

# VECTO 2.0



## Update Notes

# VECTO 2.0

## Most important updates since previous release (V1.4):

- **Declaration Mode**
  - Sets generic parameters for calculation
  - Locks non-user input parameters in GUI
- **Updated GUI for new parameters and charts**
- **New internal visualizer for fast post processing** (replaces closed external tool GRAPHi)
- **WHTC Correction**
- **Start/Stop auxiliary correction**

# Declaration Mode

- Declaration Mode is (de-)activated in the GUI as global parameter, i.e. is active for all following calculations ☒ Declaration Mode
- When active all non- user-input parameters are locked

## Example: Axle configuration in vehicle file:

Declaration Mode OFF (Engineering Mode)

Relative axle load and wheels inertia are user-defined

Declaration Mode ON

Relative axle load is set according to HDV class and mission profile.

Wheels inertia depends on selected wheels

# Declaration Mode

- Automatic assignment of generic values

## Examples:

- Mission profiles ...based on HDV class
- Loading ...based on HDV class and mission profile
- Trailer RRC & weight ...based on HDV class and mission profile
- Shift polygons ...based on full load curves
- Engine inertia ...based on engine displacement

# Start/Stop FC Correction

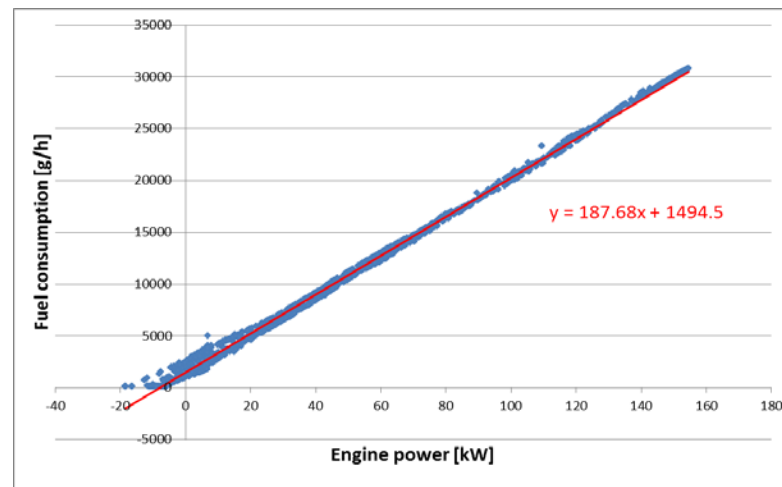
**Auxiliary power demand is constant for the whole mission profile but when Start/Stop is enabled there is no idling consumption. Therefore:**

- **Reduced engine-on time has to be considered**
- **Auxiliary energy balance must be equal to vehicles without Start/Stop**

# Start/Stop FC Correction

## VECTO Start/Stop FC Correction:

1. From all 1Hz data points of the VECTO simulation, a linear regression curve ( $y=k*x+d$ ) for fuel consumption (g/h) over engine power (kW) is calculated.



2. From the difference between the energy consumed by the auxiliaries in the simulation with Start/Stop function and the target value (kWh), a cycle average change in mechanical power “ $\Delta P_e$ ” (kW) of the internal combustion engine is calculated.
3. The correction of the fuel consumption is performed for all 1Hz time steps using  $\Delta FC \text{ (g/h)} = \Delta P_e * k$

The correction considers the use of brake energy, hence  $\Delta FC=0$  if braking power  $\geq \Delta P_e$

# WHTC Correction

1. WHTC measurement results are defined in the Engine File
2. VECTO calculates WHTC with stationary FC map
3. Correction factor is calculated as measurement / calculation ratio using weighting factors

$$CF_{WHTC} = \sum_{i=1}^3 f_i \cdot \frac{FC_{meas\_i}}{FC_{calc\_i}} \quad [-]$$

$CF_{WHTC}$  = WHTC Correction Factor [-]

$i$  = index for each part (Urban, Rural, Motorway)

$f_i$  = Weighting factor per part [-]

$FC_{meas\_i}$  = WHTC measurement result per part (input parameter) [g/kWh]

$FC_{calc\_i}$  = Calculated FC per part [g/kWh]

4. The correction factor is multiplied to the VECTO FC results

# VECTO 1.4 RC4

10.10.2013



## Update Notes



# VECTO 1.4

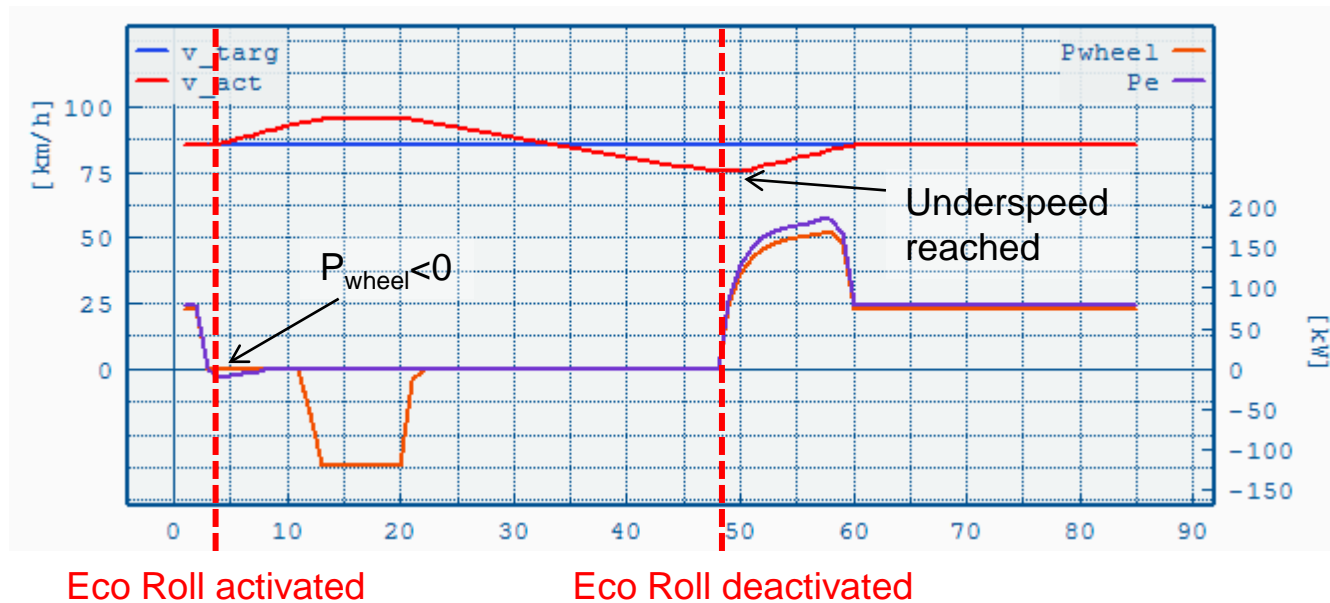
## Update Overview:

- Eco-Roll and Look-Ahead Coasting revised
- Major update in Gearbox/Torque Converter
- Engine Only Mode: Engine motoring points can be defined explicitly in load cycle
- Full load and drag curves (.vfld) can be defined for each gear separately
- Load-dependent rolling resistance coefficients
- Start-Stop activation delay time can be defined in job file
- Various bug fixes and optimisations

# Eco Roll

## New rules for Eco Roll (de-)activation:

- Activation if  $P_{\text{wheel}}^* < 0$
- Deactivation if Underspeed is reached



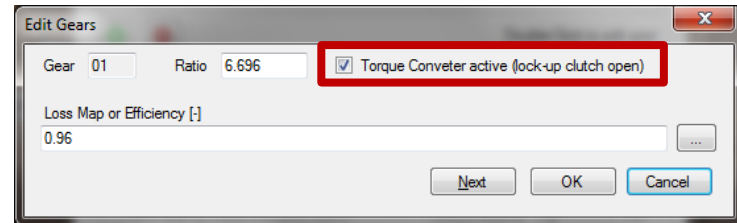
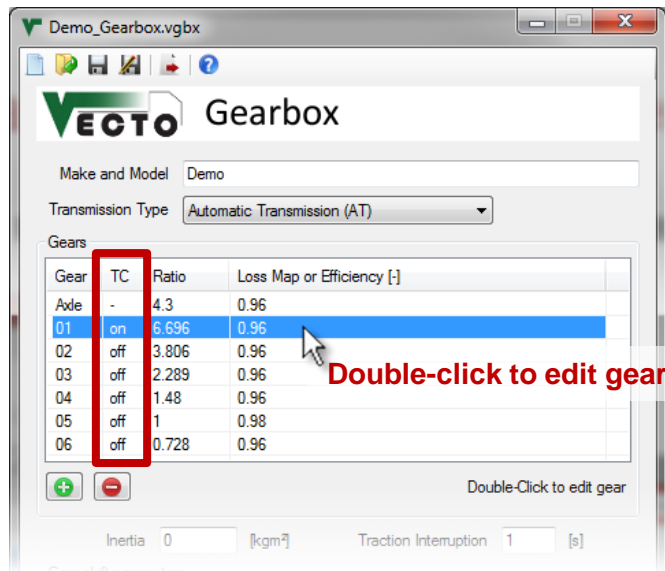
\*  $P_{\text{wheel}}$  = Total power demand at wheels

# Look-Ahead Coasting

- Real coasting also if road gradient  $> 0$ 
  - Deceleration may be so high that no braking is necessary. In this case the braking phase will be omitted. (Before V1.4 coasting was not affected by road gradient, if  $> 0$ )
- Distance Correction now also affects coasting phases
  - Lower distance error
  - Coasting phases may be interrupted temporary to correct distance

# Gearbox & Toque Converter

Torque converter can now be defined in multiple gears

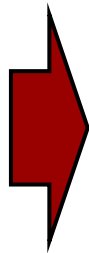


Note: Old Gearbox files (V1.3.1) are compatible with V1.4

# Gearbox & Toque Converter

**Example:** Torque converter active in first and second gear

Gear	TC	Ratio
01	on	6.696
02	on	3.806
03	off	3.806
04	off	2.289
05	off	1.48
06	off	1



Gear 1 = First mechanical gear with TC active\*

Gear 2 = Second mechanical gear with TC active

Gear 3 = Second mechanical gear with TC inactive

Gear 2 and 3 are the same mechanical gear  
(same gear ratio)

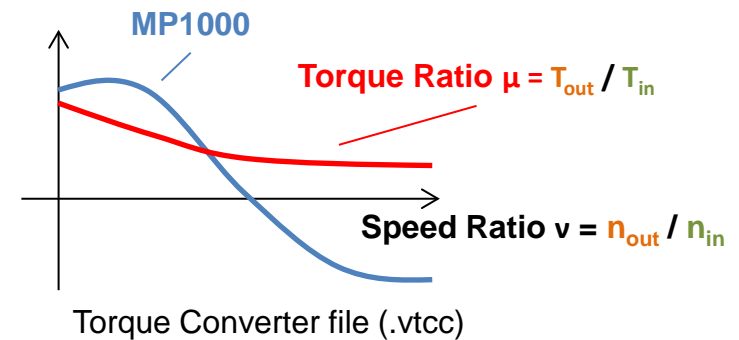
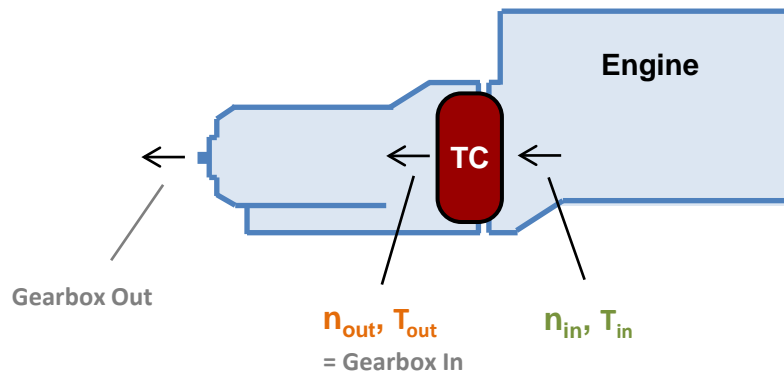
**Note:** Gear numbers in results are the same as here (i.e. no more "0.5" gear)!

