



## **Company Information**

<b>Company Name</b>	<i>Belmont Trolley</i>	<b>Date Submitted</b>	<i>3/4/2021</i>
<b>Project Title</b>	<i>Retrofit Design of Trolley Power System from Diesel to Battery Power (TROLLEY BATT)</i>	<b>Planned Starting Semester</b>	<i>Fall 2021</i>

## **Senior Design Project Description**

### **Personnel**

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

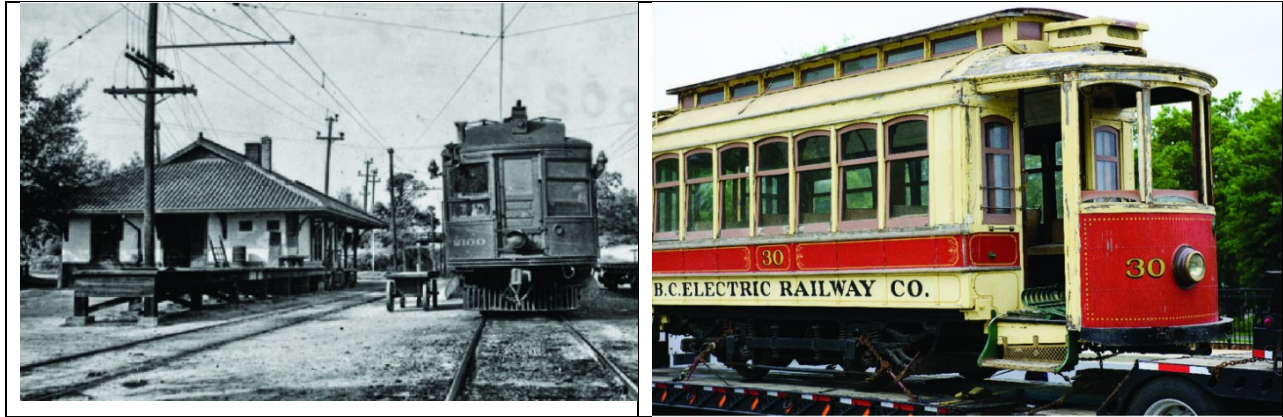
Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills.

<b>Discipline</b>	<b>Number</b>	<b>Discipline</b>	<b>Number</b>
Mechanical	3	Electrical	3
Computer		Systems	
Other (          Civil          )	1		

### **Company and Project Overview:**

In 1911 leaders at Southern Power Company, William States Lee and James Buchanan “Buck” Duke, built the Piedmont and Northern Railway (P&N), an electrically-powered, interurban rail system linking major cities across the Piedmont of the Carolinas. The arrival of the railway created unprecedented growth in North Carolina’s textile industry.

One of P&N’s busy divisions ran 24 miles between Charlotte and Gastonia, NC. In 1916, at the request of Belmont’s booming textile mills, P&N added a three-mile route from its main line near the city of Mount Holly to downtown Belmont. Along these tracks, three small, city-style trolley cars carried passengers and workers between the mills and the main line.



Although P&N continued its freight service in the region until the late 1960s, Belmont's streetcar service ended in 1932. When complete, the historic Trolley will run from downtown Belmont, N.C., to Belmont Abbey College, shuttling up to 20 commuters, residents and visitors at a leisurely pace. The line will run parallel to the Belmont Rail Trail, a greenway following the path of the Carolina Thread Trail through Belmont.

Trolley Car 30 was built in 1912 by J.G. Brill Company, the Trolley was shipped from Porto, Portugal, where it ran faithfully until the 1980s. In the 1990s, Car 30 returned to the U.S. to launch a trolley project near Portland, Oregon. But the project never materialized and the car sat idle until it was acquired by Fraser Valley Heritage Railway Society in Surrey, British Columbia, Canada. Fraser Valley had the Trolley for 10 years before deciding to sell it. Through a tip from a friend, the Belmont Trolley organization made the purchase and arranged for Car 30's long transport from Surrey to Belmont. Here, the renovated Trolley will embark on a new journey of service. This project will be to redesign the current diesel powered trolley so it can operate under battery power.

### **Project Requirements:**

The student team will be working together for the retrofitting of a historic trolley from a diesel locomotive to an electric locomotive powered by Li-ion battery pack. The tasks are to design and construct the power supply for the trolley.

The scopes of work will include the following:

- 1) Collect data on existing trolley including power requirements, existing power supply and locomotive designs.
- 2) Meeting with client at site.
- 3) Preliminary power electronic design.
- 4) Circuit board, controls and material pricing.
- 5) Li-ion battery acquisition.
- 6) Battery cooling and safety (fire and impact) design.
- 7) Cost estimation.
- 8) Component construction.
- 9) Project schedule and delivery.



During the initial project planning stage of this project, additional or more detailed tasks will be identified. Students are divided into four core areas (locomotive power supply design, power electronic design, safety and cooling design and environmental impact and logistic design). Civil student will review routes, grades, usage plans, etc. to calculate battery sizing needs.

### **Expected Deliverables/Results:**

- Design for the removal process if the diesel machinery
- Design covering all mechanical and electrical aspects of retrofitting the trolley car to run under battery power.
- Detailed estimated budget for all expenditures required by mid-semester 1, so that Trolley board can have funding available for semester 2
- Installation and validation testing of designed and built systems on location in Belmont.



**Disposition of Deliverables at the End of the Project:**

Students are graded based on their display and presentation of their team's work product. It is mandatory that they exhibit at the Expo, so if the work product was tested at the supporter's location, it must be returned to campus for the Expo. After the expo, the team and supporter should arrange the handover of the work product to the industry supporter. This handover must be concluded within 7 days of the Expo.

**List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):**

- Interest in rail transportation and renewable energy
- Ability to travel to Belmont NC (travel reimbursement available per ISL Purchasing procedures). Due to the Trolley size it will not be possible to move it to a Senior Design lab on campus, so the semester 2 build work will have to be done at the Trolley's Belmont facility. Students choosing this project must be able to support this travel and work location, especially in Semester 2.