Fuel-Based Mobile Source Emissions Inventory Methods

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1864

A SMART SIGN

Provides emissions information for voluntary repairs and for fuel based emissions inventory.

Corpus Christi will have one soon.


YOU CAR'S HEALTH
GOOD
$AV NG YOU MONEY!
03-871-7777
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Mobile Source Emissions Inventory Methods

Travel Based Model

MOBILE emission factors

-g/mile probably wrong

→ Speed correction factors

→ Vehicle miles traveled

-very uncertain

→ Inventory

-legally correct but …

Fuel Based Data

Measured grams pollutant per kg of fuel from RSD

-quantifiable uncertainty

→ Fuel sales from tax department

-quite precise

→ Inventory

-uncertainty can be estimated

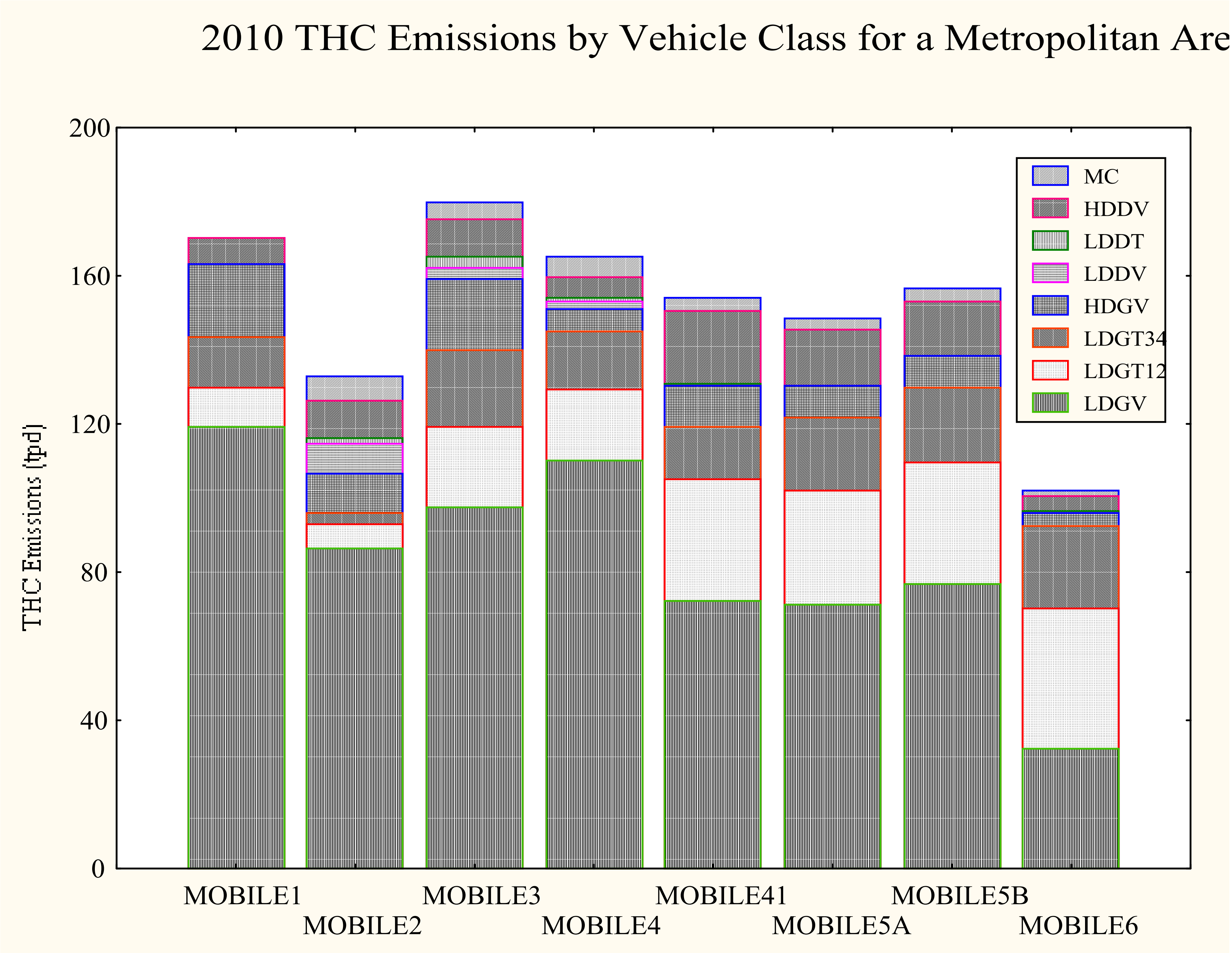
Model vs Measure

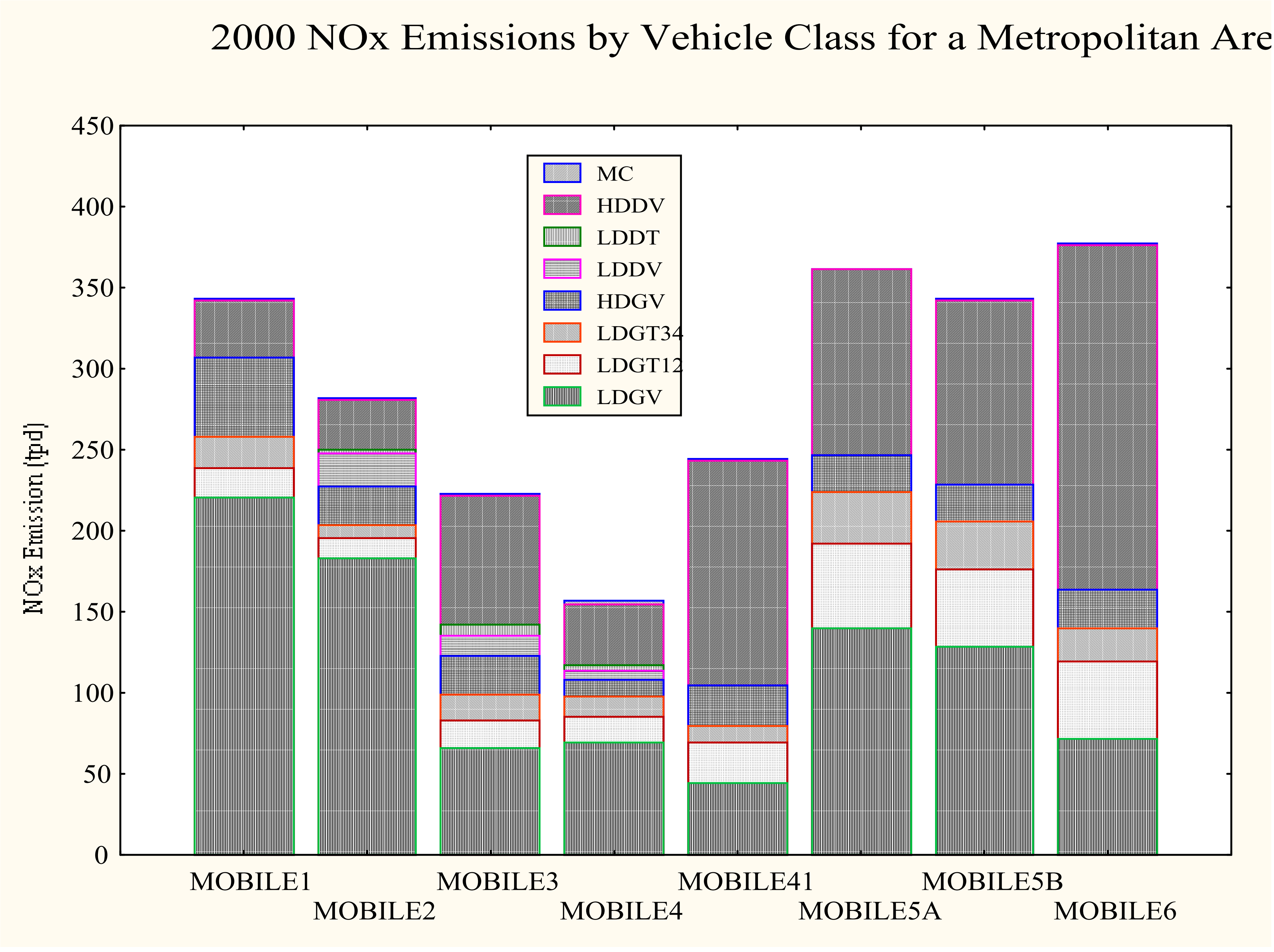
- Model MOBILE
- Legally correct
- No uncertainty
- Very likely wrong

- On-road Remote Sensing
- Mass Emissions per gallon of fuel
- Need to go from State to local fuel data by census or DMV
- Quantified uncertainty

