Exercises 4-6

Exercise Setup

- Folders for each Exercise

- User to save input/output to folders for each Exercise

Exercise #4: Changing Technology Group Fractions

- Context: This example evaluates emission changes if the Government introduces a tax incentive program. In this case, introducing Euro V in 2010 for light goods vehicles greater than 3.5 tonnes (vehicle class LGV6).

- The table below shows the accelerate phase-in of Euro V for LGV6
  - Model Year: 2010-2012 40% Euro V
  - Model Year: 2013+ 100%

Exercise #4: Changing TG Fractions

- Scenario data:
  - Geographic Area: Hong Kong SAR
  - Calendar Years: 2015
  - Season: Annual
  - Scenario Type: BURDEN
  - Output File types: Text (CSV)
  - Output Frequency: daily
  - Pollutants: PM10, VOC
- Perform a Base Case Run
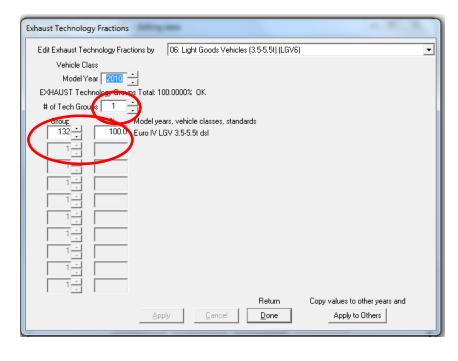- Update Tech Group (TG) distribution using data on next slide
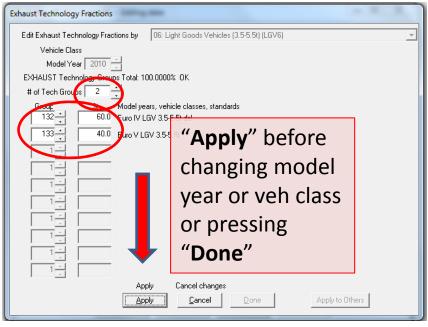
Exercise #4: New LGV6 Exhaust TG Fractions to Apply

Exh TG ->	132	133
Model Year	Euro IV	Euro V
2010	60%	40%

Exercise #4: Exhaust TG Modification Tab

Before Edit

After Edit

"**Apply**" before changing model year or veh class or pressing "**Done**"

Exercise #4: Solution

VEH TYPE	VEH TECH	POLLUTANT	PROCESS	EMISSIONS	BASIS	Case
LGV6	DSL	NOx	Run Exh	6.09	Day	Base Case
LGV6	DSL	NOx	Run Exh	6.02	Day	Euro V

VEH TYPE	VEH TECH	POLLUTANT	PROCESS	EMISSIONS	BASIS	Case
LGV6	DSL	NOx		0.08	Day	Difference

Exercise #5: Changing VKT

- Context: EMFAC users involved with planning are frequently asked to estimate emissions for an area, say Kwai Chung, in Hong Kong. The territory-wide VKT by vehicle class and fuel type will not be applicable here resulting in a change in VKT. VKT by class will have to be changed. We take one vehicle class and one fuel type, say petrol private cars, as an example.

- Two ways the user can change VKT:
  1) adjust the population to match desired VKT since VKT is calculated from Population*Accrual (i.e., "conformity" approach); or,
  2) directly alter via the VKT GUI

Exercise #5: Changing VKT

- Problem: Determine emissions in 2015 for petrol private cars (Vehicle Class 1) given a forecasted VKT of 1,609,000 km/day.

- This Exercise will be conducted in three phases:
  - 5: "base" case
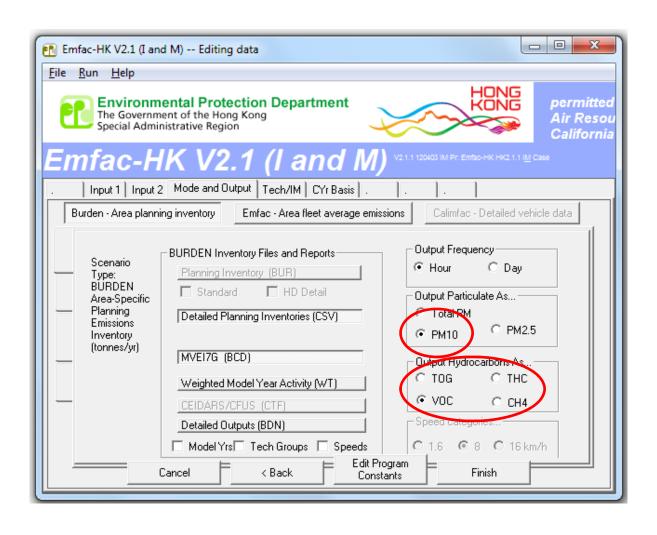 - 5a: "conformity" adjustment
  - 5b: direct VKT adjustment

