EMFAC-HK Vehicle Emission Model

Training Materials

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What is EMFAC-HK

- Computer model written in FORTRAN which is adapted from ARB's EMFAC model
- Calculates emission factors (g/km) for a "Fleet Average Vehicle" and Total emissions (tons/hr, tons/day)
- Used for gasoline, diesel, LPG on-road vehicles
- Calculates Emissions for All HK Vehicle Types
- Exhaust and Evaporative Hydrocarbon Emissions (HC)
- Exhaust Carbon Monoxide (CO)
- Exhaust Nitrogen Oxides (NOx)
- Exhaust PM

Vehicle Classification Chart

V3.x Index	**Vehicle Class Description**	**Gross Vehicle Weight (tonnes)**
1	Private Cars	ALL
2	Taxi	ALL
3	Light Goods Vehicles (<=2.5t)	<=2.5t
4	Light Goods Vehicles (2.5-3.5t)	>2.5-3.5t
5	Light Goods Vehicles (3.5-5.5t)	>3.5-5.5t
6	Medium & Heavy Goods Vehicles (5.5-15t)	>5.5-15t
7	Medium & Heavy Goods Vehicles (>=15t)	>15t
8	Public Light Buses	ALL
9	Private Light Buses (<=3.5t)	<=3.5t
10	Private Light Buses (>3.5t)	>3.5t
11	Non-franchised Buses (<6.4t)	<=6.36t
12	Non-franchised Buses (6.4-15t)	>6.36-15t
13	Non-franchised Buses (>15t)	>15t
14	Single Deck Franchised Buses	ALL
15	Double Deck Franchised Buses	ALL
16	Motor Cycles	ALL

What Can the Model Do?

- Analytical Tool that can be applied for local and regional Air Quality Planning
- Can be used to estimate emission impacts from:
  - Future Vehicle Fleets
  - Diesel/Alternate Fuel Use
  - Vehicle Speeds
  - Ambient Temperature
  - Fuel properties - RVP/Oxygen content/Sulfur content/RFG
  - Air Conditioning
  - Cold Starts
  - Inspection/Maintenance Programs
  - New Vehicle Standards
  - Other Strategies
    - Evaporative Controls
    - Refueling Controls

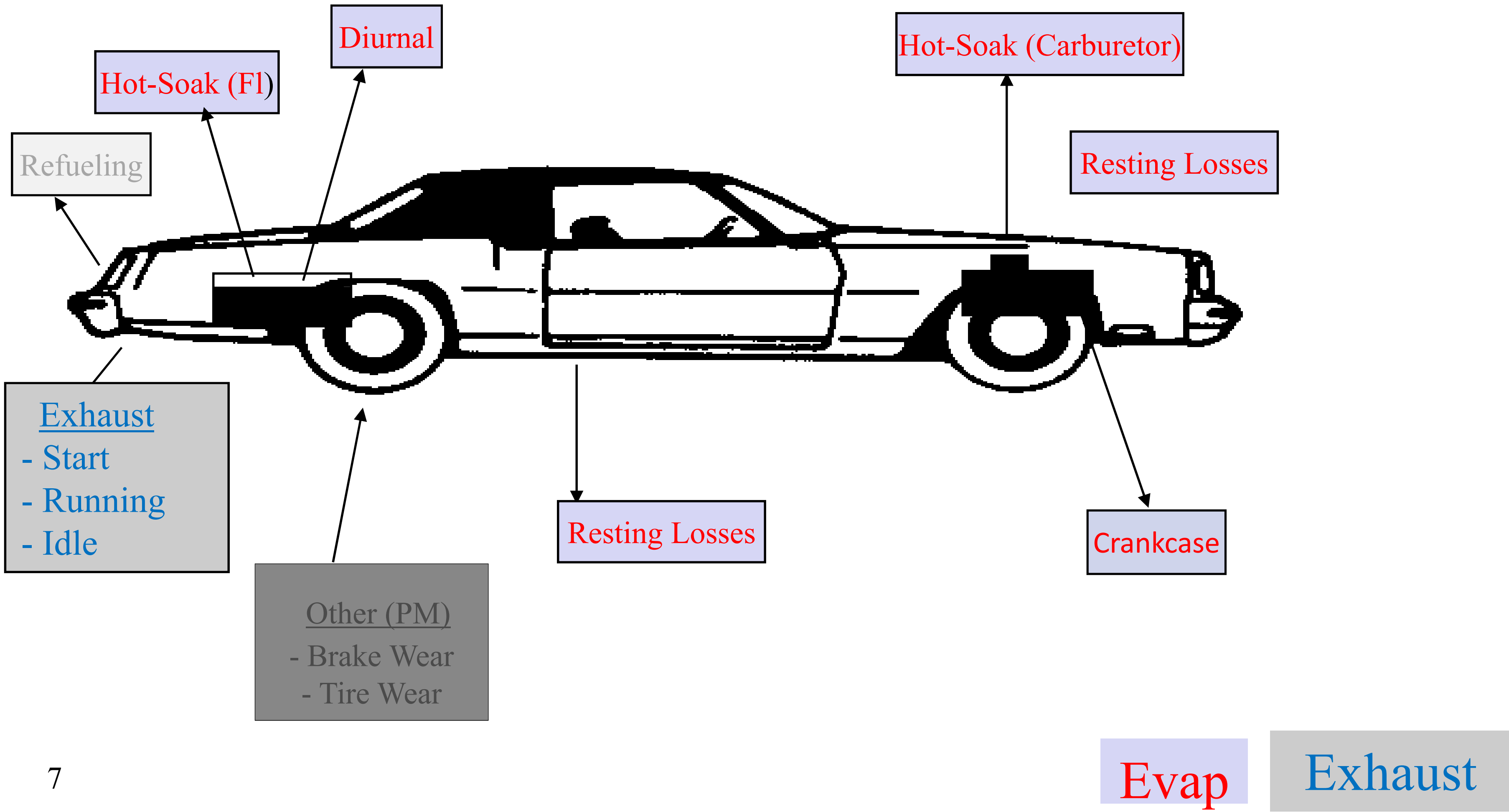
Uses of Model

- Project Specific Vehicle emissions impact
- National Implementation Plan Inventories and Control Strategy Analysis
- Conformity Demonstrations
- National Inventories
- New Regulation Development
- Local/fleet-specific analyses
- Impact on local roadways/intersections
- Setting up of Roadway Network Speed Limits

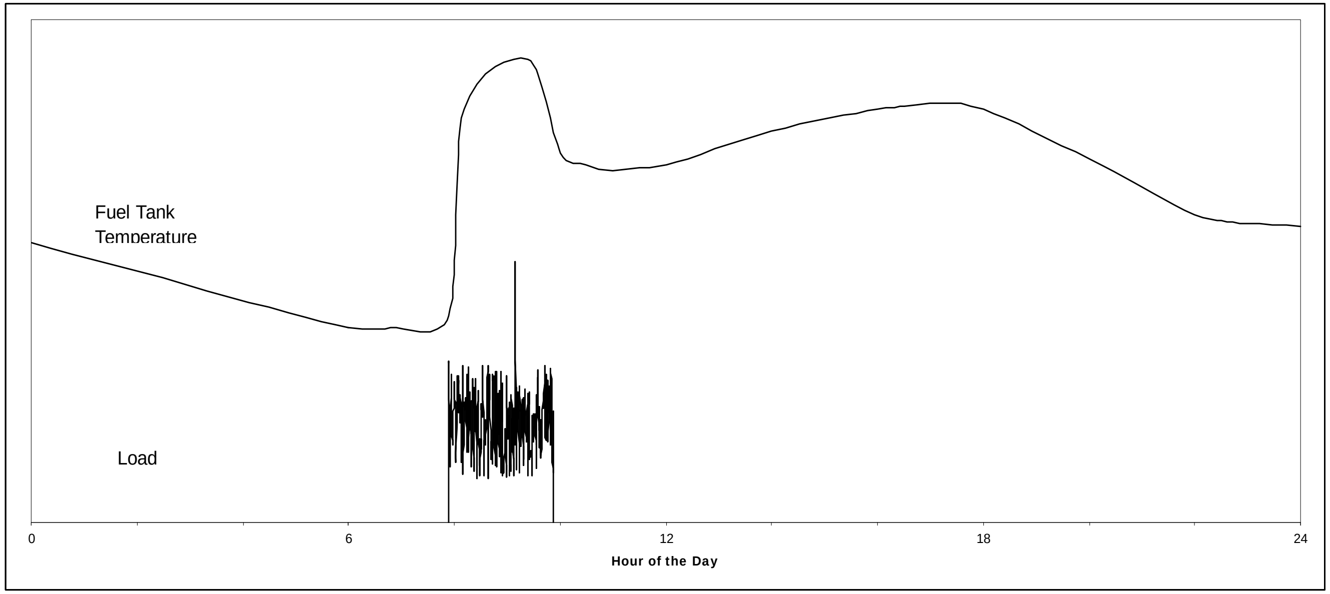
Vehicle Emissions Data Used for Development of Model

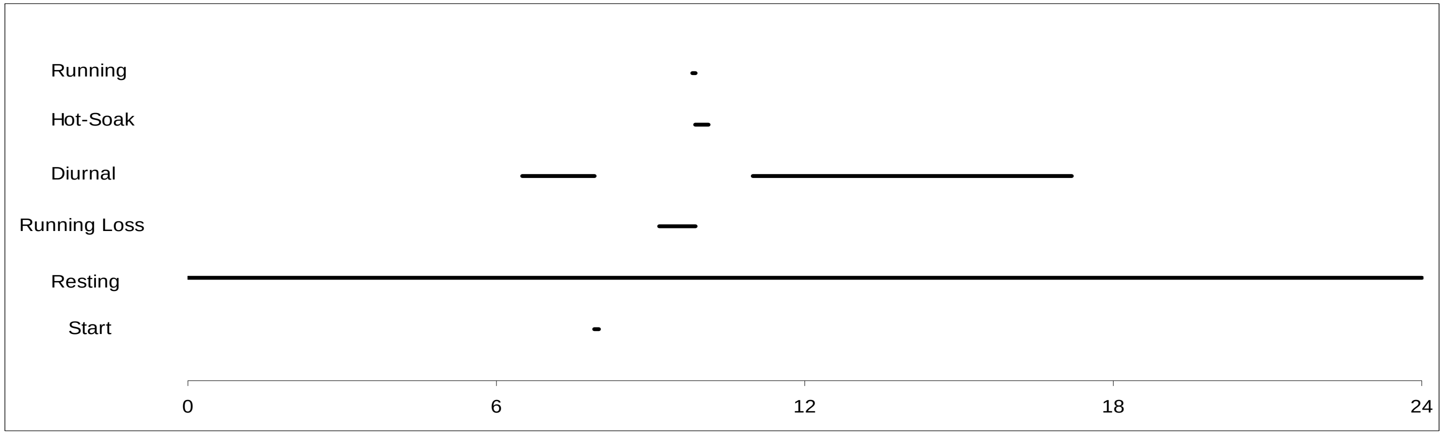
- Hong Kong PEMS and activity data
- Vehicles tested in real Hong Kong conditions
- Estimates made for new vehicles and as they age
- Changes in emissions for temperatures, fuel labs, cold start conditions, mileage, etc.
- Vehicles of various technologies tested in as use state
- Developed emission relationships
- Remote Sensing data can be used to characterize (eg. Emission Regime fractions)

Emissions Processes



When Do Emissions Occur?





