

*Precast Concrete*

*...Sustainable Structures for Tomorrow*



**NORR**

An Ingenium Group Company

Rolfe Kaartinen, Principal  
NORR Limited, Architects & Engineers

[www.norrlimited.com](http://www.norrlimited.com)



(A presentation on behalf of the) Canadian Precast Concrete Institute

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# Sustainable Parking Garage Practices

Proximity, energy efficiency, recyclability and minimal waste are keys to meeting environmental standards that are gaining client interest.

# What is “Green” Design?

Design and construction practices that significantly reduce or eliminate the negative impact of buildings on the environment and occupants are in five broad areas:

- Sustainable site planning
- Safeguarding water and water efficiency
- Energy efficiency and renewable energy
- Conservation of materials and resources
- Indoor environmental quality

# North America First LEED Certified Parking Garage

Santa Monica, CA

The Santa Monica Parking garage features:

- photovoltaic roof panels
- a storm drain water treatment system
- recycled construction materials
- energy efficient mechanical systems



# Precast Concrete

- No construction material or product can guarantee LEED Certification of your project
- Precast concrete components may be able can help reach as many as 23 of the 26 points needed to achieve LEED certification.



# Sustainable Parking Garages

*Precast concrete is designed to optimize (lessen) the amount of concrete used and has minimal site waste in manufacturing and at the site.*

# Sustainable Attributes

- Components can help achieve sustainability in a variety of ways:
  - Their ability to be recycled
  - Local manufacturing capability
  - Thermal mass
  - insulation
- These attributes help reduce the expended energy needed to manufacture, transport and erect materials - key sustainable requirements.



# Building Reuse

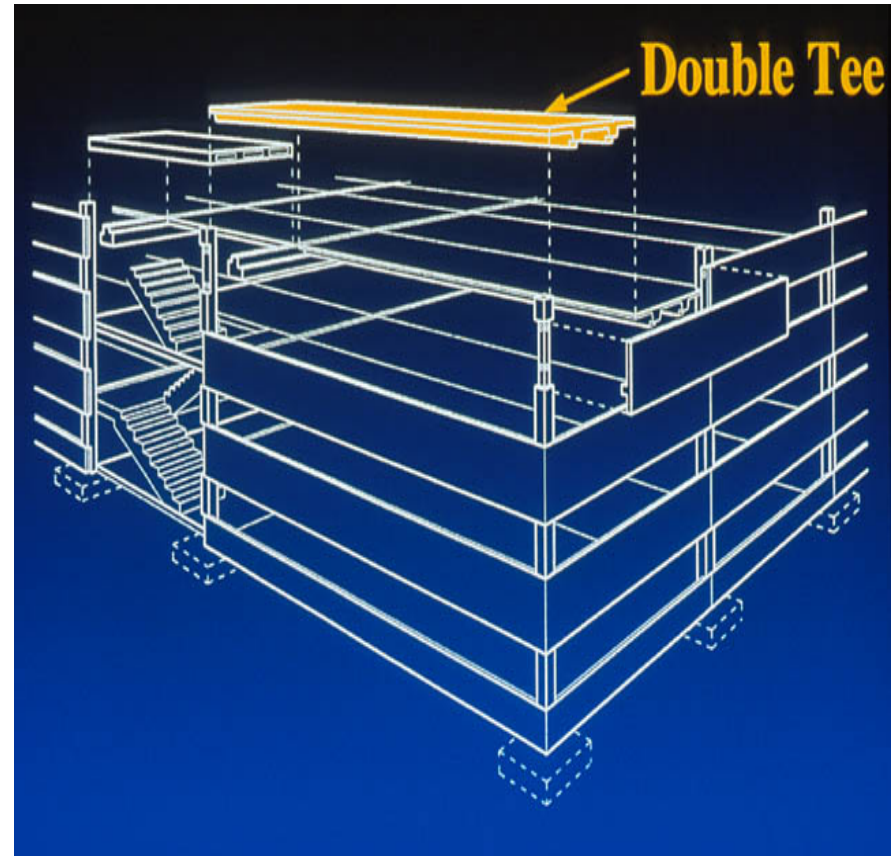
- A key factor in building reuse is the durability of the original structure. Building reuse generally means leaving the main portion of the building structure and shell in place when renovating.
- This helps the environment by conserving resources and reducing wastes and the environmental impacts of new construction. Construction and demolition waste contribute to solid waste going to landfills.





# Building Reuse

- Concrete's durability gives it a strong advantage in this category
- Precast concrete structural systems and precast spandrel panel systems can provide long service life.
- Double tees components offer long interior spans.
- Structures are easier to remodel or reconfigure as tenant needs change.
- This ensures that a structure can remain in place longer with only minor adjustments needed.



# Building Reuse

- Precast parking structures can be designed for future vertical expansion in mind, with heavy load-bearing framing to accommodate additional parking and/or commercial office space can be added on top of the parking structure.



# Construction Waste Management

- Reducing construction, demolition and land-clearing waste that would normally end up in landfill is good for the environment.
- Precast components are made in manufacturing facility and shipped just –in –time for installation reducing congestion and waste on the site.