Exercise #5a: Changing VKT ("Conformity" Approach)

- Scenario data:
  - Geographic Area: Hong Kong SAR
  - Calendar Years: 2015
  - Season: Annual
  - Scenario Type: BURDEN
  - Output File types: Text (CSV), BCD
  - Output Frequency: hourly
  - Pollutants: PM_{10}, VOC

- VKT for private cars = 1,609,000 km/day

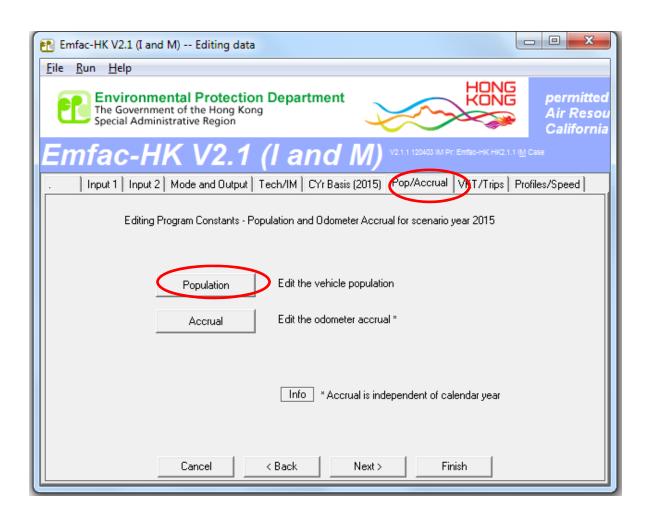- Use "conformity" approach: adjust population to match desired VKT

Exercise #5a: Notes

- Determine Population Adjustment to Match VKT
  - Find "base" population and VKT for vehicle class and fuel for 2015.
    - Enter scenario data in Input 1 screen
    - Edit Program Constants
    - Click "Population" key in Tab Pop/Accrual Screen
      - Select *By Vehicle and Fuel*:
      - PC petrol population? (Vehicle Class 1, Fuel=1):
    - Advance to VKT Screen
      - Tab *By Vehicle and Fuel*:
      - PC VKT (Vehicle Class=1, Fuel=1)?:
  - Determine VKT adjustment factor?
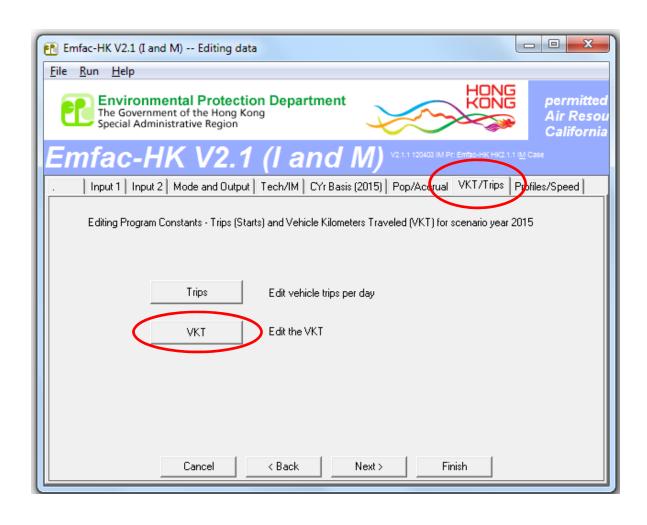
- Multiply population by VKT adjustment factor:

Exercise #5a: Mode and Output Tab
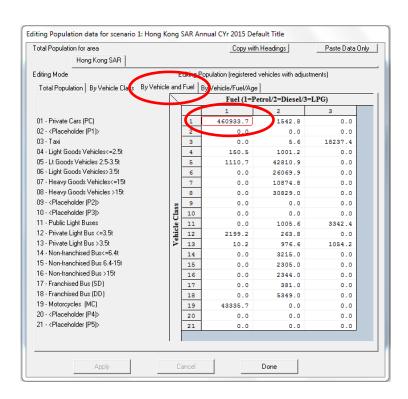
Exercise #5a: Pop/Accrual Tab
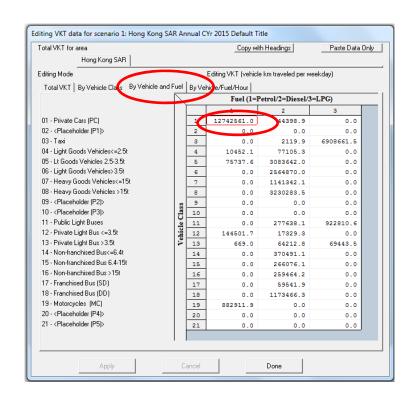
Exercise #5a: VKT/Trips Tab