\* TC active = lock-up clutch open

# Toque Converter Setup

### Conventional Automatic Transmission

- Torque converter file is defined for torque converter only



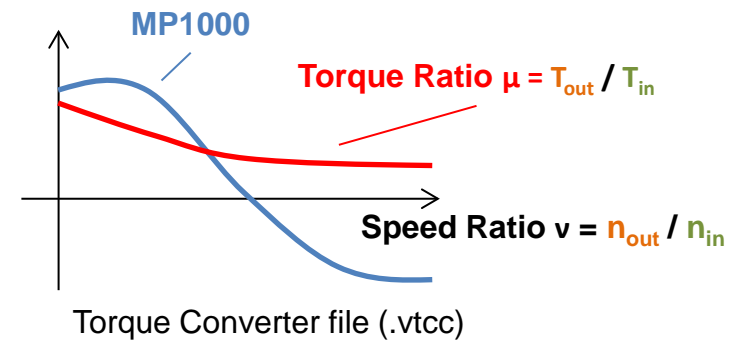
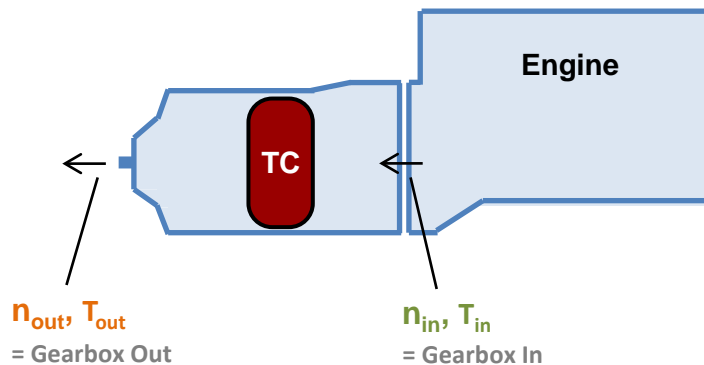
- Define TC gear with ratio of first (mechanical) gear
- Set transmission losses of first gear (map or constant efficiency)

Gear	TC	Ratio	Loss Map or Efficiency [-]
Axle	-	4.3	lossmap_Axle.csv
01	on	6.696	lossmap_G01.csv
02	off	6.696	lossmap_G01.csv
03	off	3.806	lossmap_G02.csv
04	off	2.289	lossmap_G03.csv
05	off	1.48	lossmap_G04.csv
06	off	1	lossmap_G05.csv

# Toque Converter Setup

## Power-distributed Automatic Transmission

- Torque converter file is defined for the whole gearbox



- Define TC gear with ratio = 1
- Set transmission efficiency to 1 (= 100%) because losses are covered by .vtcc file

Gear	TC	Ratio	Loss Map or Efficiency [-]
Axle	-	4.3	lossmap_Axle.csv
01	on	1	1
02	off	6.696	lossmap_G01.csv
03	off	3.806	lossmap_G02.csv
04	off	2.289	lossmap_G03.csv
05	off	1.48	lossmap_G04.csv
06	off	1	lossmap_G05.csv

# Gearbox & Torque Converter

## More changes:

- Same gear numbers in output as in GBX file, i.e. first gear with TC is not "TC" or "0.5" but simply "1"
- "Minimum time between two gear shifts" now also limits torque converter shifts
- Unlimited number of gears and new gear list in GUI without fixed gear number
- Improved gear shift model for torque converter
- Driving Cycle Preprocessing and Gear Shift Model now use approximated efficiency values based in the transmission loss maps.
  - Reduces calculation time significantly with little to no impact on fuel consumption.

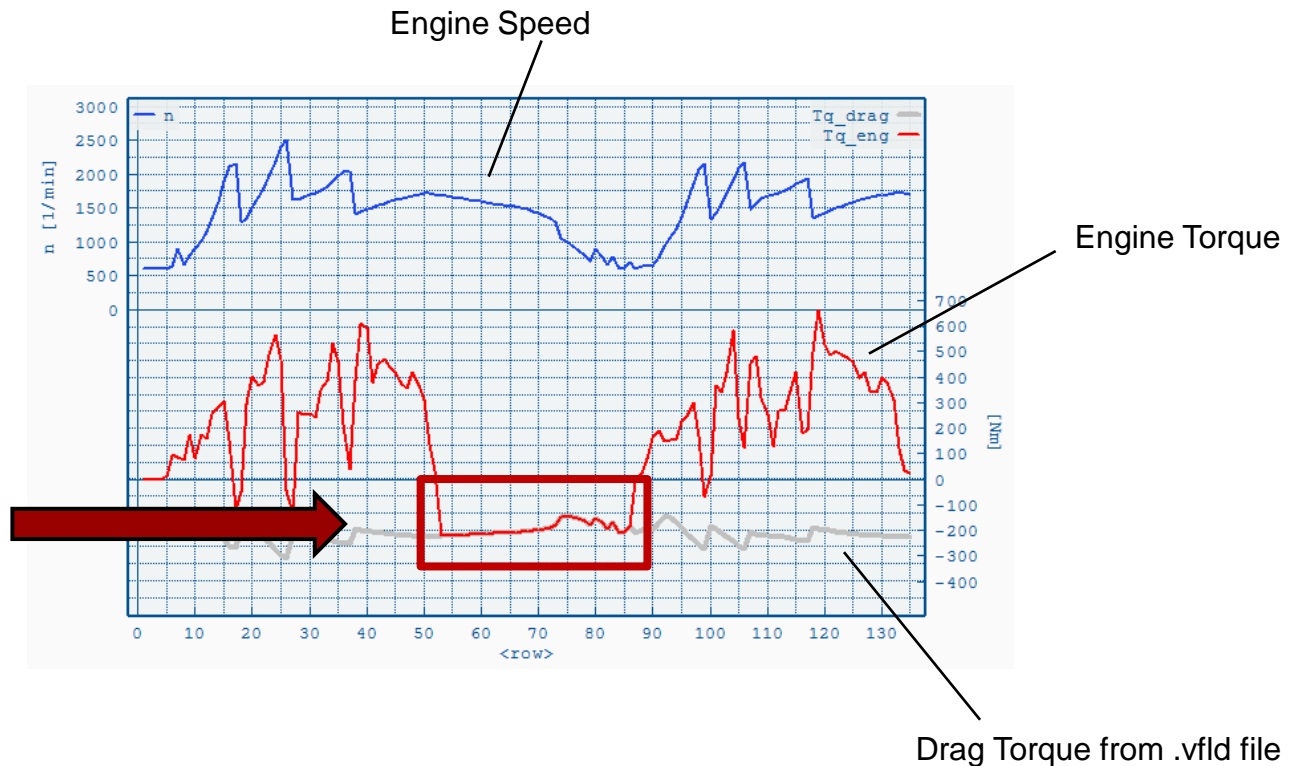


# Motoring in Engine Only Mode

Engine motoring points can be defined explicitly in load cycle by using the **<DRAG>** keyword

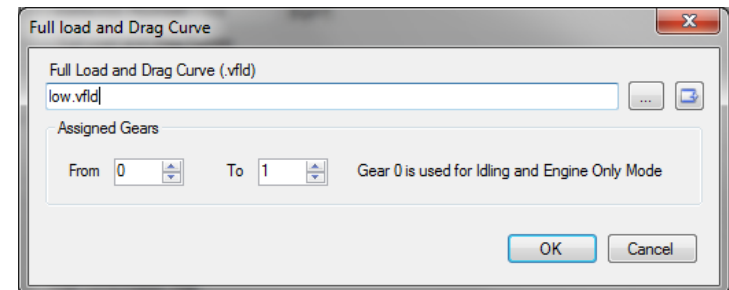
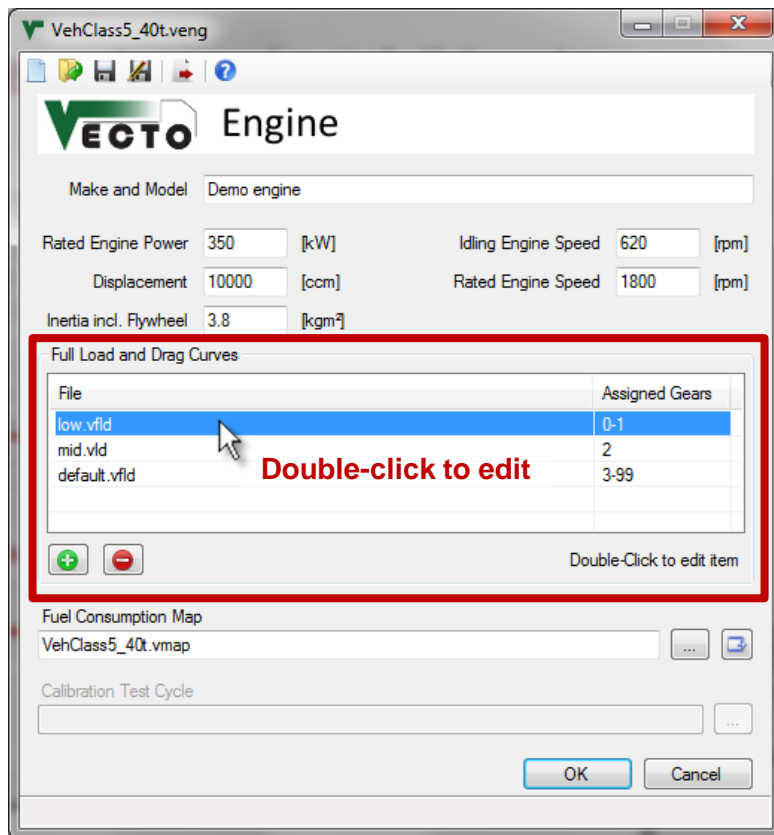
Load cycle (.vdri)

<n>	<Pe>
c [rpm]	[kW]
600	0.0
600	0.0
600	0.0
600	0.0
600	0.3
647	3.8
895	7.9
...	...
1702	5.8
1686	<DRAG>
1670	<DRAG>
1657	<DRAG>
1645	<DRAG>
...	...
600	0.1
644	1.0
...	...



