INSPECTION AND MAINTENANCE
AS ESTIMATED BY THE EMFAC EMISSIONS INVENTORY MODEL

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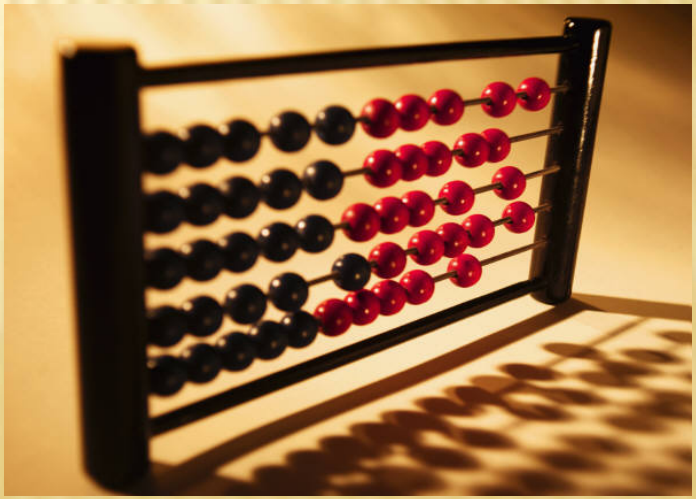
SCAQMD SMOG CHECK TECHNOLOGY FOURM and ROUNDTABLE DISCUSSION

CALIFORNIA'S EMISSION FACTOR MODEL

- EMFAC has been used for almost 30 years
- Major Revisions in 1980s and 2000
- Model is Data Driven (Empirical)
- Analyses are Quantized



HISTORY OF CALIMFAC

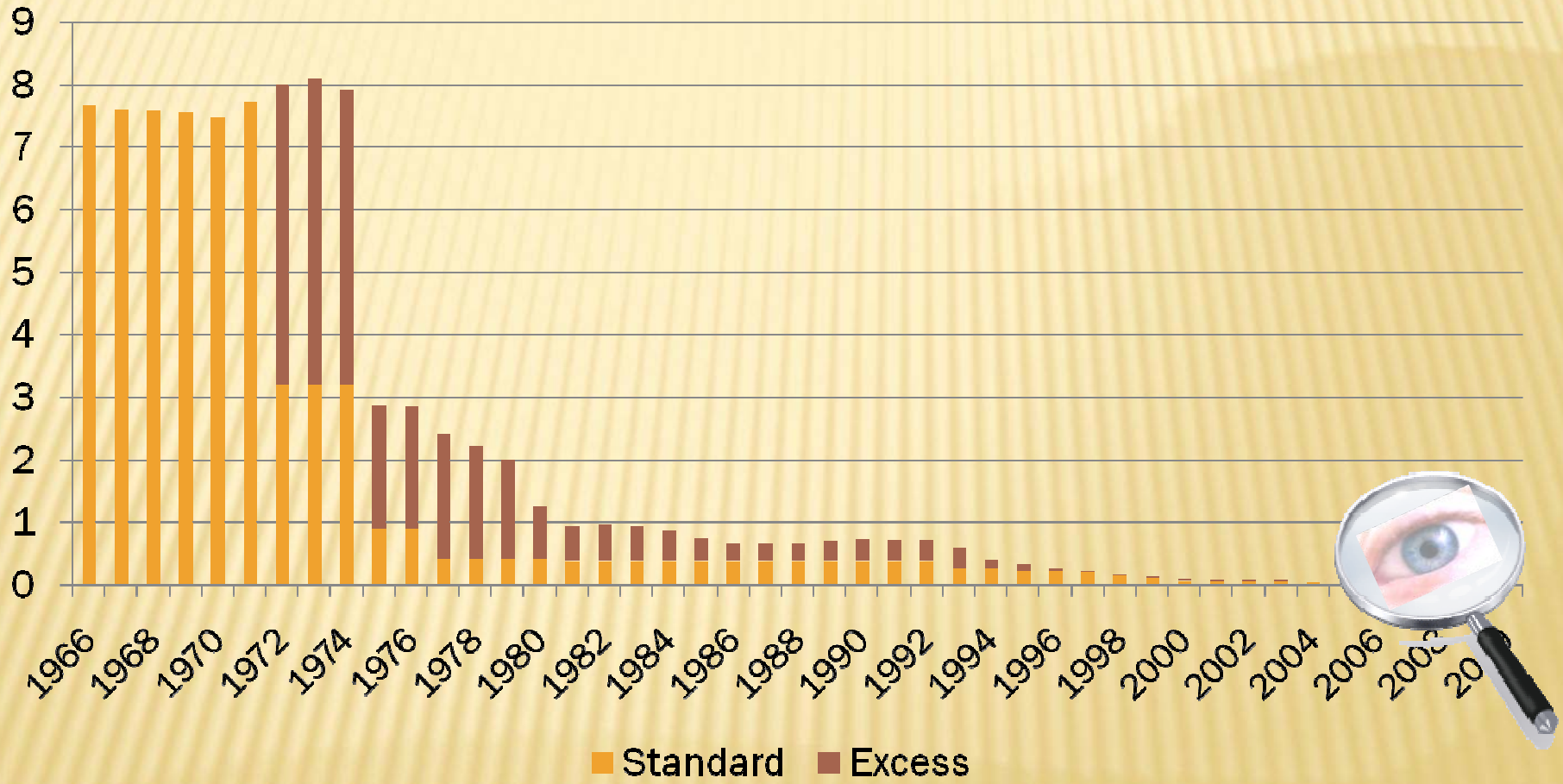
- Developed in the 1980s as a Tool for Assessing the Relative Benefits of Different I/M Options.
- Borrowed Heavily from US EPA's Tech IV Model but used California Specific Data
- Major Revision in the 1990s to Reflect New Progra[illegible]lements

BASIC INVENTORY CALCULATION

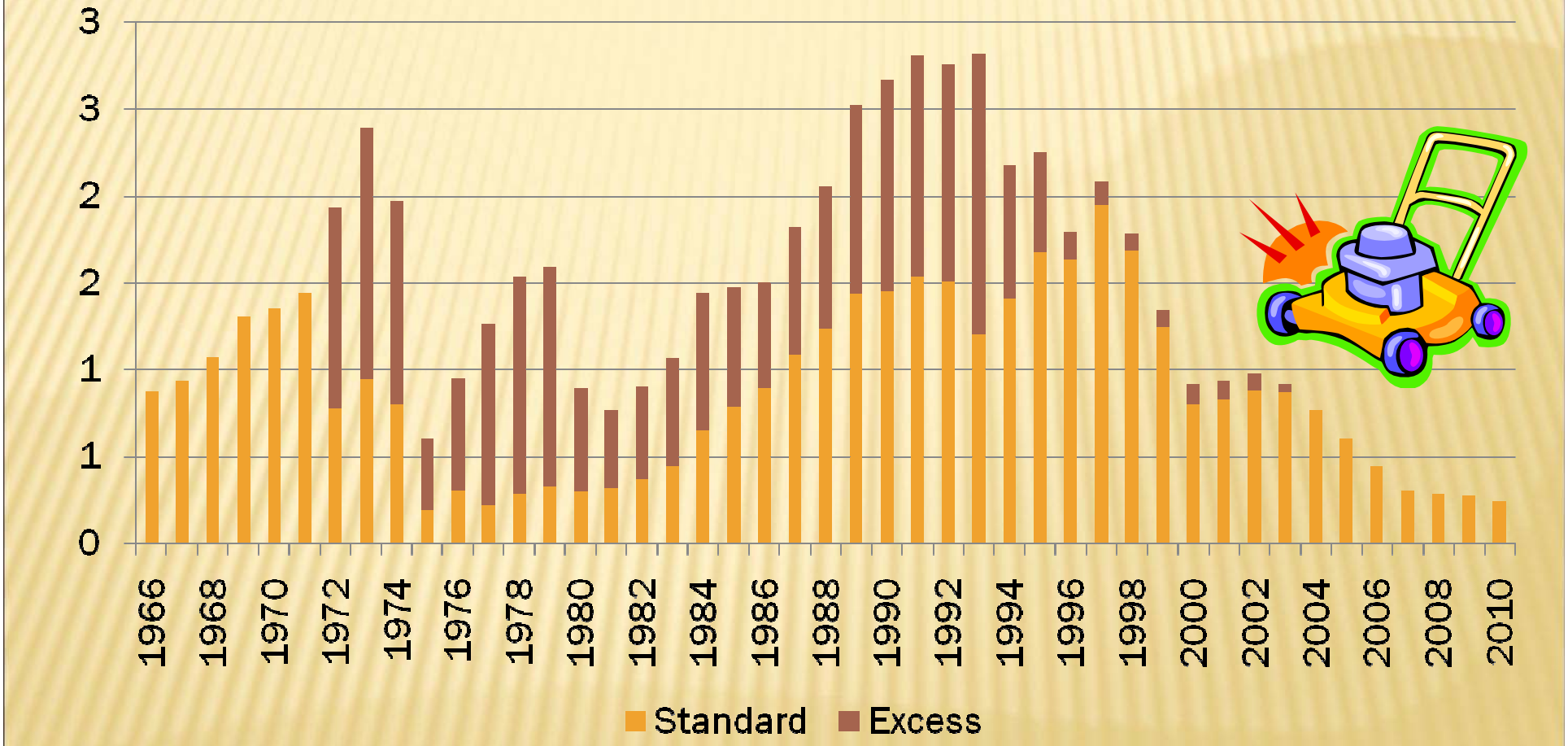
- **Tons per Day = Emissions * Population * Activity * Correction Factor(s)**

- **Emissions** - From Vehicle Testing
- **Population** - From DMV
- **Activity**
  - **Mileage Accrual** - From BAR
  - **Speed** - From COGs and MPOs
  - **VMT** - From COGs and MPOs
- **Corrections** - Speed/Temp/Fuel/Humidity/Altitude/(I/M)

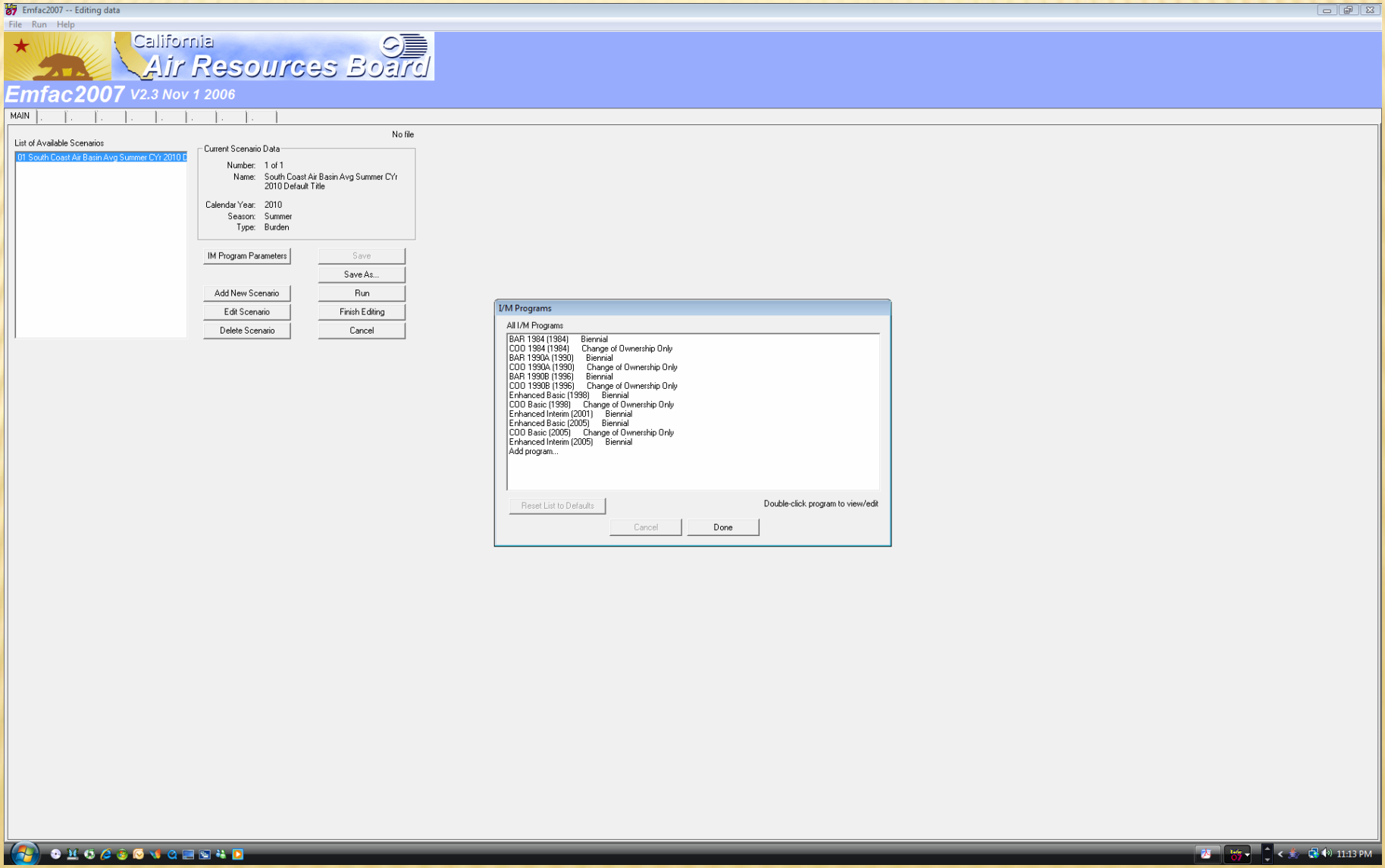
HYDROCARBON EMISSIONS (GRAMS/MILE)



