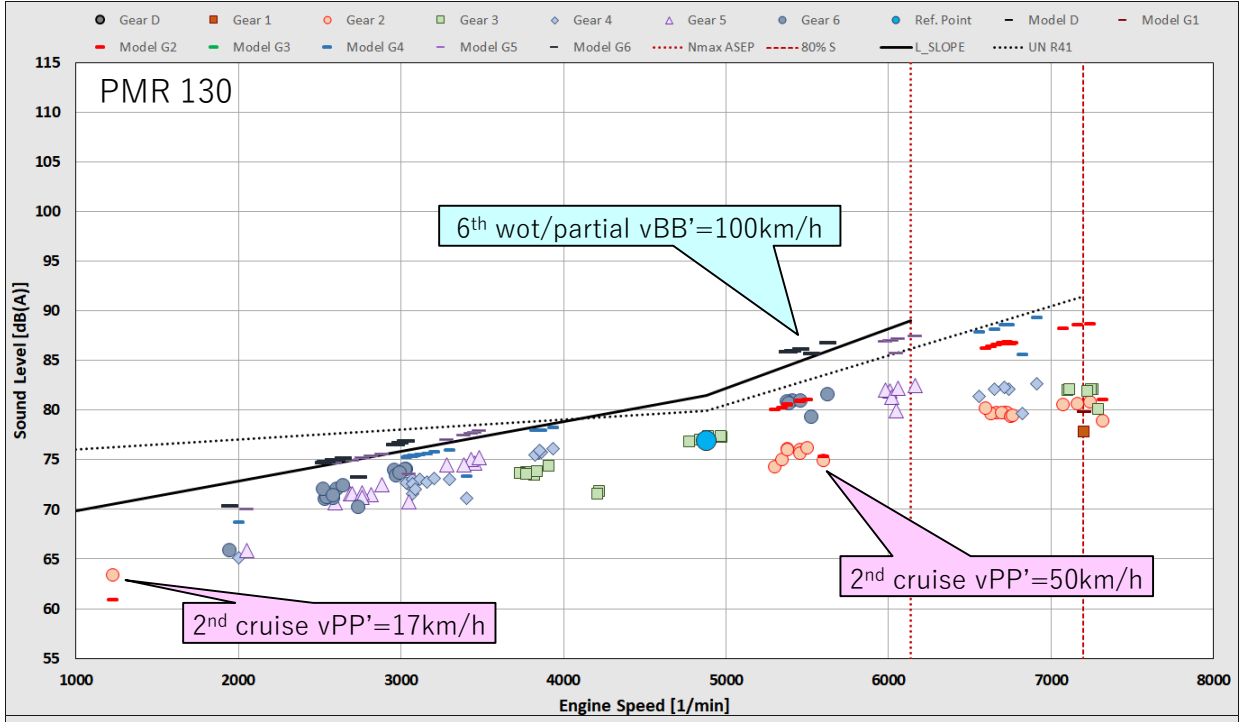
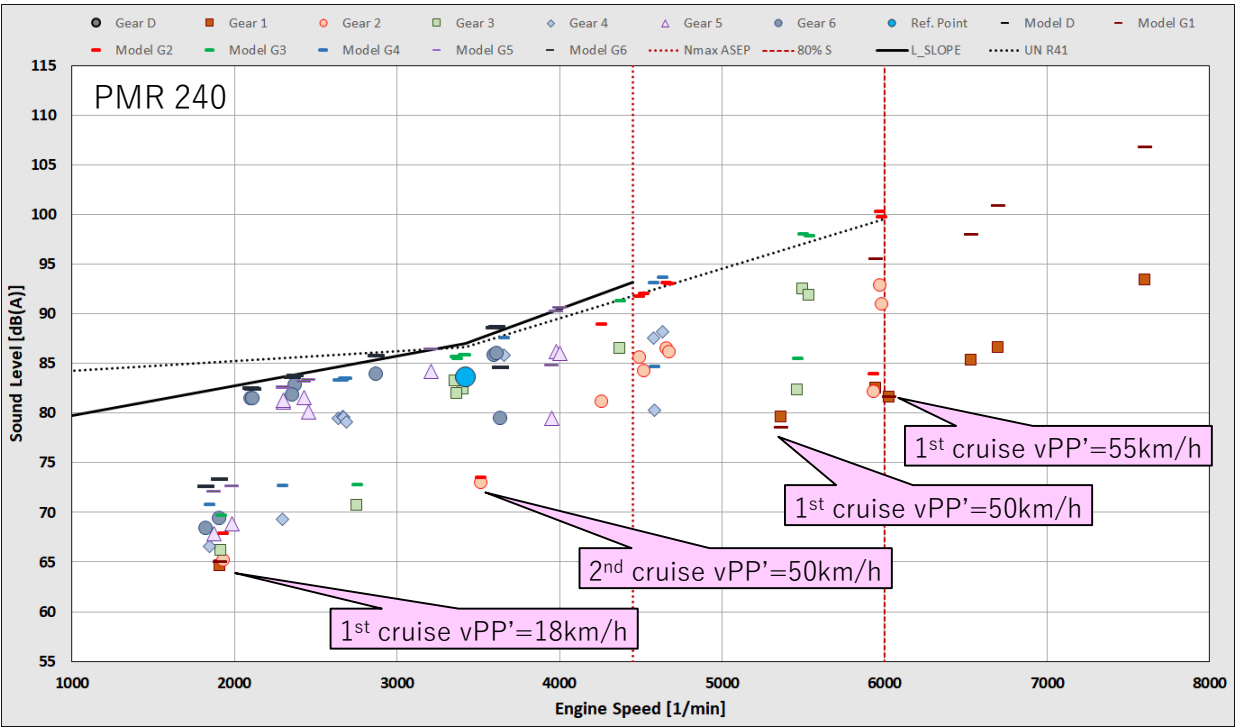
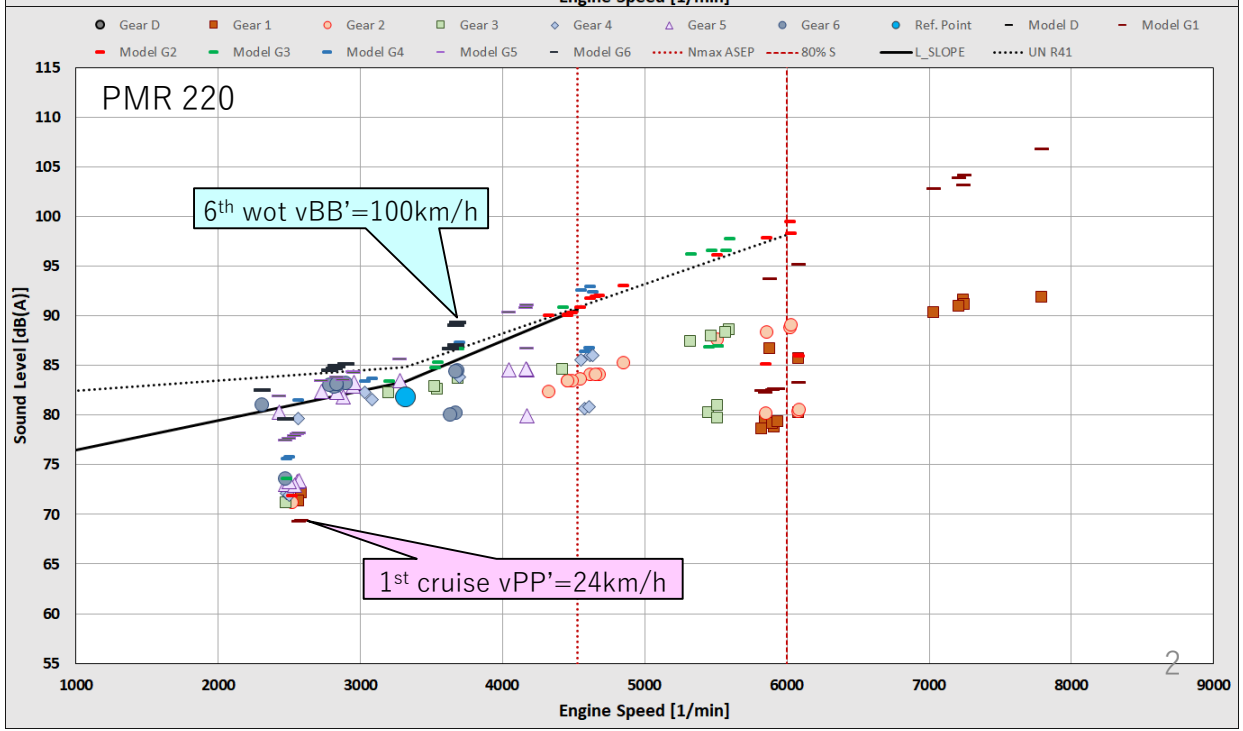
Study for ASEP 2nd step
Sound model consideration