DO NOT REMOVE NEGATIVE RSD READINGS FROM YOUR DATA SET

- It is WRONG to do so
- Vehicles with zero emissions should deliver an equal number of negative and positive readings
- Negative readings set to zero give them emissions they do not have

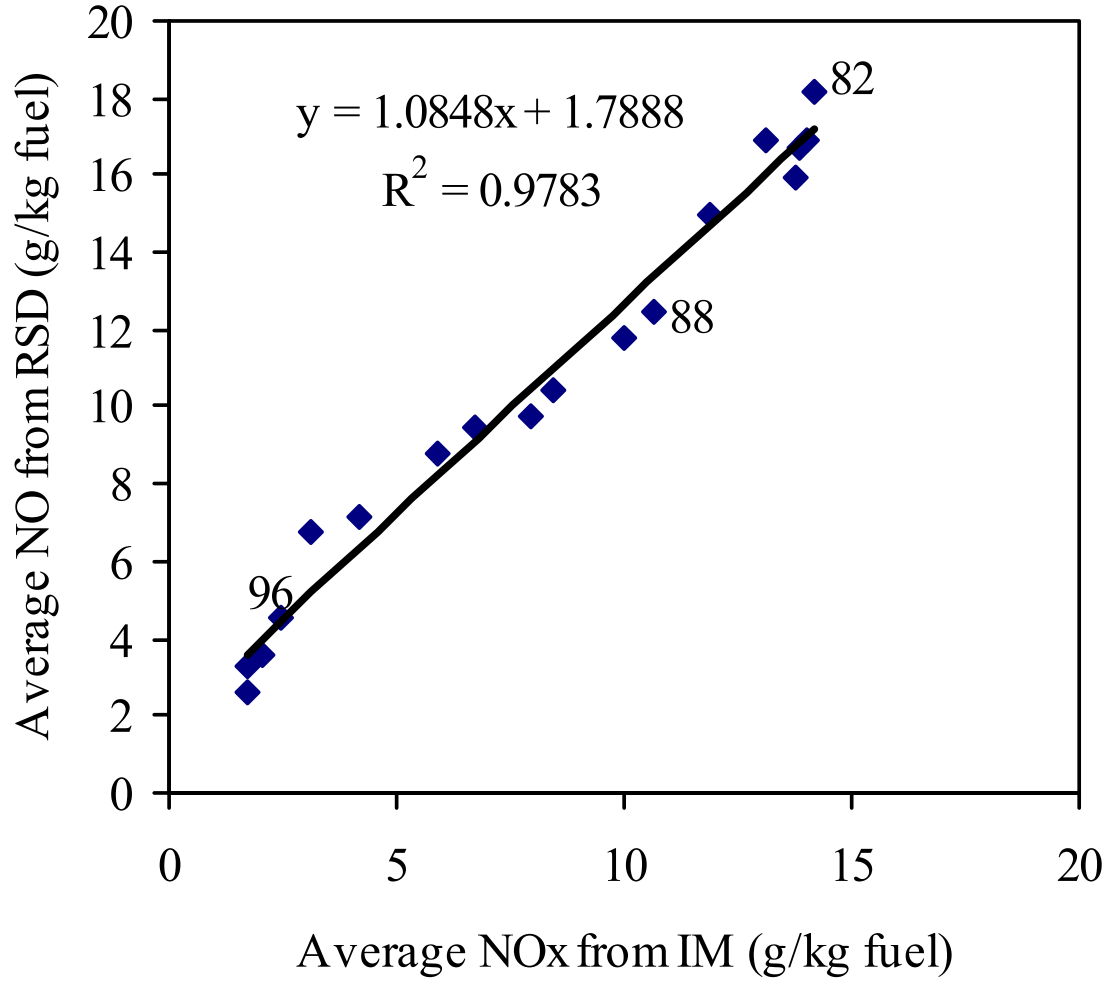

2010 THC Emissions by Vehicle Class for a Metropolitan Are
THC Emissions (tpd)
200
160
120
80
40
0
MC
HDDV
LDDT
LDDV
HDGV
LDGT34
LDGT12
LDGV
MOBILE1
MOBILE2
MOBILE3
MOBILE4
MOBILE41
MOBILE5A
MOBILE5B
MOBILE6


