



# Evaluation of Arizona's Enhanced I/M Program

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by

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## Data and Analysis

- 3 years of IM240 data: 1995 to 1997
- 19 months of remote sensing data: Jan 1996 to Aug 1997
- Short-term: Jan 1996 to June 97
  - 412,000 vehicles with matched IM240 and remote sensing measurements
- Long-term: 1995 and 1997
  - track individual vehicles over 2 I/M cycles
  - 222,000 vehicles with initial IM240 in 1995 and 1997

## I/M Emission Reductions: MOBILE5 Compared with Arizona IM240

	Vehicles	CO	HC	NOx
MOBILE5*		16.2%	16.9%	16.7%
1995 AZ IM240 (random sample)*	7,600	16.2%	14.3%	7.6%
1996-97 AZ IM240 (all tests)	412,000	13.5%	13.0%	6.3%
1996-97 AZ IM240 (random sample)	4,000	12.4%	13.7%	7.5%

Percent of MOBILE5 emission reduction:

1995 AZ IM240 (random sample)*	100%	85%	46%
1996-97 AZ IM240 (all tests)	83%	77%	38%
1996-97 AZ IM240 (random sample)	77%	81%	45%

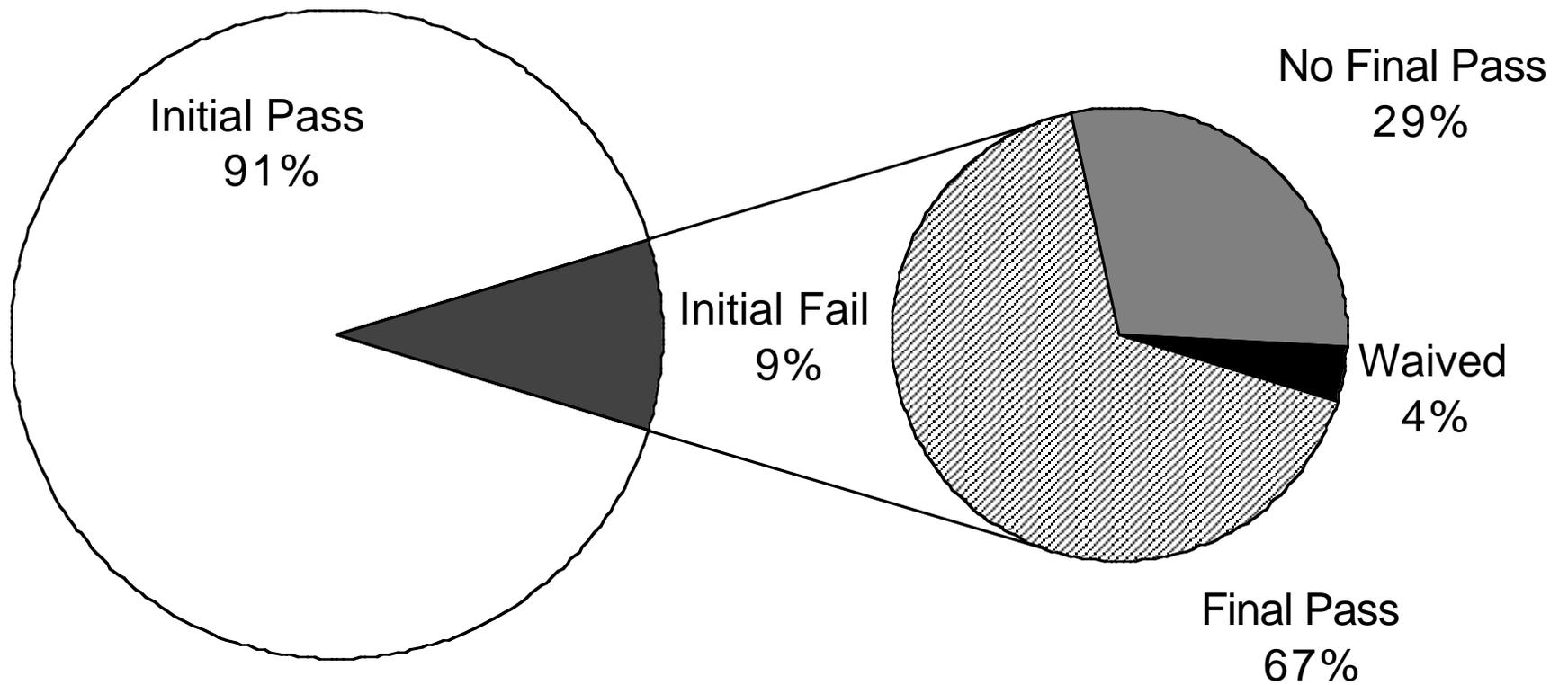
\* Analysis of the Arizona IM240 Test Program and Comparison with the TECH5 Model, Glover and Brzezinski, May 1997.

