Category(ies) of vehicle: M & N

(ISO) COAST-BY DRUM INDOOR METHOD ISO TC31 WG11, ISO 20908

TIRE ROAD NOISE MEASUREMENT UNCERTAINTIES

MAIN MESSAGES FROM THE PRESENTATION(S)

ISO 13325 standard [1] related to outdoor characterization of tyre sound emission is an expensive method with high dispersion. That justifies to develop an indoor sound emission measurement method with drum in indoor chamber (ISO 20908 standard [2])

The concept is based on:
- Microphone array in front of a coupled tyre/drum
- Corrections applied on noise result of 1 tyre to extend it to 4 tyres and to compensate microphone distance
- An alignment process with outdoor methods is proposed to establish corrections to apply to indoor results
- Development of a unique and standardized drum surface replicating the reference test track to reduce uncertainties with a better operational efficiency and improve correlation between sites (not yet available nor implemented in the standard, under development)

SUMMARY

Firstly, the test protocol described in the ISO 13325 [1] is reminded. This standard is related to the characterization of the tyre coast-by sound emission. This method consists in tyre noise measurements on an ISO test track at different vehicle speeds (from 70 to 90 kph). A linear regression is calculated to give the noise level of tyres at 80 kph. The "ISO TC31/WG 11" working group highlighted that a +/- 2 dB ([1]) measurement dispersion has been estimated due to some impacting parameters as tracks, vehicles, weather conditions, etc (see ISO 13325 amendment [4]). The author also argues that the current outdoor method is expensive.

The proposal of the ISO TC31/WG 11 working group is to develop an indoor sound emission measurement method using a drum in indoor chamber (ISO 20908 standard [2]). In this case, the environment could be controlled, there would be no influence of the vehicle and a better operational efficiency, allowing to reduce costs.
The method concept is the same as the outdoor standard with the use of a microphone array to simulate the trajectory of the vehicle as seen by the single microphone used in the outdoor method. In the presented experiment, the microphone array is at 1.8 m distance from a coupled tyre/drum. Corrections are applied to simulate the noise level of 4 tyres, and the microphone array distance from the tyre. The author precises that other sets-up could be implemented, as circular array or one moving microphone.

The next step is to quantify the correlation with the current outdoor methods on tracks (ISO 13325 standard [1] and UN R117 regulation). Different factors can affect indoor measurements as the drum diameter, the horn, the semi-anechoic chamber, and the rig. So, an alignment process has been proposed for C1 tyres. This process consists of a test campaign of 9 C1 ([2]) tyres according to the outdoor and indoor methods. These measurements allow to establish corrections applied to drum results. This process could be renewed each 2 years.

Then, the measurement uncertainties of the indoor methods have been estimated at +/- 2.2 dB ([3]) between sites. The main impacting factor identified is the drum surfaces deviation. To reduce this uncertainty, the author recommends working on a unique and standardized drum surface replicating the reference test track.

The author explained that works are ongoing to consolidate these initial results, and that he would like to implement this method in regulation, assuming acceptable performances.

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The author concluded its presentation by giving some details on a current project by the WG11 working group. The concept is to produce thin surfaces reproducing on ISO 10844 tracks that could be used as drum surfaces. It would reduce uncertainties and improve correlation between sites. The concept consists of molding an ISO test track with a polyurethane mold. Then, to produce thin surfaces which will be fixed on drums. Thus, each drum will have a surface identical to that of the track and to that of the other drums.

ADDITIONAL POINTS FROM DISCUSSIONS IN THE TF-VS

- Several road surfaces could be imagined and not only current ISO 10844 [3] to be able to characterize textures representative of real world and make possible for both road & tyre manufacturers to build products taking into account their mutual interactions.
  → an EC program could be developed to take into account road/ tyre/ vehicles.
- Get data at 50km/h should not be a problem, then an amendment to ISO could be proposed – however, much more difficult is how to simulate the torque.
- ISO will continue to work on a new test method to measure tyres for UN-R117 but data is needed to show good performances without changing the current limits, for discussions with Contracting Parties – for the time being no project for UN-R51.

REFERENCES

TFVS-05-05 (ISO): 20211026 -- WG11 indoor method concept for GRBP TFVS

[1]: ISO 13325:2019, Tyres — Coast-by methods for measurement of tyre-to-road sound emission
[2]: ISO 20908, Tyre sound emission test — Methods of drum
[3] ISO 10844:2014, Acoustics — Specification of test tracks for measuring noise emitted by road vehicles and their tyres

Please note that data have been updated after the presentation done during the 05th session of the UN TF-VS → *nb.: an updated presentation will be done in the future to the TF-VS.*

(1) Since this initial presentation, ISO TC31/WG11 has performed new estimations on ISO 13325 uncertainties, showing that track to track peak variation could be estimated at 5.4 dB, this value bringing a total uncertainty of +/- 3.1 dB for a coverage of 95%. See [4]: ISO 13325:2019/Amd.1:2023(E) (under publication process).

(2) Published ISO 20908:2022 requests 12 tyres to be measured to establish correlation and correct indoor measurement values.

(3) Published ISO 20908:2022 indicates an uncertainty of +/- 2 dB, without using unique surface concept under development. However, since ISO 13325 uncertainties have been re estimated to +/- 3.1 dB mainly due to track-to-track variation, the uncertainty of +/- 2 dB will not be reachable, unless using identical surfaces on drums.