

VECTO 2.0.4

-AUX.2 11.03.2016



Release Notes

VECTO 2.0.4-AUX.2

Important additions and enhancements since AUX.Alpha.3:

- Correction to fuel calculation to bring better consistency with 'Vecto Classic Auxiliaries' calculations with zero auxiliary power
- A range of improvements to the UI
- A range of other bug-fixes and corrections to improve error-handling
- **The User Manual has also been updated with minor clarifications/amendments**

VECTO 2.0.4

-AUX.Alpha.3

07.08.2015



Release Notes

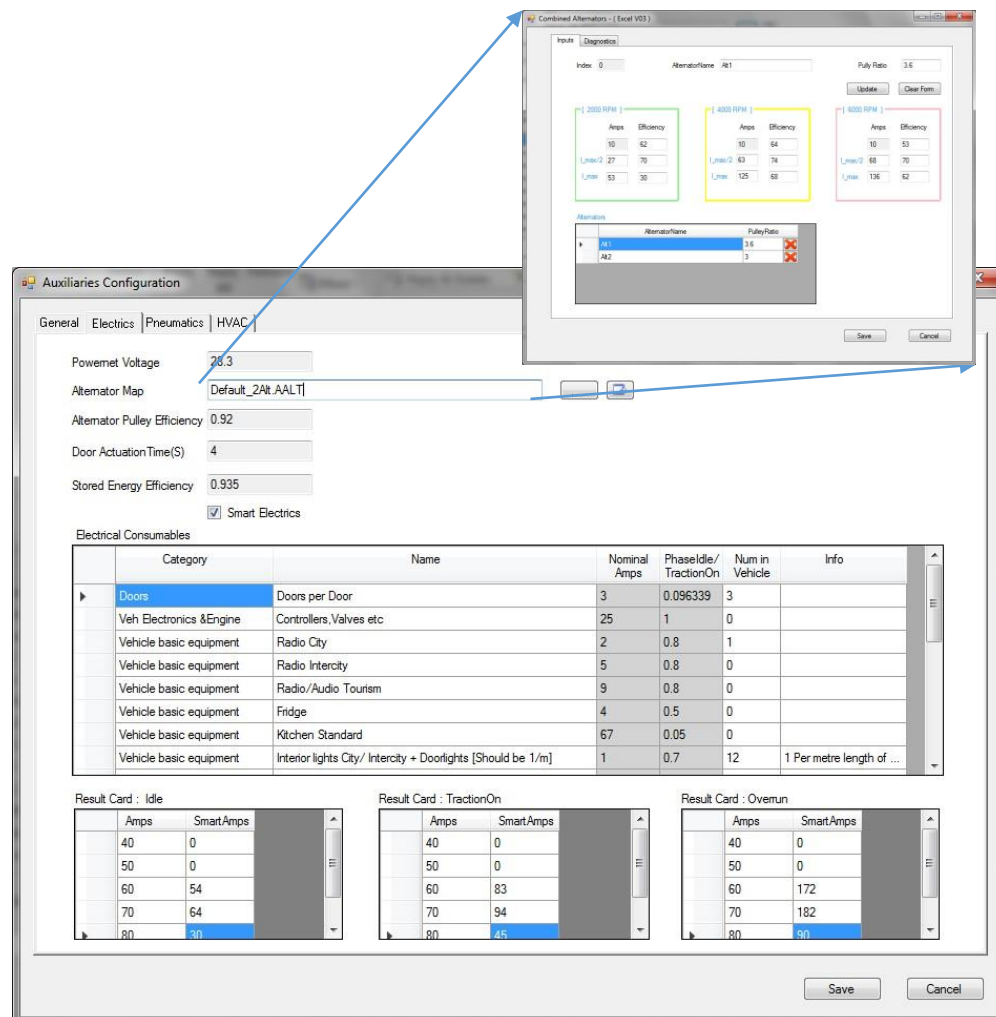
VECTO 2.0.4-AUX.Alpha.3

Important additions and enhancements since AUX.Alpha.2:

- Major improvement in run time for advanced auxiliaries mode
- Amendments to default values, calculated values, cell locked/unlocked status for a range of parameters across the advanced auxiliaries modules
- Revision to combined alternators sub-module to match ACEA TF5 proposals
- Addition of an HVAC climatic conditions batch-mode, and ability to disable the HVAC module
- Advanced auxiliaries module results now passed to VSUM file
- A range of other bug-fixes and corrections
- **The User Manual has also been updated with the new/amended functionality**

Bus Auxiliaries - Electrics

- The “Electrics” tab defines various parameters for electric auxiliaries used on the vehicle, updates include:
 - Revisions to the Combined Alternators sub-module to be consistent with ACEA TF5 recommended approach.
 - Amendments also to “Electrical Consumables” table editable status of certain fields.



Bus Auxiliaries - Pneumatics

- The “Pneumatics” tab defines various parameters for pneumatic auxiliaries used on the vehicle. Updates in the latest release include:
 - Revisions to default values provided when new file is created.
 - Four Default Compressor Map (.ACMP) files provided:
 - DEFAULT_1-Cylinder_1-Stage_393ccm
 - DEFAULT_2-Cylinder_1-Stage_650ccm
 - DEFAULT_2-Cylinder_2-Stage_398ccm
 - DEFAULT_3-Cylinder_2-Stage_598ccm
 - Bug-fixes to pneumatics module calculations

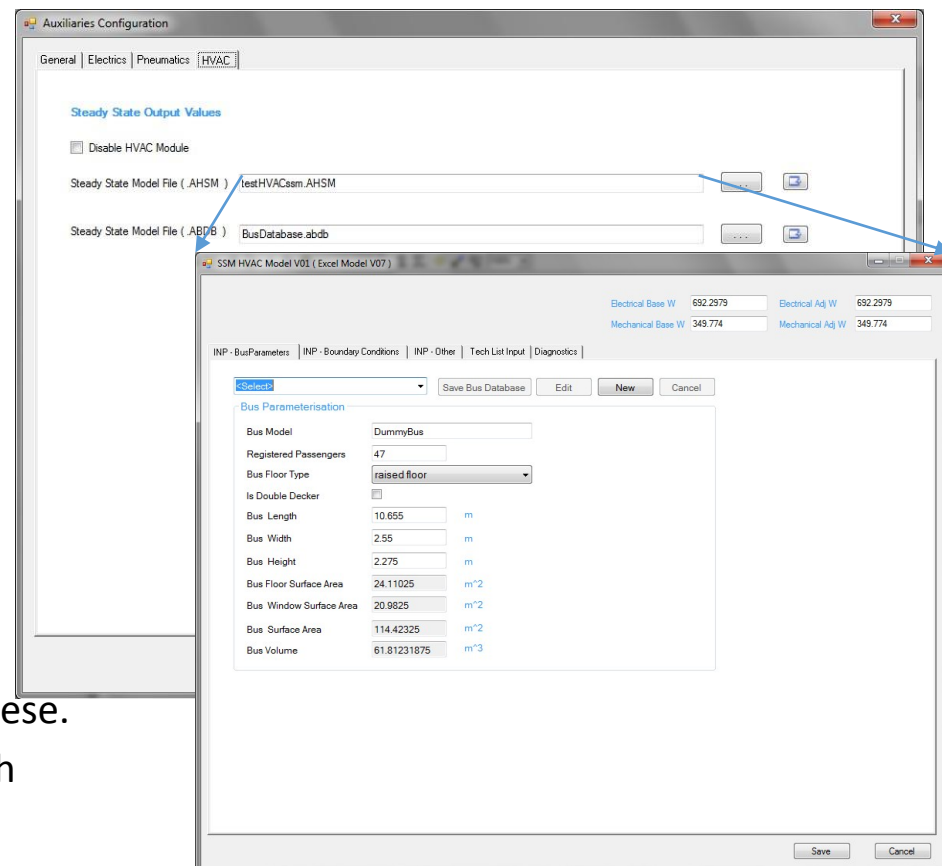
The screenshot shows the 'Auxiliaries Configuration' dialog box with the 'Pneumatics' tab selected. The dialog is divided into two main sections: 'Pneumatic Auxiliaries Data' and 'Pneumatic Variables'.

Pneumatic Auxiliaries Data		Pneumatic Variables	
AdBlue NI per Minute	21.25	Compressor Map	DEFAULT_2-Cylinder_1-Stage_650ccm.ACMP
Air Controlled Suspension NI / Minute	15	Compressor Gear Ratio	1
Braking No Retarder NI/KG	0.00081	Compressor Gear Efficiency	0.97
Braking With Retarder NI/KG	0.0006	AdBlue Dosing	Pneumatic
Breaking Per Kneeling NI/KG in MM	0.000066	Air Suspension Control	Mechanically
Dead Vol Blowouts /L / Hour	24	Door Operation	Pneumatic
Dead Volume Litres	30	Kneeling Height Millimeters	70
Non Smart Regen Fraction Total Air Demand	0.26	Actuations Map	testPneumaticActuationsMap.apac
Overrun Utilisation For Compression Fraction	0.97	Retarder Brake	<input checked="" type="checkbox"/>
Per Door Opening NI	12.7	Smart Pneumatics	<input type="checkbox"/>
Per Stop Brake Actuation NI/KG	0.00064	Smart Regeneration	<input type="checkbox"/>
Smart Regen Fraction Total Air Demand	0.12		

Buttons: Save, Cancel

Bus Auxiliaries - HVAC

- The “HVAC” tab defines various parameters for heating, ventilation and air conditioning (HVAC) auxiliaries used on the vehicle, calculated from the HVAC Steady State Model (HVAC SSM):
 - Steady State Model File (.AHSM)
 - Bus Parameter Database (.ABDB)
 - Disable HVAC Module tickbox (**new**)
- Updates to HVAC Steady State Model Editor in latest release:
 - Added editing capability to bus parameters database
 - Updated default values, calculations and locked status of certain fields
 - Added selection of A/C compressor type
 - Added Climatic Conditions batch-mode, plus DefaultClimatic.AENV input file for these.
 - Amended Technology List table in line with ACEA TF5 proposals



VECTO 2.0.4

-AUX.Alpha.2

29.04.2015

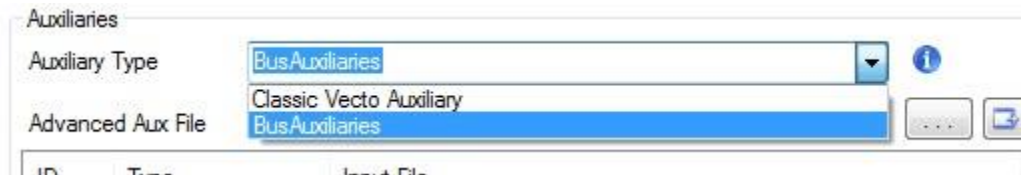


Release Notes

VECTO 2.0.4-AUX.Alpha.2

Important additions and enhancements:

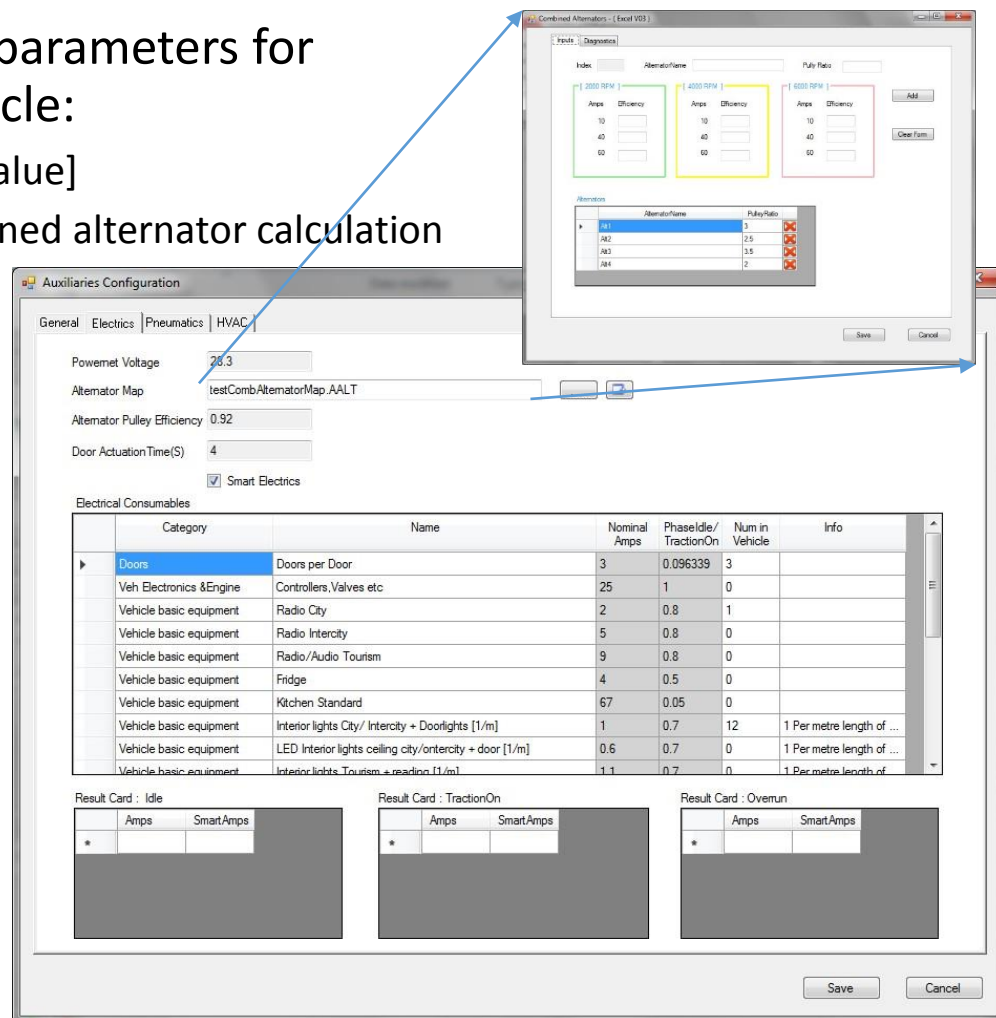
- **Advanced/Bus auxiliaries functionality developed by Ricardo-AEA and Ricardo UK has been added and can be activated (or disabled) via the Job Editor:**



- **Bus Auxiliaries Editor contains allows the different advanced auxiliary types to be configured (.aux file):**
 - Electrics
 - Pneumatics
 - HVAC
- **A number of new file types have also been defined to support the new Advanced Auxiliaries module in VECTO, using existing JSON and CSV formats**
- **The User Manual has been updated with the new functionality**

Bus Auxiliaries - Electrics

- The “Electrics” tab defines various parameters for electric auxiliaries used on the vehicle:
 - Powernet Voltage [locked field/fixed value]
 - Alternator Map (.AALT file, with combined alternator calculation module)
 - Alternator Pulley Efficiency [locked field/fixed value]
 - Door Actuation Time(S) [locked field/fixed value]
 - Smart Electrics [On/Off]
- The “Electrical Consumables” table contains a list electrical equipment that place demand on the engine.



Bus Auxiliaries - Pneumatics

- The “Pneumatics” tab defines various parameters for pneumatic auxiliaries used on the vehicle:
 - Data for various pneumatic auxiliaries and the relevant pneumatic variables can be edited in the adjacent text boxes.
 - Compressor Map (.ACMP) file
 - Actuators Map (.APAC) file
 - The “Retarder Brake”, “Smart Pneumatics” and “Smart Regeneration” and enable via check boxes.

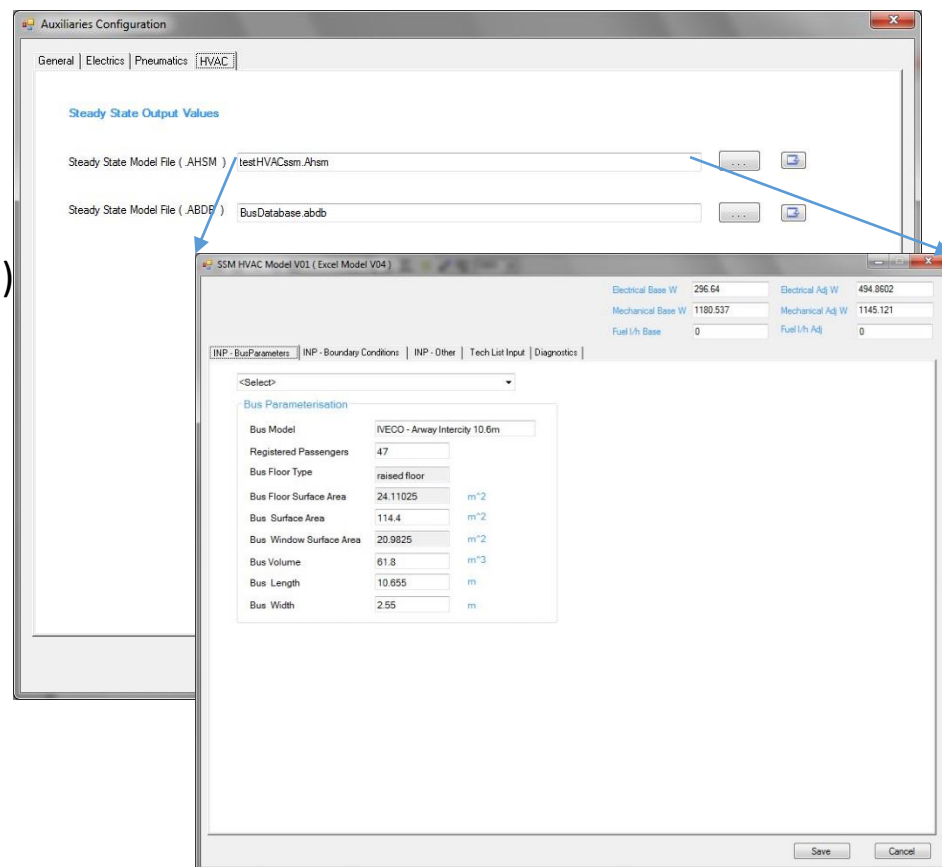
The screenshot shows the 'Auxiliaries Configuration' dialog box with the 'Pneumatics' tab selected. The dialog is divided into two main sections: 'Pneumatic Auxiliaries Data' and 'Pneumatic Variables'.

Pneumatic Auxiliaries Data		Pneumatic Variables	
AdBlue NI per Minute	21.25	Compressor Map	testCompressorMap.acmp
Air Controlled Suspension NI / Minute	15	Compressor Gear Ratio	1
Braking No Retarder NI/KG	0.00081	Compressor Gear Efficiency	0.8
Braking With Retarder NI/KG	0.0005	AdBlue Dosing	Pneumatic
Braking Per Kneeling NI/KG in MM	0.000066	Air Suspension Control	Electrically
Dead Vol Blowouts /L / Hour	24	Door Operation	Pneumatic
Dead Volume Litres	30	Kneeling Height Millimeters	80
Non Smart Regen Fraction Total Air Demand	0.26	Actuators Map	testPneumaticActuatorsMap.APAC
Overrun Utilisation For Compression Fraction	0.97	Retarder Brake	<input checked="" type="checkbox"/>
Per Door Opening NI	12.7	Smart Pneumatics	<input checked="" type="checkbox"/>
Per Stop Brake Actuation NI/KG	0.00064	Smart Regeneration	<input checked="" type="checkbox"/>
Smart Regen Fraction Total Air Demand	0.12		

Buttons: Save, Cancel

Bus Auxiliaries - HVAC

- The “HVAC” tab defines various parameters for heating, ventilation and air conditioning (HVAC) auxiliaries used on the vehicle, calculated from the HVAC Steady State Model (HVAC SSM):
 - Steady State Model File (.AHSM)
 - Bus Parameter Database (.ABDB)
- HVAC Steady State Model Editor:
 - The HVAC Steady-State Model (HVAC SSM) Editor defines various data and parameters for calculation of HVAC auxiliary demands (electrical, mechanical and fuelling) from the vehicle, replicating key inputs/functionality from the HVAC CO2SIM model developed for ACEA:
 - Bus Parameters Inputs
 - Boundary Conditions Inputs
 - Other Inputs
 - Technology List Inputs



VECTO 2.0.1

19.04.2014



Release Notes

VECTO 2.0.1

Important additions and enhancements:

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

Incompatible changes since previous release (V1.4):

- **File-format changes for Input/Output files**
 - Old file-formats scrapped; CSV and JSON used everywhere
 - CSVs: Use "#" for comments, one and only one header-line required

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

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

$$CF_{WHTC} = \sum_{i=1}^3 f_i \cdot \frac{FC_{meas_i}}{FC_{calc_i}} [-]$$

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

Start/Stop FC Correction

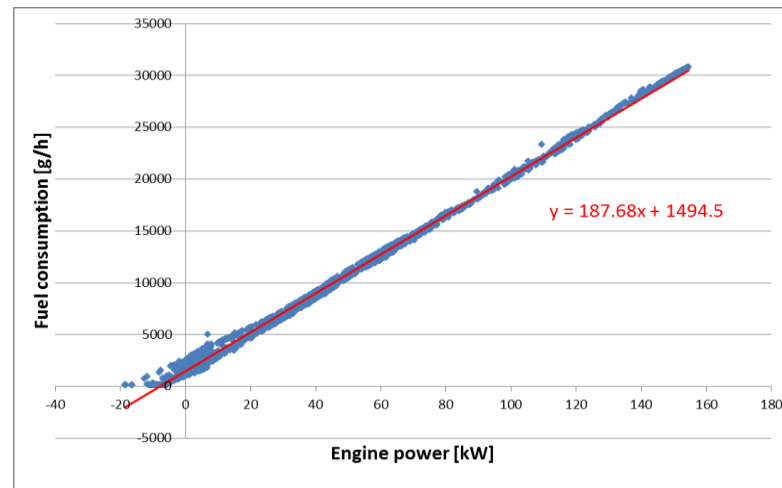
Auxiliary power demand is constant for the whole mission profile but when Start/Stop is enabled there is no idling consumption. Therefore:

- **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 “ ΔP_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 $\geq \Delta P_e$

File-format changes

- Old format scrapped; only JSON and CSV is supported
- CSVs: New comment symbol is "#" (instead of "c")
- CSVs: One and only one header-line is required (which must not be a comment line)
- The formats are described in the HTML User Manual under “Input and Output Files” > “CSV Format” and in each input file page of the user manual.

