A concept for performance based ASEP data processing

Issued by your chairman

May 2007

Starting points of this concept

- ASEP should use the same basis as Annex 3
  - Performance based
  - Design independent
  - All noise values based on total vehicle noise; no separation of sub sources

- **Driving conditions**: defined in terms of vehicle speed and vehicle acceleration; no design related parameters such as engine speed or selected gear.

- **ASEP Noise Limit curve:** constructed on base of vehicle speed and vehicle acceleration; no design dependent parameters such as engine speed or selected gear.

- Anchor point of limit curve is Annex 3 limit value, not the Annex 3 test result.

- Measurements: as already agreed:
  - WOT within boundary conditions
  - boundary conditions itself still between square brackets

Noise model of this concept

- $L_p = C_1 + C_2*(a-a_{ref}) + C_3*(v-v_{ref})$

- C_1 is the expected noise level at the reference condition ($a = a_{ref}$; $v = v_{ref}$).
  C_1 depends on the noise level of interest (e.g. average of a group; maximum of a group etceteras) as well as on the vehicle type

- C_2 and C_3 are the expected slope of noise versus acceleration rate and noise versus vehicle speed.

- The coefficients C_2 and C_3 have been obtained from various sources of data available to the Netherlands:
  - Pass by measurements on designated and instrumented vehicles on a test track
  - Road side measurements on random vehicles from the traffic
  - On board measurements on instrumented vehicles, while driving in urban traffic

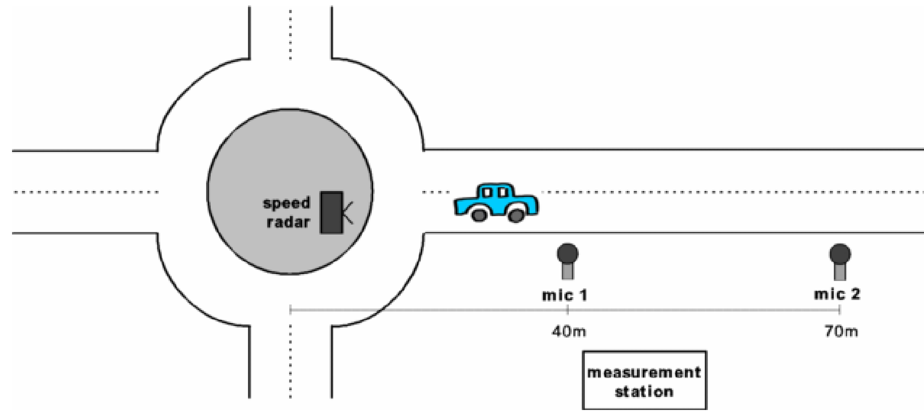
- The best fitting coefficients are
    - $C_2 = 4,0$
    - $C_3 = 0,3$

- The estimation of C_2 and C_3 is most reliable around
  - v = 50 km/h and
  - a = 1 m/s^2