# Gear-dependent full load curves

Each .vfld file can be assigned to a single gear or a range of gears



Note: Old Engine files (V1.3.1) are compatible with V1.4

# Load-dependent rolling resistance coefficient

- For each axle the  $RRC^*$  and test load  $F_z^*$  are defined

Relative axle load  $s_{(i)}$   
(share of total weight)

$RRC_{ISO(i)}^*$

$F_{zISO(i)}^*$

Twin Tyres => nr. of wheels  $w_{(i)}$   
yes =>  $w_{(i)} = 4$   
no =>  $w_{(i)} = 2$

Double-click to edit axle config.

- Total RRC calculation

$$RRC = \sum_{i=1}^n s_{(i)} \cdot RRC_{ISO(i)} \cdot \left( \frac{s_{(i)} \cdot m \cdot g}{w_{(i)} \cdot F_{zISO(i)}} \right)^{\beta-1}$$

$m$  [kg] = total vehicle weight  
 $g$  [m/s<sup>2</sup>] = 9.81  
 $\beta$  [-] = 0.9

\* according to ISO 28580 (Test load: 85% of max. load capacity)

# Full Changelog V1.4 (1/3)

## VECTO 1.4

- Bugfix: FC interpolation failed when load points matched map points exactly.
- Bugfix: Invalid "FC= -10000!" errors when outside of FC-Map
- Bugfix: Vehicle stand-still at end of cycle was ignored (distance-based cycles only)
- Bugfix: Distance Correction didn't work right with Look Ahead Coasting. Now distance error is acceptable but at the cost of partly interrupted coasting phases. Should be revised in future updates.
- FC extrapolation will not abort calculation. Invalid FC values are marked in output as "ERROR".
- No abortion if transmission output and input torque have different signs ( $In > 0$ ,  $Out < 0$ ). (Caused "Transmission Loss Map invalid" error messages)
- Eco-Roll revised. New rules:
  - Engages if  $P_{wheel} < 0$
  - Disengages if Underspeed is reached.
- Look-Ahead Coasting now uses real coasting also if road gradient  $> 0$  which means the coasting deceleration can be so high that no braking is necessary. In this case the braking phase will be omitted and the total deceleration time can be shorter than expected by the given target coasting deceleration.
- "Minimum (actual) speed" instead of "Min. Target Speed" for Eco-Roll, Overspeed and Look Ahead Coasting
- Load-dependent rolling resistance coefficient

# Full Changelog V1.4 (2/3)

## VECTO 1.4 (cont.)

- Major update in Gearbox/Torque Converter:
  - Torque converter can be defined in multiple gears
  - Same gear numbers in output as in GBX file, i.e. first gear with TC is not "TC" or "0.5" but simply "1"
  - "Minimum time between two gear shifts" now also limits torque converter shifts
  - Unlimited number of gears and new gear list in GUI without fixed gear number
  - Improved gear shift model for torque converter
  - Driving Cycle Pre-processing and Gear Shift Model now use approximated efficiency values based in the transmission loss maps. Reduces calculation time significantly with little to no impact on fuel consumption.
- Full load and drag curves (.vfld) can be defined for each gear separately.
- Engine Only Mode: Engine motoring points can be defined explicitly in load cycle with "<DRAG>"
- When speed is under 5km/h and engine in motoring operating then gearbox shifts to Neutral
- Start-Stop activation delay time can be defined in job file
- File signing features added:
  - After each calculation a signature file (.vsig) is created which includes signatures for all input and result files. The file itself is also signed.
  - Signature files can be verified or manually created under "Tools" > "Sign or Verify Files"

# Full Changelog V1.4 (3/3)

## VECTO 1.4 (cont.)

- Changes in header and new parameters in modal results (.vmod):
  - engine speed => n
  - torque => Tq\_eng
  - Pe => Pe\_eng
  - New: Tq\_clutch = torque at clutch (before clutch, engine-side)
  - New: Tq\_full = full load torque
  - New: Tq\_drag = drag torque
  - Removed: Pe\_norm, n\_norm
- Changes in summary results (.vsum)
  - Total altitude change instead of average gradient
  - Auxiliary energy consumption for each auxiliary
  - Removed: Pe\_norm, n\_norm
- Same job file list for BATCH and STANDARD (Job file list does not change when switching mode)
- Updated some error messages (units)
- Driving Cycle stop times corrected (No more zero stop times).

# VECTO 1.3.1

16.05.2013



## Update Notes

# VECTO 1.3.1

## Update Overview (since V1.0):

- Driver Model:
  - Overspeed
  - Eco-Roll
  - Look Ahead Coasting
- New Gear Shift Model
  - Shifting based on used-defined shift polygons
  - Sequential shifting or gear skipping
  - Optional shifting inside polygons
  - Start gear calculation
- Torque Converter Calculation
- Engine Only Mode
- Engine Start/Stop
- Visualizer (GRAPHi)
- User Manual updated with function descriptions
- Error messages linked to user manual
- Demo Data updated



# Driver Model

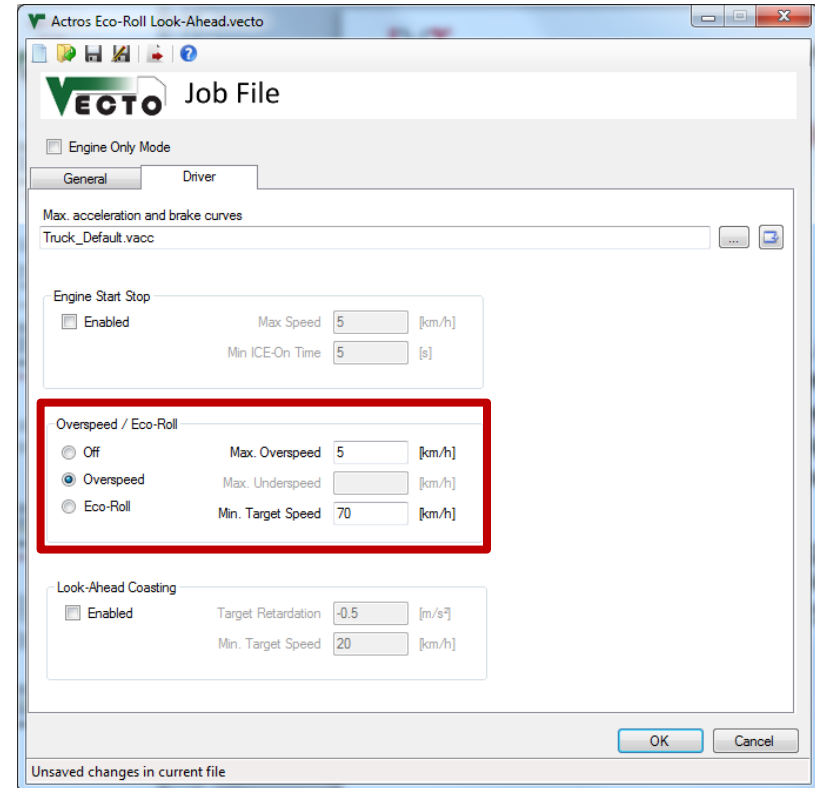
## Overview:

- Overspeed
  - If  $P_{\text{wheel}} < 0$ : Coasting with brakes not applied for speed  $<$  target speed + allowed overspeed
- Eco-Roll
  - If  $P_{\text{wheel}} < 0$ : Neutral gear, engine idling.
  - Engine and service brake if target speed + allowed overspeed is reached.
  - Normal driving if target speed + allowed underspeed is reached.
- Look Ahead Coasting
  - Phase of coasting put in front of braking phases

# VECTO Editor - Driver Tab

## Overspeed:

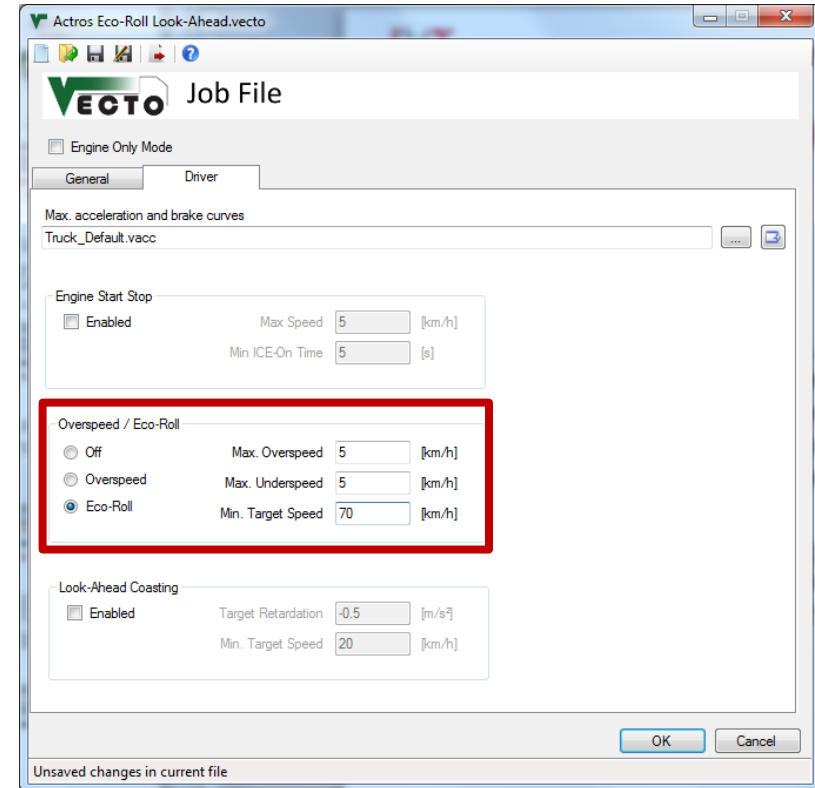
- **Functionality:**
  - If  $P_{\text{wheel}} < 0$ : Coasting with brakes not applied for speed < target speed + allowed overspeed
- **Parameters:**
  - Minimum Target Speed, e.g. 70km/h
  - Allowed Overspeed, e.g. 5km/h



# VECTO Editor - Driver Tab

## Eco-Roll:

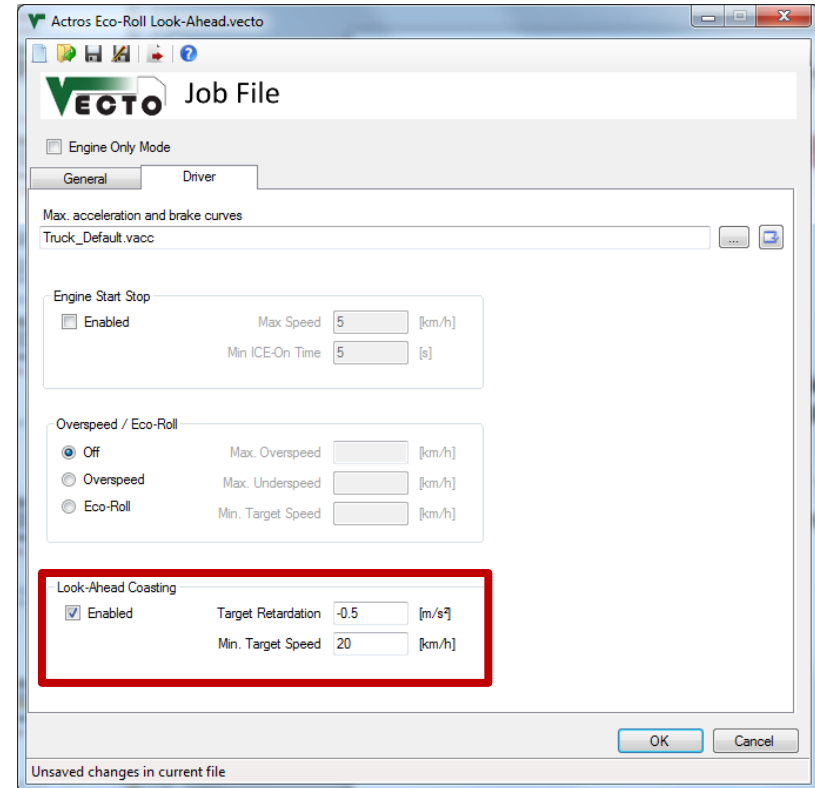
- **Functionality:**
  - If  $P_{\text{wheel}} < 0$ : Neutral gear, engine idling.
  - Engine and service brake if target speed + allowed overspeed is reached.
  - Normal driving if target speed + allowed underspeed is reached.
- **Parameters:**
  - Minimum Target Speed, e.g. 70km/h
  - Allowed Overspeed, e.g. 5km/h
  - Allowed Underspeed, e.g. 5km/h



