

# Waterloo Institute for Sustainable Energy

## Helical Piling Applications

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# Our Agenda Today

- Almita Helical Pile Overview
- Environmental and Economic Advantages
- Helical Pile Applications
- Design Considerations
- Q & A

# Helical Pile Design

Installation  
Drive Holes

Pipe Shaft

One or more helical shaped circular plates affixed to a steel central shaft

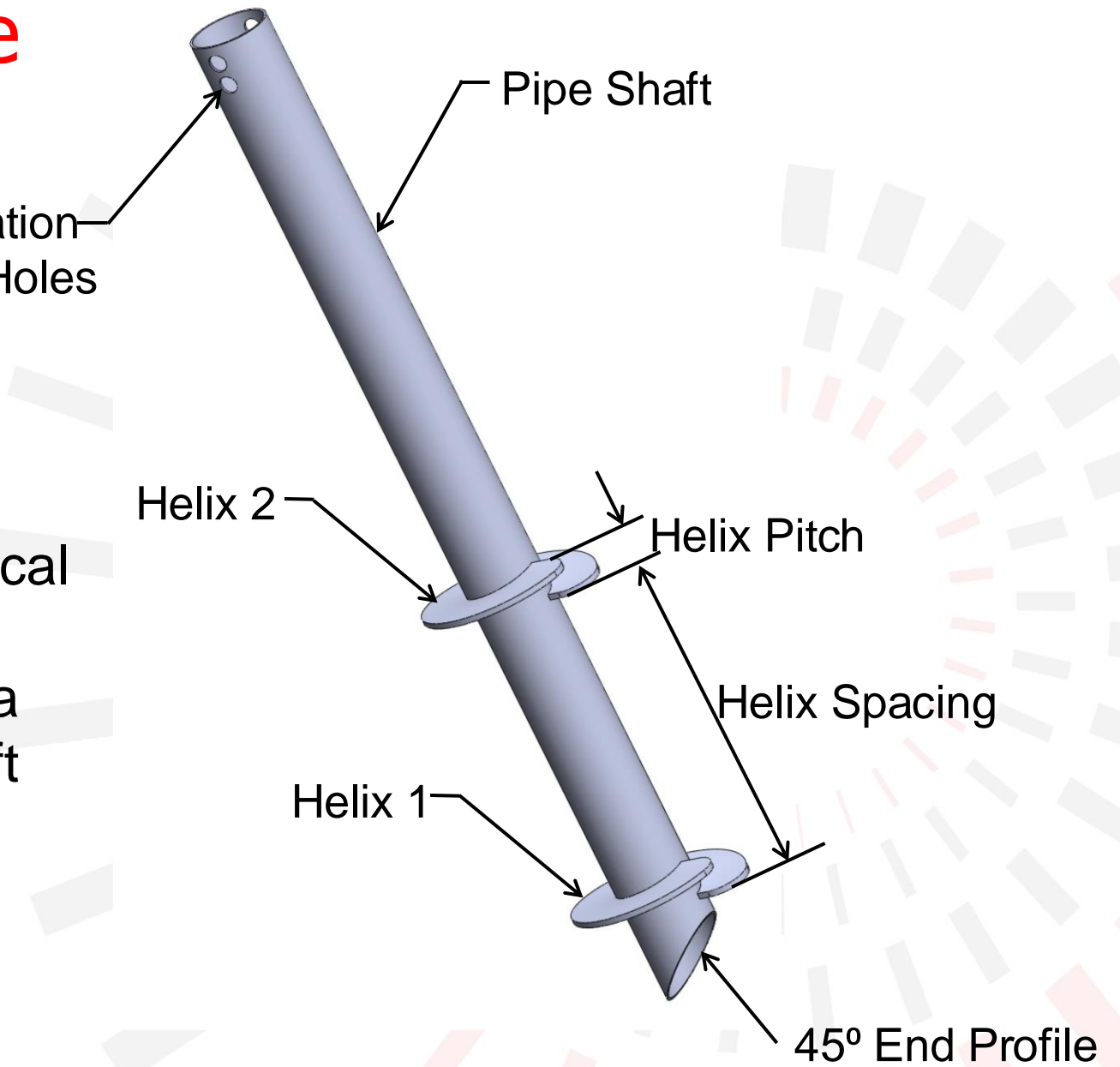
Helix 2

Helix Pitch

Helix Spacing

Helix 1

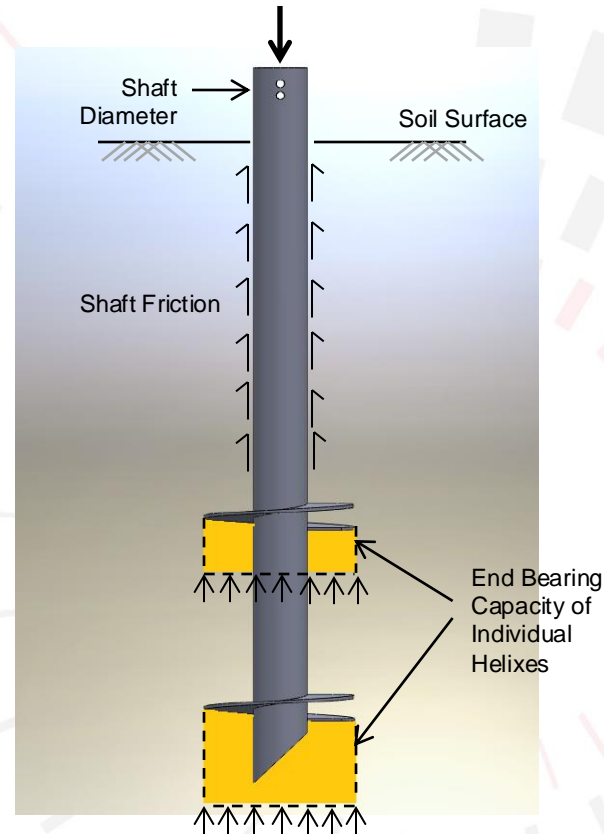
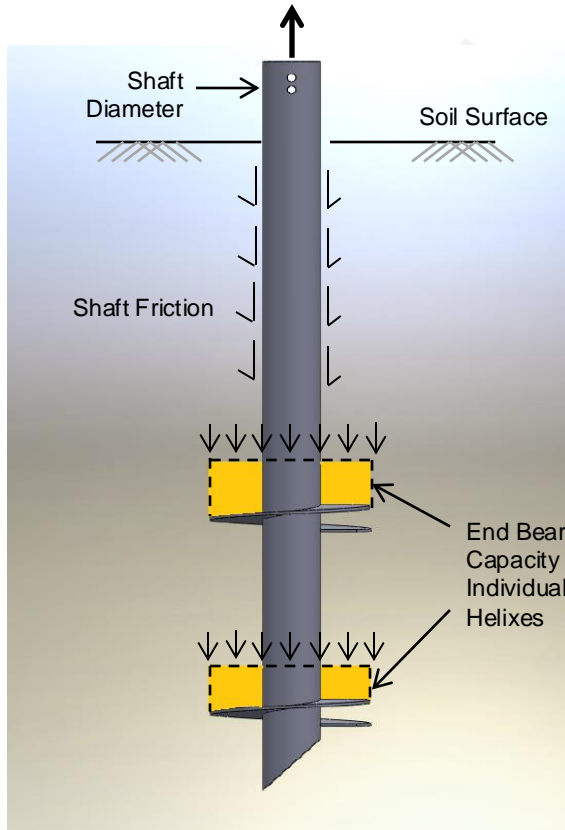
45° End Profile



# Individual Bearing Model (IBM)

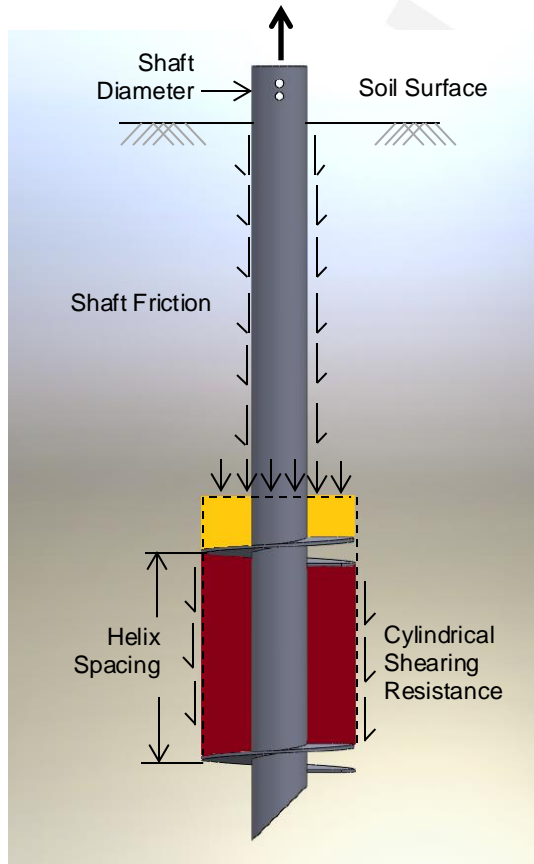
Ultimate Uplift Capacity ( $Q_u$ )

Ultimate Compression Capacity ( $Q_c$ )

