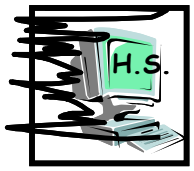
# Ad-hoc R51 ASEP Group




## Description of the F/D ASEP concept

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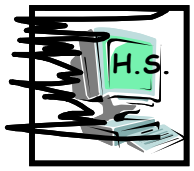
# Aim




**The Annex 3 test is a single or dual gear test.**

**It can be foreseen that the 2 m/s² acceleration limitation quite frequently results in a single gear test at low engine speed for high powered vehicles.**

**A vehicle is ok, if the Annex 3 result does not exceed the limit value.**

**Real world driving covers a lot of driving conditions that are not covered by the Annex 3 test(s). Annex 10 shall ensure that the noise emission behaviour of the vehicle under these conditions does not deviate significantly from what one would expect from the noise limit of Annex 3.**

# Reference engine speed


**Reference engine speed for ASEP threshold curve:**

- **n_wot_i would be in line with Annex 3 but is not suitable because of huge variations for the same pmr (see figure 1).**
- **Alternative proposal:**

  **$n\_norm\_ASEP\_ref = 2.2 * pmr^{-0.43}$ (equation 1)**

  **pmr – power to mass ratio index.**
- **n_norm_ASEP_ref is based on statistics used for the development of Annex 3 procedure, it is shown in figure 2 together with the limit and L_TA_ASEP values.**