## Analyzed 3 Groups of Vehicles, Based on I/M Results

- “Initial Pass”
- “Final Pass”
  - includes vehicles that passed retest without any repairs
- “No Final Pass”
  - includes vehicles with no retest
  - includes vehicles that failed subsequent retest
  - includes waived vehicles (unidentified; roughly 4% of failed vehicles)

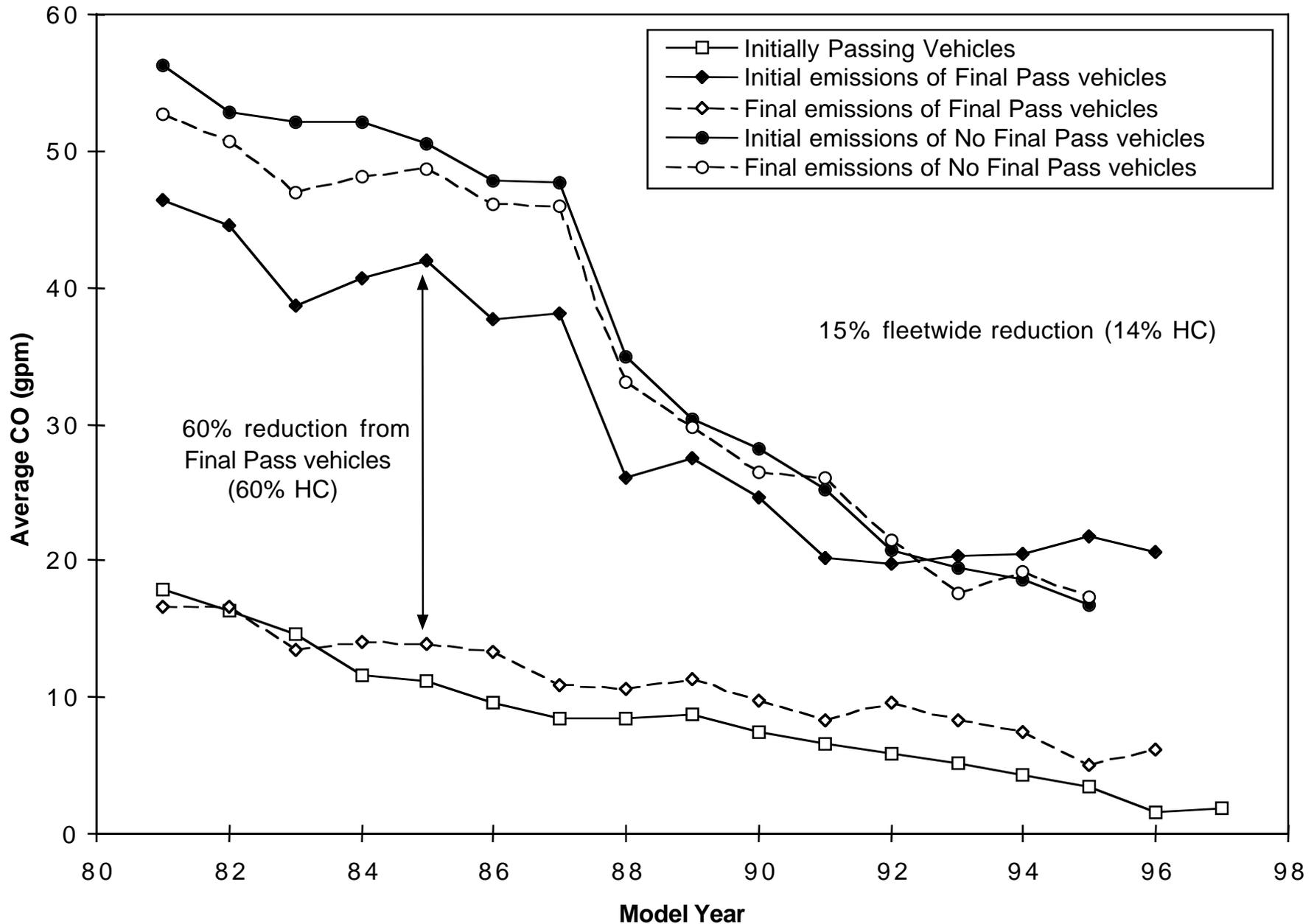
# Distribution of Cars by I/M Test Result