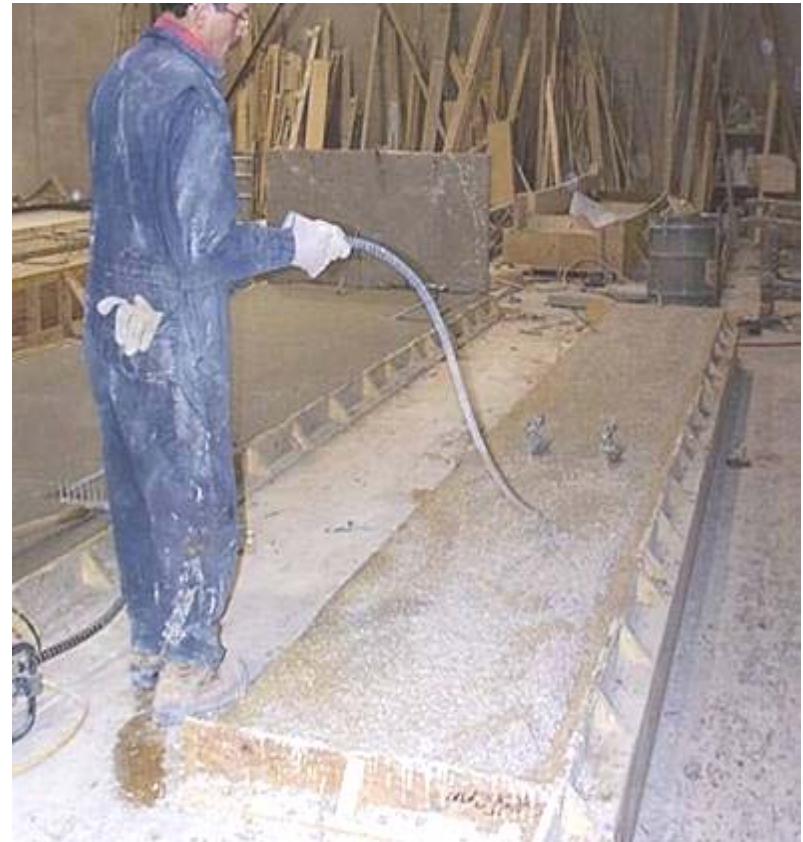
# Construction Waste Management

- Concrete's inorganic composition makes it an ideal material to be recycled.
- Concrete is frequently crushed and reused as aggregate for road bases or construction fill.



# Construction Waste Management

- For instance, gray water often is recycled in future mixes, between 5 and 20 percent of aggregate in a mix can consist of recycled concrete and sand used in finishing can be reused.
- Steel forms and other materials used in casting are reused many times.



# Construction Waste Management

- A properly designed parking system will result in:
  - smaller structural members
  - longer spans
  - less material used on-site.
- This translates directly into both economic and environmental savings.
- Using less material means using fewer natural resources and less manufacturing and transportation energy.



# [ Recycle ]

- Double tees, columns and beams and spandrel panels from an un-needed parking garage can be reused in another structure.



# Recycled Content

- Supplementary cementitious materials can replace a portion of the cement in a mix.
- These materials are considered post-industrial recycled ingredients.





# Recycled Content

- The most common supplementary cementitious materials:
  - **Fly ash** is the residue remaining from fossil-fuel power plants.
  - **Silica fume** is the by-product from the electric-arc furnace used in the production of silicon or ferrosilicon alloys.
  - **Slag cement** is created from iron blast-furnace slag.
- *The use of fly ash can increase setting times. This may be an economic factor in precast concrete manufacturing if casting can not be maintained on a daily cycle.*
- All these waste products would end up in landfill if not reused. In many cases, the use of fly ash and other supplementary materials can produce a more durable product than a total-cement mix.

# Recycled Content

- The best approach is to talk with the supplier in advance and avoid prescribing an amount of fly ash beforehand.
- Ask the supplier to use the maximum amount that's effective and give them a performance standard for the application, not just a percentage.
- The goal for long-term performance of a structure should optimize the use of fly ash, not maximize it.



# Local & Regional Materials

- The LEED rating system promotes using at least 20 percent of building materials are manufactured within an 800 km (500-mile) radius of the site.
- And material in product are regionally extracted or recovered within 800 km.
- Precast concrete meets both of these requirements in virtually all cases.



# Local & Regional Materials

- Most precast plants are within 320 km/200 miles of the project, and the raw materials used to produce the precast concrete components:
  - cement
  - aggregates
  - prestressing strand
  - rebar and wire meshare usually obtained from sources within 320 km (200 miles) of the precast plant.



# Local & Regional Materials

- This advantage leads many designers to replace granite, stone and other imported products with precast concrete.



# Case Samples



# Expandable

- Precast with brick finish makes structure blend in with surroundings.
- Designers of this new four-level, car parking structure in the City of Gatineau (formerly Hull) took advantage of the flexibility and
- versatility inherent in precast concrete to create a infill parking
- garage that remains visually interesting.