HYDROCARBON EMISSIONS (TONS/DAY)



EMFAC 2007 I/M SCREENSHOT



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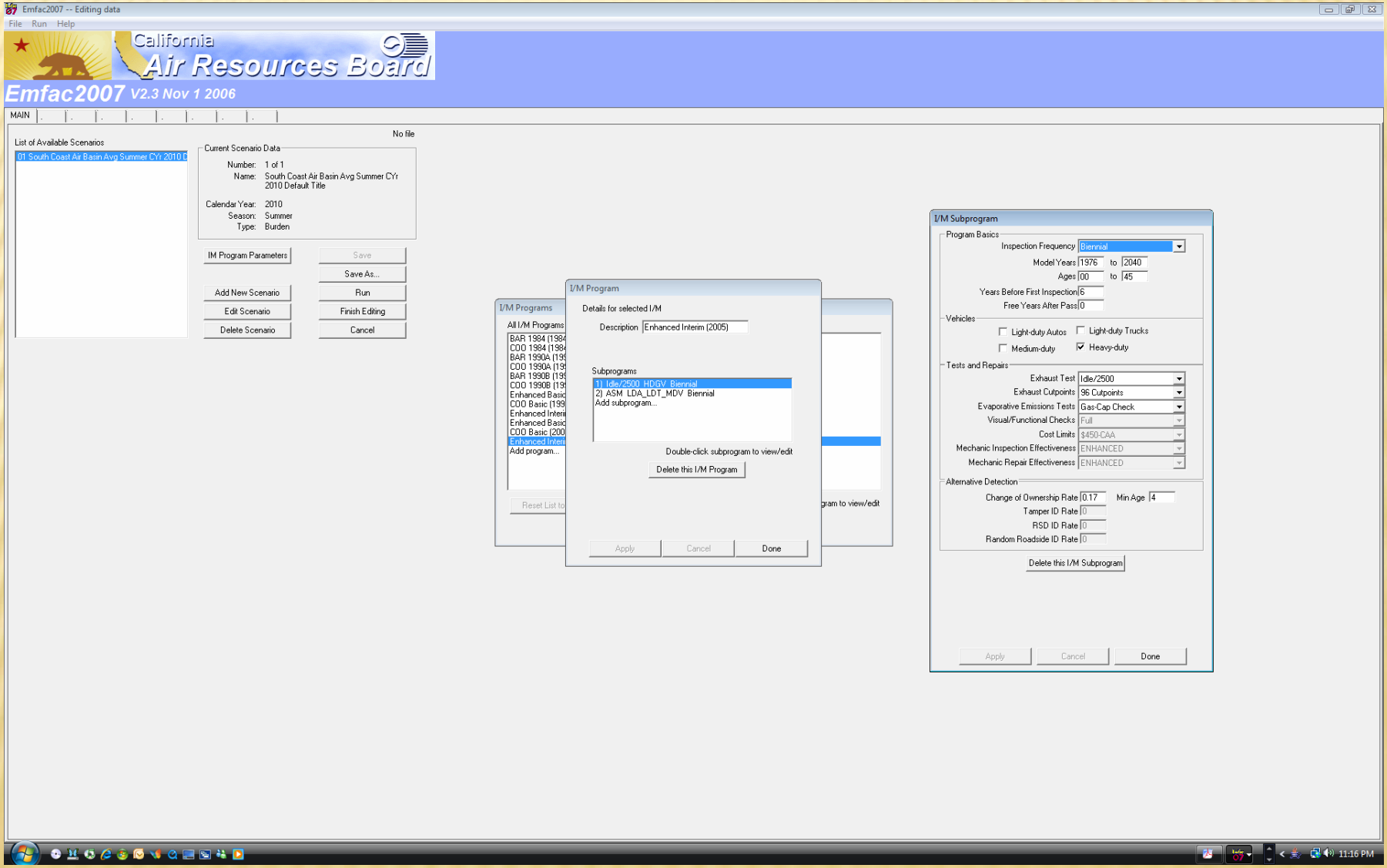
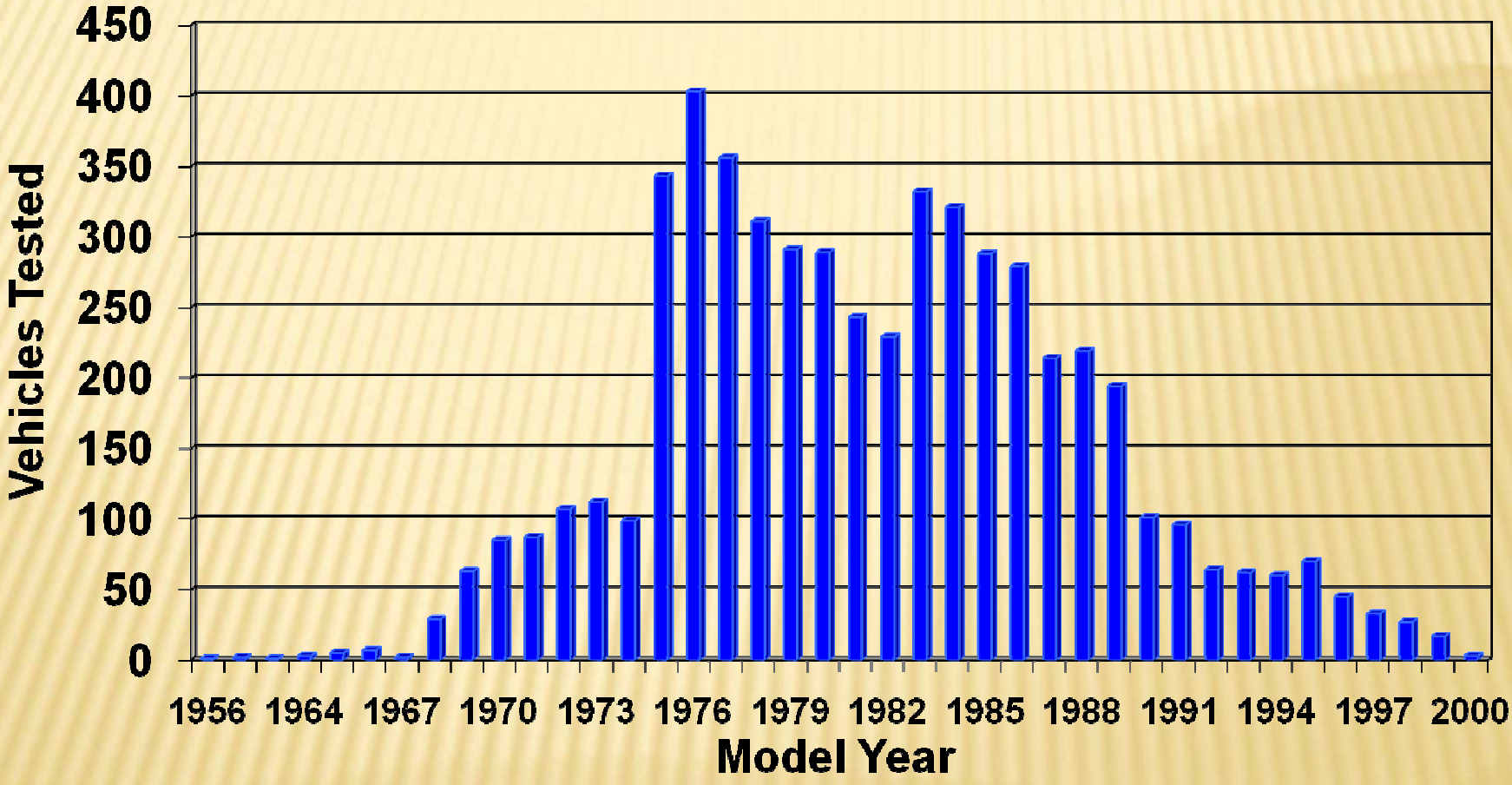


MODEL YEAR DISTRIBUTION

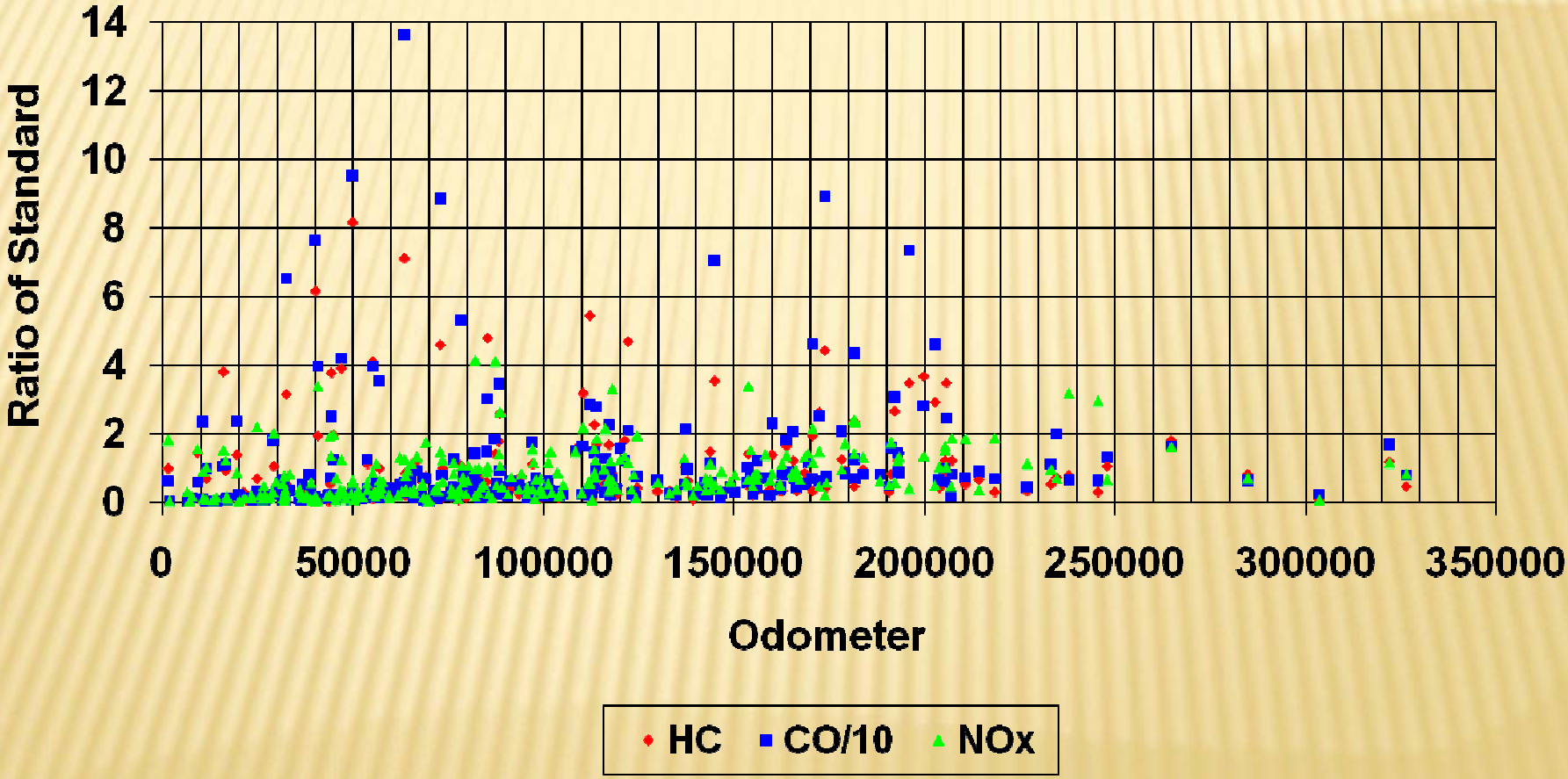
(ARB'S LIGHT-DUTY SURVEILLANCE DATABASE)