- See next sheets for some data sources of C_2 and C_3

Examples of data sources for the determination of C_2 and C_3

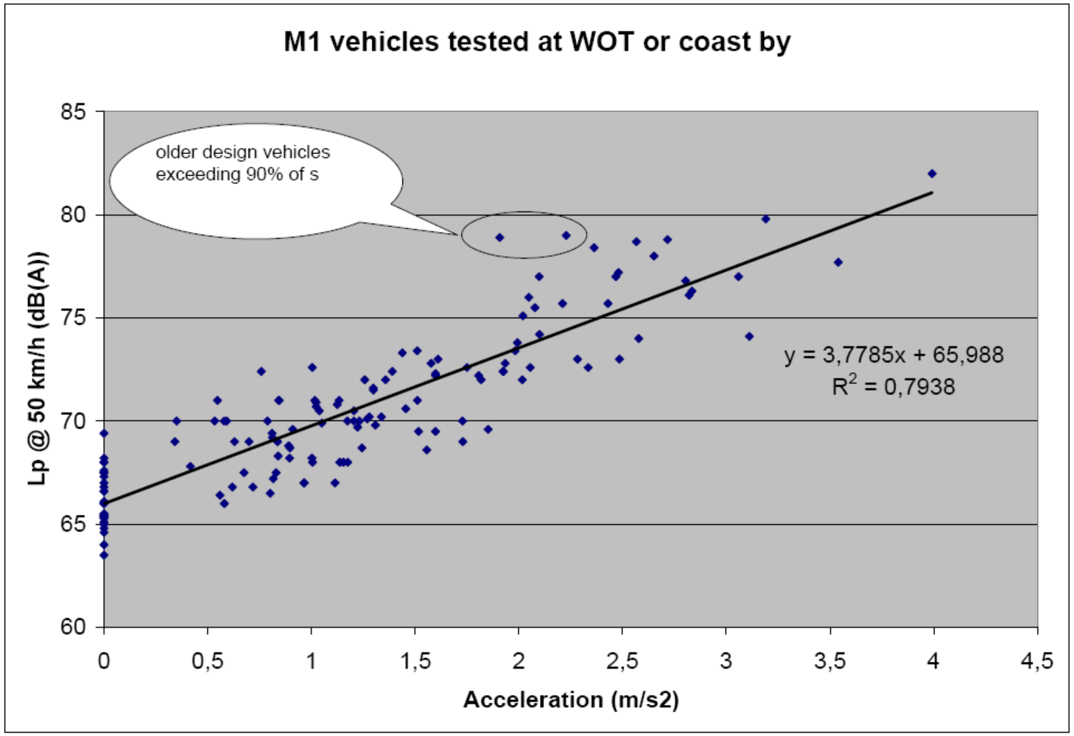
Test track measurements



Road side measurements

On board measurements in urban traffic

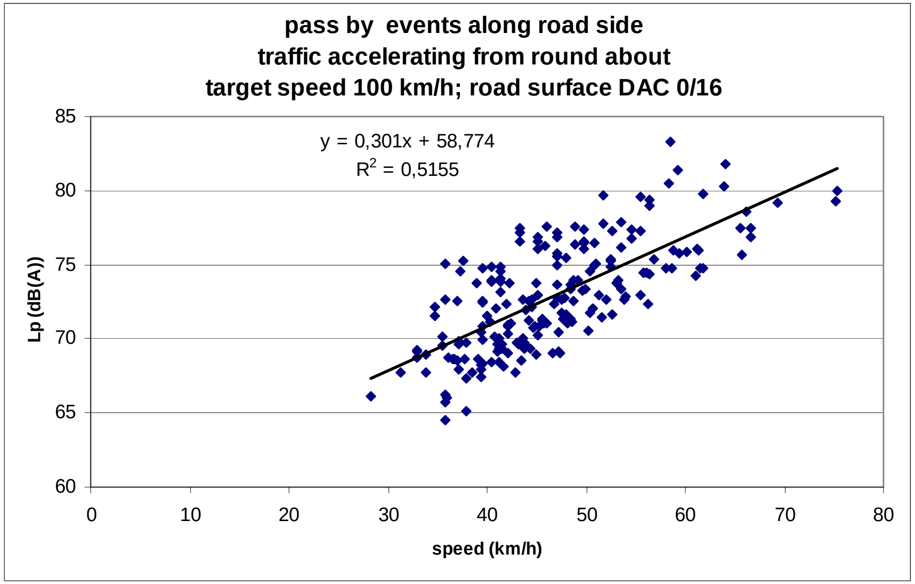
Examples of data sources for the determination of C_2 and C_3

