Against the Wind

As you drive into the Alberta City of Lethbridge you are greeted with an unusual welcome sign. It is a large gold ball on a heavy chain suspended from an arch. It is a weather vane that gives you a feeling for the winds that roll out of the mountains across the wide open prairie.

Not far away, near Pincher Creek, you will come upon a field of Windmills. Slender white spires topped with three thin blades, set against a backdrop of the Rocky Mountains and a clear blue sky. As you get closer you are amazed at the size of these structures that are so bold as to stand against the wind.

According to the Canadian Wind Energy Association, a single wind turbine (1.8 mega watts) in an average year will produce 5,000 mega watt hours of electricity. Enough to power over 600 Canadian homes. Using wind to produce electricity rather than burning coal will leave 2.2 million kilograms of coal in the ground and reduce 5,000 tonnes of greenhouse gases annually. The same impact as taking 1,000 cars off the road or planting 25,000 trees.

Modern turbines are extremely efficient. Designers are continually working to optimize turbine weight in relation to machine output. Improvements translate into reduced construction and infrastructure costs, and ultimately higher return on investment.

The massive size of these structures, the unusually high winds and the deep soil overburden, introduce challenges that are met through the use of Corrugated Steel Pipe.

The latest installations, near Pincher Creek, stand up to 78 metres above the ground at the hub. The rotors cover a diameter of 80 metres sweeping an area of 5,027 square metres. Rotors begin to turn at a wind velocity of 4 metres per second (m/s). Nominal wind speed is 16 m/s. Rotors stop when winds exceed 25 m/s to prevent damage. At the top of each tower is a nacelle containing the working

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elements of the turbine and weighing over 63 tonnes. Attached to this are the propellers weighing an additional 35 tonnes. Like the mast of a huge sailboat under full sail these towers have to be stepped.

At many turbine sites around the world the towers are securely anchored to bedrock. This is not an option here as bedrock is covered with a deep soil overburden. The solution is to install a caisson base of sufficient depth and mass to resist the overturning forces.

A typical caisson installation begins with an excavation 8 metres deep and 4.5 metres in diameter. An 8 metre long Galvanized Corrugated Steel Pipe 4,250mm in diameter, 2.8mm thick with a 125 x 25 mm corrugation is lowered into the hole and set in a vertical position. Lifts of grout are poured on the outside to secure it against the excavated walls. There are heavy steel rings at the top and bottom of the shaft. These are connected with long steel bolts, which pass through the rings. A smaller 8 metre length of CSP, 2700mm diameter, 2.8mm thick with a 68 x 13mm corrugation is placed inside of the rings leaving a 775 mm space between the inner and outer pipe. The inner pipe is back filled with native material and then the space between the two pipes is filled with concrete. Once the concrete is set the bolts are tightened in preparation for mounting of the wind turbine tower.

Transporting pipes of this size can introduce additional challenges as highway clearances and special permits are required. The relatively lightweight and long lengths of Corrugated Steel Pipe make nesting of different diameters on one truck a cost saving consideration. Even larger diameter caissons are possible using site erected Structural Plate Corrugated Steel Pipe.

For product details and specifications refer to CSA-G401 and The Handbook of Steel Drainage & Highway Construction Products.