Comments and/or Recommendations regarding to JRC Study on MPR for Category 2

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58th EVE IWG

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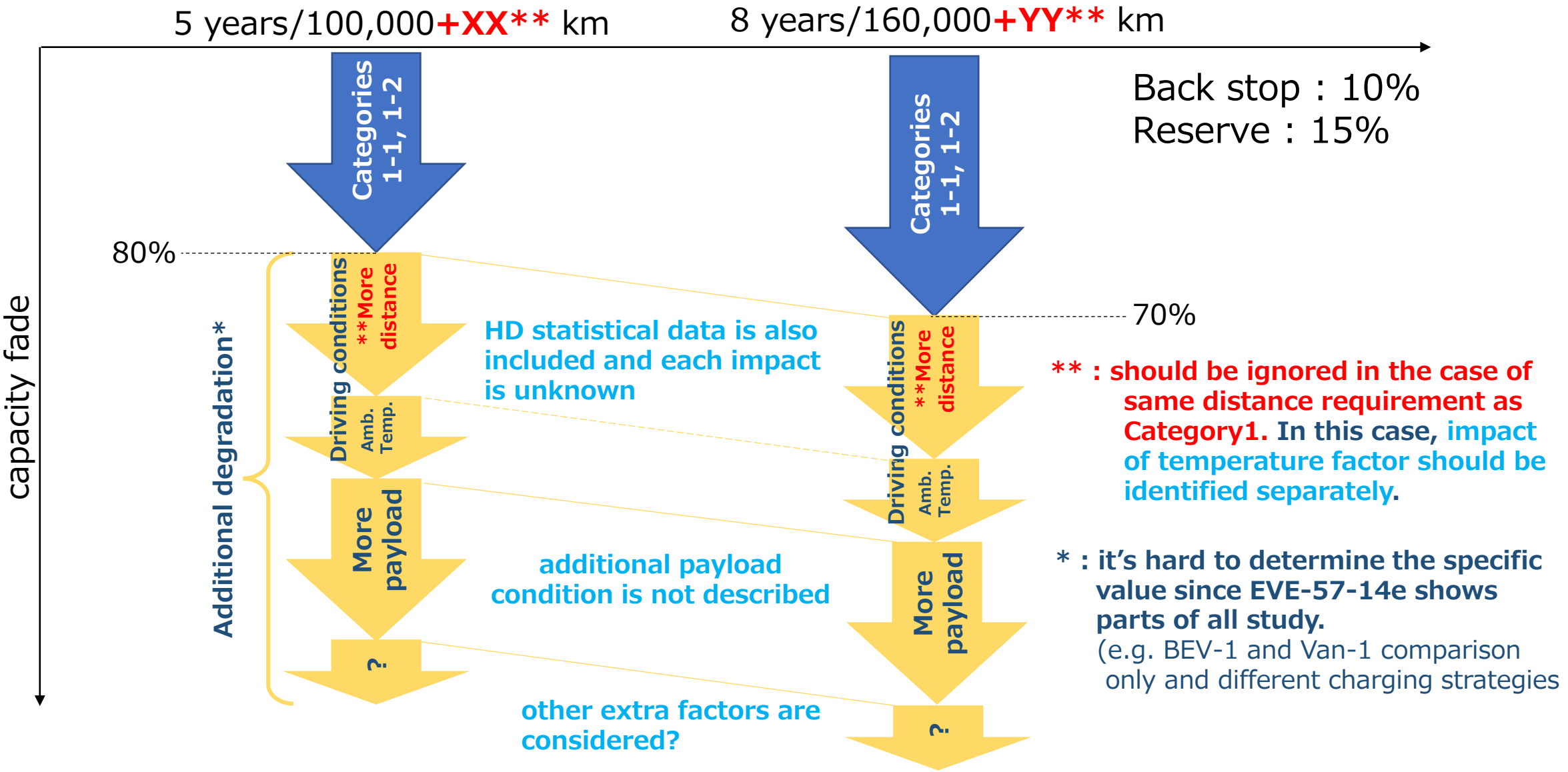
General Comments

- ✓ JRC study is one of main evidences to determine the MPR for category 2 vehicles
- ✓ Appreciate technical study under the difficult situation in where few market data is available
- ✓ Japan is not able to contribute to provide the technical evidence since our technical study and market experience is quite limited at this time

→ For the initial MPR determination, Japan follows EVE IWG decision based on JRC study and other technical evidence, if available

Initial Observations on JRC study



Confirmations/Recommendations

Starting Point	JRC study applies TEMA model which identifies the Category 1 MPR, that's why 15% reserve is included

↓then, consider **extra factors** related to Category2 features compared with Category1

extra factors	Confirmations/Recommendations	overall
1. Driving distance	Statistical data for **only Category2 shall be used** for the analysis	TEMA model well covers the extra factors (please refer to appendix) to determine the extra impact on battery degradation for each vehicle architectures (e-Van1~4). Appreciate if **each vehicle data is provided**.
2. Payload	**What is payload value** for this study ? (in the WLTP world : Cate.1=15, Cate.2=28%)	
3. Battery temperature	**What kind of battery cooling architecture** is considered to determine the battery temp. ? Is the **energy consumption** also considered ?	
4. SOC profile	well-covered	
5. Charging strategies	well-covered	
(1+2)'. Energy throughput	heavily affected by **real-world energy consumption** in addition to distance and payload → can TEMA model provide also "energy throughput" data for further analysis ?	