Full Changelog V2.0

- Bugfix: FC extrapolation will not abort calculation. Invalid FC values are marked in output as "ERROR"
- Updated CSV file format. Now only one header with units included
- Changed input file comment symbol from "c" to "#"
- Replaced old Demo/Default Data with "Demo Vehicles"
- Updated User Manual
- Introduced Declaration Mode
- Updated GUI including Charts
- New internal Graph for VMOD files (replaces GRAPHi)
- Shift polygons can be set separately for each gear
- Removed rated power (not used anymore)
- Removed rated engine speed from engine file. Now calculated from vfld file.

VECTO 1.4 RC4

10.10.2013



Update Notes

VECTO 1.4

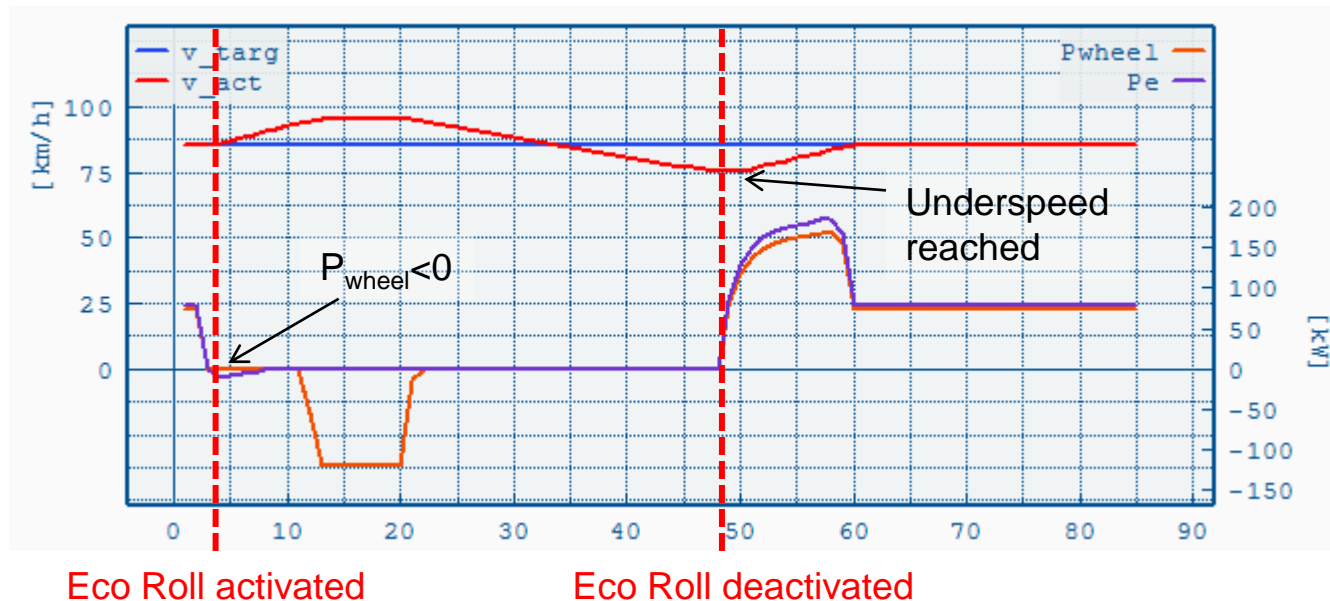
Update Overview:

- 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



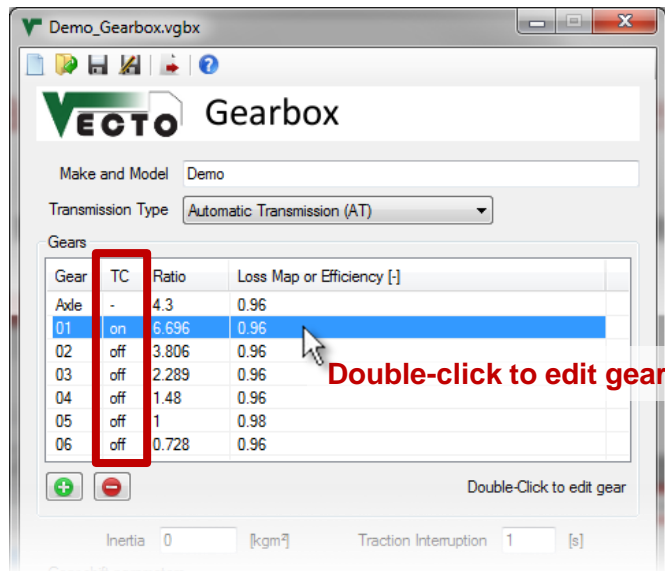
* P_{wheel} = Total power demand at wheels

Look-Ahead Coasting

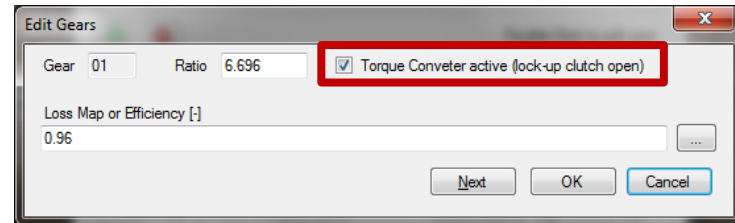
- Real coasting also if road gradient > 0
 - Deceleration may be so high that no braking is necessary. In this case the braking phase will be omitted. (Before V1.4 coasting was not affected by road gradient, if > 0)
- Distance Correction now also affects coasting phases
 - Lower distance error
 - Coasting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

Gearbox & Toque Converter

Torque converter can now be defined in multiple gears



Double-click to edit gear



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
Axle	-	4.3
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)

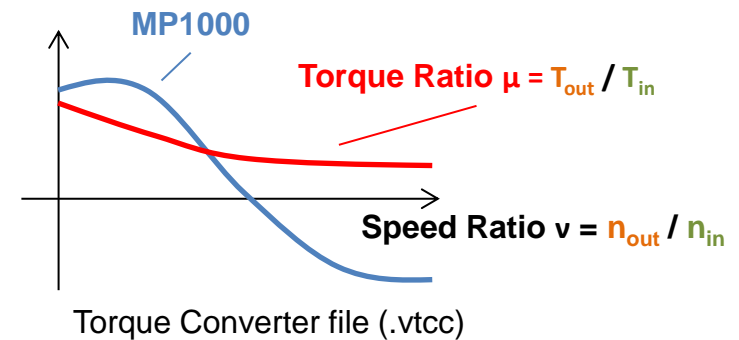
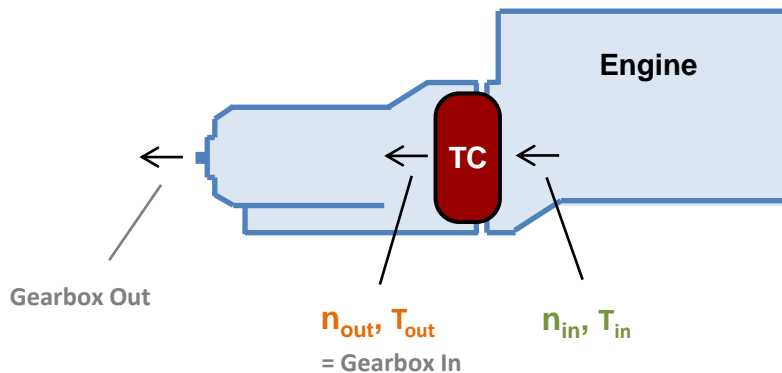
Note: Gear numbers in results are the same as here (i.e. no more "0.5" gear)!

* TC active = lock-up clutch open

Toque Converter Setup

Conventional Automatic Transmission

- Torque converter file is defined for torque converter only



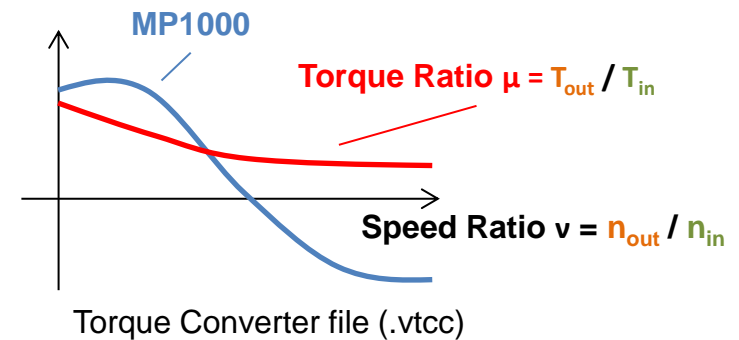
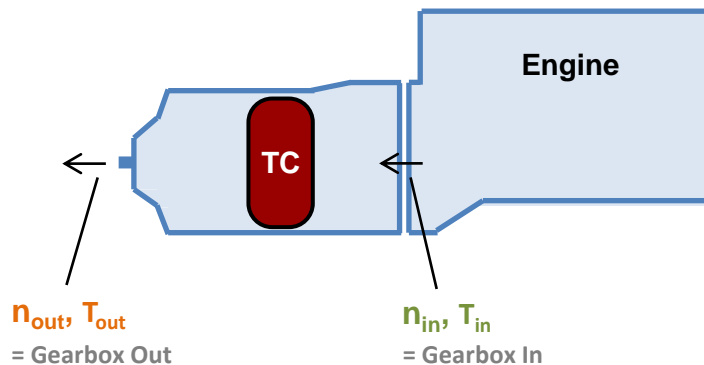
- Define TC gear with ratio of first (mechanical) gear
- Set transmission losses of first gear (map or constant efficiency)

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:

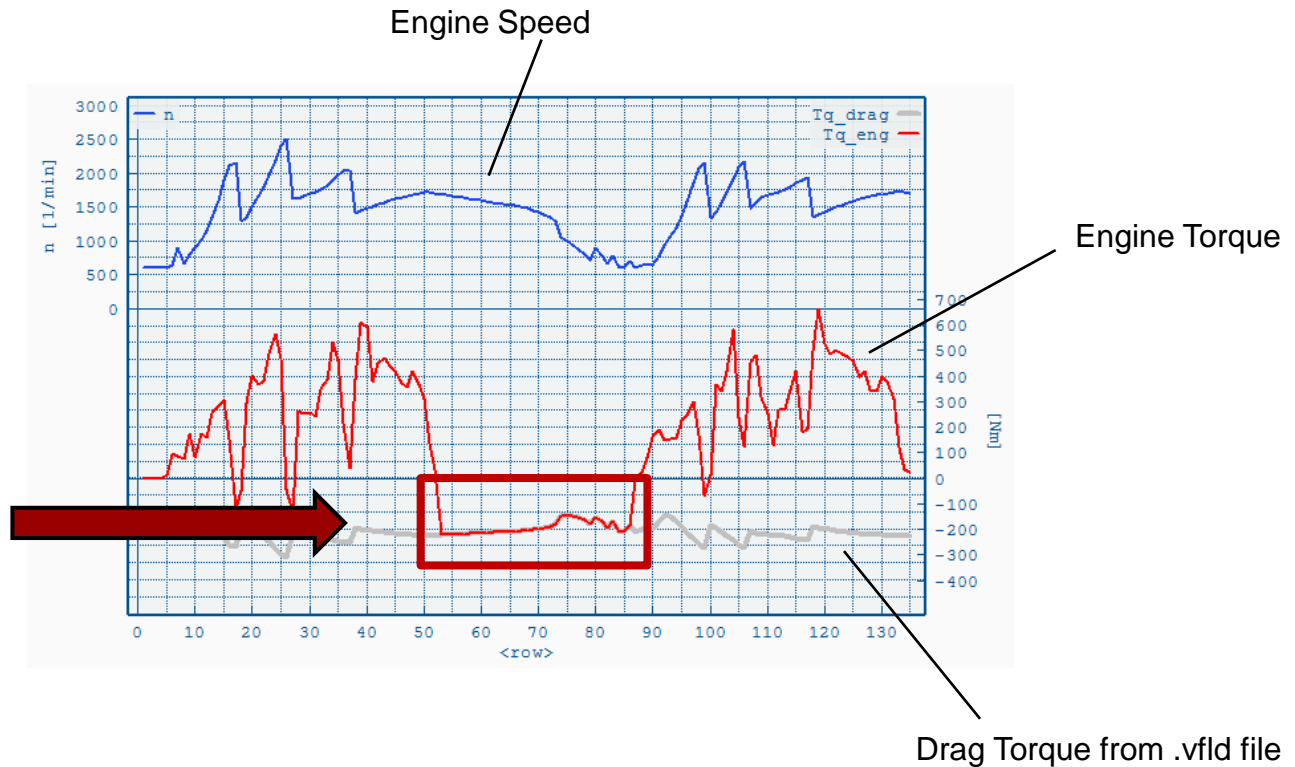
- Same gear numbers in output as in GBX file, i.e. first gear with TC is not "TC" or "0.5" but simply "1"
- "Minimum time between two gear shifts" now also limits torque converter shifts
- Unlimited number of gears and new gear list in GUI without fixed gear number
- Improved gear shift model for torque 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

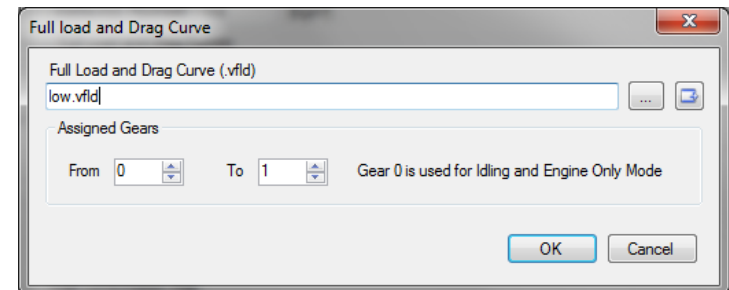
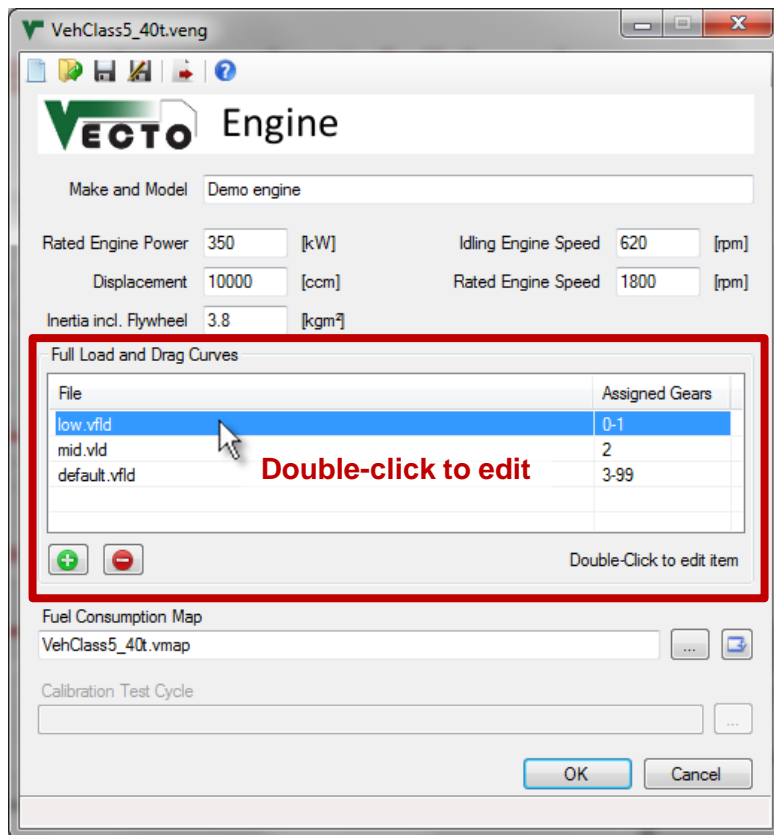
Load cycle (.vldi)

<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/s²] = 9.81
 β [-] = 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

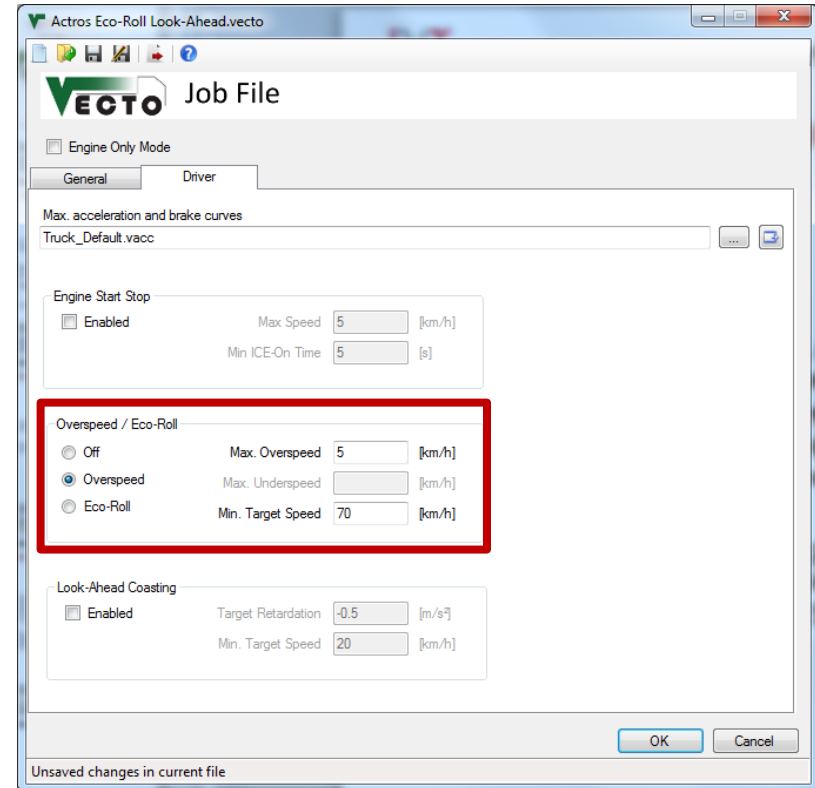
Overview:

- 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:

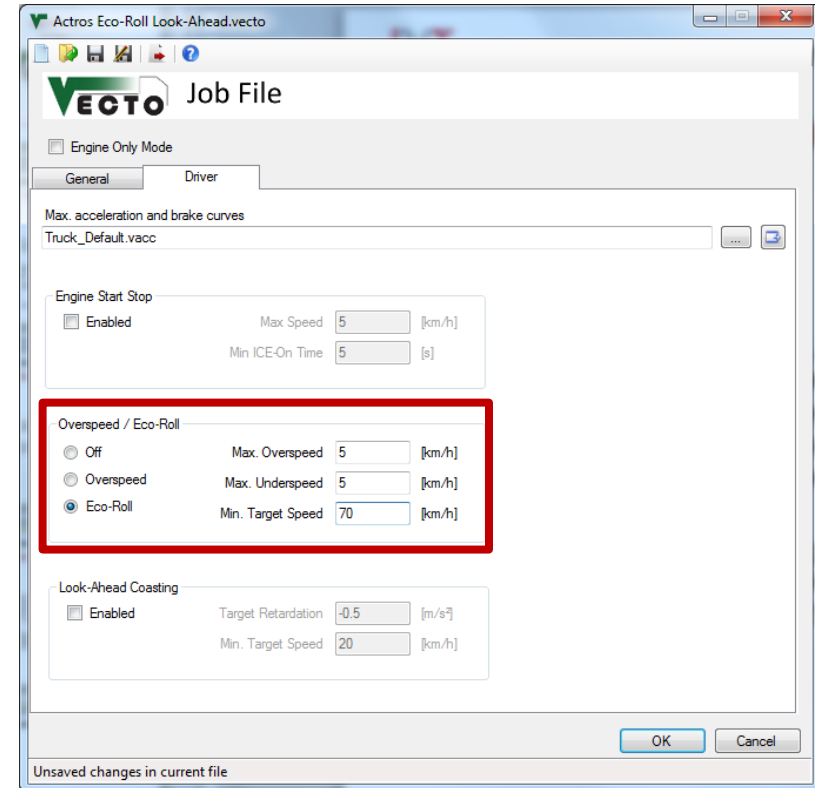
- **Functionality:**
 - If $P_{\text{wheel}} < 0$: Coasting with brakes not applied for speed < target speed + allowed overspeed
- **Parameters:**
 - Minimum Target Speed, e.g. 70km/h
 - Allowed Overspeed, e.g. 5km/h



VECTO Editor - Driver Tab

Eco-Roll:

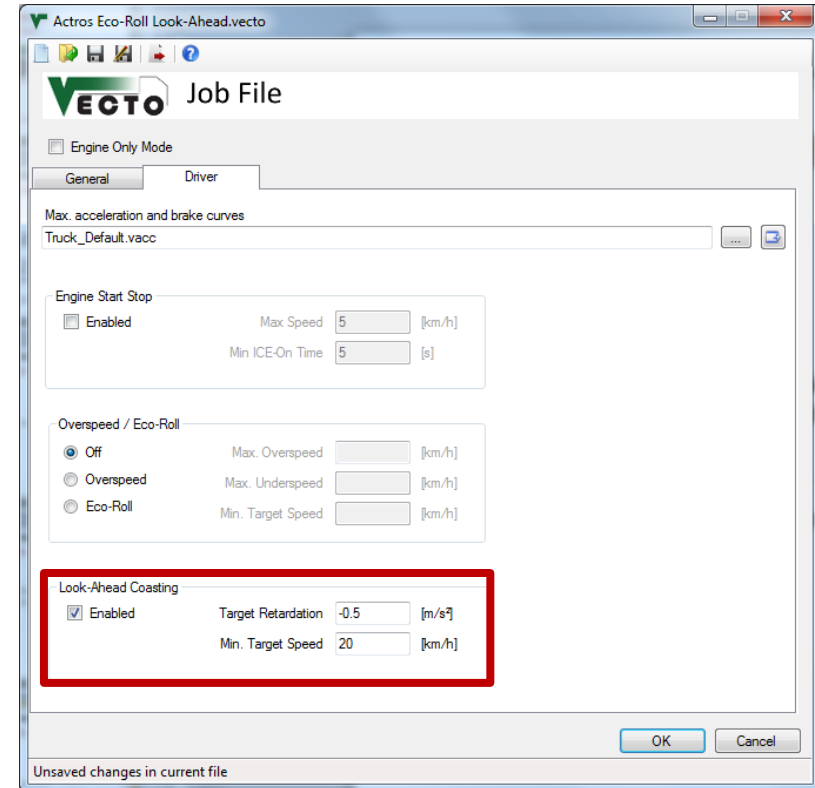
- **Functionality:**
 - If $P_{\text{wheel}} < 0$: Neutral gear, engine idling.
 - Engine and service brake if target speed + allowed overspeed is reached.
 - Normal driving if target speed + allowed underspeed is reached.
- **Parameters:**
 - Minimum Target Speed, e.g. 70km/h
 - Allowed Overspeed, e.g. 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. -0.5m/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: TCfile.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 [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 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 μ	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.

The screenshot shows the 'Demo_Gearbox.vgbox' window. It includes a table of gear characteristics:

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

Below the table, there are fields for 'Inertia' (0 [kgm²]) and 'Traction Interruption' (1 [s]). The 'Gear shift parameters' section includes 'Shift polygons file' (ShiftPolygons.vgbs), 'Allow shift-up inside polygons (AMT)' (unchecked), 'Torque reserve' (20 [%]), 'Skip Gears (MT, AMT)' (checked), and 'Minimum time between two gear shifts' (3 [s]). The 'Start Gear' section has 'Torque reserve' (40 [%]), 'Reference vehicle speed at clutch-in' (2 [m/s]), and 'Reference acceleration at clutch-in' (1.5 [m/s²]). The 'Torque Converter' section is checked for 'Installed (AT)' and has a red box around the 'Torque converter characteristics file' field, which is set to 'Tcfile.vtcc'. The 'Reference rpm for torque characteristic' is set to 1000 [1/min].

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

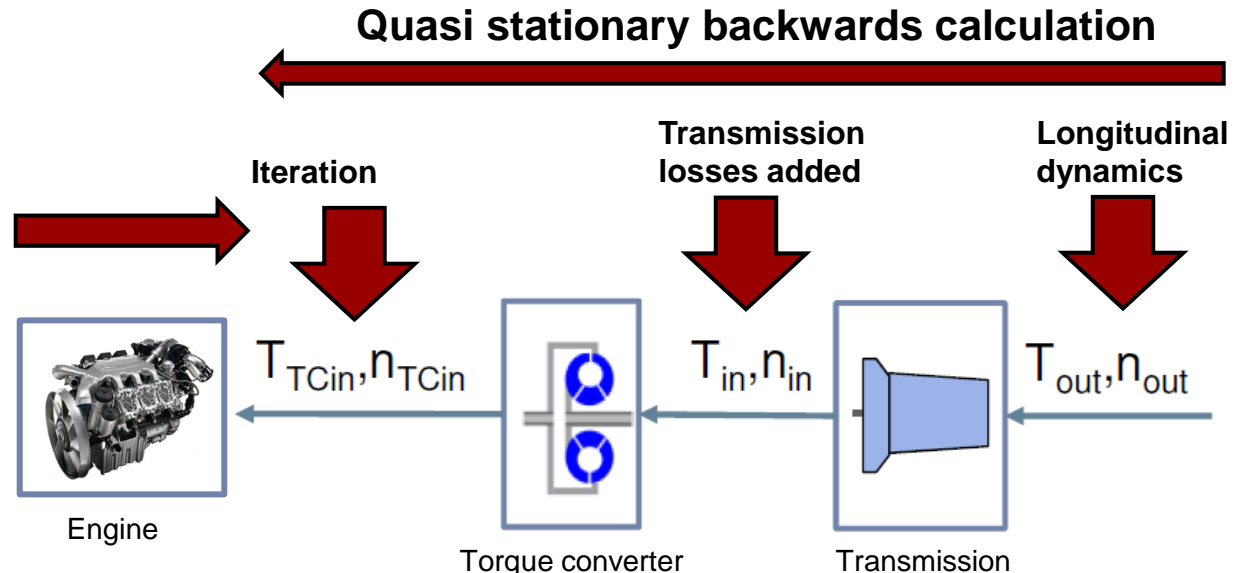
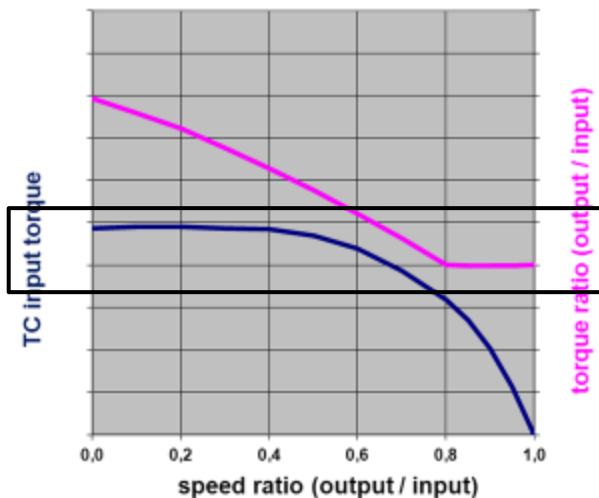
Reference rpm for torque characteristic: 1000 [1/min]

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)

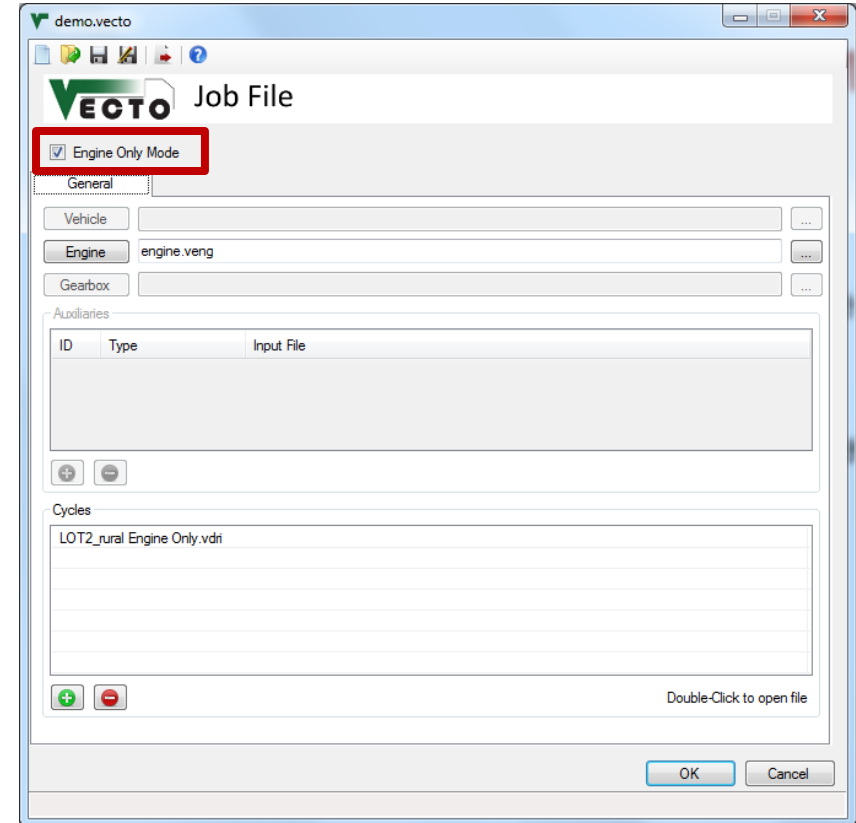


Engine Only Mode (.vecto file)

- 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]

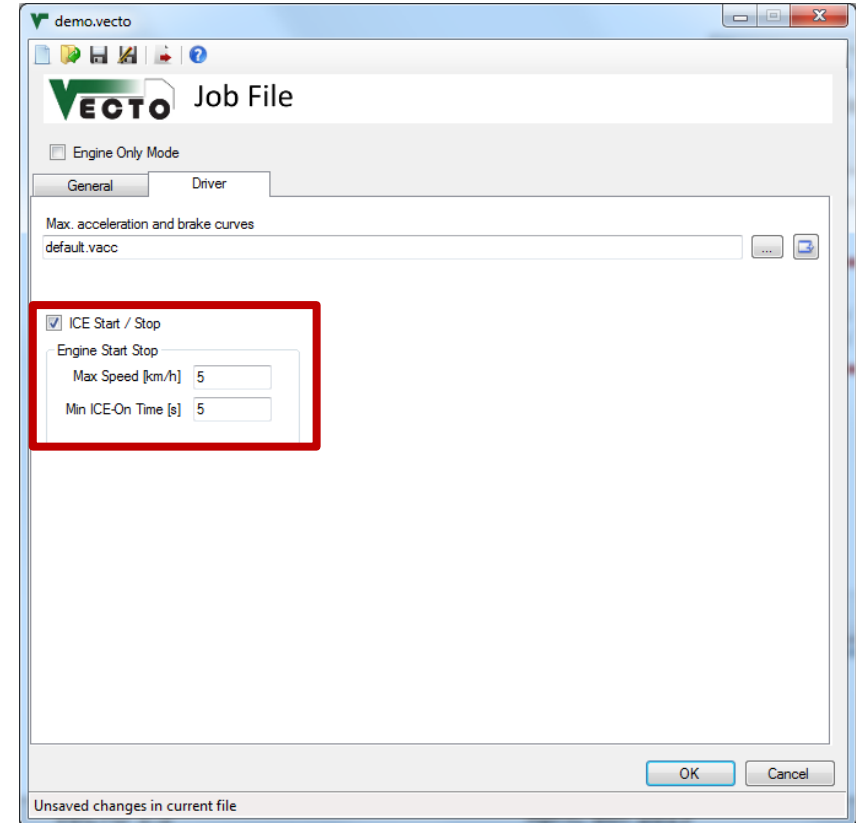
or

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

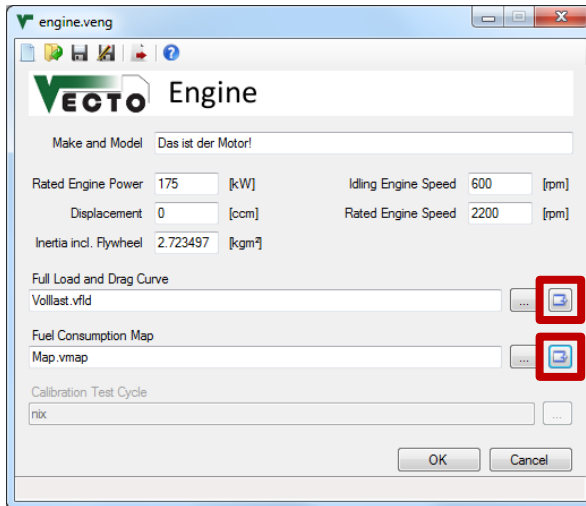


Engine Start / Stop (.vecto file)

