

# Development of tyre abrasion test methods by Indoor Drum Method

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JAPAN AUTOMOBILE STANDARDS INTERNATIONALIZATION CENTER

- ◆ Test machine
- ◆ Running condition
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  - Others
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  - Texture & Material
  - Control
- ◆ Environment
- ◆ Sequence
- ◆ Test Procedure
- ◆ Validation
- ◆ Measurement
- ◆ Evaluation

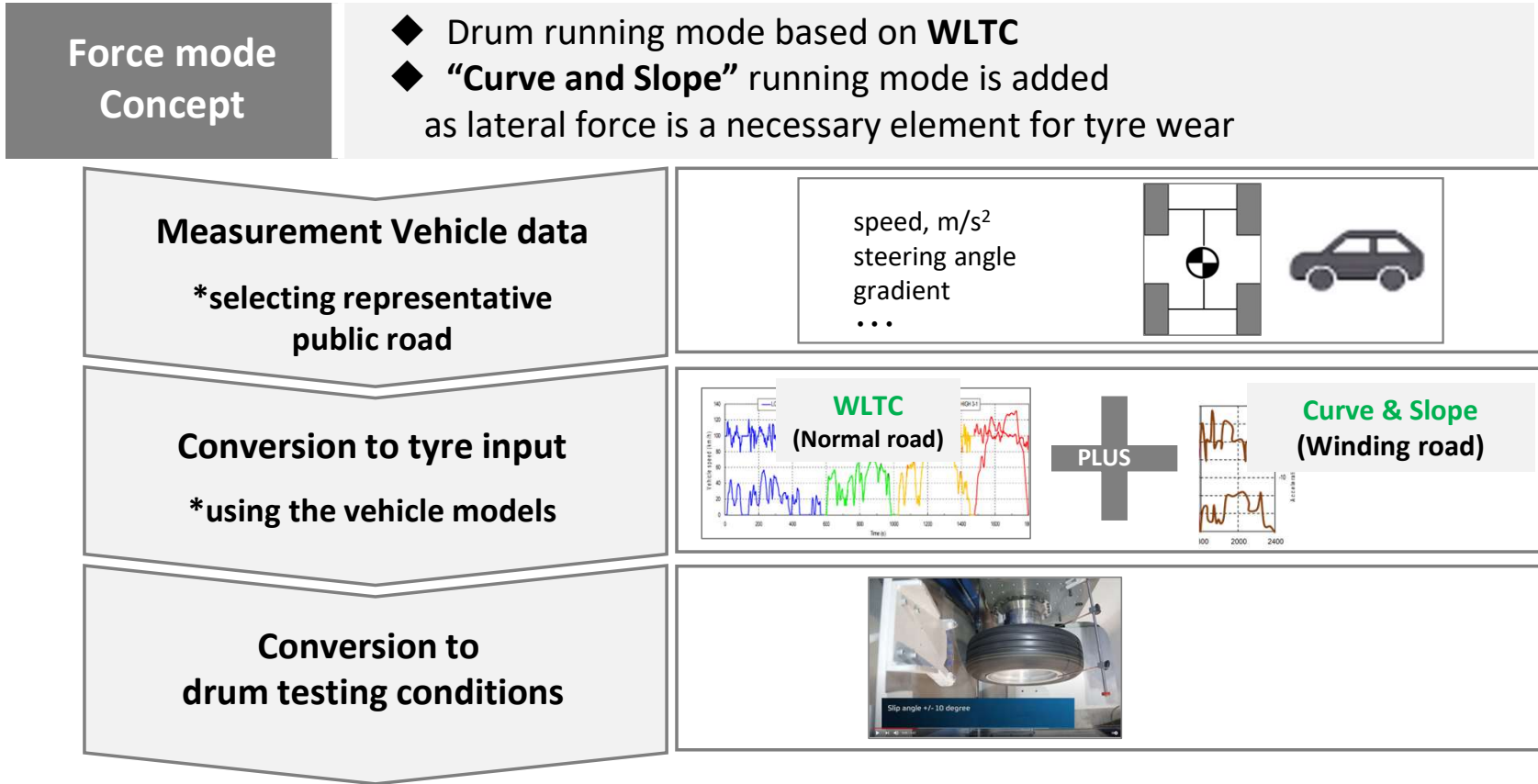
### **Test machine :**

- ❑ Test Drum: External Drum
- ❑ Drum diameter, width : 1.7m or above, more than tyre width