Calculation Methodology/Structure

Main Calculations

Primary Groups

Technology/Emission Standards	- Many groups
Emissions Regime	- Super/High/Normal
Emissions Type	- Start/Running/Evap(with different processes)

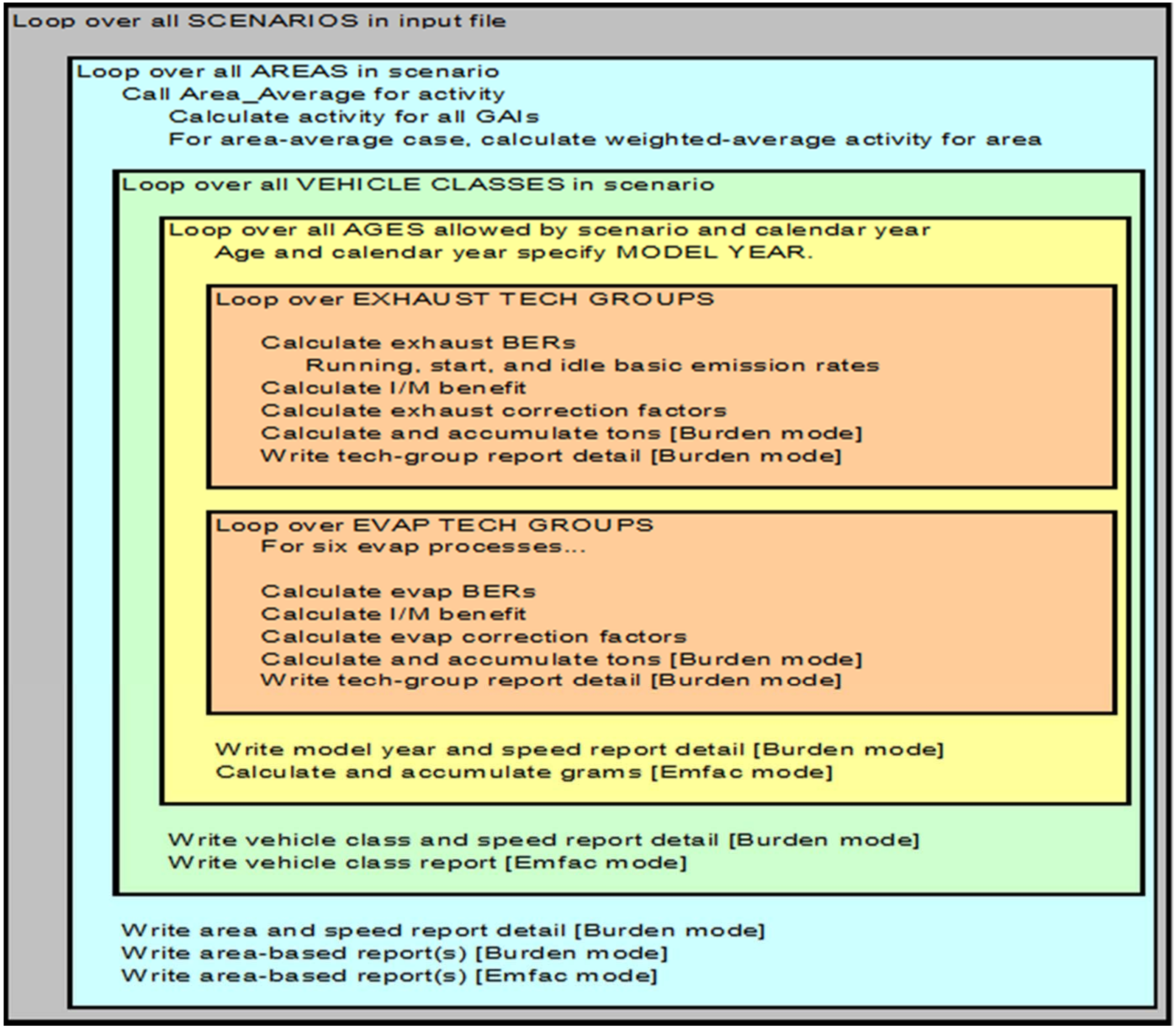
2-Step Process

- Emission Factor Calculations
- Activity Matrices

Examples of Technology Groups

Vehicle Class	Fuel Type	Vehicle Emission Standards	Tech Group Index
PC	Diesel	pre-Euro	170
PC	Diesel	pre-Euro Traps Retrofitted	171
PC	Diesel	pre-Euro DOC Retrofitted	172
PC	Diesel	Euro I	173
PC	Diesel	Euro IV	176
PC	Diesel	Euro V - SCR	175
PC	Diesel	Euro V - DPF & SCR	174
PC	Diesel	Euro VI	177
PC	Petrol	pre-ULP	1
PC	Petrol	Unleaded Petrol Vehicles	8
PC	Petrol	Euro I	10
PC	Petrol	Euro II	13
PC	Petrol	Euro III	23
PC	Petrol	Euro IV	24
PC	Petrol	Euro V & VI	29

Vehicle Class	Fuel Type	Vehicle Emission Standards	Tech Group Index
HGV8	Diesel	pre-Euro	153
HGV8	Diesel	pre-Euro DOC Retrofitted	155
HGV8	Diesel	Euro I	154
HGV8	Diesel	Euro II	157
HGV8	Diesel	Euro III	159
HGV8	Diesel	Euro IV	160
HGV8	Diesel	Euro IV - DPF	163
HGV8	Diesel	Euro IV - SCR	164
HGV8	Diesel	Euro V	161
HGV8	Diesel	Euro V - DPF	165
HGV8	Diesel	Euro V - SCR	166
HGV8	Diesel	Euro VI	162



Loop over all SCENARIOS in input file
Loop over all AREAS in scenario
Call Area_Average for activity
Calculate activity for all GAIs
For area-average case, calculate weighted-average activity for area
Loop over all VEHICLE CLASSES in scenario
Loop over all AGES allowed by scenario and calendar year
Age and calendar year specify MODEL YEAR.
Loop over EXHAUST TECH GROUPS
Calculate exhaust BERs
Running, start, and idle basic emission rates
Calculate I/M benefit
Calculate exhaust correction factors
Calculate and accumulate tons [Burden mode]
Write tech-group report detail [Burden mode]
Loop over EVAP TECH GROUPS
For six evap processes...
Calculate evap BERs
Calculate I/M benefit
Calculate evap correction factors
Calculate and accumulate tons [Burden mode]
Write tech-group report detail [Burden mode]
Write model year and speed report detail [Burden mode]
Calculate and accumulate grams [Emfac mode]
Write vehicle class and speed report detail [Burden mode]
Write vehicle class report [Emfac mode]
Write area and speed report detail [Burden mode]
Write area-based report(s) [Burden mode]
Write area-based report(s) [Emfac mode]

Exhaust Calculations

- For Each Calendar Year and Vehicle Type
  - Calculate emissions (each Pollutant) for each Age- three primary steps
    - Estimate Exhaust emissions
    - Estimate impact of Inspection program
    - Use correction factors to model local situation
  - Combine emissions for all Ages

Exhaust Calculations

Exhaust subroutine

- Each Age is associated with a particular Model year
- In each model year there are few technology groups assigned
- For each technology groups
  – Estimate emitter category Regime Fraction
  – Estimate emitter category Regime Emissions

Emitter Category-
Regime Fractions

- For each Age and Vehicle type the odometer is assigned
- Regime Size Calculated for Super, High, and Normal Emitters
- Regime Size is calculated as (data in Reg_Size):

$$\text{RegSize} = \mathit{func}\ (\text{Odometer})$$

Regime growth rates developed based on local data

Exhaust Calculations Emitter Category Emissions

- For Each Myr, Age, Tech group :

Stored within EMFAC-HK

$$E_{emit\_cat} = E_{zero} + Det\_rate * Odo$$

$$E_{emit\_cat} = func\ (\text{poll, mode, tech group, reg})$$

Vehicles Used for Updating the EMFAC-HK Model

Vehicle Class	Fuel Type	Emission Standard							Total
		Pre-Euro	Euro I	Euro II	Euro III	Euro IV	Euro V	Euro VI	
Cars	Petrol			3	10	18	3		34
Taxis	LPG				17	5	1		23
Public light buses	LPG				6	4			10
	Diesel			1	2	1			4
Private light buses	Diesel		1	1	3	1			6
Light goods vehicles <= 5.5t	Diesel	5	4	11	22	16	6	1	64
Heavy goods vehicles > 5.5t	Diesel	4	1	4	18	10	6	1	44
Single Deck Coaches	Diesel			2	9	18	10		39
Franchised Buses (w DPF)	Diesel			4	2		6	6	18
Total		9	6	26	89	73	32	7	242

Euro III & IV Diesel Vehicles
Used for Updating the EMFAC-HK Model

Vehicle Class	Euro III					Euro IV				
	Nil	DOC	DOC & EGR	DPF	EGR	DOC & EGR	POC & DOC, EGR	DPF & EGR	SCR	SCR & DOC/ EGR
Public light buses		2						1		
Private light buses		1	2					1		
Light goods vehicles <=5.5 t		5	17			7	4	5		
Heavy goods vehicles > 5.5t	5	5	6		2	4	2	2		2
Single Deck Coaches	2		6		1	2		4	10	2
Franchised Buses				2						
Total	7	13	31	2	3	13	6	13	10	4

Euro V & VI Diesel Vehicles Used for Updating the EMFAC-HK Model

Vehicle Class	Euro V					Euro VI	
	DOC & EGR	EGR	DPF & EGR	DPF, EGR & SCR	SCR	DOC, DPF & SCR	DPF, EGR & SCR
Public light buses							
Private light buses							
Light goods vehicles <=5.5 t			4	2			
Heavy goods vehicles > 5.5t	1		4	1		1	
Single Deck Coaches		1	6		3		
Franchised Buses					6		6
Total	1	1	14	3	3	1	6

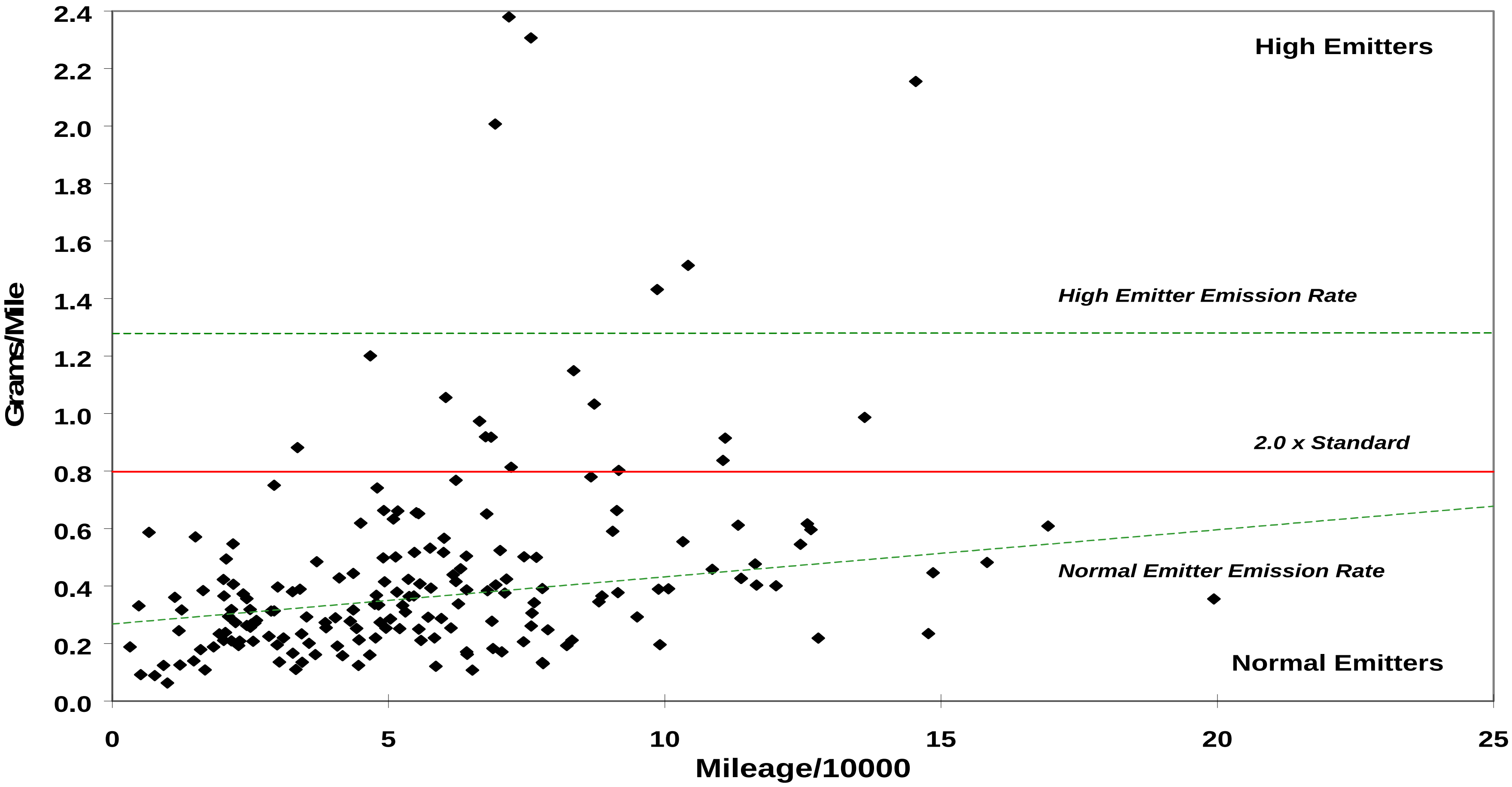
Zero Mile Emission Factors (ZMEF) and (Deterioration Rates (DR)

- Calculated emission factors (EF) at 1-minute, 8-minute and 1-hour averages of PEMS data of each vehicle;

- For each Tech Group, estimated the ZMEF and DR by median of EFs of vehicles at average speed between 25 km/hr and 35 km/hr.

