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भारतीय मानक **मसौदा**

स्वचल वाहन - वाहन गत्यात्मक परीक्षण पद्धतियाँ
भाग 5 व्यक्तिपरक मूल्यांकन वाहन सवारी, प्रहस्तन, स्टीयरिंग

Draft *Indian Standard*

AUTOMOTIVE VEHICLES-VEHICLE DYNAMICS TEST METHODS
PART 5 SUBJECTIVE EVALUATION VEHICLE RIDE, HANDLING, STEERING

ICS 43.100

Automotive Braking Systems, Vehicle Testing, Steering and performance Evaluation Sectional Committee, TED 04	**Last date for receipt of comments is 20/08/2024**

FOREWORD

(Formal Clause to be added later)

Subjective assessment and rating are some of the oldest known methods to evaluate ride and handling performance. In the early years of automotive product development, it was possibly the single mode of development post vehicle design to validate and develop a vehicles suspension, steering and chassis characteristics. The last few decades have seen big progress in objective instrumentation and sensor technology; moreover, with the onset of higher computing power, strong CAE tools have emerged and together complement physical and virtual validation of ride and handling. However, subjective evaluation remains an effective process to perform fine ride and handling tuning and ultimately understand true customer perception of the final product. Hence it will probably continue to survive for as long as the end customer is a human body.

The composition of the Committee responsible for formulating this standard is given in Annex B (Will be added later)

Draft *Indian Standard*

AUTOMOTIVE VEHICLES-VEHICLE DYNAMICS TEST METHODS PART 5 SUBJECTIVE EVALUATION VEHICLE RIDE, HANDLING, STEERING

1 SCOPE

This Standard Explains the Various parameter which can be used to evaluate Ride, Handling and steerability of the vehicle during development or assessment of vehicle. Also provides general rating scale guidelines that can be considered during evaluation either as absolute or relatively with reference vehicle. Rating scale can differ based on image of the vehicle. These parameters can be assessed by expert driver on Test tracks where assessment needed controlled and safe environment without external disturbances.

Note
This standard provides guidelines for various parameters used to subjective evaluate Ride, Handling and Steering associated with ride and Handling of Vehicle & not for any regulatory requirements.

2 REFERENCES

The following standards contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS/ISO	*Title*
IS 17128 (Part 1) : 2019	Automotive Vehicles — Vehicle Dynamics Test Methods Part 1 general test conditions
IS 17128 (Part 3) : 2021	Automotive Vehicles — Vehicle Dynamics Measurements Test Procedure Part-3 — Transient Response Test Procedure Open Loop And Closed Loop Test
Doc: TED 04 (25916) Part-4: XXXX	Automotive Vehicles — Vehicle Dynamics Measurements Test Procedure Part 4 — Ride Comfort Measurements (*under development*)
SAE J1441 : 2016	Subjective Rating Scale for Vehicle Ride and Handling

3 Introduction to Subjective Evaluation & Rating for Ride, Handling

The human body is a very complex multi body dynamic system fully equipped with millions of biological sensors. Experienced trained evaluators essentially use these sensors to detect small differences in design, which may or may not always be measurable or quantifiable objectively or analytically.

Many different evaluation schemes have been reported and described in various detail in engineering literature, and it is beyond the scope of this standard to come up with a complete review or a single guideline. Instead, these standard hopes to inspire and offer some basic guidelines and definitions if used can help structure the subjective assessment more precisely and utilise it more effectively for a ride and handling development criterion:

3.1 Definition of the evaluation parameters, criteria, and precise description of the evaluation conditions

Ride and handling is multidimensional discipline. This means that several independent criteria and parameters need to be defined and separated from each other. For each criterion, there should be one critical task or boundary condition where the differences between good and bad design are evident. Most criteria require real driving exercises on the test track or public road. Pure static evaluation is not enough.

3.2 Reference vehicle

It is much easier to compare two vehicles than rate a single vehicle without any reference. The reference vehicle needs to be in a controlled condition over the time of usage.

3.3 Descriptive rating scale

The rating scale should be clearly defined and not too fine. It is important that all evaluators have the same understanding of a rating scale and its levels.

Subjective Assessment Rating Scale as defined in SAE J1441, which explains a 10-point subjective rating scale for vehicle handling. However, it does not explain how to perform a subjective assessment. In practice, most of automakers and tyre companies use this scale as a reference. This rating scale can be used in absence of Automakers own scale.