◆Results of Sound Model ～MT

- In the case of “cruise”, particularly in lower gears, fails are often seen; there are no sufficient allowance against the expected values.
- On the other hand, for “wot” at higher speeds in higher gears, the expected values obtained from the sound model sometimes go far beyond the current limit line (i.e. the limit will be relaxed).

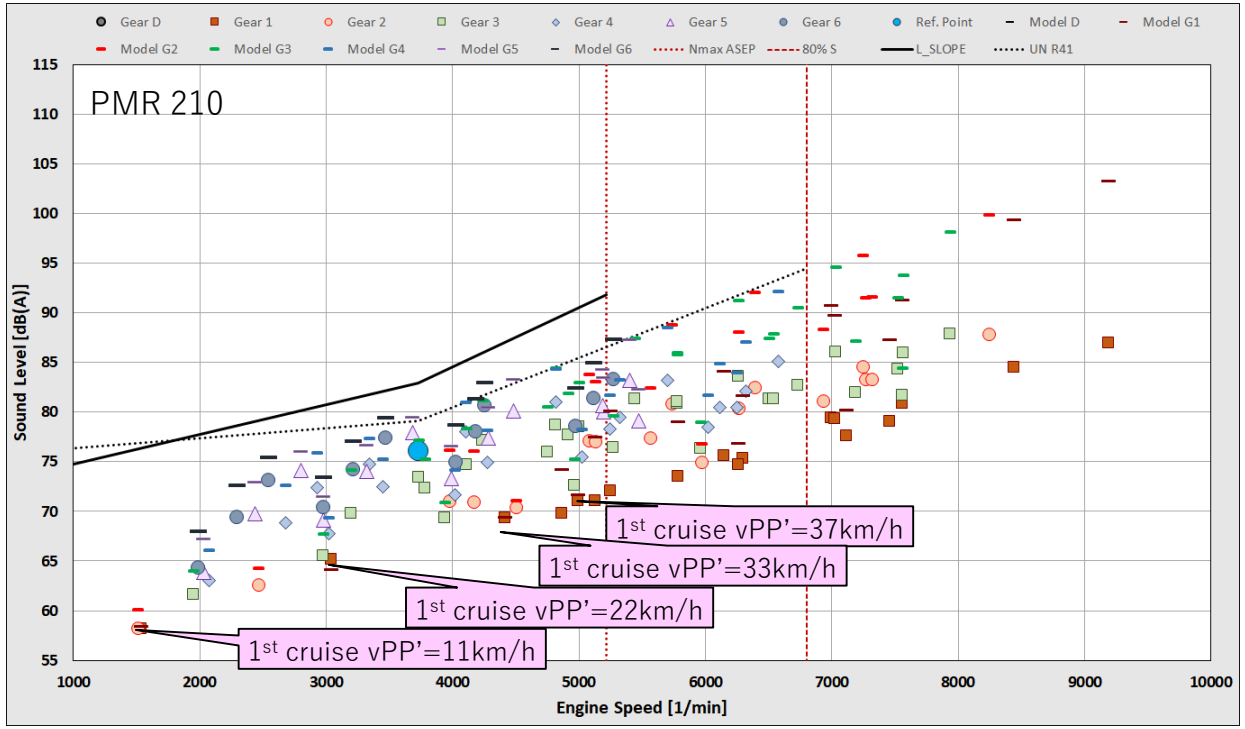


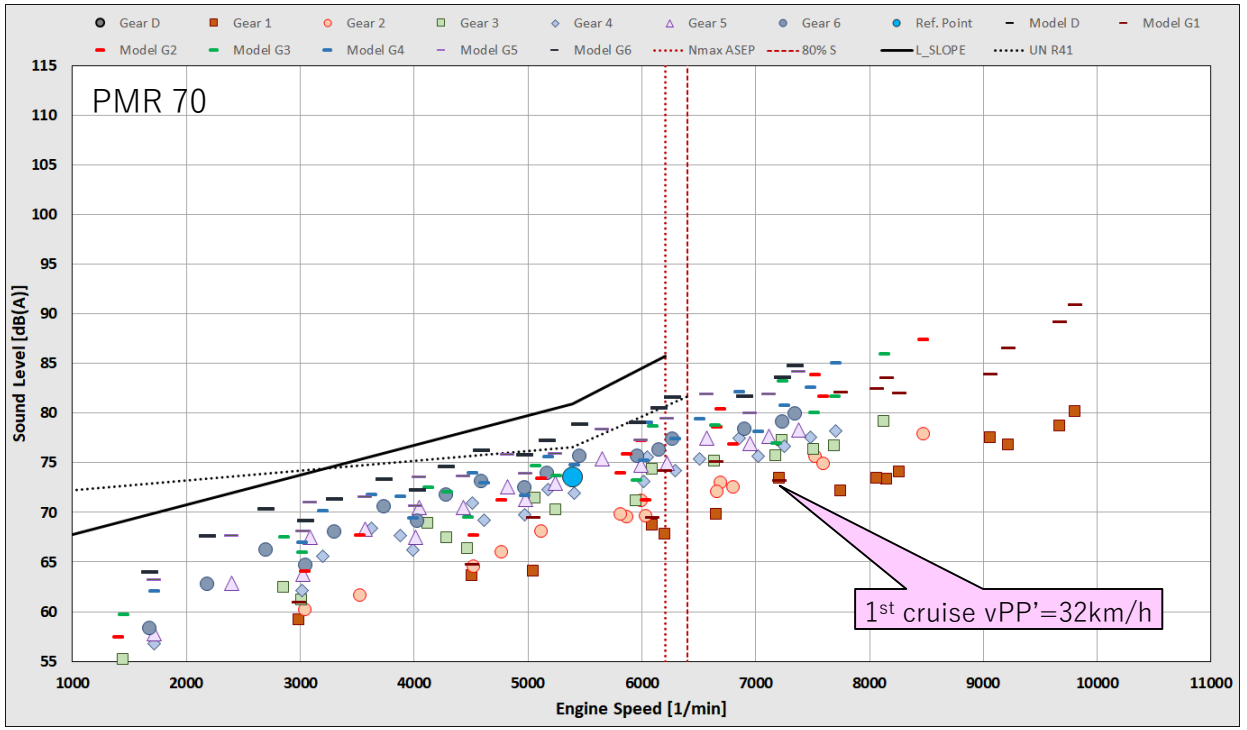




◆Results of Sound Model ～MT

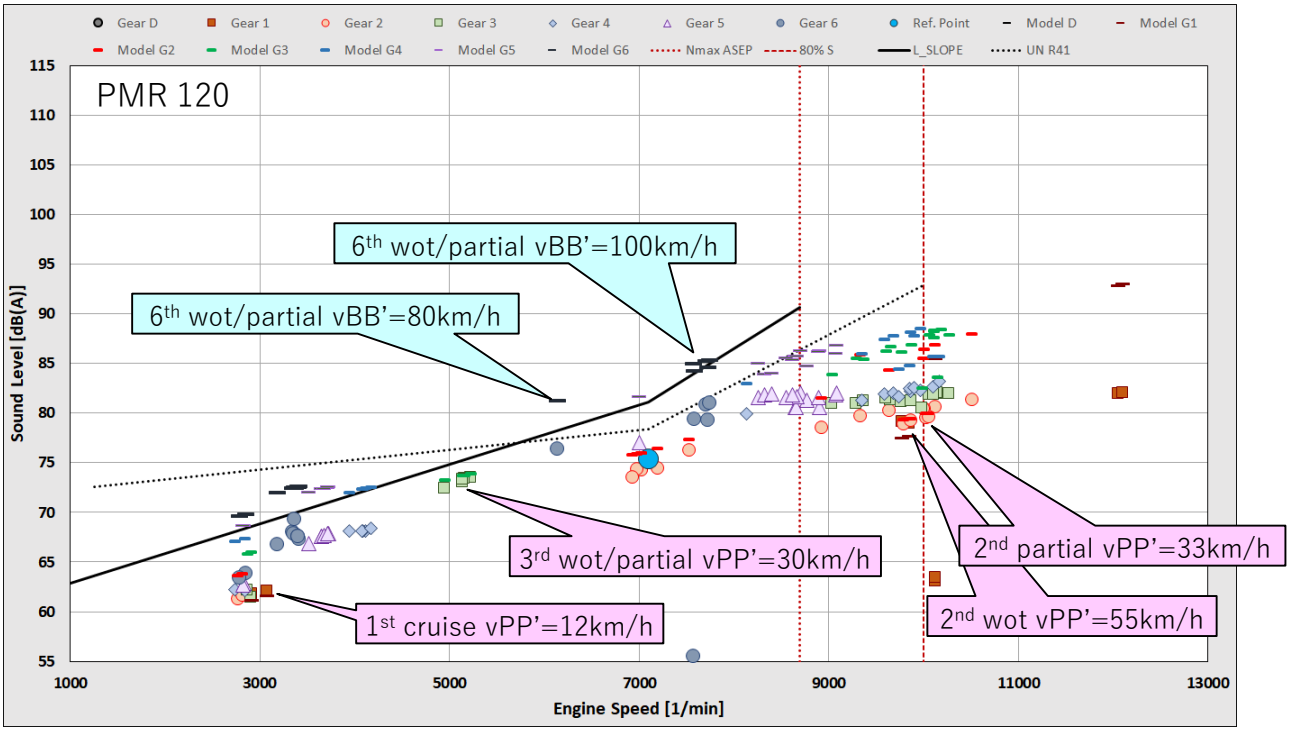
- For other vehicle models, fails are sporadically seen for “cruise” in lower gears likewise.

