# PRT Group
# Engineering 8700 Civil Project
# Work Plan

Client: Tiller Engineering

Date of Submission: January 29th, 2010

Submitted to: Dr. Steve Bruneau

Location: St John's, Newfoundland

PRT Group:
Edwin Tsui
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January 29, 2010

Mr. Jonathan Walsh, P. Eng.
Tiller Engineering Inc.
119 Springdale St.
St. John's, NL
709.579.6703 (ph)
jwalsh@tillereng.ca

Dear Mr. Walsh,

RE: Work Plan

Please accept the accompanying Work Plan.

This report is a requirement of course Civil Project ENGI 8700 which is due on January 29, 2009. This report is an overview of the project requirements, and the final deliverables to be expected. You will find enclosed in the report the project description, statement of project requirements, methodology, tasks, schedule, cost, deliverables, and risks. Attached in the appendix of the report you will also find our Company SOQ.

Sincerely,

PRT Group

cc: Dr. Steven Bruneau

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# 1.0 Project Description

The project for our client Tiller Engineering is a structural design project for monopoles. Tiller is expecting to be faced with the challenge of having to design multiple monopoles for their clients, the cellular companies. These companies need to provide cellular service to remote rural areas due to regulations being pushed by the Canadian government. The choice of monopoles and point-to-point microwave transmission has been chosen for carrying cellular service to these areas; as it often compares very favorably with cabled systems such as fibre, which require right-of-way, trenching, conduit, splicing, etc. This system known as a microwave hop uses microwave communications channel between two stations with directive antennas that are aimed at each other. There is a transmitting antenna (microwave dish) that focuses the radio beam on the receiving antenna which collects the incoming signal. Additionally, each antenna must be within line of sight of the next antenna. As the antennas have a limited distance between them the need for multiple monopoles in a microwave hop are usually required.

With the expected inflow of monopole design Tiller Engineering has approached the PRT Group with the project of creating a monopole “look up” chart for various heights spanning from 30 to 130 feet. The purpose of this table is to provide a building block and starting point for Tiller Engineering when beginning the design of site specific monopoles for this high demand period and for future reference. The table shall include three different types of materials for the monopole which consist of wood (Douglas fir), steel, and FRP composite material. Our study will cover the analysis and design of a series of antenna pole structures of various heights from 30 ft to 130 ft in 10 ft intervals using CSA S37-01. This will include 11 designs for each material for a total of 33 monopoles. Included in the design of the pole will be the design of the foundations for rock and normal soil conditions, rock anchors, guys, and guy connections. It shall be noted that the monopoles shall only be guyed if absolutely necessary as it is more cost effective to occupy a minimal area. A typical AutoCAD drawing will be produced for the foundations, rock anchors, and guy connections. To help aid in the choice between selecting different monopoles in design a cost estimate will be provide based on the cost of the material used. All the information stated above will be compiled into a quick look-up table that Tiller Engineering can use as a reference when designing their site specific monopoles.

The work for this project as begun on Monday January 11, 2010, and will be completed on Tuesday April 6, 2010. The project shall have a midterm progress report and presentation completed on Tuesday February 16, 2010. At final result of this project will include a final report, a look up chart organizing all design and cost information, AutoCAD drawings, and a softcopy of S-Frame files.


## 2.0 Statement of Project Requirements

The end result for our project is a design look up chart. This requires multiple tasks, analysis, and design to be calculated, compiled and organized in an easy view format. As this is not a site specific project the analysis shall be run with constant parameters. A list of information requirements for the table is listed below.

- Research and select (2) two Andrew 4ft dish to use in analysis.
- Design steel poles from 30-130 ft for a total of 11 poles.
- Design wooden poles (Duglas Fir) from 30-130 ft for a total of 11 poles.
- Research and Design FRP composite material poles from 30 – 130 ft for a total of 11 poles.
- Design guy wires for applicable poles above.
- Design connections
- Design (3) three rock anchors each at different capacities.

