

Motorcycles - Lane change test procedure

1. Scope

This standard specifies the lane change test procedures for motorcycles (including motorized bicycles).

2. Normative reference

The following standards contain which, thorough reference in this Standard, constitute provisions of this Standard. The most recent editions of the standard indicated below shall be applied.

JASO T803 Glossary of terms relating to motorcycle and moped stability and controllability.

JASO Z117-1 Road vehicles – Vehicle dynamics test method – Part 1: General conditions for passenger cars

3. Definitions

Definitions of main terms used in this standard shall be based on **JASO T803**. The main terms specified in **JASO T803** and used in this standard shall be as follows.

a) Steer torque

Torque applied to the steering shaft.

b) Steer angle

Rotation angle of the steering system that relates to the steering shaft. When the center plane of the front wheel is in parallel with the longitudinal center plane of the motorcycle, the steer angle is specified as 0°.

c) Yaw velocity

Angular velocity of the $z^{1)}$ axis.

Note:¹⁾

x , y , and z form a horizontal coordinate system of a motorcycle, where the reference point is set to the center of gravity of the motorcycle.

d) Roll velocity

Angular velocity of the $x'^{2)}$ axis.

Note:²⁾

x' , y' , and z' form a right-handed orthogonal coordinate system, where the reference point is set to the center of gravity of the motorcycle.

4. Test conditions

4.1 Test vehicle conditions

4.1.1 Tyre

The tyre condition shall be as follows. The measured values or set values described herein shall be recorded in **Annex A**.

- a) The standard tyre condition is defined as a condition where the tyre is specified in the specification of a test vehicle, has a tread depth of 90 % or more of that of a new one, and was manufactured in a year.

- b) In the case of a new tyre, it shall be used after 20 km or more of running-in operation on a general paved road or a test road as specified in 7.1, without hard breaking and steering operation.
- c) The tyre pressure (in a cold period) is adjusted to the value specified in the specification of the test vehicle, with the test vehicle being equipped with measuring devices, and the tolerance is set to ± 5 kPa.

Remark: There is a possibility that a tread depth and an abnormal abrasion affect the test results. Therefore, it is desirable to take these factors into consideration when comparing the test results of different vehicles or tyres.

4.1.2 Load conditions

The load condition of a test vehicle shall be set between the complete vehicle kerb mass plus driver mass and the total mass of the vehicle, and the maximum load capacity³⁾ of the tyre shall not be exceeded. The position of the center of gravity and the inertia moment shall be within the range of normal use, in a state where fuel is supplied, there is a passenger (or no passenger), and measuring devices are installed. In addition, the total mass of the driver and the measuring devices shall be equal to or less than 105 kg. The measured results of the load shall be recorded in **Annex A**.

Note:³⁾

The maximum load capacity shall be the value specified in **JATMA YEAR BOOK**.

4.1.3 Condition of moving parts

Moving parts that affect the test results shall be adjusted to have the values specified by the manufacturer of the test vehicle. When the value of a moving part deviates from the value specified by the manufacturer, it shall be described in the special notes of **Annex A**.

Remark: Moving parts that affect the test results include steering system parts, suspension system parts, drive train parts, etc.

4.2 Test road

The test road shall have an asphalt-paved surface, a concrete-paved surface, or a high friction surface, and it is desirable that the road surface is horizontal, clean, uniformly solid, and dry. The inclination shall not exceed 2.5 % in any direction.

4.3 Weather conditions

The wind speed shall not exceed 5 m/s. In addition, the wind speed components that are orthogonal to the traveling direction of the test vehicle shall not exceed 4 m/s. The weather condition including the maximum wind speed during the test shall be recorded in **Annex A**.

4.4 Occupants

The number of occupants shall be one or the prescribed number.

5. Measurement items

The measurement items in the test include the steer torque, steer angle, yaw velocity, roll velocity, and forward velocity.

Remark: The angular velocity of the z' axis is used for yaw velocity.

6. Measuring devices

Table 1 shows the recommended values of the measuring range and the tolerance of measuring devices corresponding to the measurement items set forth in **5**. When recording data, the cut-off frequency of a measuring device combined with a converter and a recorder shall be 10 Hz or more.