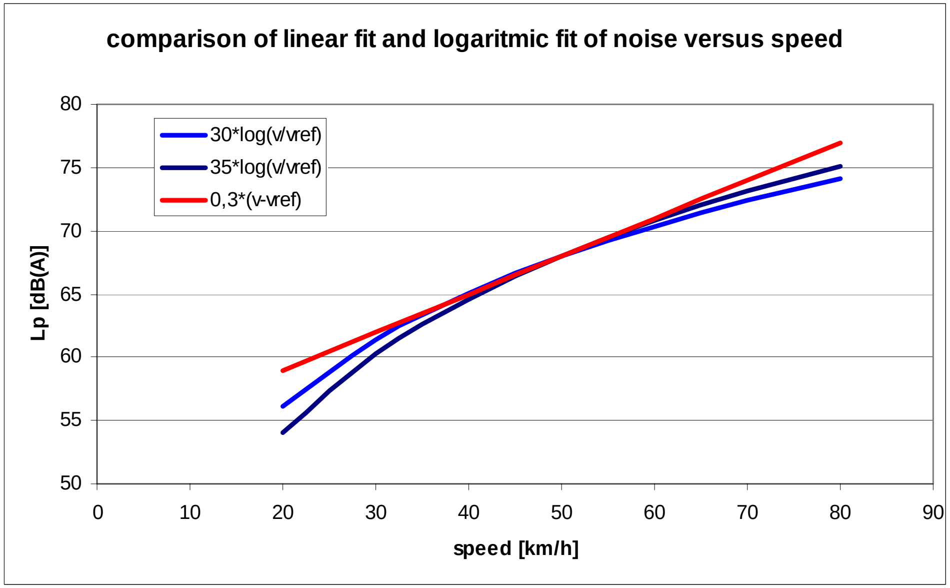


- The graph shows noise measurement on a test track of a dBase of 29 vehicles. Both the WOT acceleration events in 2nd, 3rd, 4th and 5th gear and the coast by events show to fit well to the model assumption of $C_2 = 4$.

- First gear operation, automatic gearboxes and CVT's were not available in this dBase and have to be checked