- Engine will be turned off if:
 - Power demand (without Aux) ≤ 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

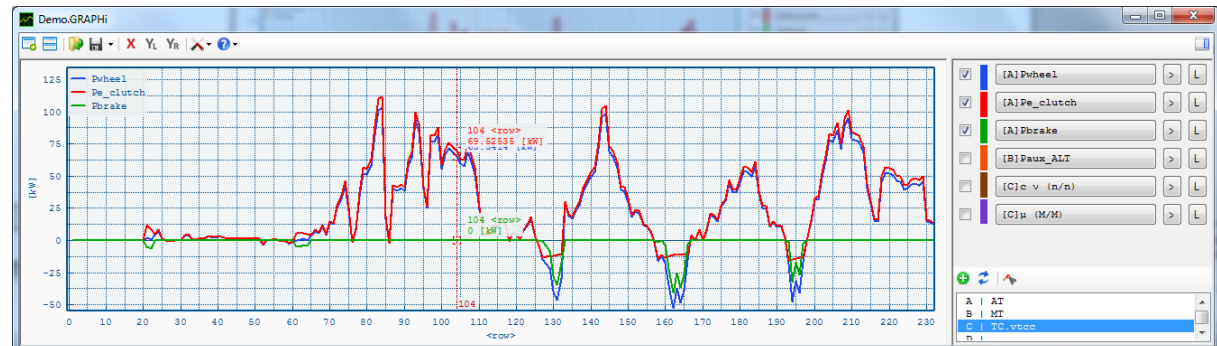
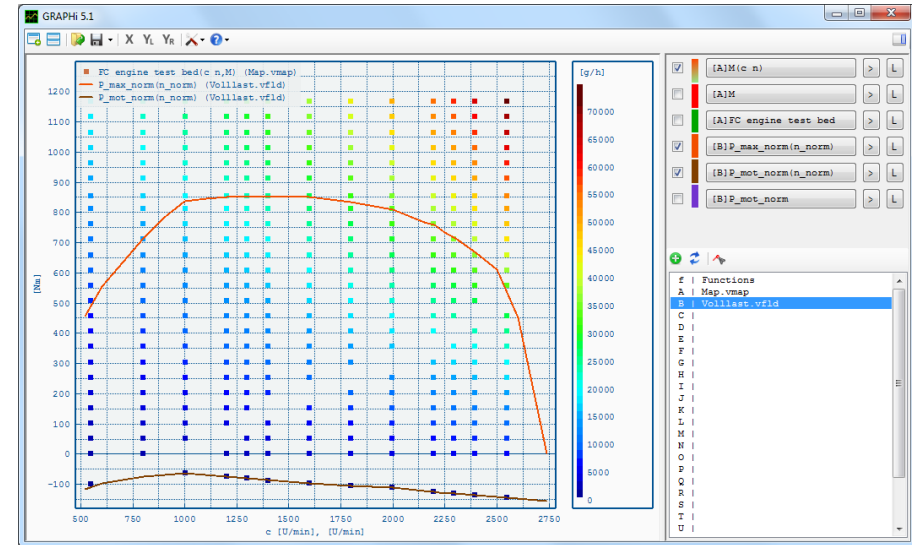


Opens a menu with three options:

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

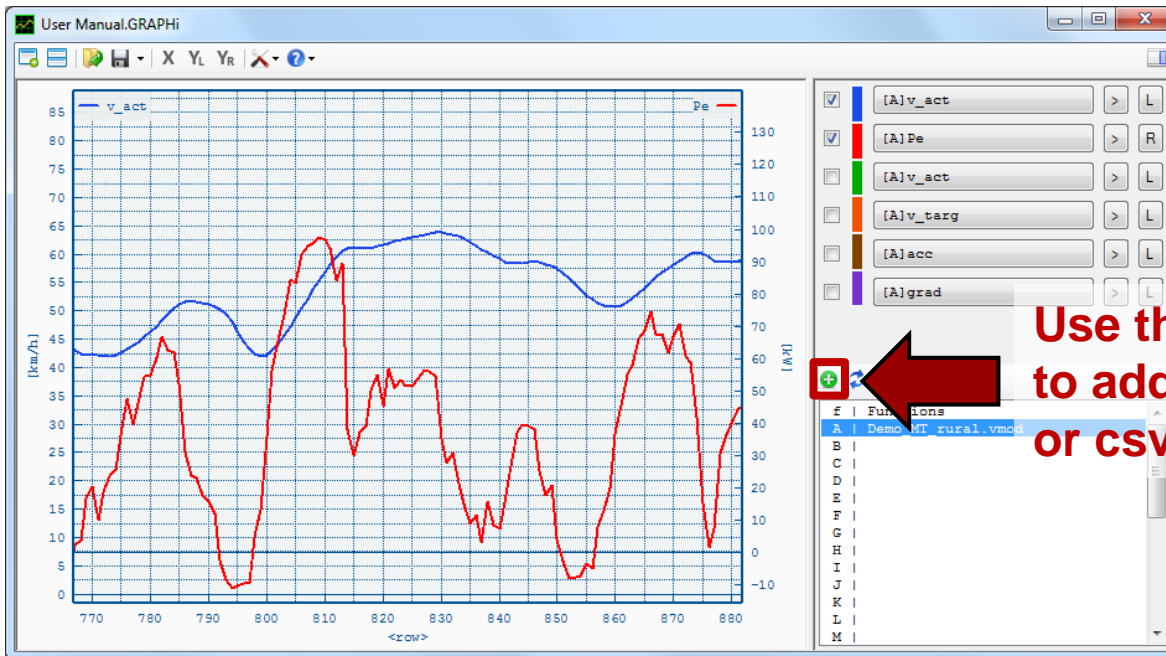
Visualizer (GRAPHi)

- 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)

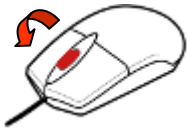
Once a file is loaded, it remains in memory without accessing the file on the hard drive (unless manually reloaded).

GRAPHi Quick Start (2/5)

Mouse Controls



Move

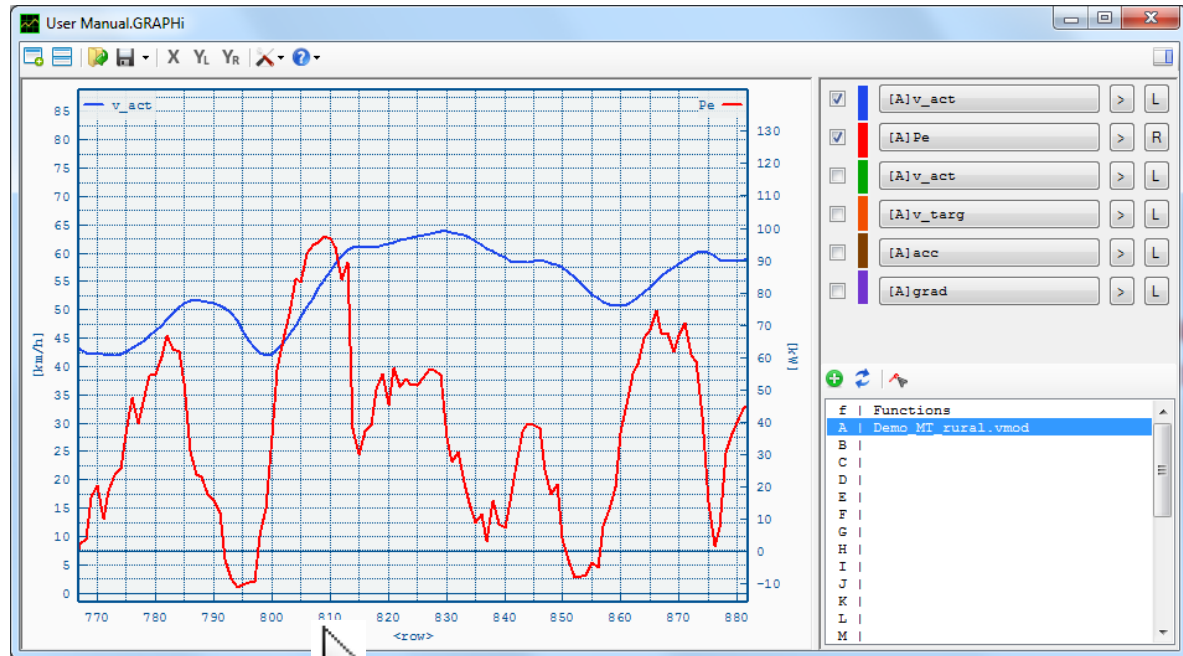


Zoom



Zoom-Box

Click 1: 1st corner
Click 2: 2nd corner
(Right-Click to Cancel)

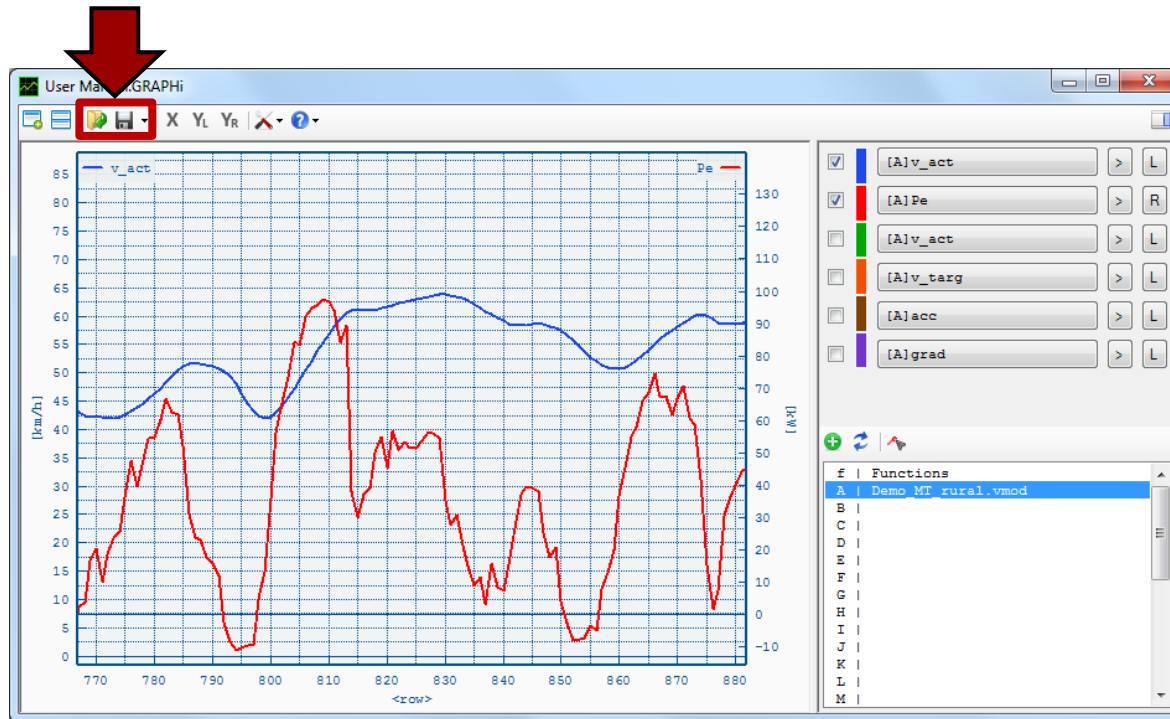


Hold cursor over x-axis to zoom/move x-axis only!!!