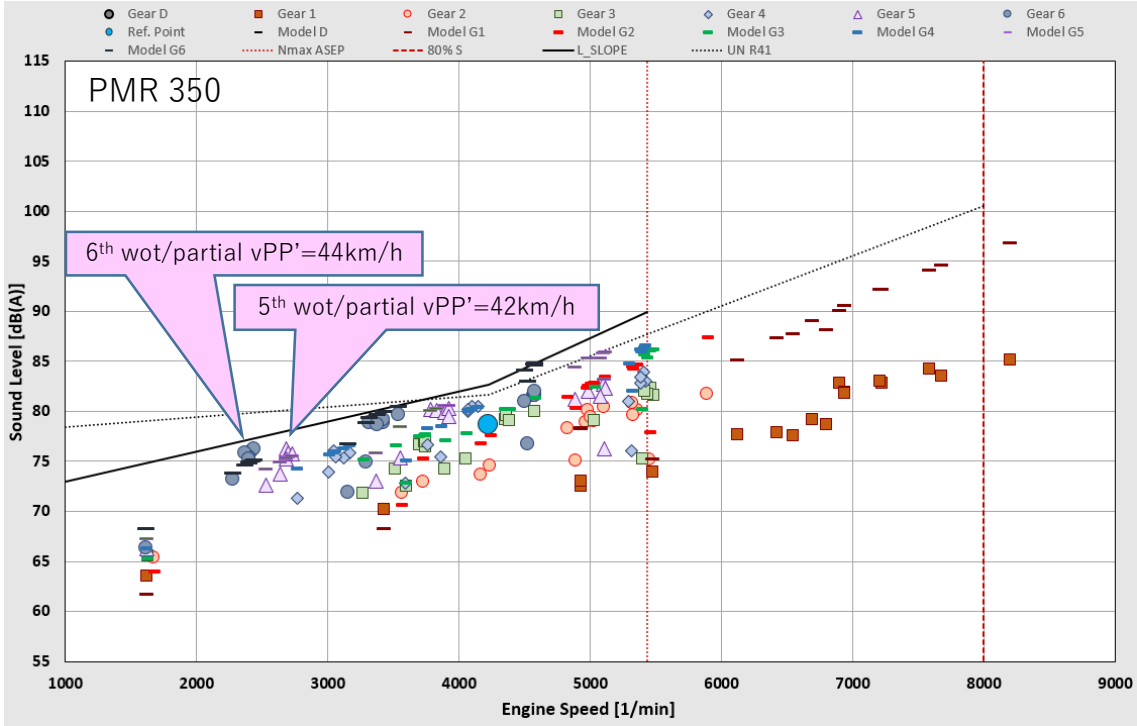




◆Results of Sound Model ～MT

- In addition to the Lcrs fails for lower gears (shown in the previous pages), fails are also seen both for “wot” and “partial”, regardless of gears; there is very little margin relative to expected values
- Also, as shown in the previous two pages, the higher the gear that is used for “wot” and “partial”, the more the expected values obtained from the model increase, making the limit more relaxed compared to the current limit line.
- As a result, some problems would arise when applying Sound Model as it is to PTWs (MT). Even completely “clean”, quiet vehicles could unreasonably become illegal, or, *vice versa*, far more relaxed expectation values are calculated. In particular, it is unpredictable in what conditions problem-free vehicles can become “illegal”, the results suggest it is at this point difficult to construct a sound model suitable for PTWs (MT) characteristics.

