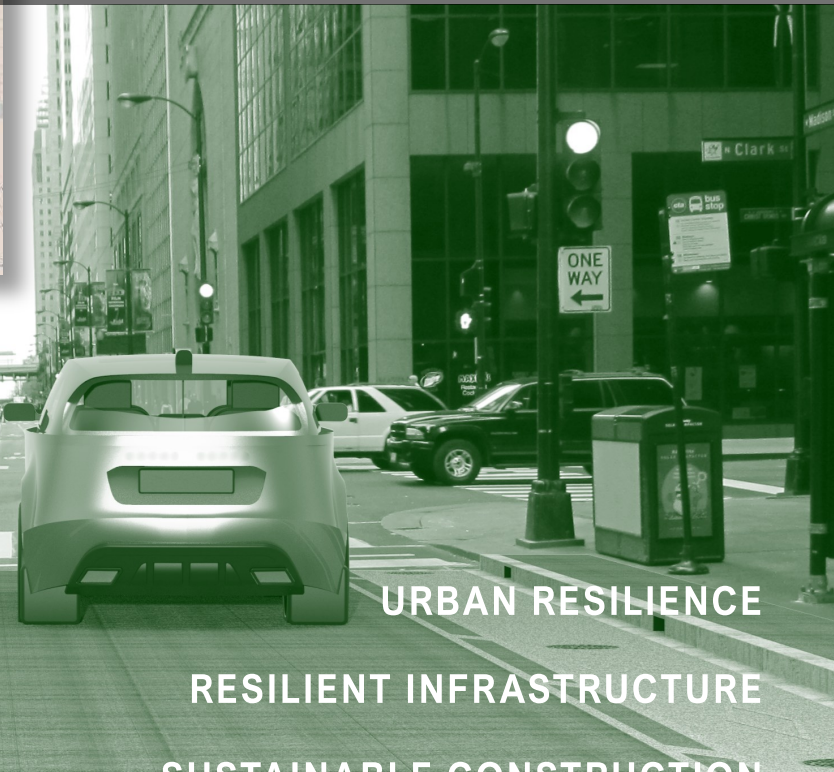


# Flood-Mitigating & Sustainable Rigid Pavements



URBAN RESILIENCE

RESILIENT INFRASTRUCTURE

SUSTAINABLE CONSTRUCTION

 CUPOLEX<sup>®</sup>

# Converting Risk-Driving Impervious Spaces into Resilient Assets

To achieve greater resilience, cities must turn to cost-effective and practical technologies. There is one risk driver that cities have in overabundance but could easily convert into a resilient asset: impervious spaces. Sidewalks, public realms and plazas, streets, bike lanes and park spaces make the DNA of virtually every city. Every year, municipalities budget for the maintenance and repair of impervious spaces and improve or construct new ones. Like editing the DNA to remove a genetic weakness, integrating large-scale stormwater capture under nearly every possible impervious surface can begin to convert how cities behave with water.

**CUPOLEX® concrete cast-in-place engineered rigid pavements are designed for stormwater capture to mitigate flood risk. This design converts risk-driving impervious pavements into resilient assets and extends the life of existing water infrastructure by reducing the hydrological load.**

## SUSTAINABLE ENGINEERED CONCRETE ROADS & HIGHWAYS

The concrete pavement industry is actively seeking new and innovative solutions to build more economical, more sustainable and more durable roads. CUPOLEX® is an engineered structural concrete pavement system that is evolving in the Road and Highway construction industry. An engineered CUPOLEX® concrete pavement design consists of interlocking, modular, dome-shaped high-density plastic units that serve as a permanent formwork within the concrete pavement structure. The resulting product is a concrete pavement slab with a system of interconnected vault-like voids below the surface. The CUPOLEX® concrete pavement is engineered to provide carrying capacities equivalent to conventional concrete thickened pavements, but requires less concrete to do so and also provides drainage and stormwater benefits. The CUPOLEX® form-based engineering methodology can provide significant material and potential cost savings, when compared to conventional jointed plain concrete pavements.

## CUPOLEX® DESIGN FEATURES

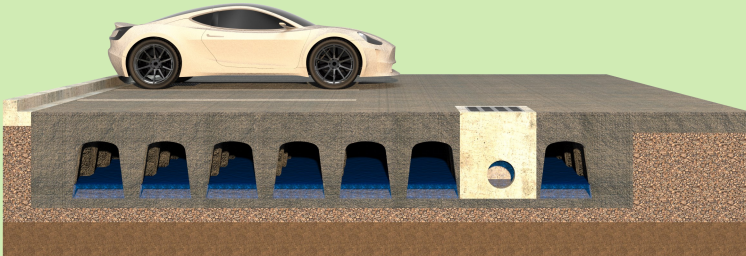
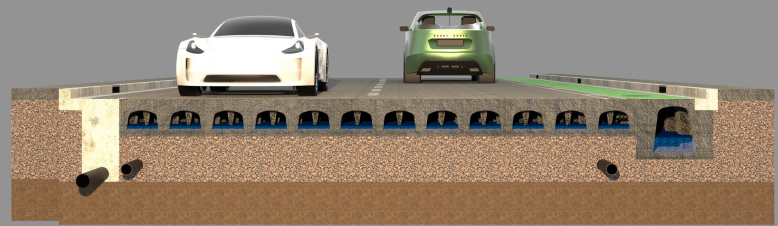
- CUPOLEX® engineered concrete pavements are designed to provide carrying capacities equivalent to conventional concrete pavements
- Concrete pavement is engineered to reduce the slab's contact with the base layers providing protection to the pavement from moisture and humidity
- Allows for the quick, easy and cost-effective installation and repair of buried utilities, such as cables and pipes, after construction.
- Reduces slab curling, when compared to conventional concrete pavements.
- Reduces the need for granular base materials or engineered fill.
- Stormwater management solutions are integrated below roads and pavements.
- Effective control of expansive soils and frost action below pavements.
- Reduces the environmental impact by saving concrete and conserves valuable aggregate. One truckload of CUPOLEX® replaces over 50 truckloads of gravel.
- Is compatible with conventional slip-form paving equipment, allowing for fast and easy paving.
- Pavement has a low potential for cracking. Furthermore, the low overall variability in strains reduces the potential for fatigue failures.
- The ability to reduce the initial construction costs of concrete pavements can make them much more attractive economically to transportation agencies.
- Could be integrated into pervious concrete pavements.