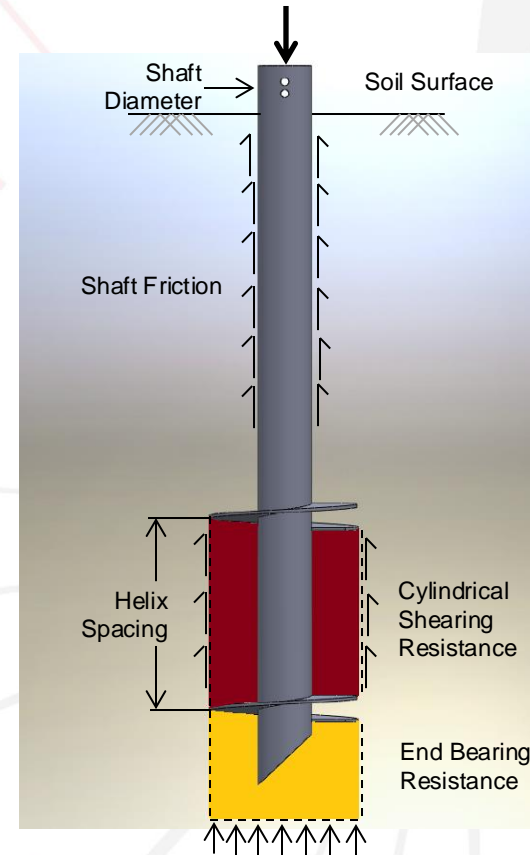


# Cylindrical Shear Method (CSM)

**Ultimate Uplift Capacity ( $Q_u$ )**



**Ultimate Compression Capacity ( $Q_c$ )**

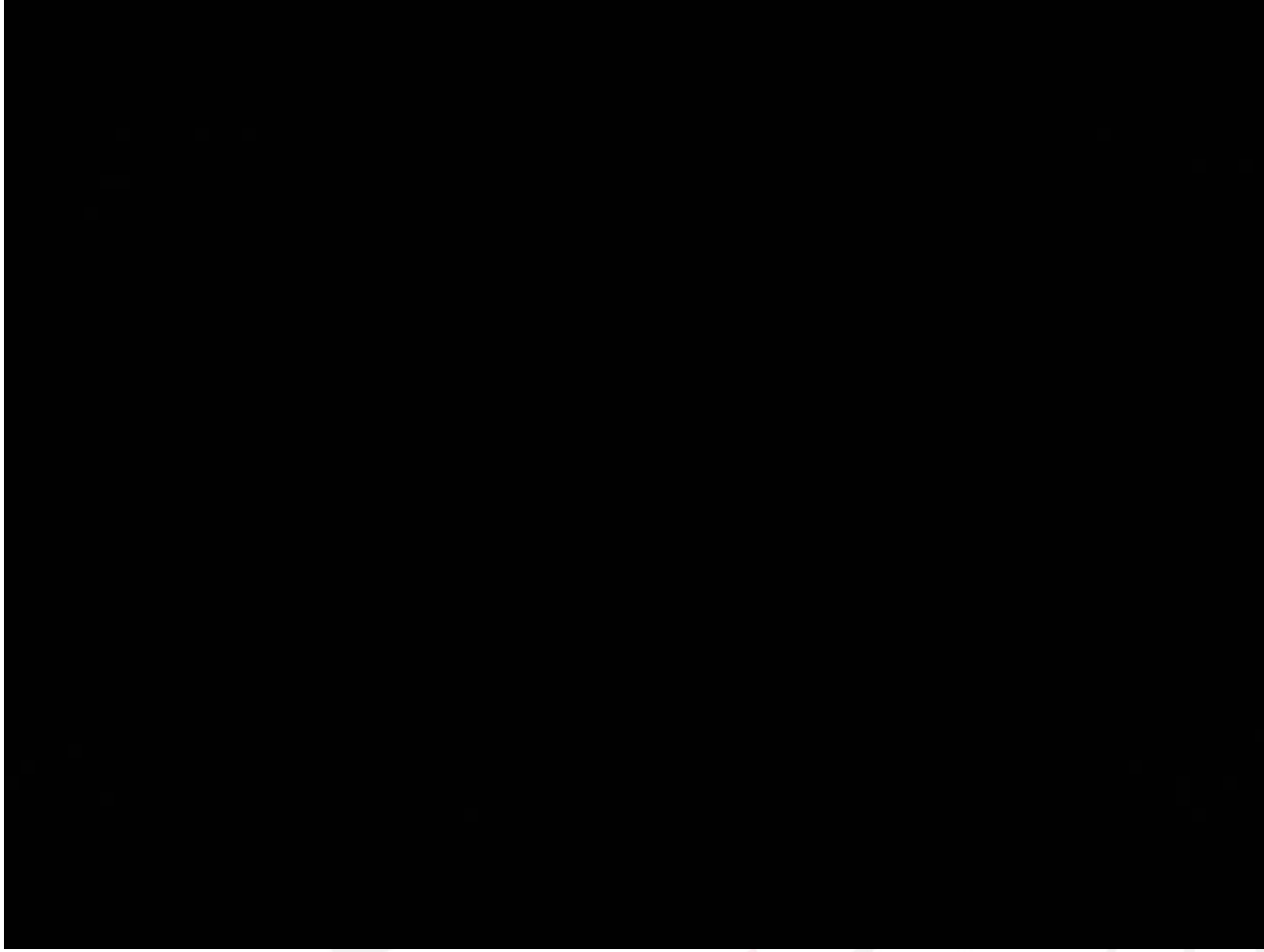


# About Almita

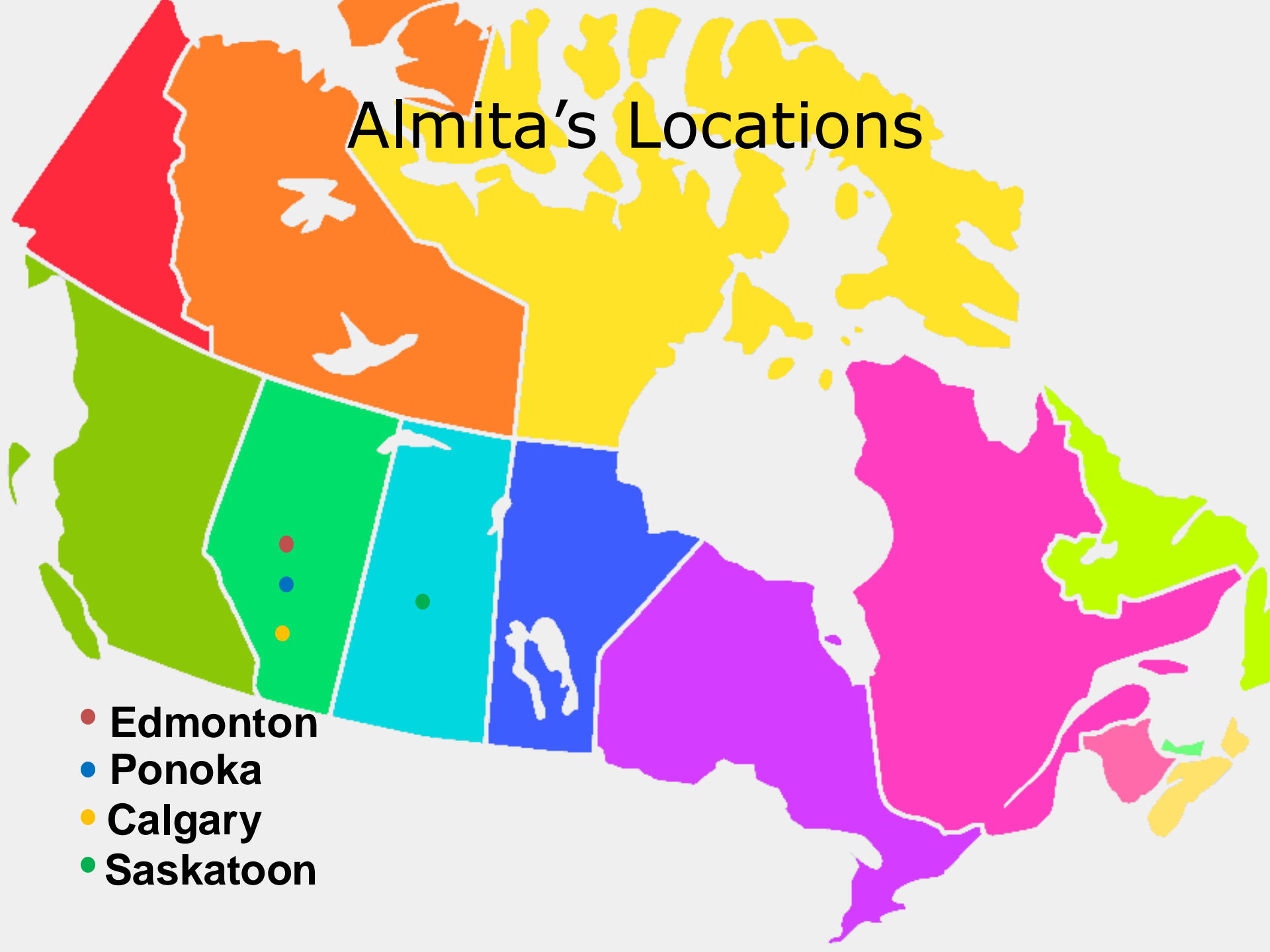
- Canada's leader in engineering, manufacturing and installation of helical piles since 1991
- Almita and our External Installer Network install nearly 40,000 "Fit for Purpose" helical piles a year
- 191 employees including 11 geotechnical and structural engineers
- Founding Member of Institute of Helical Pile Engineering



complete support



# Almita's Locations



- Edmonton
- Ponoka
- Calgary
- Saskatoon





# Industries we serve

## Power Transmission and Distribution


- Solar panel & related infrastructure foundations
- Wind turbine foundations
- Transmission tower and power pole base foundations
- Substations

## Oil & Gas

- Mining and SAGD CPFs and wellpads
- Facilities and plant sites
- Oilfield pumpjacks and batteries
- Pipelines, pump stations and anchor blocks

## Commercial & Infrastructure

- Work-camp & office trailer structures
- Commercial and industrial buildings
- Streetlight and sign bases
- Municipal and private bridges



# Environmental and Economic Advantages

# Advantages of Helical Piles

- Cost effective alternative - less material fewer trucks
- Rapid installation – typically 10 minutes per pile with agile installation units