# VECTO Editor - Driver Tab

## Look-Ahead Coasting:

- **Functionality:**
  - **Phase of coasting put in front of braking phases**
- **Parameters:**
  - Reference (target) deceleration, e.g.  $-0.5\text{m/s}^2$
  - Minimum speed, e.g. 55km/h (e.g. might be used for citybus driving)



# VECTO 1.2

09.04.2013



## Update Notes

# Gearbox updates

## Overview:

- Default settings for each transmission type
- Torque Converter implemented
- (Shift Polygons are described in the 1.1 beta Update Notes attached below)

**VECTO Gearbox**

Make and Model: Demo

Transmission Type: Custom

Gear	Ratio	Loss Map or Efficiency [-]
A	4.3	0.96
TC	6.696	0.96
01	3.806	0.96
02	2.289	0.96
03	1.48	0.96
04	1	0.98
05	0.728	0.96

Inertia: 0 [kgm²]    Traction Interruption: 1 [s]

**Gear shift parameters**

Shift polygons file: ShiftPolygons.vgbs

☐ Allow shift-up inside polygons (AMT)    Torque reserve: 20 [%]

☒ Skip Gears (MT, AMT)    Minimum time between two gear shifts: 3 [s]

**Start Gear**

Torque reserve: 40 [%]

Reference vehicle speed at clutch-in: 2 [m/s]

Reference acceleration at clutch-in: 1.5 [m/s²]

**Torque Converter**

☒ Installed (AT)

Torque converter characteristics file: TChfile.vtcc

Reference rpm for torque characteristic: 1000 [1/min]

OK    Cancel

# Gearbox updates

## Transmission Type:

- **Manual Transmission (MT):**
  - Activates the "Skip Gears" option. No torque converter.
- **Automated Manual Transmission (AMT)**
  - Activates the "Allow shift-up inside polygons" and "Skip Gears" option. No torque converter.
- **Automatic Transmission (AT)**
  - Torque converter is set and must be parameterized.
- **Custom**
  - Enables all options for user-defined settings.

**VECTO Gearbox**

Make and Model: Demo

Transmission Type: Custom

Gear	Ratio	Loss Map or Efficiency [-]
A	4.3	0.96
TC	6.696	0.96
01	3.806	0.96
02	2.289	0.96
03	1.48	0.96
04	1	0.98
05	0.728	0.96

Inertia: 0 [kgm²]    Traction Interruption: 1 [s]

**Gear shift parameters**

Shift polygons file: ShiftPolygons.vgbs

☐ Allow shift-up inside polygons (AMT)    Torque reserve: 20 [%]

☒ Skip Gears (MT, AMT)    Minimum time between two gear shifts: 3 [s]

**Start Gear**

Torque reserve: 40 [%]

Reference vehicle speed at clutch-in: 2 [m/s]

Reference acceleration at clutch-in: 1.5 [m/s²]

**Torque Converter**

☒ Installed (AT)

Torque converter characteristics file: TCfile.vtcc

Reference rpm for torque characteristic: 1000 [1/min]

OK    Cancel

# Gearbox updates

## Torque Converter (TC):

- "Installed" can only be changed if Transmission Type is "Custom"
- The torque converter is only used in the first gear (TC), i.e. the lock-up clutch is open. After TC comes gear 1 (first gear with closed lock-up clutch).

**Demo\_Gearbox.vgbx**

**VECTO Gearbox**

Make and Model: Demo

Transmission Type: Custom

Gear	Ratio	Loss Map or Efficiency [-]
A	4.3	0.96
TC	6.696	0.96
01	3.806	0.96
02	2.289	0.96
03	1.48	0.96
04	1	0.98
05	0.728	0.96

Inertia: 0 [kgm<sup>2</sup>]    Traction Interruption: 1 [s]

**Gear shift parameters**

Shift polygons file: ShiftPolygons.vgbs

☐ Allow shift-up inside polygons (AMT)    Torque reserve: 20 [%]

☒ Skip Gears (MT, AMT)    Minimum time between two gear shifts: 3 [s]

**Start Gear**

Torque reserve: 40 [%]

Reference vehicle speed at clutch-in: 2 [m/s]

Reference acceleration at clutch-in: 1.5 [m/s<sup>2</sup>]

**Torque Converter**

☒ Installed (AT)

Torque converter characteristics file: TCfile.vtcc

Reference rpm for torque characteristic: 1000 [1/min]

OK    Cancel



# Gearbox updates

## Torque Converter characteristics file (.vtcc):

- Defines:
  - torque ratio** (= Output Torque / Input Torque) and **input torque** at reference engine speed over **speed ratio** (= Output Speed / Input Speed)
- Must include data for motoring (speed ratio > 1)!**

c Speed Ratio v	Torque Ratio $\mu$	Input Torque at reference rpm
c [-]	[-]	[Nm]
0	...	...
0.1		
...	...	...
>1!	...	...

### \*VECTO CSV Format:

List Separator: Comma ","

Decimal-Mark: Dot "."

Comments/headers: "c" at the beginning of the comment line. Number and position of comment lines is not limited.

# Gearbox updates

## Reference rpm for torque characteristic:

- Needed to calculate the actual engine torque

## Calculation of engine torque (if lock-up clutch is open, gear "TC"):

$$T_{in} = T_{ref}(v) * \left( \frac{n_{in}}{n_{ref}} \right)^2$$

with:

$T_{in}$  = engine torque [Nm]

$T_{ref(v)}$  = reference torque at reference rpm (from .vtcc file) [Nm]

$n_{in}$  = engine speed [1/min]

$n_{ref}$  = reference rpm (from .vgbx file) [1/min]

**Demo\_Gearbox.vgbx**

**VECTO Gearbox**

Make and Model: Demo

Transmission Type: Custom

Gear	Ratio	Loss Map or Efficiency [-]
A	4.3	0.96
TC	6.696	0.96
01	3.806	0.96
02	2.289	0.96
03	1.48	0.96
04	1	0.98
05	0.728	0.96

Inertia: 0 [kgm²] Traction Interruption: 1 [s]

**Gear shift parameters**

Shift polygons file: ShiftPolygons.vgbs

☐ Allow shift-up inside polygons (AMT) Torque reserve: 20 [%]

☒ Skip Gears (MT, AMT) Minimum time between two gear shifts: 3 [s]

**Start Gear**

Torque reserve: 40 [%]

Reference vehicle speed at clutch-in: 2 [m/s]

Reference acceleration at clutch-in: 1.5 [m/s²]

**Torque Converter**

☒ Installed (AT)

Torque converter characteristics file: TCfile.vtcc

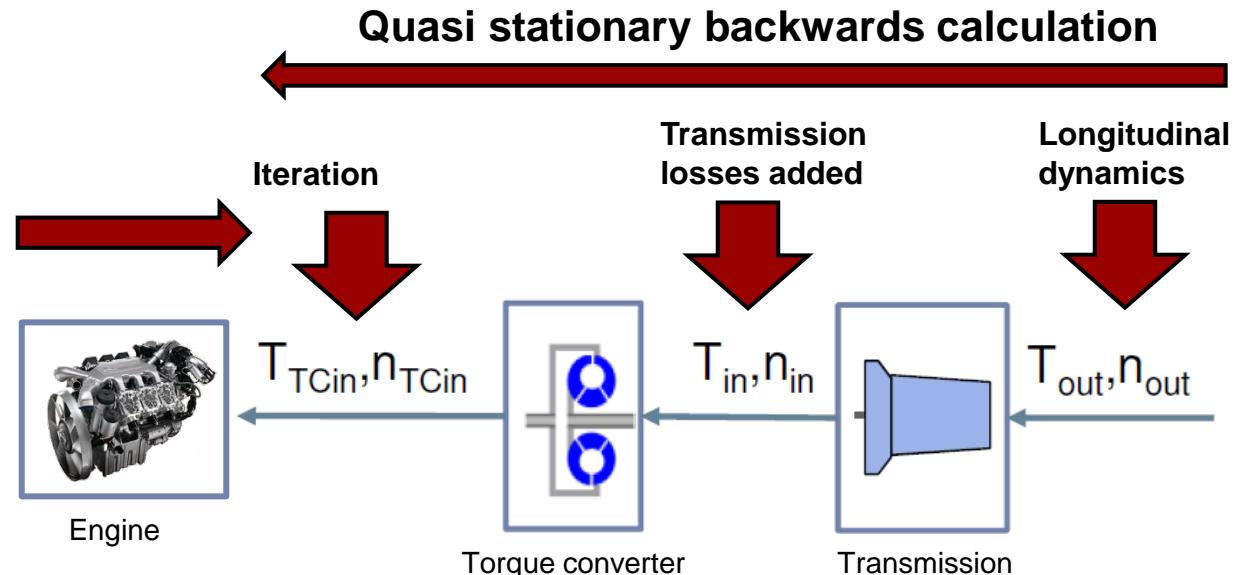
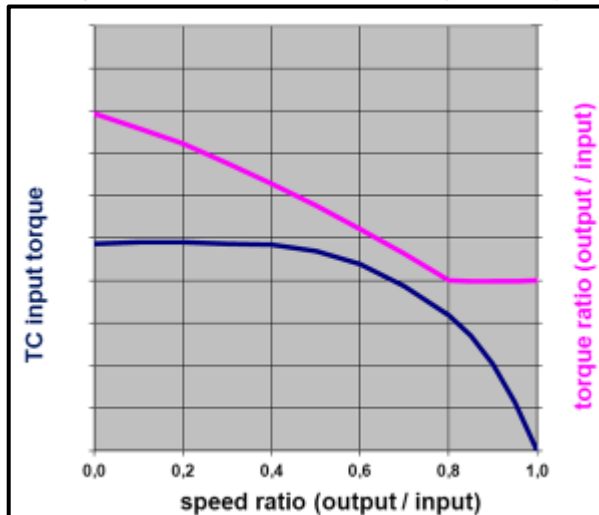
Reference rpm for torque characteristic: 1000 [1/min]

