



THE ST. LOUIS PREDICTIVE MAINTENANCE PROGRAM

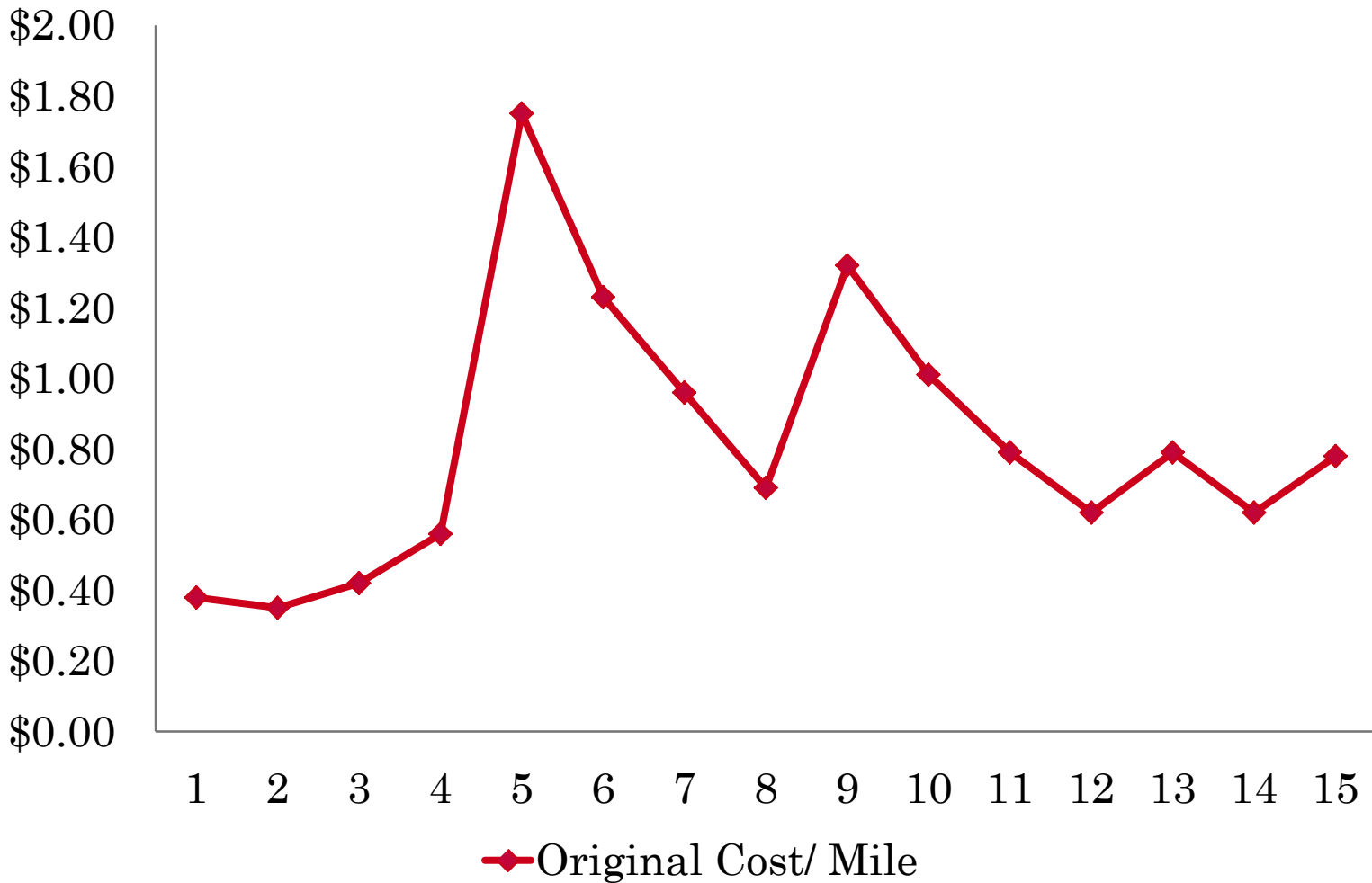
Program Results & Application in Your Organization