- For Speed Correction Factors, conducted statistical analysis on the ratios of median emission factors (in g/km) for all 8-km/hr average speed bins over basic emission rates obtained from ZMEF & DR by linear regression model.

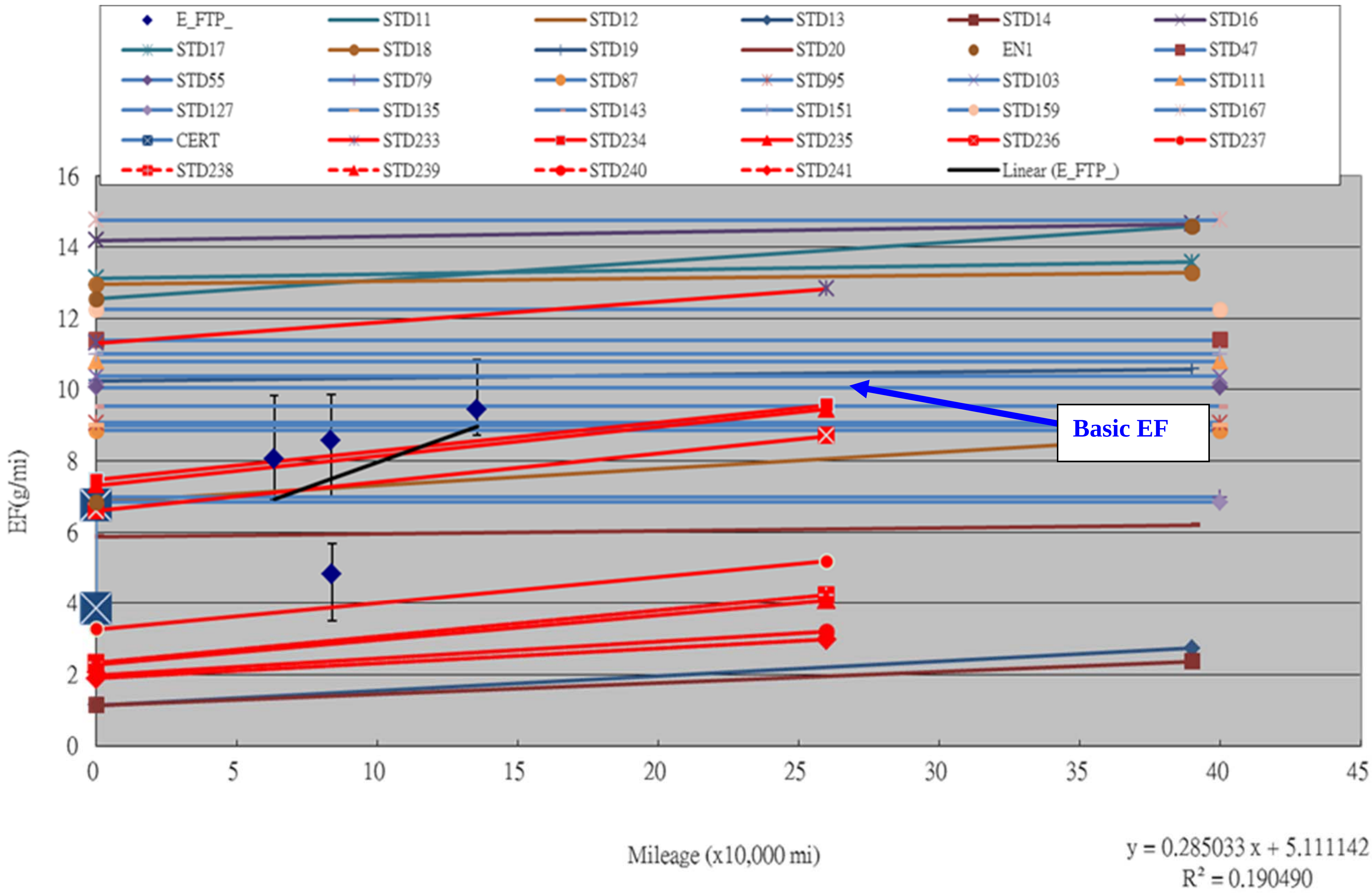
NO_x -for particular technology



Source: California Air Resources Board

NOx emission factors for Euro IV SCR Heavy Goods Vehicles > 15t and Non-Franchised Bus > 15t

EMFAC2014 Diesel HHDT 2008 for these vehicle classes is used.



Gross Emitter Model for Diesel Vehicles in Hong Kong

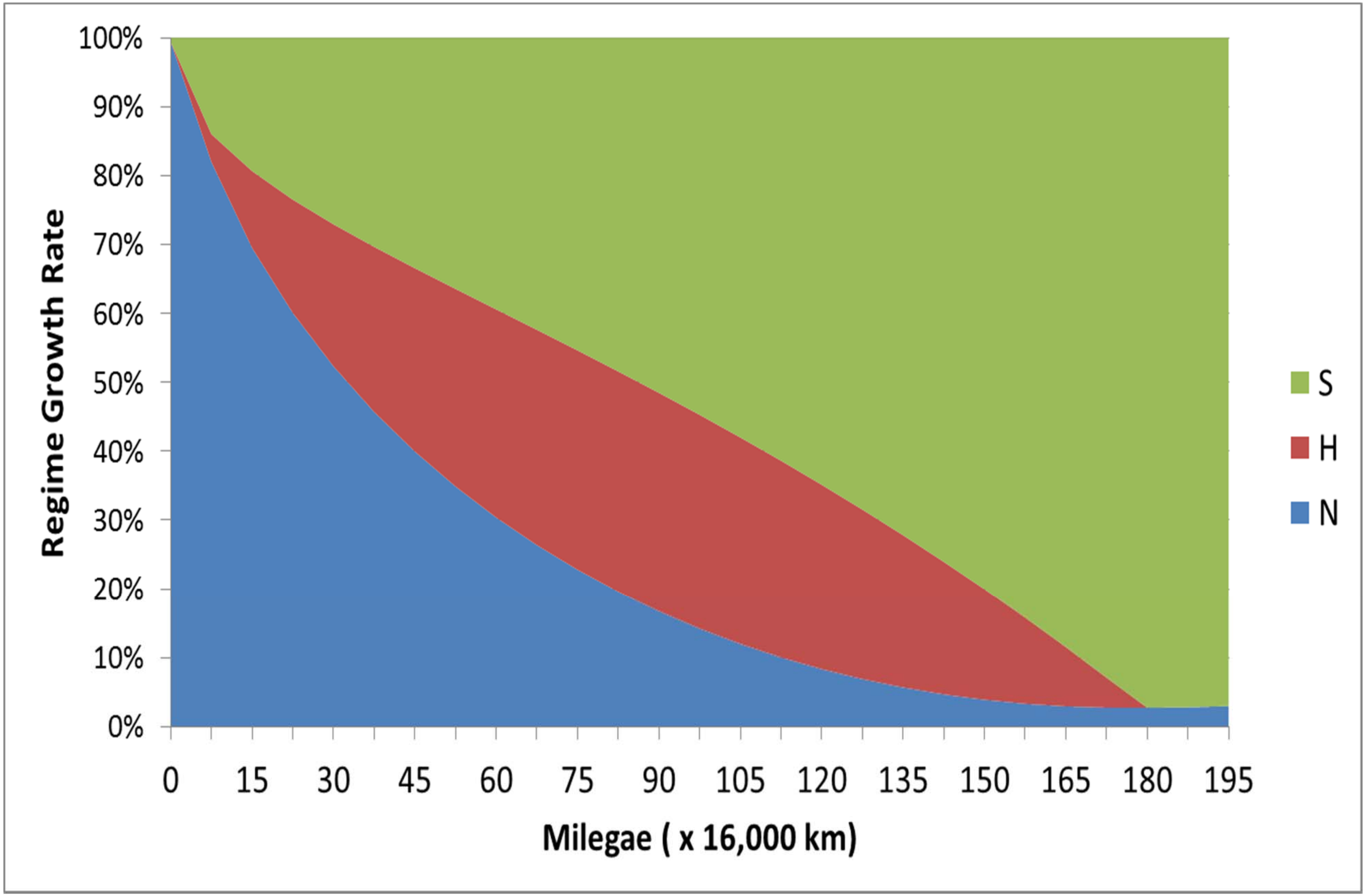
Diesel vehicles were subdivided into 2 regimes:

- normal & super
- based on smoky vehicle program result

Petrol & LPG vehicles were subdivided into 3 regimes:

- normal, high & super
- based on remote sensing data

LPG Taxi Regime Growth Rates



Exhaust Emissions

Tech Group/ Model Year Emissions
For Each Pollutant – Before I/M

$$E_{tech\_group} = E_{super} * RegSize_{super} + E_{high} * RegSize_{high} + E_{normal} * RegSize_{normal}$$

$$E_{model\_year} = \sum E_{tech\_group}(my, tg) * Tech\_Frac\ (my)$$

Exhaust I/M calculations

- I/M only causes the regime size fractions to change
- Apply % Reduction to change in Super and High emitters
- Emissions changes are caused as vehicles go from super and high emitting regimes to normal emitting regime

Vehicle Mileage Surveys

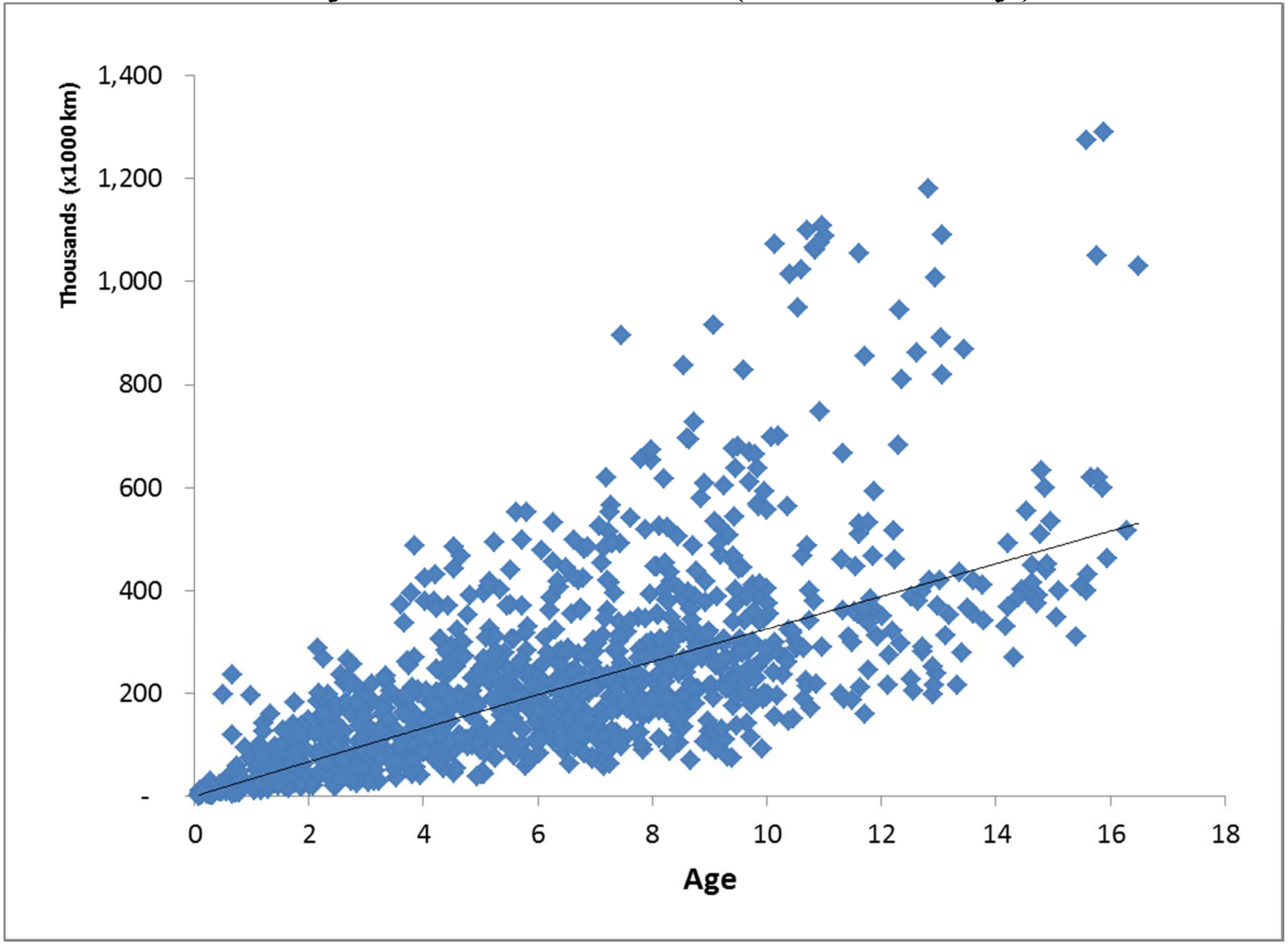
The sources included:

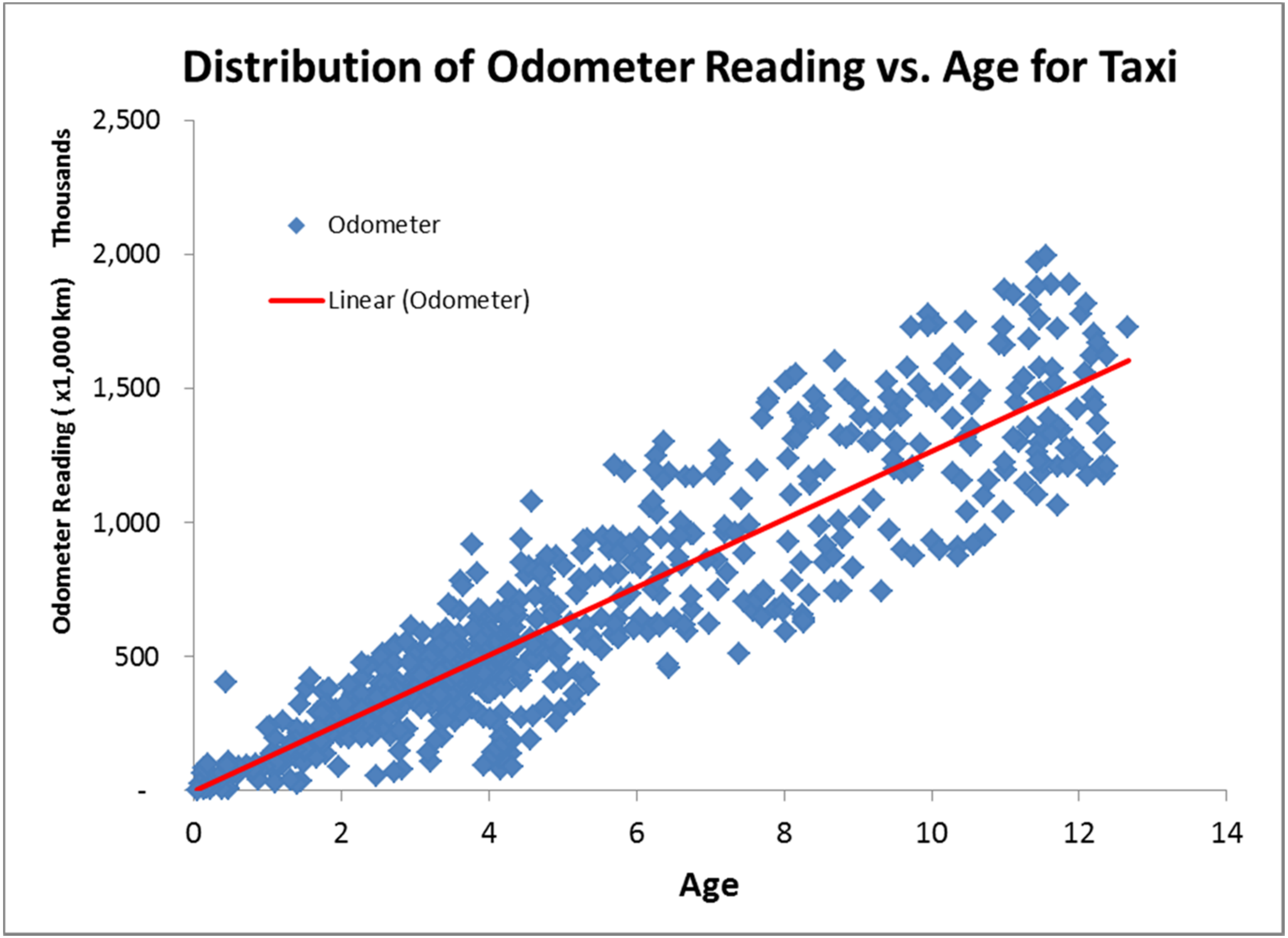
- Surveys conducted at petrol filling stations, car parks, and vehicle examination centres.
- Data provided by franchised bus companies.

Analysis:

- Screen out those with too low mileage for certain age for commercial vehicles.
- Establish a odometer-age relationship by fitting the data.

Distribution of Odometer Reading vs. Age for Medium and Heavy Goods Vehicles (2011 Survey)





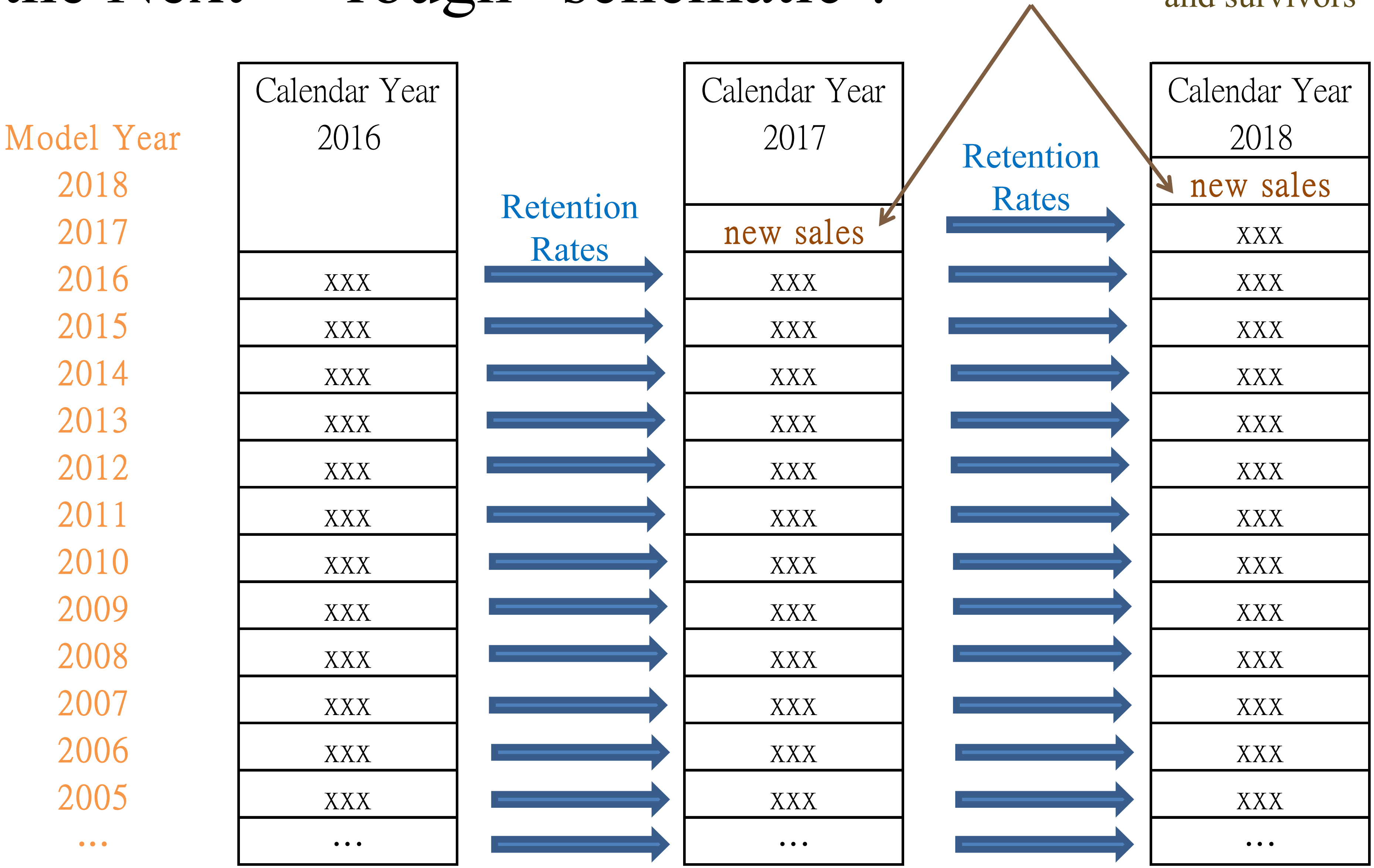
Distribution of Odometer Reading vs. Age for Taxi
Odometer
Linear (Odometer)
Odometer Reading (x1,000 km) Thousands
2,500
2,000
1,500
1,000
500
-
0
2
4
6
8
10
12
14
Age

Forecast of Vehicle Population

- EMFAC uses the population of a specific model of vehicles for consecutive calendar years to derive a variation curve of the percentage of vehicles sold still remain in the fleet after a specified amount of time has elapsed – retention rate. The curve is then used to forecast vehicle population.
- Retention rates is used in EMFAC for both forecasting to future calendar years and back-casting for those years where vehicle registration information is unavailable.

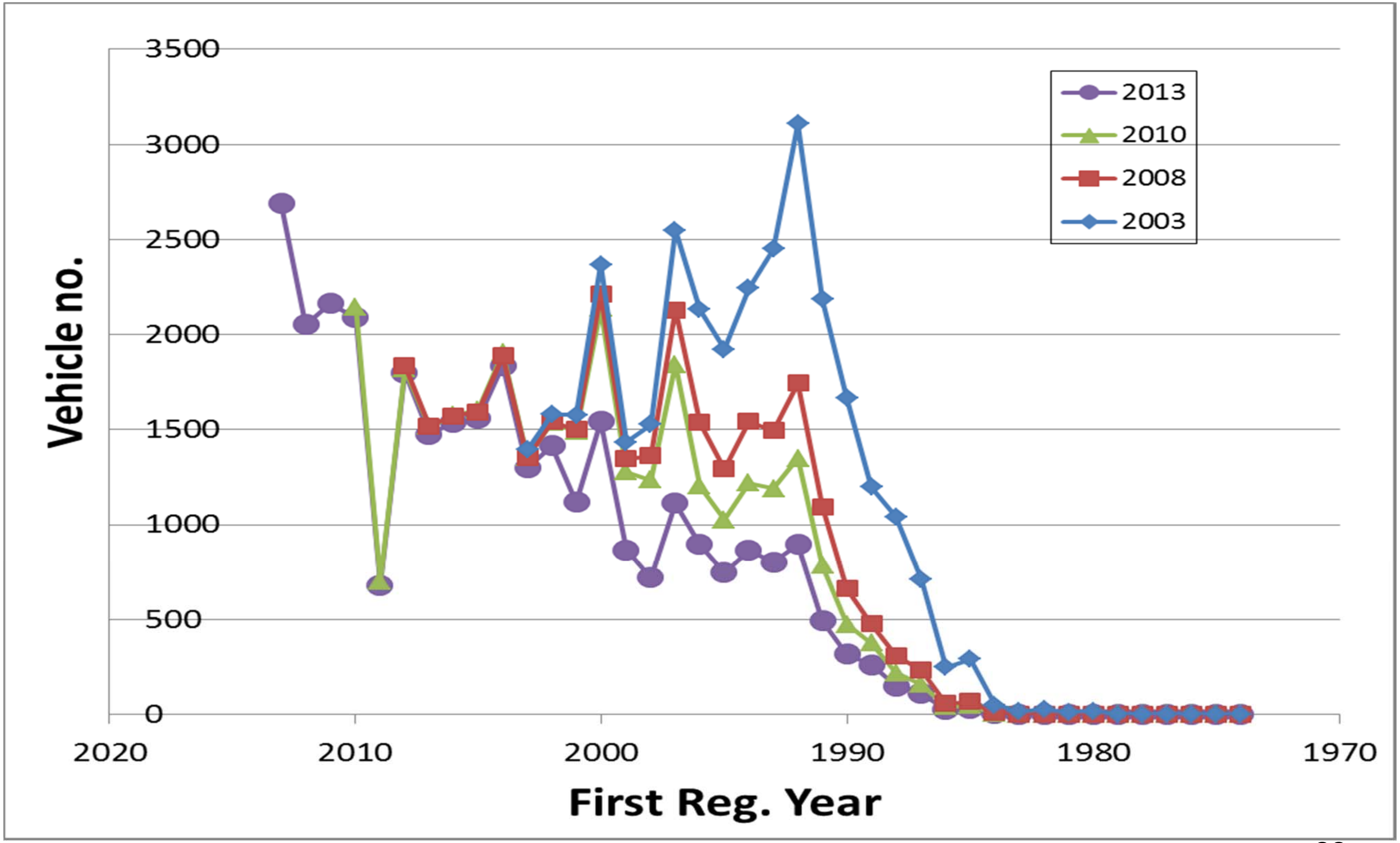
Forecast from One year to the Next – “rough” schematic#:

new sales are essentially determined by growth rates and survivors

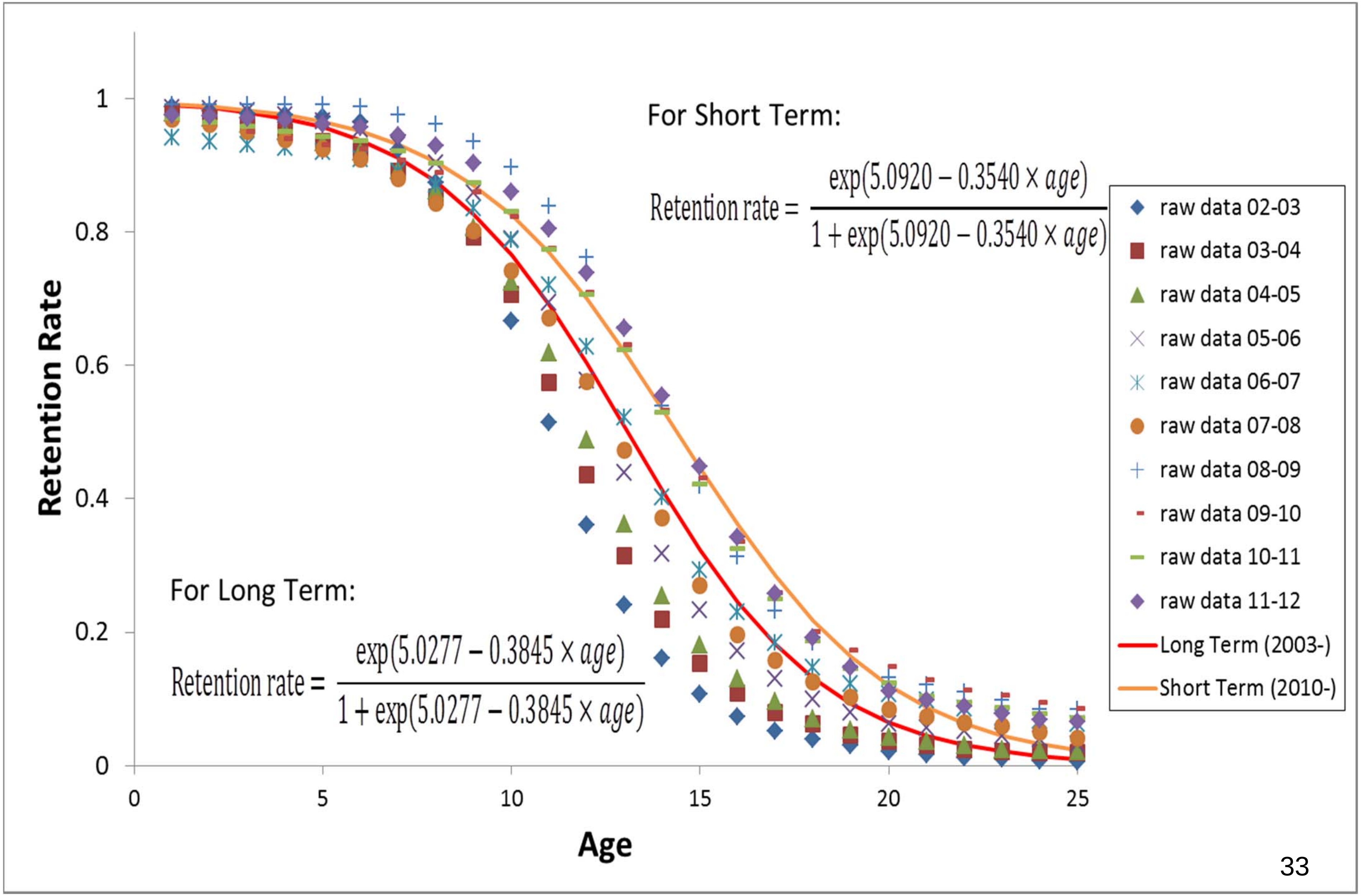


#The exact forecast method will smooth out the new sales, thus a bit different.

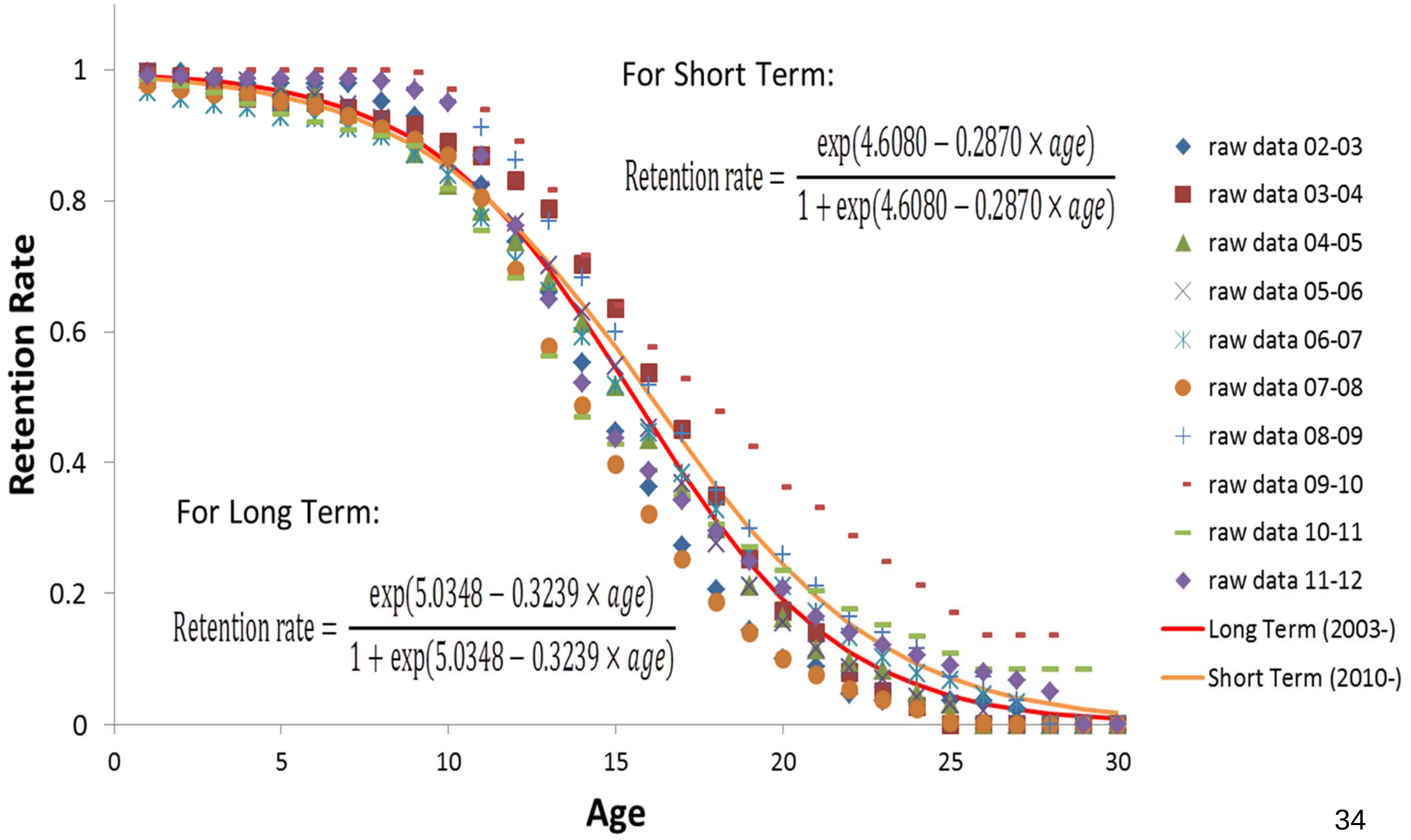
Distribution of Goods Vehicles > 15 t Population vs. 1st Reg. Year



Retention Rates for Private Cars



Retention Rates for Heavy-duty Goods Vehicles



EMFAC-HK Population Growth Rates from TD

EMFAC-HK V3.1.1

Year	Private Vehicles (private cars and motor cycles)	Goods Vehicles
	Average annual growth rates (up to the Year)	
2011	2.5%	0.0%
2015	3.5%#	0.5%
2016	4.0%#	0.5%
2021	3.0%	0.5%
2026	3.0%	0.5%
2031	3.0%	0.5%

#Note that TD's rates are given as 3% and 5% for mid-2015 to mid-2016 and mid-2016 to mid-2017. EMFAC-HK's growth rates work by year-end to year-end.

Exhaust Correction Factors

- Calculate each of the correction factors
- Call ExhCF_Altitude()
- Call ExhCF_Load()
- Call ExhCF_Speed()
- Call ExhCF_Temperature()
- Call ExhCF_NOx()
- Call ExhCF_AC()
- Call ExhCF_Fuel()
- Call ExhCF_HighIdle()
- ! Combine them into AllCF

- Call ExhCF_Finalize()

Speed and Grade Correction Factor

Speed correction Factors are calculated on the emission by speed bin.

For each speed bin, [VKT fraction spent in each speed bin] multiplied by

Example:

```
SCFactor = 0.0
        + SCF%Coefs(1) * (Speed - SAdj)
        + SCF%Coefs(2) * (Speed - SAdj)**2
        + SCF%Coefs(3) * (Speed - SAdj)**3
        + SCF%Coefs(4) * (Speed - SAdj)**4
```


AvgSCF = Sum over bin of [VKT Fraction Spent in each bin * SCFactors]

