COMPLETE MODERNIZATION of the Pennsylvania Railroad's electric freight locomotive fleet with Class E-44 locomotives will reduce the total number of units required in this service from the present 156 to 129.

This reduction in locomotive units can be accomplished while maintaining present maximum tonnages and schedules. In addition, an adequate number of locomotives for relief and protection will be available.

The graphic train charts and tabulations which follow illustrate how this substantial reduction in the Pennsylvania Railroad's motive power fleet can be achieved.
A study of tonnages and the number of trains handled by the Pennsylvania's electric freight operation from January 1, 1960 to May 1, 1960 revealed that the heaviest freight movement in the period occurred during the week of April 9-15, 1960.

Dispatcher's train movement records were obtained from the railroad for this period. Within this week, it was found that the peak movement occurred on Wednesday, Thursday, and Friday, April 13-15. Therefore, motive power requirements and utilization for this three-day period were analyzed. Dispatcher's sheets were reviewed to obtain leaving and arriving times for all freight trains hauled by electric locomotives, as well as tonnages, cars, and locomotives used.

Assigned to freight service at the time were 156 locomotives:

1 - DD-2  
49 - GG-1  
90 - P-5 and P-5A  
10 - E-2-B, E-2-C, and E-3-B  
6 - FF-2  
156 - Total Locomotive Units

This study shows that 129 E-44's can handle the freight traffic now requiring 156 units. The E-44 units would be assigned as follows:

- 37 - New York area* - Enola, Harrisburg scheduled freight trains
- 63 - All other scheduled freight trains
- 15 - Ore and other extra trains
- 115 E-44 Locomotive Units

* Greenville, Harsimus Cove, Meadows, Waverly, South Amboy

In addition, helper service would require one locomotive at Baltimore, and one at Glen. An allowance of 10% is made for shopping and protection units. The total units would then be:

- 115 - Freight trains as above
- 2 - Helper units
- 12 - Relief and Protection, Shopping Margin
- 129 - Total E-44 Locomotive Units

Graphic train charts and tabulations are included in this report to illustrate the manner in which these units could be applied.
ELECTRIC FREIGHT LOCOMOTIVE ASSIGNMENTS

NEW YORK - ENOLA, HARRISBURG

In reviewing electric freight locomotive utilization, the electrified operation was broken down into three areas:

1. New York - Enola, Harrisburg scheduled trains.
2. All other scheduled trains, including trains originating and terminating at Potomac Yard, Baltimore, Edge Moor, Thurlow, South Philadelphia, Camden, Ernest, and Morrisville.
3. Extra trains such as ore trains and empty gondola and hopper car trains.

On all but the ore trains, a balance of incoming and outgoing locomotive units at all turn-around points can be achieved. Thus, no light engine movements would be required except in extra train service.

Because of traffic requirements, train movements in the Pennsylvania’s electrified area tend to be “fleeted”. This is particularly true at the New Jersey terminals where the bulk of the inbound movements occurs between midnight and 8:00 a.m., and the outbound movements occur between 6:00 p.m. and 10:00 p.m. Because of the timing of this fleet movement, layover periods are long and equipment utilization is low. For example, in the New York - Enola, Harrisburg service, average locomotive utilization is only 34%, and the average monthly mileage based on the three-day period studied is only 5,810 miles. The actual average monthly mileage would be somewhat lower, since the three days studied constitute the peak traffic period.
GRAPHIC TRAIN CHART NO. 1

PENNSYLVANIA RAILROAD

ELECTRIC

LOCOMOTIVE UTILIZATION

NEW YORK AREA - ENOLA, HARRISBURG

HARRISBURG

GREENVILLE

MEADOWS

SOUTH AMBOY

ENOLA

WEDNESDAY, APRIL 13, '60
Train Chart No. 1 shows in graphic form the freight trains pulled by electric locomotives during the three-day period, April 13-15, 1960. Leaving and arriving times at the various terminals were taken from the Dispatcher's sheets for the three-day period. On the chart, E-44 electric locomotives have been substituted for electric locomotives at the various terminals. Included in this chart are the scheduled trains between Enola, Harrisburg, and the New York terminals (South Amboy, Meadows, Green­ ville, and Harrison Cove) only. Additional charts on following pages show other scheduled trains in the electric­ trified area, as well as extras.

A total of 37 E-44's would be required to pull the Enola, Harrisburg - New York freight trains which operated during the three days, April 13-15. Suggested assignment of locomotives is shown both in the Train Chart and in the accompanying tabulation.