# n_norm_ASEP_ref

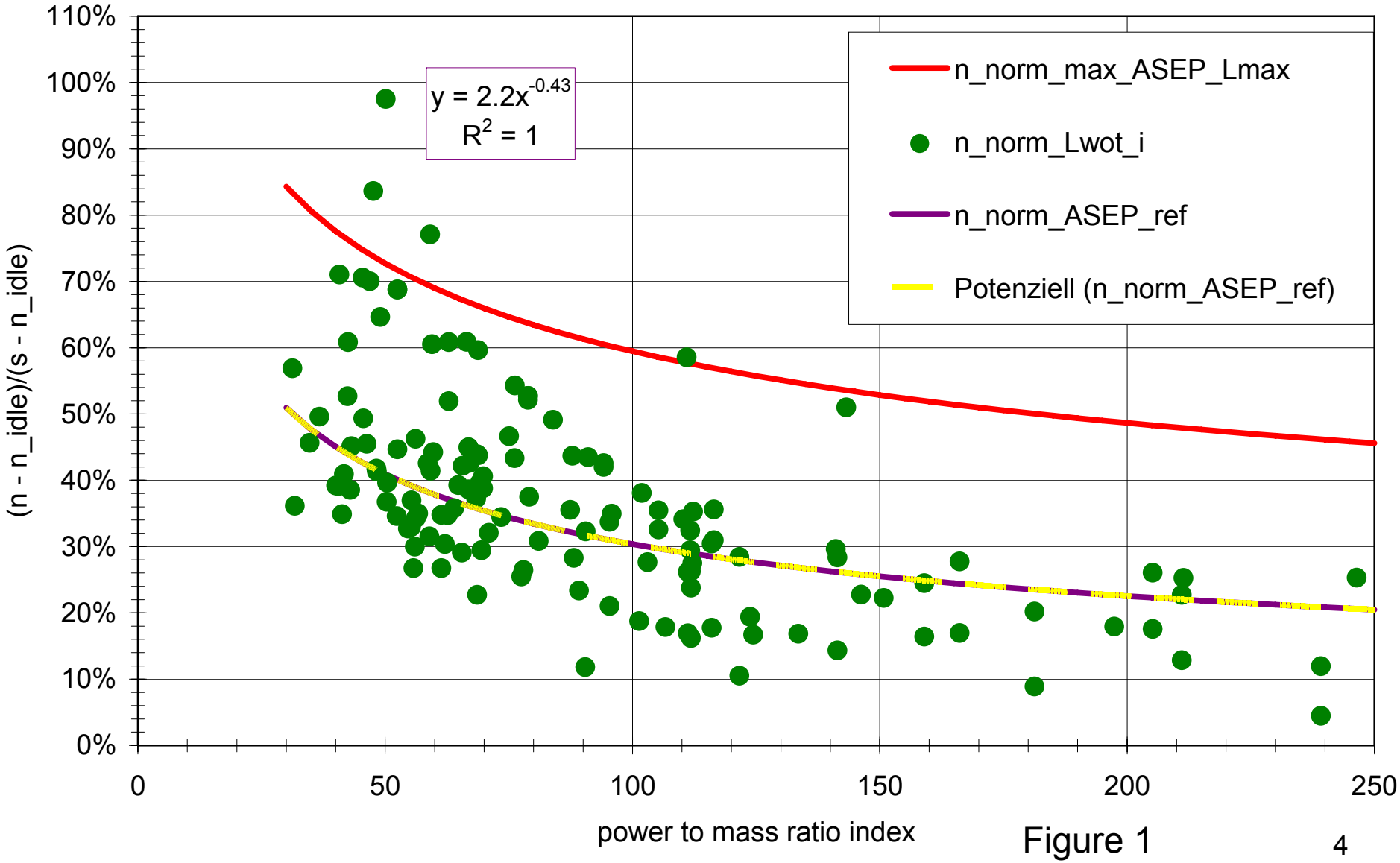



Figure 1

# Limit values and L_TA_ASEP

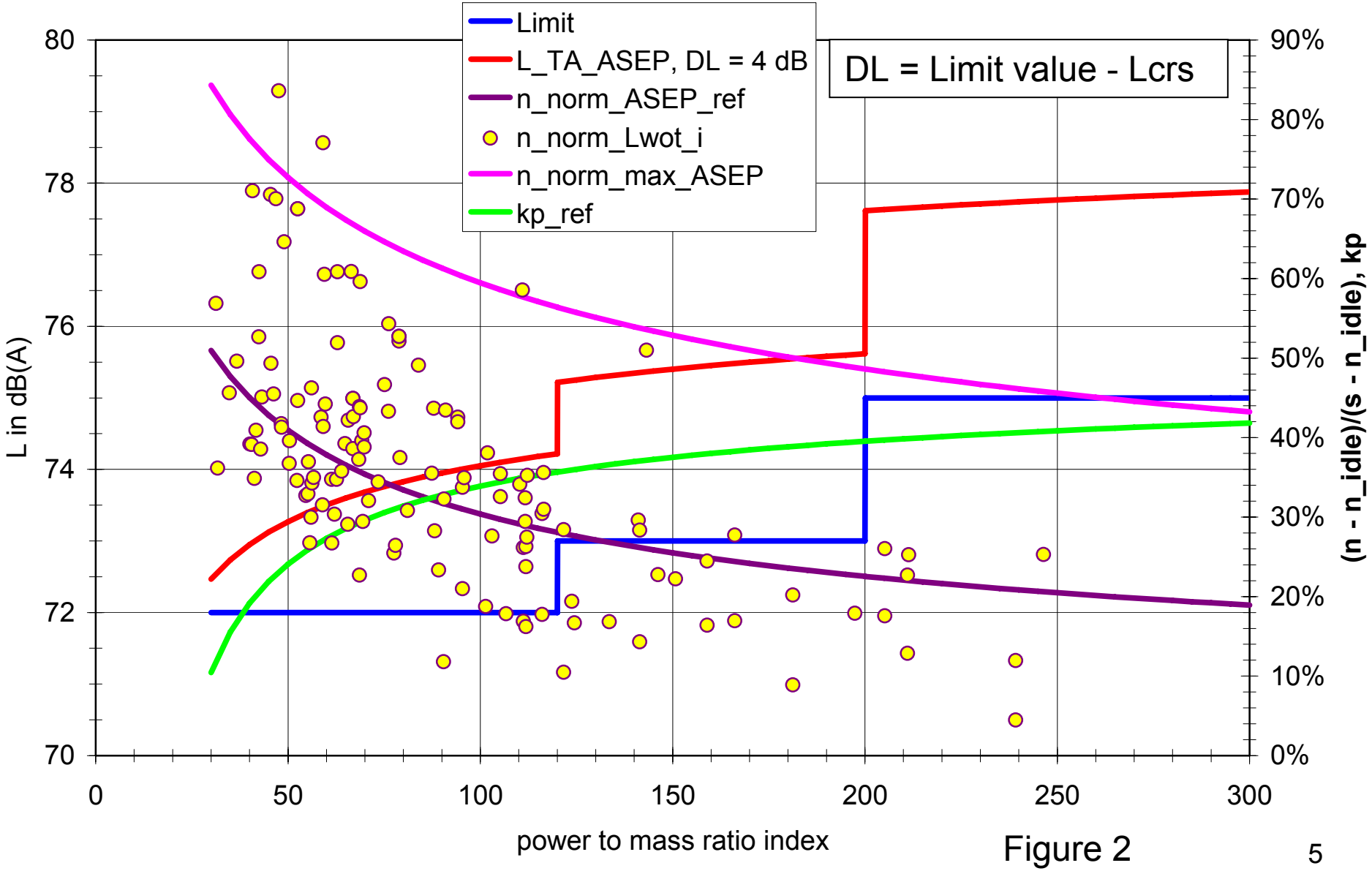



Figure 2

# Reference threshold level L_TA_ASEP


Annex3: Lurban = kp*Lcrs + (1 – kp)*Lwot (Eq 2)

Lwot = (Lurban – kp*Lcrs)/(1 – kp) (Eq 3)

Annex 10:

- replace Lurban by L_limit and use the reference value for kp (kp_ref) in order to get the reference level L_TA_ASEP

  L_TA_ASEP = (L_limit – kp_ref*Lcrs)/(1 – kp), (Eq 4)

  kp_ref = 1 – a_urban/a_wot_ref (Eq 5)
- Use a slope of 4 dB/1000 rpm for engine speeds below n_ASEP_ref and 5 dB/1000 rpm for engine speeds above n_ASEP_ref.
- German limit value proposal is used for the calculation.

# L_TA_ASEP = f(Lcrs)


- The reference level L_TA_ASEP is a function of Lcrs as shown in figures 3 and 4. The lower Lcrs the higher is L_TA_ASEP. The difference increases with increasing power to mass ratio.
- A high powered vehicle with a high Lcrs has a lower L_TA_ASEP and thus Lwot threshold than a vehicle with a low Lcrs.
- In real traffic, where nearly all accelerations are partial load accelerations, a vehicle with a low Lcrs is less noisy than a vehicle with a high Lcrs.
- The choice of a low Lcrs is rewarded by higher allowance for Lwot.
- The Limit - Lcrs values of the ASEP database are shown in figure 5.