- Design (3) three foundations for rock and soil conditions each at different capacities.
- AutoCAD typical drawings for foundations, rock anchors, and connections.
- Cost Estimate for all 33 poles, foundations, guys, connections, and rock anchors.

When designing the poles the antenna selected will be the heaviest antenna that can be located as manufactured by Andrews. This antenna along with the pole will be used in calculating wind, ice, and dead loads on the pole structure. The loading on the microwave dish will be calculated using software from Andrew called ANTwind. These loads will be analyzed in S-Frame and an appropriate pole section shall be chosen. As FRP composite material poles are very new to the industry research will be conducted so an accurate analysis and design can be completed. Based on deflections of the monopole guy wires maybe required at a certain height. When required, they will be designed for all the applicable poles. The connections for attaching the guys to the pole will also be designed. Typical connections will be used for wood and steel poles; however an effective analysis and design will have to be performed on the connection for the composite poles. For the guys, rock anchors will need to be designed. For this project three (3) rock anchors will be designed at three capacities based on the loads calculated in the guys. As this is not a site specific project three of each type of foundations (rock and soil) shall be designed for the monopoles based on different capacities. As there is no geotechnical data it will be done based on normal soil conditions. When all design is completed a cost estimate shall be conducted for the structural components of the monopoles. It is expected that values for wood and steel will be easily attainable, were as composite pole cost may come from internet research or from a reasonable educated guess.

# 3.0 Methodology

## 3.1 Group Members

Each member of the group will work on most aspects of the project, but each member has been assigned a role that utilises their strengths.

### 3.1.1 Edwin Tsui (Information & Technology Lead)

Edwin will work primarily with the software components of the project. He will work with S-Frame, AutoCAD and other software as required.

### 3.1.2 Vanessa Pynn (Structural Analysis Lead)

Vanessa will be the lead for the structural analysis and design components of the project. Her previous work experience will be useful for the group.

### 3.1.3 Ashley Rex (Organization & Administrative Lead)

Ashley will focus the group on meeting the work tasks according to schedule. She is also in charge of organizing the groups work and in contacting the client with weekly updates.

### 3.2 Scheduled Group Meeting Times

The Group has scheduled Monday and Tuesday afternoons as a meeting period. Additional group time will be scheduled as necessary.

The PRT Group has scheduled Monday afternoons at 4:00 PM as a meeting time with their client. These meetings may be rescheduled at the client's request.

### 3.3 Client interaction and role

The client has assigned Jonathan Walsh (P. Eng) as an advisor to the PRT Group. He will assist and guide the group as necessary, and is available to answer questions and provide documents pertaining to the design of poles, foundations, guy wires and anchors.

Carla Bryant (B. Eng) has also been made available to assist with the geotechnical (foundation and rock anchor design) components of the project. She will provide relevant documentation and answer questions to assist the group.

### 3.4 Desired outcomes

The group's desired outcome is to obtain accurate design specifications for 3 types of poles (steel, wood and composite) ranging in height from 30-130 feet in 10 foot increments.
The design specifications will include the foundation design, rock anchor design, the location and specifications for guy wires (if applicable), and will include a cost approximation.

### 3.5 Reporting and Deliverables

The group will submit a weekly progress summary to the client informing them of the group's goals, achievements, difficulties and their progress according to the scheduled timeline.

### 3.6 Troubleshooting

The group will consult with professors at Memorial University for structural and geotechnical aid as necessary. Questions relating directly to poles may also be presented to the client. The client has offered to assist the group via email, phone, and if necessary, in person at the client's office.

## 4.0 Tasks

#### 4.1.1 Research and select 4 foot dishes from Andrew (1 week)

ANTWind software from Andrew will be used to calculate the wind loading caused by the selected dishes. The loads from the dishes will be used with CSA-S37-01 to determine the loads on the pole.

This task will be performed by Vanessa and Ashley.

### 4.1.2 Design steel poles ranging from 30-130 feet in height (2 weeks)

The group will design the poles according to the standards listed in CSA-S37-01. S-Frame will be used for structural analysis. Calculations performed by hand will be performed to supplement the computer analysis for selected poles.