OK Cancel

# Torque Converter Calculation

- Same polygon-based gear shift model as MT/AMT
- Torque Converter (TC):
  - Defined as (virtual) separate gear, i.e. **only first gear with TC active**
  - While TC active: Iterative calculation of engine torque and speed based on TC characteristic
  - Creeping: Engine speed set to idling. Brakes engaged to absorb surplus torque

Torque converter characteristic (.vtcc file)

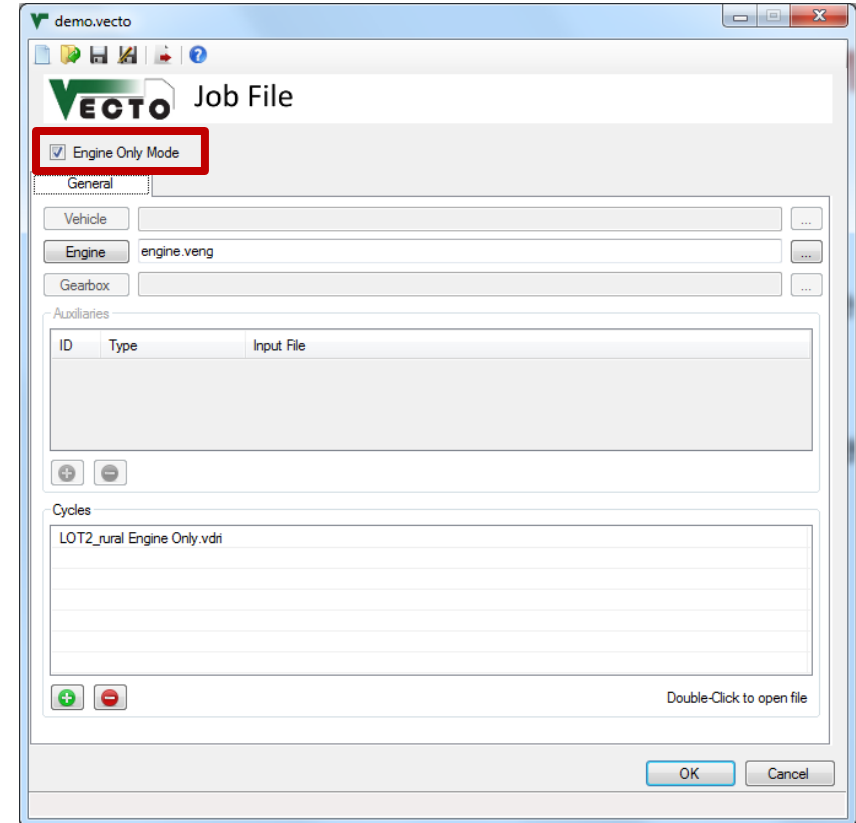


# Engine Only Mode (.vecto file)

- Calculate fuel consumption using a predefined load cycle
- No gearbox, vehicle or Aux file required
- Cycle format (see User Manual):
  - engine speed **<n>** [1/min]
  - engine power **<Pe>** [kW]

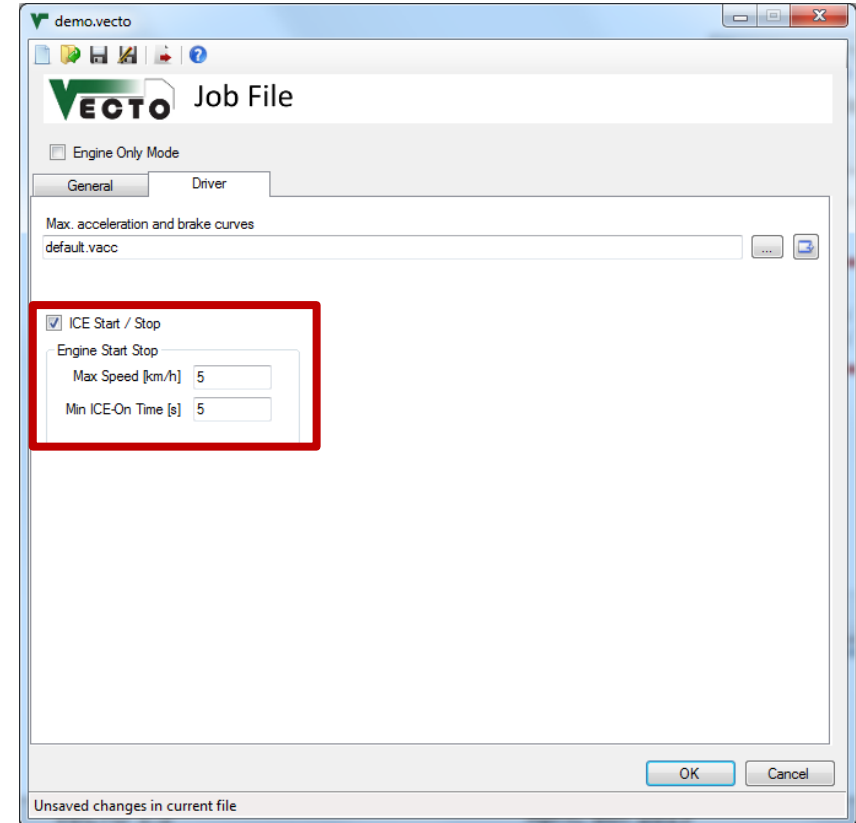
**or**

  - engine torque **<Me>** [Nm]
  - [Optional] Additional power demand (aux) **<Padd>**
- **Engine inertia (from .veng file) is added to the input torque!**

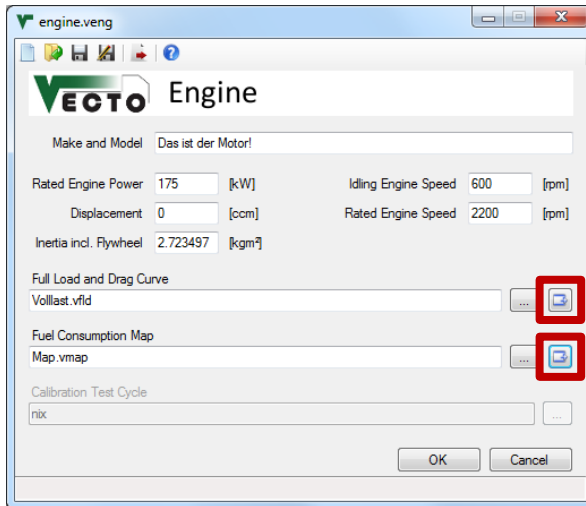


# Engine Start / Stop (.vecto file)

- Engine will be turned off if:
  - Power demand (without Aux)  $\leq 0$
  - Vehicle speed is below "**Max speed [km/h]**"
  - Engine was running for at least "**Min ICE-On Time [s]**"
- **TBD: Invalid auxiliary consumption work over cycle**



# New "Open file" button

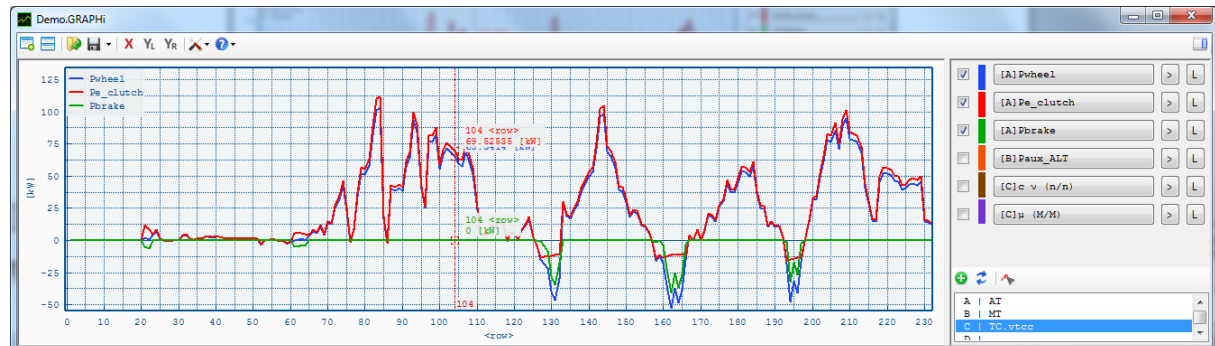
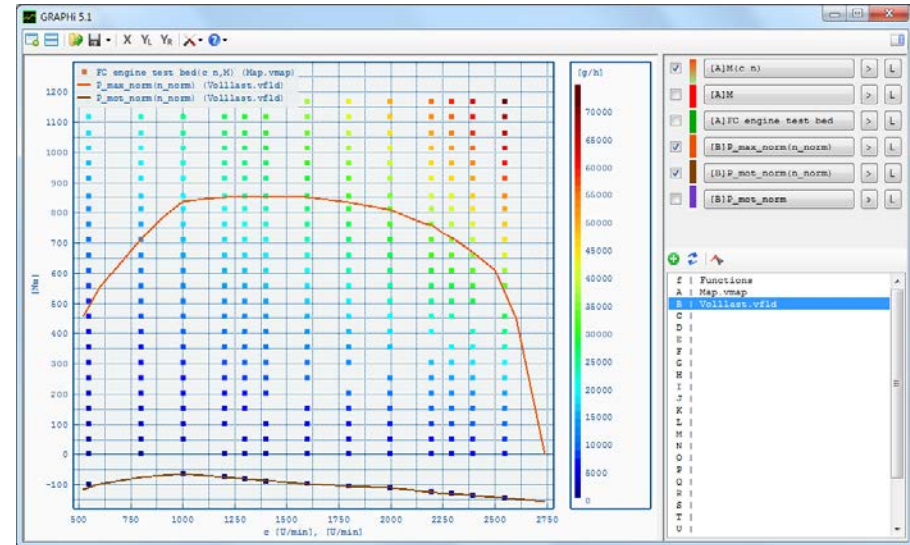


Opens a menu with three options:

- Open with GRAPHi (see next slide)
- Open with user-defined tool (see Settings)
- Show in Folder (opens explorer)

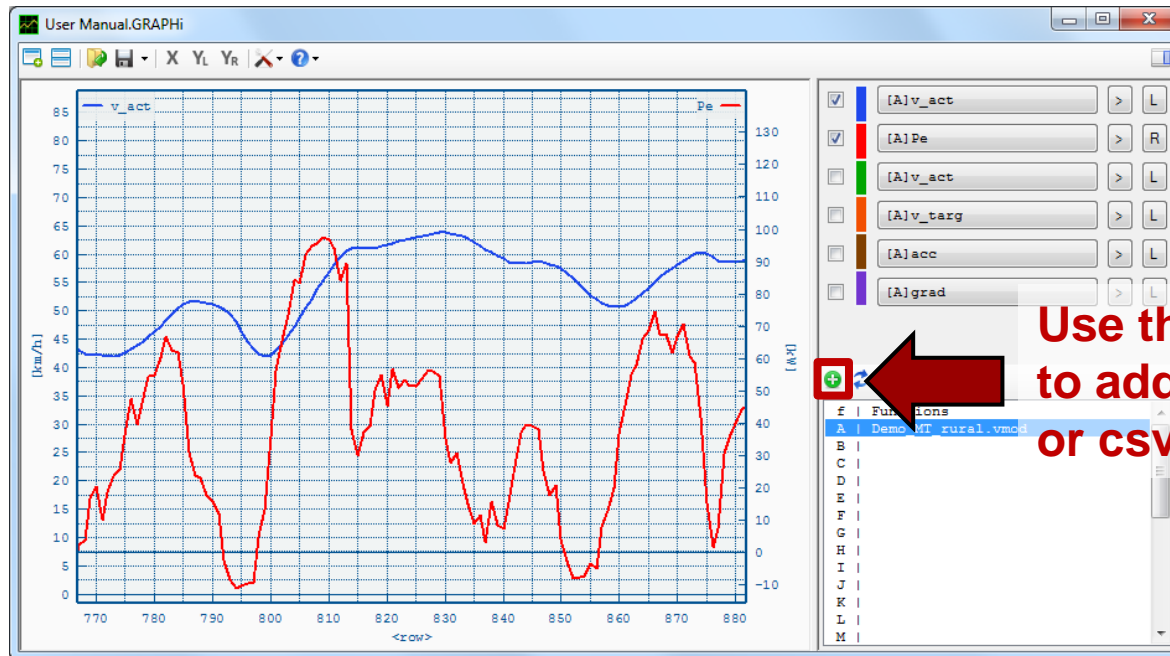
# Visualizer (GRAPHi)

- Independent 2D visualisation tool (see "GRAPHi" subfolder)
- Supports CSV and MS Excel files
- User Manual included ("?" button)
- Located in "GRAPHi" subfolder
- Note: GRAPHi is not a permanent part of VECTO and will be provided by TUG for a limited time only



# GRAPHi Quick Start (1/5)

## Opening files



Use the "+" Button to add files (excel or csv)

Once a file is loaded, it remains in memory without accessing the file on the hard drive (unless manually reloaded).