Examples of data sources for the determination of C_2 and C_3

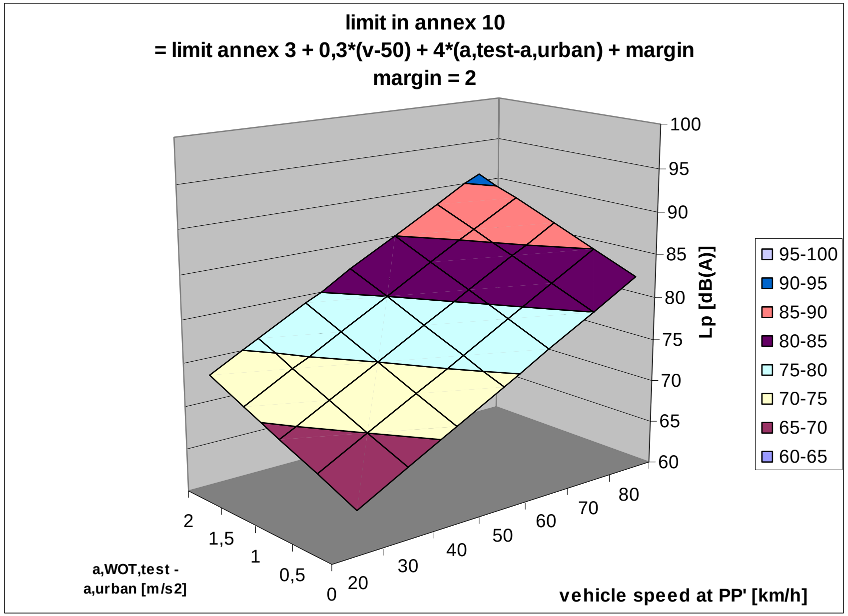


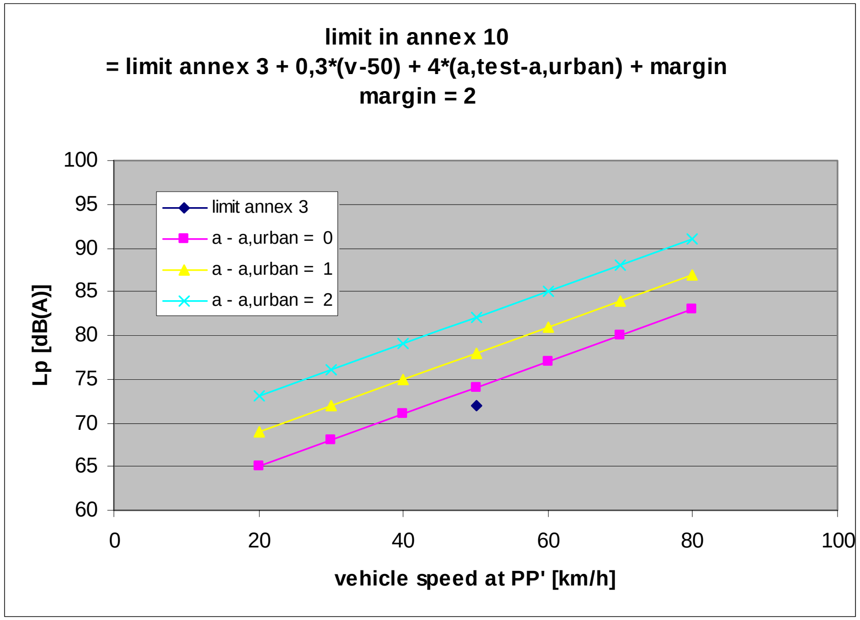


- The left graph shows noise measurements along the road side. Random vehicles from the traffic where measured while pulling away from a round about. The calculated speed index shows to fit well to the model assumption of C_3 = 0,3. The relatively big spread around the regression curve is caused by a spread in vehicle types and a spread in acceleration.
- Rolling noise is often measured in the range between 30 and 35*log(v). The right graph shows that around 50 km/h the 30 log (v) and 35 log(v) are very close to the model assumption of C_3 = 0,3.
- The speed coefficient C_3 = 0,3 is equal to the speed coefficient in a former proposal from Germany / mr Steven dated 22-3-2005 (TRANS-WP29-GRB-42-inf05)

Possibilities of limitation in this concept

- Reference conditions:
  - Limit annex 3
  - $V_{PP'}$ = 50 km/h (= reference condition of annex 3)
  - a = a_{urban} (= reference condition of annex 3)
- $Limit_{annex10} = Limit_{annex3} + 0{,}3*(v-50) + 4{,}0*(a_{WOT,test} - a_{urban})$ + margin
- Margin determines the stringency of the limit
- This limit can be represented by a surface in a 3D graph (left) or by multiple parallel lines in a 2D graph (right)