VEHICLE SURVEILLANCE PROGRAM

Project	Vehicles	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98	0
1	183																				
2	432																				
3	385																				
4	350																				
5	339																				
6	310																				
7	338																				
8	299																				
9	699																				
10	250																				
11	490																				
12	250																				
13	345																				
14	330																				
15	251																				
16	251																				

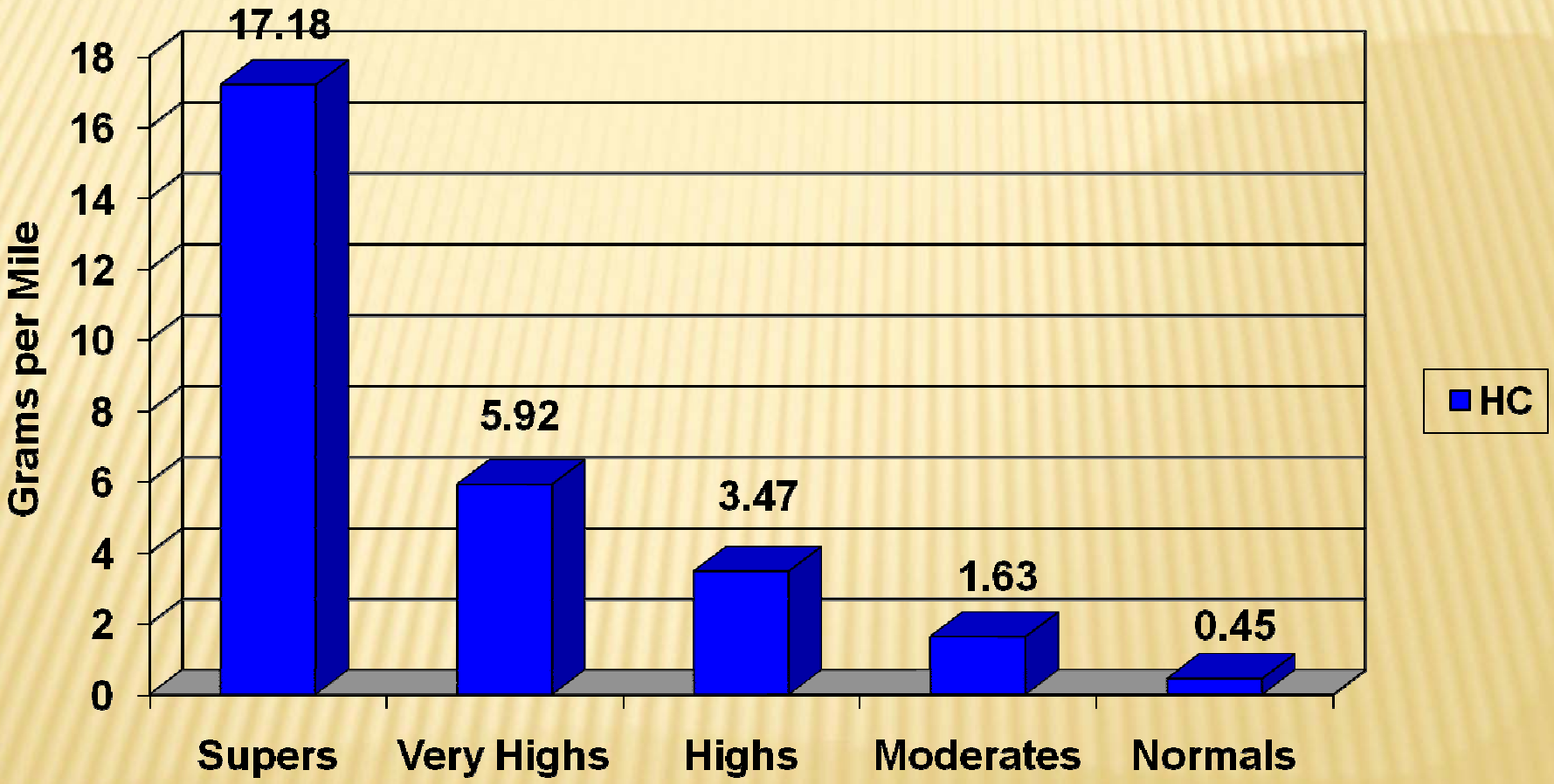
EMISSIONS AS A FUNCTION OF MILEAGE



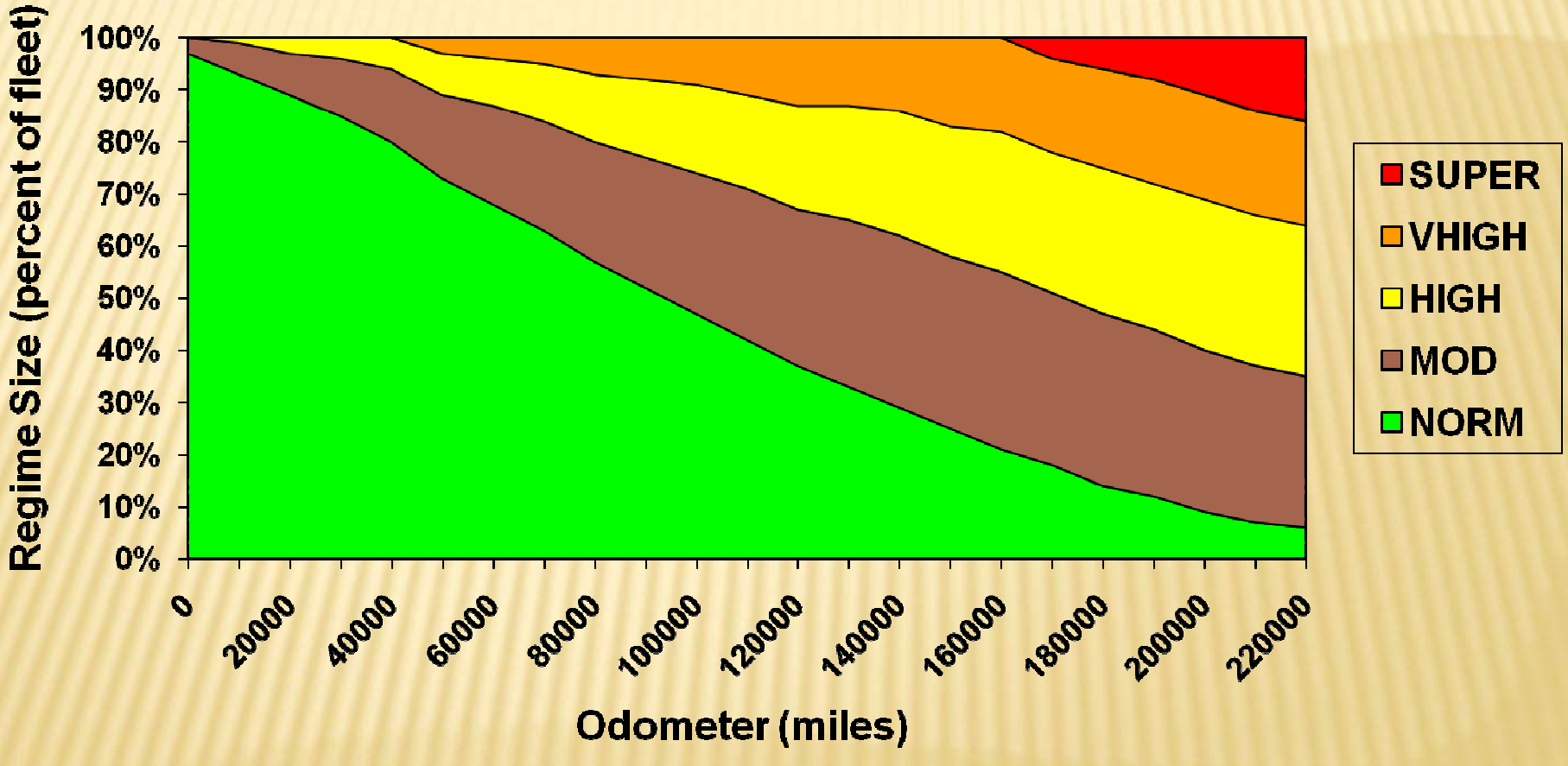
EMISSION REGIMES
(MULTIPLES OF THE STANDARD)

Regime	HC	CO	NOx
Super	>9	>10	>4
Very High	< or = 9	< or = 10	< or = 4
High	< or = 5	< or = 6	< or = 3
Moderate	< or = 2	< or = 2	< or = 2
Normal	< or = 1	< = 1	< = 1