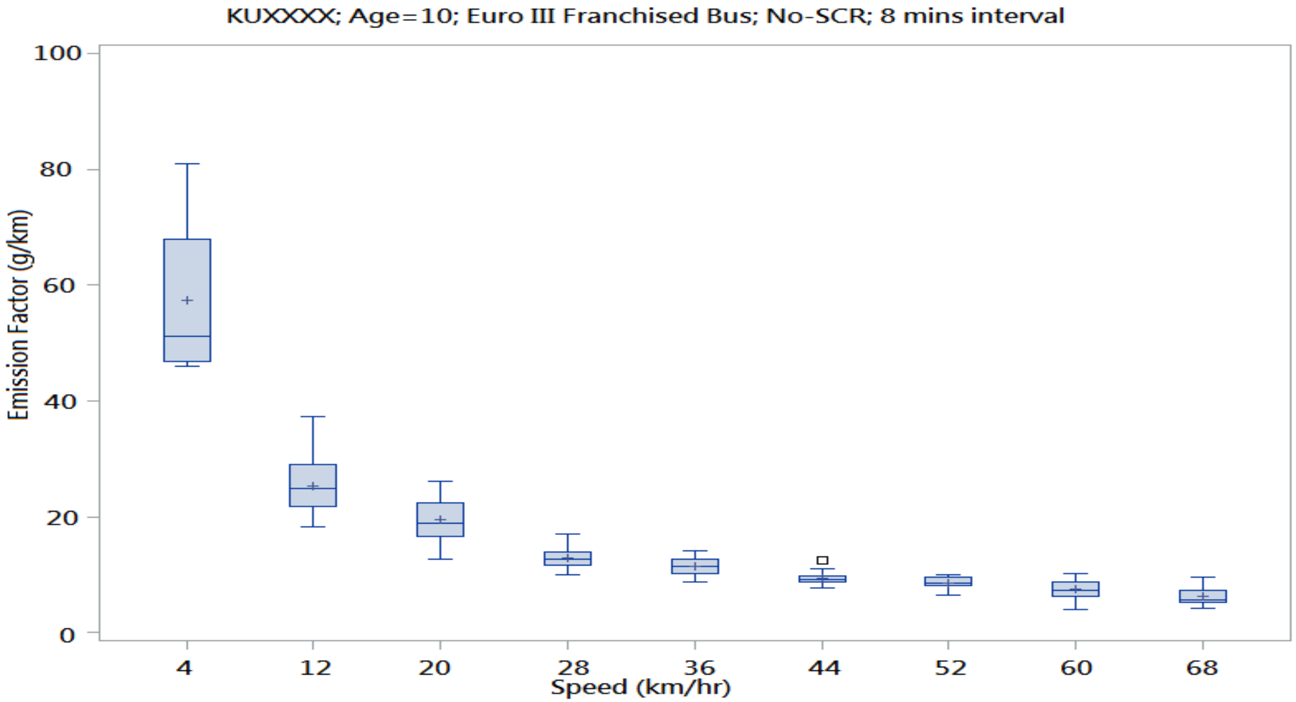
Calculation of Speed Correction Factors

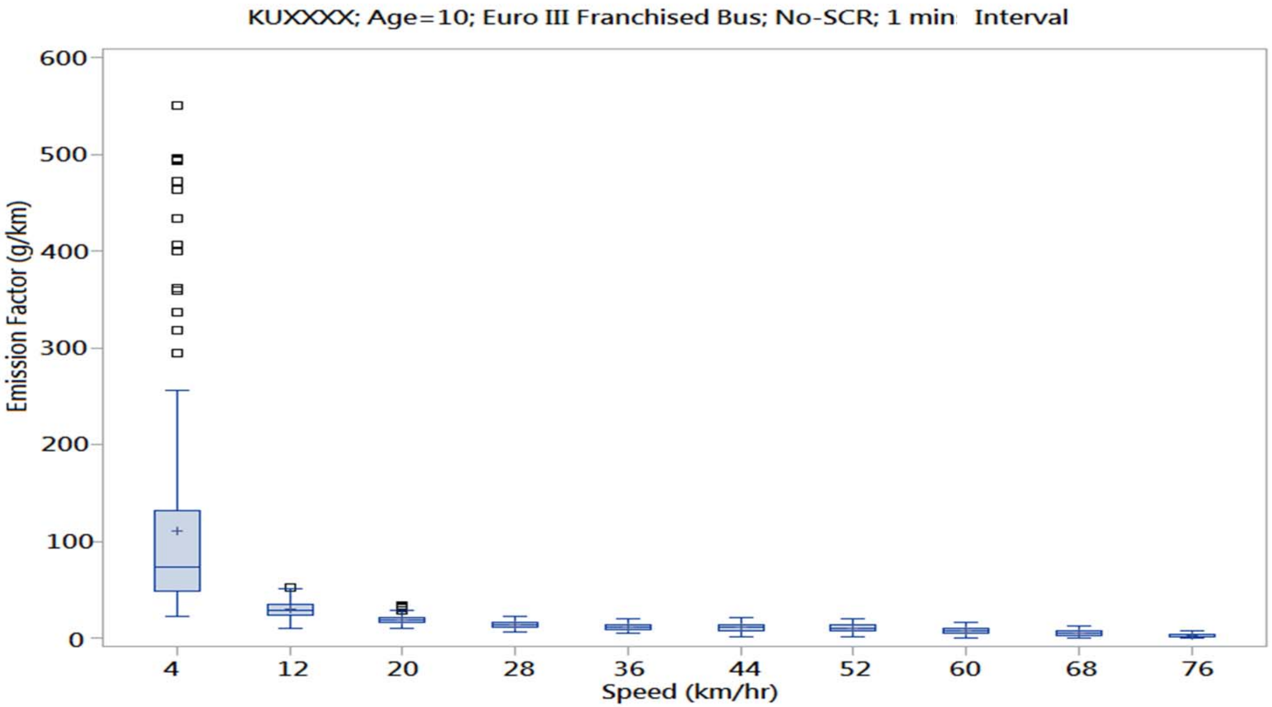
$$SCF_{speed} = \frac{Emissions_{speed}}{Emission_{speed=30km/hr}}$$

SCF is used:

- in Burden mode with Speed Fraction for emission estimation.
- in EMFAC mode to get the matrices of EF by speed

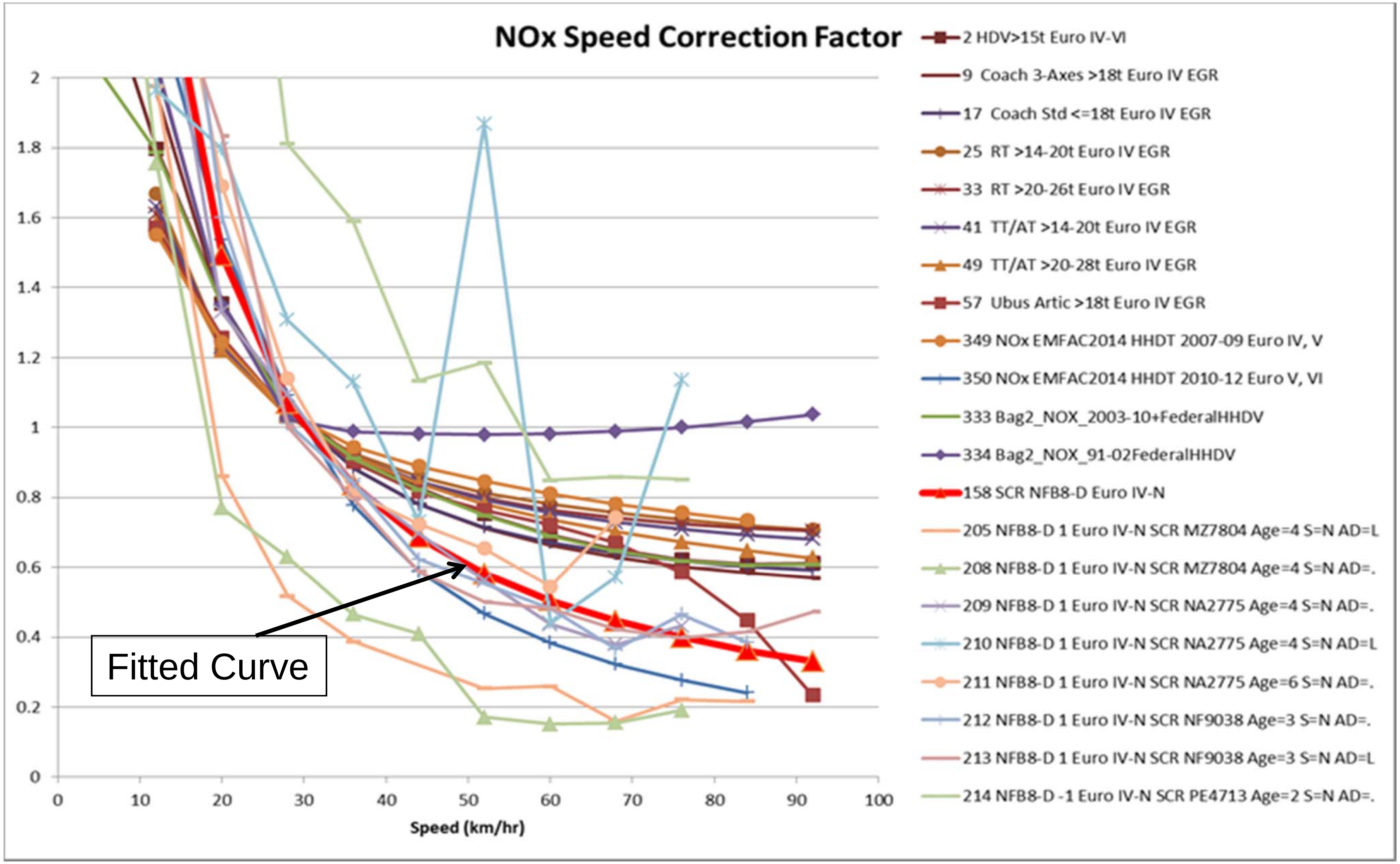
A Euro III Franchised Bus: 8-minute average NOx emission factors





The same Euro III Franchised Bus: 1-minute average NOx emission factors

NOx Speed Correction Factor: Euro IV Heavy Goods Vehicles and Non-Franchised Bus >15t with SCR



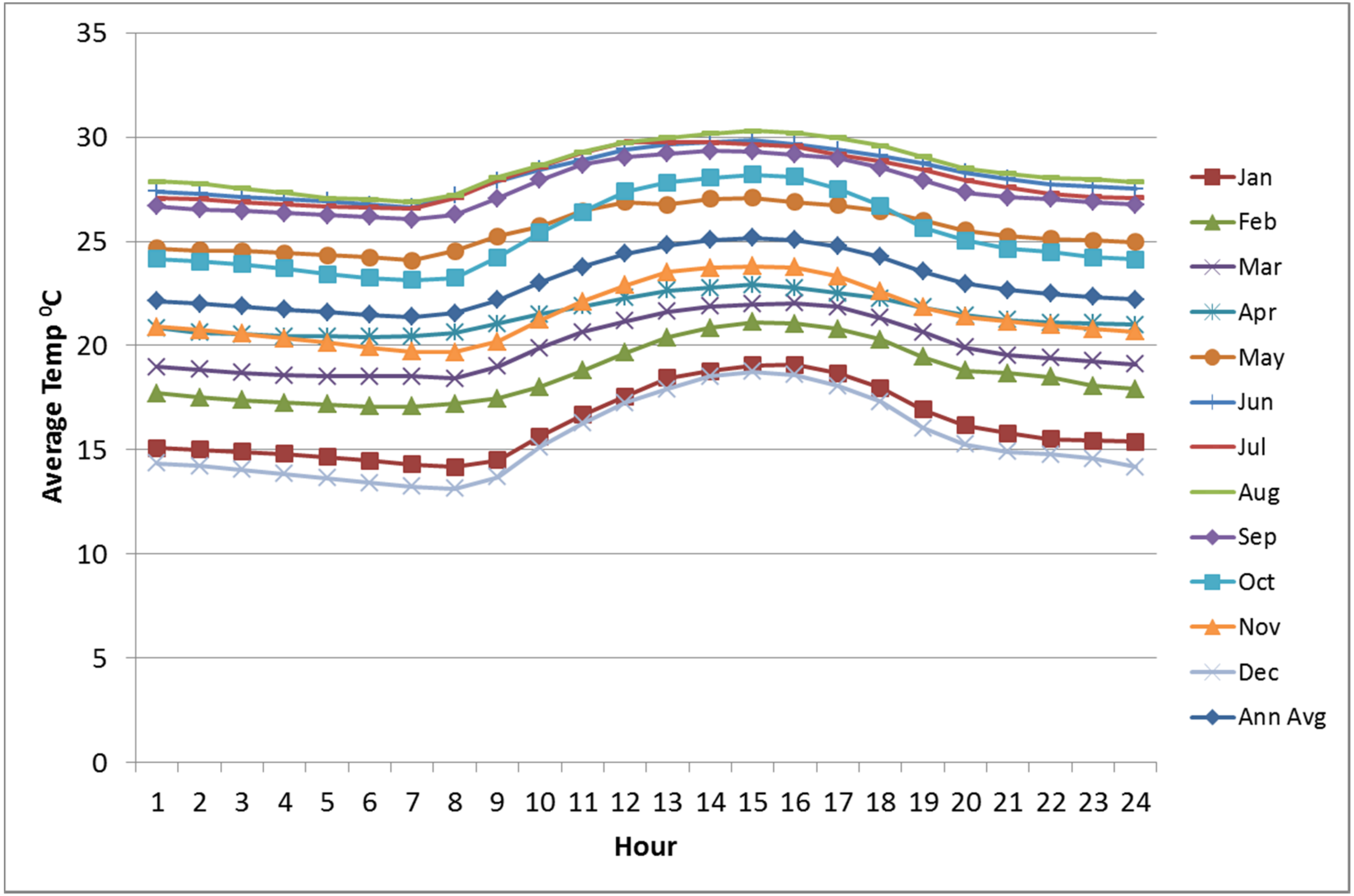
Temperature Correction Factor

- Temperature correction based on the temperature for area and hour
- For example, equation for cat vehicles is :

TCF = 1 + A * (TEMP-75) + B * (TEMP-75)**2 + C * (TEMP-75)***3

, where Coefficients A, B ,C are dependent on Pollutant, driving mode, and tech group.