Exercise #5a: Base Case Values

2015 Population by Fuel
460933 vehicles (gas/petrol)

2015 VKT by Fuel
12,742,561 km/day (1=gas/petrol)

Editing Population data for scenario 1: Hong Kong SAR Annual CYr 2015 Default Title

Total Population for area | Copy with Headings | Paste Data Only

Hong Kong SAR

Editing Mode — Editing Population (registered vehicles with adjustments)

Total Population | By Vehicle Class | By Vehicle and Fuel | By Vehicle/Fuel/Age

Fuel (1=Petrol/2=Diesel/3=LPG)

Vehicle Class		1	2	3
01 - Private Cars (PC)	1	460933.7	1542.8	0.0
02 - <Placeholder (P1)>	2	0.0	0.0	0.0
03 - Taxi	3	0.0	5.6	18237.4
04 - Light Goods Vehicles<=2.5t	4	150.5	1001.2	0.0
05 - Lt Goods Vehicles 2.5-3.5t	5	1110.7	42810.9	0.0
06 - Light Goods Vehicles>3.5t	6	0.0	26069.9	0.0
07 - Heavy Goods Vehicles<=15t	7	0.0	10874.8	0.0
08 - Heavy Goods Vehicles >15t	8	0.0	30829.0	0.0
09 - <Placeholder (P2)>	9	0.0	0.0	0.0
10 - <Placeholder (P3)>	10	0.0	0.0	0.0
11 - Public Light Buses	11	0.0	1005.6	3342.4
12 - Private Light Bus <=3.5t	12	2199.2	263.8	0.0
13 - Private Light Bus >3.5t	13	10.2	976.6	1054.2
14 - Non-franchised Bus<=6.4t	14	0.0	3215.0	0.0
15 - Non-franchised Bus 6.4-15t	15	0.0	2305.0	0.0
16 - Non-franchised Bus >15t	16	0.0	2344.0	0.0
17 - Franchised Bus (SD)	17	0.0	381.0	0.0
18 - Franchised Bus (DD)	18	0.0	5349.0	0.0
19 - Motorcycles (MC)	19	43335.7	0.0	0.0
20 - <Placeholder (P4)>	20	0.0	0.0	0.0
21 - <Placeholder (P5)>	21	0.0	0.0	0.0

Apply | Cancel | Done

Editing VKT data for scenario 1: Hong Kong SAR Annual CYr 2015 Default Title

Total VKT for area | Copy with Headings | Paste Data Only

Hong Kong SAR

Editing Mode — Editing VKT (vehicle km traveled per weekday)

Total VKT | By Vehicle Class | By Vehicle and Fuel | By Vehicle/Fuel/Hour

Fuel (1=Petrol/2=Diesel/3=LPG)