REGIME SPECIFIC EMISSION RATE



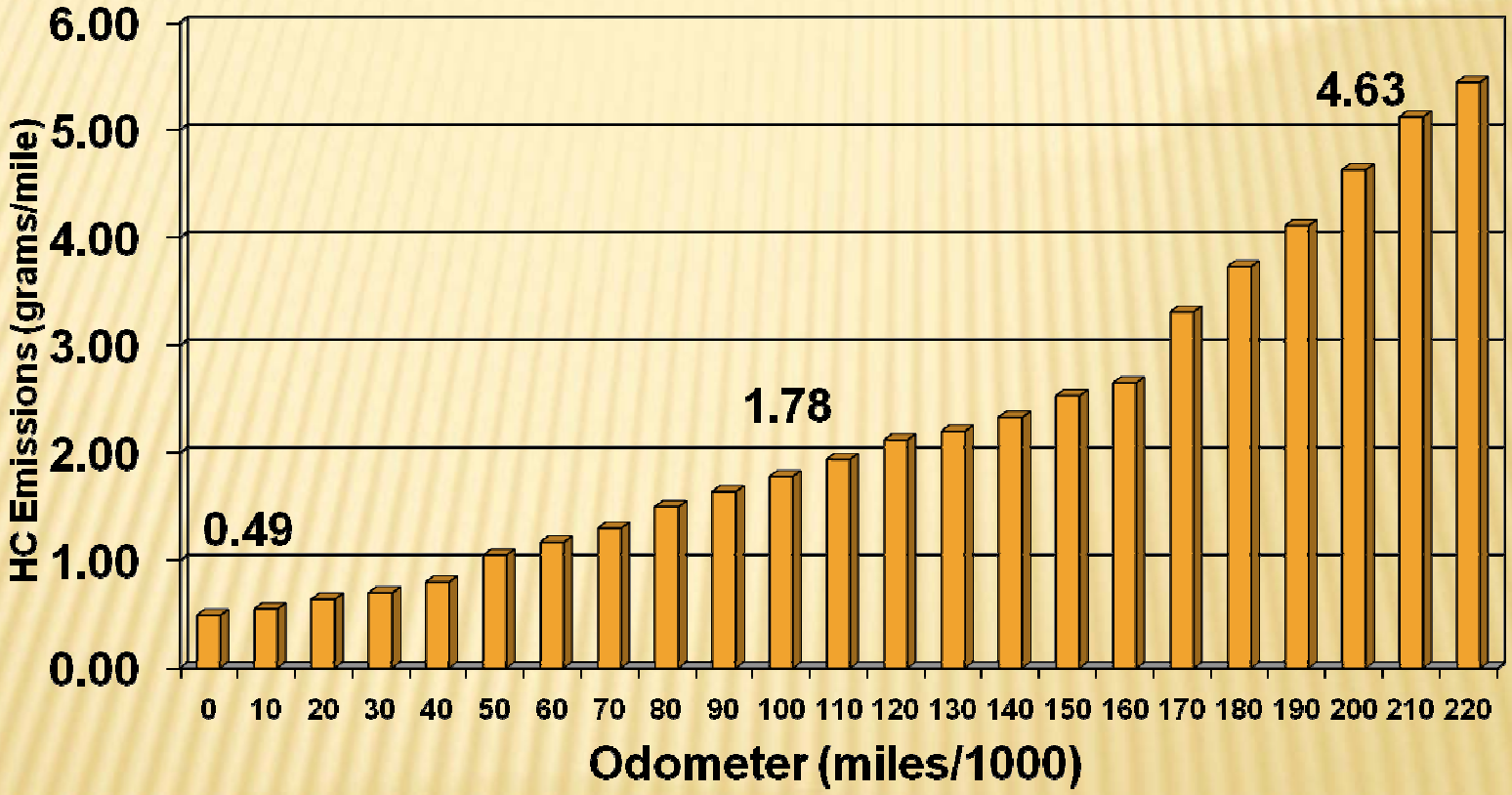
REGIME GROWTH FUNCTION



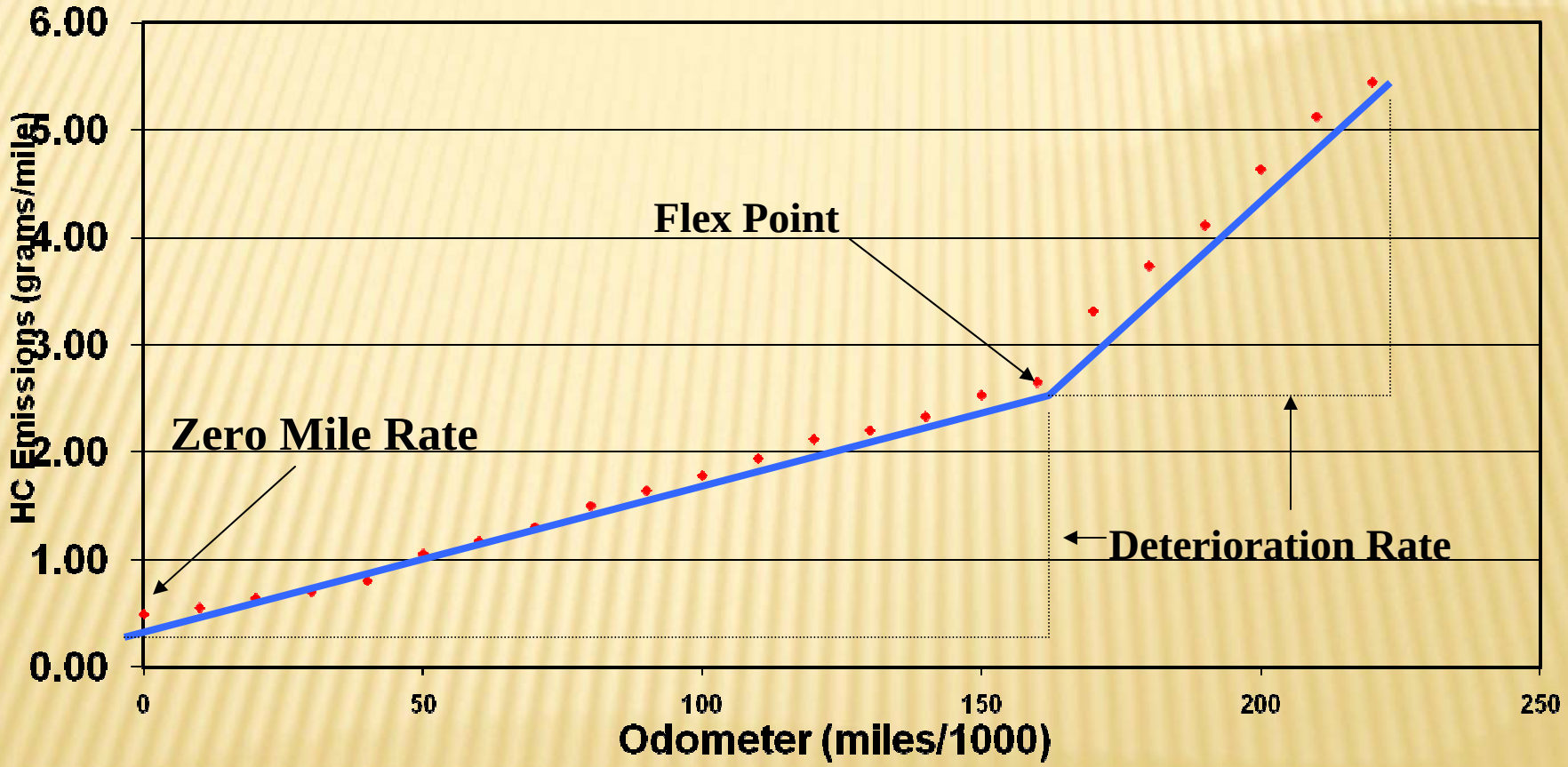
EMISSIONS CALCULATION
(EXHAUST HYDROCARBONS)

	Norm	Mod	High	V-High	Super
Emissions (gms/mi)	0.45	1.63	3.47	5.92	17.18
Regime (% of fleet)	47%	27%	17%	9%	0%
@100,000 miles	(.47*.45+.27*1.63+.17*3.47+.09*5.92+0*17.18) = **1.78**				
Emissions (gms/mi)	0.45	1.63	3.47	5.92	17.18
Regime (% of fleet)	9%	31%	29%	20%	11%
@200,000 miles	(.09*.45+.31*1.63+.29*3.47+.2*5.92+.11*17.18) = **4.63**				

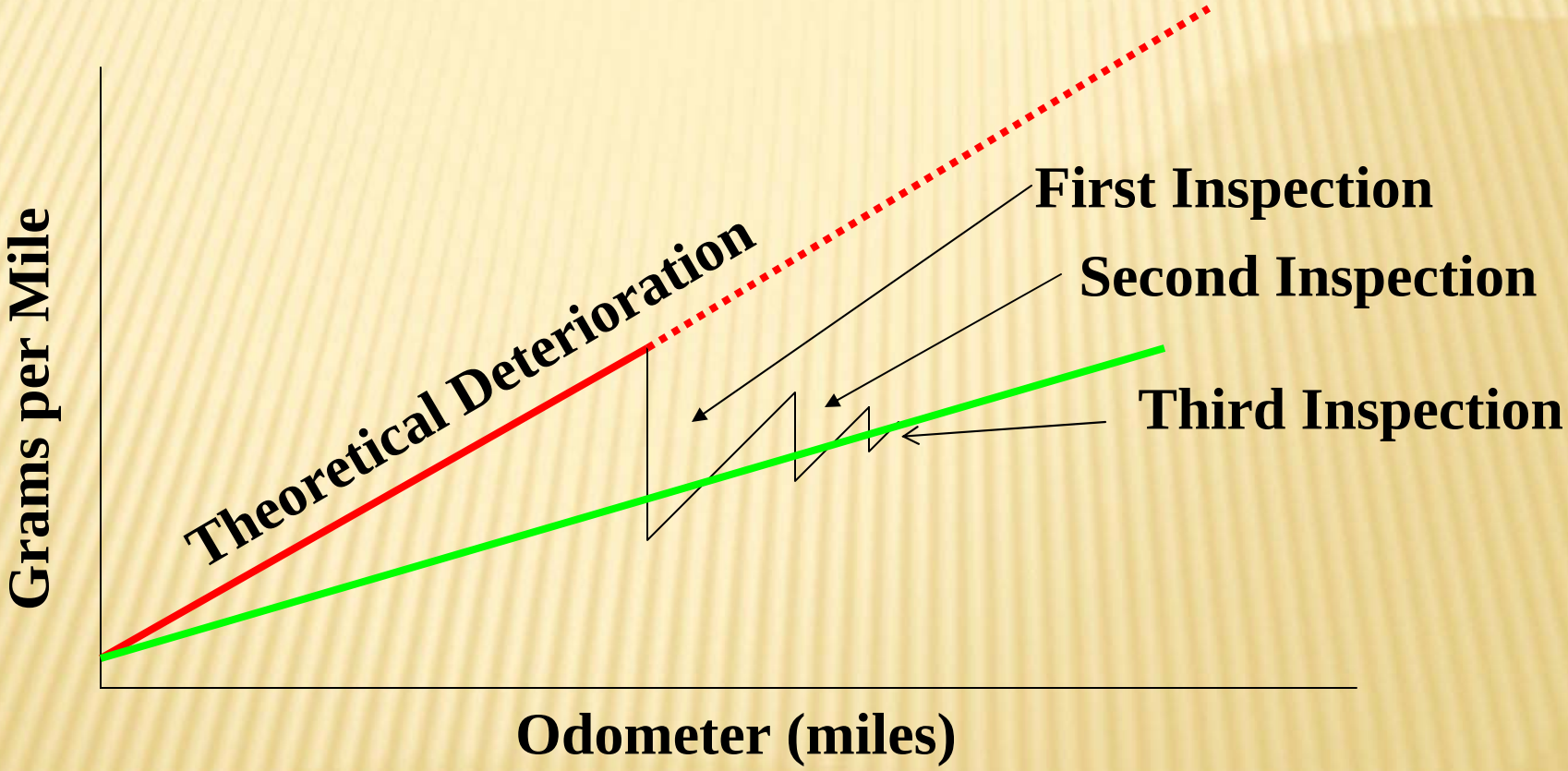
HYDROCARBON EMISSION FACTOR



HYDROCARBON EMISSION FACTOR
(ILLUSTRATION)

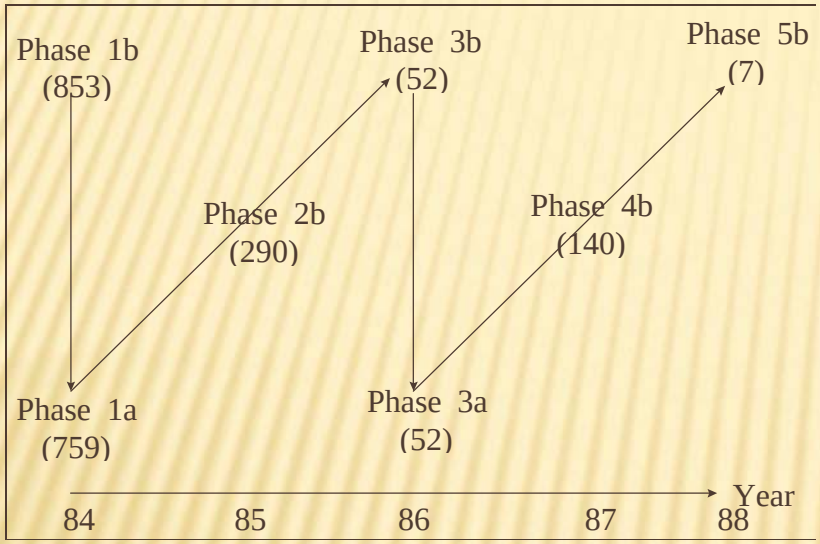


I/M SAWTOOTH

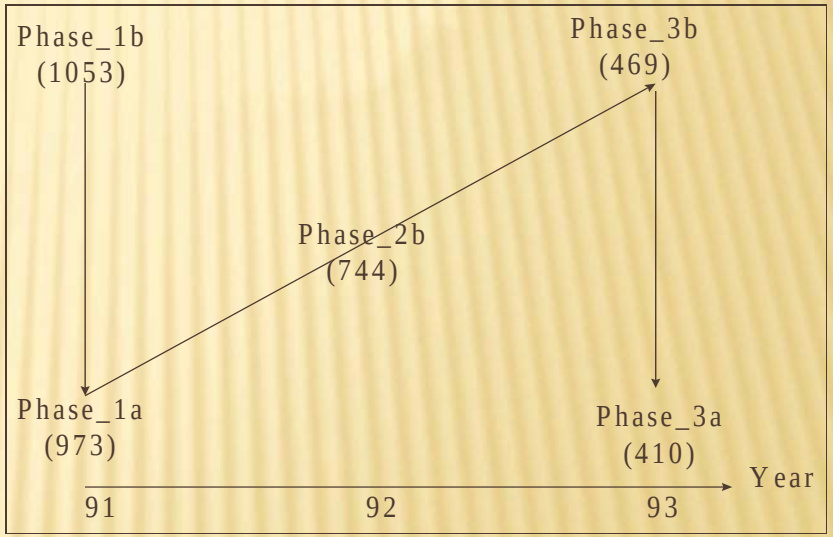

Grams per Mile
Theoretical Deterioration
First Inspection
Second Inspection
Third Inspection
Odometer (miles)