GRAPHi Quick Start (3/5)

Opening and Saving Sessions

Save/Load Session (.GRAPHi file)



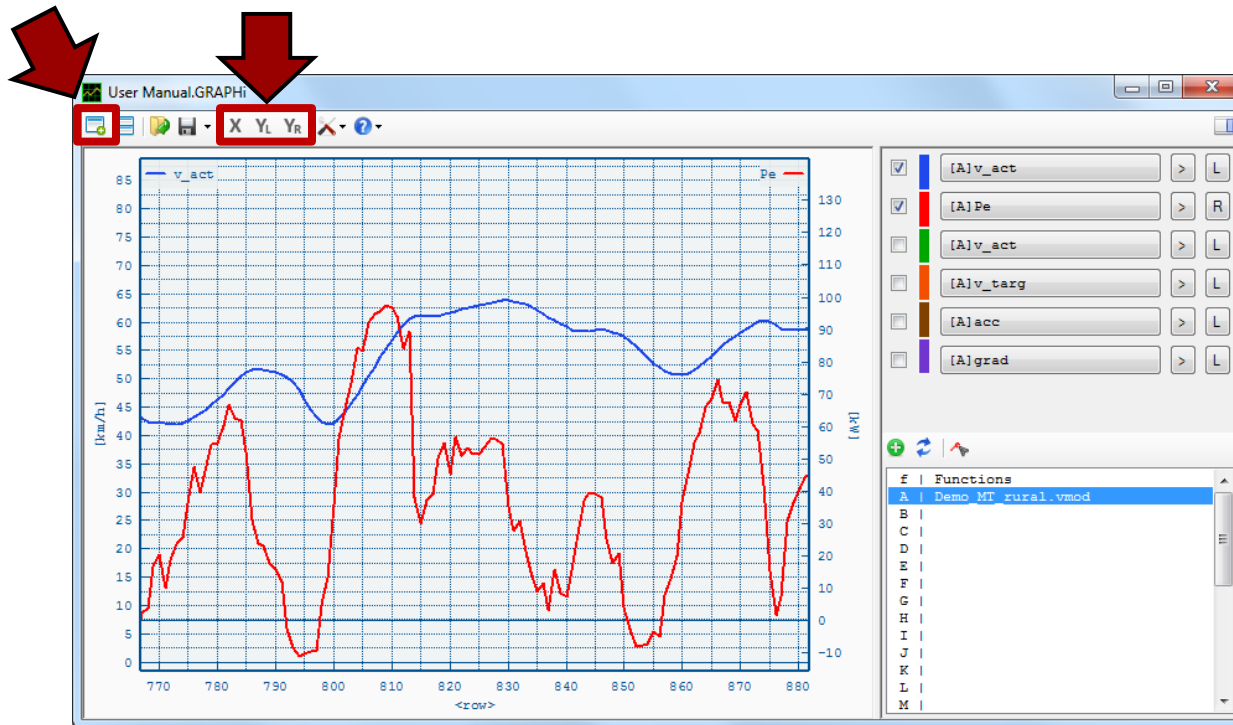
Session files (.GRAPHi) include all data to restore a session. Source files are saved only as reference, i.e. the original files must be accessible.

GRAPHi Quick Start (4/5)

Windows and Syncing

Add Window

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

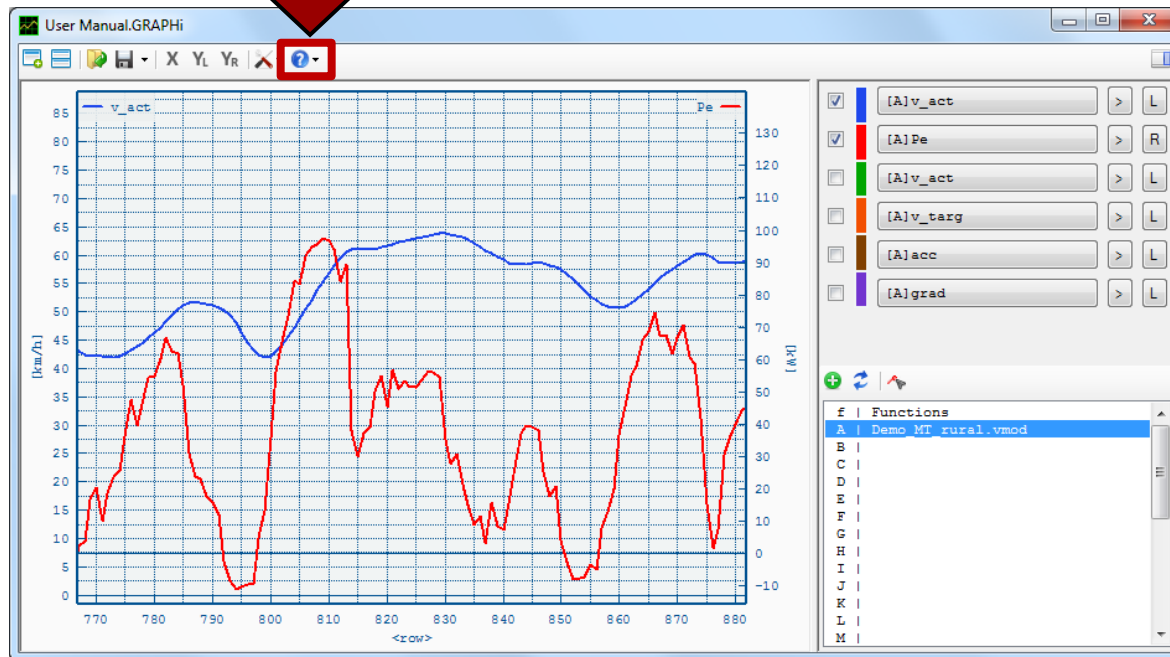


Syncing means changes to the synced axes in one window are reflected by all other windows which have the same axes synced.

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

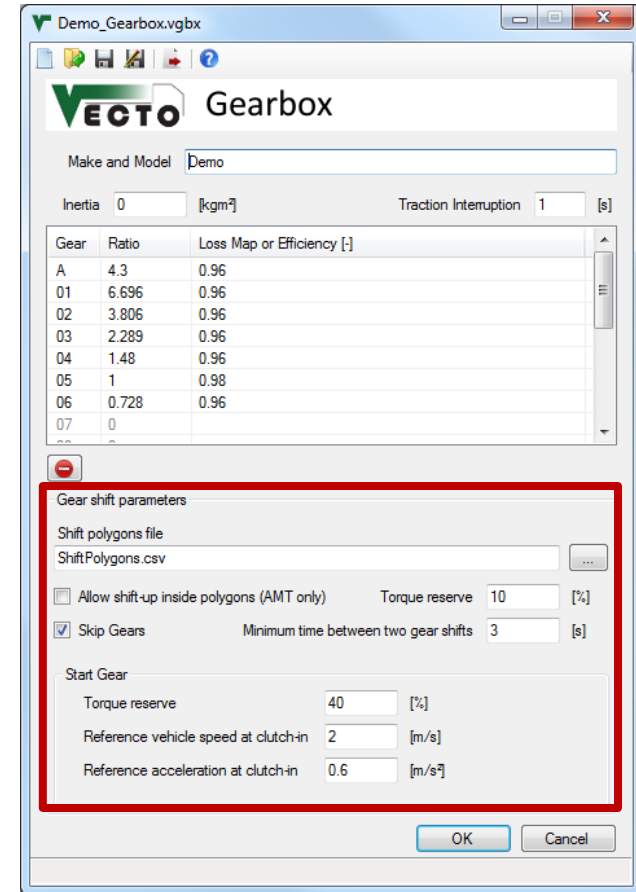


Update Notes

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

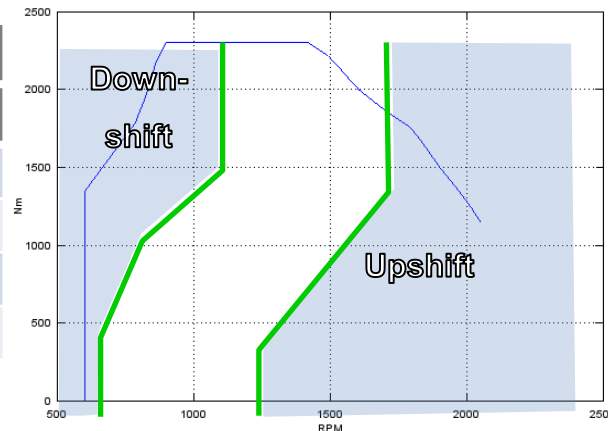


New parameters in .vgbx file

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
...

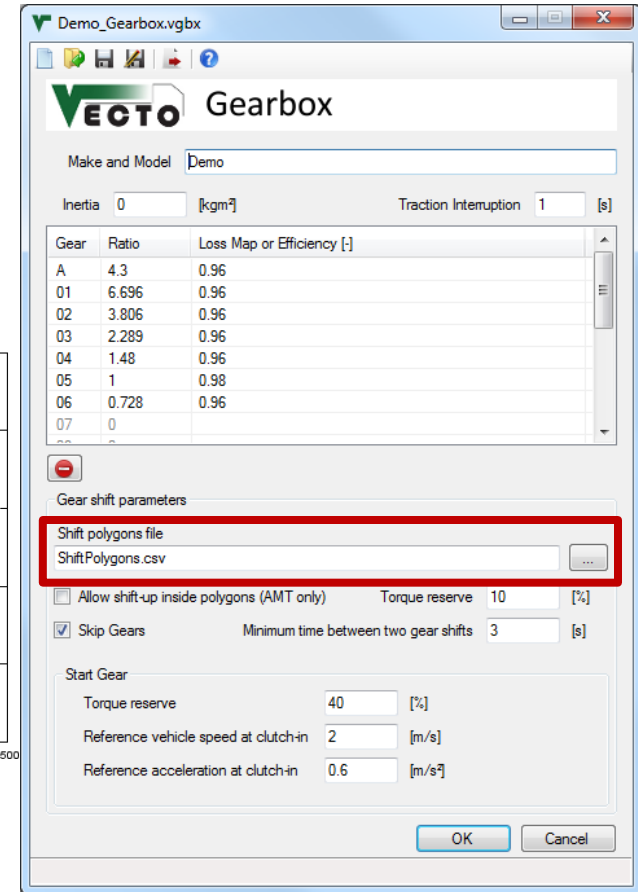


*VECTO CSV Format:

List Separator: Comma ","

Decimal-Mark: Dot "."