Table 1 Recommended values of measuring range and tolerance of measuring devices

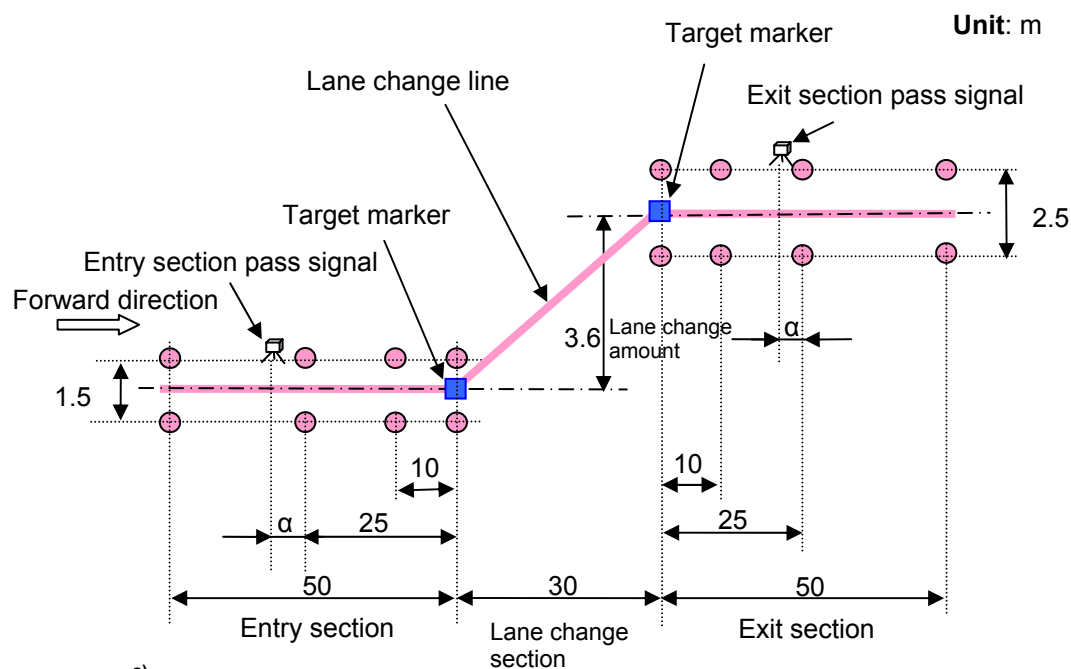
Measurement item	Measuring range	Tolerance ^{a)}
Steer torque N·m	±100	±1
Steer angle °	±10	±0.1
Yaw velocity °/s	±100	±1
Roll velocity °/s	±100	±1
Forward velocity km/h	0 to 110	±1.1
Note: ^{a)} The tolerance includes that of a converter and a recorder. When the tolerance shown in this table is exceeded, an actual tolerance shall be recorded as reference in the special notes of Annex A .		

7. Test method

7.1 Test preparation

7.1.1 Test course

The test course includes a left lane change course and a right lane change course, and the layout of the measuring sections is shown in **Figure 1**. Approximately 500 m is required for the total length of the test course when a run-up section and a decelerating section are included. Therefore, the course layout must have some room.



Note:^{a)}

The right lane change course is vertically symmetrical.

Figure 1 Test course (example of left lane change course^{a)})

The main layout shall be as follows.

a) Lane change amount

The amount shall be 3.6 m.

b) Lane change section

The length shall be 30 m.

c) Entry section and exit section

The length shall be 50 m.

d) Target marker

Square target markers are drawn at the positions shown in **Figure 1** and cause the front wheel to pass the markers. The square shape of the target marker is shown in **Figure 2**. The target markers shall be drawn, for example, with a choke, which is not slippery, such that whether or not the front wheel has passed the markers can be easily determined.