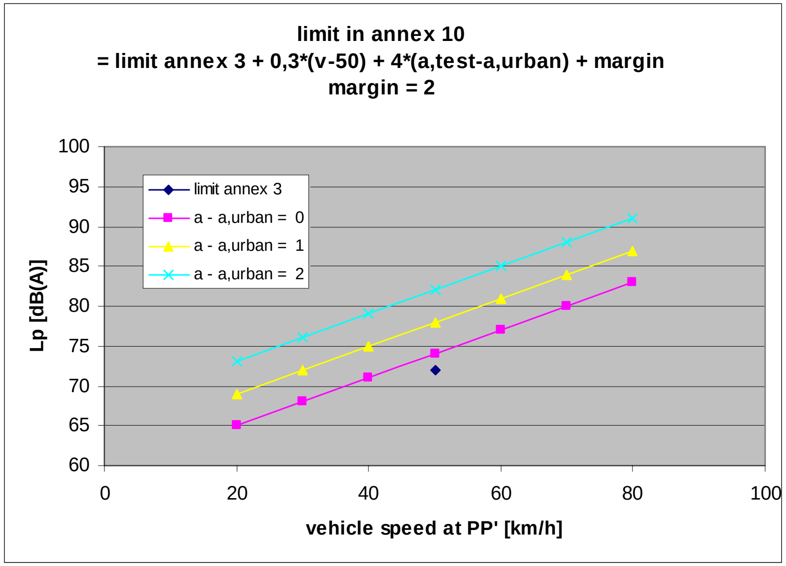


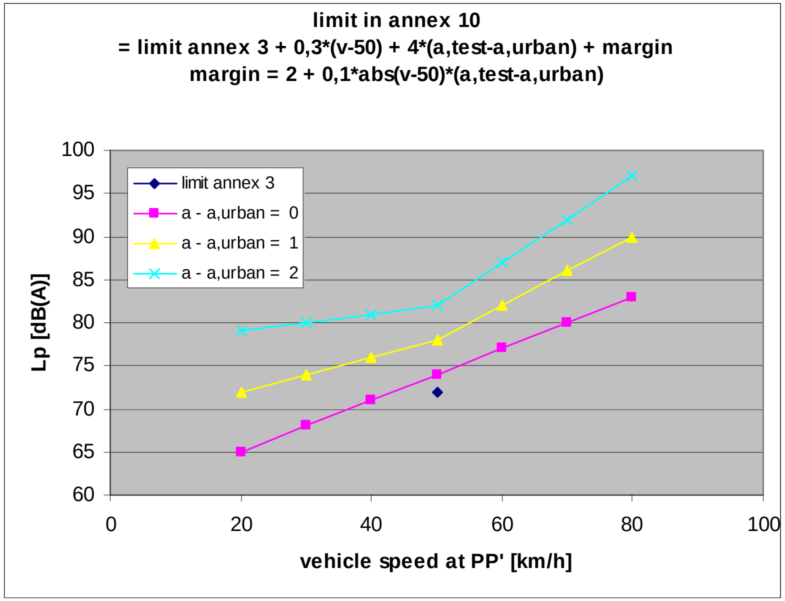


Options for a margin in this concept

- constant margin
  - an example is given in the upper figure; in this case the margin is independent from the distance from the operating condition of annex 3

- margin depending on vehicle speed v and vehicle acceleration a
  - an example is given in the lower figure; in this case the margin is higher if the operating condition is further away from the operating condition of annex 3
  - Aspects for a choosing such a system
    - Uncertainty in noise model increases with distance from reference condition
    - Smooth instead of stepwise increase of the margin between the areas of control
    - Smooth instead of stepwise increase of the allowance for high performance vehicles, which is based on performance
      - Bigger allowance for fast accelerating super sport cars
      - Smaller allowance for slower accelerating mass production vehicles and “GTI’s”