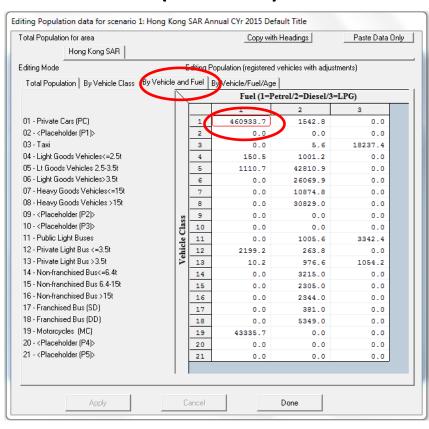| Vehicle Class		1	2	3
01 - Private Cars (PC)	1	12742561.0	44398.9	0.0
02 - <Placeholder (P1)>	2	0.0	0.0	0.0
03 - Taxi	3	0.0	2119.9	6908661.5
04 - Light Goods Vehicles<=2.5t	4	10452.1	77105.3	0.0
05 - Lt Goods Vehicles 2.5-3.5t	5	75737.6	3083642.0	0.0
06 - Light Goods Vehicles>3.5t	6	0.0	2564870.0	0.0
07 - Heavy Goods Vehicles<=15t	7	0.0	1141342.1	0.0
08 - Heavy Goods Vehicles >15t	8	0.0	3230283.5	0.0
09 - <Placeholder (P2)>	9	0.0	0.0	0.0
10 - <Placeholder (P3)>	10	0.0	0.0	0.0
11 - Public Light Buses	11	0.0	277638.1	922810.6
12 - Private Light Bus <=3.5t	12	144501.7	17329.3	0.0
13 - Private Light Bus >3.5t	13	669.0	64212.8	69443.5
14 - Non-franchised Bus<=6.4t	14	0.0	370491.1	0.0
15 - Non-franchised Bus 6.4-15t	15	0.0	266076.1	0.0
16 - Non-franchised Bus >15t	16	0.0	259464.2	0.0
17 - Franchised Bus (SD)	17	0.0	59541.9	0.0
18 - Franchised Bus (DD)	18	0.0	1173466.3	0.0
19 - Motorcycles (MC)	19	882911.9	0.0	0.0
20 - <Placeholder (P4)>	20	0.0	0.0	0.0
21 - <Placeholder (P5)>	21	0.0	0.0	0.0

Apply | Cancel | Done

Exercise #5a: VKT Adjustment using Population

- Find "base" population and VKT for vehicle class and fuel (PC petrol) for 2015:
  - Population (2015): 460,933 vehicles
  - VLT (2015 base): 12,742,561 kilometers
- Determine VKT adjustment factor:
  - 1609000/12742561 = 0.12627
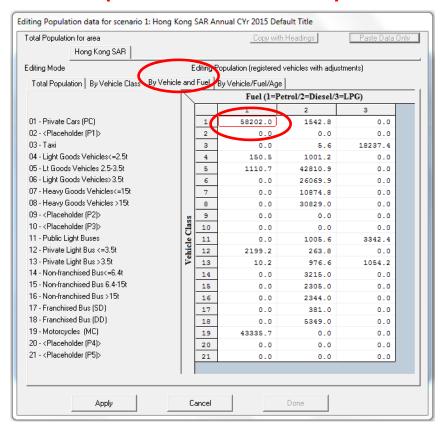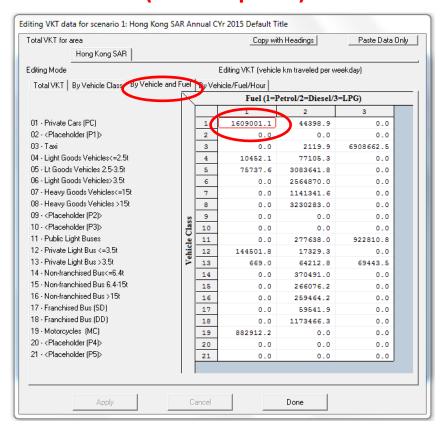- Multiply population by factor:
  - 460933 * 0.1274 = 58202

Exercise #5a: Population Edits

2015 Population
(Base Case)

2015 Population
(Edited for VKT Match)

Exercise #5a: Verify VKT Adjustment

**2015 VKT
(Base Case)**

**2015 VKT
(After Pop Edit)**

Exercise #5b: Changing VKT (Directly)

- Problem: Determine emissions in 2015 for petrol private cars (Vehicle Class 1) given a forecasted VKT of 1,609,000 km/day.

- Scenario data:
  - Geographic Area: Hong Kong SAR
  - Calendar Years: 2015
  - Season: Annual
  - Scenario Type: BURDEN
  - Output File types: Text (CSV), BCD
  - Output Frequency: hourly
  - Pollutants: PM_{10}, VOC

- VKT for petrol private cars = 1,609,000 km/day

- Direct entry of new VKT

Exercise #5b: Editing VKT Screen

2015 VKT
(Base Case)

2015 VKT
(After VKT Edit)

Exercise #5c: Changing VKT - Comparison of #5a and #5b Output

- Problem: determine difference in NOx running and starting exhaust emissions output from Exercises #5a and #5b for petrol private cars.

- Purpose: examine results from alternate VKT edit approaches

- Extract/compare NOx running and starting exhaust emissions from Test/*.CSV. Use values for the day.