**Ray Friem, Chief Operating Officer
Metro Transit**

STRATEGIC FLEET MAINTENANCE

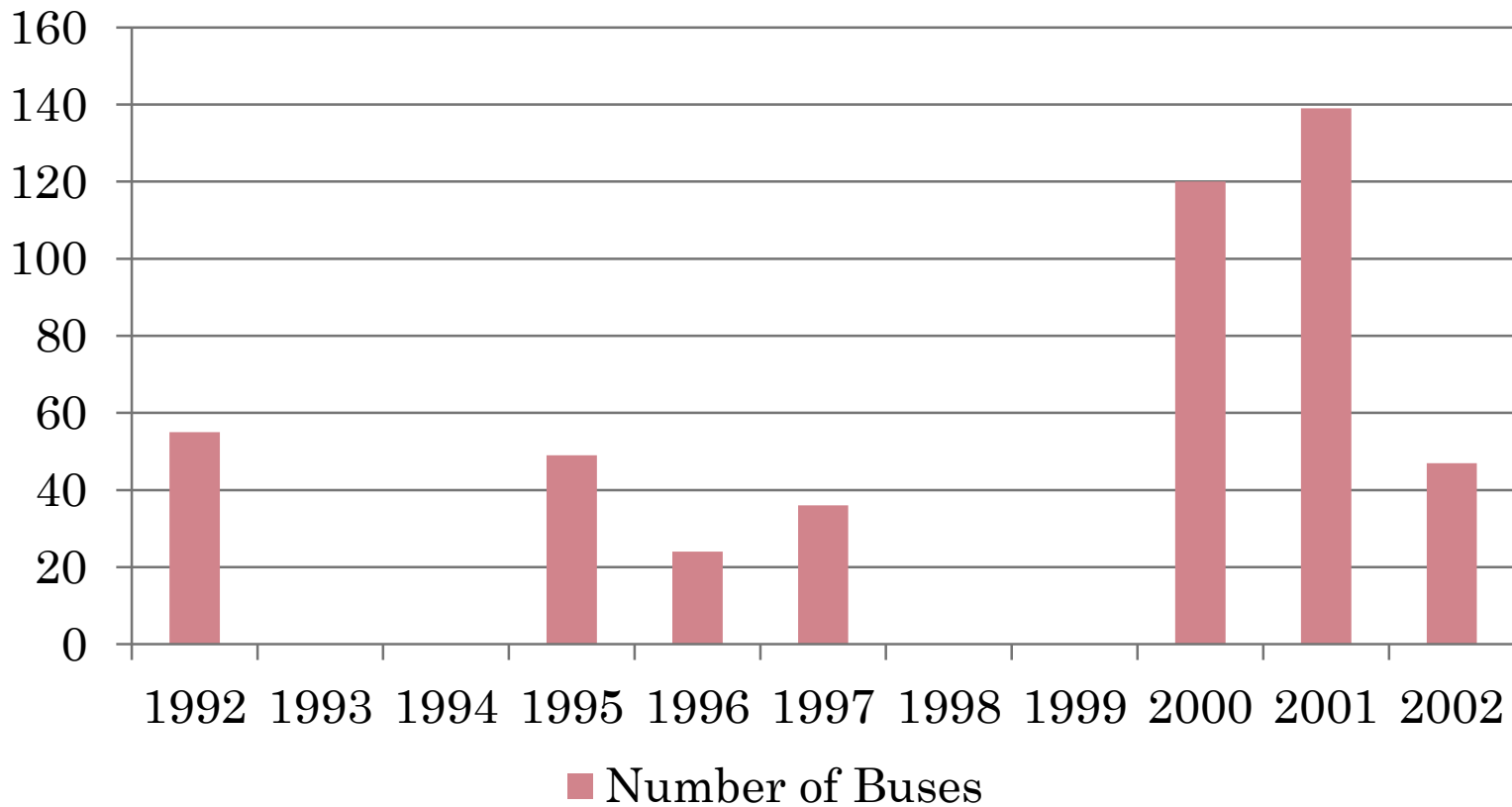


PRE-PROGRAM BUS MAINTENANCE COST PER MILE

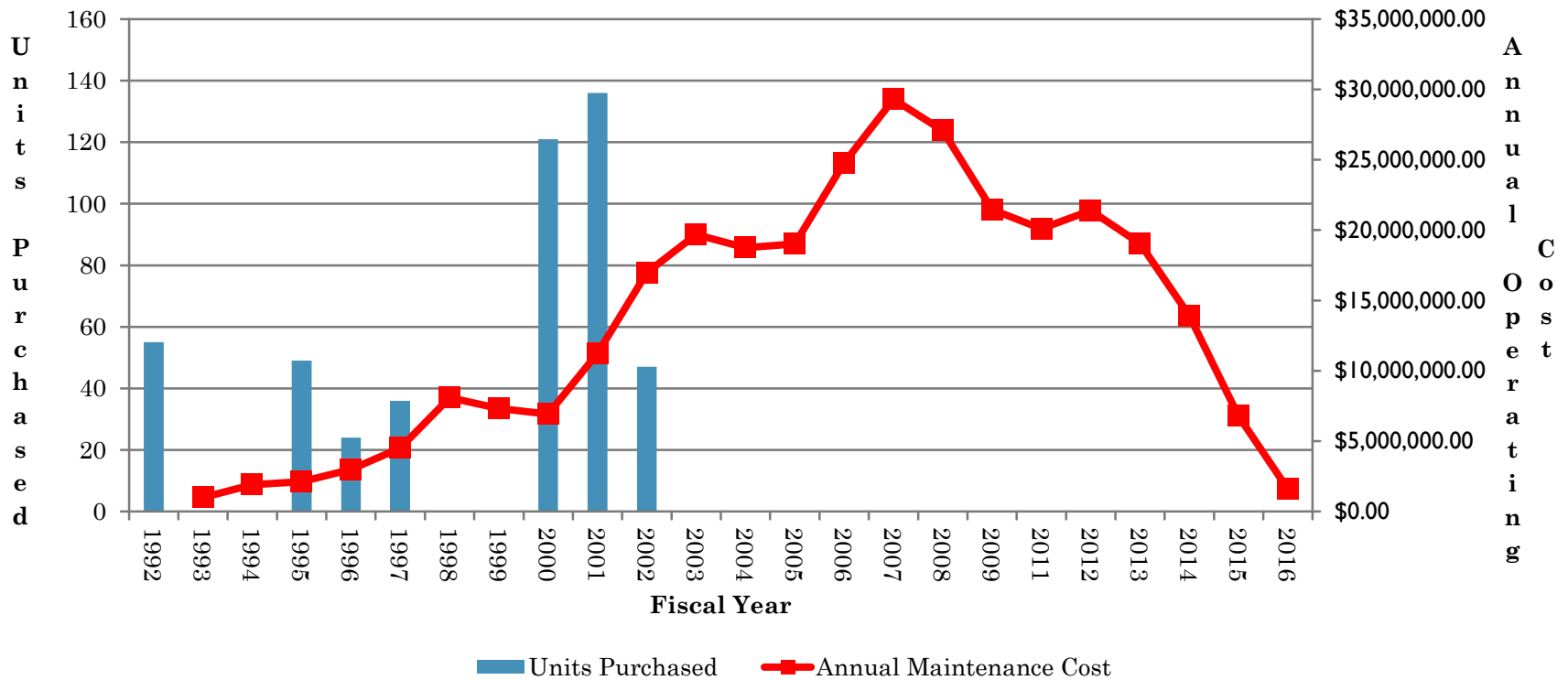


HISTORICAL BUS REPLACEMENT STRATEGY

Number of Buses Purchased Based On Funding (earmarks)



PROCUREMENT STRATEGY DRIVES OPERATING COST



TRADITIONAL MAINTENANCE PROGRAM

HISTORICALLY

1500 MILE PACE

1500, 3000, 4500, 6000, 7500, 9000, 10,500, 12,000 repeat

Driven by the need to adjust brakes every 1500 miles

3000 MILE PACE

3000, 6000, 9000, 12,000 repeat

Changed with the advent of automatic slack adjusters but synced with the need to change Oil at 6000, ATF at 12,000 and Diff lube at 24,0000 miles



Metro

TRADITIONAL MAINTENANCE PROGRAM

- Components changed as needed
- Bus to main rebuild center for major engine repair or replacement and body repairs (usually mid-life)
- Dwell time on major repairs of 100 days or more
- Low expectations



IN 2002 IT WAS CLEAR THAT WE ABSOLUTELY HAD TO BREAK THIS CYCLE IF THE TRANSIT SYSTEM WOULD BE SUCCESSFUL

- System had just completed the purchase of 260 new buses in the past two years for a bus fleet that was 415 buses (now 380 plus contingency).
 - That meant that we had about 5 years before major work and cost for midlife activities would commence.
 - Further, our work load was immediately lessened by the new buses, in other words, we had time, but time works both for you and against you.
- It was imperative that we do everything we could to break the cycle.