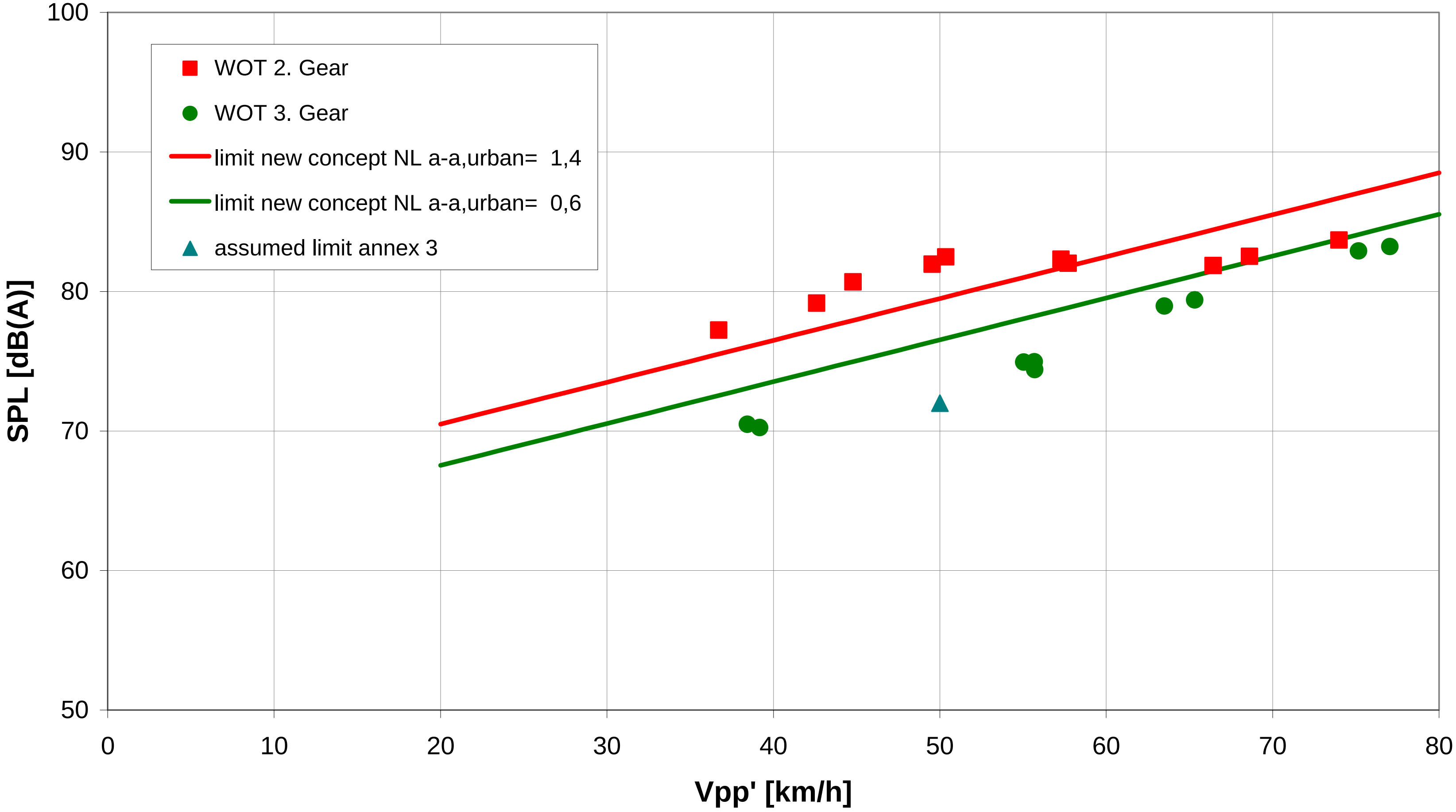


Evaluation of this concept

- Does it reject the vehicles with irregular noise behavior?
- Can normal vehicles pass normally?
- Examples are necessary
  - Limited data available to the Netherlands:
  - two examples are given in GRBIG-ASEP-06-002
    - Vehicle with flap in exhaust
    - Vehicle with silent engine
  - All members of GBIG ASEP are asked to evaluate this concept and show other examples
    - A calculation tool will be provided on the base of the spreadsheet of mr Gerhard