### **Running condition**

- ❑ Tyre Load : 80% of the tyre LI
  
- ❑ Tyre inflation pressure :
  - ✓ Standard Load : 210kPa
  - ✓ Reinforced, Extra load : 250kPa
  
- ❑ Force condition : Condition proposed by JARI →Next page
  
- ❑ Running distance : 5000km
  
- ❑ Running velocity : Constant speed (60km/h for mountain/slope, 100km/h for flat road)

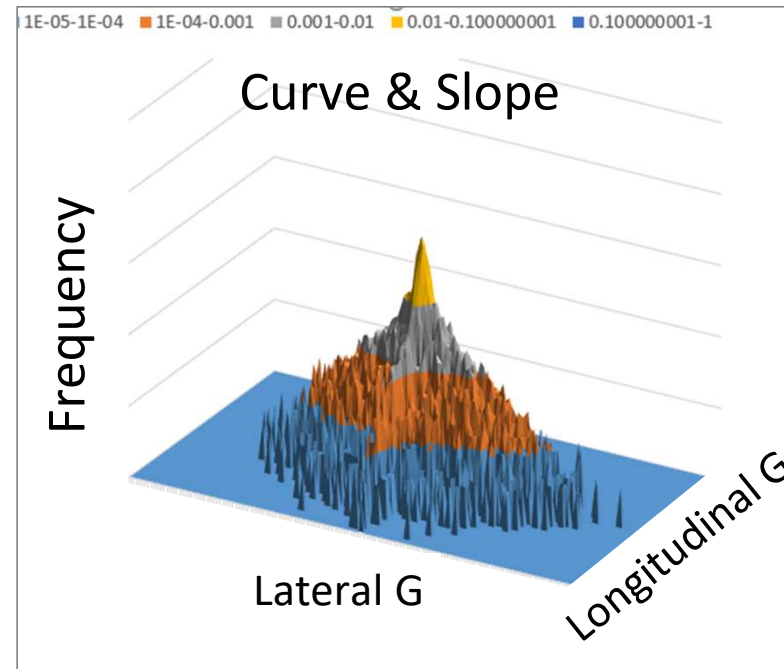
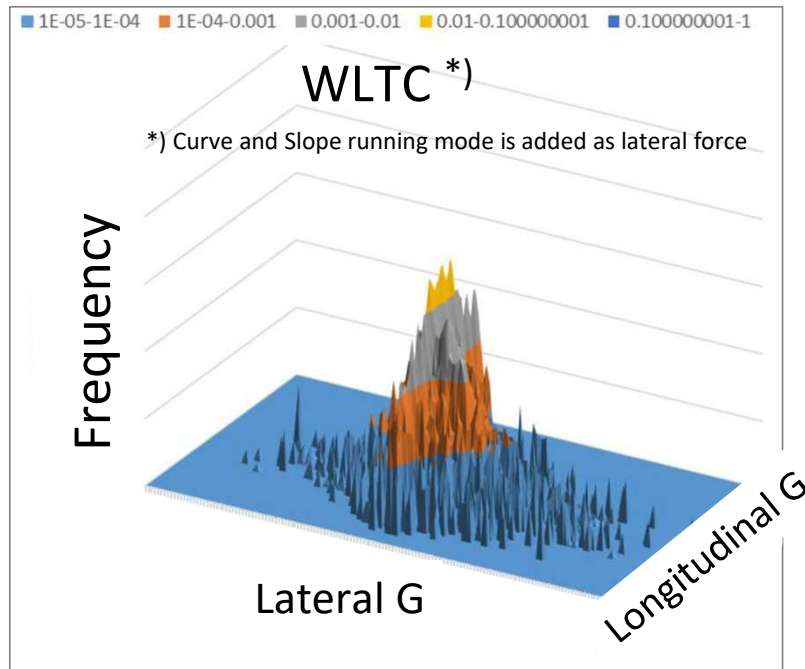
# Force for indoor drum test