All 3 members of the group will work on this task.

### 4.1.3 Design wood poles ranging from 30-130 feet in height (2 weeks)

The group will design the poles according to the standards listed in CSA-S37-01. S-Frame will be used for structural analysis. Calculations performed by hand will be performed to supplement the computer analysis for selected poles.

All 3 members of the group will work on this task.

### 4.1.4 Research & Design composite poles ranging from 30-130 feet in height (3 weeks)

Research will be done on the internet and with information provided by the client for the design of composite poles.

The group will design the poles according to the standards listed in CSA-S37-01. S-Frame will be used for structural analysis. Calculations performed by hand will be performed to supplement the computer analysis for selected poles.

All 3 members of the group will work on the design portion of this task. The research will be performed by one or two members.

### 4.1.5 Design guy wires for applicable poles (concurrent with pole design – approximately 5 weeks)

The group will select an appropriate guy wire thickness, the location of the guy wires, and the fastener for the wires to the pole as necessary. Guy wires will not be required for all poles, and therefore their design will be performed on an as-needed basis.

All 3 members of the group will work on the design portion of this task.

### 4.1.6 Design of rock anchors (2 weeks)

Three typical anchors will be designed based on the capacity / force range on guy wires. The rock anchors will cover a low, medium and high guy wire force range. The client will supply background documentation and examples of design to aid the group.

One or two members of the group will work on the design portion of this task.

### 4.1.7 Design of foundation for rock and soil based on normal soil conditions (3 per tower type at 30, 80 and 130 ft in height) (3 weeks)

The group will design several different foundations for each pole material. Foundations will be designed for short, medium and tall poles. The group may consult with the geotechnical advisors at Memorial University for assistance.

One or two members of the group will work on the design portion of this task.

### 4.1.8 Cost estimating (1 week)

The client will provide cost estimating figures for the majority of the materials. The group will research information for the cost of composite poles.

The group will assign a cost estimate for each pole type at each height based on the results of their structural design and analysis (height, material, foundation, guy wires, anchors, etc).

Ashley will work primarily on this task, with support from the other two group members.

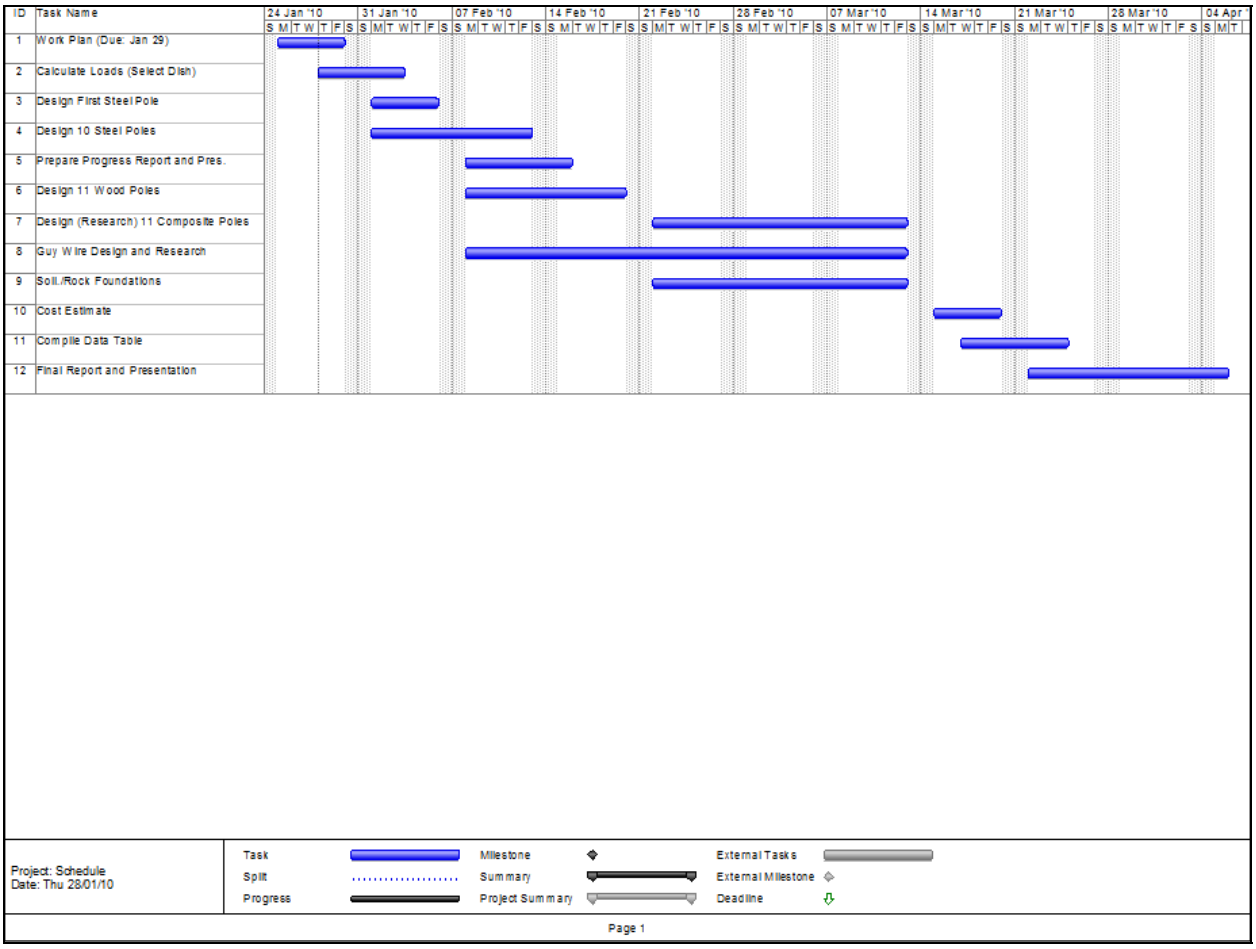
### 4.1.9 Chart compiling all data in easy to reference format (1 week)