## Edifice de Stationnement Rue Leduc Gatineau, Québec, Canada



# Expandable

- The system of precast concrete structural pieces helps to reduce the mass and added a sculptural effect that breaks the façade into a series of smaller components.
- The structure was designed with projecting columns in front of the spandrels. Columns and panels have accent lines to reduce the scale of the pieces. Many of the precast concrete panels have thin bricks inset at the factory so the structure resembles the other buildings in the area.





# [ Expandable ]

- The use of a total precast concrete system (258 pieces) including columns, beams, long-span double tees and spandrel panels permitted a compact, efficient construction schedule with little disruption to adjacent properties.
- The structure was designed for future vertical expansion in mind with heavy load-bearing framing to accommodate additional parking and commercial office space to be added on top of the parking structure.



# Innovative Mixed-use Design

## Metro Park Halifax, Nova Scotia, Canada



- Metro Park, a new high tech, seven level parking and commercial structure, opened in the early spring of 2002 adding much needed parking spaces in the downtown area of Halifax.
- The building was constructed with a precast prestressed concrete building system comprising of beams, columns, architectural spandrels, shearwalls, litewalls and double tee floor slabs.

# [ Innovative Mixed-use Design ]

- The layout of the garage is continuous interwoven spiral ramp with two-way traffic flow. The building was serviced with two precast concrete stair towers and one elevator.



# Innovative Mixed-use Design

- The designers wanted the Parking structure to lend in with surrounding older brick and stone in downtown Halifax.
- To accomplish this, the lower two floors were clad with earth colored pigmented precast concrete panels to express the architecture of the area.



# Innovative Mixed-use Design



# Credits

- **Owner:** Halifax Regional Municipality - Halifax, Nova Scotia  
**Developer:** The Hardman Group - Halifax, Nova Scotia  
**Architects:** Duffus Romans Kundzins Rounsefell Architects Ltd. - Halifax, Nova Scotia  
**Structural Consultants:** Campbell Comeau Engineering Limited - Halifax, Nova Scotia  
**General Contractor:** McAlpine Construction - Halifax, Nova Scotia  
**Precast Fabricator:** Strescon Limited - Saint John, New Brunswick

# [ Mixed Use, Retail Offices, Parking ]

Award Winning  
Project

Downtown Multi-Use  
Parking Facility  
Burlington, Ontario

2004 Ontario  
Concrete Award  
winner for Material  
Development and  
Innovation



# Mixed Use, Retail Offices, Parking

## THE CHALLENGE

- The building site presented a number of major challenges.
- The structure had to be open and user friendly, operate as a parking garage and also be recognizable as a civic building.
- Minimal material storage was available because the structure occupied most of the site.
- Careful consideration had to be made for access, dust control, noise and the impact on surrounding busy streets.





# Mixed Use, Retail Offices, Parking

## THE PROJECT

- This 360 car, 6 storey garage and 1,000 sq m office was built using high performance precast concrete that was designed to increase the long term durability of the structure and to endure the corrosive elements of road salt.
- The civic offices were incorporated as part of the precast garage structure.



# Mixed Use, Retail Offices, Parking

- **THE DETAILS**

267 Double Tees - 11,550 sq m

29 Beams - 195 m

103 Spandrels - 1,060 m

35 Columns - 390 m

21 Column Walls - 580 sq m

3 Shear Walls - 370 sq m

- **Owner:** The Corporation of The City of Burlington

**Architect:** Stark Ireland Architects Inc.

**Precaster:** Pre-Con Inc.

**Structural Engineer:** Brenik Engineering

**Project Manager:** Dineen Construction Corporation

# Moveable

City Of Ottawa Parking Garage,  
Laurier Ave, Ottawa, ON



- The parking garage opened January 1988 as a temporary parking unit and was built to be movable.
- The garage houses 373 parking spaces on three floors.

# Innovative Precast Design, NORR Ltd

Award Winning Project  
Canadian Plaza at the  
Peace Bridge, Canadian  
Customs & Immigration,  
Fort Erie, Ontario

This 2005 project  
received an Ontario  
Concrete Awards, for  
Precast Concrete -  
Structural Design  
Innovation.



# Halifax Airport Garage, NORR Limited

- 2400 space parking garage for the Halifax International Airport Authority including consolidated rental car facilities



# Halifax Airport Garage, NORR Limited

- Use of florescent lighting versus metal halide within the garage will provide annual savings of 25% electrical use and annual maintenance costs cut in half
- Use of perimeter light sensors to use natural daylight
- Use of pre-topped precast T's will save on applied flooring/traffic toppings
- Provisions for future garage expansion built-in
- Natural ventilation eliminates mechanical equipment



# Toronto Airport Garage, NORR Limited

- 8500 space parking garage for the Greater Toronto Airports Authority including consolidated rental car facilities provisions



# Toronto Airport Garage, NORR Limited

- Use of florescent lighting versus metal halide within the garage will provide annual savings of 25% electrical use and annual maintenance costs cut in half
- Use of perimeter light sensors to use natural daylight
- Provisions for future garage expansion built-in
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# Acknowledgements

- CPCI: Brian Hall

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