

Combining Multiple Data Types in a Single Measurement Tool



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About Amtrak

- National Railroad Passenger Corporation
- 46 routes:
 - 2 Northeast Corridor
 - 15 Long Distance
 - 29 State Supported (Short Distance)
- Approximately 300 trains per day
- 31.3 million passengers
- 6.5 billion passenger miles
- 12.8 billion seat miles
- 51% average load factor
- 96% cost recovery ratio

And we have lots of data...

Diesel Fuel Allocated Gallons
Business Class Riders
Boards
Baggage Car Units Used
Berth Miles
Customer Allocated Costs
Canadian Boarder Crossing
Coach Class Riders
Commuter Elec Loco Miles
Commuter Elec Loco Trips
Coach OBS Labor Hours
Coach Class Passenger Miles
Coach Class Revenue
Car Unit Trips
Deboards
Diesel-Hauled Berth Miles
Diesel-Hauled Gross Ton Miles
Food Service OBS Labor Hours
Diesel Power Allocation Factor
Food Service Revenue
Diesel-Hauled Seat Miles
Diesel-Hauled Total Train Miles
Diesel Unit Miles
Diesel Loco Unit Trips
Electric-Hauled Berth Miles
Electric-Propelled Car Miles
Electric-Hauled Gross Ton Miles
Engineer Labor Hours

Electric Traction Power Allocation Factor
Electric-Hauled Seat Miles
Electric-Hauled Total Train Miles
Electric Loco and EMU Unit Miles
Electric Loco and EMU Unit Trips
First Class Riders
First Class Revenue
First Class Passenger Miles
Frequency of Train Trips
Gallons
GE Units
Total Gross Ton Miles
Total Trailing Ton Miles
Locomotive Unit Trips
Mechanical Direct Costs
Car Turnaround Mech Labor Hours
Maintenance of Way Direct Costs
Total OBS Labor Hours
Power Allocation Statistics
Passenger Related Transportation
Revenue
Business Class Passenger Miles
Passenger Car Unit Trips
Sleeping Car Room Miles
Usage Time for RSO Operations
Sleeping Car OBS Labor Hours
Total Seat Miles - All Classes
Station Ticket Issuance

Travel Agent Sales
Total Boards And Deboards
Total Coach Miles
Total Diesel-Hauled Seat and Berth Miles
Conductor and Engineer Labor Hours
Total Electric-Hauled Seat and Berth Miles
Conductor Labor Hours
Total Locomotive Miles
Total Operated Passenger Miles
Total Riders
Total Transportation Revenue
Total Seat and Berth Miles
Total Operated Train Miles
Total Unit Trips
Locomotive and Car Unit Miles
Locomotive and Car Unit Trips
Average Locos and Cars Used per Day
Trip-length-weighted Boards and Deboards
Non-Amtrak GTM
Non-Amtrak TTM
Ops Trans Direct Cost
Point-to Point KWH
Adjusted Miles for Grade and Speed
Changes
Station Stop Additional KWH
Adjusted Miles for Station Stops
Total Adjusted Miles
Train Resistance Constant



***HOW DO WE BRING ALL OF
THIS TOGETHER?***

**First,
a
different
question.**

What is it That Public Transportation Makes?

TRAINS?

- Nope, CAF, Alstom, and other manufacturers do that.

SEATS?

- Not really, because people don't pay a fare just to sit on the bus, they want to go somewhere.

PUBLIC TRANSPORTATION MAKES...

Seat Miles

Seat miles are our basic *unit of production*.

A *unit of production* is what we make.

A seat alone is not, since we do not sell it sitting still.

We sell a seat in motion.

We measure motion by the distance traveled, or miles.

Seat Miles

Seat Miles = Seats/Train X No. of Miles

The Challenge of Seats

Amtrak trains, like all mass transportation, is extremely “perishable.”

Once an empty seat departs, you cannot sell it, and the revenue opportunity is gone.



So What do We Fill Seat Miles With?

- The answer is what we actually sell.
- We make seat miles, and people purchase fares to use them.
- So, sold seat miles become...