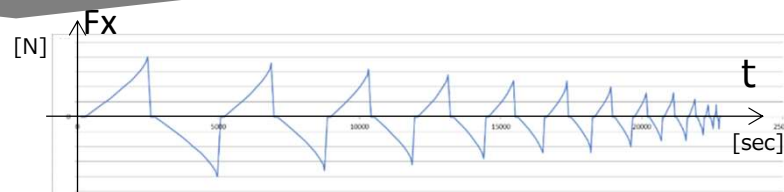
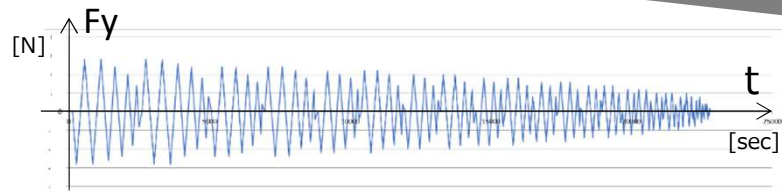
- ✓ Converting the vehicle driving conditions representing the world into the test conditions of indoor drums
- ✓ Drum running mode developed by contract research to JARI, a core member of developing WLTP / GTR-15

\*JARI: Japan Automobile Research Institute

# Development for driving mode: Lateral / Longitudinal force frequency distribution of WLTC and Curve & Slope



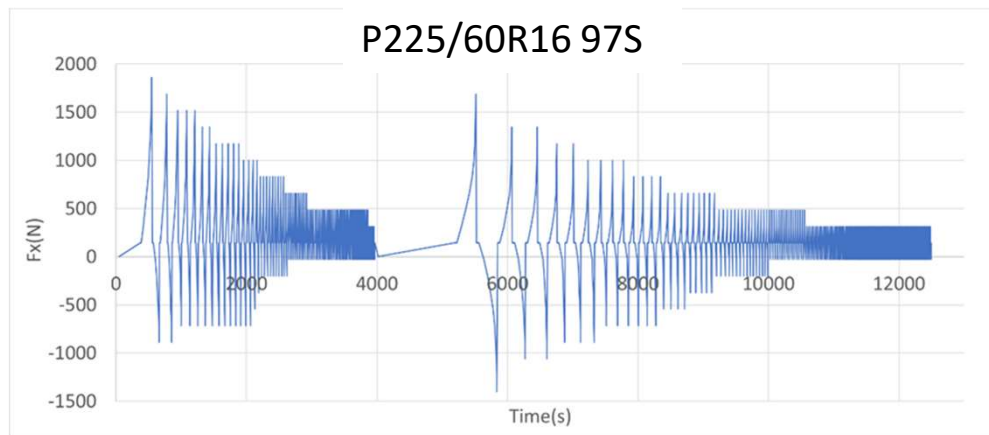
Conversion to Drum testing conditions



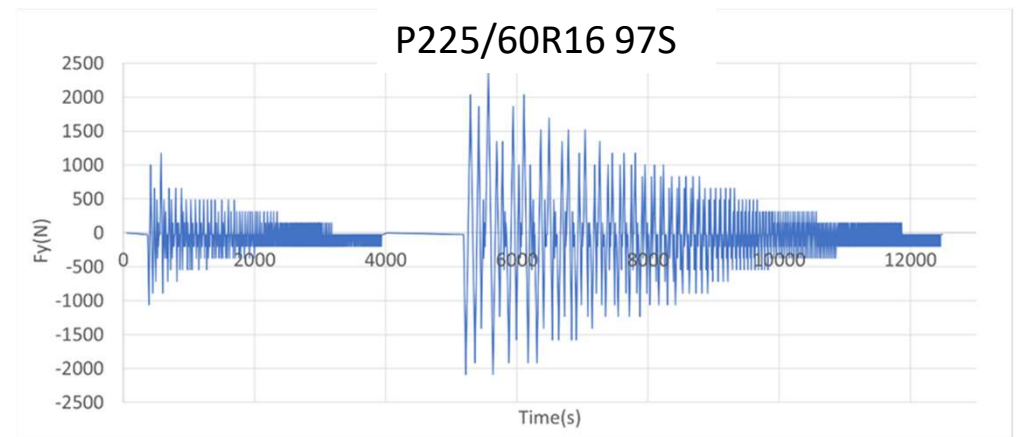
# Input Conditions for Indoor Abrasion Drum