Monthly Average Temperature by Hour in 2013



Humidity for NOx

The basic form of the correction factor is as follows:

$$RHUM\_CF = \frac{(1 + (M\_MANOS * (Ht - Hs))) * (1 + (M\_CLASS * (H - Hs)))}{1 + M\_CLASS * (Ht - Hs)}$$

where:

RHUM_CF = humidity correction factor (ratio)

M_MANOS = -0.0047, a constant derived by Manos et al (1972) in "Effect of Laboratory Conditions on Exhaust Emissions“

Ht = tech group specific base humidity (grains/lb) (different for Light and Heavy vehicles, stored in RHCFData.for)

Hs = 75 grains/lb, standard humidity

M_CLASS = tech group specific humidity correction factor constant (different for DSL and Petrol, stored in RHCFData.for)

H = scenario humidity to which correction is to be performed (grains/lb)

Absolute Humidity

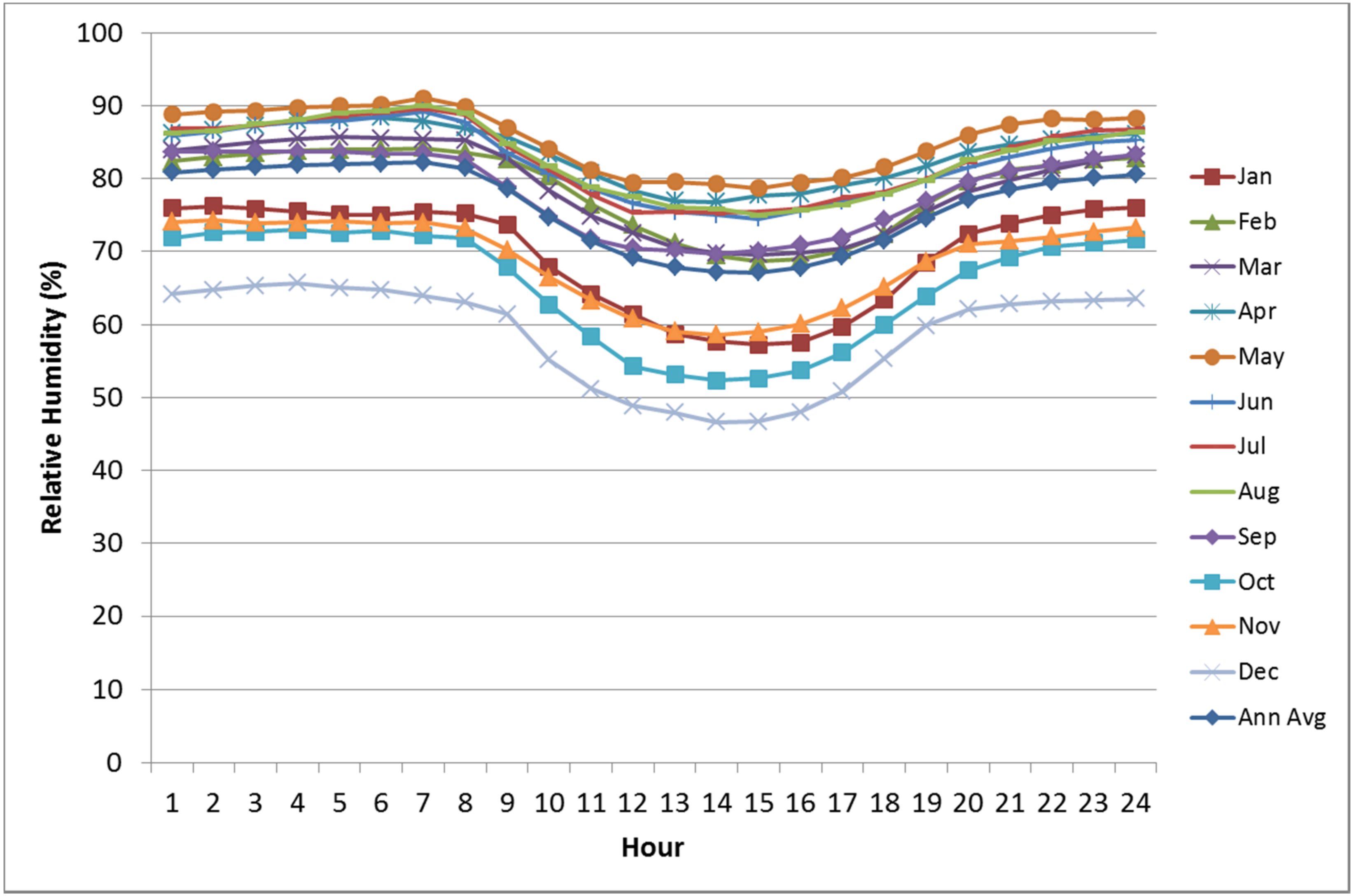
$H = RH * (A + B * T + C * T^{2} + D * T^{3})$

H = RH * (A + B * T + C * T**2 + D * T**3)

where:

H	= scenario humidity (grains/lb)
T	= scenario temperature (deg F)
A	= -0.09132
B	= 0.01594
C	= -0.00029
D	= 4.37E-06

Monthly Average Relative Humidity by Hour in 2013



AC Correction

BERadj = (ACon) * (m * BER + C) + (1 - ACon) * BER

where:

- BERadj = base emission rate adjusted for A/C usage
- ACon = air conditioning activity factor
- m = slope of regression equation
- BER = base emission rate
- C = constant from regression equation

AC On Fraction

ACon = ACfrac * ACfunc * COMPon

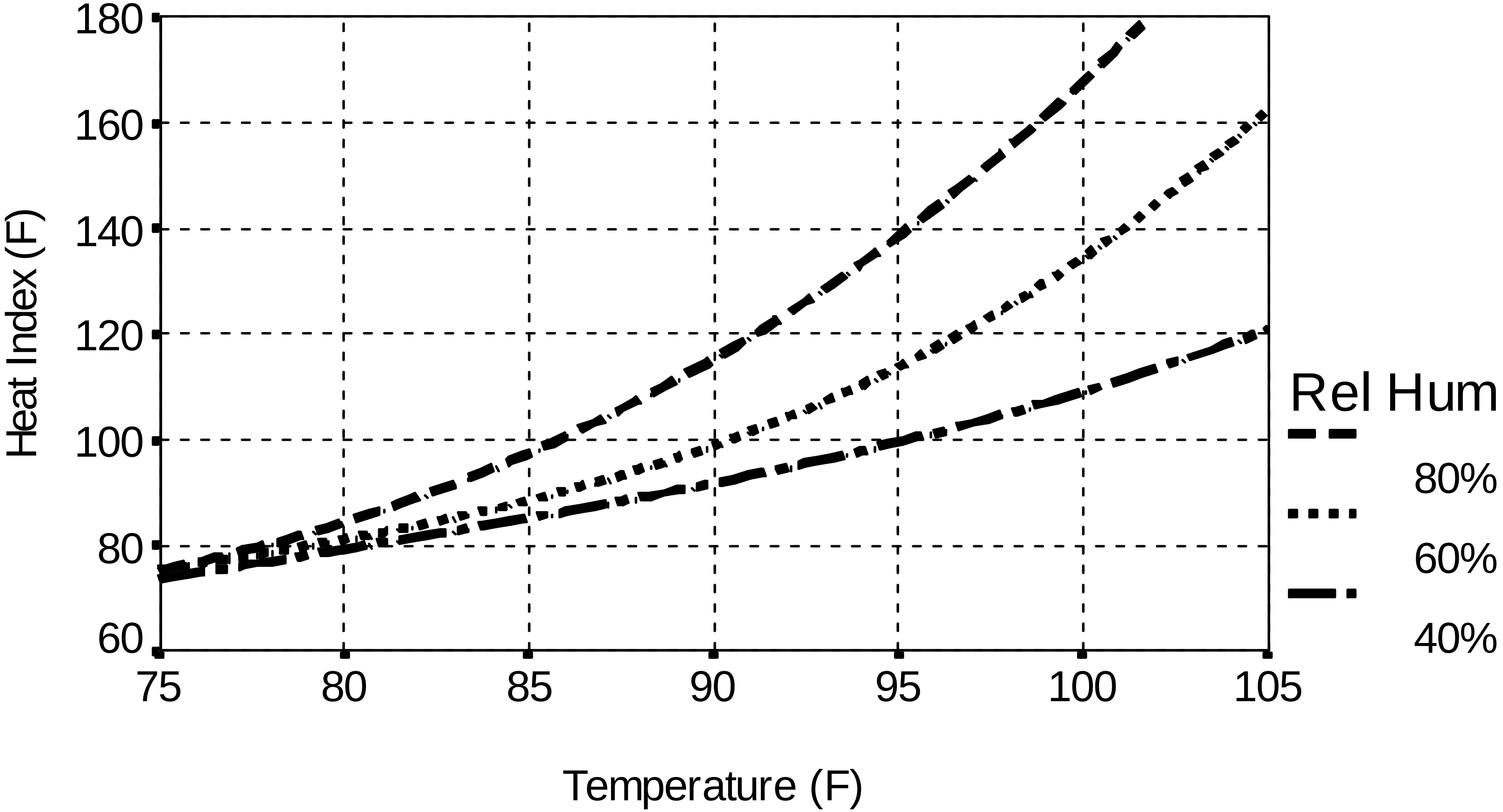
where:

ACfrac = Fraction of vehicles equipped with A/C units

ACfunc = Fraction of A/C units functional

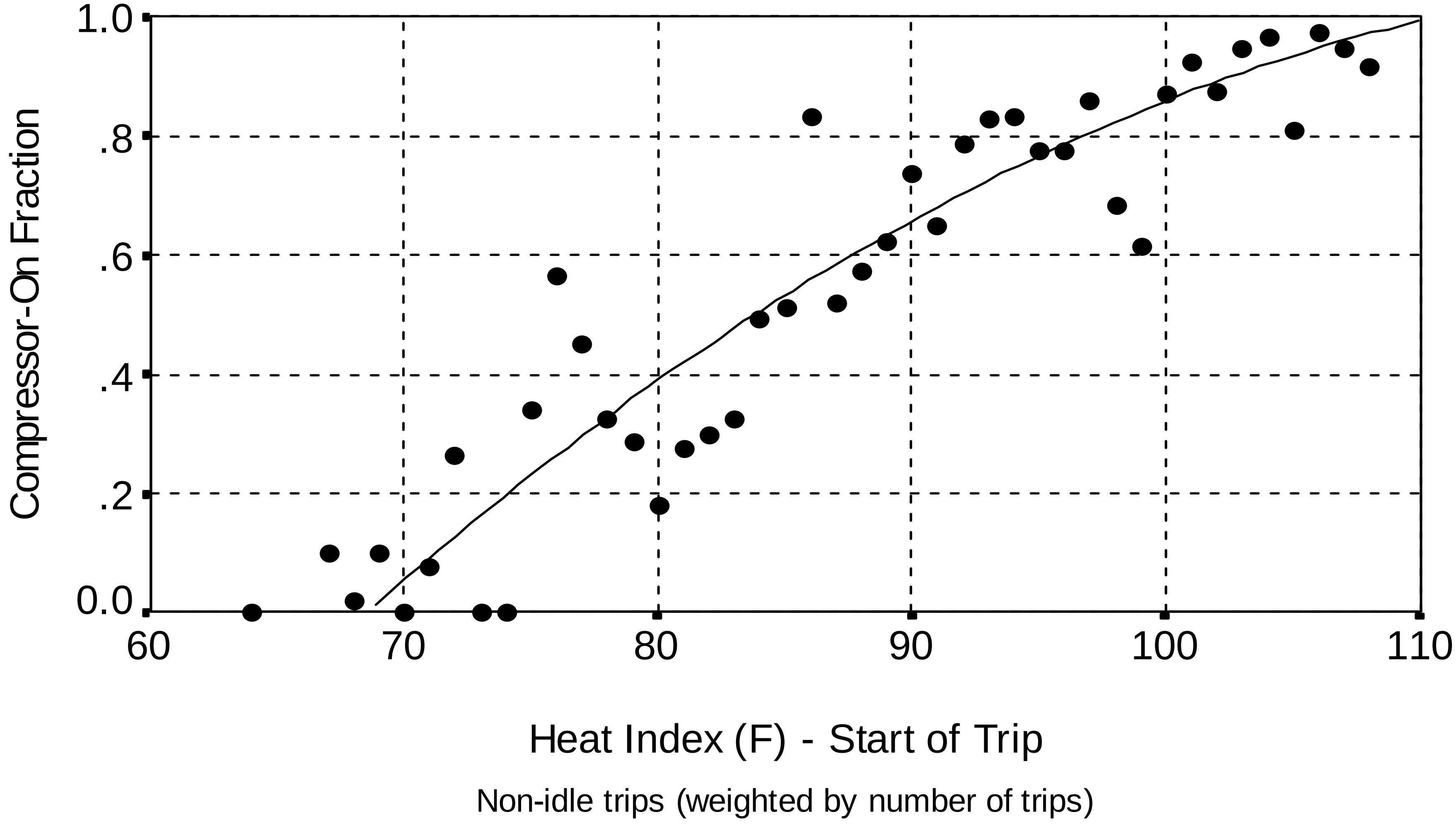
COMPon = Factor representing compressor activity as a function of temperature and humidity.