Passenger Miles

Passenger Miles = Passengers X Trip Length

Passenger Miles

10 passenger miles = 1 passenger traveling
10 miles

OR

10 passenger miles = 10 passengers
traveling 1 mile

Utilization Measure is Average Load Factor

$$\text{Load Factor} = \frac{\text{Passenger Miles}}{\text{Seat Miles}}$$

Load Factor

- It is the amount of time that the total available seats provided are occupied by passengers.
- Load Factor is the key measure for intercity mass transportation providers, such as airlines.
- Load Factor is a bit more complex for Amtrak (and other surface transportation) as trains make multiple en-route stops.
 - **PEAK** load factor
 - **AVERAGE** load factor

Load Factor (i.e., average load factor)

- (Average) Load Factor tells us how full our trains are over the entire length of their trips.
- A load factor of 100% means **all** of the available seats are occupied by passengers for the **entire length** of every trip.

What's an Acceptable Load Factor?

Airlines use break-even load factor as performance base. Since Amtrak is not solely driven by profit, fully-allocated break-even load factor is far above what is acceptable.

Since Amtrak has two levels of ***variable profit (loss)***, we can calculate break-even load factor for each level.

BREAK EVEN LOAD FACTOR

=

Operating Cost per Seat Mile

Passenger Revenue per Passenger Mile

Calculated at Each Variable-Fixed Cost Level:

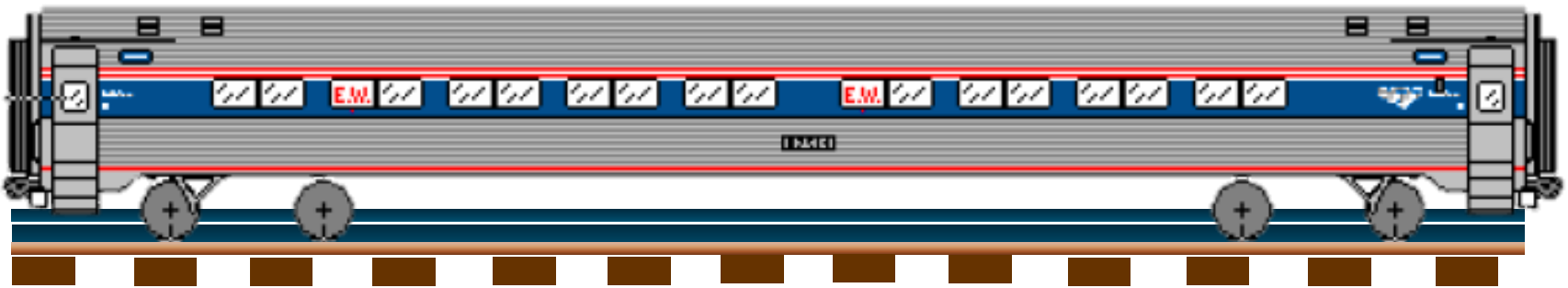
- Frequency Variable
- Route Variable
- System / Fixed

Variable vs. Fixed Costs?

ABOVE THE RAIL

AVOIDABLE COSTS
INCREMENTAL COSTS

VARIABLE COSTS



FIXED COSTS

BELOW THE RAIL

SUNK COSTS
BACKBONE COSTS

Three Levels of Variable and Fixed Costs

First Level:

Frequency Variable Costs

- Costs that vary with number of train frequencies on a route or number of cars and/or locomotives on an individual train frequency.
- Generally do not require separate management decisions, but change with change in service.
- Include costs such as: Crew Labor, Host RR, Fuel & Power, Commissary Provisions.

Three Levels of Variable and Fixed Costs

Second Level:

Route Variable Costs

- Dependent on changes on the entire route or region and/or generally require separate management action to achieve a change in cost.
- Include costs such as: Car & Locomotive Maintenance and Turnaround, Commissary Operations, Call Center Staffing, M of W.

Three Levels of Variable and Fixed Costs

Third Level:

System / Fixed Costs

- Not impacted by individual changes to Amtrak's National Train System and require separate management decisions.
- Include costs such as: National Police, Operations Management, G&A.