Fx and Fy at each time should change linearly and smoothly from one Fx and Fy value to the next.

Graph A.1 – Example of Fx



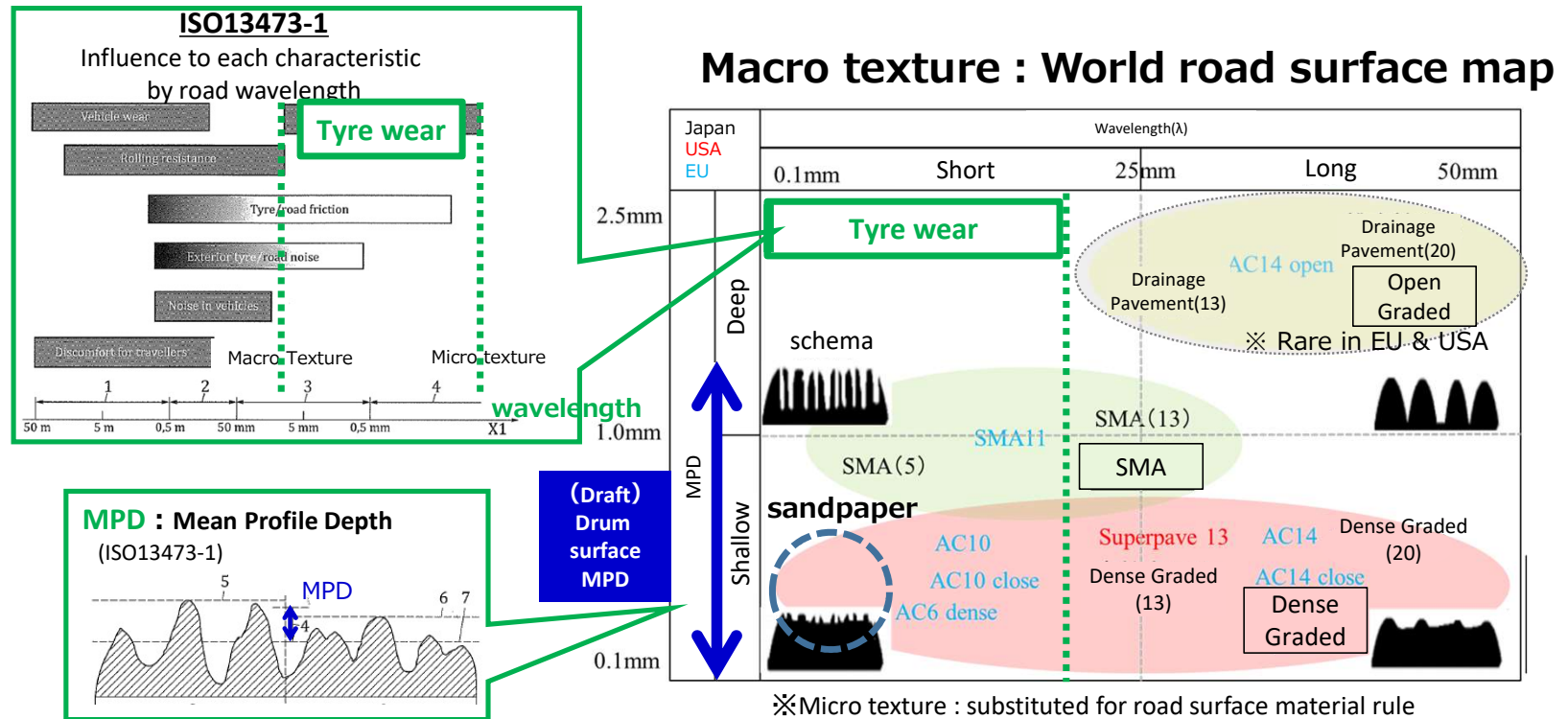
Graph A.2 – Example of Fy



## Drum Surface

- ❑ Texture : The range of surface shape [MPD, xx;xx] →Next page
  
- ❑ Material : Sand or stone or substitute materials shall be the constituent elements of a drum surface  
→Next page
  