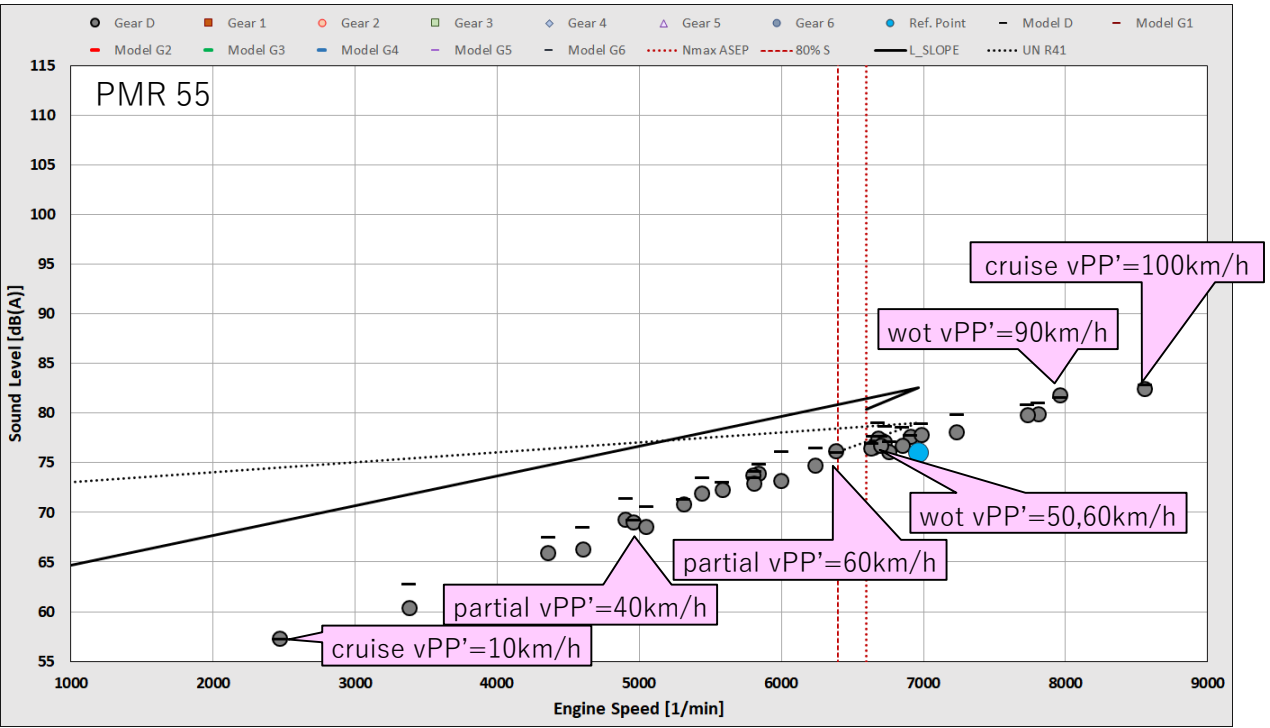


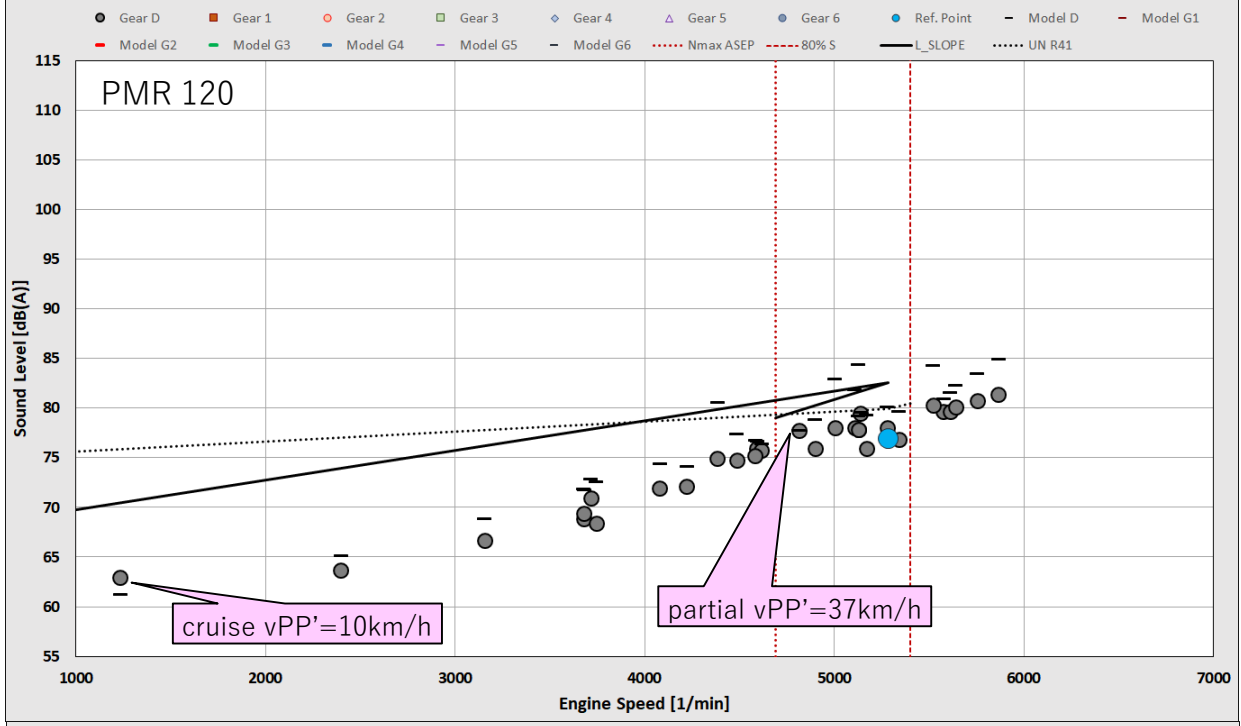


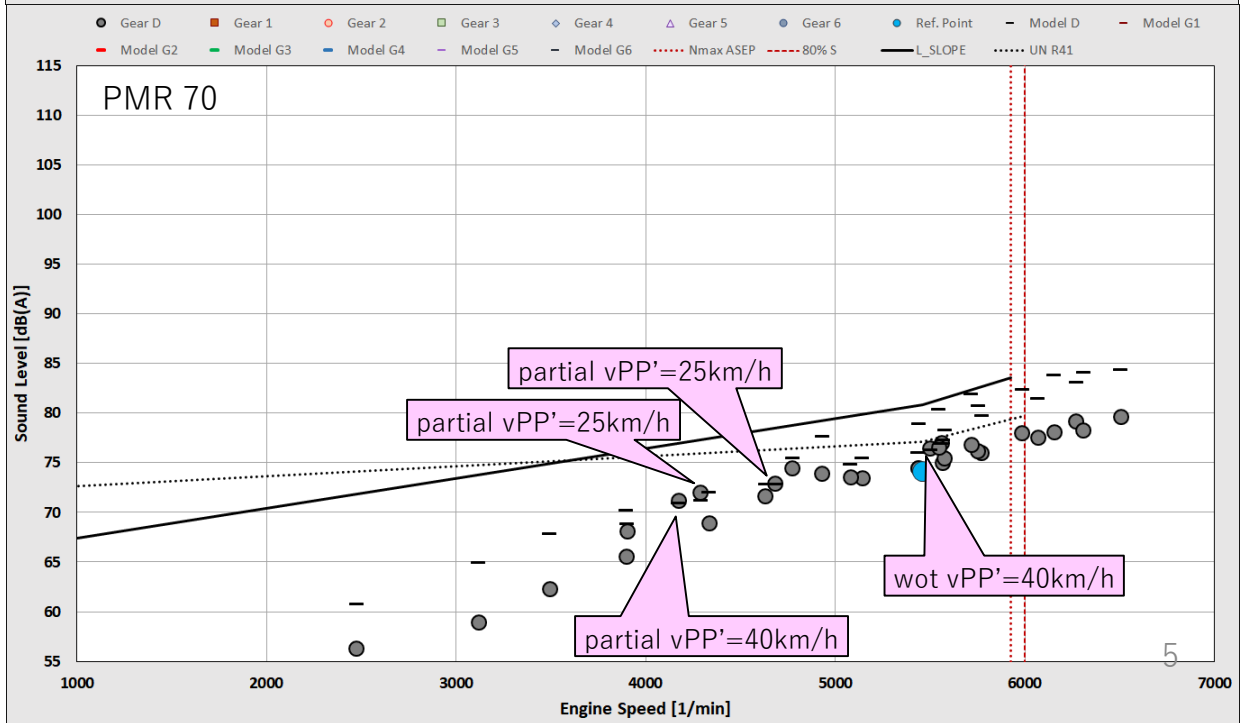
Different models have different fail cases: the same adjustment cannot cover all models

◆Results of Sound Model ～CVT

- Similarly to MT models, fails are seen for various vehicle speeds and loads, or the SPLs have very little margin to the expected values in some cases.
- Therefore, application of the Sound Model to PTWs (CVT) appears difficult in the same way as MT models.