2000 NOx Emissions by Vehicle Class for a Metropolitan Are
NOx Emission (tpd)
450
400
350
300
250
200
150
100
50
0
MC
HDDV
LDDT
LDDV
HDGV
LDGT34
LDGT12
LDGV
MOBILE1
MOBILE2
MOBILE3
MOBILE4
MOBILE41
MOBILE5A
MOBILE5B
MOBILE6

Remote Sensing versus IM240 Correlation in grams/kg

- Data averaged by model year correlate very well
- Cost of RSD: $25,000
- Cost of IM240: $25,000,000

Denver 1999 NO



Calculations for Fuel-Based Approach

$$\frac{gCO}{kgFUEL} = \frac{28 \times \frac{\%CO}{\%CO_2}}{\frac{\%CO}{\%CO_2} + 1 + (6 \times \frac{\%HC}{\%CO_2})} \times (\frac{1}{0.014})$$

$$\frac{gHC}{kgFUEL} = \frac{88 \times \frac{\%HC}{\%CO_2}}{\frac{\%CO}{\%CO_2} + 1 + (6 \times \frac{\%HC}{\%CO_2})} \times (\frac{1}{0.014})$$

$$\frac{gNO}{kgFUEL} = \frac{30 \times \frac{\%NO}{\%CO_2}}{\frac{\%CO}{\%CO_2} + 1 + (6 \times \frac{\%HC}{\%CO_2})} \times (\frac{1}{0.014})$$

Calculations of Emission Factors in Fuel-Based Approach

$$t_{yv} = \frac{n_{yv}}{N}$$

y = model year subgroup
v = vehicle type subgroup (car or truck)
t = fraction of travel of subgroup
n = number of measurements of subgroup
N = total number of measurements

$$f_{yv} = \frac{(t_{yv} / F_{yv})}{\sum_{v=V_1}^{V_n} \sum_{y=Y_1}^{Y_n} (t_{yv} / F_{yv})}$$

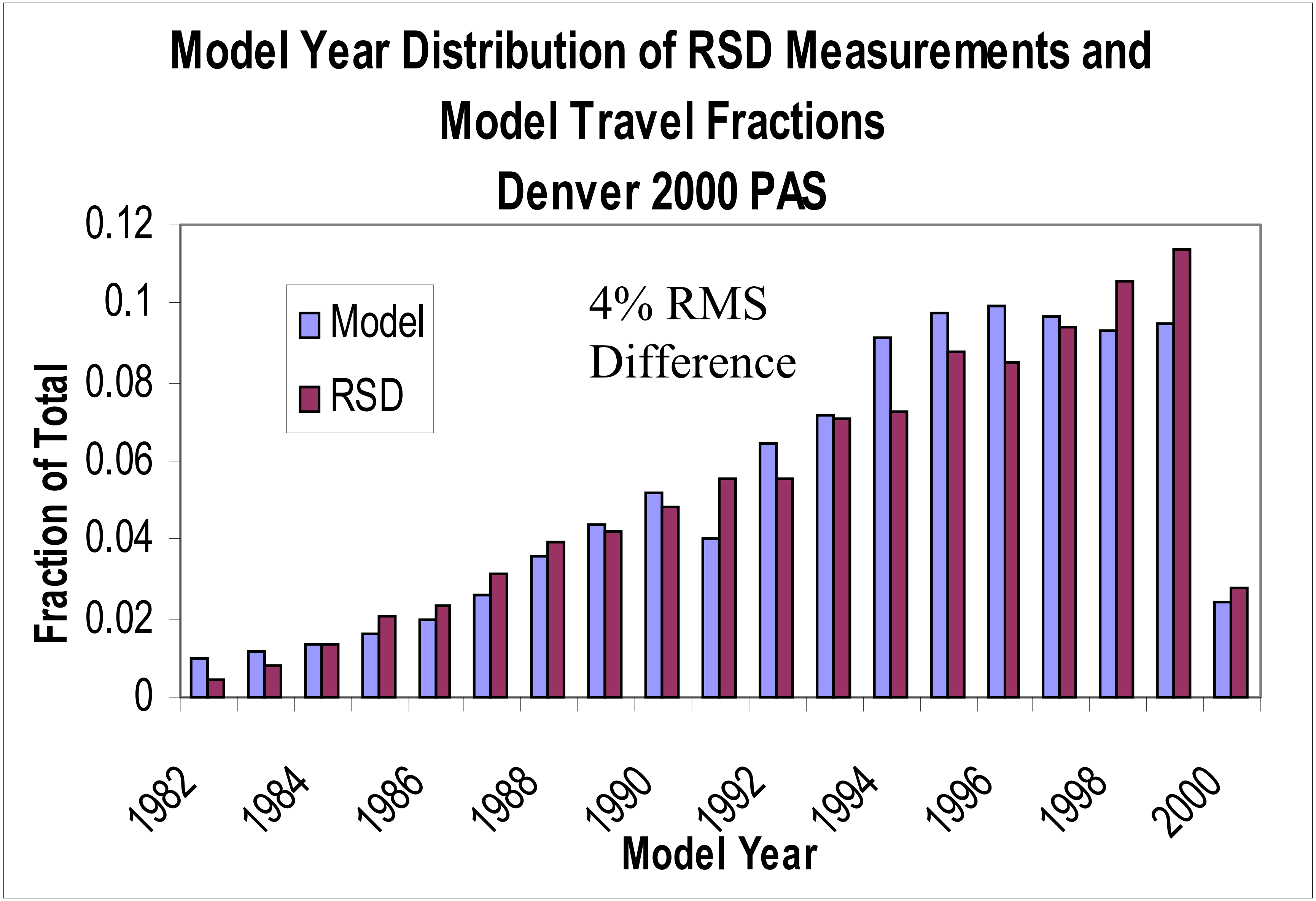
F_{yv} = fuel economy of MY subgroup y and vehicle type v
$Y_1 \ldots Y_n$ = various model years measured
$V_1 \ldots V_n$ = vehicle types measured
f_{yv} = relative fuel economy of subgroup y and v