I/M EVALUATION DATA

1984 Program



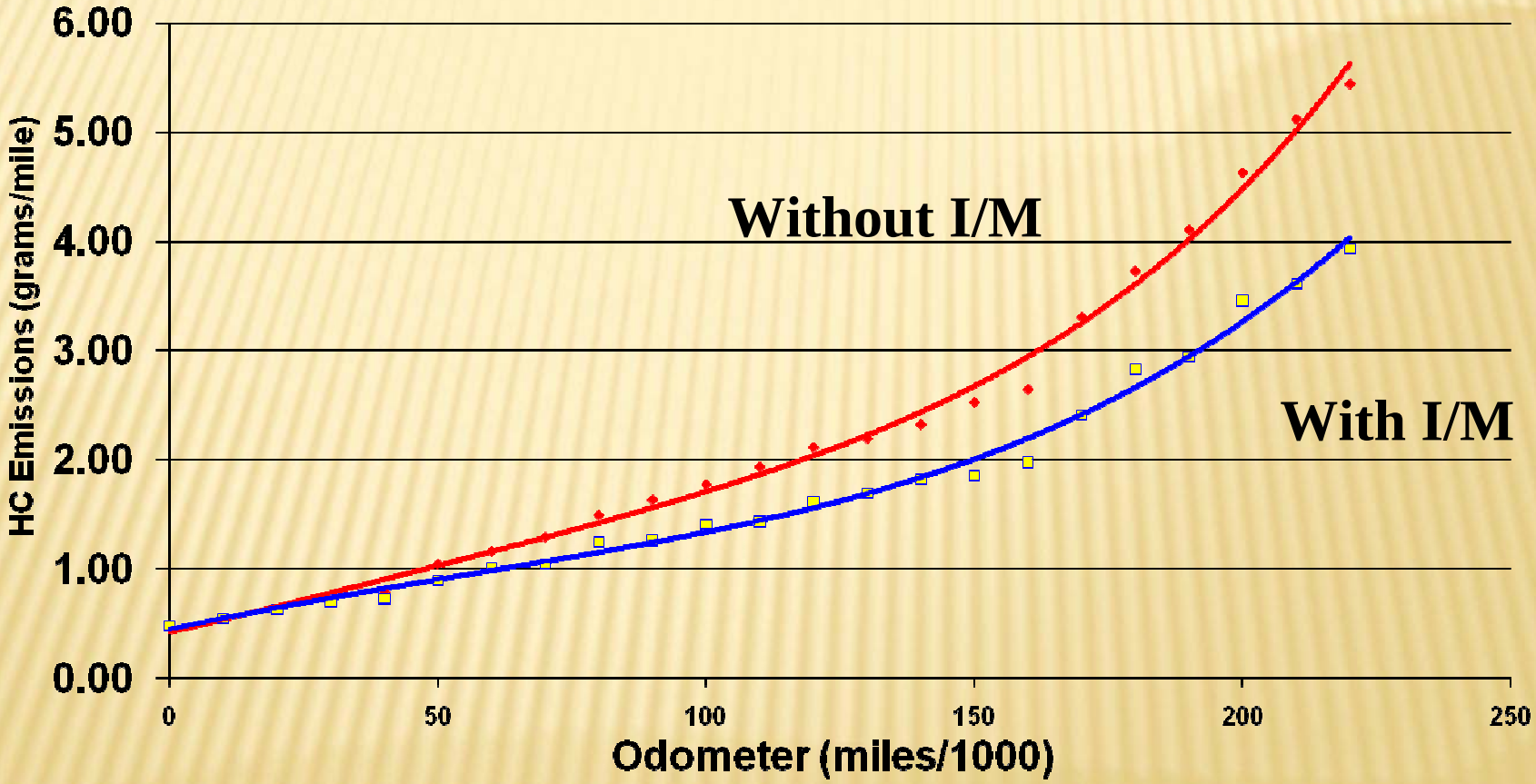
1990 Program



Enhanced Program

- ID rates based on 600+ vehicles

HYDROCARBON EMISSION BENEFIT
(ILLUSTRATION)



I/M BENEFIT CALCULATION

2.2% Reduction	Norm	Mod	High	V-High	Super
Emissions	0.45	1.63	3.47	5.92	17.18
Regime	47%	27%	17%	9%	0%
Before I/M	(.47*.45+.27*1.63+.17*3.47+.09*5.92+0*.1718) = **1.78**				
Emissions	0.45	1.63	3.47	5.92	17.18
Regime	48%	27%	16%	9%	0%
After I/M	(.48*.45+.27*1.63+.16*3.47+.09*5.92+0*.1718) = **1.74**				

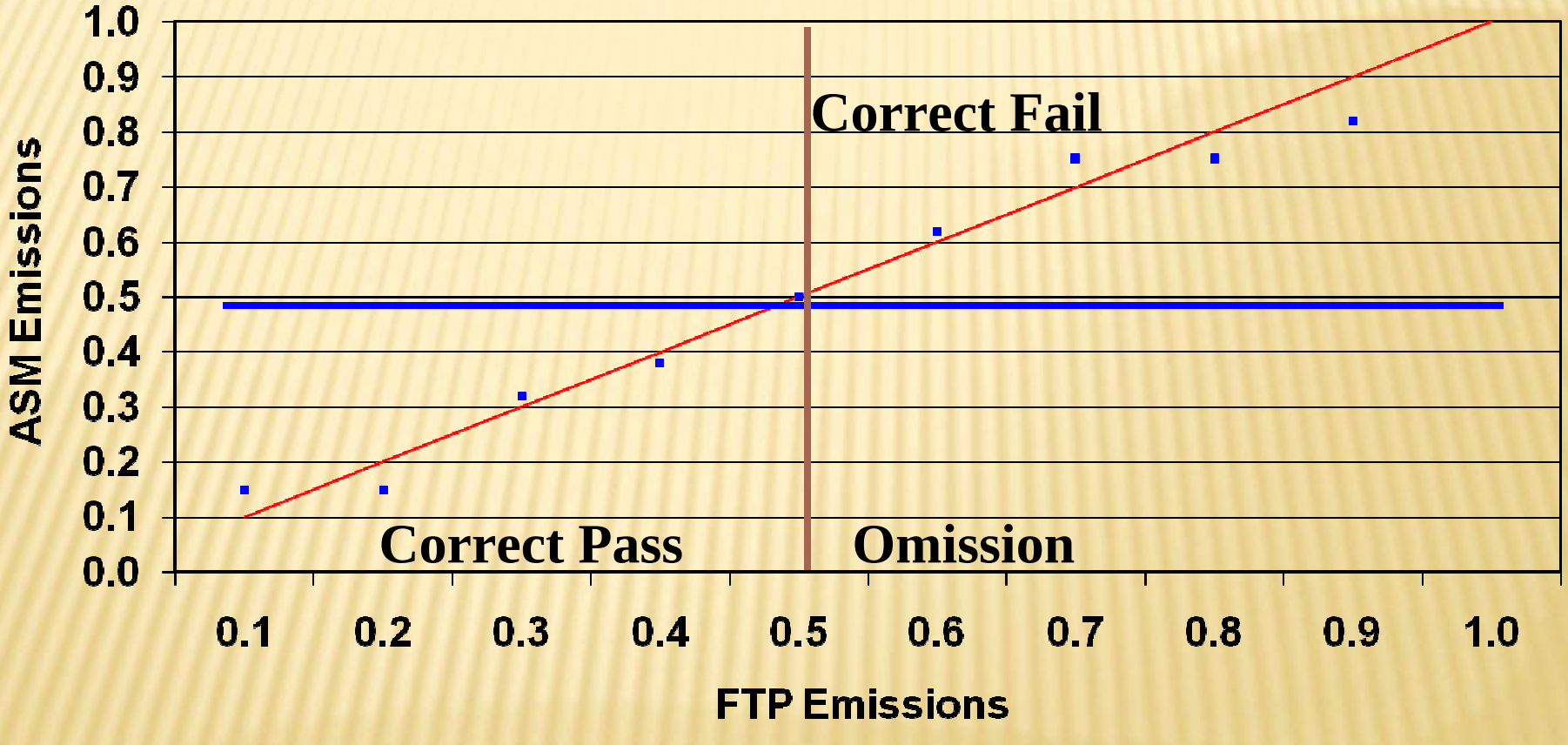
ESTIMATING I/M BENEFITS

	Initial Test				Post Repair Regime				
ER	100K	ID	Pass	Fail	**N**	**M**	**H**	**VH**	**S**
S	0	82%	0	0	0%	0%	13%	58%	29%
VH	9	66%	3	6	2%	4%	21%	67%	6%
H	17	69%	5	12	4%	7%	75%	13%	1%
M	27	39%	16	11	4%	87%	9%	0%	0%
N	47	3%	46	1	85%	15%	0%	0%	0%
Total	100		70	30					

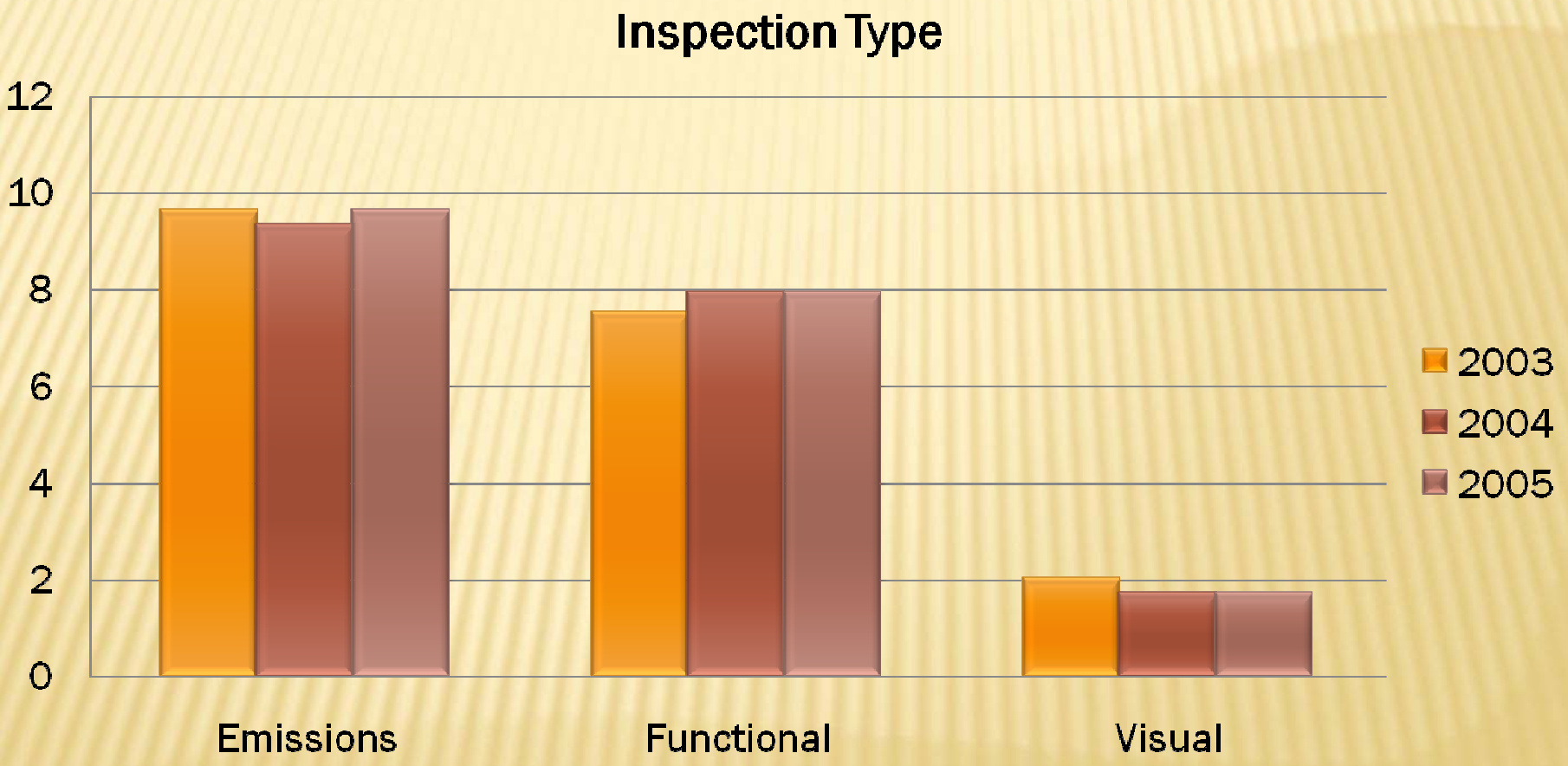
FACTORS IMPACTING I/M BENEFITS

- Probability of Failing
  - Function of Cut points/Test Type/Technology /Mileage
- Probability of Detection
  - Emissions vs. Visual/Functional/Technology(OBD)/Station Type*
- Probability of Proper Repair
  - Mechanic Efficiency
  - Repair Cost Limit
  - Station Type*