The group's results will be compiled into a single reference chart. The chart will contain all of the group's findings for each pole type at each height and will be presented in an aesthetically pleasing manner. A combination of various computer software programs will be used to compile the chart.

This task will be primarily assigned to Edwin, with support from the other two group members.

## 5.0 Schedule

The group has organized a schedule for the work tasks of the project. Some of the tasks will occur concurrently. The client has approved of the schedule. 5 days of floating time have been budgeted for work tasks that require more time than allocated according to the schedule.




The group will adhere to the schedule as closely as possible. Weekly progress reports will be provided to the client to ensure that work is proceeding as scheduled. Any modifications such as early completions or delays will be reported to the client.

There are also several project milestones which are not included in this schedule. These include the work plan submittal, the mid-project report submittal and presentation, and the final report submittal and presentation.

## 6.0 Cost

The costs associated with the work for this client include the following:

- Cost of printing documents and drawings (Estimated at $20.00)

- Cost of transportation to visit the client (Estimated at $30.00)
- Cost of printing and binding reports (Estimated at $15.00)
- Cost of photo copying (Estimated at $30.00)

The total expected costs for this project is $95.00.

## 7.0 Deliverables

The deliverables for this project include the final report, AutoCAD drawings, a large chart containing the results of the group's analysis, and exports of the software assisted analysis performed by the group.

The group will provide a bound hard copy of the report to the client, as well as all of the documentation in a digital format.

## 8.0 Risks

The group expects that the design for steel and wooden poles will encounter few difficulties. The design for composite beams may be problematic for obtaining data; Composite beams are uncommon and may be require extensive research before design can proceed.

The client has indicated a preference for STAAD as structural analysis software, but the group will be using S-Frame due to licensing limitations. The group has believes that S-Frame will provide analysis of a comparable quality and accuracy, but it is possible that client may have difficulties in interpreting the data outputs from S-Frame.