*1996-97 Arizona IM240*



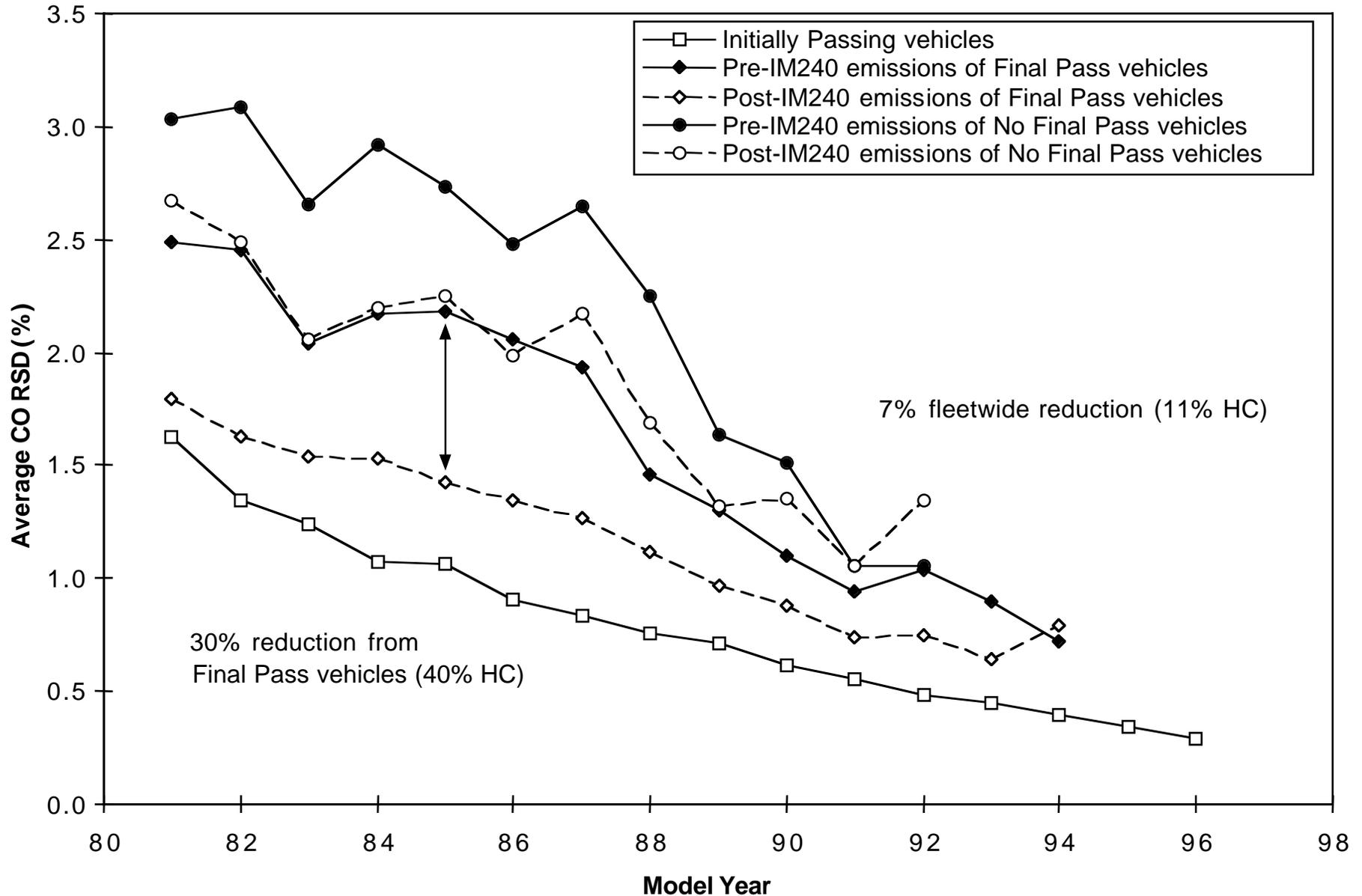
# Average CO gpm by MY and I/M Result

## 1996-97 Arizona IM240



# Average RSD CO by MY and I/M Result

*Up to 90 days before and after I/M test, 1996-97 Arizona Remote Sensing*



