



Comparison of key parameters for the novel real-world braking schedule for measuring brake wear PM and PN emissions with the WLTP in-use driving behaviour data from Europe and Japan

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Introduction



- **A novel real-world braking schedule for measuring brake wear PM and PN emissions was developed based on customer data from the WLTP in-use driving behaviour database.**
- **The request to use customer data limited the database to the European part, which was exclusively customer data.**
- **The cycle development was mainly based on the following distributions:**
 - **Brake event duration distribution,**
 - **Start speed distribution of brake events,**
 - **Average deceleration distribution of brake events,**
 - **Distribution of the time between consecutive brake events.**

Comparison of the distributions for the cycle with WLTP in-use data



- The following figures show a comparison of the distributions from the test cycle with distributions derived from the WLTP in-use data of Europe and Japan.
- The distributions of the average deceleration values and the time between consecutive brake events are in good agreement with the distributions from the Japanese WLTP in-use data.
- The two other distributions (brake event duration and start speed) show some differences caused by differences in the vehicle speed distributions.
- For the start speed the test cycle distribution seems to be a good compromise between Europe and Japan.

Comparison of the distributions with WLTP in-use data from Japan

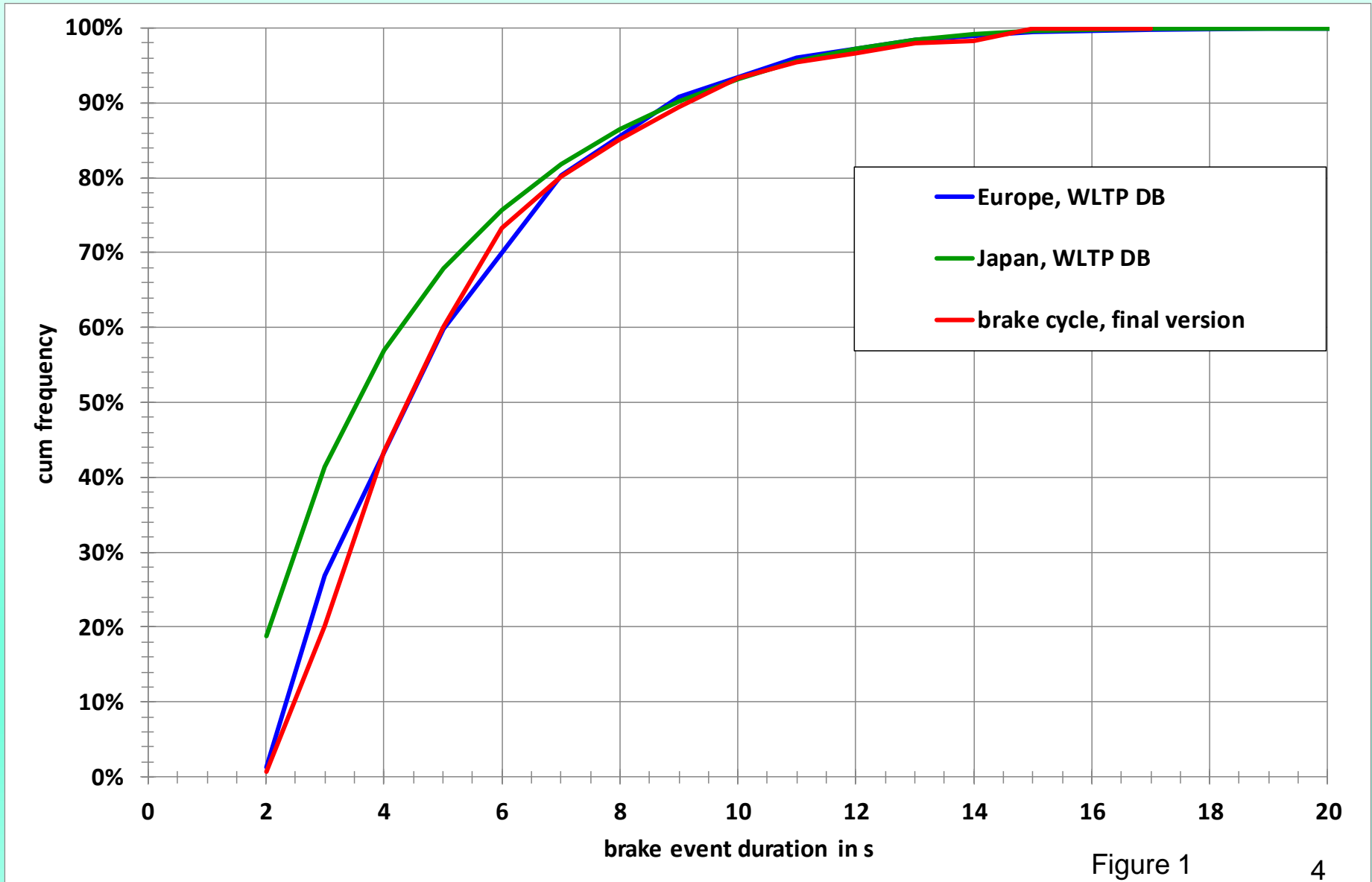


Figure 1