# L_TA_ASEP vs pmr

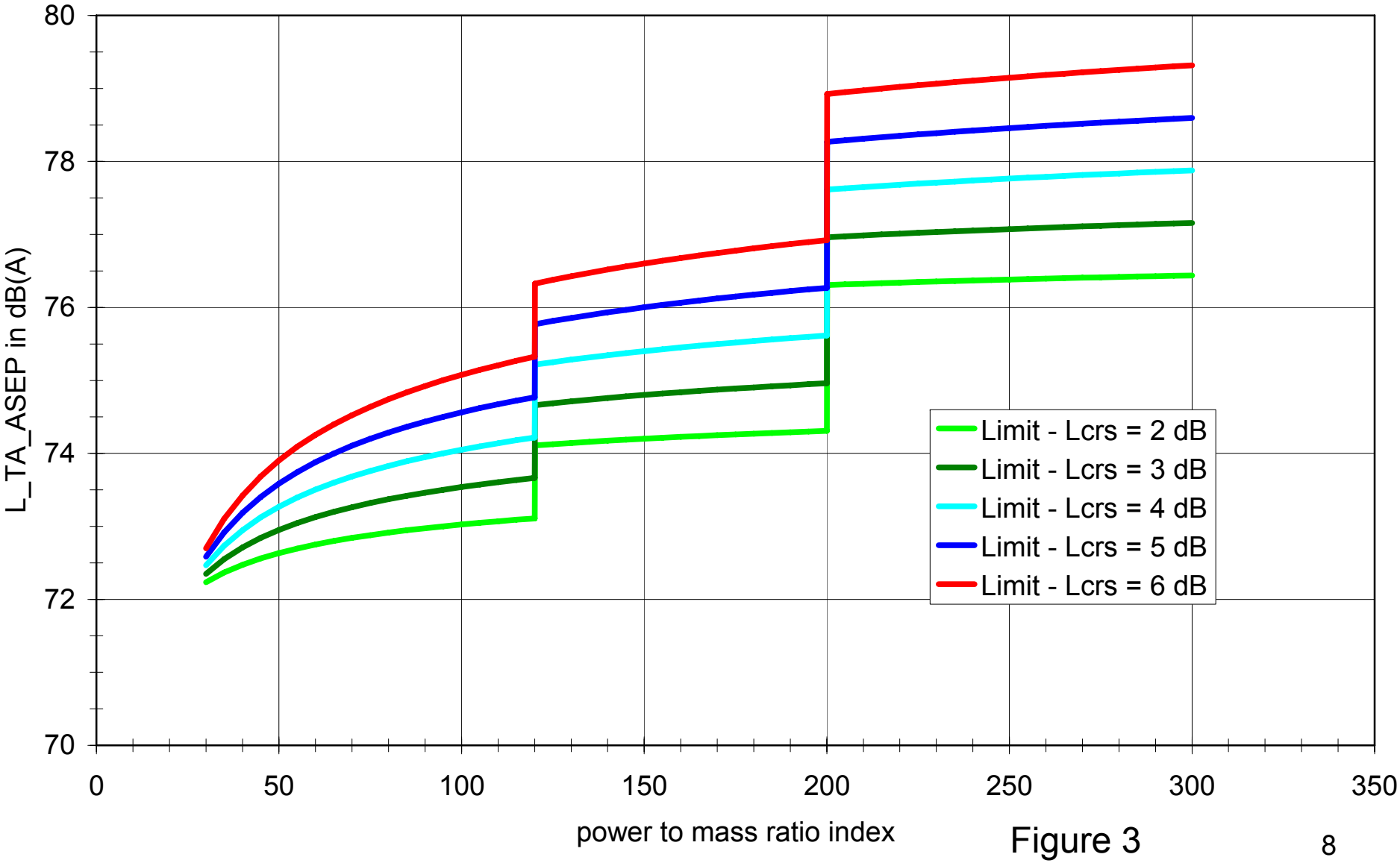



Figure 3

# L_TA_ASEP vs n_norm_ASEP_ref

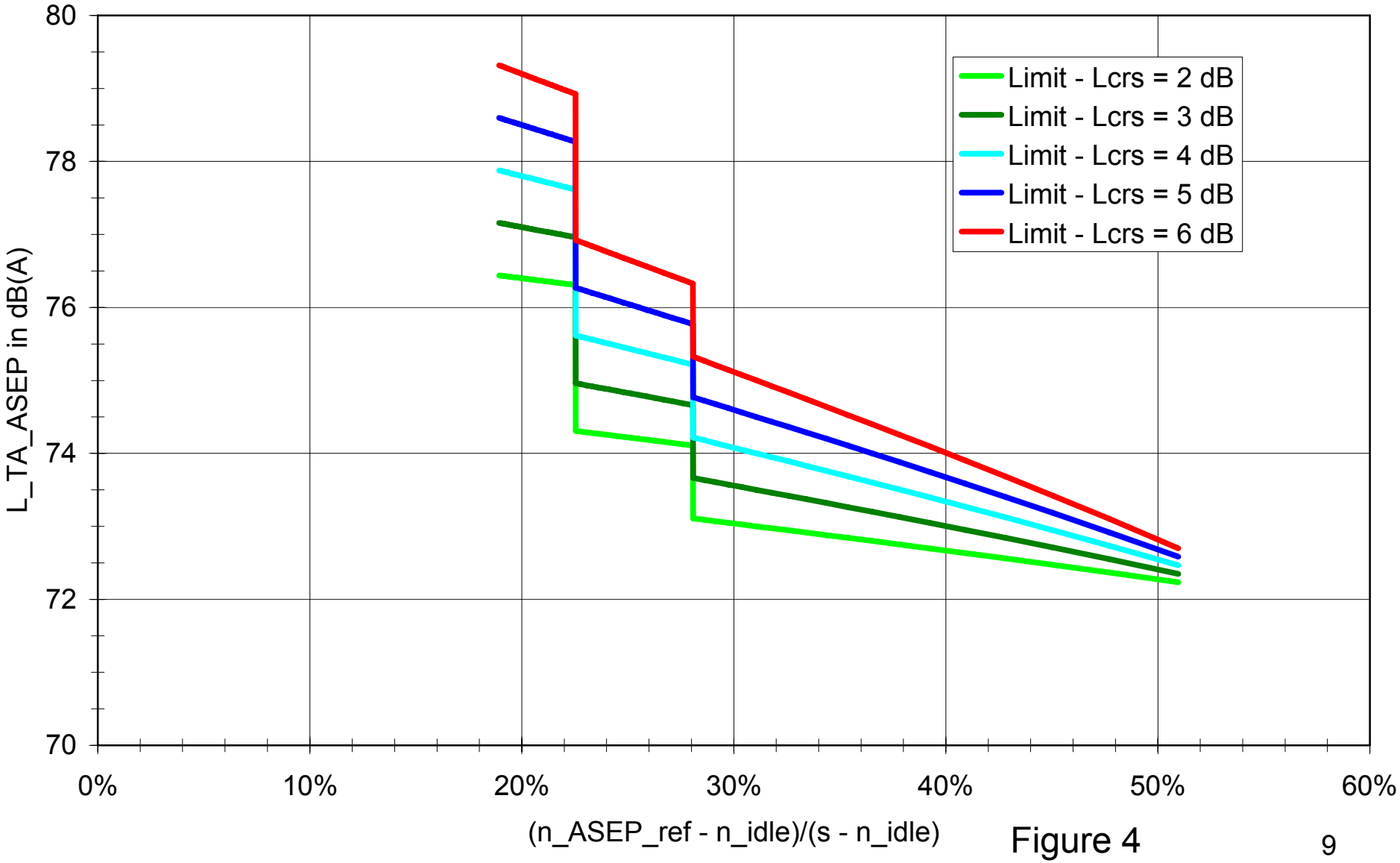



Figure 4

# Limit – Lcrs vs pmr

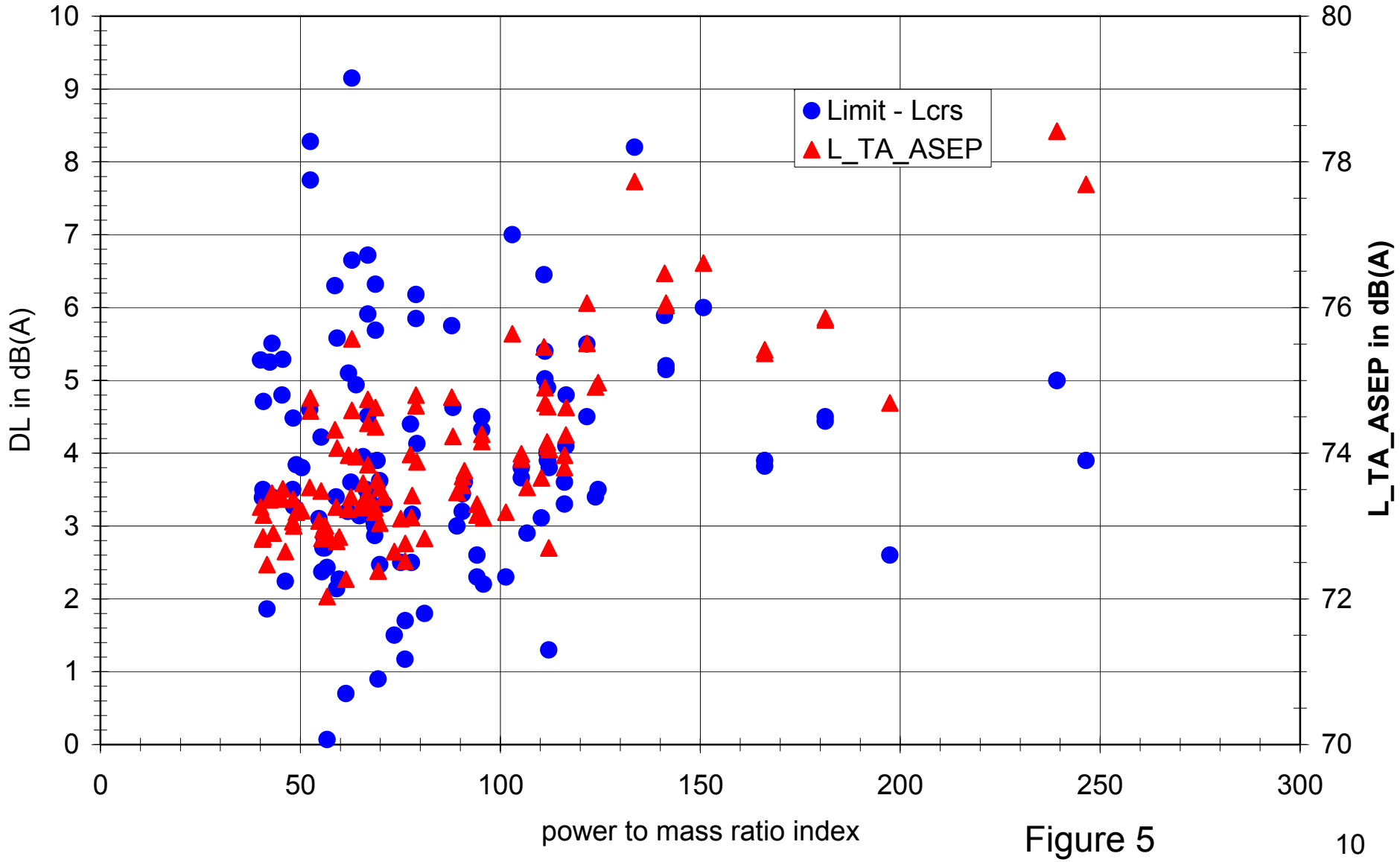
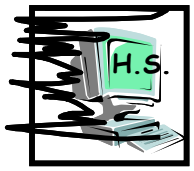



