

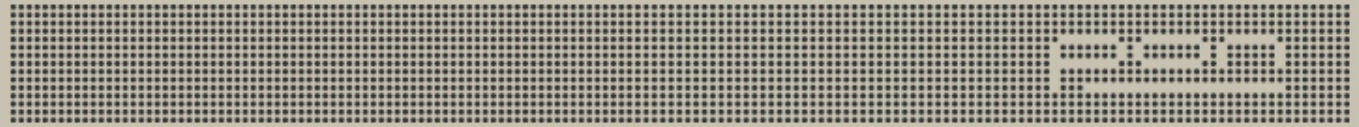
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Evaluation of the applicability of the Common Artemis Driving Cycle for Type Approval purposes

Raymond Gense

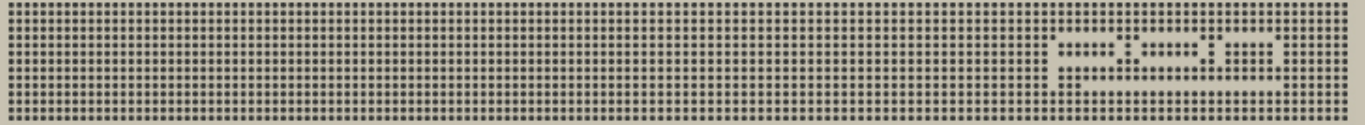
Manager Sustainable Development Pon

WLTP working group Jan 2009



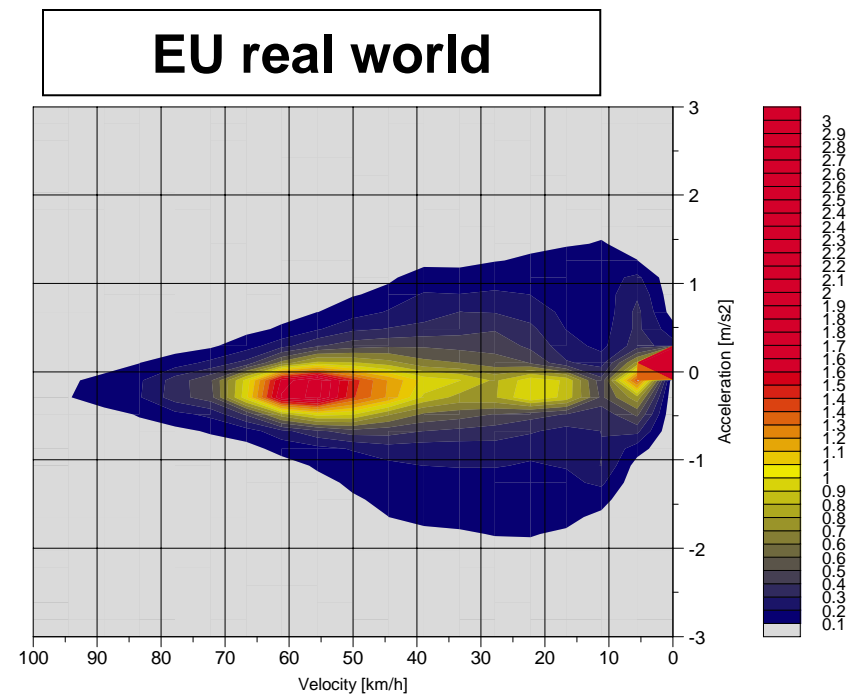
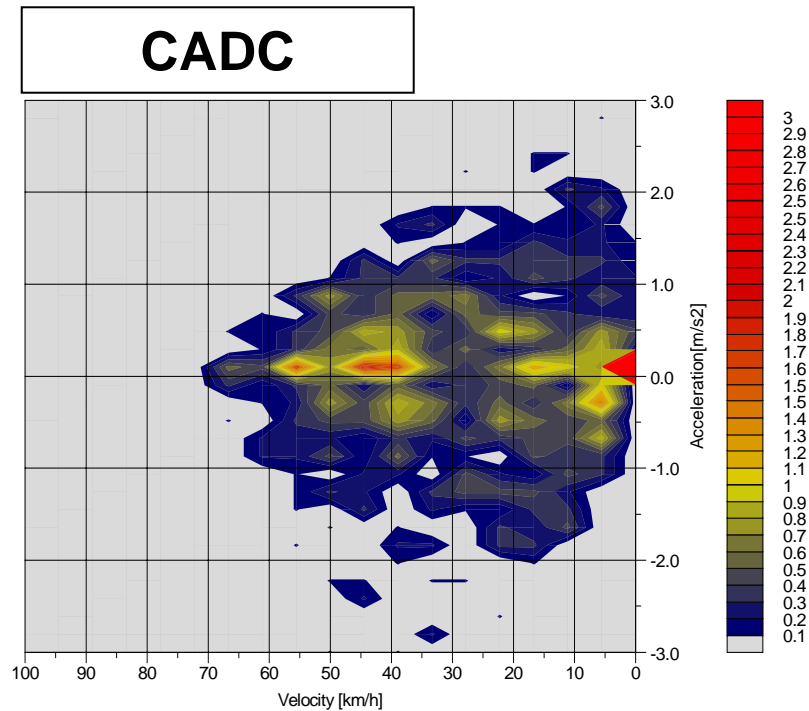
CADC development process