- Versatile foundation system - works well in compression and tension and can be installed at any angle
- Can be installed in most soil profiles, on uneven terrain, and in any weather condition
- Can sustain load immediately after installation
- Very safe installation!

# Screw Piles vs. Cast In Place Concrete

- No large diameter auger or bucket drill is required for pre-excavating
- No tailings
- No concrete curing time
- No rebar, anchor bolts, no liners
- No dewatering (no casing)
- Installed in all types of weather
- Avoid typical installation problems such as necking or cavities within concrete
- Smaller crew size

# Screw Piles vs. Steel Driven Piles

## Driven Piles

- Large safety zone due to working height of piling rig
- Pounding force may necessitate larger pile than needed for working loads
- Usually require deep embedment
- Driven pile equipment is large (high mast) and slow to move

## Screw Piles

- No hammer noise pollution - preferred method in environmentally sensitive areas or urban areas
- Achievable install rates of 5-8 piles / hr
- Easy to remove when site restoration required
- Extra support vehicles not normally required for screw pile installation
- Approximately half the steel to support a similar load



# Helical Pile Applications



# Solar Farm



- 5 installation crews
- ~350 piles/day installed
- 65 Semi-truckloads of materials
- 26,000 piles installed in less than 4 months
- Finished 17 days ahead of schedule