# APPLICATIONS

## Roads

We design CUPOLEX® concrete rigid pavements with integrated stormwater capture. The resulting product is a concrete pavement, capable of providing carrying capacities equivalent to conventional road pavements but requiring less concrete.



## Parking Lots

CUPOLEX® concrete cast-in-place engineered rigid pavements are designed for stormwater capture to mitigate flood risk. This design converts risk-driving impervious pavements into resilient assets and extends the life of existing water infrastructure by reducing the hydrological load.



## Right-of-Ways & Medians

The ability of CUPOLEX® to reduce the initial construction costs of concrete road pavements makes them much more attractive economically to transportation agencies

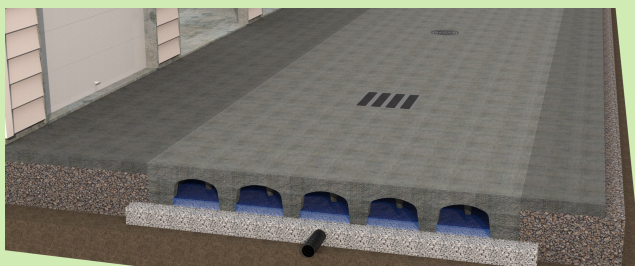
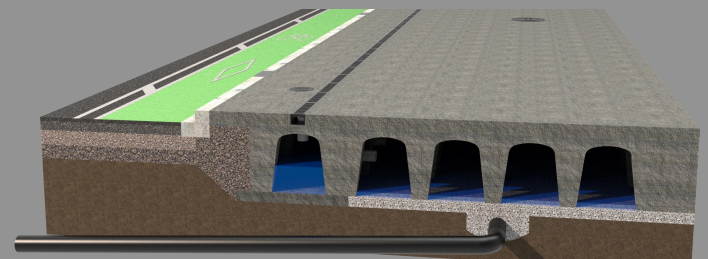


## Streetscapes

Transforming urban impervious pavements in areas of flood vulnerability can now be done cost-effectively with much less interruption in traffic patterns and the local economy.

## Sidewalks

Instead of looking at sidewalks as pedestrian mobility, they can now be designed for subsurface stormwater capture, which in turn reduces and delays the disruptive effects of floods and also filters and percolates pluvial water in underground aquifers.



## Laneways

Stormwater management solutions are cost-effectively integrated below the pavement to allow municipalities to improve or construct new ones.



## REDUCING THE ENVIRONMENTAL IMPACT

The concrete industry is investing significant resources into reducing the environmental impact of its product. The production of cement and concrete require large amounts of raw materials and energy, making the cement and concrete industry a major producer of greenhouse gases. However, CUPOLEX® also has the potential to reduce this impact by reducing the amount of concrete required, while continuing to produce equally durable infrastructure.

According to a research study, a 230 mm jointed plain concrete slab over a 200 mm Granular 'A' base is a suitable 25 year pavement design for major arterial roadways with an annual average daily truck traffic (AADTT) of 10,000 (ARA 2011). The CUPOLEX® slab, having slightly more capacity, is able to carry additional truck capacity on a daily basis or provide additional life beyond 25 years. Based on an MEPDG analysis, the equivalent flexible pavement would consist of 180 mm of hot mix asphalt, 150 mm of granular base and 600 mm of granular subbase (ARA 2011). The CUPOLEX® concrete alternative has a significantly reduced pavement structure thicknesses, which conserves valuable aggregate and provides economic savings.

## CUSTOMIZED DESIGN PACKAGE

### CUSTOMIZED DESIGN PACKAGE

**Design Application Analysis** – Our firm helps clients determine the Engineered CUPOLEX® system solutions that address specific site needs.

**Value Engineering** – CUPOLEX® works with value -engineering at the forefront of each project. We provide the best alternatives for every project.

**Structural Systems Evaluation** – Every project is unique. Our team reviews multiple structural CUPOLEX® systems to determine the best fit for each project.

**Preliminary Structural Design** – We work with our clients and their designers to determine the performance of a given CUPOLEX® structure under the prescribed loads and/or other effects or requirements while using principles of statics, dynamics and mechanics of materials to determine the size and arrangement of CUPOLEX® structural elements.

**Material & Cost Estimating** – Our collective experience helps us to provide our clients with material recommendations to reduce costs while maintaining the function of the CUPOLEX® structure.

**Engineered Design Drawings** – Issued for construction (IFC) and supported with FEA structural calculations, PE stamp, construction documents and specifications.

**CUPOLEX® Installation Shop Drawings** – With detailed CUPOLEX® formwork installation procedures issued to contractors.

**Onsite Support** – Construction training, monitoring and inspections for successful construction, and we present the information in a comprehensive report.

**Construction Administration** – We provide responses to request for information and interpretation of CUPOLEX® design drawings, with completion statements and regulatory compliance reporting where required.