## Two Factors May Explain the Discrepancy between IM240 and RSD Results

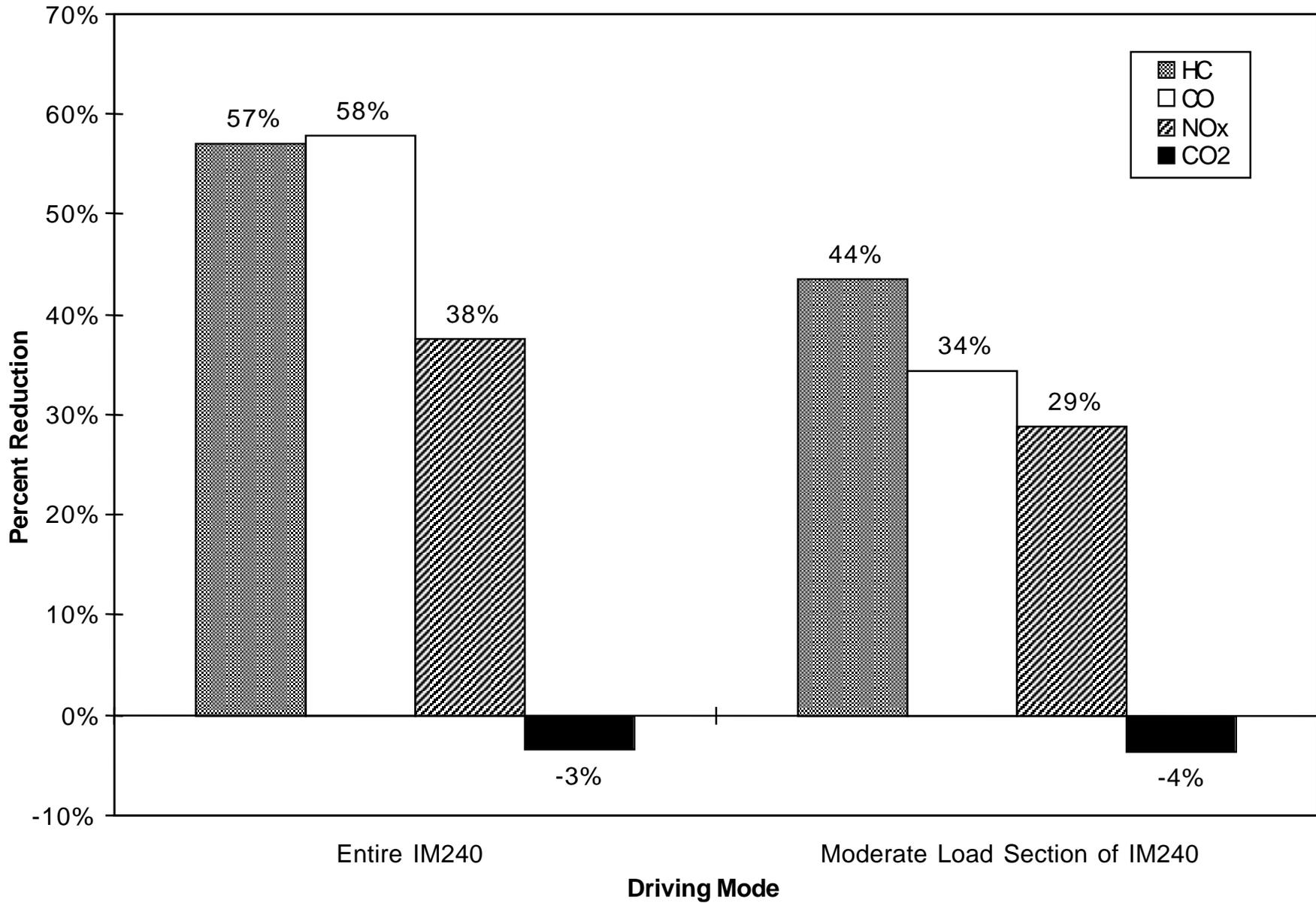
- Repair effectiveness (percent change in emissions) is sensitive to driving mode
- Emissions reductions depend on when post-repair emissions are measured