  – Note: you'll need to add results for NCAT and CAT

Exercise #5c: Solution

Process	Base	#5a: Pop-adjusted VKT	#5b: VKT direct
Vehicles	460934	**58202**	460934
VKT	12742561	1609005	1609000
Trips	691400	**87303**	691400
Run Exhaust (tonne/day)	0.568	0.0717	0.0717
Start Exhaust (tonne/day)	0.0899	**0.01135**	0.0899

Notes:
Results show how the model adjusted trips in Exercise #5a, thus, starting exhaust as well. Running exhaust emissions do not differ.
Exercise #5b shows it is possible to directly input VKT into EMFAC-HK; however, it is generally not recommended to do this independent of vehicle population because of the desire to properly estimate start and evaporative emissions tied to the size of the vehicle fleet.

Exercise #6: Changing Trips

- Context: If Hong Kong institutes a new Transportation Control Measure (TCM) that reduces trips for petrol Private Cars in 2015 to 250,000 trips per day. The planner is then asked to estimate the potential emission reductions from this new TCM. There are two potential methods for doing this analysis and both are examined in this Exercise.

    1)   adjust the population to match desired trips (i.e., "conformity" approach);
    2)   Directly alter via the Trips GUI

    – If VKT only is changed, the model alters number of trips/starts in order to match VKT.

- This Exercise will be conducted in two phases:
    – 6a: "conformity" adjustment
    – 6b: direct trips adjustment

Exercise #6a: Changing Trips ("Conformity" Approach)

- Problem: Determine emissions in 2015 for PC petrol(MC Vehicle Class 1) given forecasted trips of 250,000 trips/day.   Use MC model only.

- Scenario data:
  - Geographic Area: Hong Kong SAR
  - Calendar Years: 2015
  - Season: Annual
  - Scenario Type: BURDEN
  - Output File types: Text (CSV), BCD
  - Output Frequency: day
  - Pollutants: PM_{10}, VOC

- Trips for PC petrol cars = 250,000 trips/day

- Use "conformity" approach: adjust population to match desired trips

Exercise #6a: Notes

- Determine Population Adjustment to Match Trips
  - use "base" population and trips for vehicle class and fuel (PC petrol) for 2015.
    - Enter scenario data in Input 1 screen
    - Edit Program Constants
    - Advance to Population Screen
      - Tab *By Vehicle and Fuel*:
      - PC petrol population? (Vehicle Class 1, Fuel=1):
    - Advance to Trips Screen
      - Tab *By Vehicle and Fuel*:
      - PC petrol trips (Vehicle Class=1, Fuel=1)?:
  - Determine Trips adjustment factor?

- Multiply population by trips adjustment factor:

Exercise #6a: Base Case Values

2015 Population by Fuel
460934 vehicles (gas/petrol)

2015 Trips by Fuel
691400 trips (gas/petrol)

Exercise #6a: Trips Adjustment using Population

- Find "base" population and trips for vehicle class and fuel (PC petrol) for 2015:
  - Population (2015): 460,934 vehicles
  - Trips (2015 base): 691,400 trips
- Determine Trips adjustment factor:
  - 250000/691400 = 0.361
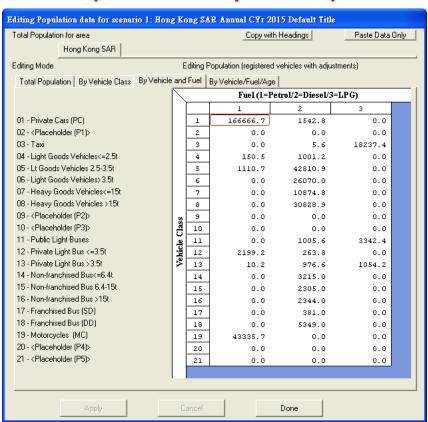- Multiply population by factor:
  - 460934 * 0.361 = 166667 vehicles