Figure 5

# threshold curve L_ASEP(n, v)




- In order to take into account propulsion noise and rolling noise for different driving conditions the threshold curve is defined as follows:

- $L\_max\_ASEP(n,v) = L\_TA\_ASEP - DL\_ASEP + 10*\log \{(10^{DL/10} - 1)*10^{Gn*(n - n\_ASEP\_ref)/10} + (v/50)^{Gv/10} \}$ (Eq 6)
  with $DL\_ASEP = MAX(2 ; L\_TA\_ASEP - Lcrs(annex\ 3))$

  Gn = 4/5 dB(A) / 1000 rpm

  Gv = 34 dB(A) (ave of ASEP database values)

- German limit value proposal is used for the calculation.
- Examples for pmr = 40 and pmr = 250 are shown in figures 8 and 9.
- A lower Lcrs results in higher L_max_ASEP (compare figures 8 and 10.

# L_max_ASEP vs n_norm

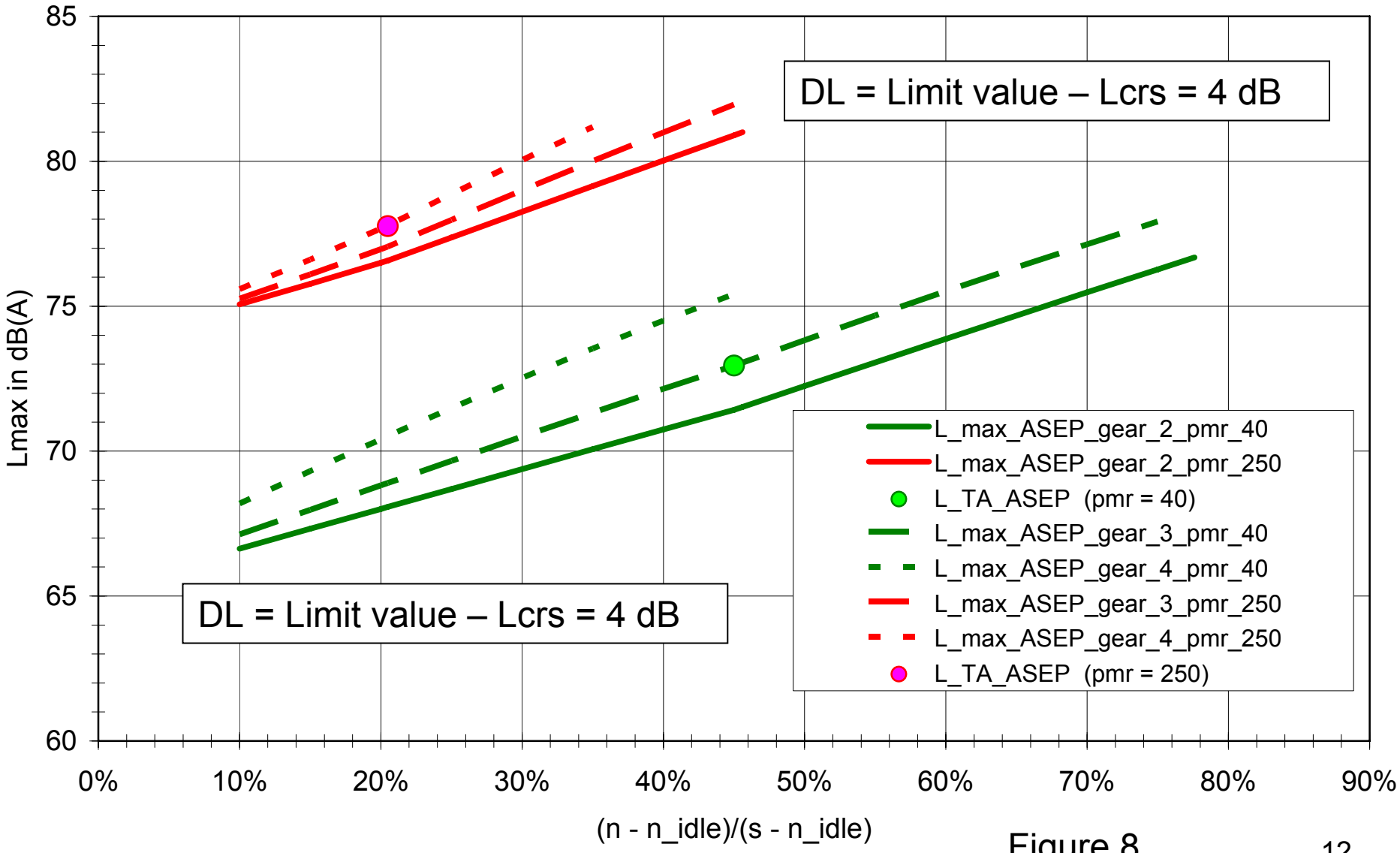



Figure 8

# L_max_ASEP vs v

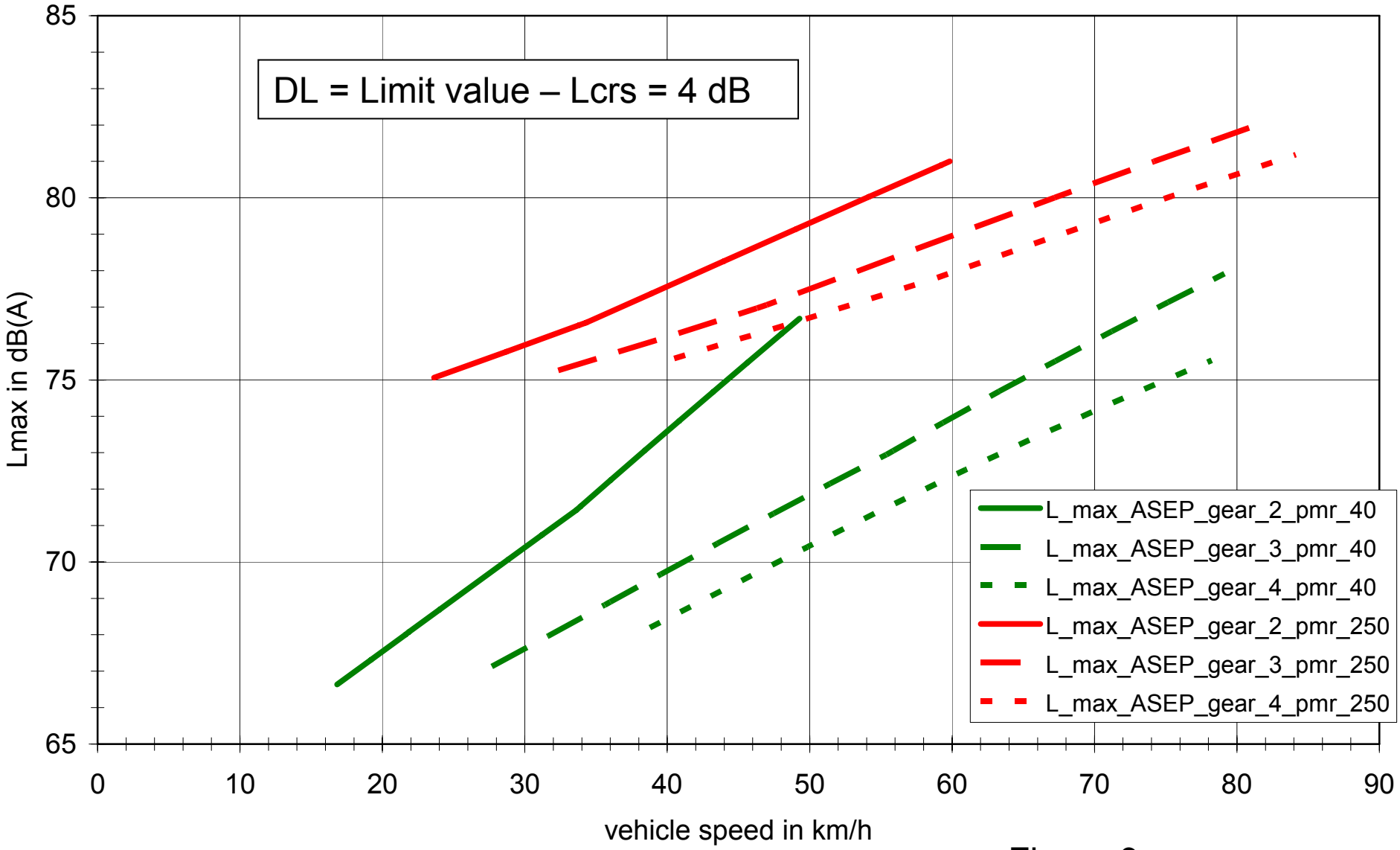



Figure 9

# L_max_ASEP vs n_norm

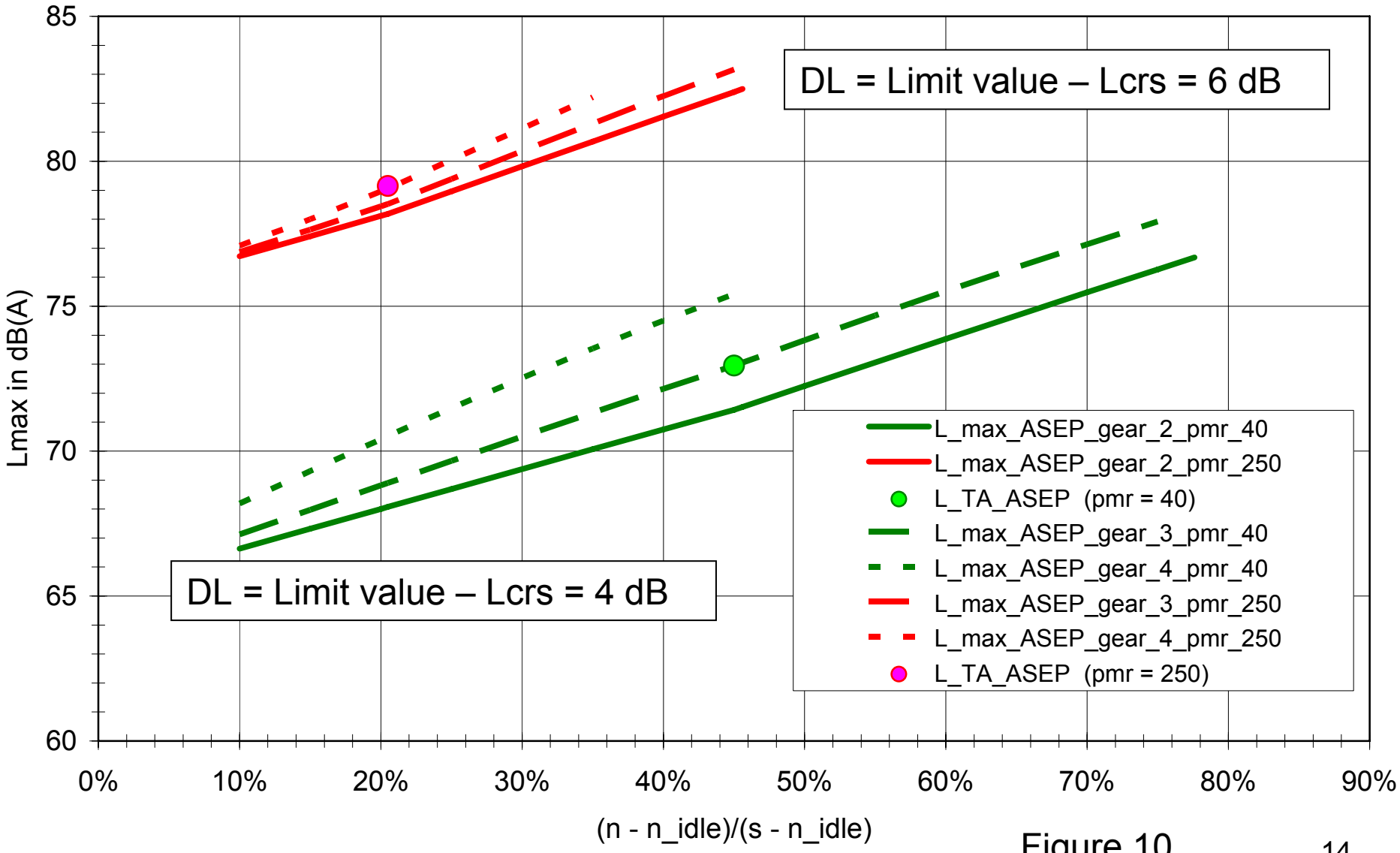
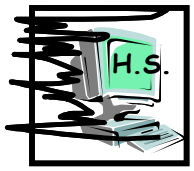



Figure 10

# Influence of acc limitation to 2 m/s²




- The limitation of the acceleration in annex 3 to 2 m/s² leads most probably to lower engine speeds than n_ASEP_ref and lower kp values than kp_ref (see figure 11).
- The influence on Lwot_i is shown in figure 12.