REDESIGNED BUS & VAN FLEET MAINTENANCE IN 2002

CMO MANDATE

Design a Program that could:

- Control operating cost
- Manage life cycle cost
- Extend the life of a bus beyond 12 years / 500,000 miles.
 - Required to stagger future procurement efforts.
- If necessary retire some buses early on mileage only to further stretch procurement cycle.



PROGRAM GOALS

- Budgeting should be consistent and predictable
- Plan our work so that both operating and capital costs are consistent from year to year
 - This is a go-long strategy that may require more than one capital purchase cycle to complete



PREDICTIVE MAINTENANCE

- Basic Concept: Replace or overhaul parts before they fail in service
 - Ensure your preventative maintenance is part of your fleet management strategy
 - Rigidly enforce configuration management
 - No sub-fleets within sub-fleets
- Measure, adjust, and measure again
 - Perform replacement at regular intervals



MANAGE AND PROGRAM LIFE CYCLE AND COST

- Determine expected life for asset
 - Bus 15 years and 800,000 miles

- Create a maintenance program in order to attain the expected life
 - Condition based maintenance point every 50,000 miles
 - PM inspection schedule at 10,000 miles
 - Oil change only (Jiffy Lube) at 6,000 miles



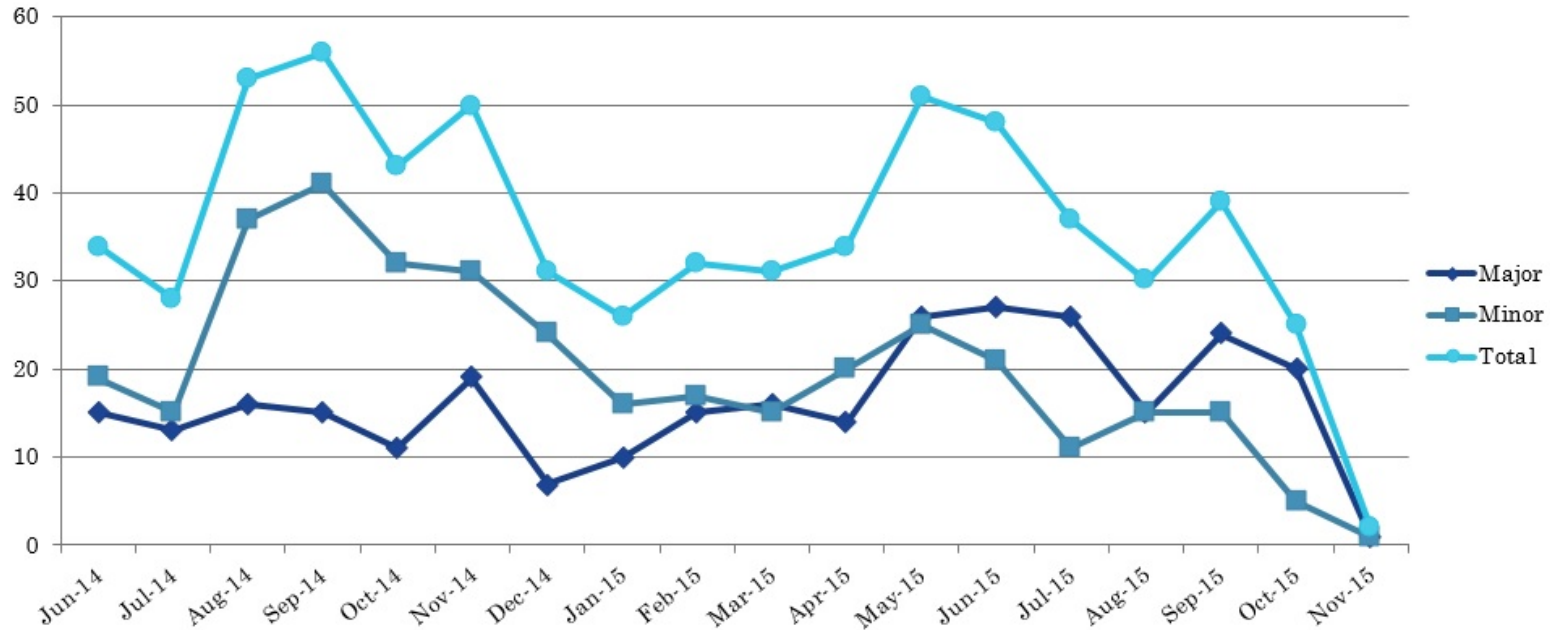
PREDICTIVE MAINTENANCE PLAN

- Minor actions every 50,000 miles
 - 50k, 150k, 250k, 350k, 450k, 550k
- Major actions every 100,000 miles
 - 100k, 200k, 300k, 400k, 500k, 600k