Comparison of the distributions with WLTP in-use data from Japan

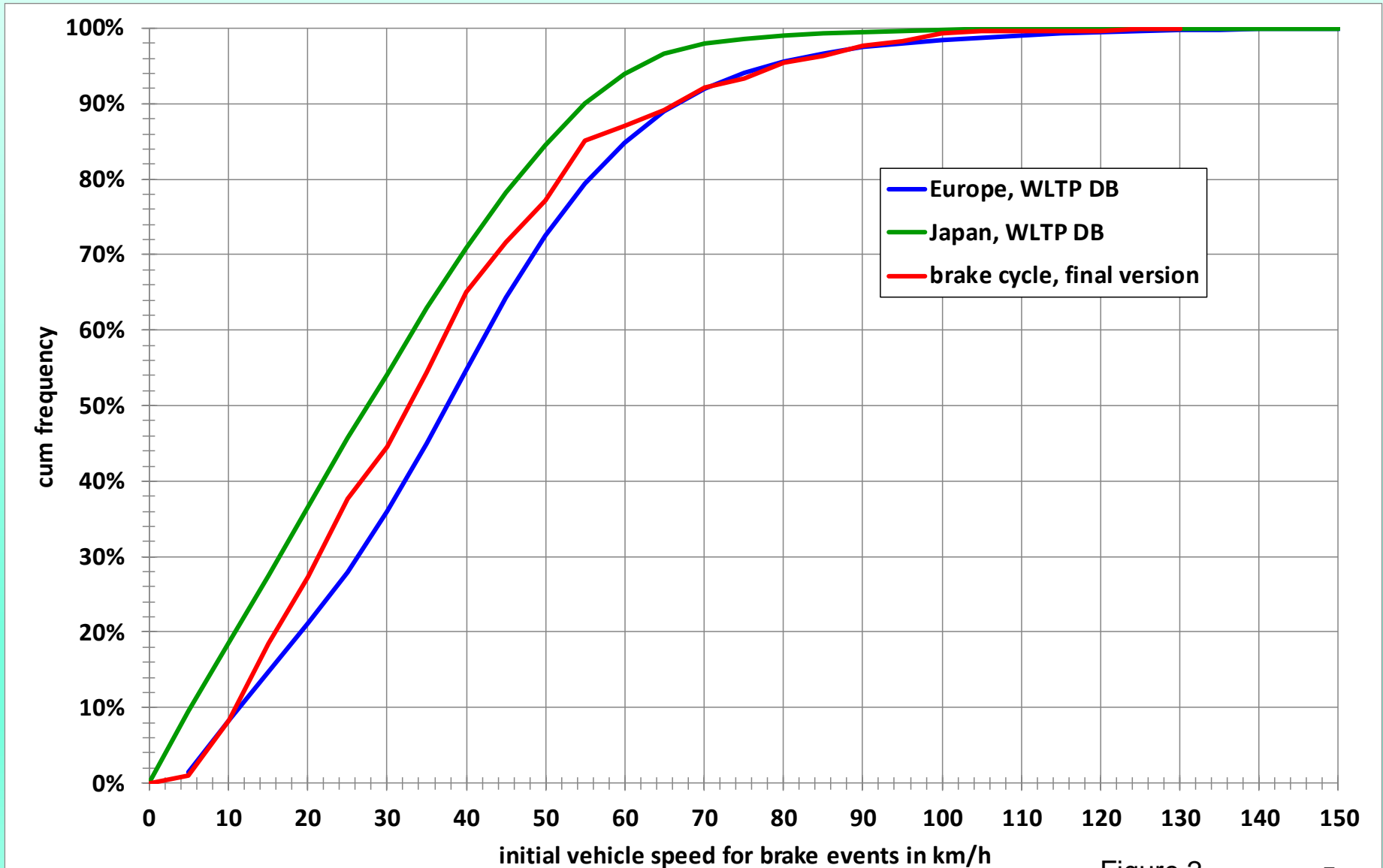


Figure 2

Comparison of the distributions with WLTP in-use data from Japan

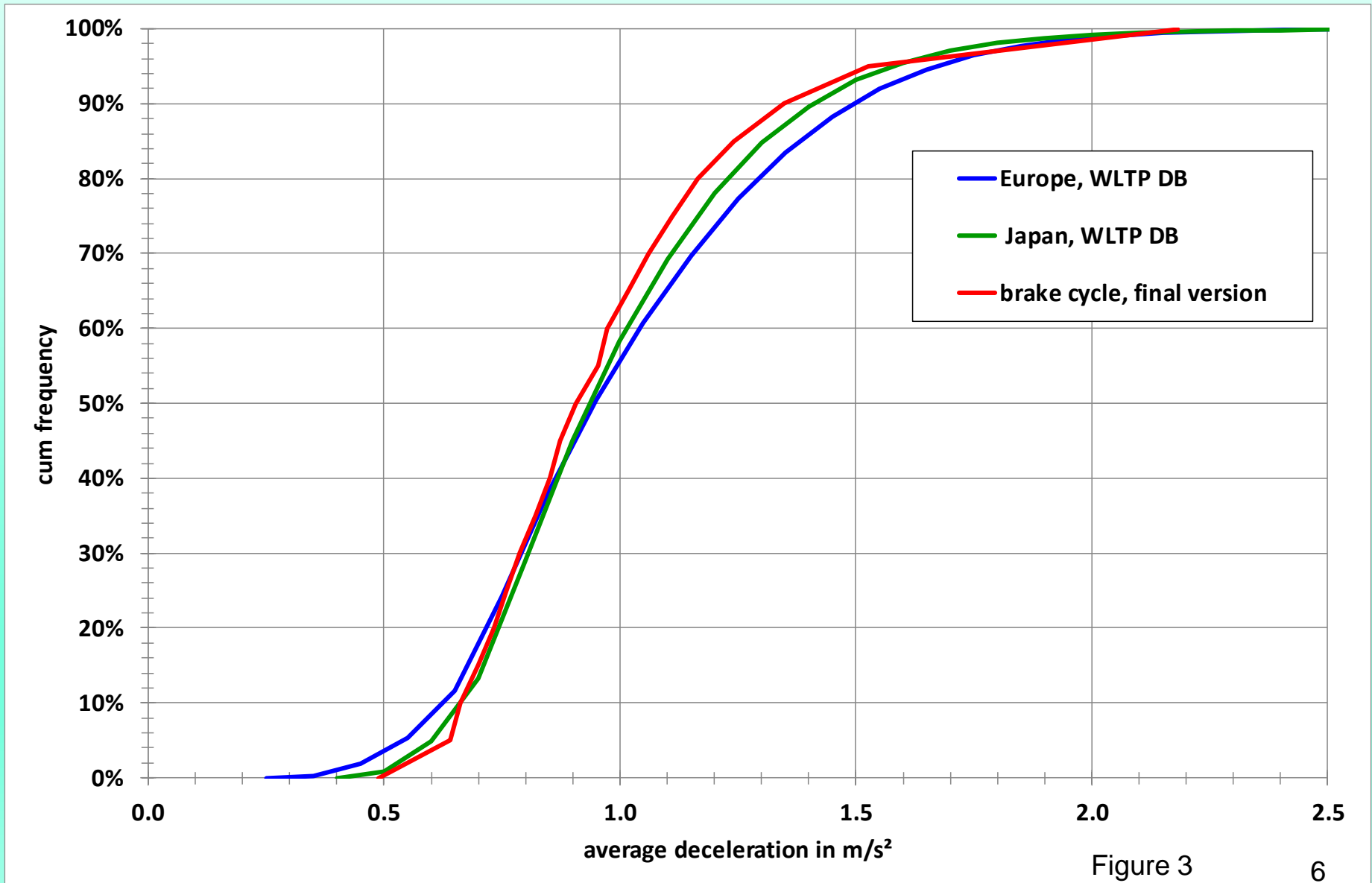


Figure 3

Comparison of the distributions with WLTP in-use data from Japan

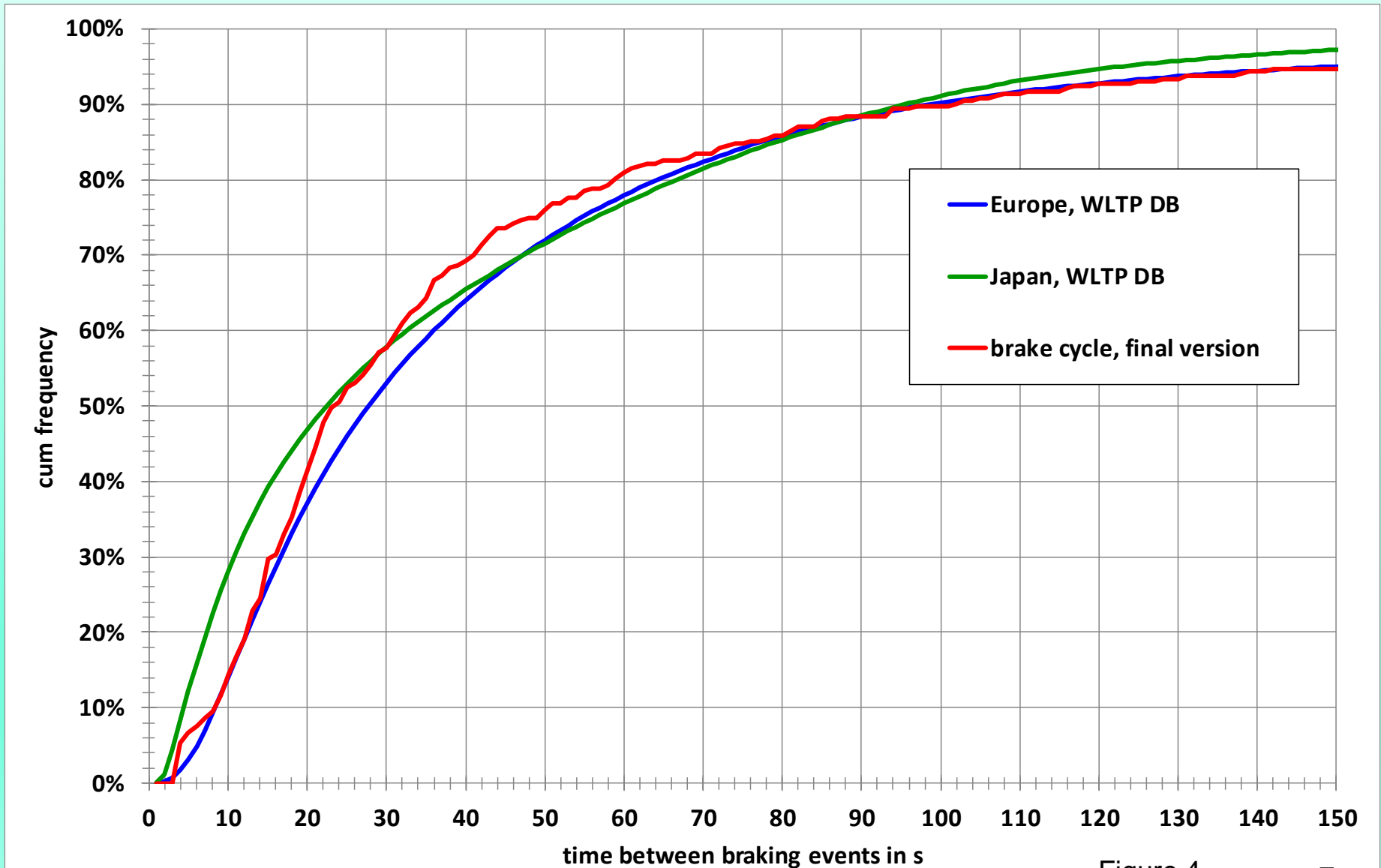


Figure 4

Further remarks



- As promised in Geneva, the 92 short trips of the cycle were binned in the four different speed classes according to the approach used for the WLTC development (depending on the maximum speed of the short trip).
 - Low: $v_{\max} \leq 60$ km/h,
 - Medium: $60 \text{ km/h} < v_{\max} \leq 80$ km/h,
 - High: $80 \text{ km/h} < v_{\max} \leq 110$ km/h,
 - Extra high: $v_{\max} > 110$ km/h.
- Since the requirements for a brake cycle are different, the short trips of the four speed bins are distributed randomly over the cycle and not ranked in ascending order.

Further remarks



- **The two short trips belonging to the extra high speed bin are following one after the other and are located at the end of the cycle followed by three low speed short trips.**
- **But it must be mentioned that only two brake events within these two short trips have v_{start} values above 110 km/h (see table 1).**
- **Compared to the total number of brake events (303) this is less than 1 %.**

Brake events in the extra high speed short trips



brake events for the extra high speed short trips		
brake event no	duration in s	v_start in km/h
289	9	64.9
290	10	112.0
291	9	68.2
292	10	80.9
293	8	73.4
294	12	39.3
295	16	132.5
296	9	41.6

End



Thank you for your attention!