Data of vehicle with flap in exhaust

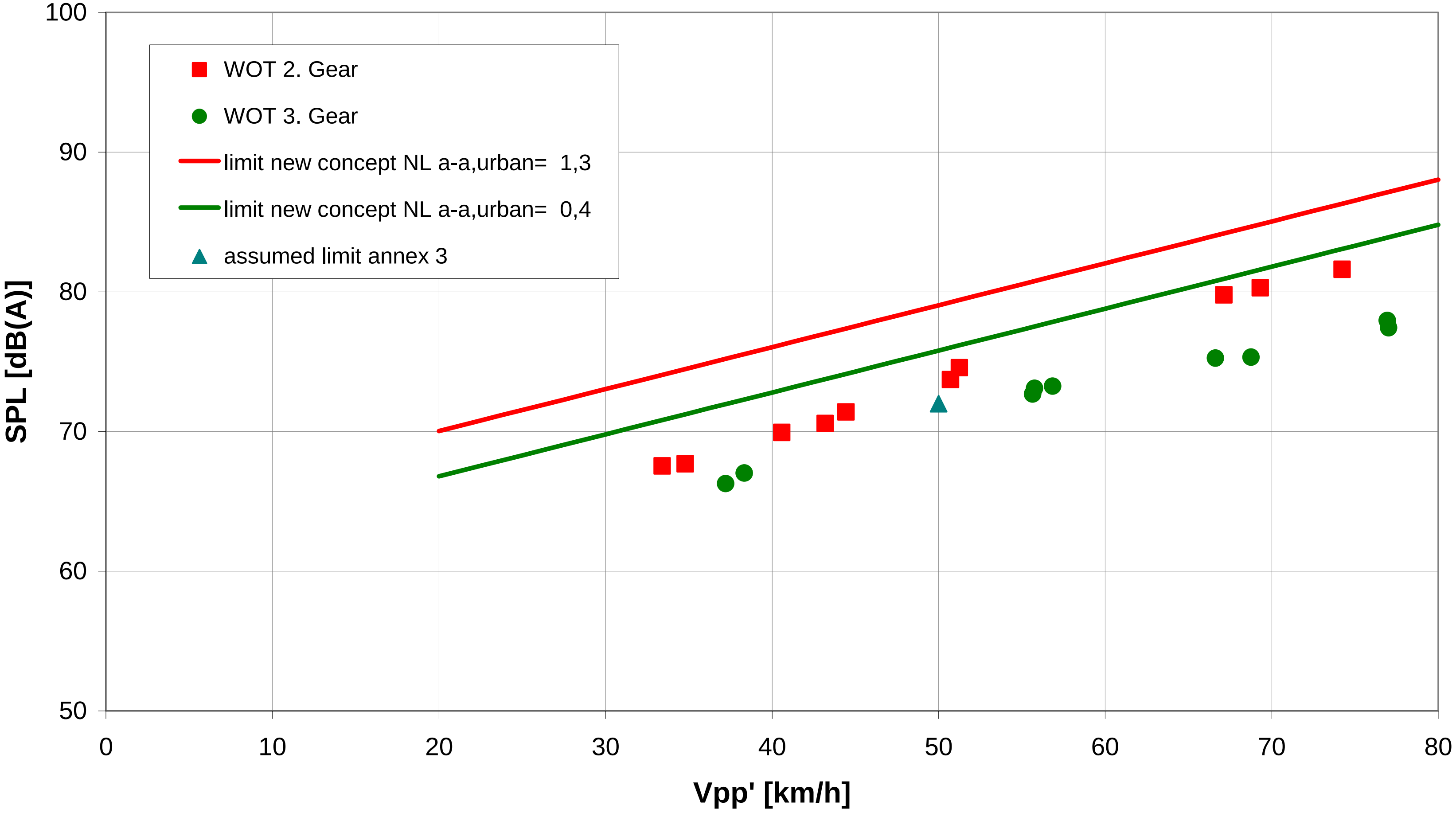
In this example the limit curves are constructed with: margin = 2
Every dot has to be compared to its own limit, which depends on the actual a,WOT,test.
For this vehicle the individual limits are very close to the shown red and green curves



– Conclusion: vehicle rejected

Data of vehicle with silent engine

In this example the limit curves are constructed with: margin = 2
Every dot has to be compared to its own limit, which depends on the actual a,WOT,test.
For this vehicle the individual limits are very close to the shown red and green curves



– Conclusion: vehicle passes

Question to all ASEP members

- Could you evaluate this new concept on the base of your existing data?