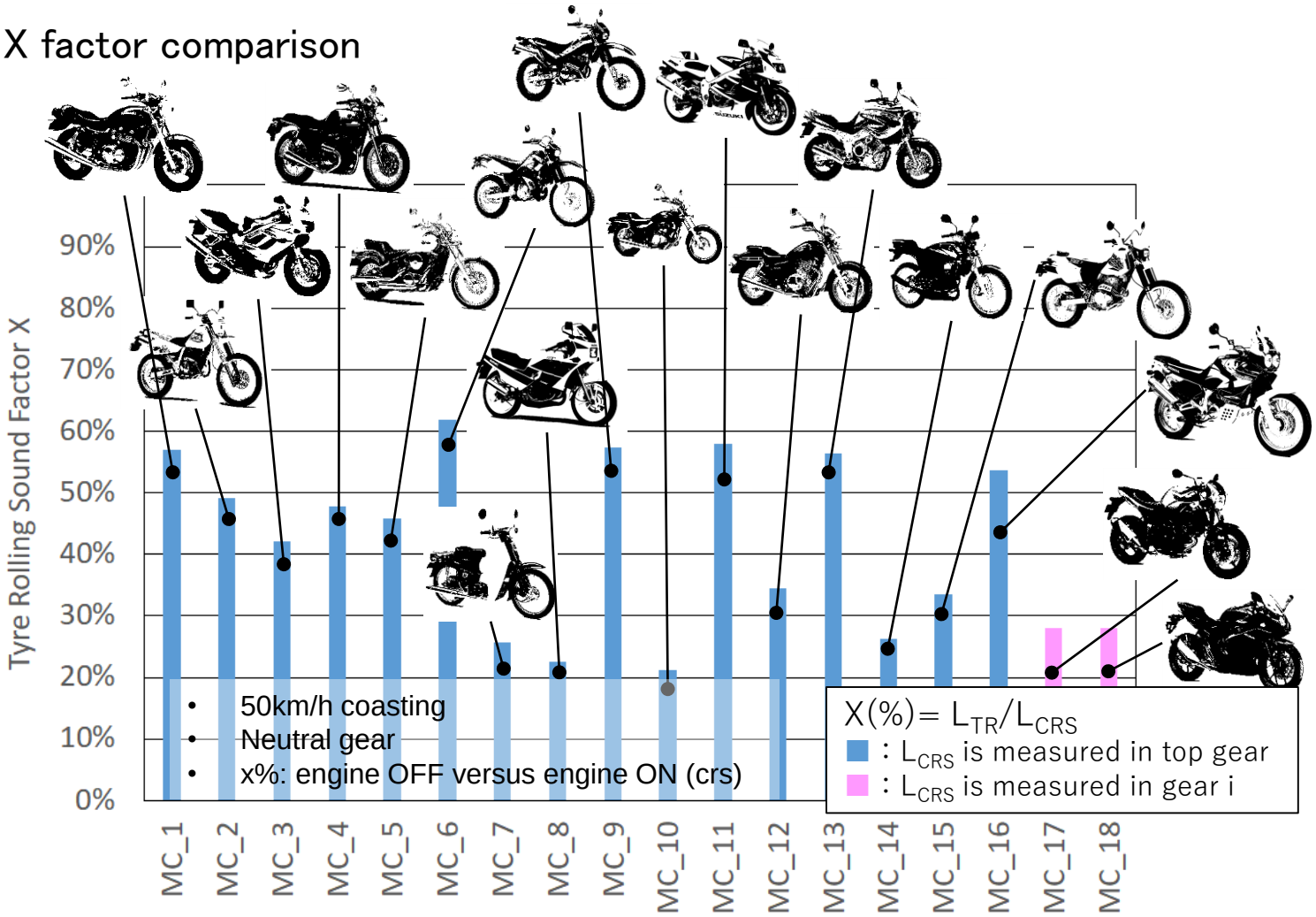






◆Tyre Rolling Sound Component

X factor comparison

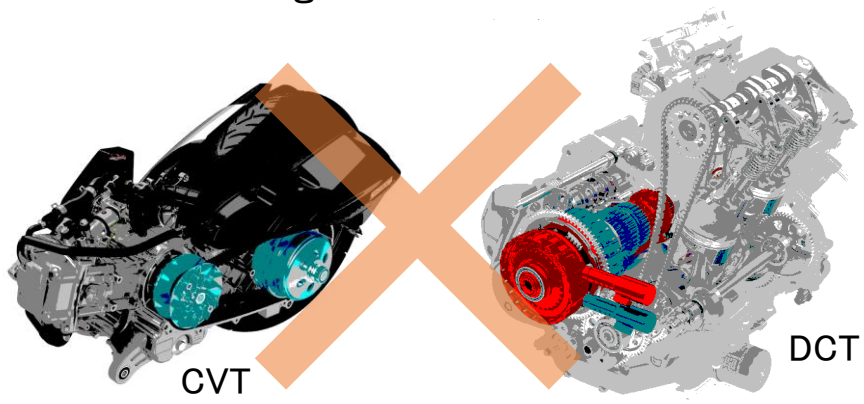


Example: Additional coast test runs to define factor X

Ex. MC_A:
3 types x 2 manufacturers = 6 tyres

6 additional test runs need to define X factor for each tyre.