## Discrepancy between IM240 and RSD Results Explained in Part by Vehicle Operation

- Emissions are sensitive to vehicle driving mode; is repair effectiveness as well? Distribution of RSD modes likely different than IM240 distribution
- Analyzed second-by-second data on 1,000 vehicles with full IM240 tests before and after repair
- Divided IM240 trace into modes of distinct vehicle operation, including the moderately loaded portion of the IM240

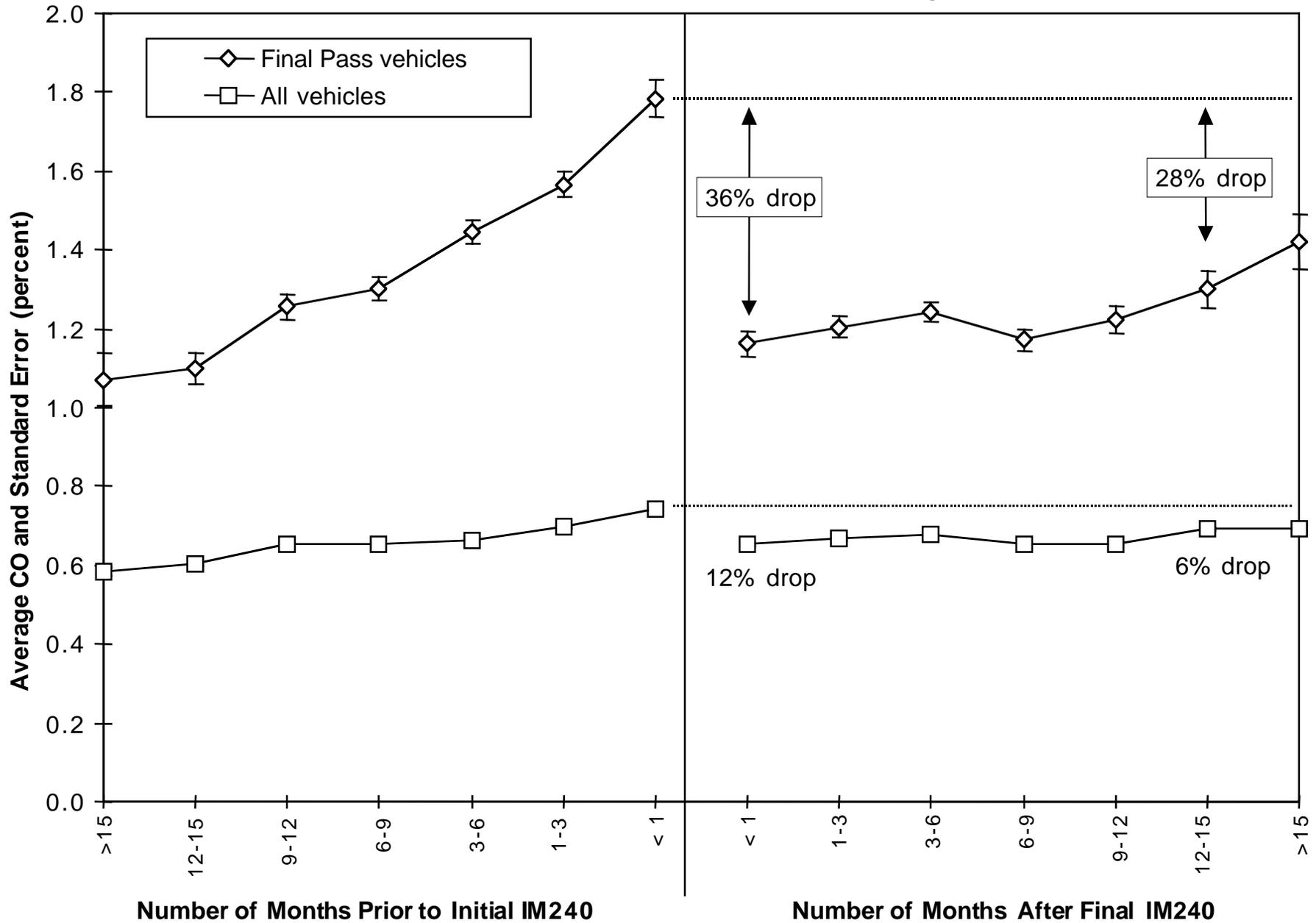
# Emission Reductions Due to IM240 Repairs