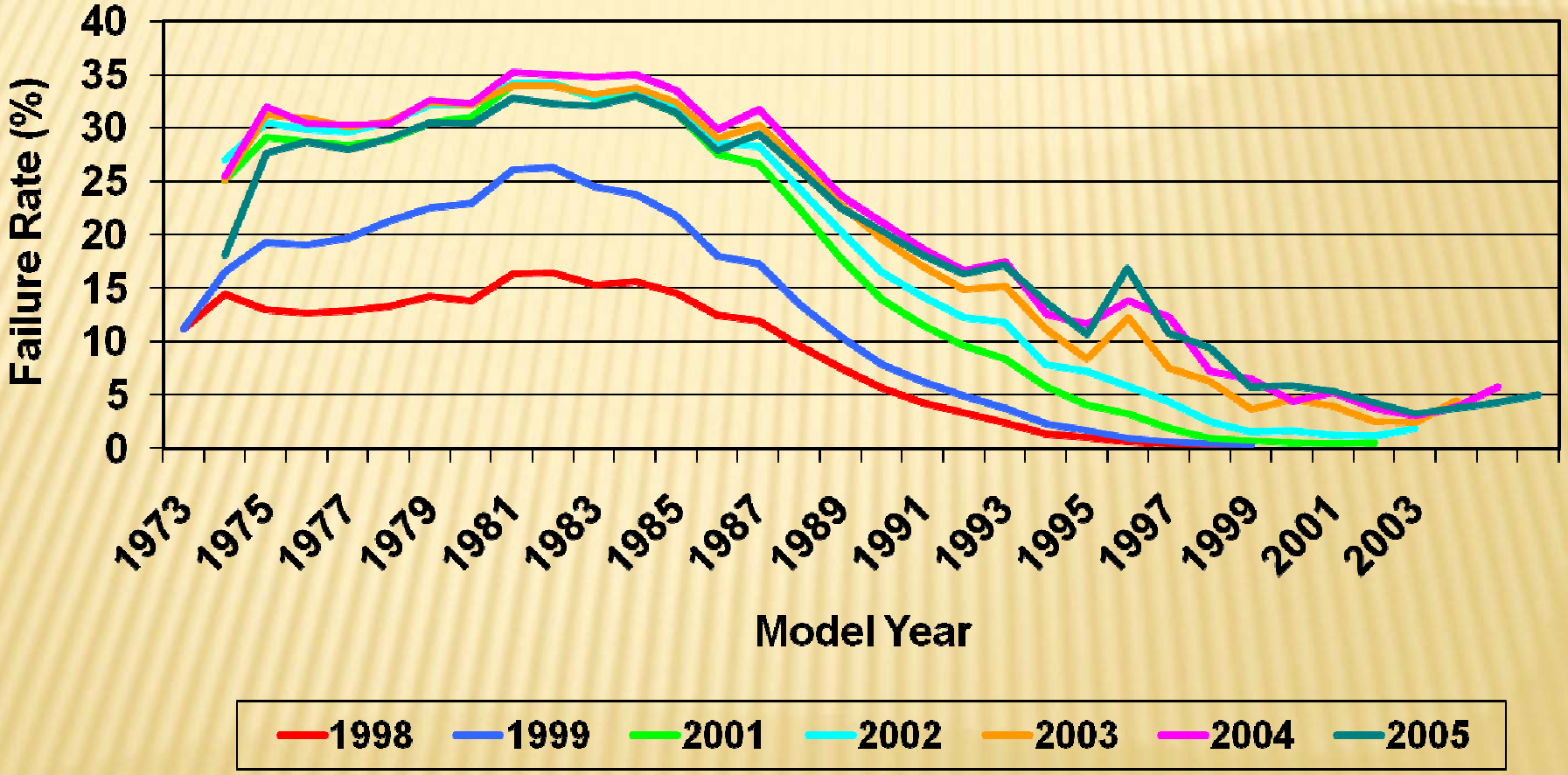
ASM CUTPOINT ANALYSIS



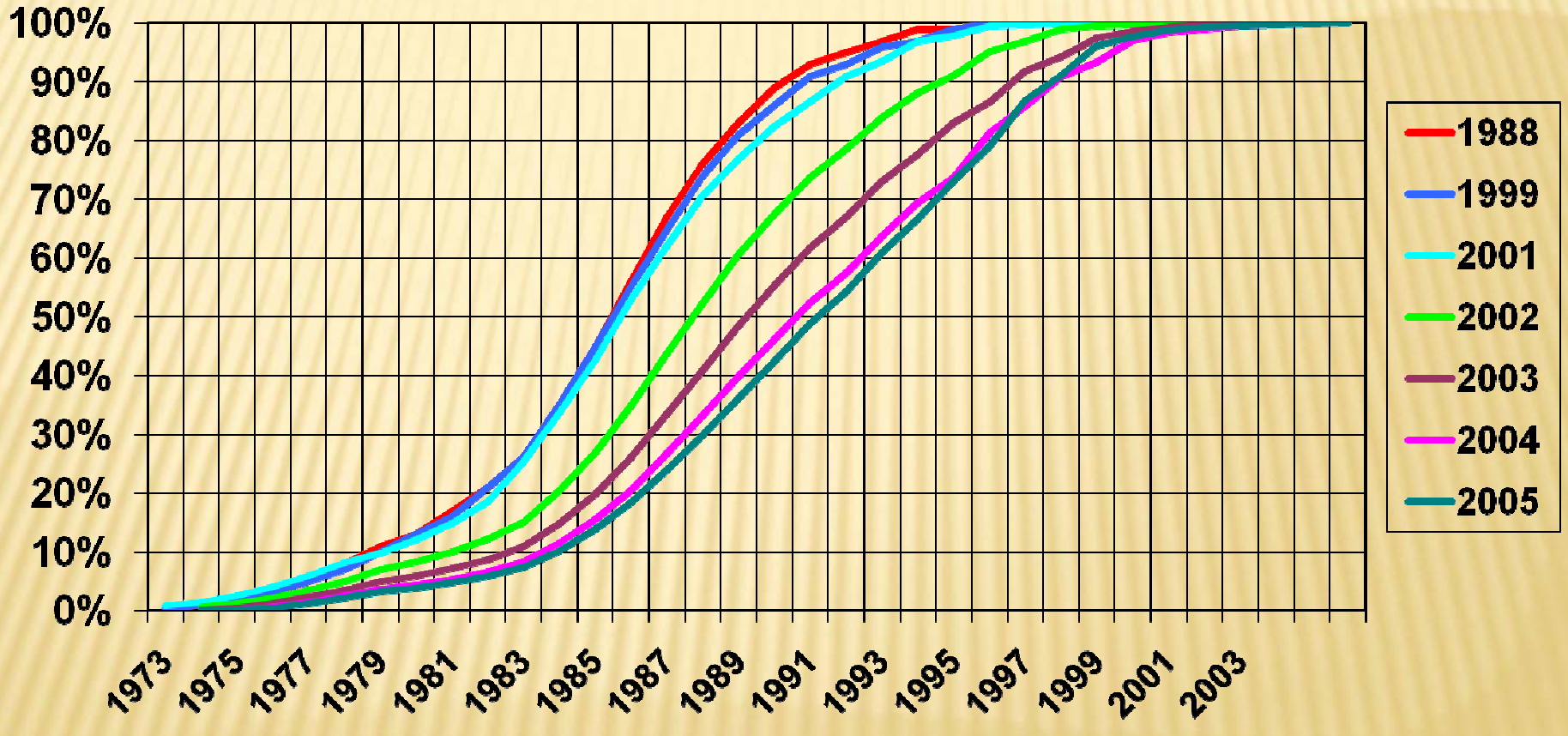
COMPARATIVE FAILURE RATES



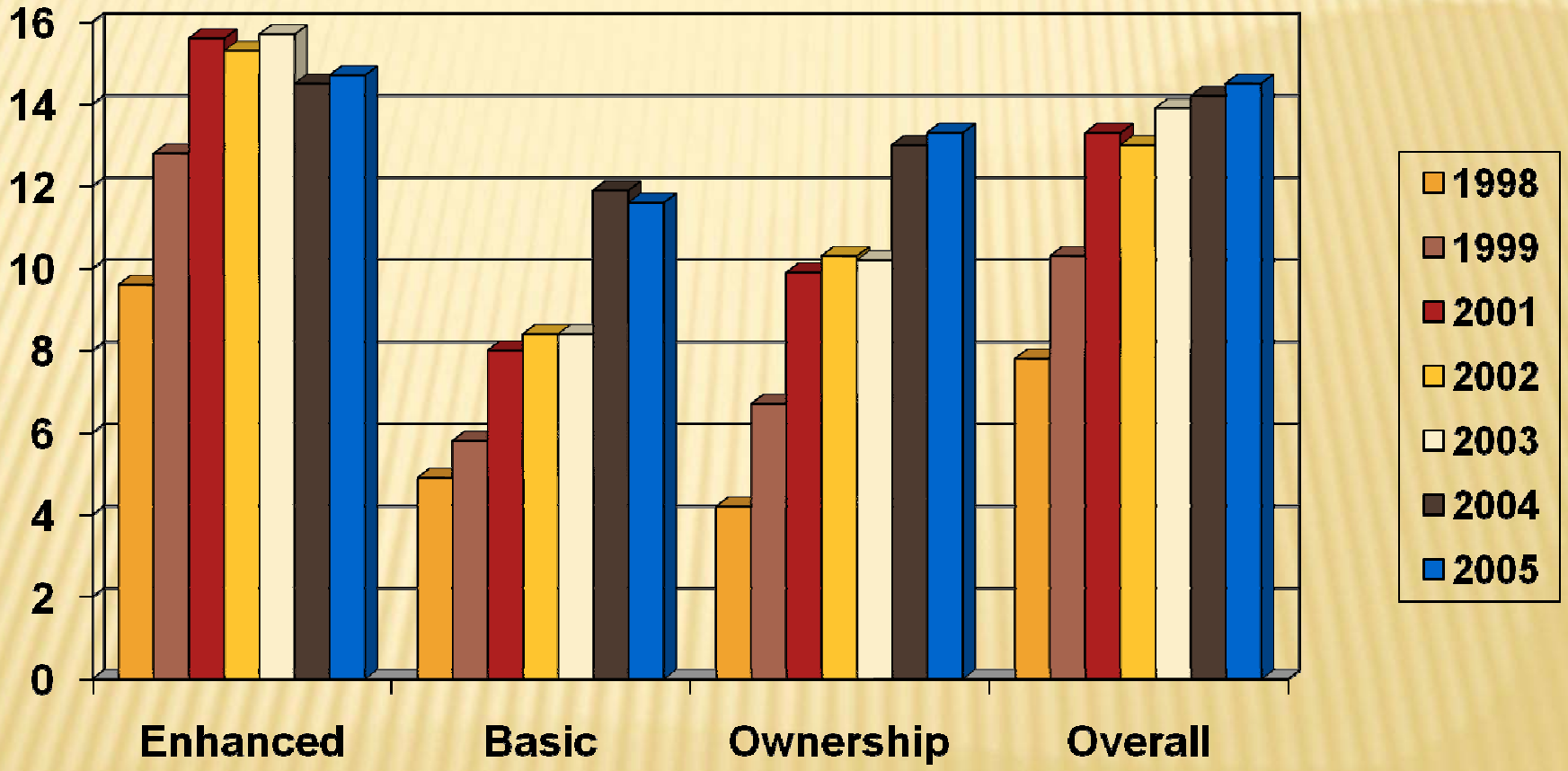
ANALYSIS OF BAR DATA
FAILURE RATE BY MODEL YEAR