# 9.0 Appendix

## 9.1 Appendix A: SOQ

## ABOUT US

PRT Group formed in early 2010 with the intent of providing consultation services for the design, structural, and project management industries. It is a small local engineering firm which provides creative solutions for clients.  PRT Group welcomes diversity with the willingness and inspiration to tackle the most unique or changeling projects. As a group they believe in environmentally conscious design, quality, safety, meeting client's needs, respect and valuing people and teamwork. The team consists of three intelligent, fast adapting and motivated junior engineers, who embrace the highest standards of personal and professional integrity.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**PRT GROUP**

## ENGINEERING SERVICES

Structural
Geotechnical
Project Management

## VANESSA PYNN

During Vanessa's cooperative education at Memorial University she has obtained high quality academic skills along with valuable work experience from the many diverse work terms. Through both work and university she has demonstrated her ability to be determined, motivated, organized, and quick learning. Her work experiences have allowed her to develop skills in such fields as cost estimating, research, construction and inspecting.

Vanessa's Professional Experience Includes:

- Cost estimating for:
  **Peter Kiewit Sons:** quantity take offs of concrete and earthworks for large scale projects such as VALE INCO Long Harbour Processing Plant.
- Research for **Centre for Marine CNG** on natural gas storage solutions for compressed natural gas. Extensive research on existing and new solutions.
- Inspections for water mains with **BAE Group**. Conducted the water main leak detection program. Tested for and pin-pointed leaks with specialized leak detection equipment. Coordinated program progress with client.
- Project Management and Construction with:
  **Bell Aliant** Odyssey Project: Responsible for installation of HSPA equipment on towers/rooftops. Put together an installation manual for training aid. Reviewed and revised rooftop drawings.
  **Magna Contracting**: Responsible for aiding project manager in daily duties, shop drawings, closing tenders, communication with subcontractors, and clients, and responsible for all safety inspections, documentation, and ongoing issues.

## ASHLEY REX

Throughout the course of the engineering program Ashley has gained valuable experience in various fields including municipal, geotechnical and materials engineering.
Ashley's organizational skills, personable character and work ethic make her an important component of the PRT Group. She has been described by previous employers as being a team player who is exceedingly dependable and enthusiastic when assigned new tasks.

Ashley's professional experience includes:

- Geotechnical and Materials Engineering with **Stantec** in St. John's. Responsible for compression testing of concrete, complete sieve analysis and asphalt testing.
- Materials Engineering with **Department of Transportation** (Soils Division) in St. John`s. Project required testing the asphalt of both existing and newly paved roads. Conducted analysis with computer systems such as; ArcGIS, View and Edge Dropoff for measuring the ruts of the roads.
- Conducted research with **C-CORE** for the offshore oil and gas industry. Work with MATLAB predicting collision probability between offshore vessels and icebergs. Performed experimental work and analysis of with polycrystalline ice at the NRC-IOT.
- Municipal Engineering with **SGE Acres** in Clarenville. Research work, preliminary drafting and cost estimates and job summaries.

## EDWIN TSUI

Edwin is a well-rounded addition to the PRT Group. His six work terms through the Civil Engineering program at Memorial University have provided him with many different and diverse work experiences and opportunities. He is technically proficient with many different pieces of software and approaches his work with an energetic and enthusiastic mindset. Previous employers have described him as efficient and resourceful.

Edwin's professional experience includes:

- Construction work site experience as an electrician apprentice with **City- Lite Electrical Inc**.. Worked onsite for the construction of the Tommy Sexton Center from start to finish.
- Cost estimating, preliminary drafting, municipal design and surveying with **Al-Terra Engineering Ltd.** in Red Deer, Alberta.
- Project Management with the **St John`s International Airport Authority**: Responsible for the selection, installation and integration of the automated pay-on-foot parking system. Assisted and aided with projects pertaining to both land and airside operations.
- Maintained and formatted statistical data and reports with respect to Health, Safety, Environment and Quality with **Husky Energy**. Performed research relating to health, safety and environment for onshore and offshore work.

## OUR GOAL

Our goal at PRT Group is to provide innovative engineering solutions to our clients with professional engineering services in the fields of structural, geotechnical and project management which exceed our client's expectations.

**Contact Information:**

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