- Databases used to develop the CADC
 - Modem/Hyzem **pre 1999** speed pattern and **shift data** (France, UK, Germany, Greece)
 - Pre 2000-2004 Swiss data
 - Pre 2000-2004 German data
 - No opportunity for additional dedicated data collection in the project
- Types of collecting the data
 - Swiss data collected by logging driving behavior of professional drivers following the traffic
 - Modem/Hyzem data collected by logging daily car traveling of civilians (M1 and N1)
- Combining the Swiss and the Modem/Hyzem databases
 - Separation of the data into “kinematic segments”
 - Modem/Hyzem “kinematic segments” were clustered into 12 road categories (segments are classified on their kinematic parameters, road details are lost)

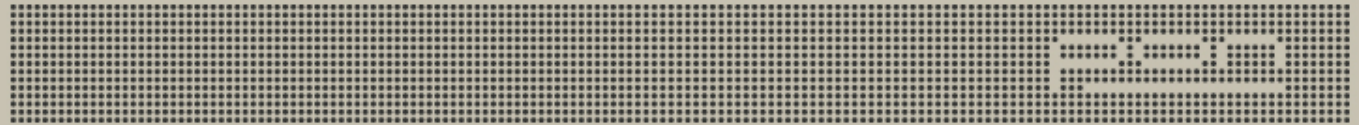


Cycle statistics conclusions:

- Compared to “real world EU”:
 - CADC is relative low speed in the urban part
 - CADC is relative high dynamic in the urban part
 - CADC is relative high speed on rural and highway



Compared to UN real world ?

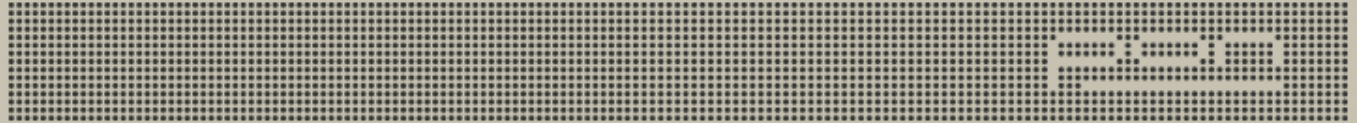


Gear change strategy

- Based on *pre Artemis* data analyses Inrets from *pre 1999* Moden/Hyzem data
- 4 Classes made based on pre 1999 vehicle parameters (low power and torque)
- All based on 5 speed gear boxes.
- **Class 1:** The power to weight ratio > 76 W/kg, V_{\max} in the third gear > 110 km/h (high powered vehicles, mainly sports cars)
- **Class 2:** The power to weight ratio < 76 W/kg, V_{\max} in the third gear > 118 km/h
- **Class 4:** The power to weight ratio < 60 W/kg, V_{\max} in the third gear < 102 km/h
- **Class 3:** All other vehicles

Result:

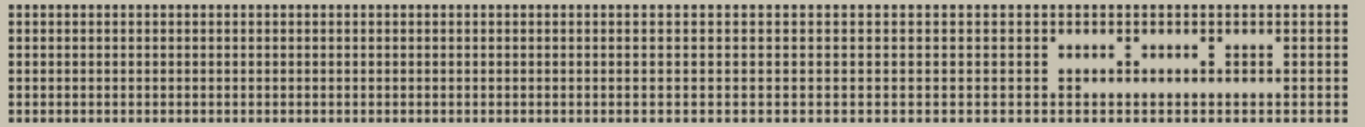
- Relative high shifting points for Petrol engines
- Unrealistic high shifting points for modern high power Diesel engines (class 1)



Practical experience with CADC:

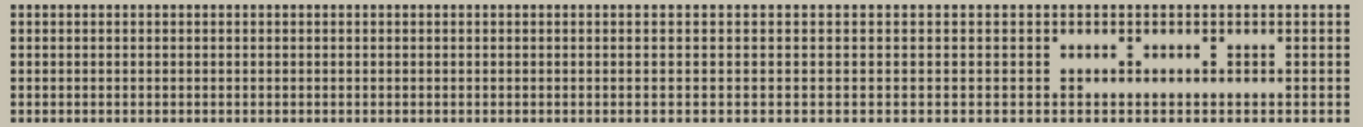
On the Chassis Dynamometer:

- High dynamics at low speed can lead to slip on CD
- High dynamics lead to bad drive ability (reproducibility)
- High rev's gear change leads to unrealistic and badly reproducible gearshifts
- High speed part can lead to overheated engines and tires, due to limited cooling capacity of some older test facilities
- Cold start not included in procedure
- High test drivers work load, due to long running time and unrealistic driving behaviour (bad reproducibility)



The NEDC and CADC cycles in relation to important criteria for driving cycles

	Relevance for TA	NEDC	CADC
1. Similar basic characteristics as real world driving	+	-	+
2. Match fuel consumption and emissions in rel. terms (ranking)	+++	0	+
3. Match fuel consumption and emissions in abs. terms	++	0	+
4. Prevention of cycle beating	+++	-	+
5. Simplicity and reproducibility	+++	+++	-
6. Achievable performance (vehicle)	+++	+++	+
7. Achievable performance (equipment)	++	+++	0
8. Special modes represented in the test (Cold start, AC) represented in test cycle	+++	++	0



Over all conclusions :

- **CADC for Type Approval purposes is not appropriate, due to:**
 - **“Real world” content still limited especially in relation tot non EU regions**
 - **Gear shift strategy not applicable/realistic***
 - **Bad reproducibility of the procedure**
 - **No cold start is included in de procedure**
 - **Cycle beating prevention not taken into account**

* Unrealistic high revolutions (DACH-NL-ENG-S partners already use different strategy)



Thank you

R.gense@pon.nl