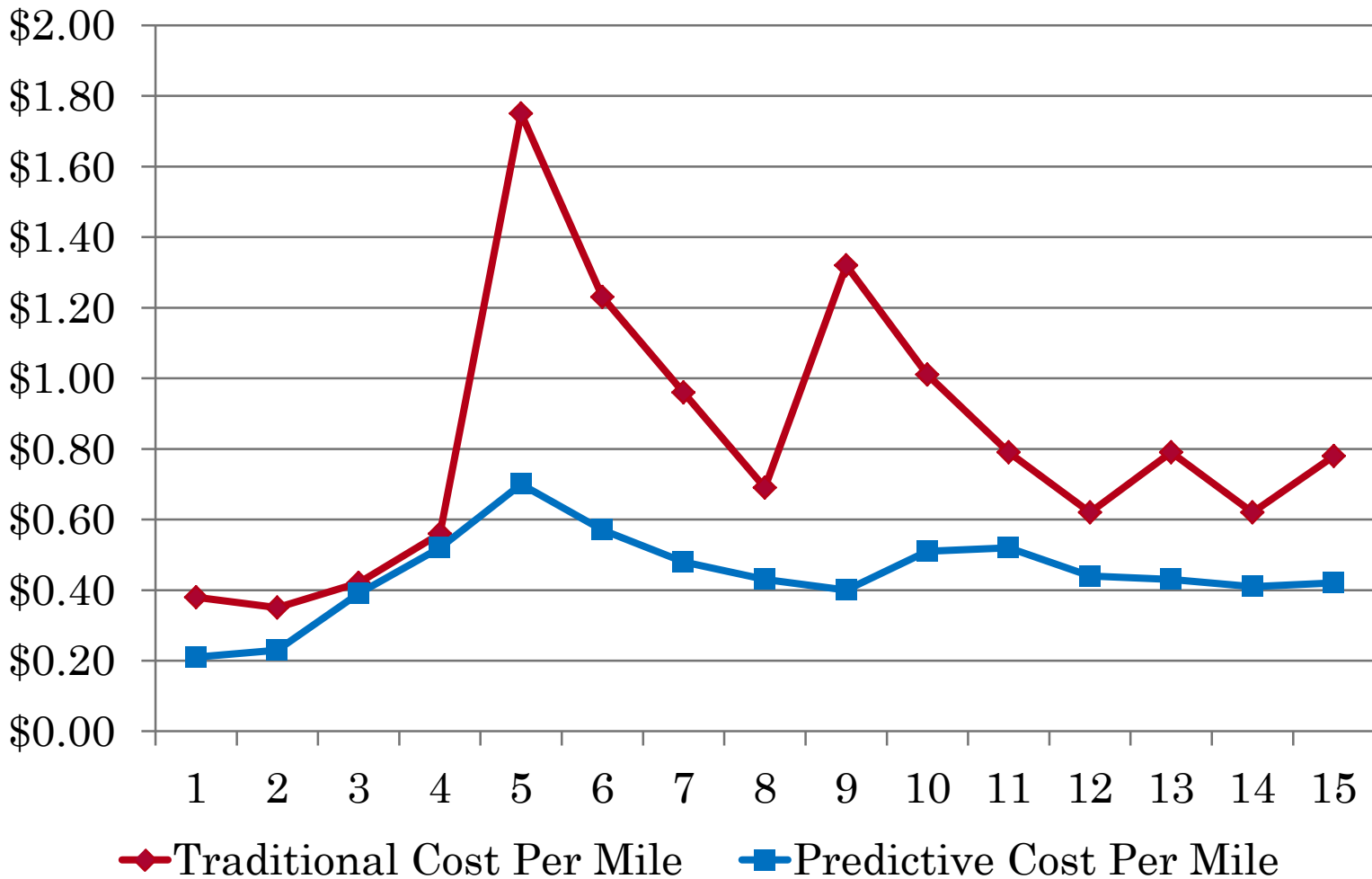


PREDICTIVE MAINTENANCE PLAN

FORECAST K INSPECTIONS FOR 18 MONTHS



BASE VS. PROGRAM BUS MAINTENANCE COST PER MILE



HOW EXACTLY DOES OUR PREDICTIVE MAINTENANCE PROGRAM SAVE US MONEY?

- We looked at when historical failures occurred and found:
 - We would bring a bus in four times to replace four identical components as they failed individually.
 - (Changing them all at once saved three trips into the shop).
 - We were running components into the ground, for example transmissions:
 - Complete Overhaul of failed unit costs between \$10K and \$16K depending on model. Providing overhaul of seals and bearings before failure costs \$4K.
 - By determining which components historically failed and scheduling them for replacement in the 50K mile increment before failure we could predict when we needed the part (Inventory reduction / Cost of \$\$\$)

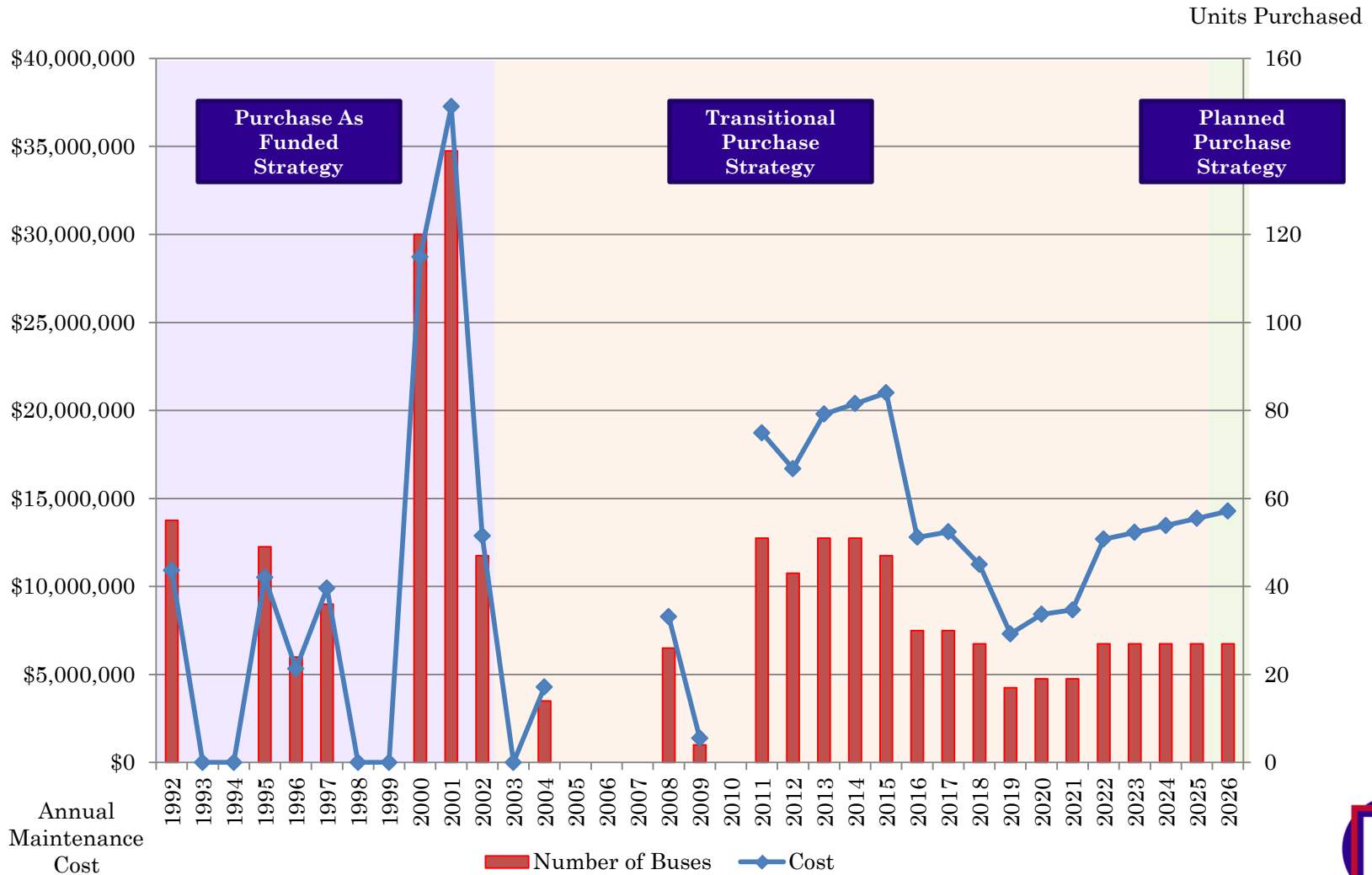


HOW EXACTLY DOES OUR PREDICTIVE MAINTENANCE PROGRAM SAVE US MONEY?

