WLTP Strawman Proposal for DHC

United States Delegation

GRPE meeting in Geneva
January 15, 2010

Additional Ideas for DHC

- Acknowledge that harmonization is the goal
- However, there is the concern averaging and combining disparate driving traces from different nations (and road types) could be problematic for some contracting parties
  - i.e. concern with averaging “apples with oranges”
- Proposal
  1. Statistically separate similar driving patterns from different countries
  2. Define N “*phases*” (or “*bags*”) of driving that captures these differences
  3. Each nation could average the N Phases, using weights appropriate for their regions

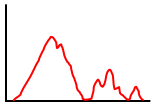
1. Separate similar driving patterns from different countries

- It is conceivable that peak driving in one country or region could be statistically similar to off-peak driving in another
- It could also turn out that (Similarly,) “urban” driving in one city could be similar to “rural” driving in another
- The proposal is to do a statistical analysis of the data before it is “*classified*” or “*binned*” and combined
- This analysis would look for patterns of similar driving around the world and group them

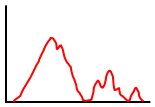
Similarity

- Contracting parties would submit second-by-second driving data by certain criteria
  - Peak vs off peak
  - Local vs arterial vs motorway (other road types?)
- Test statistically for differences
  - Chi-Square tests?
    - Applied to histograms (one-way, two-way, etc.)
    - Perhaps too sensitive?
  - Kolmogorov-Smirnov?
    - Applied to cumulative frequency distributions
      - One-way, two-way

Example

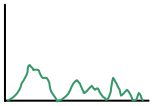


- India rural …

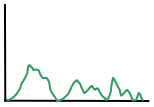


- US urban off peak …

- Phase 2



- Japan urban peak …

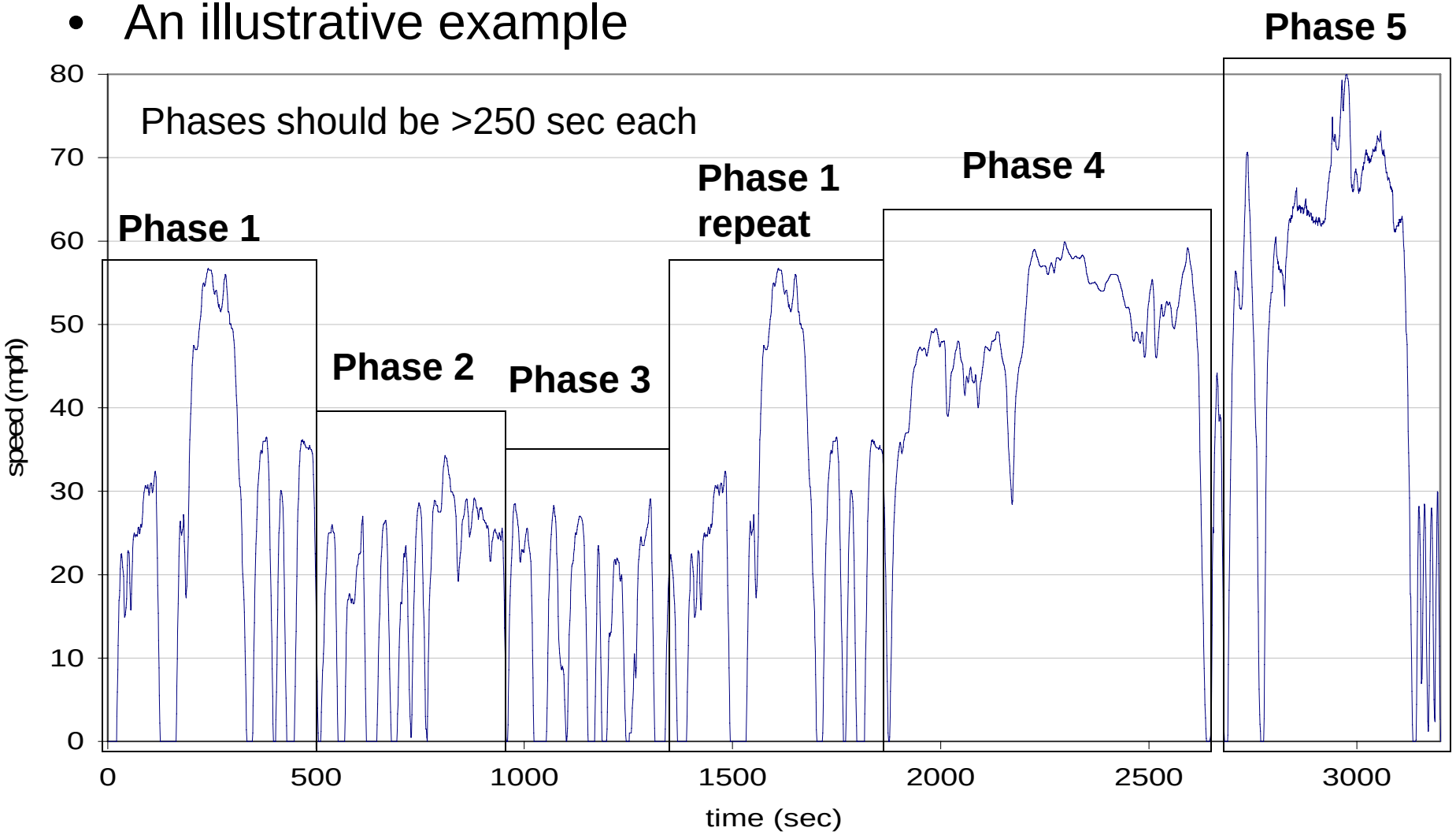


- Europe urban off-peak …

- Phase 3

2. Define N phases of driving that captures these differences

- An illustrative example



3. Each nation could average the *N* Phases, using weights appropriate for their regions

e.g $E_{\text{cycle}}(\text{g/km}) = W_1E_1 + W_2E_2 + W_3E_3 + \cdots + W_NE_N$

$$\sum W_N = 1.0$$

	Phase1 W_1	Phase 2 W_2	Phase 3 W_3	…	Phase *N* W_N
EU	0.1	0.25	0.32	…	0.15
China	0.3	0	0.1	…	0.45
India	0.25	0.05	0.15	…	0.5
Japan	0.08	0.3	0.28	…	0.12
…	…	…	…	…	…
U.S.	0.2	0.1	0.25	…	0.35

Goal is harmonization

- Country specific weighting factors should be used in the event that a single cycle cannot satisfy all needs
- Will manufacturers use different engine calibrations for each region? (especially on hybrid electric vehicles)
  - For conventional gasoline (petrol) vehicles, calibrations will probably not differ much – if emissions standards are similar
  - US drivers (who drive mostly on highways) are still buying many Toyota Priuses (which were originally calibrated largely for urban driving)
  - If manufacturers need to have separate calibration for India than U.S. (for example), perhaps that could be the best option for the consumers of those two nations
    - In 2005 US consumers demanded that labels (on hybrids especially) be more representative of real world fuel economy, so EPA added extra (off cycle) phases to the FTP cycle and weighted them specifically for US driving activity

Conclusions

- The approach provides an alternative way to combine disparate data by first looking for similarities in the data before averaging
- This alternative methodology would still provide a harmonized drive cycle based on common speed traces
  - Use of common sets of weights would allow comparison across regions
- Each contracting party could have different emission rates via regional weights
  - Allows for harmonization as well as regional specificity or uniqueness - Very flexible!
  - Engine calibrations not expected to vary widely (with similar emissions standards)
  - If variations occur, then customers will likely demand it