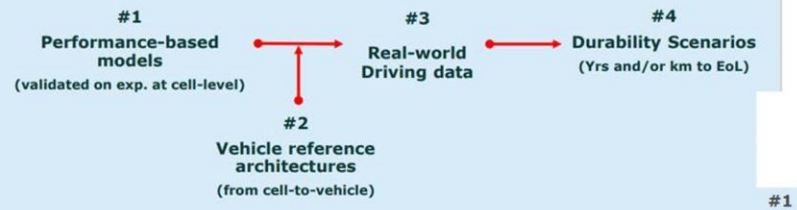
Determination of the MPR for Category2

Category2 extra factors		5 years		8 years		Remarks
		100K km	100K + XX km	160K km	160K + YY km	
TEMA simulation	1. Driving distance	NA	B_1	NA	D_1	XX/YY : determine the statistical data
	2. Payload	A_2	B_2	C_2	D_2	
	3. Battery temperature	A_3	B_3	A_3	D_3	consider battery cooling architecture
	4. SOC profile	A_4	B_4	A_4	D_4	
	5. Charging strategies	A_5	B_5	A_5	D_5	
Total of each vehicle (e-Van1~4)		$\sum_{n=2}^{5}(A\_n)$	$\sum_{n=1}^{5}(B\_n)$	$\sum_{n=2}^{5}(C\_n)$	$\sum_{n=1}^{5}(D\_n)$	
Representative Value		**Average ? Median ? 90% tile?**				One of discussion points other than technical observation
Consider X factors		A_6	B_6	C_6	D_6	technical improvement and/or social needs
MPR for Category2		**80-$\sum_{n=2}^{6}(A\_n)$**	**80-$\sum_{n=1}^{6}(B\_n)$**	**70-$\sum_{n=2}^{6}(C\_n)$**	**70-$\sum_{n=1}^{6}(D\_n)$**	

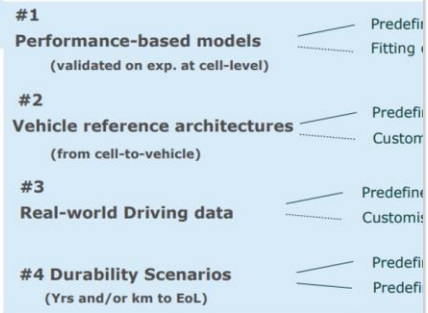
Appendix : TEMA Model

1. Driving distance
2. Payload
3. Battery temperature
4. SOC profile
5. Charging strategies

Summary of the JRC TEMA logical passages



Generalising JRC TEMA durability model: is it po



- **The model capacity fade is calculated at the net of the capacity fade reserve. i.e.:**

$$Q_{loss\text{-}total} = Q_{loss\text{-}calendar} + Q_{loss\text{-}cycle} - Reserve$$

- **5 recharge strategies adopted:**
  - ✓Str. 1 = Long Stop Random AC;
  - ✓Str. 2 = Short-Stop Random DC;
  - ✓Str. 3 = Night AC - Str. 4 = Smart AC;
  - ✓Str. 5 = Long-Stop AC 3-phases;
- **5 vehicle segments:**
  - ✓ B-segment BEV
  - ✓ D-segment premium
  - ✓ D segment PHEV
  - ✓ 2 additional BEVs (i.e

5.

- 3 news recharge strategies defined for a total of 19 ones available in TEMA :
  - ✓Str. 17 = Short stop DC with SOC and trip length control (SOC <30% or trip length > 40km)
  - ✓Str. 18 = lunch break DC (more than 20 minutes)
  - ✓Str. 19 = lunch break DC and Night-charging AC
  - ✓Already available Str. 16 = Return "home/depot" recharging AC
- Analyses done for:
  - Str. 6 = Long Stop Random AC;
  - Str. 7 = Short-Stop Random DC;
  - Str. 8 = Night AC from 10 p.m.; Str.12 Night Ac from 6 p.m.
  - Str. 11 = Smart AC;
  - Str. 9 = Long-Stop AC 3-phases;
  - Str. 16, Str.17, Str. 18 and Str. 19

Input to JRC TEMA

General parameters		• Age of the car since manufacture [yrs] • Run-in km • Vehicle technology (BEV, PHEV) • EoL threshold for capacity fade and power fade
Environmental parameters		• Ambient temperature max and min for each month of the year [°C]
Duty cycle parameters	1. 2. 3.	Average number of trips per month Average driven distance [km] • Average driving time [h] Average driving speed [km/h] Average energy consumption [Wh/km] Average resting time without charging [h] • Average parking time [sec]
Charging data	3. 5.	Average recharging time [h] Recharging power [kW] Charging mode/level Average number of recharge per month
Battery parameters	3. 4.	• Battery chemistry • Battery architecture (no. of modules, no. of cells, cell voltage, cell current, series/parallel connection i.e. 48S 2P 2S etc.) • Reference battery voltage [V] • Battery capacity [Wh] • Battery reserve [%] Average weighted battery temperature [°C] Battery temperature min and max (BMS) [°C] Average battery SoC min driving [%] Average battery Delta SoC during charging [%] Average battery SoC parking no charging [%]