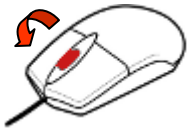


# GRAPHi Quick Start (2/5)

## Mouse Controls



**Move**

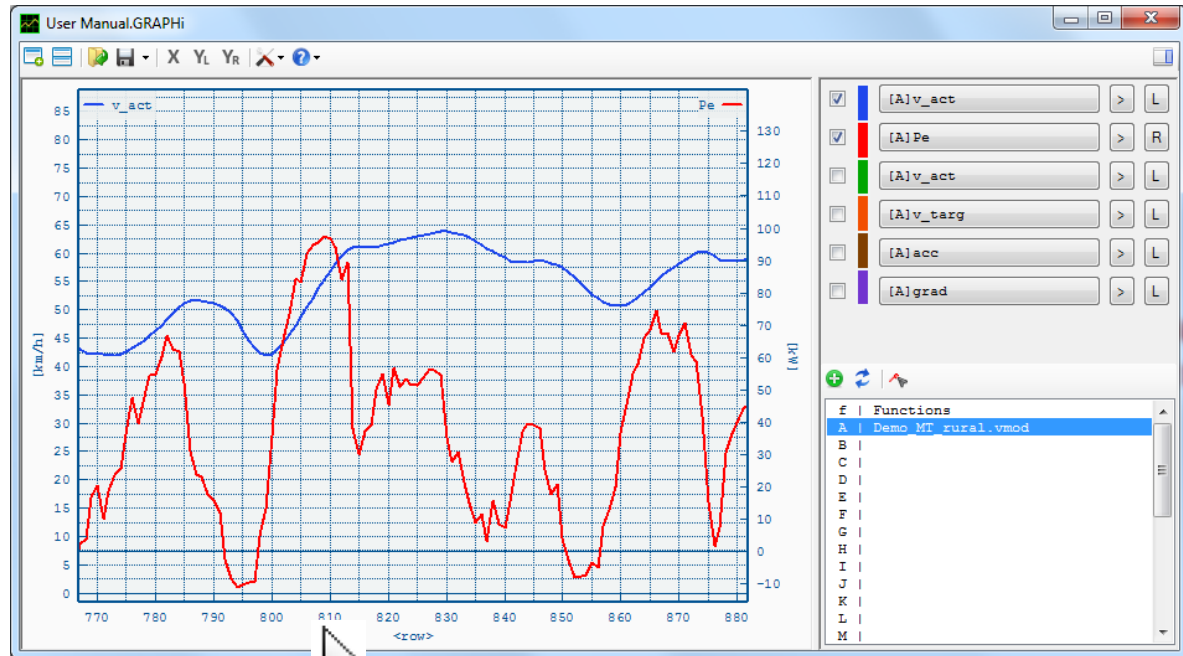


**Zoom**



**Zoom-Box**

Click 1: 1<sup>st</sup> corner  
Click 2: 2<sup>nd</sup> corner  
(Right-Click to Cancel)

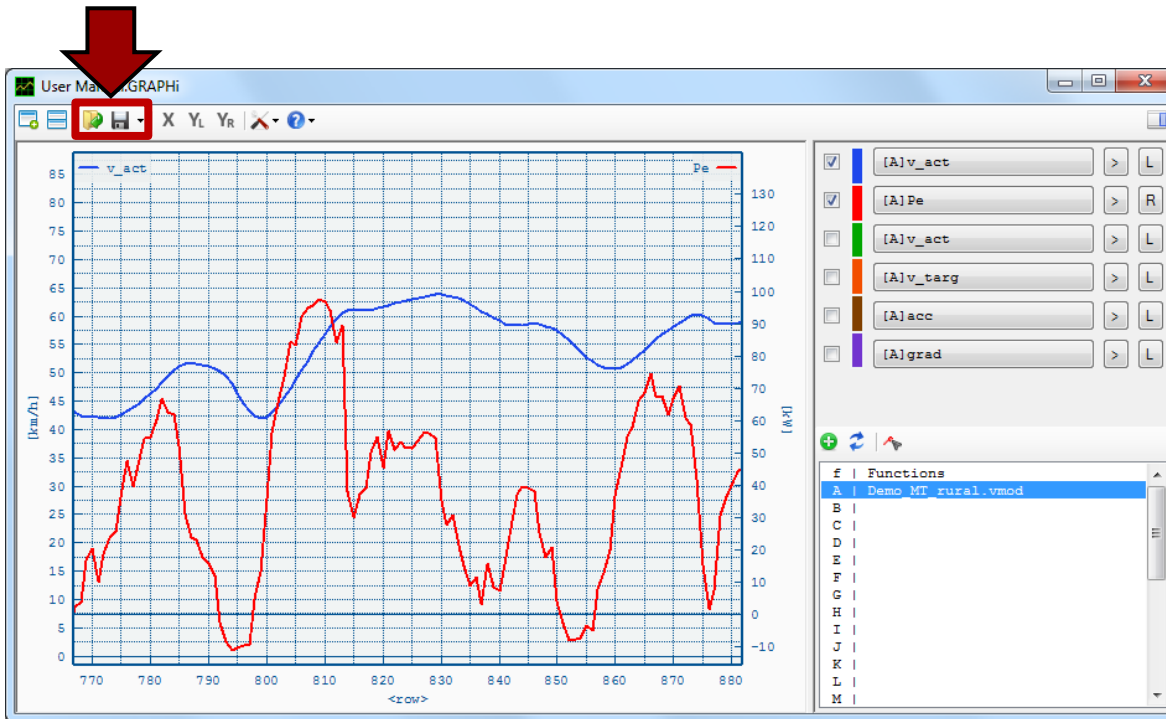


**Hold cursor over x-axis to zoom/move x-axis only!!!**

# GRAPHi Quick Start (3/5)

## Opening and Saving Sessions

Save/Load Session (.GRAPHi file)



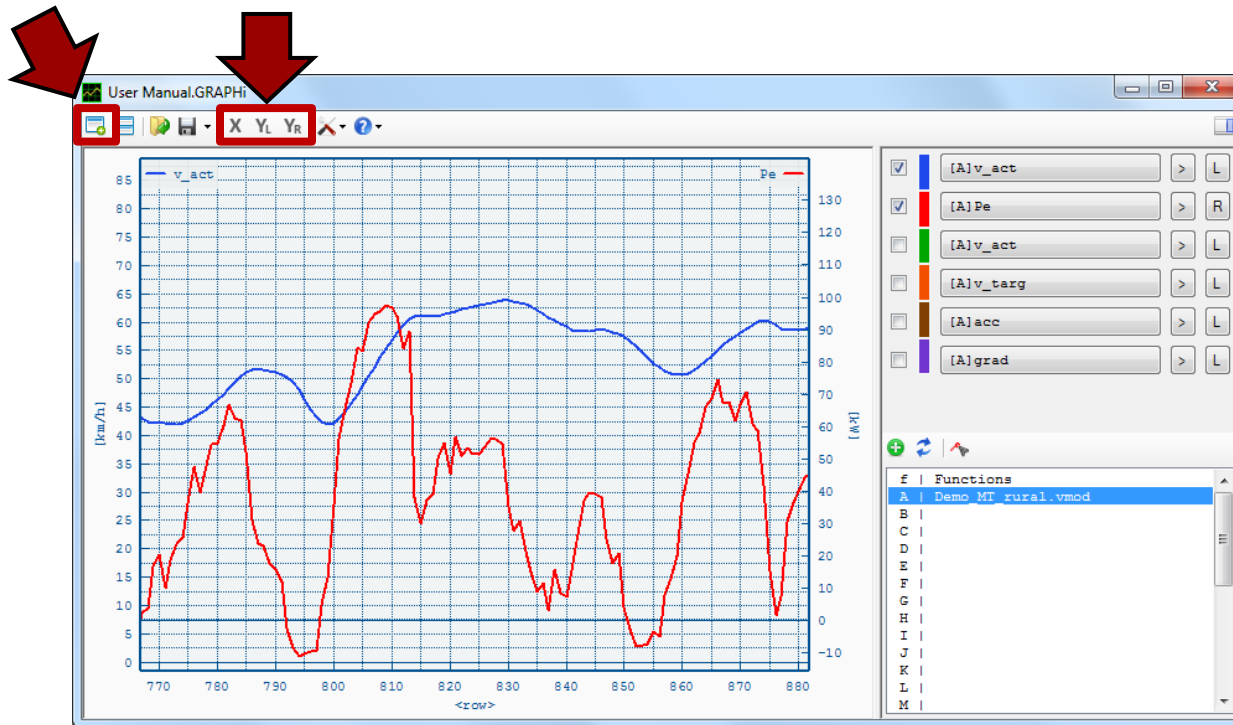
**Session files (.GRAPHi) include all data to restore a session. Source files are saved only as reference, i.e. the original files must be accessible.**

# GRAPHi Quick Start (4/5)

## Windows and Syncing

Add Window

Sync open windows (x-axis, left and right y-axis)