# Influence of acc limitation to 2 m/s²

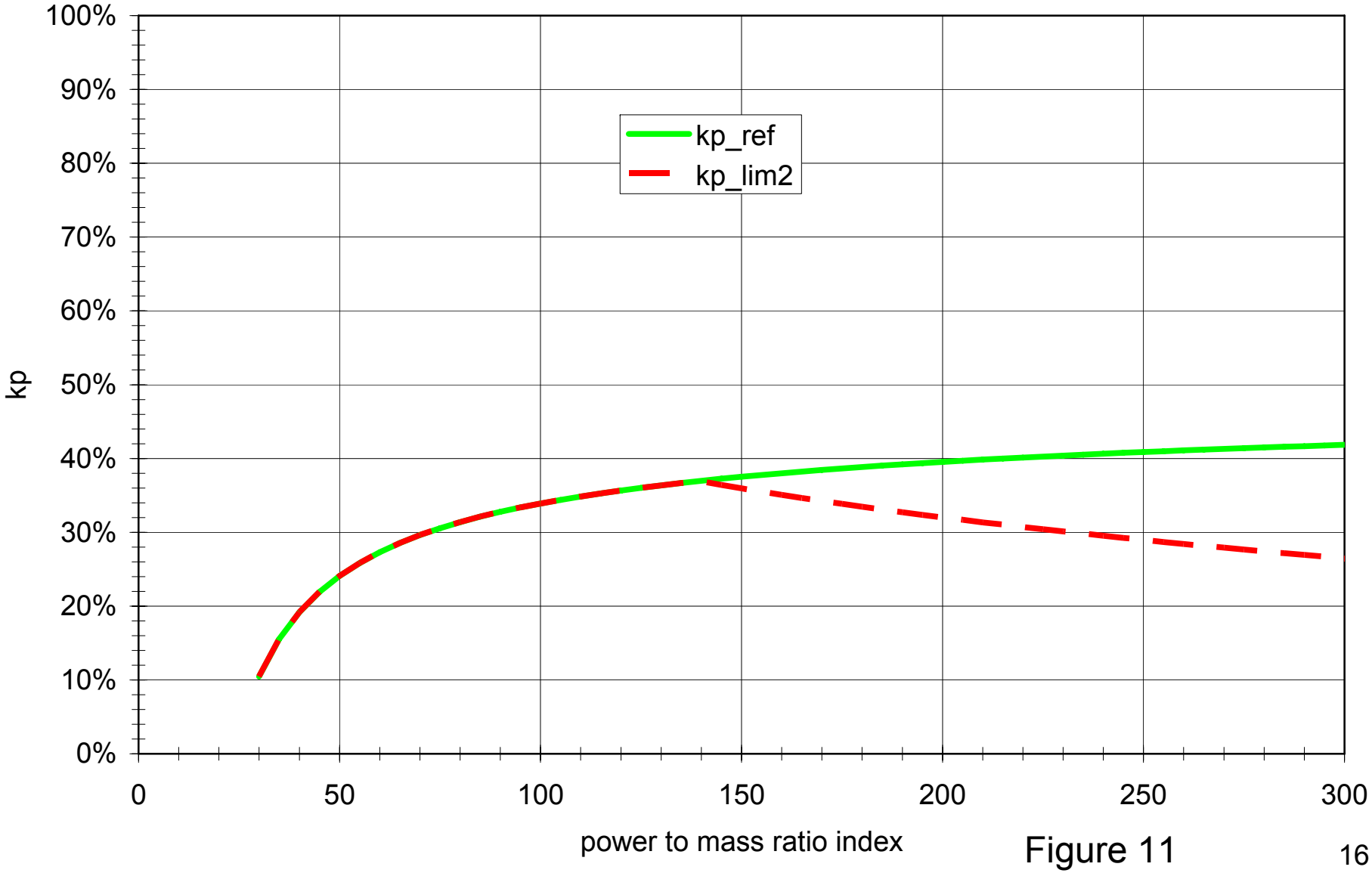



Figure 11

# Influence of acc limitation to 2 m/s
## Example for correction of L_TA_ASEP

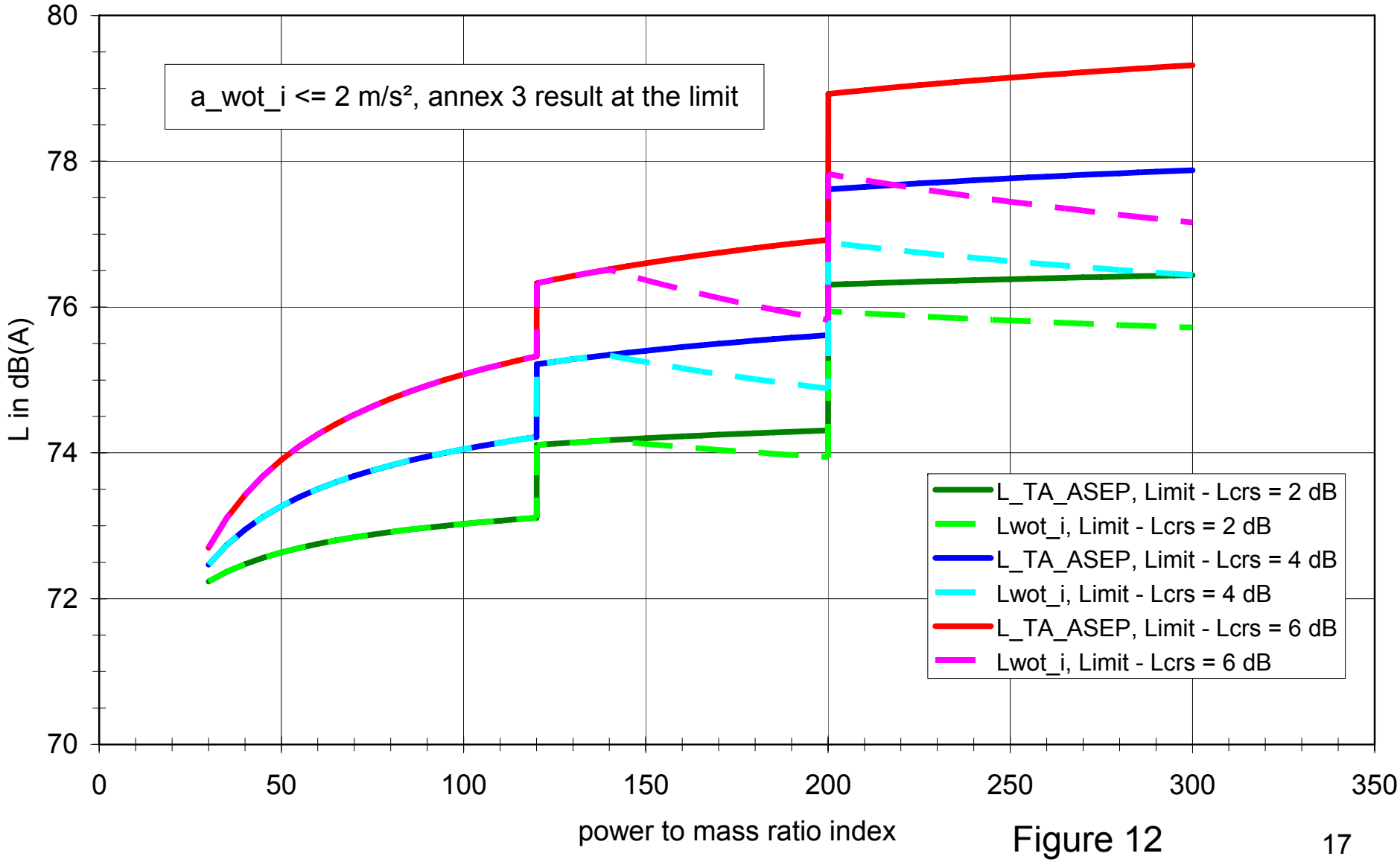



Figure 12

# Example for high tyre noise influence


- In cases where the tyre noise influence is high, the threshold curve L_max_ASEP(n, v) might also be exceeded. There is one extreme example in the ASEP database where Lwot and Lcrs have the same values (vehicle 3-5).