# Monopole Tower Base





# Transmission Line Bucket Pile



# Street Lighting



# Rail Stabilization



# Batter Angles (from vertical to horizontal)





# Helical Pile Design

CANADIAN  
**FOUNDATION  
ENGINEERING  
MANUAL**  
4th EDITION

CANADIAN GEOTECHNICAL SOCIETY 2006



# Canadian Foundation Engineering Manual

Helical (Screw ) Piles have been  
incorporated into the latest  
Edition of the CFEM  
- Almita contributed  
Section 18.2.1.4

# Conventional Bearing Capacities

1. Individual Bearing Model (IBM)
2. Cylindrical Shear Model (CSM)

Selection depends mainly on:

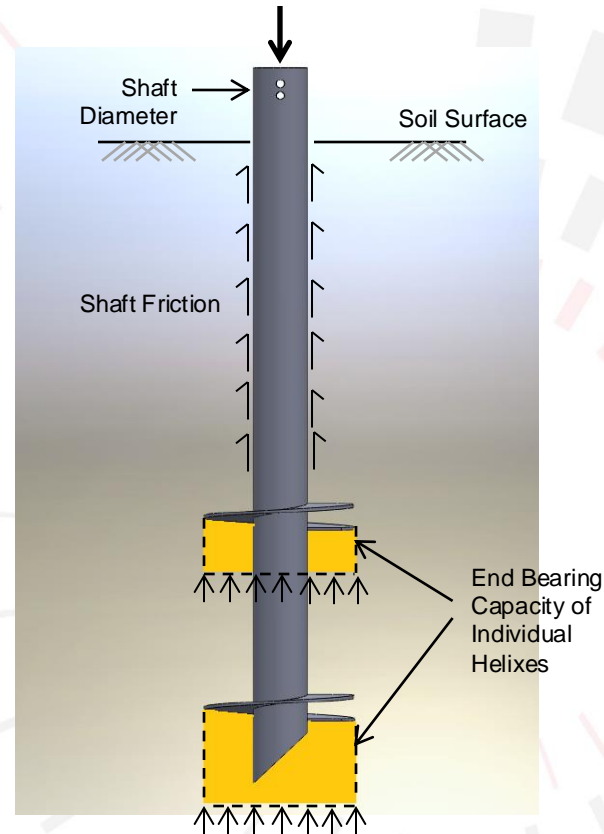
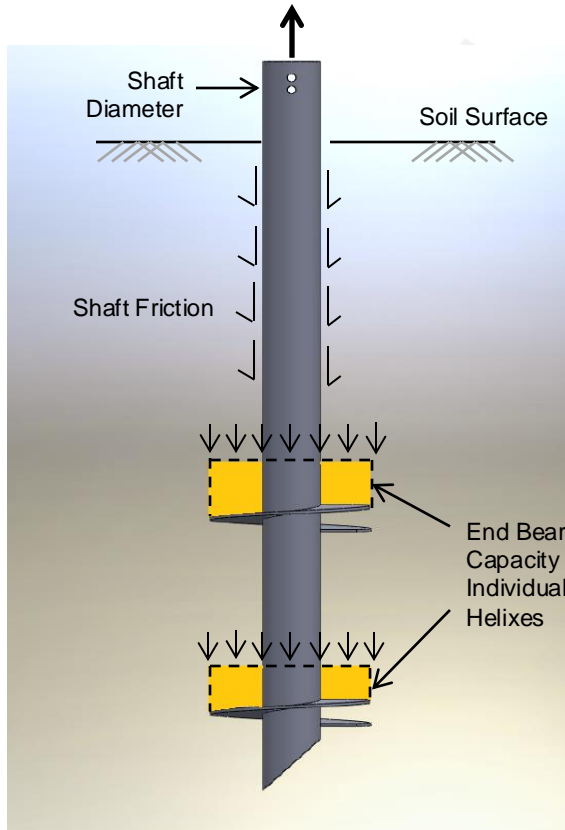
- Helical pile configuration: Spacing ratio (SR)
- Surrounding soil properties: Cohesive or Cohesionless

Both **IBM** and **CSM** should be used for optimization of designs

# Individual Bearing Model (IBM)

Ultimate Uplift Capacity ( $Q_u$ )

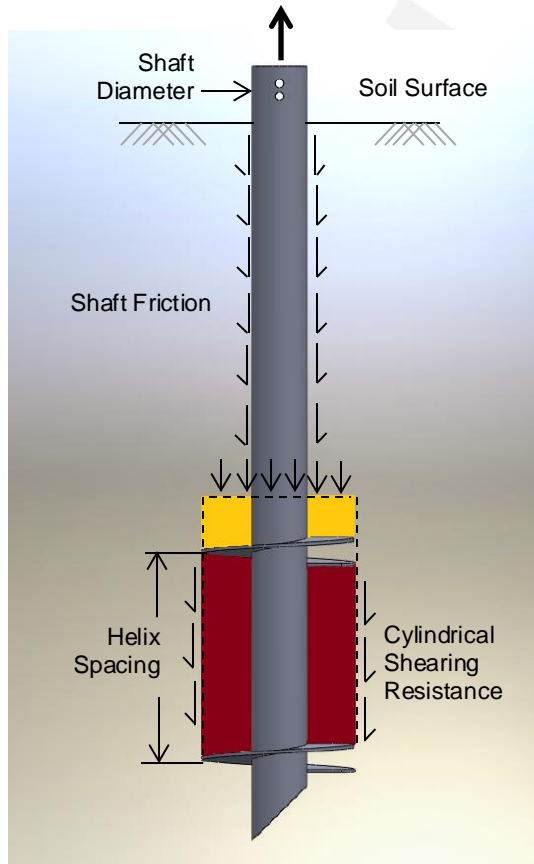
Ultimate Compression Capacity ( $Q_c$ )