1080 Vehicles, 1996 Arizona IM240



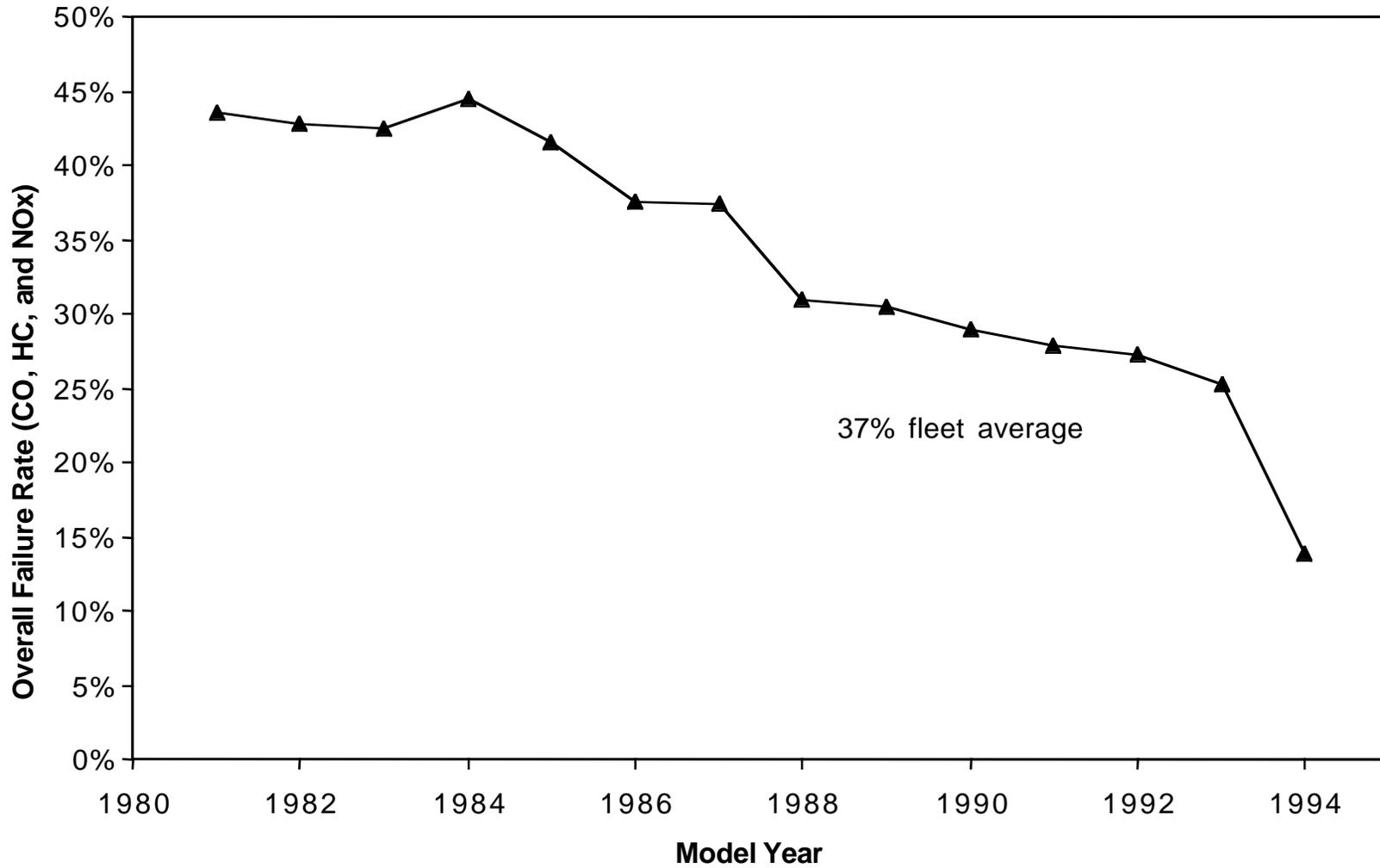
# Average CO RSD Emissions by Time Period