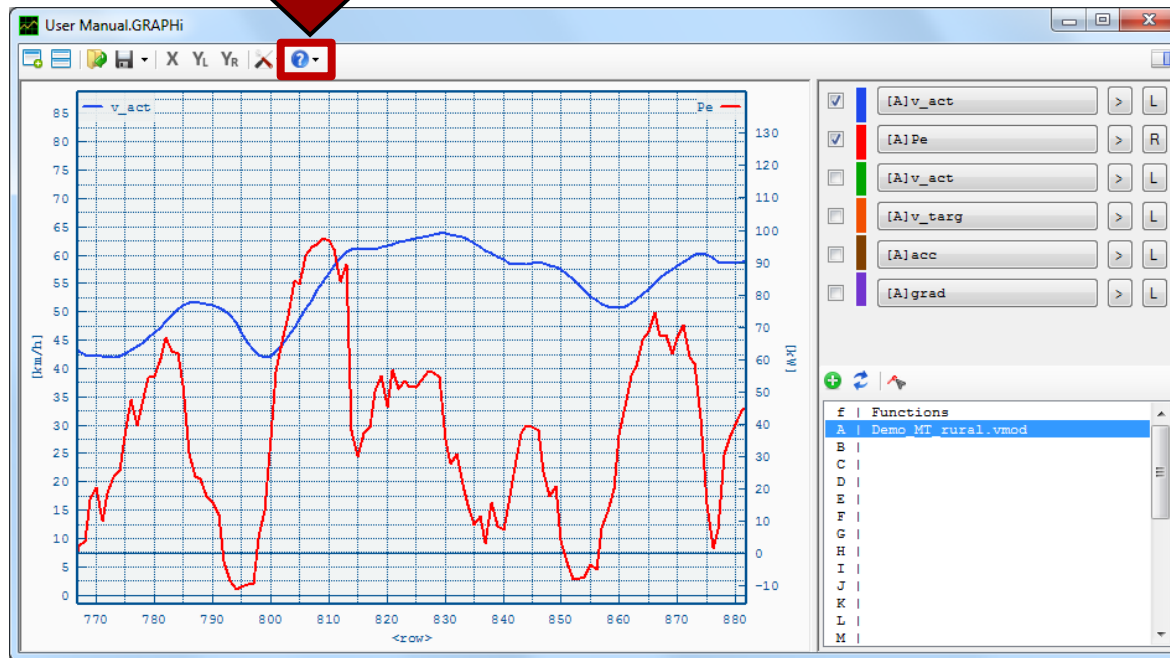


**Syncing means changes to the synced axes in one window are reflected by all other windows which have the same axes synced.**

# GRAPHi Quick Start (5/5)

## User Manual

The User Manual can be opened here



# Full Changelog V1.2

## VECTO 1.2

- Engine Start/Stop implemented
- Bugfix: Fixed error in FC interpolation (invalid extrapolation errors)
- FC Extrapolation will abort the calculation
- Transmission Type selection in Gearbox (.vgbx) file.
  - Enables/Disables transmission type-specific options
  - In Proof-Of-Concept mode "Custom" type is available with all options enabled.
- Automatic Transmission mode with Torque converter: Input parameters in Gearbox file !!still being tested!!
- Option to open files with GRAPHi or user-defined tool
- User Manual updated
- Bugfix: Files with relative paths were not located correctly
- Corrected comment line for wheels inertia and axle config in .vveh file
- Changed RRC unit in GUI from [-] to [N/N]
- Transmission Loss Maps are not converted to n,Pe-Maps anymore. Should fix non-linear interpolation effects.
- Engine Only Mode

# VECTO 1.1 beta

05.02.2013

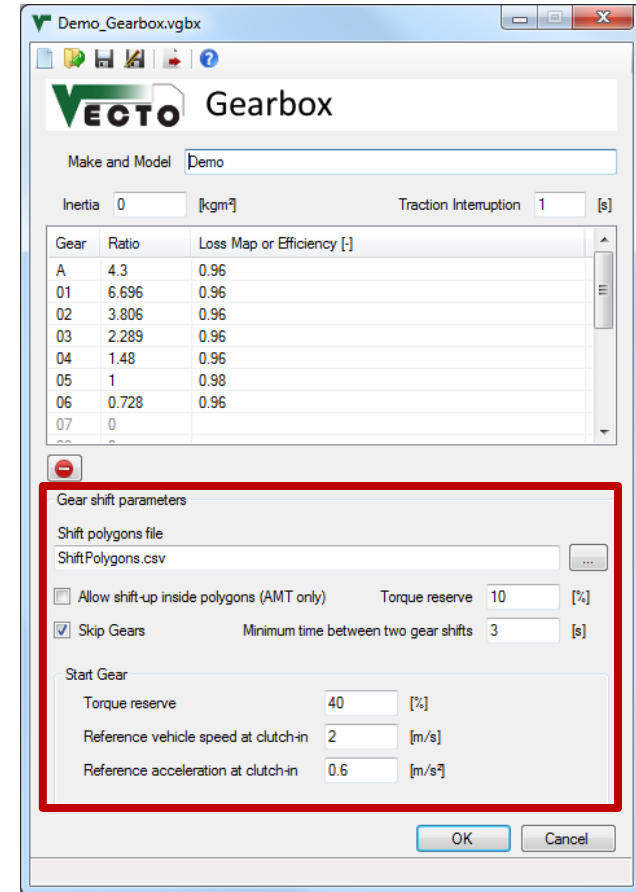


## Update Notes

# New gear shift model for MT and AMT

## Overview:

- Shifting based on user-defined shift polygons
- Sequential shifting or gear skipping
- Optional shifting inside polygons
- Customisable start gear calculation

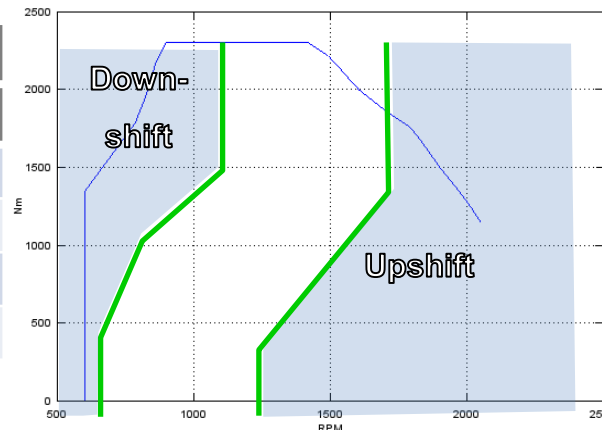


# New parameters in .vgbx file

## Shift polygons file:

- CSV file\* defining up- and downshift rpms over torque
- File must cover full engine range including motoring
- Two or more rows required

c Torque	Downshift	Upshift
c [Nm]	[rpm]	[rpm]
-500	650	900
0	650	900
500	700	950
...	...	...

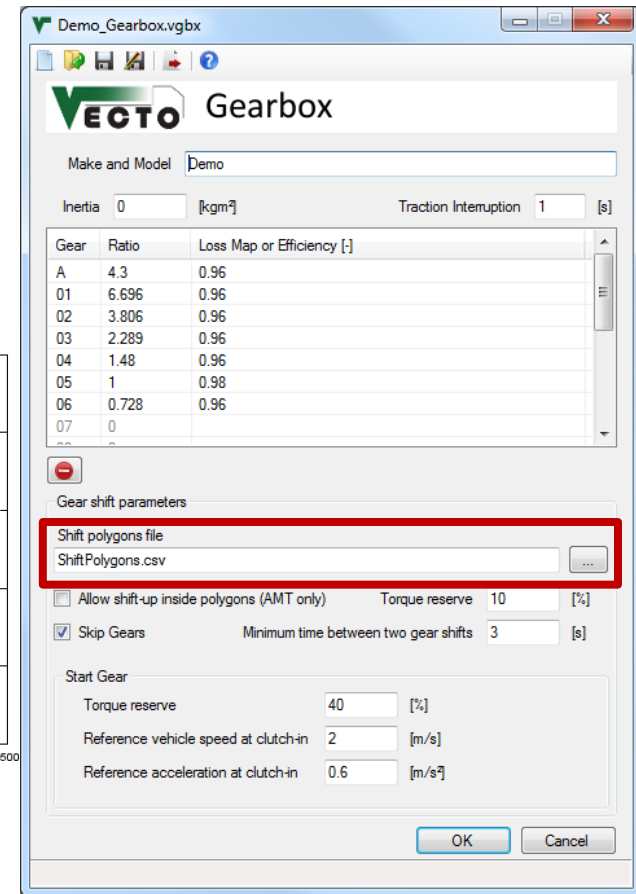


### \*VECTO CSV Format:

List Separator: Comma ","

Decimal-Mark: Dot "."

Comments/headers: "c" at the beginning of the comment line. Number and position of comment lines is not limited.

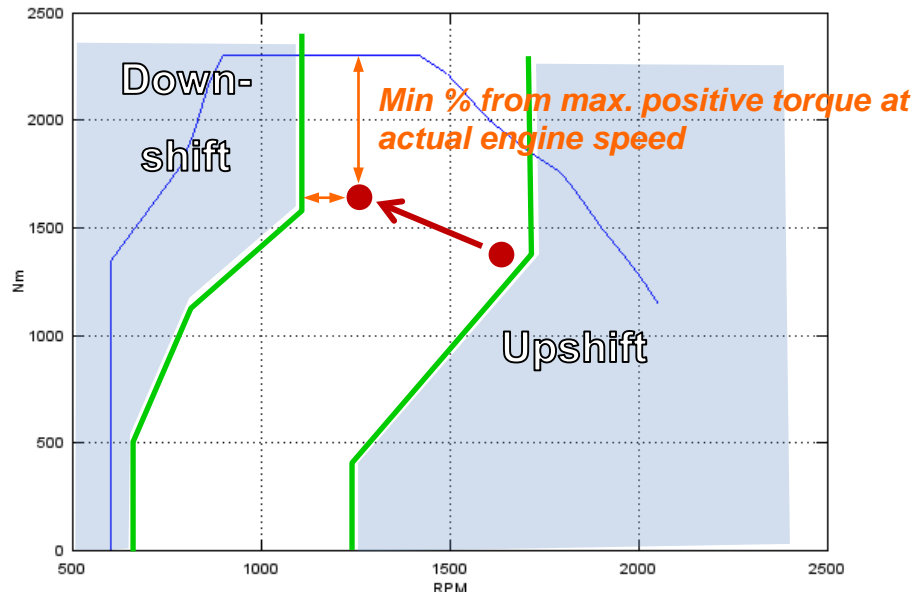




# New parameters in .vgbx file

## Allow shift-up inside polygons (AMT):

- Only if **torque reserve** is provided and **rpm** is still above **Down-shift-rpm**



Demo\_Gearbox.vgbx

**VECTO Gearbox**

Make and Model: Demo

Inertia: 0 [kgm<sup>2</sup>] Traction Interruption: 1 [s]

Gear	Ratio	Loss Map or Efficiency [-]
A	4.3	0.96
01	6.696	0.96
02	3.806	0.96
03	2.289	0.96
04	1.48	0.96
05	1	0.98
06	0.728	0.96
07	0	

**Gear shift parameters**

Shift polygons file: ShiftPolygons.csv

☒ Allow shift-up inside polygons (AMT only) Torque reserve: 10 [%]

☒ Skip Gears Minimum time between two gear shifts: 3 [s]

**Start Gear**

Torque reserve: 40 [%]

Reference vehicle speed at clutch-in: 2 [m/s]