Temperature, Humidity, and Heat Index



Note: Heat Index values based on shady conditions

Compressor-On vs. Heat Index



Fuel Correction Factors

- Correction factors are dependent on
  - Driving mode
  - Pollutant
  - Season
  - Fuel regulation (via model year)
  - Tech group

Combined Correction Factor

Example for normal regime:

```
CF = CF
    &        + ALTCF
    &        * LOADCF
    &        * SCFACTOR(iPer, iReg)
    &        * EX_TCF(iMode,iAge,iPer,iMon,iReg)
    &        * RH_CF(iPer,iMon,iReg)
    &        * AC_CF(iPer,iAge,iMon)
    &        * FCF(iMode,iAge,iMon)
    &        * HI_CF
```

Burden Calculations

- Emission Rate E_{model_year}, for pollutant
- Correction Factors (CF)
- Activity (Population, VMT, Starts)
- Calculate for both No_I/M and Post I/M
- Estimate Tons/year :

  E_{model_year} * ALL_CF * Activity

```
Loop over all SCENARIOS in input file
    Loop over all AREAS in scenario
        Call Area_Average for activity
            Calculate activity for all GAIs
            For area-average case, calculate weighted-average activity for area
        Loop over all VEHICLE CLASSES in scenario
            Loop over all AGES allowed by scenario and calendar year
                Age and calendar year specify MODEL YEAR.
                Loop over EXHAUST TECH GROUPS
                    Calculate exhaust BERs
                        Running, start, and idle basic emission rates
                    Calculate I/M benefit
                    Calculate exhaust correction factors
                    Calculate and accumulate tons [Burden mode]
                    Write tech-group report detail [Burden mode]
                Loop over EVAP TECH GROUPS
                    For six evap processes...
                    Calculate evap BERs
                    Calculate I/M benefit
                    Calculate evap correction factors
                    Calculate and accumulate tons [Burden mode]
                    Write tech-group report detail [Burden mode]
                Write model year and speed report detail [Burden mode]
                Calculate and accumulate grams [Emfac mode]
            Write vehicle class and speed report detail [Burden mode]
            Write vehicle class report [Emfac mode]
        Write area and speed report detail [Burden mode]
        Write area-based report(s) [Burden mode]
        Write area-based report(s) [Emfac mode]
```

Evaporative Emissions

- Evap calculations are done for a specific combination of:
  - Calendar year,
  - Area,
  - Vehicle class,
  - Vehicle age, and
  - Evap technology group.
- Evap emissions are calculated for six distinct emissions processes:
  - Hot soak
  - Running losses
  - Partial-day resting losses
  - Multi-day resting losses
  - Partial-day diurnal losses
  - Multi-day diurnal losses
- There are three emitter class regimes defined in the model:
  - Normal
  - Moderate
  - High

Hot Soak Emissions

Basic Emission Rates are calculated for each emitter regime as:

Type of Equation Based on Tech Group		Age	Odometer
	Linear	1	2
	Exponential	3	4

Emissions Calculations:

$$EF_{N,M,H} = EF_O + Det * \begin{bmatrix} Age \\ or \\ Odo \end{bmatrix}$$

or

$$= \exp\left(EF_O + Det \begin{bmatrix} Age \\ or \\ Odo \end{bmatrix} \right)$$

Running Loss Emissions

Emission rates for running loss emissions are calculated by the use of the following equation:

$$EF_{(N,M,H)} = Zm + DR * Odo + RL\_Age * Age$$

A correction factor is calculated for use later which accounts for increased running loss due to longer trips. This factor is calculated as:

RL_TOF = RL_TIME * TIME_ON[a1]
Evap_EF = $EF_{(N,M,H)}$ + RL_TOF

Partial Day Resting Losses

Stored in :

Partial day results:	Rest_BER(1,:,:,:)
Single day results:	Rest_BER(2,:,:,:)
Multiple day results:	Rest_BER(3,:,:,:)

Next, the BER is calculated as a function of temperature T. For normal and moderate emitters, between 55F and 65F the emissions relationship is linear:

$Rest\_BER\_All = (T-55) * EF_4 * RVP\_CF$

Beyond 65°F, the equation form used is a polynomial in temperature:
$Rest\_BER\_All = [EF_0 + EF_1 * T + EF_2 * T^2 + EF_3 * T^3] * RVP\_CF$

Where:

Numerator = A + B * (T+15) + C * RVP + D * (T+15) * RVP
Denominator = A + B * (T+15) + C * 9.0 + D * (T+15) * 9.0

RVP_CF = Numerator/Denominator

The Coefficients A,B, C, and D are stored in Array EVAP_TCF, which is the file TCF_Data.for

Multiple Day Resting Losses

Multiple day resting losses are calculated by scaling the partial day BERs with a multi-day factor selected based on the tech group:

$$Rest\_BER\_All_2 = Rest\_BER\_All_1 * MD\_Factor_2$$
$$Rest\_BER\_All_3 = Rest\_BER\_All_1 * MD\_Factor_3$$

Partial Day Diurnal Emissions

Stored in :

Partial day results:	Drnl_BER(1,:,:,:)
Single day results:	Drnl_BER(2,:,:,:)
Multiple day results:	Drnl_BER(3,:,:,:)

Diurnal emission factors are a function of primary temperature and RVP. In the EVAP subroutine an additive emission factor is estimated as follows and another multiplicative emission factor is applied in Burden.

Drnl_BER = F (T)
= Additive in Evap Subroutine
= Multiplicative in Burden

$$Drnl\_CF = CF_0 + CF_1 * (T + 15) + CF_2 * RVP + CF_3 * (Temp + 15) * RVP$$

$$Drnl\_BER(1) = A + B * Temp + C * Temp^2 + D * Temp^3 + Dirnl\_CF$$

Diurnal losses only occur when temperature is rising.
Diurnal emission factors are stored for each vehicle age, emitter category, and tech group.

Multiple Day Diurnal Emissions

Multiple day diurnal losses are calculated by scaling the partial day BERs with a multi-day factor selected based on the tech group:

$Drnl\_BER\_All_2 = Drnl\_BER\_All_1 * MD\_Factor_2$
$Drnl\_BER\_All_3 = Drnl\_BER\_All_1 * MD\_Factor_3$

Evap Correction Factors

Hot Soak Correction

Temperature and RVP correction: The hot soak corrections for temperature and RVP are based on "correcting" temperature from 75F to actual and "correcting" RVP from 9.0psi to actual, using the following equation form:

$$HS\_RVP\_TEMP\_CF = \frac{\exp(A + B * (T - 75) + C * (Rvp - 9))}{\exp(A + B * (75 - 75) + C * (9 - 9))}$$

Estimate the number of soak events in time periods that are below 40 minutes (5 periods, periods are 0-5, 6-10, 11-20, 21-30, 31-40 (with mean of 35), 41-50, 51-60, 61-120 etc.)

Run_Frac allows us to discount the hot soak emissions which follow very short trips (4 minutes or less).

$$\text{Run Frac} = \left[\frac{\text{Sum of Trips which are greather than 5 minutes}}{\text{Sum of all trips}}\right]$$

$P = [C_1 * [C_2 t + C_3 t^2 + C_4 t^3 + C_5 t^4]/C_6/100]$
F = frequency of trips with this time-off period at this hour

Where t is the length of the time-off period from TIME_OFF, C_1 to C_6 are constants specific to the emitter regime, and F is evaluated from array TIME_OFF_FREQ.

Partial _Soak factor = Sum(P*F) / Sum(F)

The function result is the combination of the two corrections:

HS_BER_TO_GM_PER_HR = Run_Frac * **Partial_Soak**

The final hot soak correction factor is the combination of temperature and RVP correction and basis conversion:

CF = HS_RVP_TEMP_CF * HS_BER_TO_GM_PER_HR

Running Loss Correction

$$RL_{CF} = \frac{A + Time\_On * (B * RVP * Temp + C + RVP + D * Temp)}{E + F * TIME\_ON}$$

RL_{CF} are only valid for Time_On values < 60 minutes

Evap EF ( ) =

$$\sum_{TIMEON} RL\_TOF * RL_{cf} * TIME\_ON\_FREQ$$

Time ON Matrix

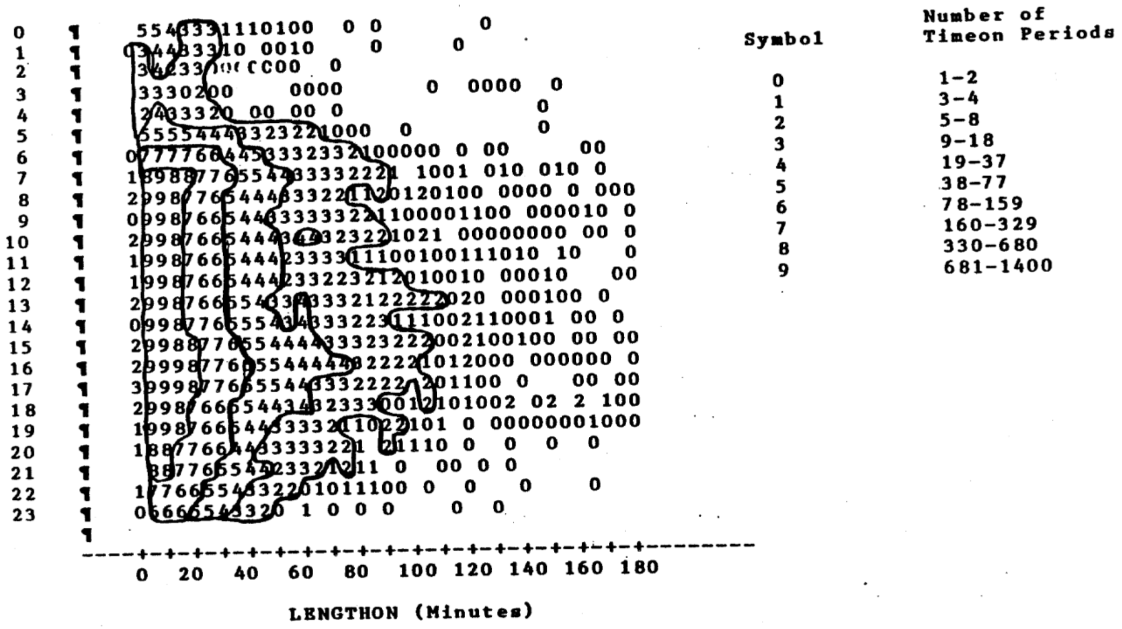


Figure 6-11. Frequency Distributions of Timeon Periods (Monday-Friday)

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Diurnal and Resting Loss Corrections

The four resting and diurnal loss processes are not corrected any further for RVP and Temperature, the corrections are include in the raw BER:

Partial day resting loss CF	=	1.0
Multi-Day Resting Loss CF	=	1.0
Partial Day Diurnal CF	=	1.0
Multi-Day Diurnal CF	=	1.0

Evap EF = Rest_BER (1,2,3) * Activity (AT_Rest(1,2,3)

Evap EF = Diurnal_BER (1,2,3) * Activity (AT_Rest(1,2,3)

Partial – Index 1
Multiple – Sum of 2 and 3

Time OFF (AT_Rest) Matrix

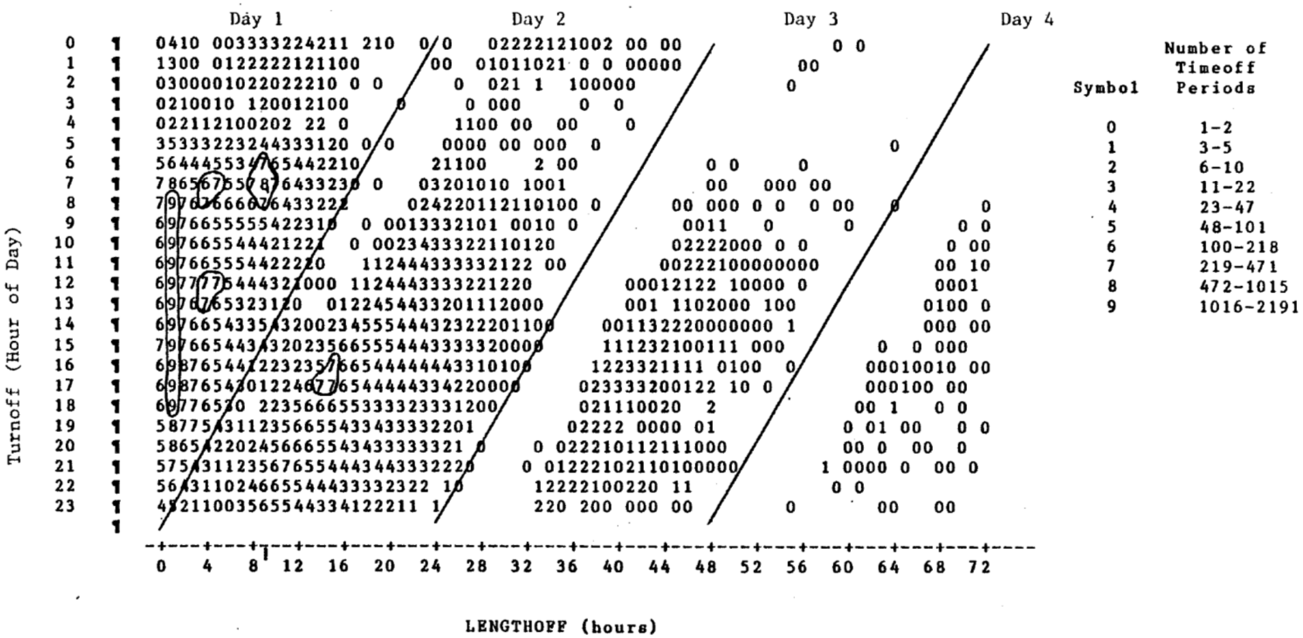

Figure 6-3. Frequency Distribution of Timeoff Periods (Monday-Friday)

The End