## 1996-97 Arizona Remote Sensing



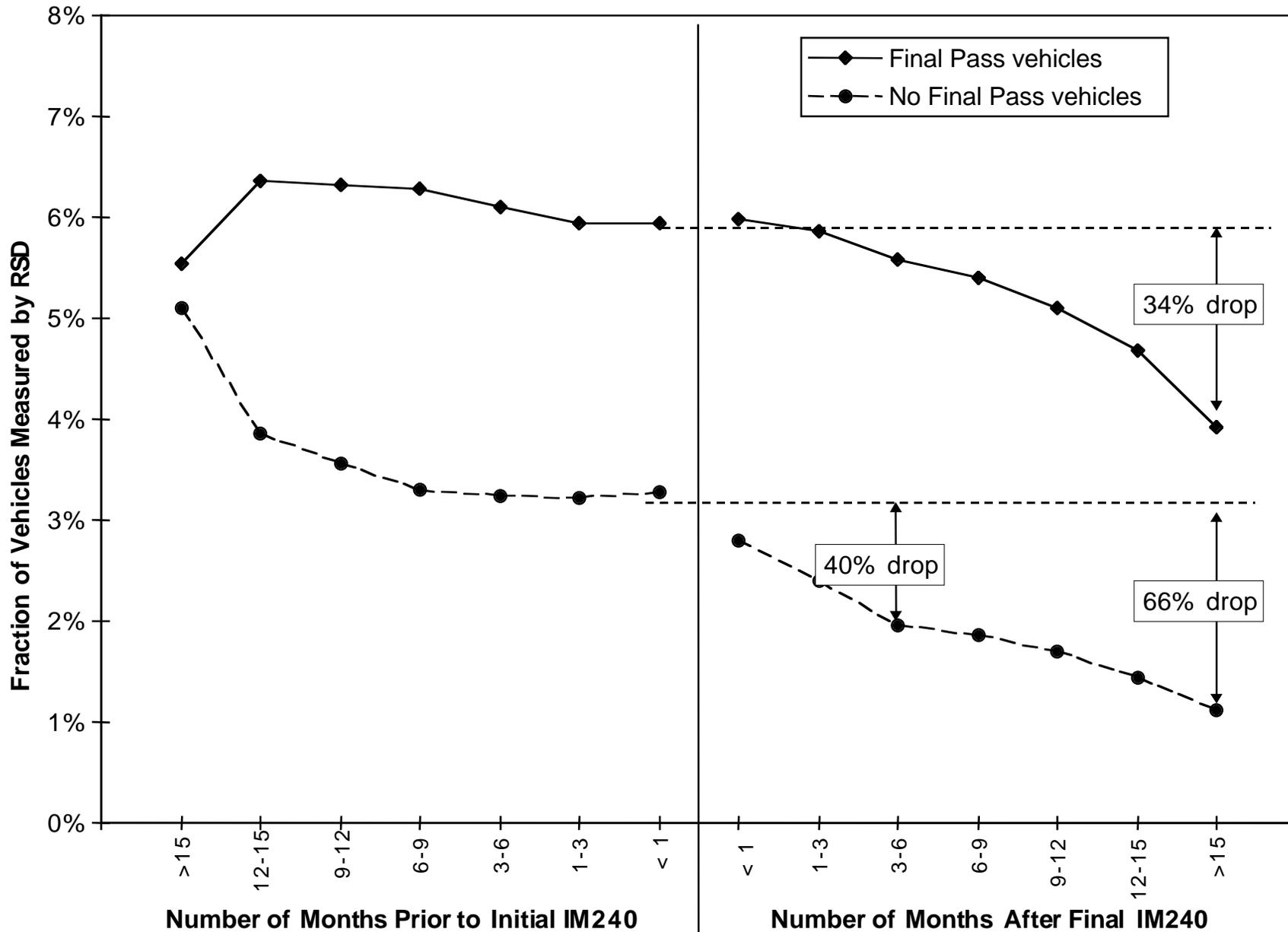
# 1997 Initial Failure Rate by Model Year

*1995 Final Pass Vehicles, 1995 and 1997 Arizona IM240*



# Remote Sensing Fleet by I/M Result and Time Period

## 1996-97 Arizona Remote Sensing



## Summary

- MOBILE5 slightly overpredicts initial reductions in CO and HC, and dramatically overpredicts initial reductions in NOx.
- About one-third of the vehicles that fail initial I/M testing do not complete the I/M program. Only a small portion of these receive a waiver.
- Initial I/M repair effectiveness as measured by remote sensing is only half of that as measured by IM240. Possible causes are sensitivity to operating mode, and how long after repair emissions are measured.
- 37% of the vehicles that initially fail and eventually pass in 1995 fail again in 1997. Half of these fail for the same combination of pollutants in both years.
- Vehicles that never pass the IM240 are still being driven in the I/M area; these vehicles are from all model years.

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