- Figure 17 shows the results for the 2. gear, figure 18 for the 3. gear.
- Requirements have to be added in order to ensure that these cases are exempted from ASEP tests.

# Example for high tyre noise influence

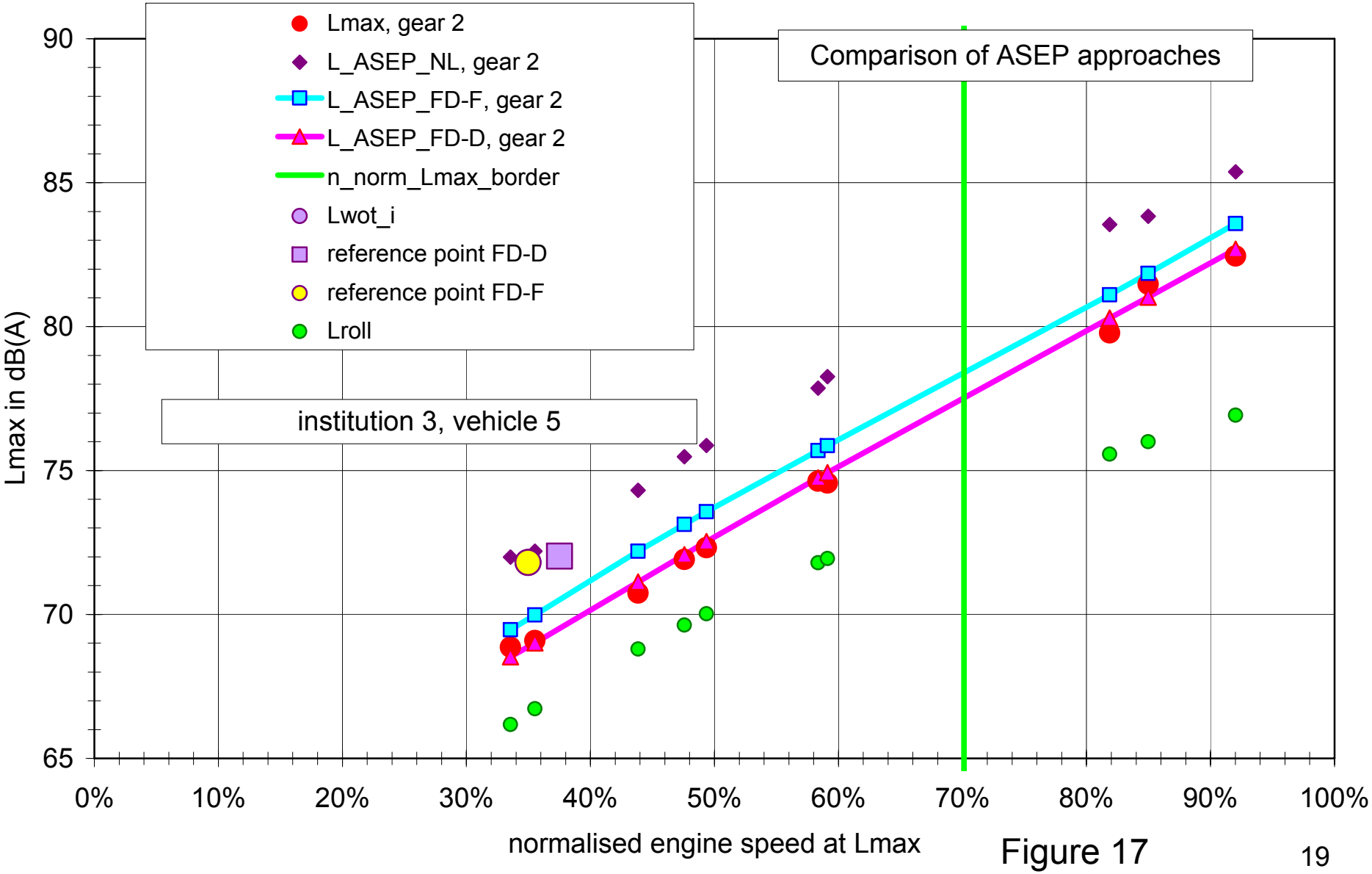



Figure 17

# Examples for different n_wot_i values


- The following figures (19 and 20) show a comparison of the DF-F and DF-D methods for vehicles of similar pmr values but different n_wot_i values.
- The figures demonstrate the advantage of a reference speed independent from the annex 3 references.

