Agenda

- C3M Power Systems
- Cincinnati Bell Connector
  - Project Description
  - Overhead Catenary System (OCS)
- Conclusion
- Questions
Introduction

- C3M Power Systems, LLC
- Capabilities and Projects
- VE Design Suggestions
History

- Rail construction experience extends past our company inception.
- Our employees have installed majority of systems for Washington Metrorail including communications systems design.
- Established company with Clark Construction in 2014, with all employees at inception having extensive rail construction experience.
- Design, construction, and maintenance of railway electrical systems.
- Based in Capitol Heights, MD
Capabilities

- Systems Construction
  - Traction Power
  - Overhead Catenary System (OCS)
  - Signaling
  - Communications
  - Electrical
Owners

- C3M and its staff have completed projects for:
# Projects

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Location</th>
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<tbody>
<tr>
<td>Cincinnati Streetcar</td>
<td>Cincinnati, OH</td>
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<tr>
<td>M1 Streetcar</td>
<td>Detroit, MI</td>
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<td>OKC MAPS3 Streetcar</td>
<td>Oklahoma City, OK</td>
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<td>WMATA (numerous)</td>
<td>Washington, DC</td>
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<tr>
<td>MTA (numerous)</td>
<td>Baltimore, MD</td>
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Cincinnati Bell Connector
Agenda

- Project Description
- Overhead Catenary System
  - Overview
  - Labor
  - Design for Installation
  - Prefabrication
  - Installation
  - Testing
  - Suggested Design Mods
Project Description

- **Overview**
  - 3.6 mile loop, with about 4.5 miles of OCS including yard.
  - First streetcar system in Cincinnati since the 1950’s
  - Connects the Over the Rhine and Central Business District Neighborhoods
  - 18 station stops along route, with a maintenance facility and yard.
  - 5 rail vehicles (Numbering continued from original car numbering)
  - Operated by Metro/SORTA (Southwest Ohio Regional Transit Authority)
C3M Started on project August 2014
Substantial Completion 4/4/2016
Revenue Service began 9/9/2016
Project Description, Cont’d

- **Construction Team**
  - Owner – Metro/SORTA/City of Cincinnati
  - Architect/Engineer – Parsons Brinckerhoff
  - General Contractor – MPDJV
    - Messer (GC)
    - Prus Construction (Civil)
    - Delta Railroad Construction (Track)
  - Systems – C3M Power Systems
Project Description, Cont’d

- **Systems**
  - Traction Power
  - Overhead Catenary System
  - Track Signaling
  - Communications/SCADA
  - Electrical
Project Description, Cont’d

- **Challenges**
  - Opposition from Mayor (Work Stoppages)
  - Not being design build, C3M utilized proactive solutions where needed through RFI/VE process
  - TPSS Locations in downtown environment (Delivery/Crane work)
  - Shared public street (work zone vs. pedestrians vs. automobile traffic)
  - New type of work for Owner and GC’s
Achievements

- Very proud to have played a significant role in providing Cincinnati with a new streetcar system.
- Construction was completed early, allowing enough time for safety and security certification, to achieve projected revenue date.
- Job completion has certainly energized the local businesses along route, allowing for increased opportunities in the City, where otherwise there may not have been.
Overhead Catenary System

- Overview
  - Downtown Loop/OTR Loop
    - Street Running, embedded track
    - Single contact wire OCS
    - 350mcm Contact Wire
    - Fixed termination only (1750 lbs)
    - @ 60 DEG. F.
Overhead Catenary System

- Overview, Cont'd

  - Maintenance Yard/Building
    - Embedded track outside, raised track inside
    - Single contact wire OCS, 350mcm
    - Fixed termination only
    - Shop door bridge assemblies for continuity
Overhead Catenary System

- Overview, Cont’d
  - Manufacturers
    - OCS Disconnect Switches – MAC Products
    - OCS Hardware – AFL Global
Pole Mounted Switch, Hook Stick Operated
Shovel handle
OCS Hardware Manufacturer
Overhead Catenary System - Power

- Overview - Traction Power Supply
  - 4 Traction Power Substations on route, 1 inside shop
  - 4 Substation houses shipped as complete units.
  - Shop substation assembled on site in gear room.
  - Manufactured by Siemens
Overhead Catenary System - Poles

- Poles
  - Tapered, round steel
  - Painted throughout route
  - Manufactured by Millerbernd
  - Installation by Others; 3rd Party,
  - Added difficulty to flow of work.
Overhead Catenary System

- Labor
  - C3M Supervision
  - Local labor force (IBEW Local 212 wiremen and 71 Linemen)
  - No local OCS experience so training provided by C3M supervisors
  - Provided through local electrical firm, B&J Electric, to allow trained workers to remain in area in case of need by owner for maintenance, etc.
Design for Prefabrication

C3M staff provides site specific design for Cantilevers, Spanwire Systems, etc, related to Pre Fab Effort.
Overhead Catenary System

- Prefabrication
  - All OCS assemblies are prefabricated.
  - Worked with AFL to develop ways to prefabricate OCS assemblies more accurately and efficiently.
Overhead Catenary System

**Installation**

**Starting Work**

- Started with Mainline working from midpoint of OTR loop toward yard for “test track” section early turnover.
- Yard immediately followed, as it was part of early turnover.
- Completed north loop (OTR Loop) then transitioned to south loop (CBD Loop)
- Allowed work crews to develop understanding of the installation before moving to more difficult areas.
Overhead Catenary System

- Installation, Cont’d
  - Other Challenges
    - Nearby overhead utilities throughout OTR loop.
    - Close proximity to OCS required great care and surveying to allow utilities to relocate existing lines to occupied housing and businesses prior to OCS installation.
Questions