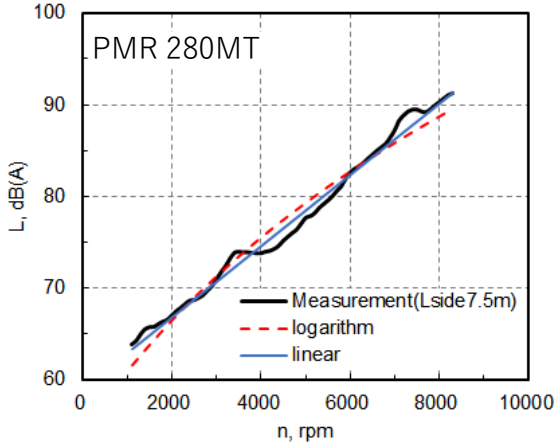
Coast running is not available

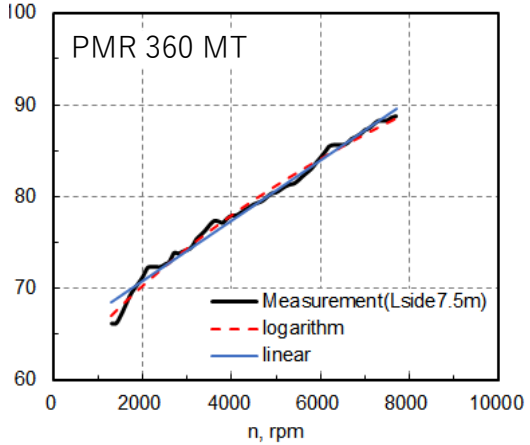


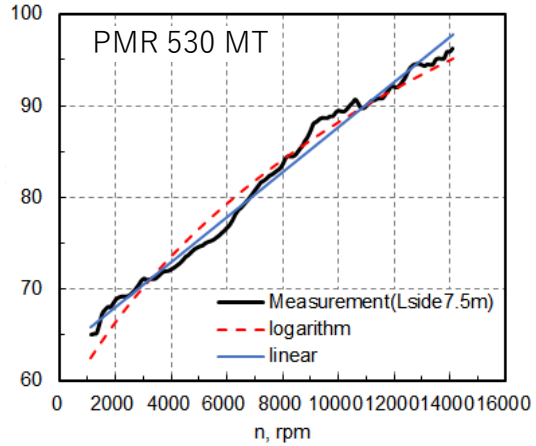
- Since X factor differs greatly by vehicle, direct measurement would be necessary when applying Sound Model.
- In addition, more than one tyre type is often specified for one vehicle model. In such a case, manufacturers will be required to perform measurement for all those tires, resulting in significant increase in burden.
- Nevertheless, defining X factor for PTWs is of big challenge because some types such as CVT and DCT are unable to coast due to their structures.

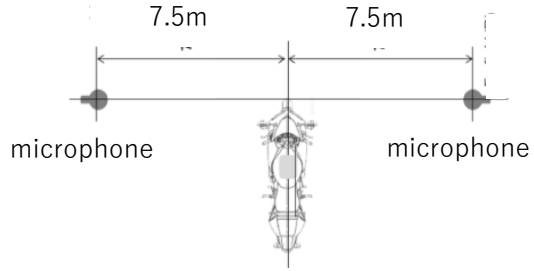
◆Power Train Mechanics Sound Component

Expected sound level of powertrain: $L_{PT,EXP} = \theta_{PT} \times log\left(\frac{n_{BB,test}+n_{shift}}{n_{BB,CRS,REP}+n_{shift}}\right) + L_{REF,PT}$