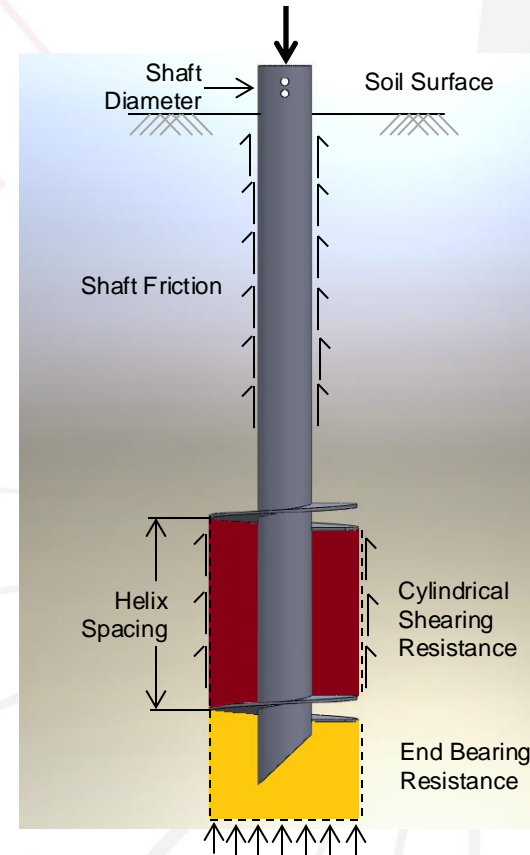


# Cylindrical Shear Method (CSM)

**Ultimate Uplift Capacity ( $Q_u$ )**



**Ultimate Compression Capacity ( $Q_c$ )**



# Estimation of Torque Installation

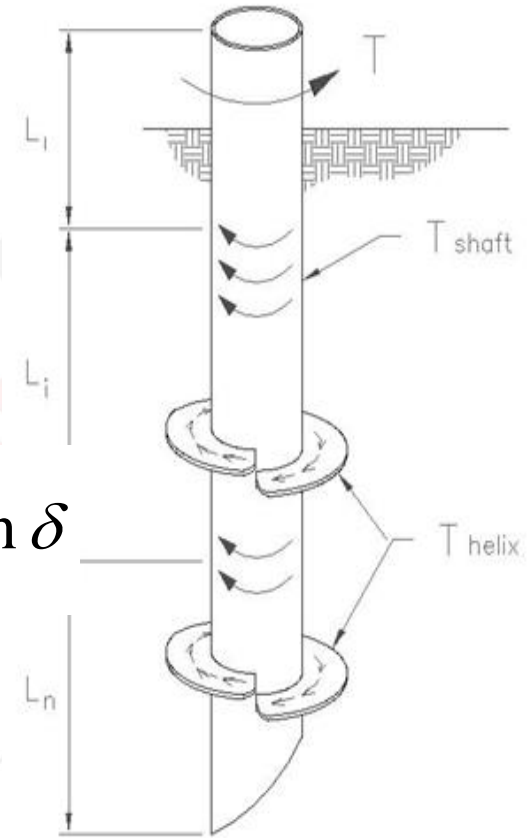
For Cohesive Soil:

$$T = \frac{1}{2} \pi d^2 \sum L_i C_{ui} \alpha + \frac{1}{6} \pi D^3 C_u n$$

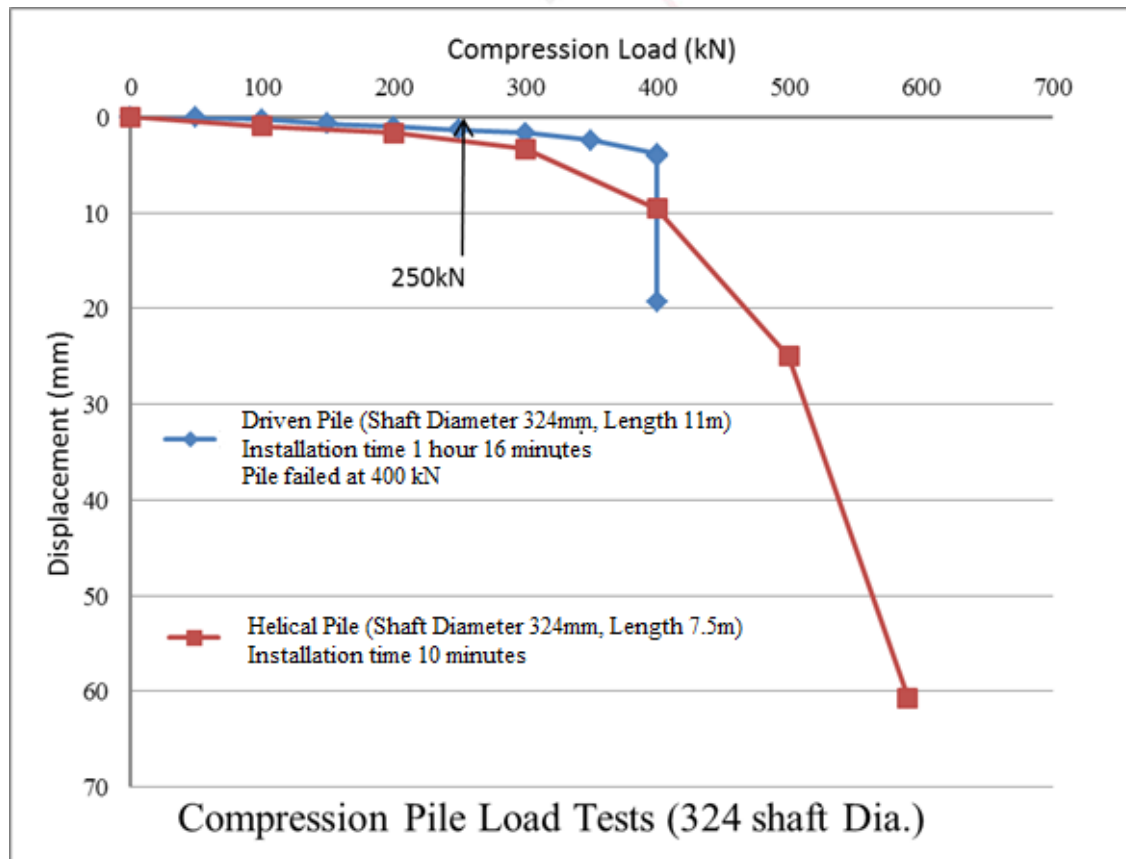
For Cohesionless Soil:

$$T = \frac{1}{4} \pi d^2 \gamma H^2 K_p \tan \delta + \sum \frac{1}{6} \pi D_i^3 \gamma H_i K_i \tan \delta$$

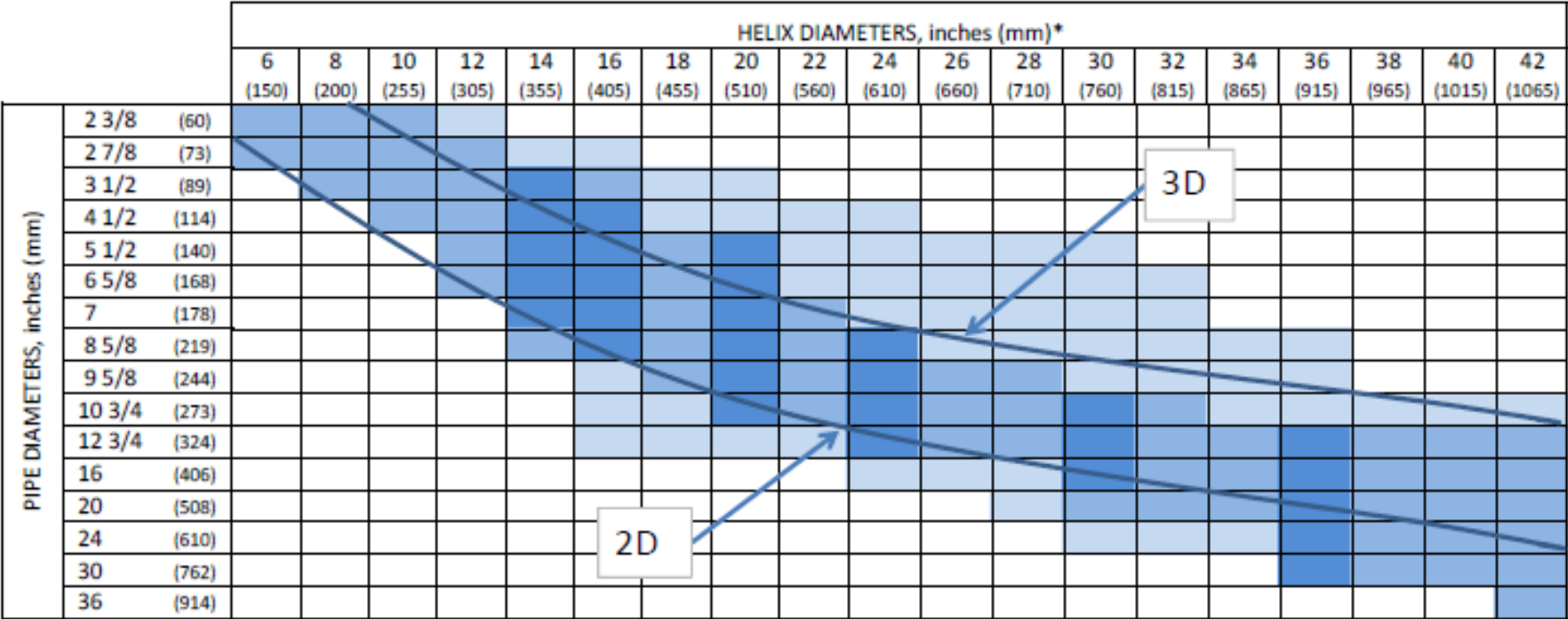
Where:  $n$  = number of helices



# Driven vs. Helical Piles Comparison in Clay Till



# Helix Diameter vs. Pipe Shaft



\* Rounded to the nearest 5mm.

- Most Common Helix Size
- Available Helix Size
- "Special Conditions" Helix Size

# Design Considerations

Group effect

Frost depth (cold climate)

Down-drag from fill

Expansive soils

Groundwater

Cobbles & boulders

Remove shallow boulders if encountered

Use battered piles to avoid obstacle.