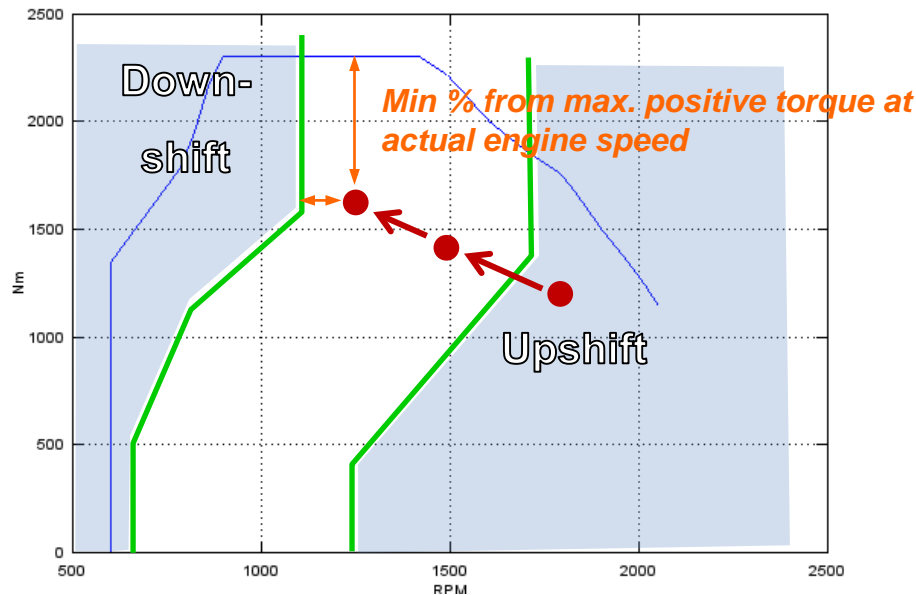
Reference acceleration at clutch-in: 0.6 [m/s<sup>2</sup>]

OK Cancel

# New parameters in .vgbx file

## Skip gears (AMT, MT):

- Whenever gear shift is initiated (because rpm crosses up- or down- shift polygon) it is possible to skip gears
- Torque reserve** must be provided and **rpm must remain below Down-shift-rpm**



The screenshot shows the VECTO Gearbox configuration window. The 'Make and Model' field is set to 'Demo'. The 'Inertia' field is 0 [kgm²] and the 'Traction Interruption' field is 1 [s]. The 'Gear' table lists the following data:

Gear	Ratio	Loss Map or Efficiency [-]
A	4.3	0.96
01	6.696	0.96
02	3.806	0.96
03	2.289	0.96
04	1.48	0.96
05	1	0.98
06	0.728	0.96
07	0	

The 'Gear shift parameters' section includes the following settings:

- Shift polygons file: ShiftPolygons.csv
- ☐ Allow shift-up inside polygons (AMT only)
- ☒ Skip Gears
- Torque reserve: 10 [%]
- Minimum time between two gear shifts: 3 [s]

The 'Start Gear' section includes the following settings:

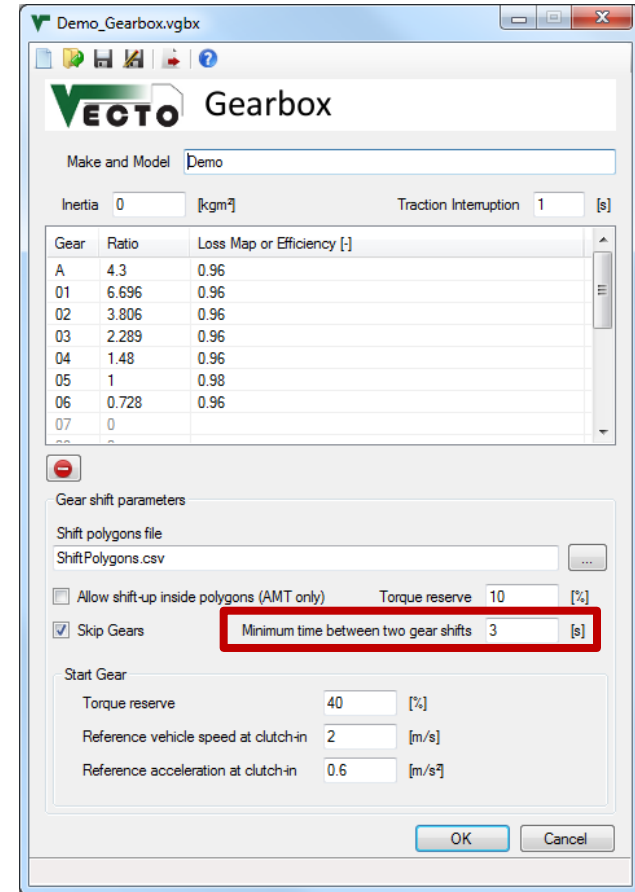
- Torque reserve: 40 [%]
- Reference vehicle speed at clutch-in: 2 [m/s]
- Reference acceleration at clutch-in: 0.6 [m/s²]

The 'OK' and 'Cancel' buttons are at the bottom right.

# New parameters in .vgbx file

## Minimum time between two gear shifts:

- Limits the time between two gear shifts in whole seconds
- Rule will be ignored if rpms are too high/low
- High values may cause high rpms during acceleration



**Demo\_Gearbox.vgbx**

**VECTO Gearbox**

Make and Model: Demo

Inertia: 0 [kgm²] Traction Interruption: 1 [s]

Gear	Ratio	Loss Map or Efficiency [-]
A	4.3	0.96
01	6.696	0.96
02	3.806	0.96
03	2.289	0.96
04	1.48	0.96
05	1	0.98
06	0.728	0.96
07	0	

**Gear shift parameters**

Shift polygons file: ShiftPolygons.csv

☐ Allow shift-up inside polygons (AMT only) Torque reserve: 10 [%]

☒ Skip Gears **Minimum time between two gear shifts: 3 [s]**

**Start Gear**

Torque reserve: 40 [%]

Reference vehicle speed at clutch-in: 2 [m/s]

Reference acceleration at clutch-in: 0.6 [m/s²]

OK Cancel

# New parameters in .vgbx file

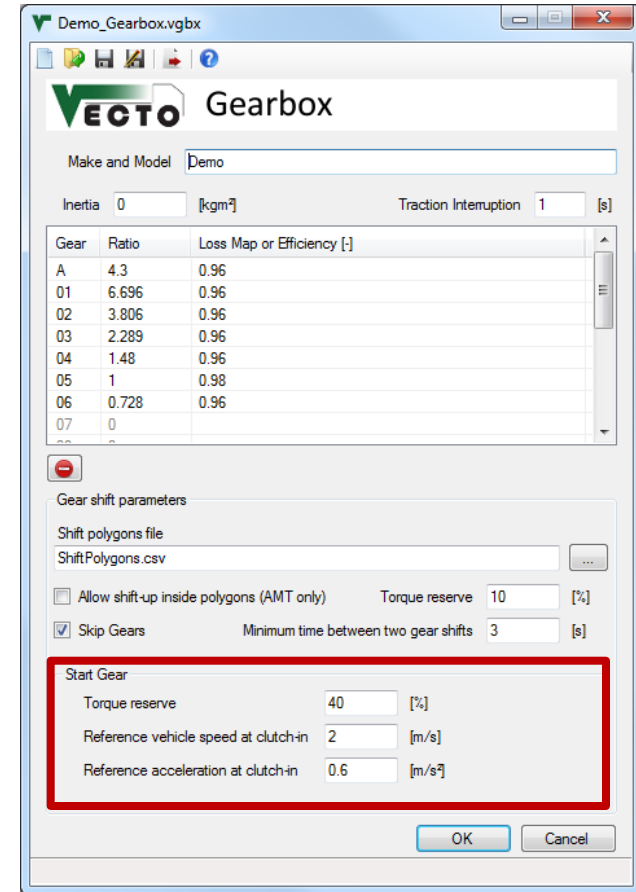
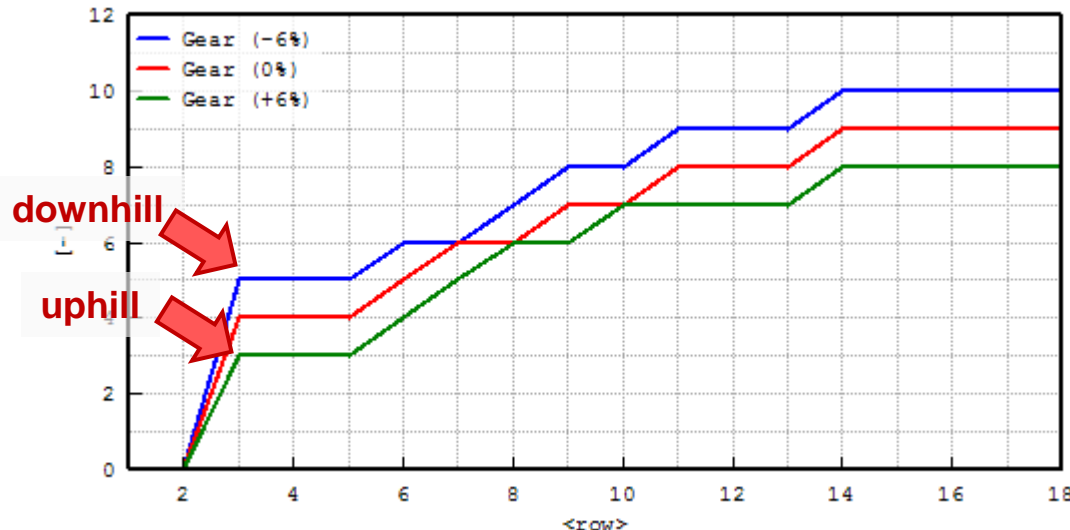
## Start gear (first gear after vehicle standstill):

- Calculated using a fictional load case with:
  - Reference speed
  - Reference acceleration
  - Actual road gradient, transm. losses and aux. power demand



**independent from target speed**

Example: Half-loaded articulated truck, 80km/h target speed:



# Important notes

- The demo data is updated for VECTO 1.1 and ready to run with the new gear shift model
- Format of .vecto files has changed:
  - Old .vecto files (V1.0) can be used with VECTO 1.1.
  - New .vecto files (V1.1) can NOT be used with VECTO 1.0.
- Format of .vgbx files has changed:
  - Old .vgbx files (V1.0) can be opened in the gearbox editor but gear shift parameters must be set before starting calculation.
  - New .vgbx files (V1.1) can be used with VECTO 1.0 but saving files will remove the new parameters.
- The old gear shift model is NOT available in VECTO 1.1.
- The User Manual and Quick Start Guide do not cover the new gear shift model yet.

# Full Changelog V1.1 beta

## VECTO 1.1 beta

- Speed values below 0.09km/h are set to 0km/h
- New gear shift model
  - Replaces old gear shift model!
  - New parameters in .vgbx file including path to gear shift polygons file
  - Old gear shift model parameters removed from .vecto file
- Command Line Arguments processing (see User Manual):
  - Changed prefix form "/" to "-"
  - Bugfix: Argument "-run" was not processed
  - Job files and driving cycles can be added via command line
  - Files without path are expected in the Working Directory
- User Manual update for command line arguments
- Various fixes in GUI
- Bugfix: Error in Cycle Conversion (distance- to time-based) when using Aux Power Input.
- Distance Correction is now active only in acceleration and cruise phases.
- Fixed cycles starting with vehicle speed = 0. In V1.0 the first and second time step were averaged to speed values > 0.
- Demo data updated for new gear shift model
- New independent licensing dll replaces TUG's version