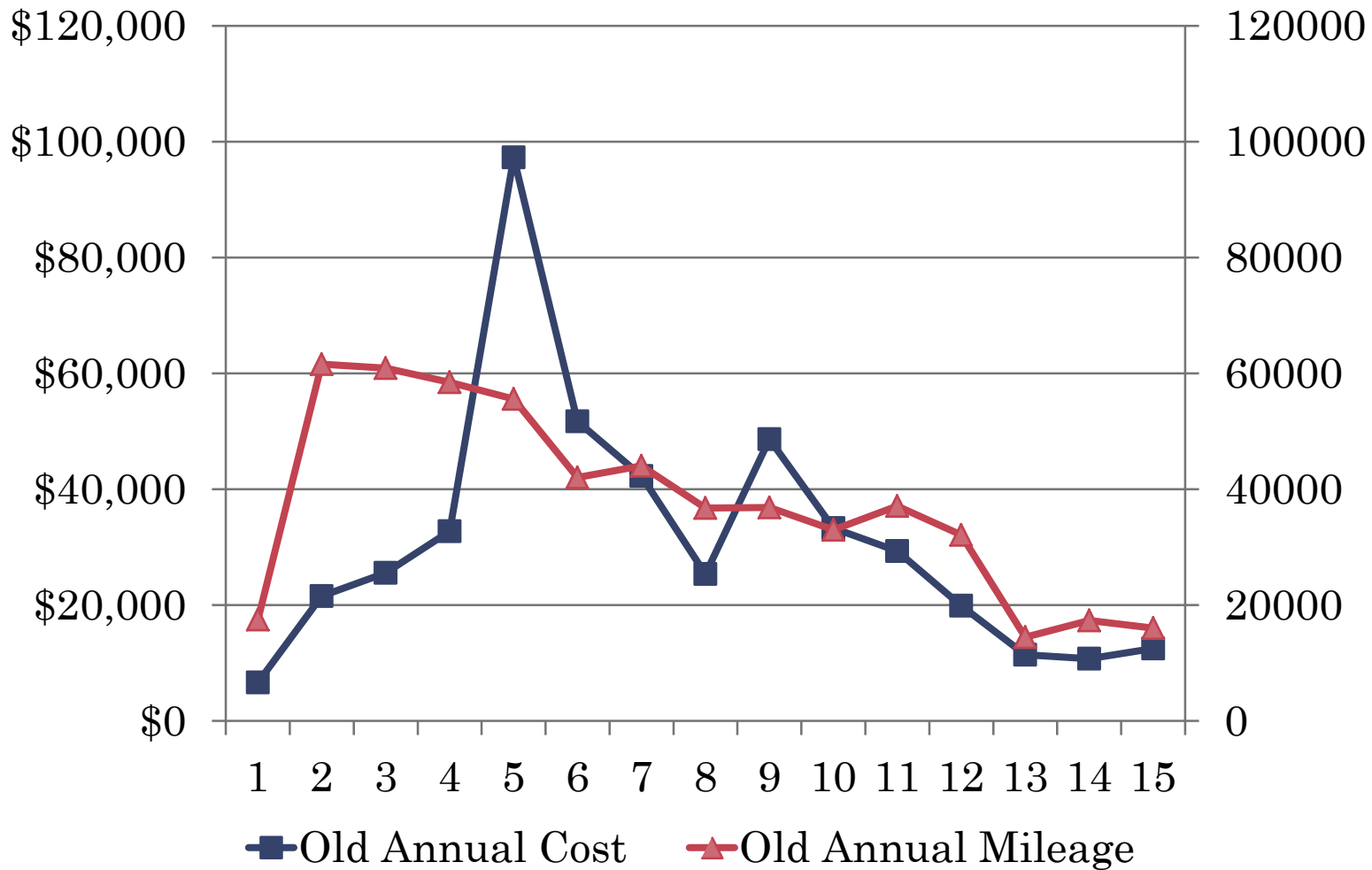
- Every failure that occurred happened with people on the bus!
 - Reduce in route failures, save on in route replacements (less angry customers = more customer revenue).
 - Reduction in Accidents:
 - Zero claims of Brake Failure in Five Years
 - Enhanced Schedule Performance
 - Helped Improve adherence to bus schedules from 75% to 93%.
- Needed the Capital Component (Rational Replacement Strategy) to Assure Success.....