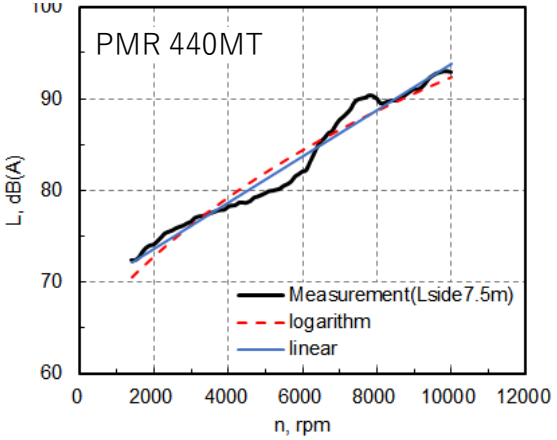


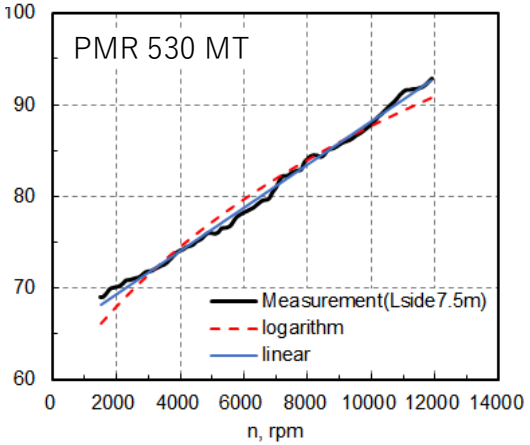


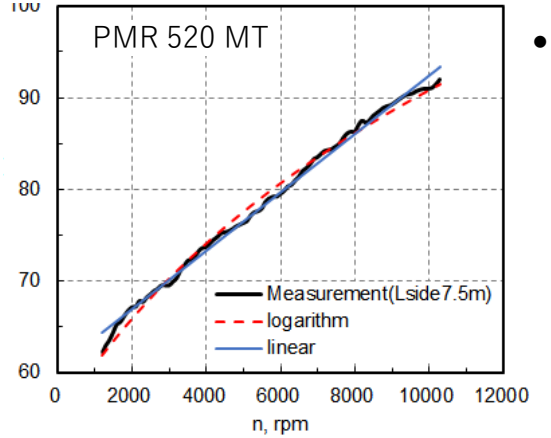




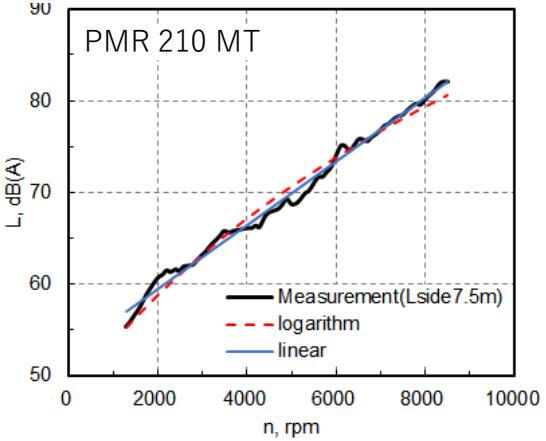
No-load measurement

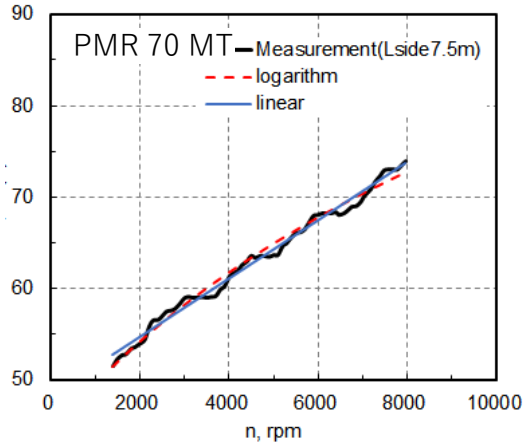






- In general, linear regression fitting has less errors than logarithmic curve fitting.



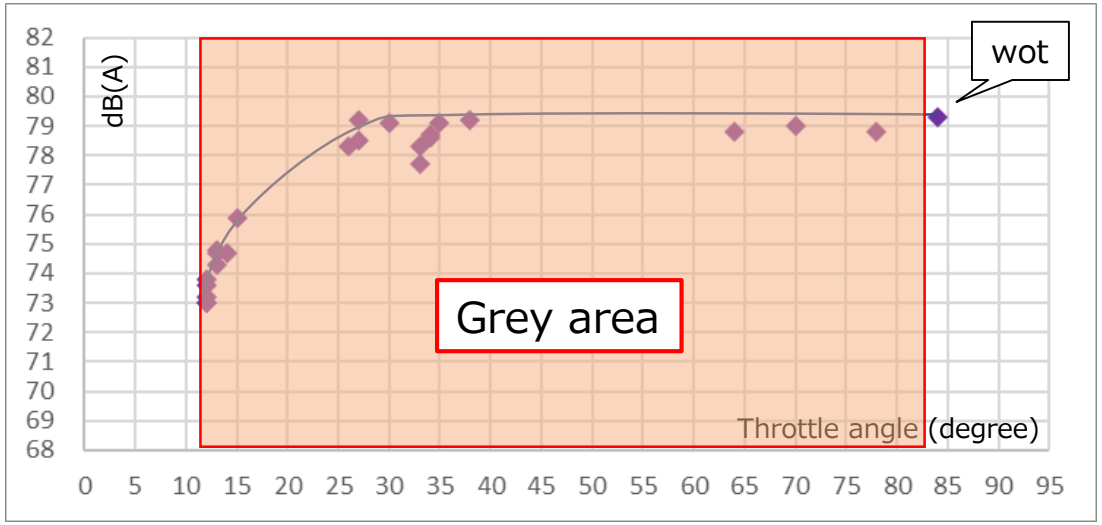


PMR CVT

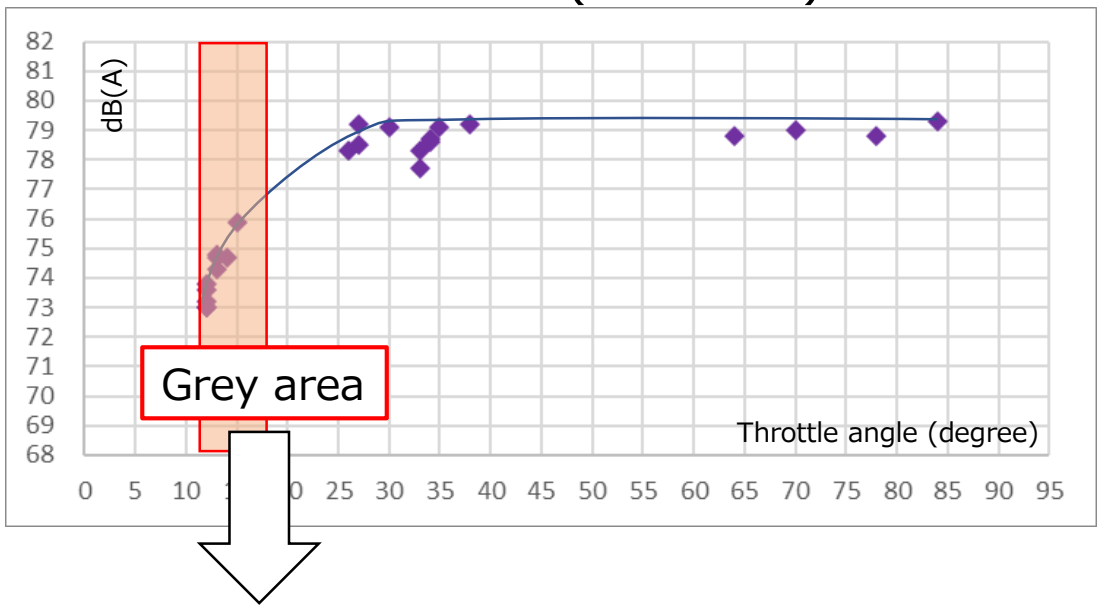
To be measured

◆Dynamic Sound Component

Current ASEP



ASEP2.0(1st STEP)



- 1st STEP (‘ASEP 2.0’) is effective to reduce grey areas.
- Most of the remaining grey area not covered by 1st STEP is around the cruise operation range..

Conclusion

■ applying the Sound Model to PTWs has some issues:

- Even clean vehicles may fail under unspecified conditions, at this point it is difficult to adjust the Sound Model to suit PTWs.
- PTW Tyre Rolling Sound Factor X varies greatly per vehicle, and actual measurement will be required. Test burden will increase accordingly. In addition, depending on vehicle structures (e.g. CVT and DCT), it may not possible to perform the coasting measurement.
- The relation between noise levels (at no-load and dynamic) and engine speeds of PTW can be more suitably represented by linear regression fitting rather than logarithmic fitting.

■ For the above reasons IMMA needs more time to investigate the model.