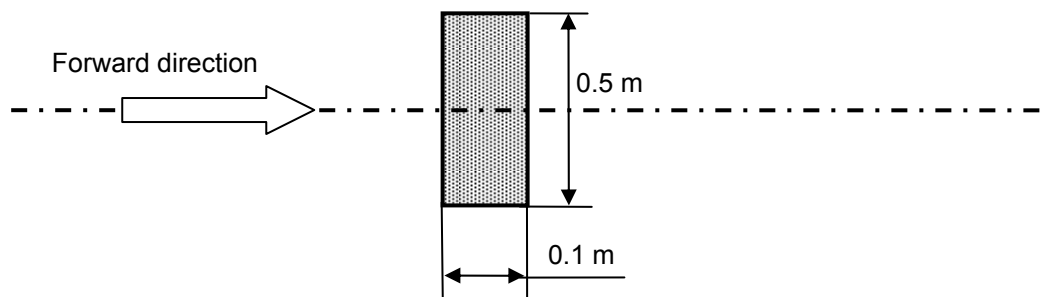


Figure 2 Target marker

e) Lane change line

The line is provided that connects the center of the target marker of the entry section and the center of the target marker of the exit section.

f) Setting of pylons

In order to reduce variation in driving operation, the width of the test course is regulated using pylons. The pylons whose height is approximately 450 mm are used, and the center of each pylon is set to the specified position (see **Figure 3**). The distance between the centers of opposite pylons and the distance between the centers of adjacent pylons are set to a specified distance (see **Figure 4**).