BUS FLEET REPLACEMENT STRATEGIES

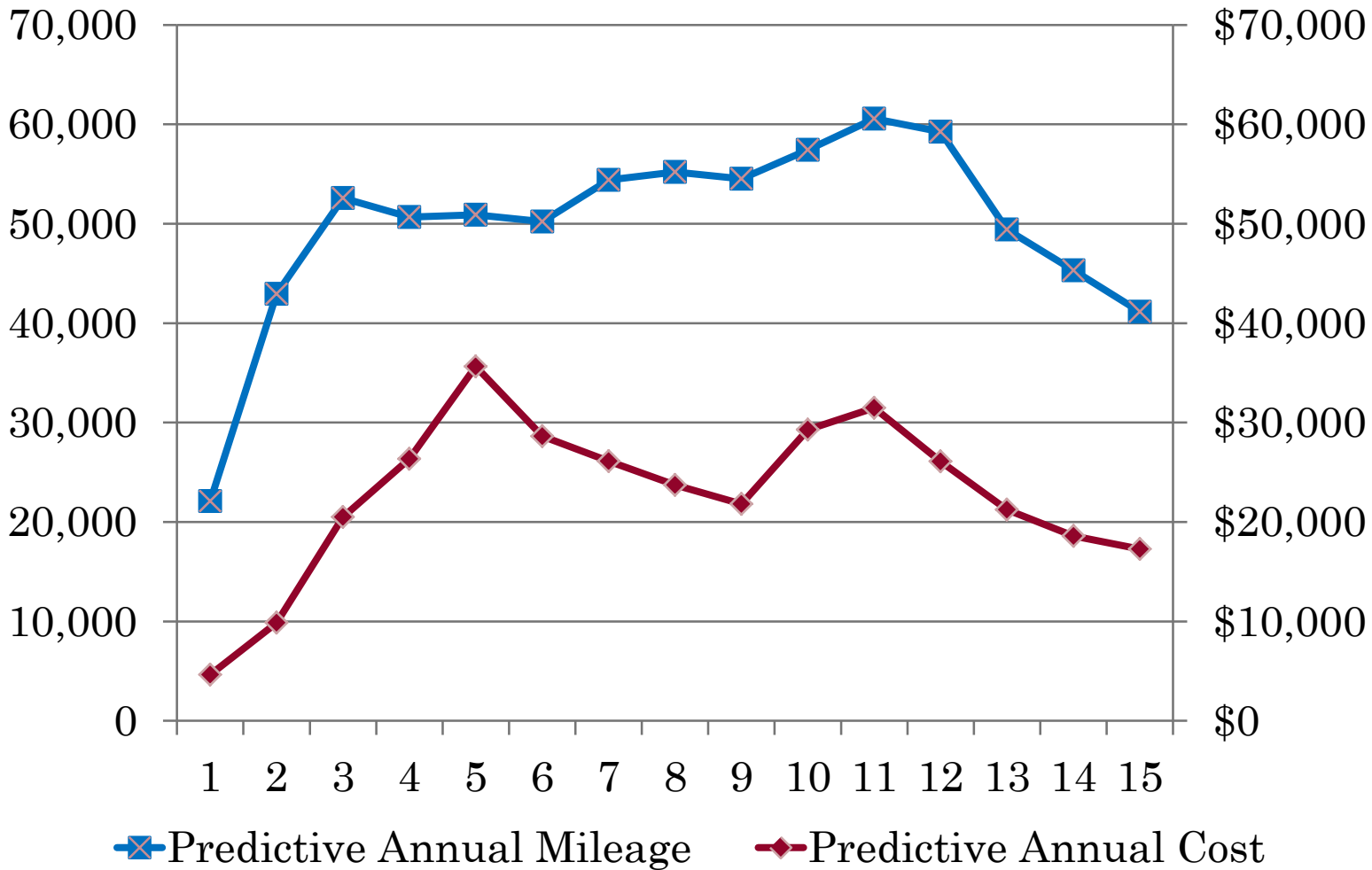


PRE-PROGRAM EXPENSE (\$) VS. VEHICLE USAGE (MILES)