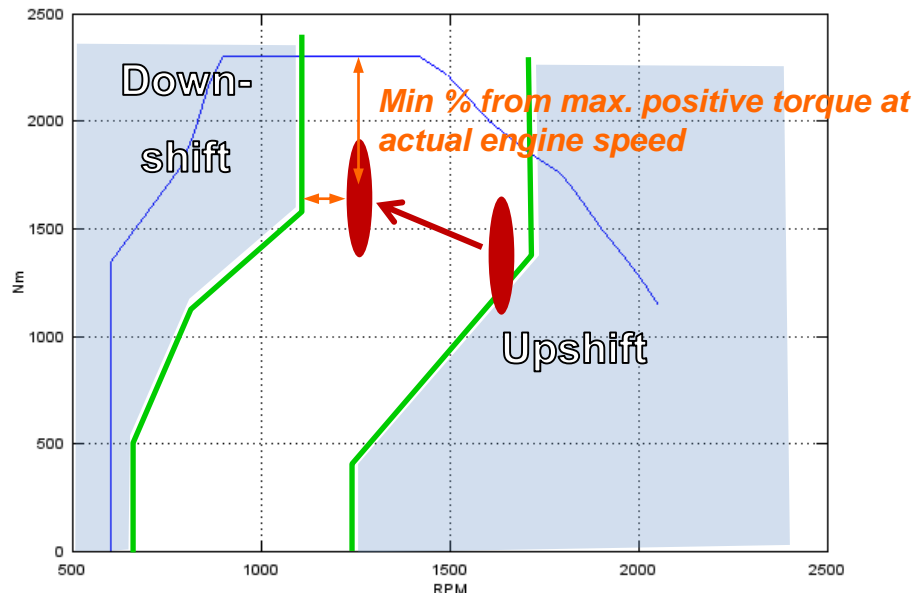
Comments/headers: "c" at the beginning of the comment line. Number and position of comment lines is not limited.



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 [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]

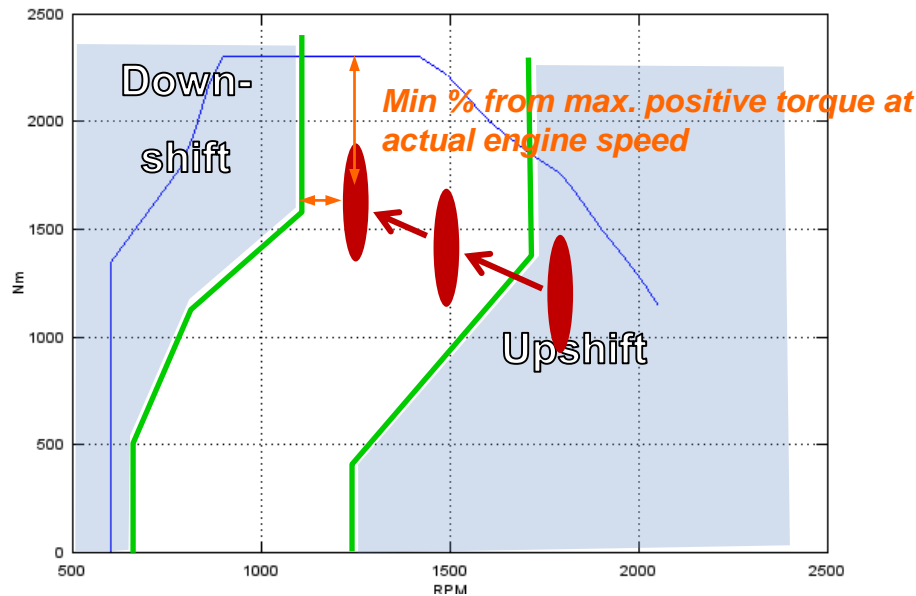
Reference acceleration at clutch-in: 0.6 [m/s²]

OK Cancel

New parameters in .vgbx file

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**



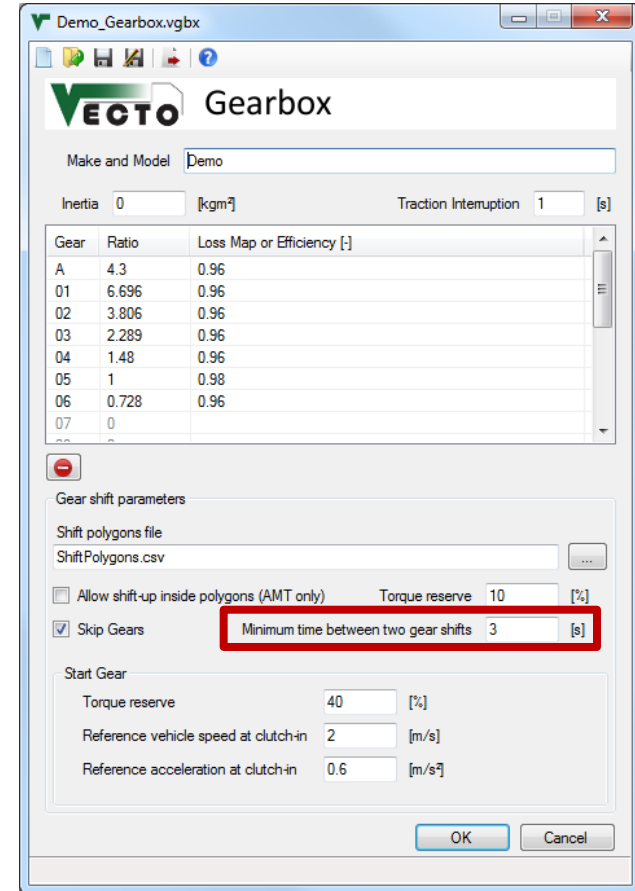
The screenshot shows the 'Demo_Gearbox.vgbx' window. The 'Gearbox' tab is active, displaying a table of gear ratios and loss maps. The 'Skip Gears' checkbox is checked. The 'Torque reserve' is set to 10%. The 'Start Gear' section shows 'Torque reserve' at 40%, 'Reference vehicle speed at clutch-in' at 2 m/s, and 'Reference acceleration at clutch-in' at 0.6 m/s².

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	

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



The screenshot shows the 'Demo_Gearbox.vgbx' configuration window. The 'Gear shift parameters' section is expanded, and the 'Skip Gears' checkbox is checked. The 'Minimum time between two gear shifts' is set to 3 seconds, which is highlighted with a red box. Other parameters include 'Torque reserve' at 10%, 'Reference vehicle speed at clutch-in' at 2 m/s, and 'Reference acceleration at clutch-in' at 0.6 m/s².

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	

New parameters in .vgbx file

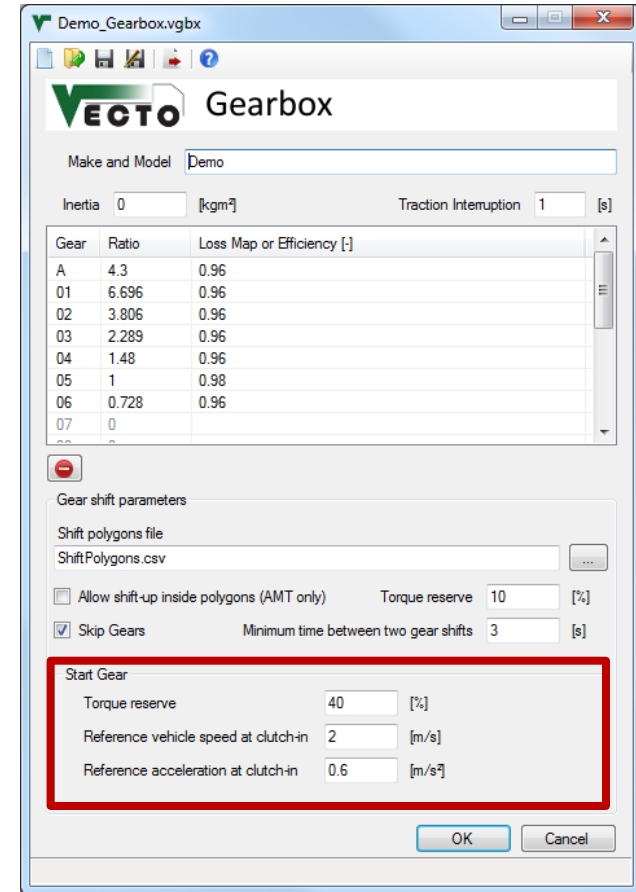
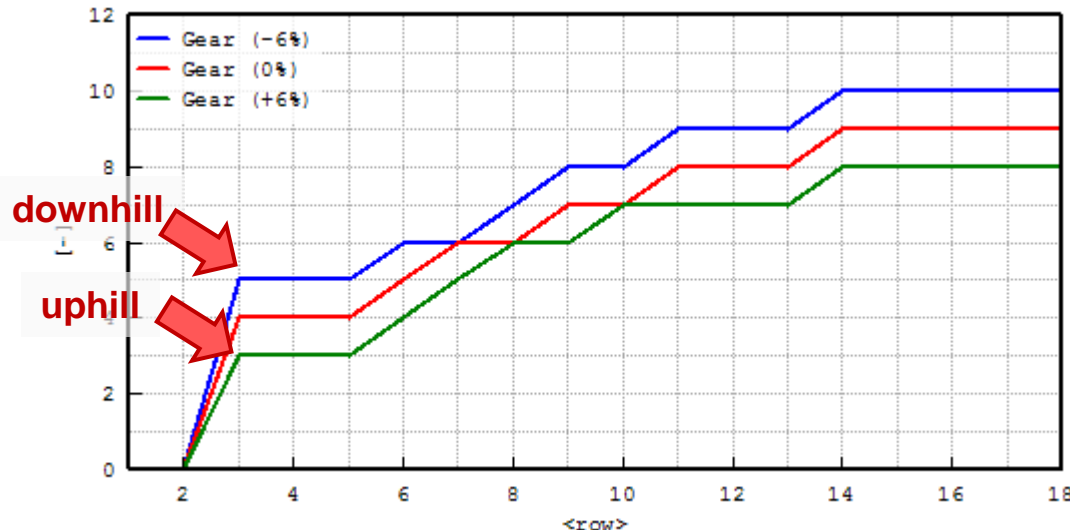
Start gear (first gear after vehicle standstill):

- 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