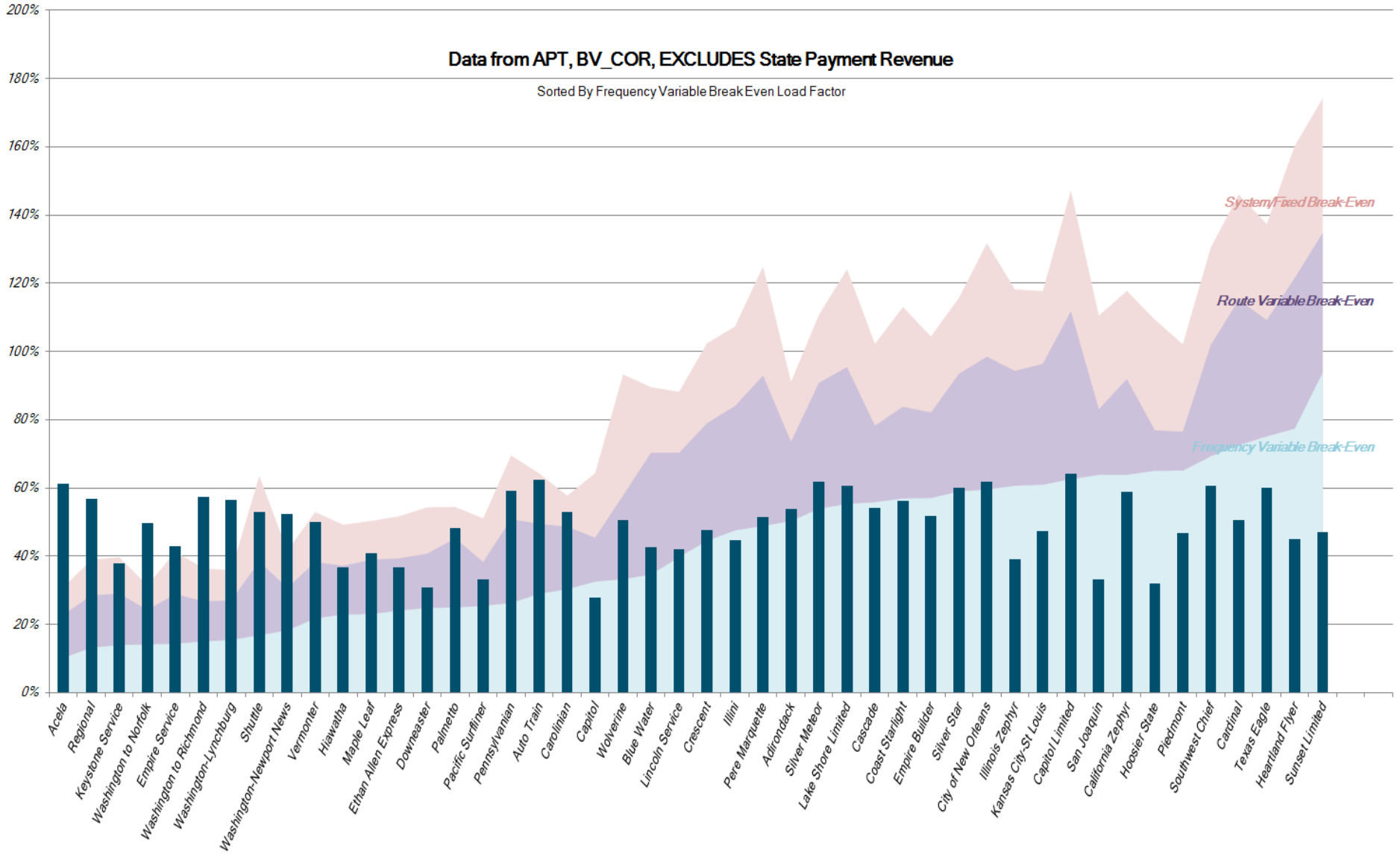
Frequency Variable, Route Variable, System-Fixed Profit (Loss)

- Each of the three level of operating costs are subtracted from **passenger revenue** for:
 - Frequency Variable Profit (Loss)
 - Variable (Frequency + Route) Profit (Loss)
 - Total (Frequency + Route + System/Fixed) Profit (Loss)
- **Passenger revenue** includes ticket revenue, food & beverage revenue, baggage revenue, passenger fees, private car revenue, etc.
- Measure of the **commercial performance** of the service, so **excludes** state payments and any other government support.