Exercise #6a: Population Edits

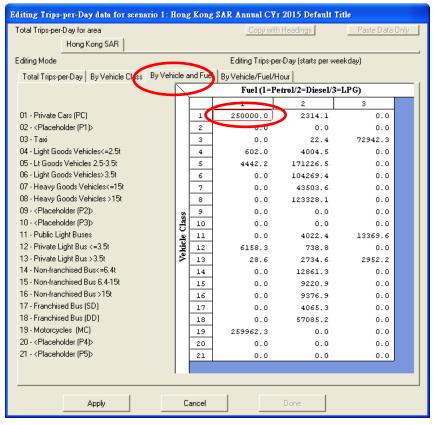**2015 Population
(Base Case)**

**2015 Population
(Edited for Trips Match)**

Exercise #6a: Verify Trips Adjustment

**2015 Trips
(Base Case)**

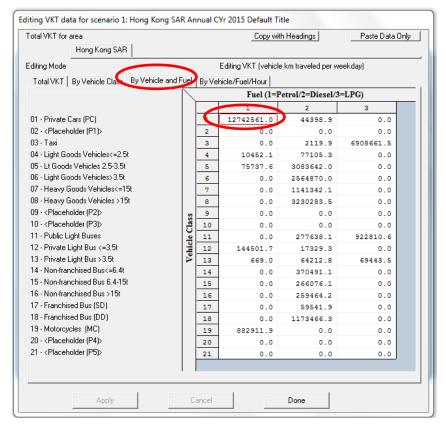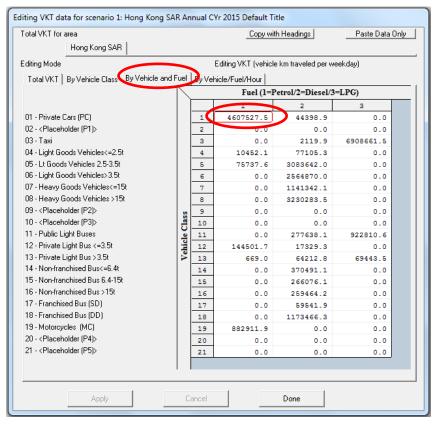**2015 Trips
(After Pop Edit)**

Exercise #6a: VKT Adjustment after Population Adjustment

**2015 VKT
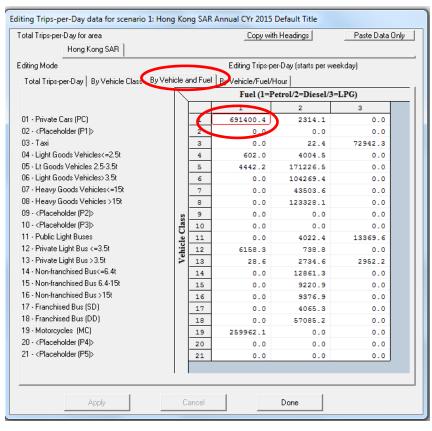(Base Case)**

**2015 VKT
(After Pop Edit)**
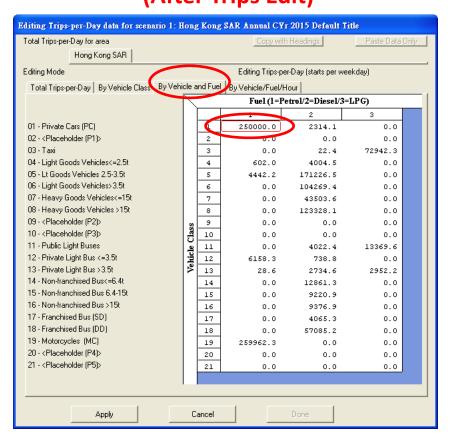
Exercise #6b: Changing Trips (Directly)

- Problem: Determine emissions in 2015 for PC petrol (Vehicle Class 1) given a forecast of 250,000 trips/day.

- Scenario data:
  - Geographic Area: Hong Kong SAR
  - Calendar Years: 2015
  - Season: Annual
  - Scenario Type: BURDEN
  - Output File types: Text (CSV), BCD
  - Output Frequency: hourly
  - Pollutants: PM_{10}, VOC

- Trips for PC petrol cars = 250,000

- Direct entry of new trips

Exercise #6b: Editing Trips Screen

**2015 Trips
(Base Case)**

**2015 Trips
(After Trips Edit)**

Exercise #6c: Changing VKT - Comparison of #6a and #6b Output

- Problem: determine difference in NOx running and starting exhaust emissions output from Exercises #6a and #6b for PC petrol cars.

- Purpose: examine results from alternate trip edit approaches

- Extract/compare NOx running and starting exhaust emissions from Test/*.CSV. Use values for the day.

    - Note: you'll need to add results for NCAT and CAT

Exercise #6c: Solution

Process	Base	#6a: Pop-adjusted Trips	#6b: Trips direct
Vehicles	460934	166667	460934
VKT	12742594	**4604530**	12742594
Trips	691400	250000	250000
Run Exhaust	0.568	**0.205**	0.568
Start Exhaust	0.0899	**0.0325**	0.0325

Notes:
Results show how altering trips via population (#6a) also alters VKT; thus, running exhaust is altered, as well. Exercise #6b shows altering trips only reduces starting exhaust.