Cyclical Curved Rail Replacement
Mixed Use Suburban Commuter Environment

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Acknowledgement

The authors gratefully acknowledge the men and women of the Metro-North Track Production Tie/Rail Gang, whose considerable skill and expertise are a major contribution to this study.
Focus of the Discussion

• Define the operating environment
• Define the work/labor environment
• Define the preliminary steps required to prepare for the job
• Define the process
• Establish minimal benchmarks for crewing, duration and equipment
• Explain finding/results of the study
Operating Environment

• Northeast Corridor
  – Approximately 300 trains daily

• Four Track System
  – Approximately 150 miles of track within Connecticut from MP 26.1 to MP 74

• Mixed Use
  – **Freight**: CSX, Genesee & Wyoming
  – **Passenger**: Metro-North, Amtrak, Shoreline East

• Gross Tonnage
  – 50 megatons per year
Work/Labor Environment

• **Labor Environment:**
  – All field employees are represented: Teamsters, ARSA, IAMS
  – Work Rule agreements apply:
    1. **Weather**—Work cessation in the rail
    2. **Equipment Qualification**—All Machine Operators must be qualified on the specific machine they are using
    3. **Maintenance Subdivision**—“Traditional Work”

• **Work Environment:**
  – Isolated location(s)
  – Distance from raw material/scrap accumulation locations
  – Loss of sidings/yards to tie-up equipment when not in use
Job Preparation & Planning

• Confer with Assistant Chief Engineer of Track to determine critical wear curves
• Site visit location(s) of proposed work to determine if there is rail on site
• Determine marshalling points for raw material, personnel, and equipment
• Coordinate track outage with Planning and Transportation
• Order Material and coordinate pick-up from the Storeroom(s)
• Coordinate with MOW Production Equipment to have all equipment prepared for work
Eight Step Analysis Framework

1. Roles, responsibilities, and organization
2. Work process and procedure
3. Current personnel assignment
4. Time study
5. Production rate matching analysis
6. Schedule and utilization analysis
7. Rightsizing
8. Benchmarking
22 Step Work Process

1. Drop rail
2. Drag rail
3. Drop tie plates
4. Remove anchors
5. Pull spikes
6. Pick up scrap
7. Thread rail out
8. Remove tie plates
9. Plug ties
10. Adze ties
11. Lay tie plates
12. Align tie plates
13. Thread rail in
14. Tamp ties up to rail
15. Drop Pandrol clips
16. Adjust plates
17. Gauge
18. Drill holes
19. Lag plates
20. Start clips
21. Adjust rail temperature
22. Fasten clips
1. Drop Continuously Welded Rail
2. Drag Rail into Place
3. Drop Tie Plates
4. Remove Rail Anchors
5. Pull Spikes
6. Pick Up Scrap
7. Thread Rail Out
8. Remove Tie Plates
9. Plug Ties
10. Adze Ties (Adzer/Cribber)
11. Lay Tie Plates
12. Align Tie Plates with Plate Cart
13. Thread Rail In
14. Tamp Ties Up to Rail
15. Drop Pandrol Clips
16. Adjust Tie Plates
17. Gauge Using Gauging Rod
18. Drill Holes (Quad Drill)
19. Lag Plates to Tie
20. Apply Pandrol Clip
21. Adjust Rail Temperature
22. Fasten Pandrol Clip
Current Personnel Assignment

- Grove Crane
- Flat Cart
- Motor Cart
- Anchor Remover
- Spike Puller
- Spike Puller
- Scrap Machine
- Qualified Welder
- Welding Foreman
- Adzer/Cribber
- Plate Thrower
- Plugger
- Plug Tamper
- Adzer/Cribber
- Plate Retriever
- Plate Layer
- Plate Gauger

Direction of Gang Production
Production Rate Measurement

Plate Distribution Production Rate

Spike Puller Production Rate (3 Spikes/Tie)

Plate Gauger Production Rate

Rail Gauging Production Rate
## Production Rate Results

<table>
<thead>
<tr>
<th>Work Step</th>
<th>Machines</th>
<th>Sample</th>
<th>Production Rates (Ft./Min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Size (Feet)</td>
<td>Interval</td>
</tr>
<tr>
<td>2-Drop Tie Plates</td>
<td></td>
<td>1,595</td>
<td>1 Min.</td>
</tr>
<tr>
<td>4-Remove Spikes</td>
<td>SP 6001, 6002</td>
<td>1,308</td>
<td>2~5 Min.</td>
</tr>
<tr>
<td>6-Thread Rail Out</td>
<td>CH 2201</td>
<td>1,179</td>
<td>1 Min.</td>
</tr>
<tr>
<td>7-Remove Tie Plates</td>
<td></td>
<td>147</td>
<td>&lt;1 Min.</td>
</tr>
<tr>
<td>8-Plug Ties</td>
<td></td>
<td>233</td>
<td>1~2 Min.</td>
</tr>
<tr>
<td>9-Plug Tamping</td>
<td></td>
<td>225</td>
<td>1 Min.</td>
</tr>
<tr>
<td>10-Adzer/Cribber</td>
<td>KA 1001</td>
<td>1,109</td>
<td>Cat. Pole</td>
</tr>
<tr>
<td>12-Gauge Tie Plates</td>
<td></td>
<td>641</td>
<td>1~2 Min.</td>
</tr>
<tr>
<td>13-Thread Rail In</td>
<td>CH 2002</td>
<td>714</td>
<td>1 Min.</td>
</tr>
<tr>
<td>14-Junior Tamper</td>
<td>MJ 3002</td>
<td>806</td>
<td>1 Min.</td>
</tr>
<tr>
<td>17-Rail Gauging</td>
<td></td>
<td>678</td>
<td>1 Min.</td>
</tr>
<tr>
<td>18-Drill Holes</td>
<td>TY 1205</td>
<td>461</td>
<td>2~5 Min.</td>
</tr>
<tr>
<td>19-Lag Plates to Tie</td>
<td>SM 4001, 4003</td>
<td>310</td>
<td>2 Min.</td>
</tr>
</tbody>
</table>
Production Rate Matching