Amtrak National Train System (TUS) Train Load Factor vs. Break Even, FY2016 Year to Date through Sep

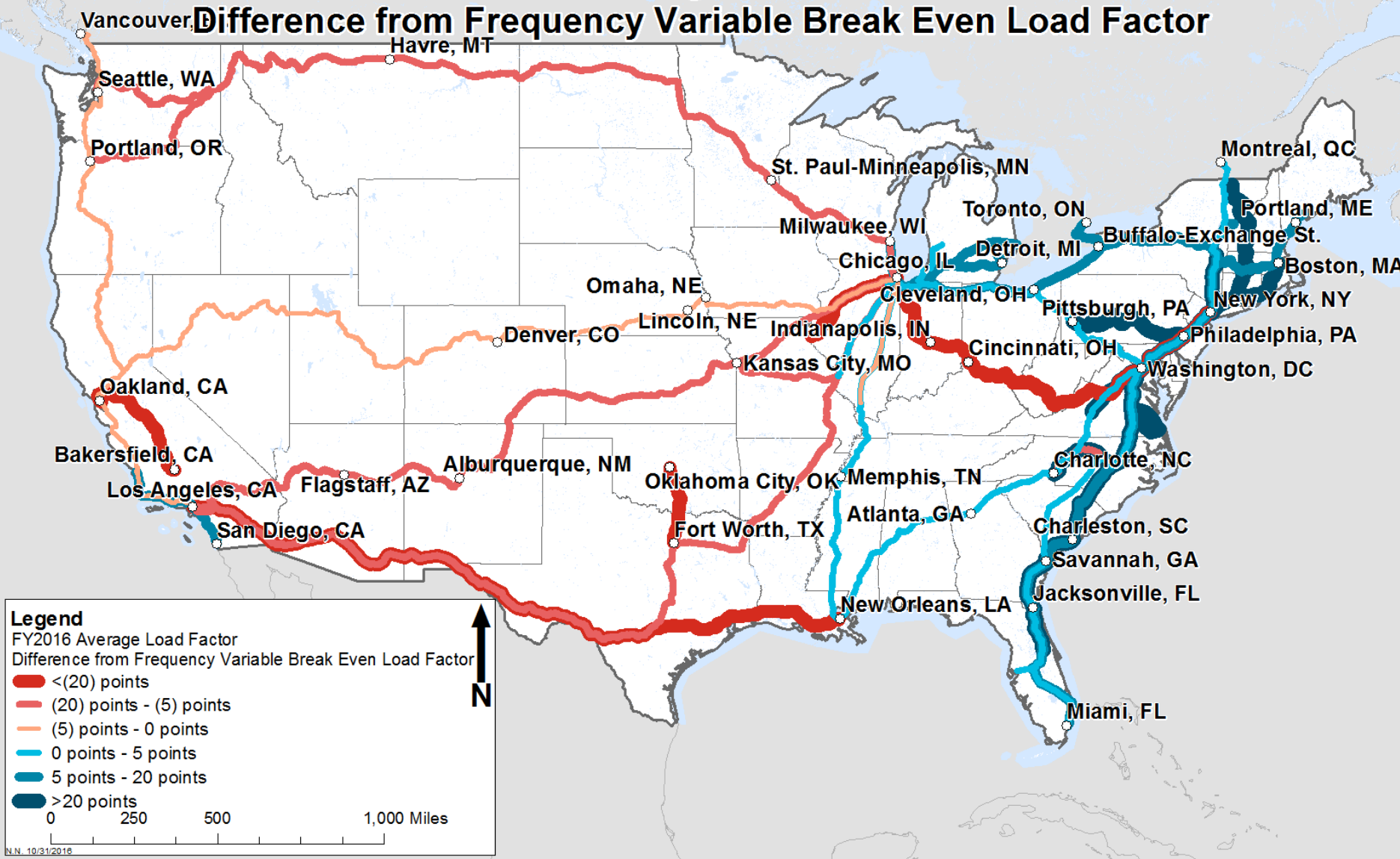
Data from APT, BV_COR, EXCLUDES State Payment Revenue

Sorted By Frequency Variable Break Even Load Factor



FY2016 Average Load Factor

Difference from Frequency Variable Break Even Load Factor



FY2016 Average Load Factor

Difference from Route Variable Break Even Load Factor



How You Can Try This at Home

What you need:

- Passenger Miles by Route
 - NTD sample won't be enough
 - APC data, robust route-by-route sample, if not 100% count
- Seat Miles by Route
- Fare Revenue by Route
- Costs by Route

How You Can Try This at Home

What to Work Through:

- What is your agency's definition of "good" in terms of route productivity?
- What costs are truly variable on your system?
- Is there a farebox recovery goal?

What's Next

- We are now working on expanding reviewing average load factors against the route break even load factors by:
 - Individual frequency (train number)
 - Station-to-station segment
- Educating front-line management on how their actions impact the break even load factor of their route(s).

QUESTIONS?

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