$$M = \sum_{v=V_1}^{V_n} \sum_{y=Y_1}^{Y_n} f_{yv} E_{yv}$$

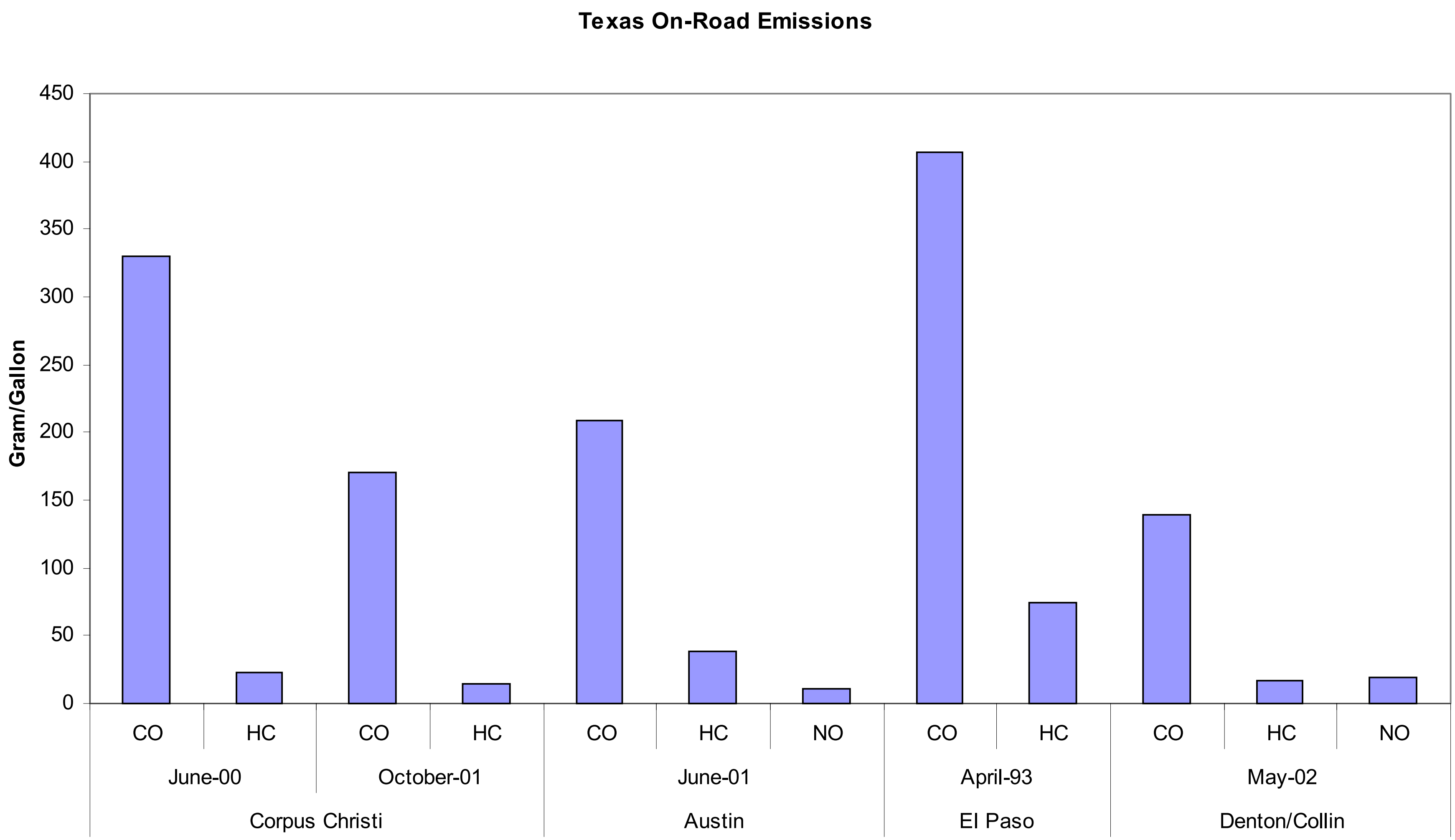
M = Emission factor of fleet

Statistics of Using RSD for Inventory

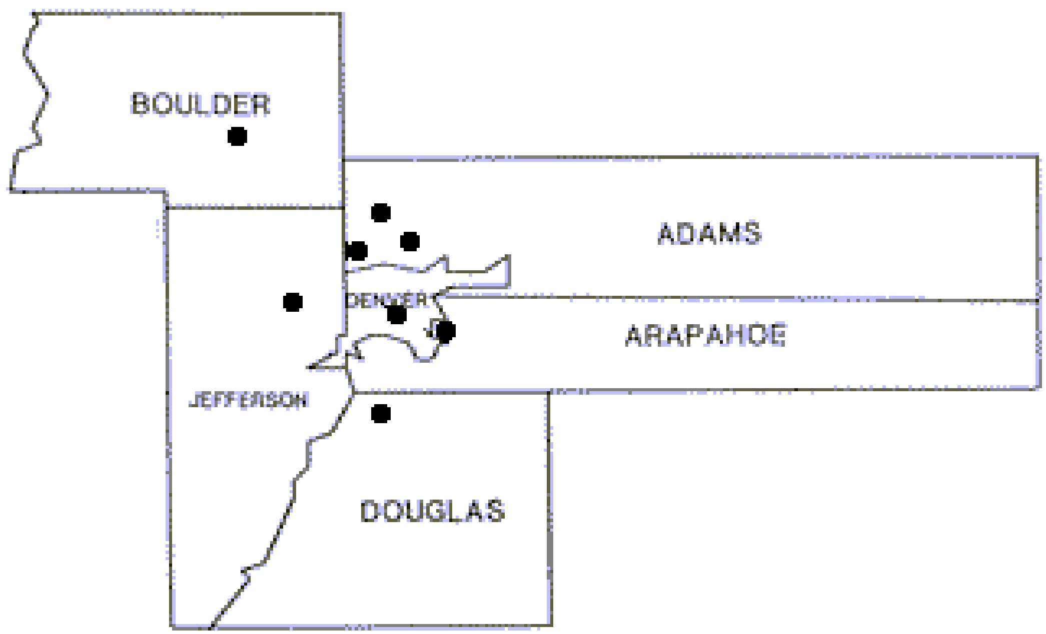
- One week’s work
- 25,000 vehicles
- Approximately 5% variability in day to day average emissions
- Adding uncertainty in fuel economy and fuel sales in area: 10% overall uncertainty

