Once licensed, civil engineers must meet ongoing continuing education requirements to maintain their license.

CASE STUDY – CONTINUING EDUCATION



FIGURE 26 MAIN HALL AT PWX CHARLOTTE 2022

Continuing education requirements for licensed civil engineers vary by state and involve completing continuing education units (CEUs) or professional development hours (PDH) over a set period. These are awarded for attending training programs covering new technologies, building codes and regulations. Failure to meet these requirements can result in disciplinary action, so it's essential for all engineers to keep up to date. These requirements help maintain high standards and ensure engineers remain up to date with the latest developments in sustainable practices and changing requirements.

The American Public Works Association (APWA) Public Works Expo (PWX) is an annual event that brings together professionals in the public works industry from all over the world. It offers an opportunity to learn, network, and stay up to date on the latest information and technologies in the public works sector. The event includes a variety of sessions, workshops, and presentations, as well as an exhibit hall featuring the latest products and services from vendors. PWX provides many opportunities for Civil engineers to obtain CEUs and PDHs.



FIGURE 27 PWX ATTENDANCE IN CHARLOTTE 2022

Attending APWA PWX is incredibly important for the professional development of civil engineers. The event provides an opportunity for engineers to learn about new technologies and techniques that can improve their work and make their projects more efficient and effective. It also offers the chance to network with other professionals in the industry, which can lead to new partnerships and collaborations. Attending PWX can help engineers stay up to date on the latest industry trends, which is critical in a field that is constantly evolving.

At the public works expo, I saw seminars on

- Efficiencies in open space and park management
- Infrastructure and street revitalisation
- Creating collaborative space in public works departments
- Post-pandemic futureproofing and resiliency.
- Case studies on collaboration
- In-house policy development and strategy

OBSERVATIONS

Many successful projects are attributed to passionate civil engineers who are proud of their work and feel they contributed to the public good. Engineers working in multiple disciplines have an advantage when it comes to collaborating with their counterparts. They better understand the whole scope of projects and what is required for success.

Post-graduate engineering jobs offer more structure and opportunities for engineers to gain well-rounded experience and grow their skills. This helps employers retain staff by providing a challenging and fulfilling work environment. Licensing exams and continuing education ensure that engineers have a high level of competency in their field.

Victoria has started registering engineers, but it still has a long way to go compared to other places. Despite this, better outcomes are achieved when engineers care about their work and are invested in the projects they are working on. This benefits not only the engineers themselves but also the community to which their projects are delivered.

When looking into successful infrastructure projects, one of the biggest factors was the people delivering them. Working as an engineer in Australia can be different and often isolating, as engineers often graduate with a degree and several weeks of experience.

RECOMMENDATIONS

12. Councils need to have good rotational programs so that engineers have an understanding of the broad picture in all parts and processes from planning, scoping, delivering, and maintenance of infrastructure
13. Councils should invest in their engineering staff by providing robust training opportunities, developing comprehensive plans, and creating a supportive environment to prioritize continuous professional development.

CONCLUSION

The 2022 MEFV study tour was an eye-opening experience that provided great insight into government projects, policies, and procedures. The attendees discovered both differences and similarities to the problems we face delivering infrastructure in Australia and the problems we will face in the future as we develop as a nation. However, speaking to various engineers and project managers showed how integral people are to creating the spaces we all live in. We saw challenges they faced that mirrored our own.

The findings from the tour have been used to develop recommendations for government organisations, such as councils, to better aid in the delivery of sustainable infrastructure and better integrate Councils' goals into usable public open space,

Without formal sustainability requirements, public and private development projects may neglect green infrastructure due to budget constraints and the pressure to deliver. However, when federal policies mandate strict sustainability standards, developers collaborate with cities to meet these requirements, fostering positive relationships and innovative solutions. Government policies at the highest level empower municipalities to enforce sustainability features in all developments, driving upfront consideration and innovative problem-solving. In cases where higher-level government standards are lacking, local councils can establish their own policies to surpass minimum state requirements.

1. Councils should develop strong policies to ensure development projects within their municipalities deliver sustainable outcomes.
2. Councils should establish clear and rigid sustainability targets to encourage innovation in project development.
3. Where higher levels of government are failing in good environmental policy development, Local Government can step in and become a leader in its own policy development and influence other levels of government.

Project managers face challenges in delivering public facilities that will meet sustainability goals on time and within budget. Tools and frameworks can help manage scope and expectations, but not all engineers have access to them. Engineers benefit from tools and education, while third-party certifications aid design. Project managers should take pride in their work, setting an example for future projects and inspiring others to prioritise sustainability and quality.

4. Councils should introduce sustainability guidelines into project management frameworks to ensure that environmental goals are achieved. Education, training and the use of champions are essential.
5. Councils use existing standards and tools such as LEED and Envision to assist in designing and delivering sustainable infrastructure.
6. Councils should demonstrate leadership in all their projects and set a standard to promote integrated sustainable infrastructure in private developments.

To address urbanisation and climate change challenges, a proactive, multifaceted approach is crucial. We must seek innovative solutions to create a sustainable future. Some redevelopment projects show how mixed-use growth can solve existing issues and generate new public amenities. Infrastructure planning must also anticipate future growth and consider how public amenities can drive economic prosperity, fostering vibrant, sustainable communities for the future.

7. Councils should prioritise revitalisation projects, even if they appear difficult. Ignoring sustainability and future planning can result in exponentially large-scale projects as the longer infrastructure needs are postponed.
8. Councils should engage with stakeholders, experts, and authorities to identify gaps in public spaces and develop plans for their sustainability.
9. Once potential projects are identified, councils should conduct thorough investigations in order to integrate social, environmental, and economic benefits into large infrastructure projects. This ensures that these benefits are considered in the early stages of planning.

Public-private partnerships provide resources for projects that may not have been feasible. Grants and incentives can involve private partners in public infrastructure. Assistance and grants motivate residents, communities, and businesses to contribute to open space and sustainability. The community's local knowledge can inform public space infrastructure. Collaborating with the community on such projects can enhance community relationships. Involving neighbourhoods in open space development can result in greater sustainability.

10. Develop programs to deliver public space infrastructure with community participation, as it can help educate the public, increase their engagement, and achieve results that the council might not be able to achieve alone.
11. Councils should invest in grants and rebate programs for green infrastructure and engage with the community to improve environmental goals for public and private land.

Passionate civil engineers contribute to successful projects and excel in interdisciplinary collaborations. Post-graduate engineering roles offer structured growth opportunities, aiding staff retention and competency and Victoria is progressing in engineer registration. Project success is greatly influenced by engineers' commitment and investment. Infrastructure project success often depends on dedicated individuals in the Australian engineering field.

12. Councils need to have good rotational programs so that engineers have clear understanding of the broad picture in all parts and processes, from planning, scoping, delivering, and maintenance of infrastructure.
13. Councils should invest in their engineering staff by providing robust training opportunities, developing comprehensive plans, and creating a supportive environment to prioritise continuous professional development.

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