# Example for different n_wot_i

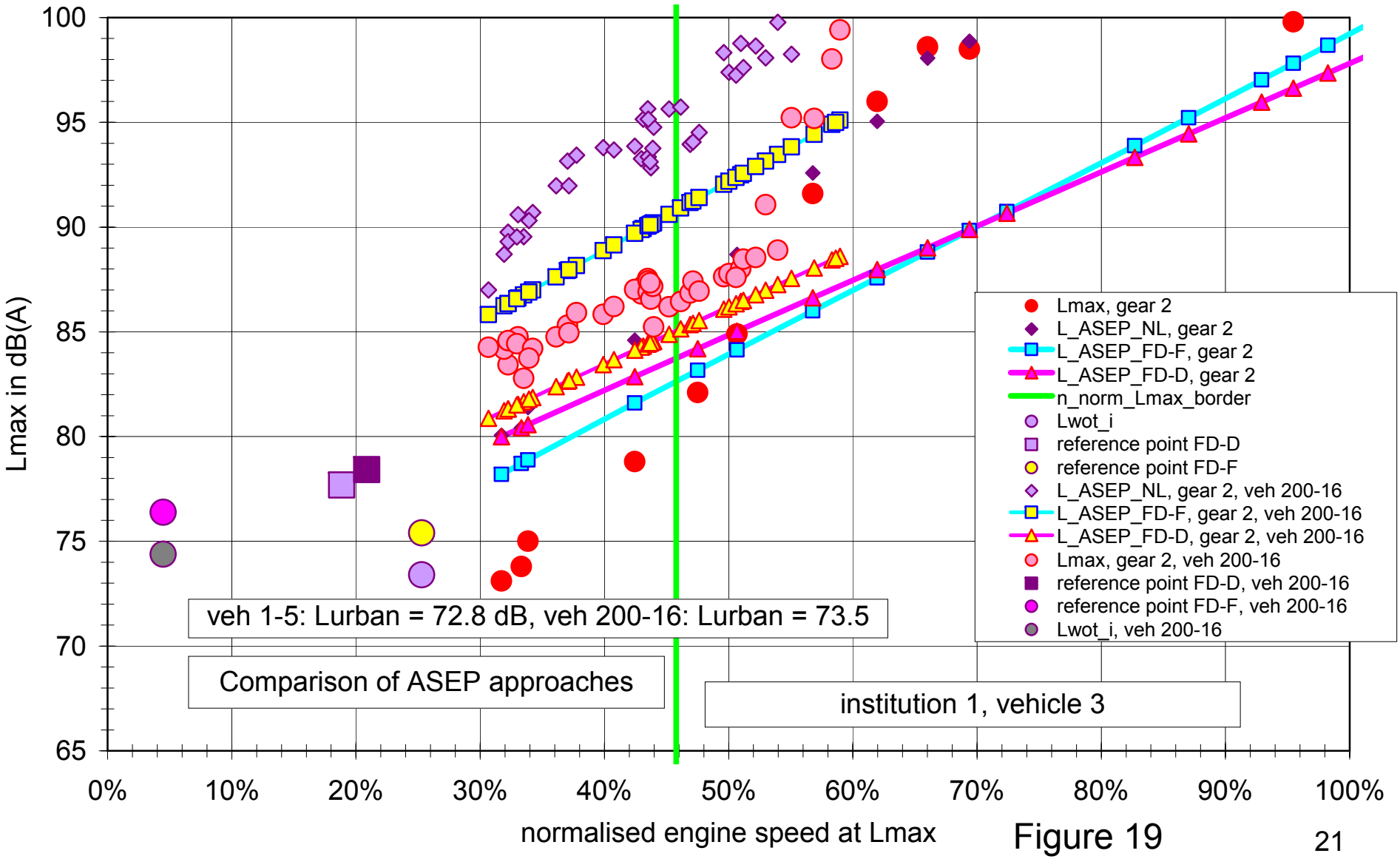



Figure 19

# Example for different n_wot_i

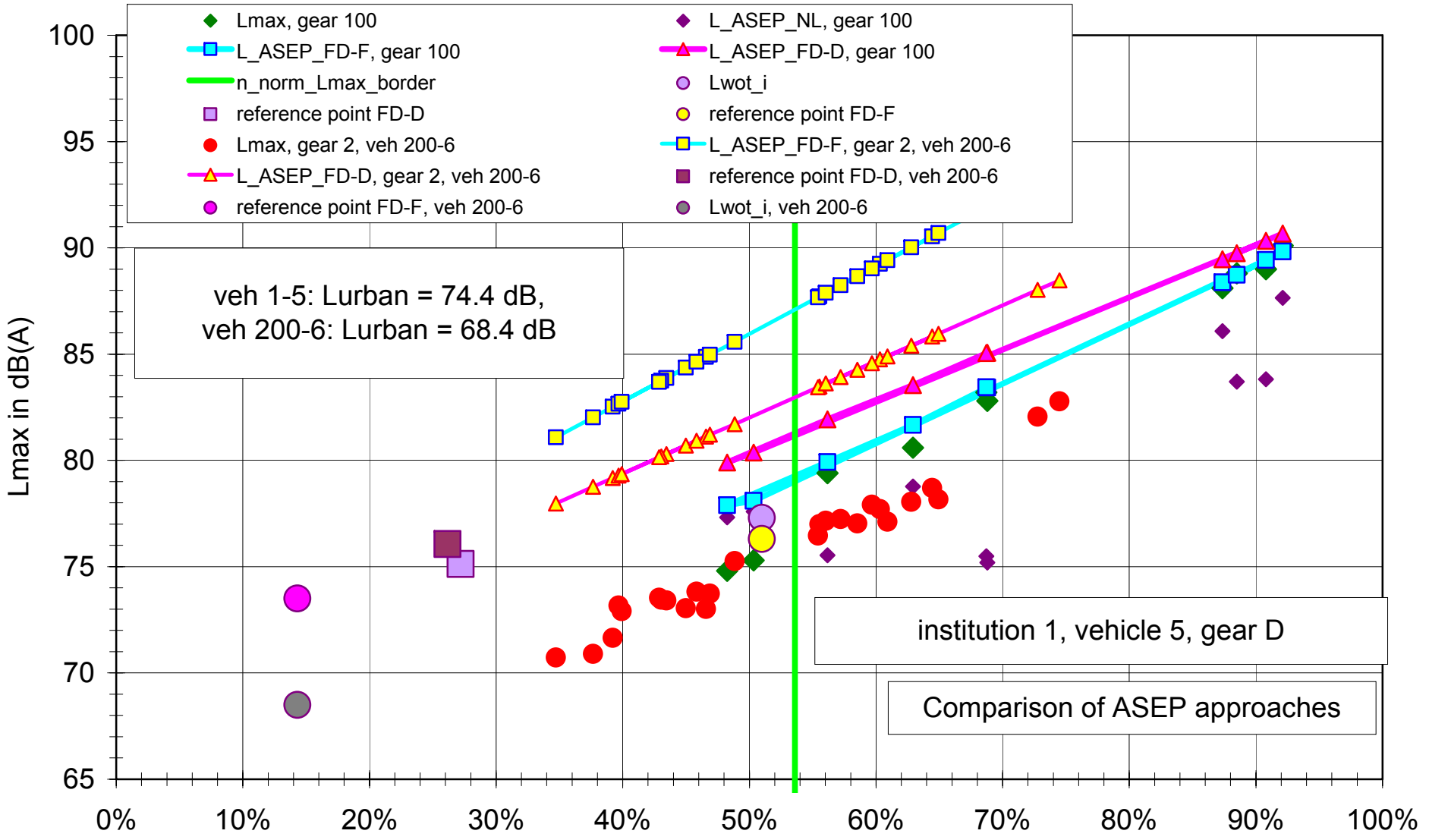



Figure 20

# End


## Thank You