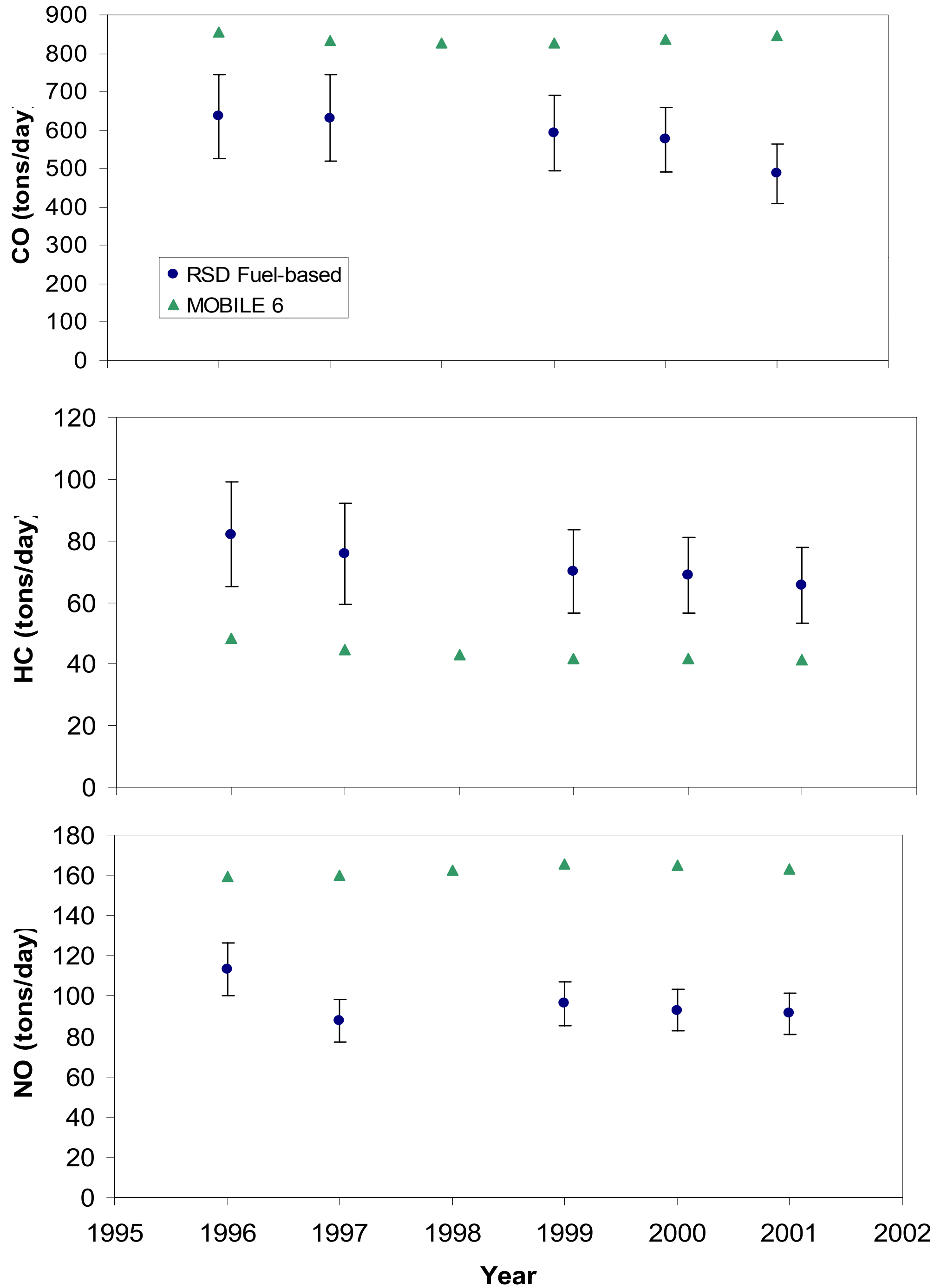


Model Year Distribution of RSD Measurements and
Model Travel Fractions
Denver 2000 PAS
0.12
0.1
0.08
0.06
0.04
0.02
0
Fraction of Total
Model
RSD
4% RMS
Difference
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
Model Year


Texas On-Road Emissions
Gram/Gallon
450
400
350
300
250
200
150
100
50
0
CO
HC
CO
HC
CO
HC
NO
CO
HC
CO
HC
NO
June-00
October-01
June-01
April-93
May-02
Corpus Christi
Austin
El Paso
Denton/Collin

Map of Denver Area with Measurement Locations





900
800
700
600
500
400
300
200
100
0
CO (tons/day)
RSD Fuel-based
MOBILE 6
120
100
80
60
40
20
0
HC (tons/day)
180
160
140
120
100
80
60
40
20
0
NO (tons/day)
1995
1996
1997
1998
1999
2000
2001
2002
Year

Implications

- RSD method ideal for mobile source emissions inventories
- Measurement and MOBILE disagree
- Only need one week of work and fuel sales to get fuel based emissions inventories