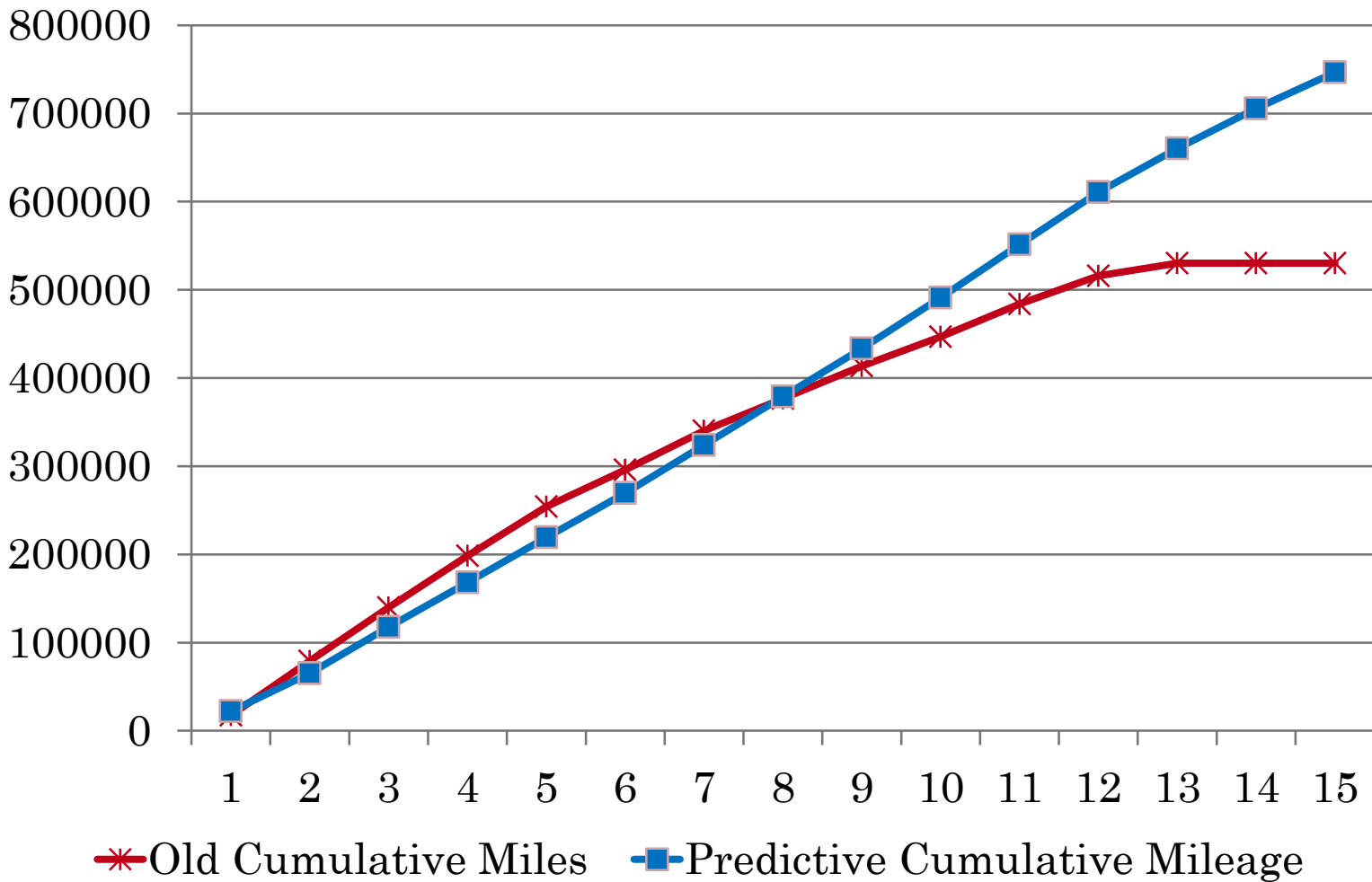


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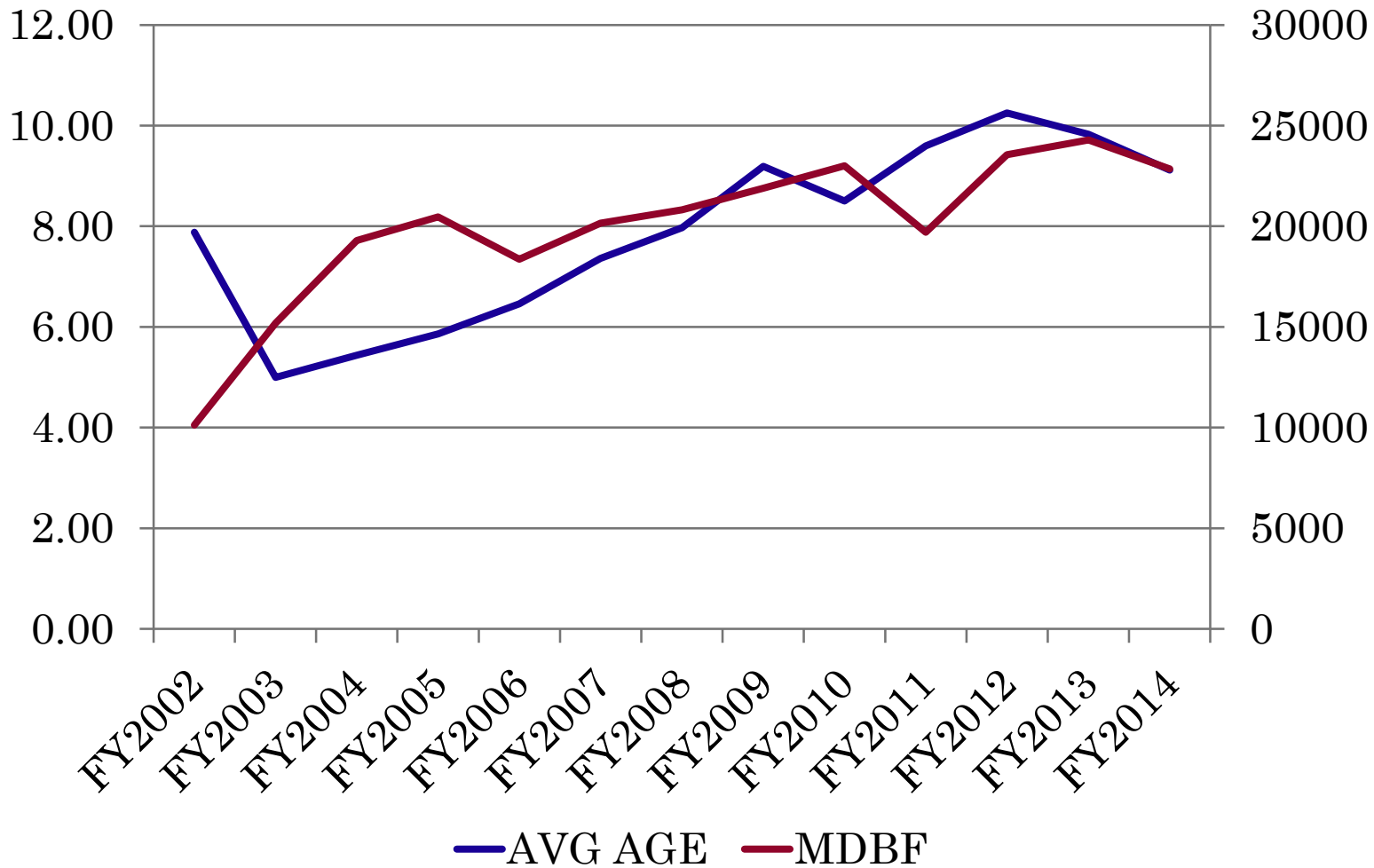
PREDICTIVE PLAN EXPENSE (\$) VS. USAGE (MILES)