Relocate pile or bridge obstacle with two piles.

Trim helixes

Corrosion protection - design life

Large lateral loads

Restricted access

Connections to superstructure

Capacity to torque correlation

# Things to Remember

- Economic, efficiency and environmental advantages
- Versatile and can be installed in all weather and at any angle
- Custom designed, or designated using Almita's CCMC certification
- Almita is the leading supplier of helical piles in Canada

# Q & A





**Thank You!**





# Anchor Thrust Block



# Anchor Thrust Block Suncor 2014



# Pump Stations



# Central Processing Facility



# Pipe Racks



# Wellpads



# Gathering Lines

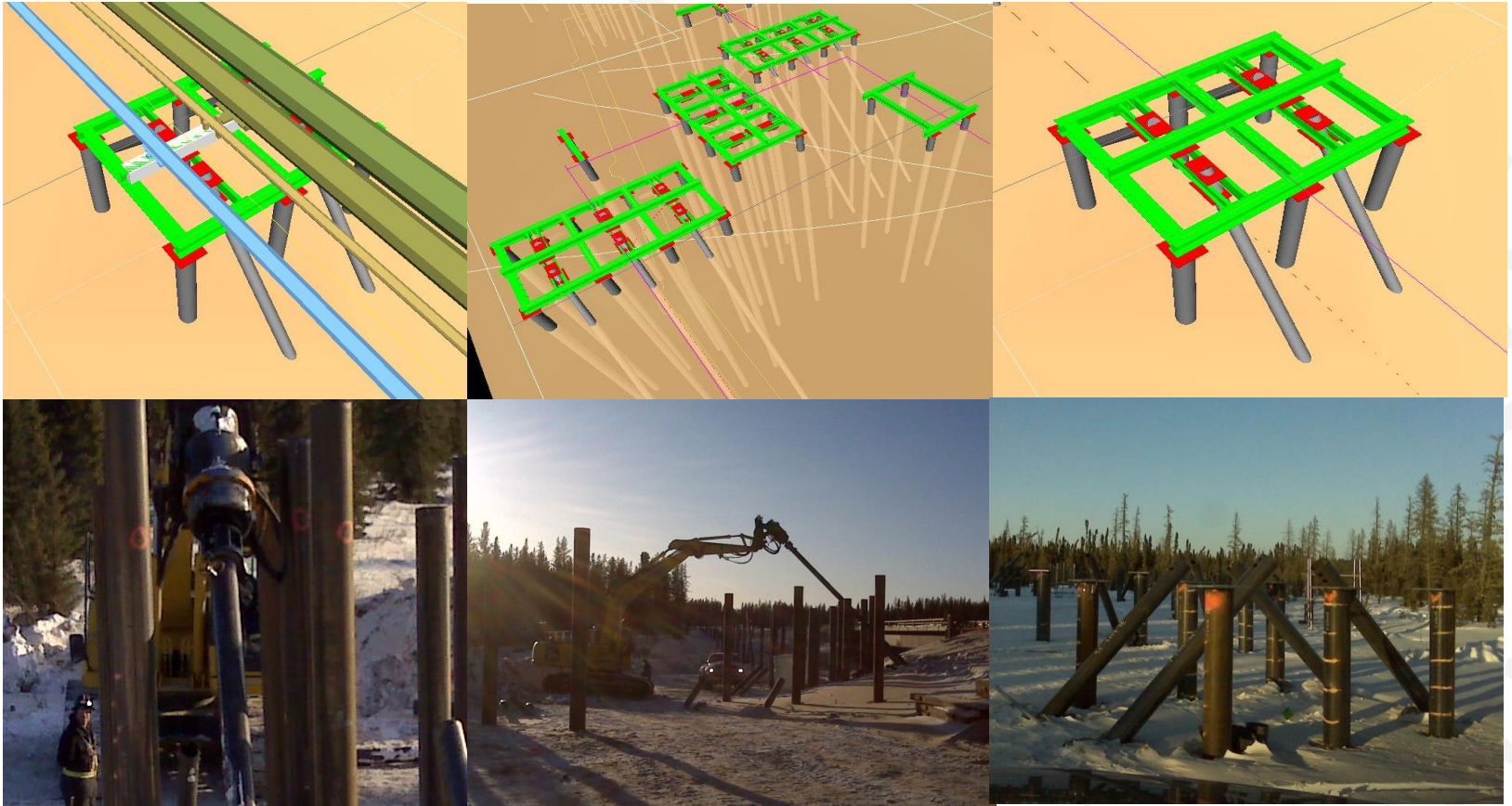


# Elevated Pipelines – Temporary Support





# Elevated Pipelines & Piperacks



Lateral Supports

# Facilities and Terminals



Conventional Oil Facilities

Terminals

# Substations



# Power Pole Base



# Lattice Towers





# Commercial Buildings



Cactus Club Restaurant



3 Story Condo

# Self Erecting Crane Supports



Piles will be removed once cranes work is complete



# Bridge Retrofit



20 Tonne becomes 40 Tonne bridge  
Screw piles installed from bridge deck and spilt the span

# Work-Camps – Single & Multi Story



# Shoring / Retaining Wall



# Retaining Wall Tie-Backs

