**Problem Statement**

Wind Energy is limited by:
- Low Hub heights
- Geographically sparse and isolated
- Expensive pre-stressed tendons
- Excessive maintenance costs

**Benefits to Sponsor**

- Sponsor will gain new insight on UHPC tower characteristics
- Reduced maintenance requirements

**Objectives and Specifications**

- Cast subscale prototype out of UHPC
- Attach strain gauges to prototype to examine strength characteristics of UHPC
- Establish precedent in tendon-less tower design for future studies.

**Associated Methods**

**Casting UHPC**
- Sand and finish molds by hand with sandpaper by securing on a lathe.
- Assemble and secure inner molds with gorilla glue and line the outside with a layer of garbage bag plastic, tape, and WD-40.
  - Line inside of baseplate with WD-40 to facilitate UHPC flow and line connection point with plastic to prevent UHPC adherence.
  - Assemble last outer mold, pour UHPC and allow curing to occur.

**Loading Apparatus**
- Attach cylindrical rod horizontally to pre-fabricated structure via welding to act as pulley structure.
- Fasten straps around the top of the tower and secure over pulley system ensuring top of the tower is perpendicular to the pulley.
- Secure opposing end of strap around S hook to incorporate to pulley system and ensure the to-be loaded rope is taut.
- Affix counterweight to rope and load tower accordingly via forklift.

**Measurement Apparatus**

Max bending stress is located at the base of the tower. Therefore, the location and placement of strain gauges will be between 0-10 centimeters from bottom. One gauge will be placed on the compressed side and one on tensioned side.

**Load Calculations**

<table>
<thead>
<tr>
<th>Subsection</th>
<th>Fiber</th>
<th>Mixed UHPC</th>
<th>3D molds</th>
<th>Attempted pour</th>
<th>Completed tower</th>
</tr>
</thead>
</table>

This project made use of the UHPC material. Moving forward we want to continue the improvement of manufacturing process and implement this material in more areas of the field of wind energy. During the course of this project we found that this material is feasible and would be even more beneficial in the long term scope of projects. Essentially we want the findings of this project to lead into even more discoveries and advancements in the field of wind energy.

We are excited to see where you take this Mr. John Buttles!