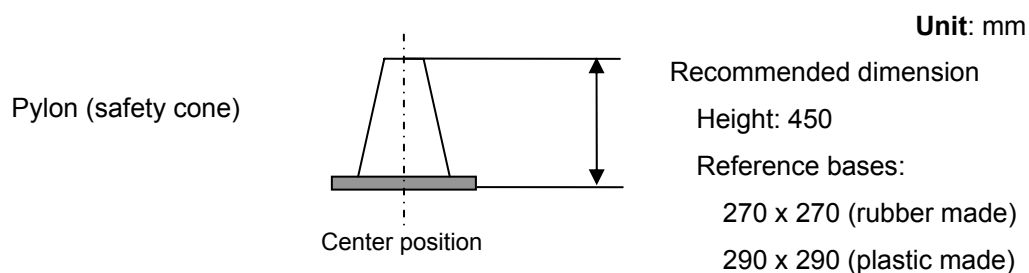


Figure 3 Pylon height

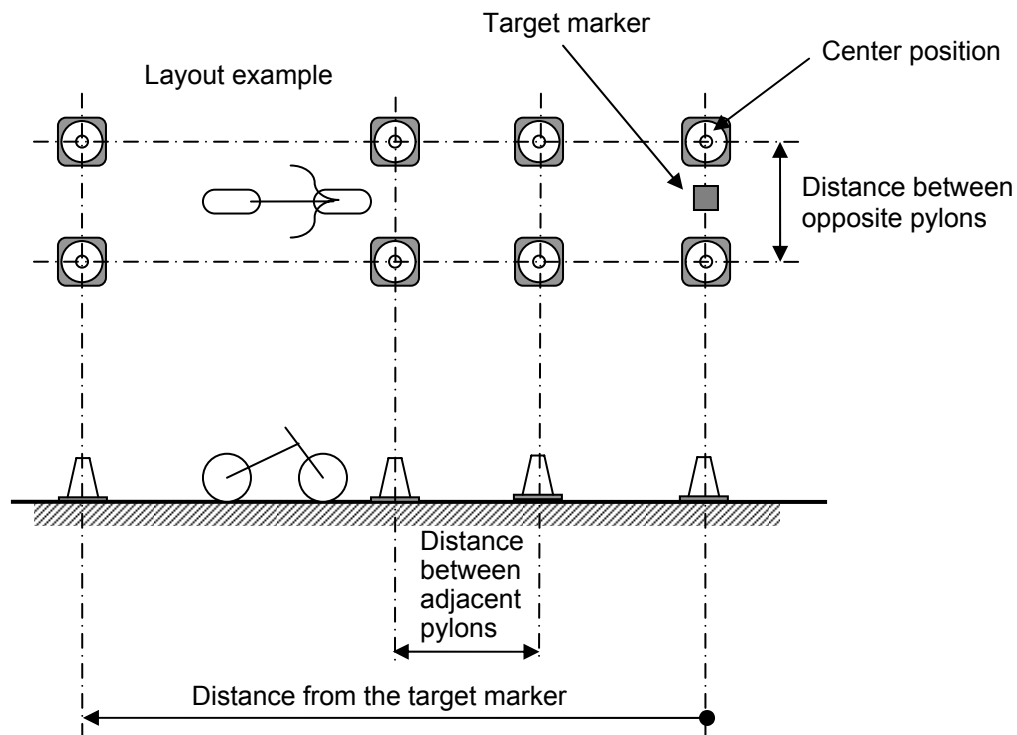


Figure 4 Pylon layout

g) Distance between opposite pylons in entry section

The distance shall be 1.5 m.

h) Distance between opposite pylons in exit section

The distance shall be 2.5 m.

i) Setting of pylons in entry section and exit section

As shown in **Figure 1**, the pylons are provided at the positions of 0, 10, 25, and 50 m from the target marker of the entry section in the opposite direction of the forward direction, and provided at the positions of 0, 10, 25, and 50 m from the target marker of the exit section in the forward direction, at intervals of each specified distance.

j) Pass signal setting

In order to specify the start point of steering operation, a pass signal is provided. The front end of the front wheel of the vehicle is set to the position 25 m ahead of the target marker of the entry section, and the pass signal is provided so as to generate a pass signal at that vehicle position (see **Figure 5**). Also in the exit section, the pass signal is provided so as to generate a pass signal when the front end of the front wheel is at the position 25 m from the target marker of the exit section. If vehicle body side sensor attachment positions differ depending on vehicles, the pass signal setting position shall be changed for each vehicle.

Unit: m

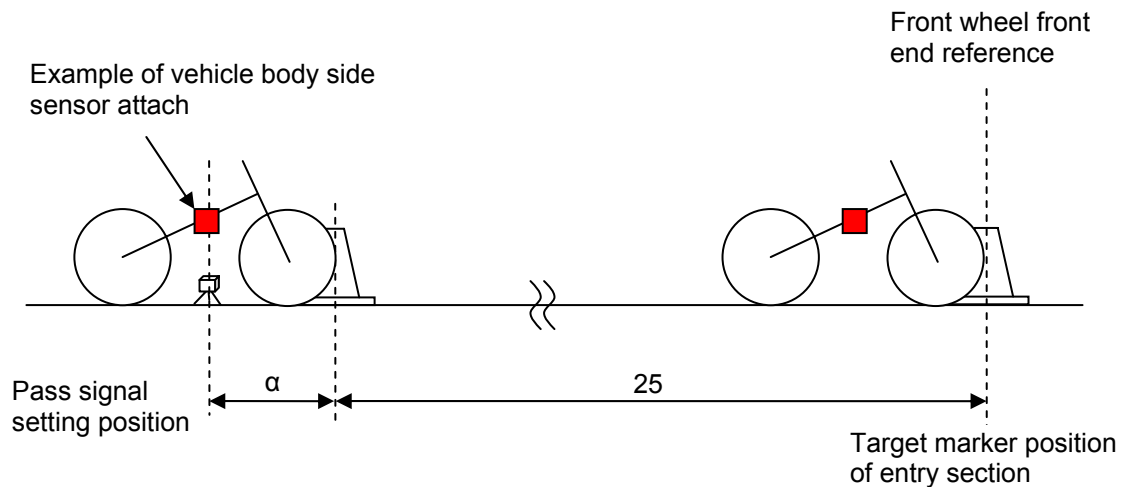


Figure 5 Pass signal setting example

7.1.2 Test vehicle preparation

Measuring devices that correspond to the measurement items set forth in 5 and have the characteristics shown in Table 1 are attached to a test vehicle so as not to interfere with normal running. The tyre pressure is adjusted under the test environment (during a cool period). Then, in order for the tyres and measuring devices to be in a stable condition, warm-up operation is performed for at least ten minutes. The warm-up operation is performed within the range of running speed in the test (hereinafter referred to as test speed), and the running road is not particular specified. When there are two occupants, the tyre pressure and suspension system must be adjusted.