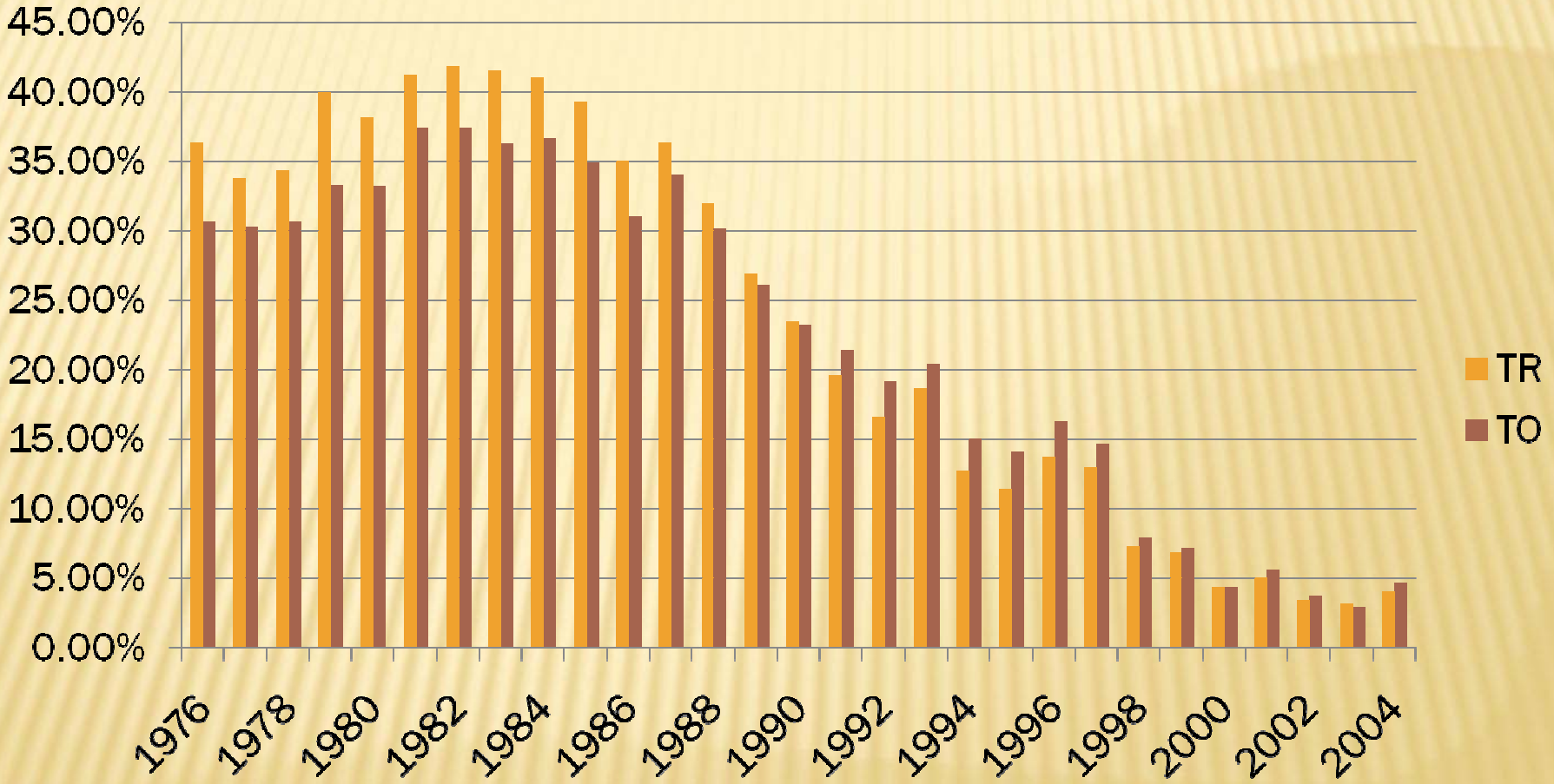
CUMULATIVE FAILURE RATE



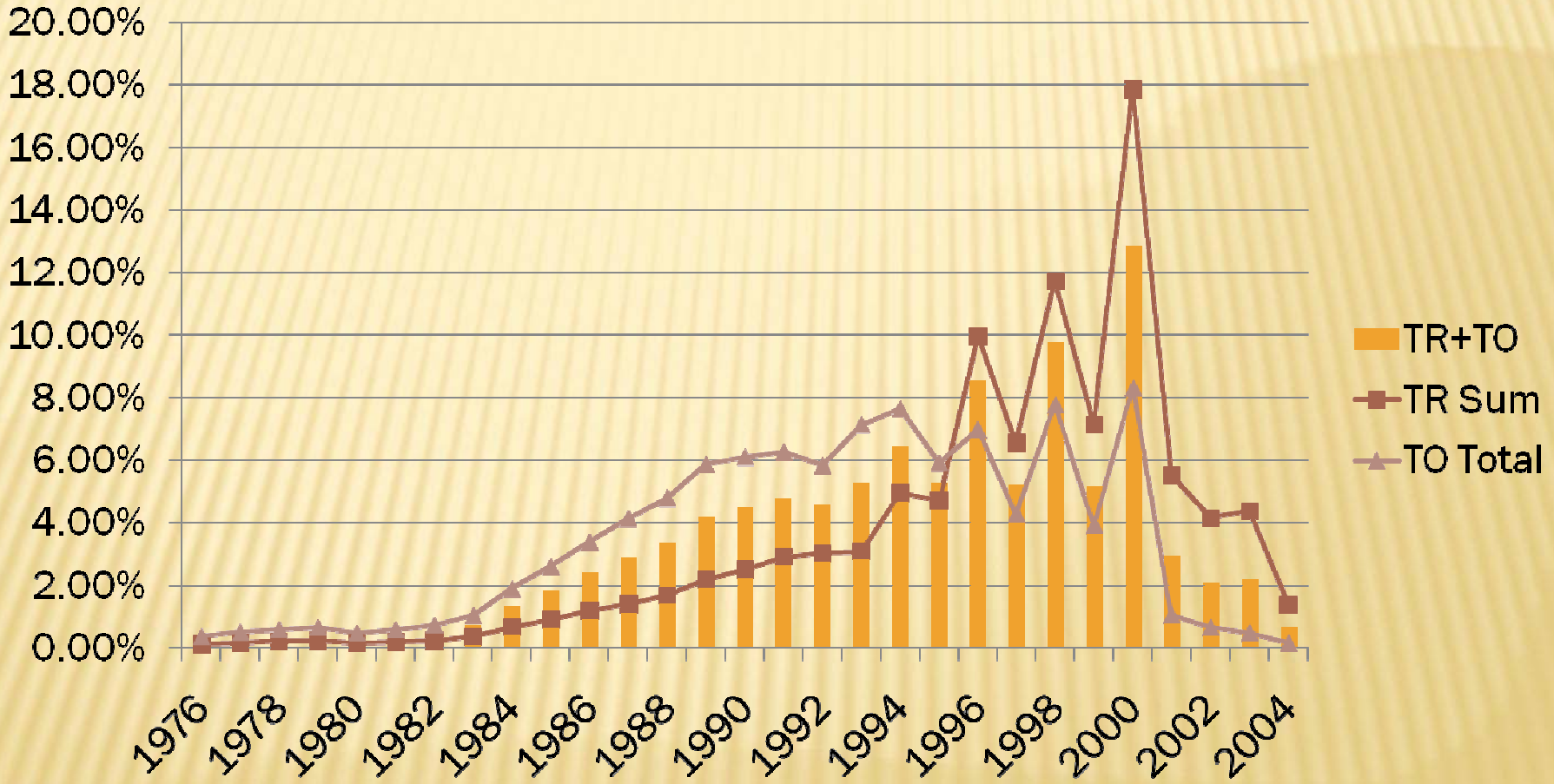
I/M FAILURE RATE BY PROGRAM TYPE



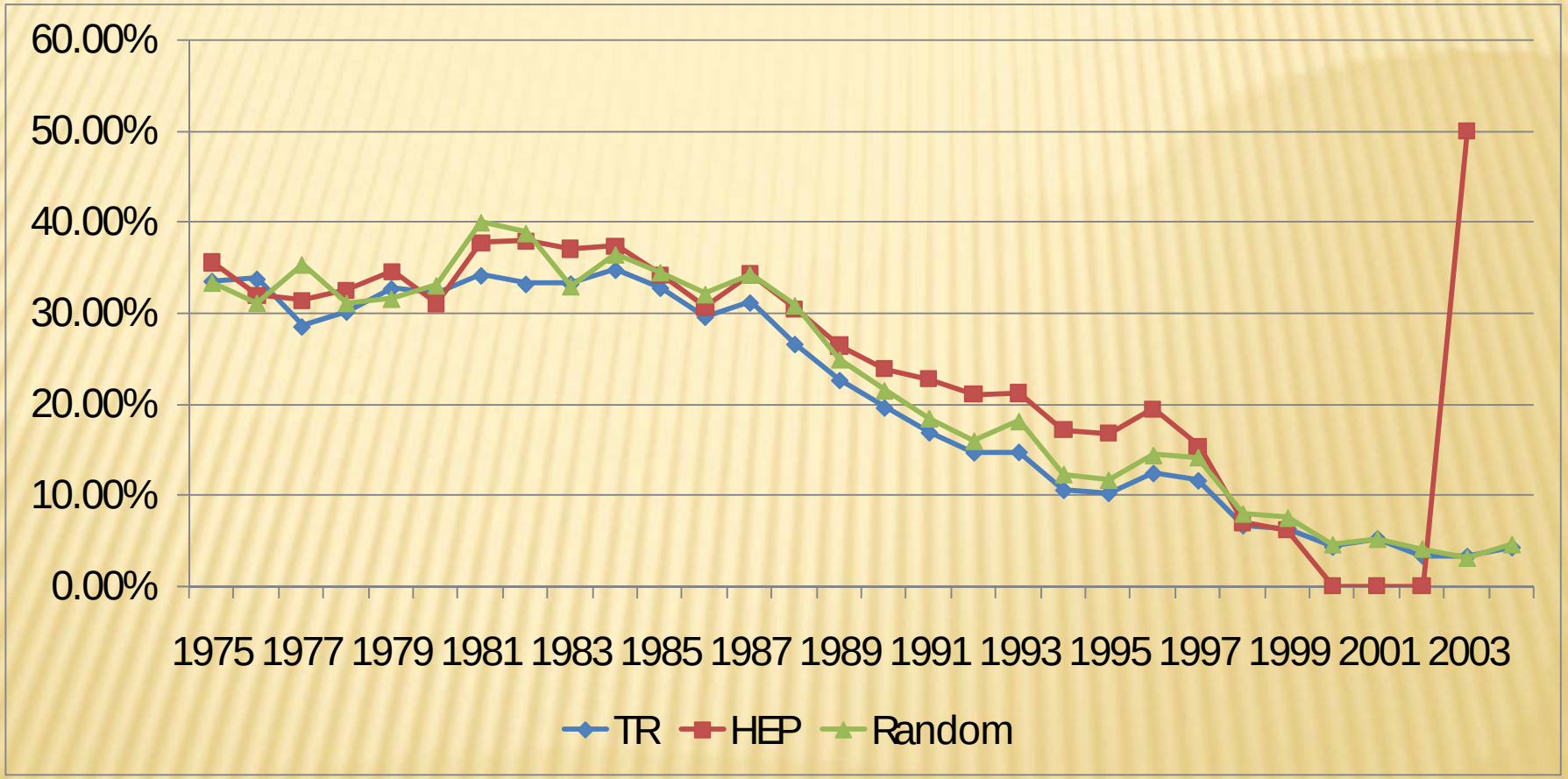
ASM FAILURE RATE BY MODEL YEAR



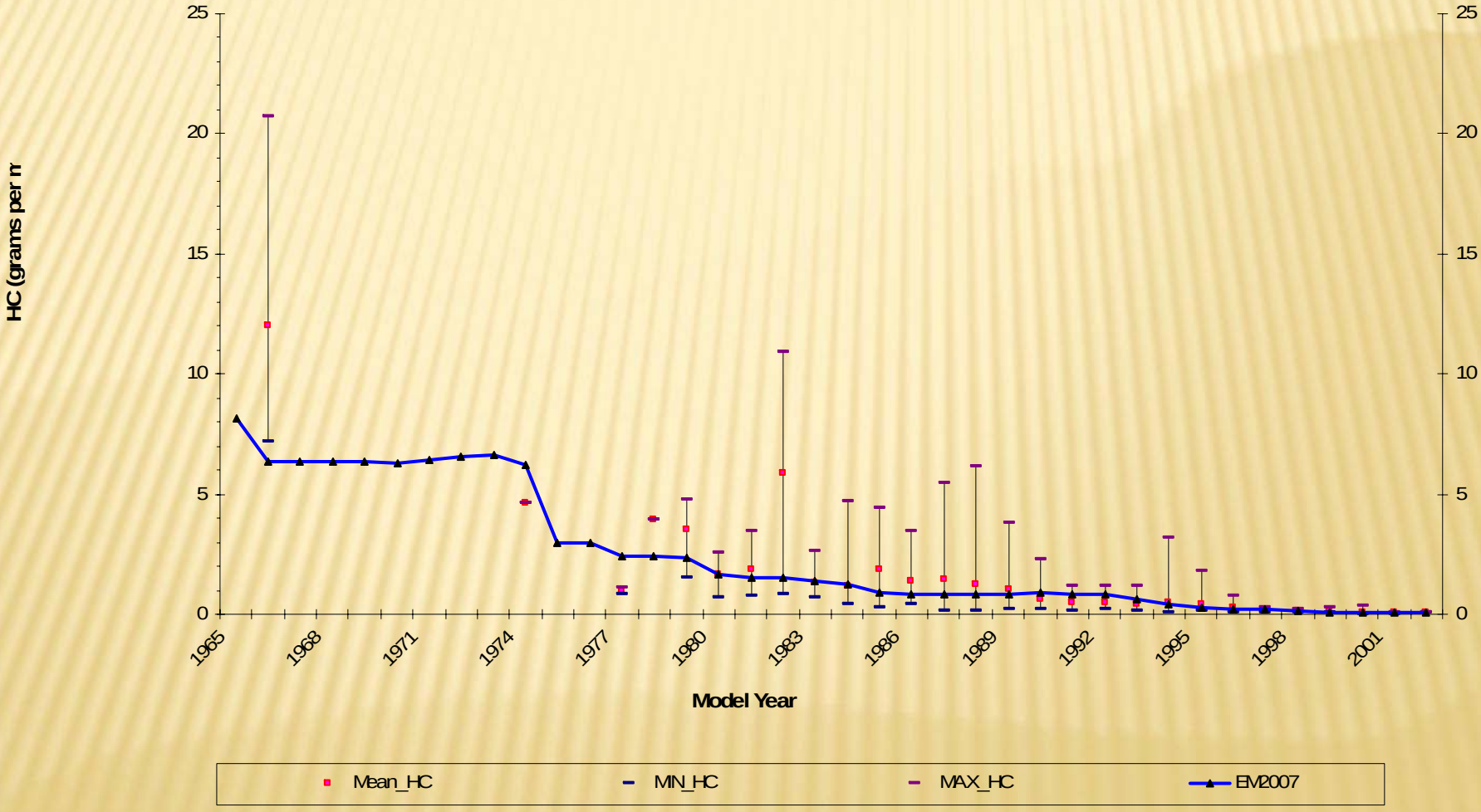
MODEL YEAR DISTRIBUTION BY PROGRAM TYPE



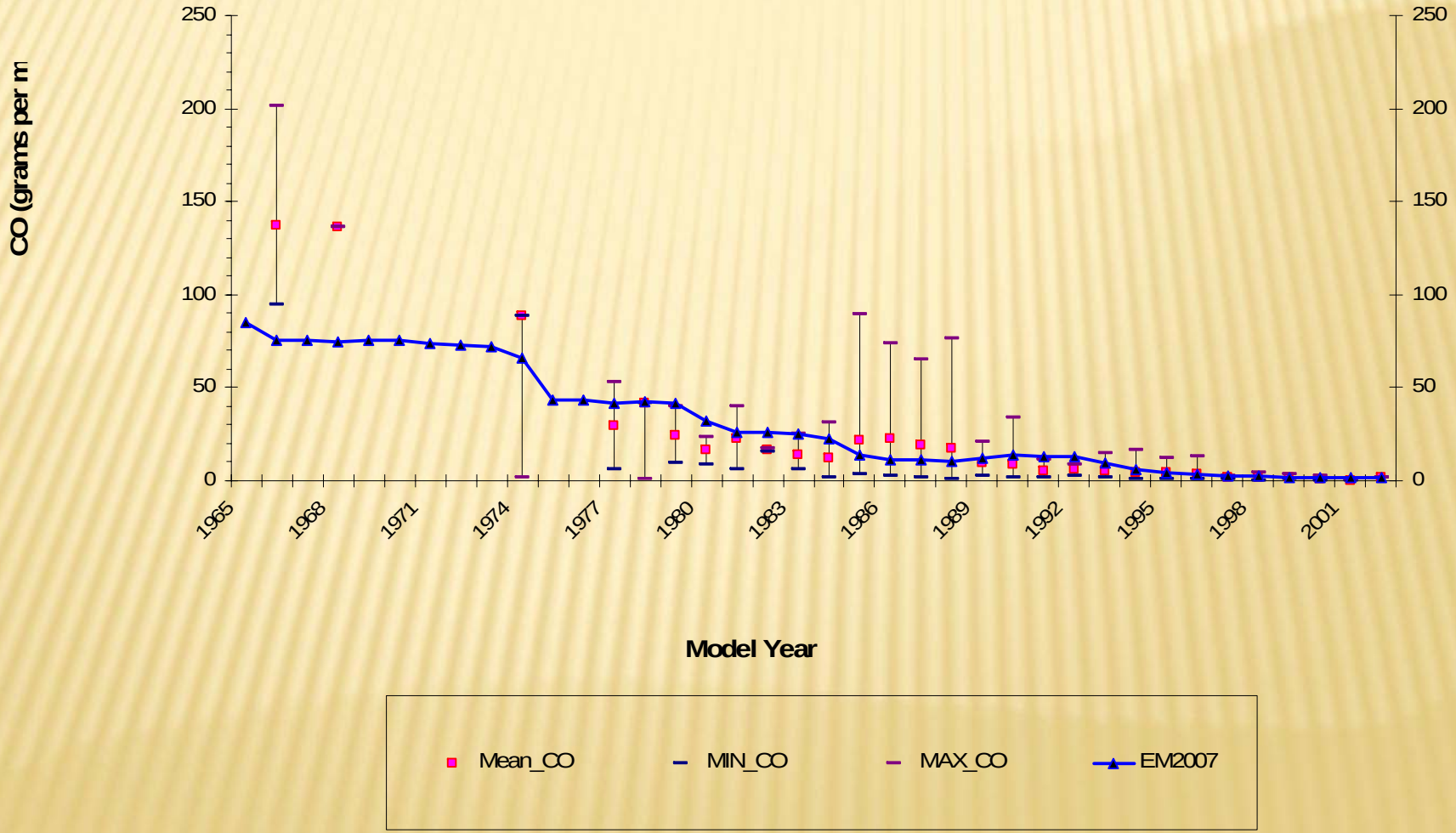
FAILURE RATE BY PROGRAM TYPE



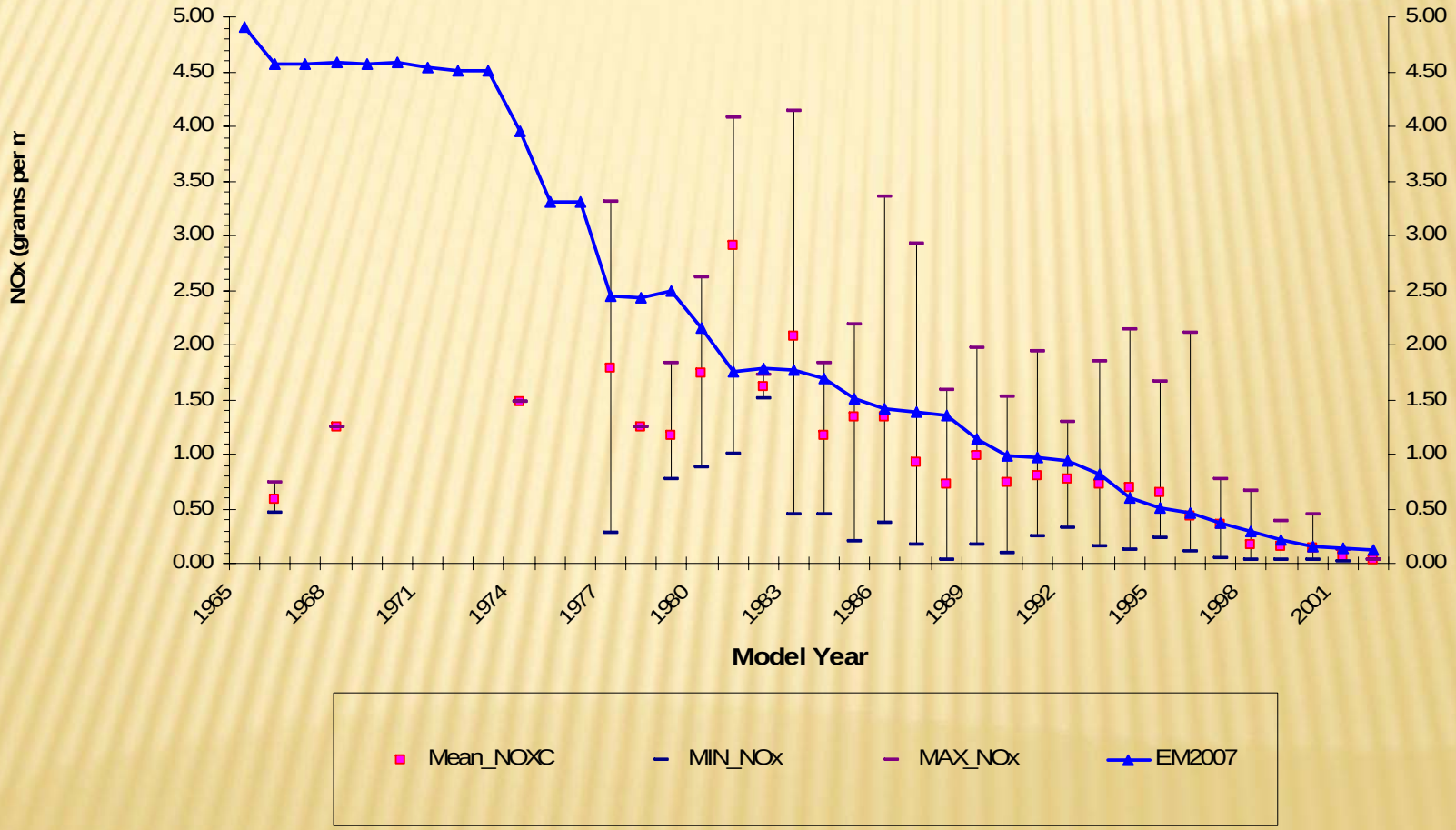
MEASURED VS MODELED EMISSIONS (HC)



MEASURED VS MODELED EMISSIONS (CO)



MEASURED VS MODELED EMISSIONS (NOX)



CONCLUSIONS

- Don’t Know Much About History…
  - Little information on the behavior of older vehicles
- The Future’s Not Ours to See…
  - The behavior of newer vehicles is based on our knowledge of older vehicles
- I Love LA…
  - The majority of emissions data in EMFAC is from SCAB

CONCLUSIONS (CONTINUED)

- What Have You Done For Me Lately?
  - I/M Evaluation programs are few and far between
- I'm In With the In-Crowd…
  - EMFAC can not model contiguous programs
- What Difference Could It Make?
  - EMFAC doesn't know the difference between test only and test and repair stations
- Same Time Next Year…
  - Little longevity of repair is assumed in the model