Production Rates at Minimum Requirement

Production Rates with Revised Assignment

<table>
<thead>
<tr>
<th>No.</th>
<th>Step</th>
<th>Curr. Assign. (Teams)</th>
<th>Revised Assign. (Teams)</th>
<th>Old Work Rate (Ft./Min.)</th>
<th>New Work Rate (Ft./Min.)</th>
<th>New Machine Utiliz.* (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Remove Spike</td>
<td>2</td>
<td>3</td>
<td>11.8</td>
<td>17.7</td>
<td>8%</td>
</tr>
<tr>
<td>17</td>
<td>Gauge Rail</td>
<td>1</td>
<td>2</td>
<td>9.1</td>
<td>18.2</td>
<td>—</td>
</tr>
<tr>
<td>18</td>
<td>Quaddrill</td>
<td>2</td>
<td>3</td>
<td>12.4</td>
<td>18.6</td>
<td>7%</td>
</tr>
<tr>
<td>19</td>
<td>Lag Plates</td>
<td>3</td>
<td>4</td>
<td>6.9</td>
<td>9.2</td>
<td>15%</td>
</tr>
</tbody>
</table>

* Note: (Machine Utilization %) = (Utilized Machine Hours) ÷ (Available Machine Hours).
## Rightsizing

<table>
<thead>
<tr>
<th>Category</th>
<th>Total Workdays</th>
<th>Coverage Required</th>
<th>Relief not Req’d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days in a Year</td>
<td>365</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rest Days</td>
<td>-104</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holidays</td>
<td>-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vacation Days</td>
<td>-25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sick Days</td>
<td>-12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal Days</td>
<td>-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training*</td>
<td>-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discipline*</td>
<td>-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bid Out Status*</td>
<td>-7</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Annual Total</strong></td>
<td><strong>251</strong></td>
<td><strong>-53 (21%)</strong></td>
<td><strong>198 (79%)</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>0</td>
<td>0.0113</td>
<td>1%</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td>0.0573</td>
<td>7%</td>
<td>14</td>
<td>17</td>
</tr>
<tr>
<td>17</td>
<td>2</td>
<td>0.1371</td>
<td>21%</td>
<td>35</td>
<td>52</td>
</tr>
<tr>
<td>16</td>
<td>3</td>
<td>0.2065</td>
<td>41%</td>
<td>52</td>
<td>104</td>
</tr>
<tr>
<td>15</td>
<td>4</td>
<td>0.2196</td>
<td>63%</td>
<td>56</td>
<td>160</td>
</tr>
<tr>
<td>14</td>
<td>5</td>
<td>0.1751</td>
<td>81%</td>
<td>44</td>
<td>204</td>
</tr>
<tr>
<td><strong>13</strong></td>
<td><strong>6</strong></td>
<td><strong>0.1086</strong></td>
<td><strong>92%</strong></td>
<td><strong>27</strong></td>
<td><strong>232</strong></td>
</tr>
<tr>
<td>12</td>
<td>7</td>
<td>0.0536</td>
<td>97%</td>
<td>14</td>
<td>245</td>
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<tr>
<td>11</td>
<td>8</td>
<td>0.0214</td>
<td>99%</td>
<td>5</td>
<td>251</td>
</tr>
<tr>
<td>≤10</td>
<td>≥9</td>
<td>0.0092</td>
<td>100%</td>
<td>2</td>
<td>253</td>
</tr>
</tbody>
</table>

- 61 heads needed to staff 45 positions!
Problem!

- Projects are crewed, equipped and conducted over a defined duration based on:
  - Site conditions,
  - Varying scopes:
    - rail type/length,
    - component replacement, etc.
  - Track outage.
- Benchmarks are therefore:
  - Not easily facilitated
  - Not 100% accurate
The Takeaway

• Slowest machine(s)/process(es)/operator(s) set the pace of the entire workgroup
• Reliance on support departments, and conflicting goals (corporate service goals versus maintaining the right of way), affect both productivity and cost of the job
• Fixed population of workers within the workgroup may lead to overstaffing on some projects
• Additional manpower cost incurred with FRA/CBU required training of incumbent machine operators
• Management and supervision must take a proactively embrace and foster new/newer technology, processes and machinery
• Foster relationships with other Class 1 and commuter roads to review their processes/machines, and incorporate