A minimum of four hours turn-around time has been pro­ vided at both the New York and the Enola, Harrisburg terminals. However, most layovers are considerably longer than this because of the "fleeted" movements of the trains. Average unit miles per month based on existing schedules and as shown in Train Chart No. 1 would be 5,810 miles, and utilization would be 34%.

The tabulation presents in another manner the information shown on the Train Chart. Unit numbers are assigned arbitrarily, 1 through 37, to arrive at the total number of locomotives required. Where two or three locomotive units are required to pull a train because of tonnage requirements, these are shown on successive lines.

### CYCLING OF E-44 ELECTRIC LOCOMOTIVES

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Origin</th>
<th>Train</th>
<th>Ta</th>
<th>Train</th>
<th>Ta</th>
<th>Train</th>
<th>Ta</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. N.Y.</td>
<td>N15</td>
<td>Morrisville</td>
<td>M12</td>
<td>N. Y.</td>
<td>N15</td>
<td>Morrisville</td>
<td>M12</td>
</tr>
<tr>
<td>2. N.Y.</td>
<td>N13</td>
<td>Morrisville</td>
<td>M12</td>
<td>N. Y.</td>
<td>N13</td>
<td>Morrisville</td>
<td>M12</td>
</tr>
<tr>
<td>5. N.Y.</td>
<td>M12</td>
<td>Edge Moor</td>
<td>B12</td>
<td>N. Y.</td>
<td>M12</td>
<td>Edge Moor</td>
<td>B12</td>
</tr>
</tbody>
</table>

### CYCLING OF E-44 ELECTRIC LOCOMOTIVES

Train Chart No. 2 illustrates the manner in which 63 E-44 units could be used to pull all but the Enola - New York scheduled trains. The chart represents a 36-hour period from midnight one day until noon on the second day. Schedules shown represent typical leaving and arriving times for the three-day period studied. Units are assigned on the basis of handling the heaviest tonnage for a particular train over the three-day period. Some helper service would be required at Baltimore southbound and Philadel­phia westbound.

The following list illustrates in tabular form the same information shown on the Train Chart. Unit numbers are assigned arbitrarily, 1 through 63, to arrive at the total number of locomotives required. Where two or three locomotive units are required to pull a train because of tonnage requirements, these are shown on successive lines.
GRAPHIC TRAIN CHART NO. 2 -- SCHEDULED FREIGHT TRAINS
The ore and other extra trains operated by the Pennsylvania Railroad during the April 13-15 period covered by this study are shown on Train Chart No. 3. These trains were taken from the dispatcher's sheets for this period, and E-44 electrics are assigned based on their tonnage ratings. However, to achieve a balance of locomotive units at various points in the area, light locomotive moves are suggested on this chart. (One Baltimore to Enola extra per day is included in Train Chart No. 2 to balance the units from AC10 Harrisburg to Baltimore.) Fifteen E-44 locomotive units would be required to operate the trains shown on Train Chart No. 3.
FURTHER REDUCTION IN ELECTRIC LOCOMOTIVE REQUIREMENTS

A further reduction in the total number of units needed to power the Pennsylvania's electric freight trains would require train rescheduling to provide a more uniform movement of traffic within this area. Realizing that existing schedules have been established because of connections, local deliveries, and other shipper requirements, a full scale study of car flow would be necessary to determine if any adjustment of schedules might be feasible. If this were undertaken and some schedule adjustment were possible, the result would be reduced total requirements not only for locomotives but for cars, yards, roadway and personnel.

An example illustrating these possible savings can be found in the New York area - Enola - Harrisburg, scheduled freight movement. A study of the April 13-15 train movements in this service shows that the best average locomotive mileage, as illustrated in Train Chart I, would be 5,810 miles per unit per month. This is equivalent to an average of one single trip per unit per day. By adjusting the schedules, each locomotive could be scheduled for one round trip per day.* With this optimum arrangement, locomotive requirements could be reduced from a total of 37 units as shown in this study to 19 units. Similar reductions could be achieved in the locomotive requirements for the balance of the scheduled electric freight trains.

* Based on eight hours per trip each direction, plus four hours layover each end.

The Pennsylvania Railroad is now increasing the efficiency of its motive power fleet by replacing P-5 and P-5A locomotives with new Class E-44 units. Complete modernization of the electric freight operation will result in substantially reduced operating costs and fewer total locomotive units. This can be achieved with a total of 129 E-44 locomotives.
Progress Is Our Most Important Product

GENERAL ELECTRIC

Locomotive and Car Equipment Department
Erie, Pennsylvania