7.2 Running method of test vehicle

7.2.1 Test conditions

The characteristic changes of the lane change direction and the test speed in the test must be confirmed based on Table 2. If a vehicle whose maximum speed is less than 100 km/h or 80 km/h is used, or if a vehicle that cannot pass the test course at 100 km/h is used, the test is performed at test speeds excluding these speeds. The tolerance range of each test speed is ± 5 km/h.

Table 2 Test conditions

Lane change direction	Left and right
Test speed km/h	60, 80, 100

7.2.2 Running method

In the running under the test conditions as specified in 7.2.1, although the test order of the left and right lane changes is not specified, it is preferable that the test is performed from the low test speed. It is necessary to control the throttle operation so that the vehicle runs at a constant speed from the entry to the exit, and the vehicle speed is in the tolerance range (± 5 km/h). Therefore, sufficient preparation running must be performed in the test preparation. The preparation running is performed to stabilize the vehicle speed and running locus.

- a) In the entry section, the test vehicle runs at a test speed while keeping an upright position. The steering operation ahead of the target marker should not be performed.
- b) The lane change is performed in the lane change section, toward the exit section. At this time, the front wheel is caused to pass on the target marker of the entry section.
- c) The lane change line is used as a target line to proceed to the exit section, and unnatural steering operation to forcibly cause the front and rear wheels to follow the line must be prevented (see **Figure 6**).
- d) The driver must return to the upright position in the exit section. The driver must make effort to pass the front wheel on the target marker of the exit section.
- e) If one of the followings occurs, the running is made invalid.
- The front wheel does not pass on the target marker of the entry section.
 - Unnatural steering operation is performed in the lane change section.
 - A portion of the vehicle other than a tyre, such as a step, contacts the ground.
 - There is a contact with the pylon.
 - The vehicle speed exceeds the tolerance range (± 5 km/h) in the measuring section.
- f) The number of drivers must be 3 or more, and 3 or more running data must be recorded for each condition. If possible, 5 or more data are recorded, and 3 average data are used for analysis. The data on invalid running is used as reference.
- g) Measurement is performed by changing the test conditions of the test speed, lane change direction, etc.
- h) In the case of two occupants, the test conditions and method are the same as those in the case of one occupant. The driver and the passenger on the rear seat have a meeting before the test running about the riding posture that fits for the test purpose.

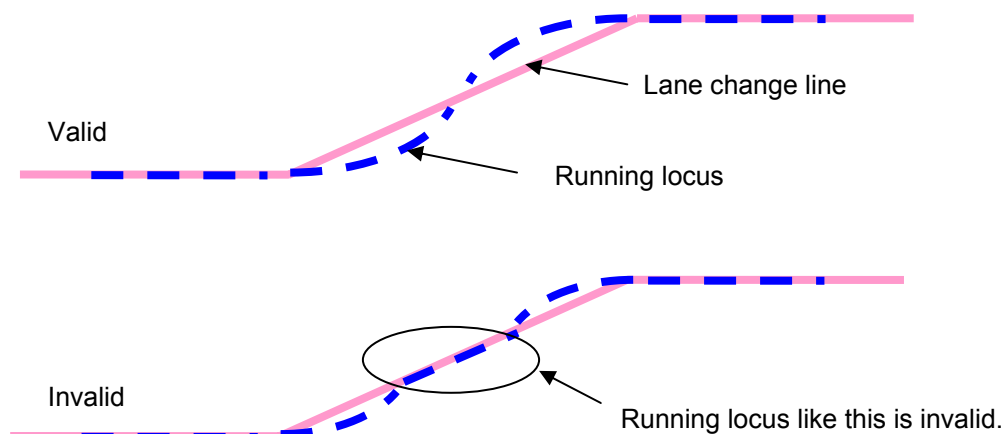


Figure 6 Running locus in lane change section

8. Analysis method of measured data

8.1 Analysis device

The frequency range required for this test is set to 0-10 Hz, taking the vibration mode (weave, wobble) of a motorcycle into consideration. Accordingly, a device suitable for this analysis must be used. When performing digital processing, an appropriate sampling rate must be set. The sampling rate must be according to **JASO Z117-1**, and must not be set to be less than double the cut-off frequency.