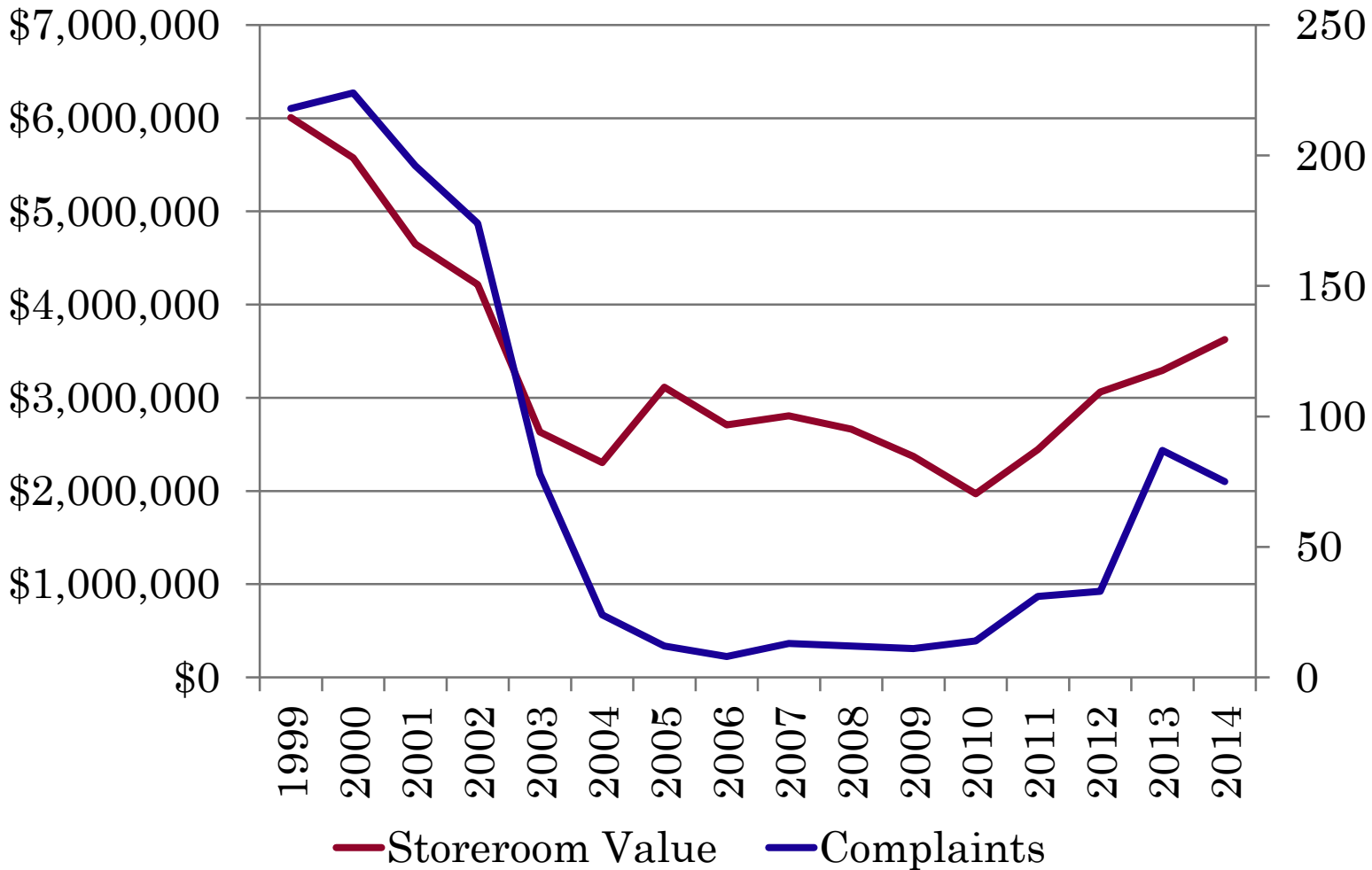
BUS LIFE-CYCLE UTILIZATION



DIRECT PROGRAM BENEFITS: GREATER VEHICLE RELIABILITY

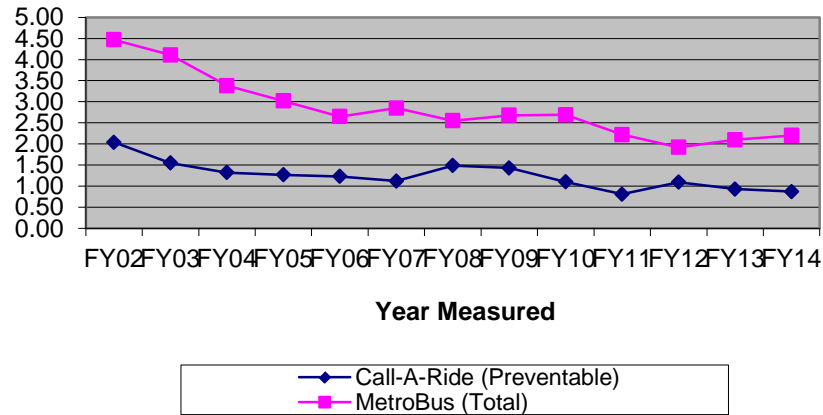


DIRECT PROGRAM BENEFITS: REDUCTION IN STOREROOM INVENTORY REQUIREMENT

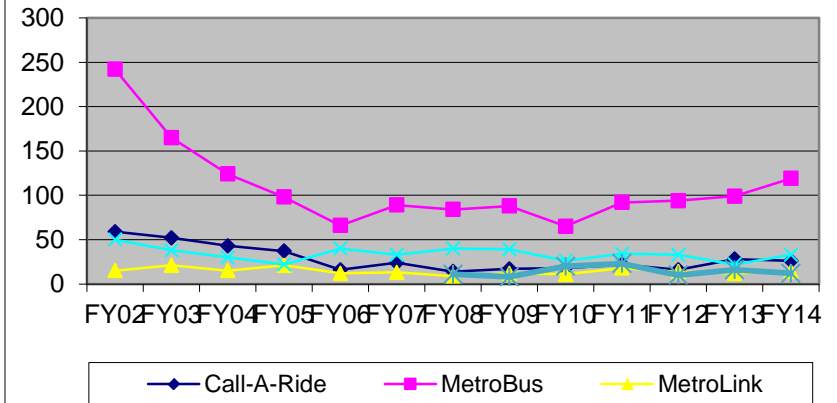


INFLUENCES OTHER SYSTEM OUTCOMES

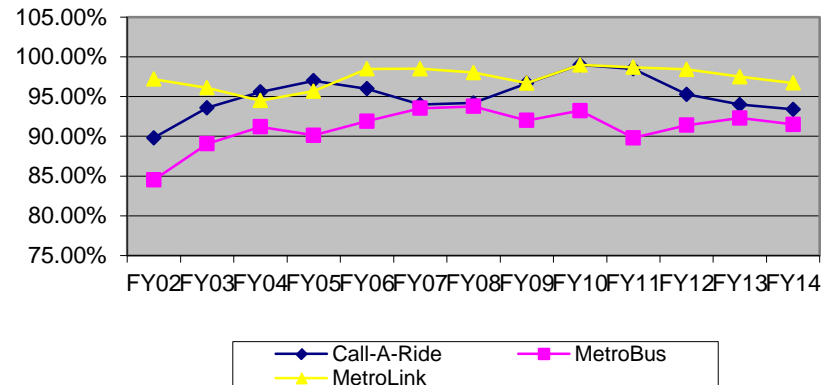
Accident Rates



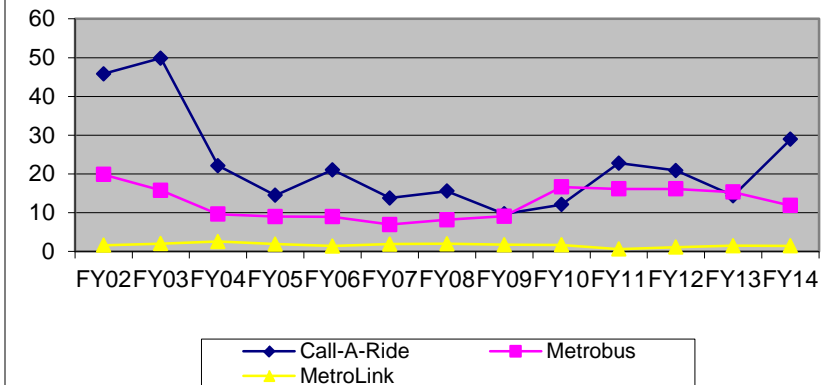
Workers Comp Claims



On Time Performance



Complaint / 100,000 Boardings



INDICATORS OF INEFFICIENT MAINTENANCE PRACTICES

- *Campaigns* or *Systems Approach*
 - The practice of moving through fleet to repair or install a single component
 - Expensive and a configuration nightmare!
- *Competitive* or *Cooperative*
 - Competition between locations fosters secrecy
- *Objective* or *Subjective*
 - Do personnel appraisal programs include objective measures both on individual (cost center), modal (division) and system levels?