- ❑ Control : Keep dry and Clean
  - ✓ Measure [MPD] before and after the test

Mapping world road surface by wavelength and MPD to define drum surface shape as tyre wear depends on road surface characteristics



MPD is used in ISO 10844\* as the definition of road surface roughness. (\*Test track for noise)

**Drum surface is defined by road surface shape [MPD]**



## Environment

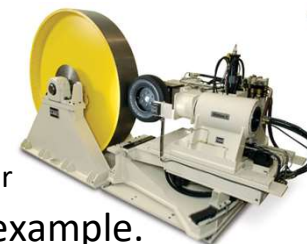
- ❑ Preparation : 3-hour conditioning
- ❑ Ambient Temperature : 25°C +/- 5°C
- ❑ Prevention of gumming : Gumming shall be prevented by certain method
  - ✓ Accepting any de-gumming devices or methods as already applied to existing indoor abrasion drum

## Sequence

- ❑ 2-position : Test both SRTT and candidate at the same time
- ❑ 1- position : Test SRTT and Candidate tyres alternately
  - ✓ SRTT 1000km → Cand. 2000km → SRTT 2000km → Cand. 2000km → SRTT 2000km → Cand. 1000km



1 Drum 2 Position



1 Drum 1 Position



<https://www.mts.com/jp/products/automotive/tire-test-systems/tire-treadwear>

\* The picture / company is just an example.

	Item	Draft Standard
Test preparation	Thermal conditioning	Place the inflated tyre in the thermal environment of the test location for a minimum of 3 h.
	Pressure adjustment	After thermal conditioning, the inflation pressure shall be adjusted to the test pressure.
	Thermal environment	During the test, the ambient temperature, at a distance of not less than 0,15m and not more than 1 m from the tyre, shall be $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$
	Mass measurement	The mass of tyre/wheel assembly shall be measured before and after test cycle for both reference and candidate tyres.
Test cycle	Input condition	Both reference tyre and candidate tyre shall be tested according to input condition. Test condition of 250 km is set as one set, and the test cycle shall be repeated 20 times until 5000 km is reached.
	Basic test cycle	Both reference tyre and candidate tyre shall be mounted different position of one drum. Test of both reference tyre and candidate tyre shall be conducted at the same time.
	Measurement and recording	<p>The following shall be measured and recorded</p> <ul style="list-style-type: none"> <li>a) Test speed</li> <li>b) Load on the tyre normal to the drum surface</li> <li>c) Test inflation pressure: initial</li> <li>d) Ambient temperature</li> <li>e) Force applied to the test tyre and testing duration, with a maximum time interval of 1s</li> <li>f) Test rim size</li> <li>g) Mass of tyre/ wheel assembly</li> <li>h) MPD of the test surface</li> <li>i) Photograph of tyre after test run</li> </ul>

## Validation

- ❑ Abrasion rate of reference tyre SRTT16 : [xx;xx] mg/km
  
- ❑ Record actual force level
  - ✓  $F_y$ :  $\pm 100\text{N}$  or 5% whichever is greater, for the difference between input peaks and actually generated peaks.
  - ✓  $F_x$ :  $\pm 100\text{N}$  or 5% whichever is greater, for the difference between input peaks and actually generated peaks.
  
- ❑ Abrasion status : record photos of tyres after test

## Measurement

- ❑ Mass loss : Measure mass of the tyre-rim assembly before and after test

## Evaluation

- ❑ Abrasion rate : Mass loss per kilometer (mg/km)
  
- ❑ Abrasion index : Mass loss of candidate compared to mass loss of SRTT