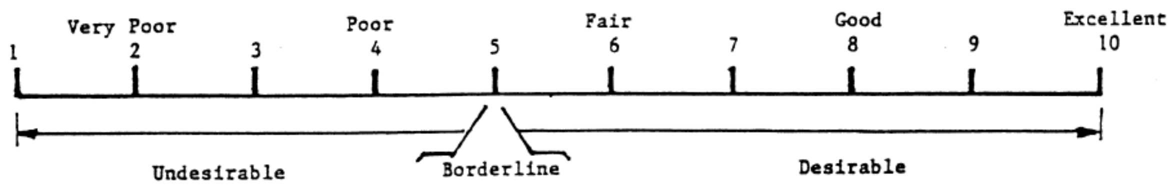

FIG 1 SUBJECT RATING SCALE

3.4 Customer-oriented weighting

The multidimensional ride and handling rating needs to be combined to one total score for each vehicle. A representative picture can only be obtained if all important comfort aspects are captured and weighted according to the customer preference for a vehicle type.

3.5 Trained evaluators

Subjective vehicle evaluation is skilled work; hence the evaluator needs to possess a high level of advanced car control, certified driving skills, precise evaluation skills and sufficient experience in chassis development. The ability to focus on specific aspects of evaluation at a time and above all the ability to separate the differences caused by boundary conditions from the true difference in vehicle performance that's being evaluated (example: low frequency engine vibrations weighted into suspension ride comfort evaluation ratings etc). It is important that he or she is disciplined enough to avoid being influenced by superficial, extraneous aspects or personal/prejudiced likes and dislikes towards or off the vehicles being evaluated.

3.6 Sufficient evaluations

Even trained evaluators do not always come up to the exact same conclusion or rating. However, a smaller number of observations and time are needed by them when compared to regular customers to come up with a precise quantification of a vehicles ride and handling characteristics that may well predict a suitable development direction for improvement or the competitiveness and customer response of the vehicle in a particular market. In some cases, for a proper ride and handling evaluation in the case of comfort for example, it may be necessary to cover a certain range of the population with a number of selected evaluators because in some comfort aspects like vibration damping, postural, ergonomics or lateral support, the comfort performance may depend on the occupant size, age and physical condition.

4. Vehicle Ride and Handling Capabilities: Subjective Assessment

Ride and handling performances of a vehicle can be grouped by five main *capabilities* such as:

a) Comfortability;
b) Straightability;
c) Steerability;
d) Controllability; and
e) Stability.

Each capability is specifically categorized into several characteristics.

The nomenclatures of the above characteristics given have been traditionally employed to express their vehicle driving concepts but not their scientific definitions. Their names may be not suitable in an engineering sense and a little different depending on each user but widely accepted terminologies in the automotive industry. All characteristics are supposedly independent from each other, while they are cross affected by their causes. Even different characteristics may share the same cause. Following paragraphs elucidate the details of these main capabilities their attributes and sub-attributes that are classically evaluated subjectively for vehicle ride and handling.

4.1 Ride Comfort and its Sub-Attributes: Comfortability

a) **Comfortability**

Comfortability in a broad sense refers to all aspects that affect human comfort in a vehicle that is in motion. Vehicle dynamics deals only with the vibrations of sprung and un-sprung masses. On the other hand, the Noise Vibration and Harshness represents the vibrations of flexible components. In this standard the comfortability representing ride performance is limited only within the scope of the vehicle dynamics. The comfortability is composed of:

1) Primary ride;
2) Secondary ride; and
3) Impact ride.

4.1.1 *Primary Ride*

Primary ride is the vibratory characteristic of a sprung mass associated with the principal stiffnesses of tyres occurred while driving on a wavy road. Its frequency ranges up to about 5 Hz, which includes some frequency band inducing motion sickness. The specific range is wholly dependent on the size of a vehicle. In general, the primary ride is principally represented by body bounce. But it may be specifically categorized into several zones of frequency ranges.

4.1.2 *Secondary Ride*

Secondary ride is the vibratory characteristic of un-sprung masses supported with the principal stiffnesses of tyres generated while driving a rough road. Its frequency ranges from about 5 to 25 Hz. Its range is also dependent on the size of a vehicle.

4.1.3 *Impact Ride*

Impact ride is wholly determined by an impact shock due to the enveloping characteristic of a tyre while driving over various impact objects. In general, it is called *impact harshness*. Its frequency usually ranges from about 25 to 60 Hz (at most 100 Hz). The impact ride does not include the local vibratory characteristic of tyre components, which produce higher-frequency vibrations belonging to an NVH scope. In reality, a driver's subjective assessment on the impact ride is also influenced by audible high frequencies in addition to tactical low frequencies.

The impact ride is generally further characterized as:

a) Impact magnitude;
b) Impact sharpness; and
c) After-impact damping.

The impact magnitude is just the size of an impact shock. The impact sharpness is the level of sharpness (or acuteness) of the impact shock, which ranges from round to sharp. The after-impact damping is the amount of damping to kill the vibration of a tyre itself after impacting. The smaller the magnitude, the less the sharpness, or the more the damping, the better.

4.2 Handling and its Sub-Attributes Straight ability

The straightability is a straight-running ability without any significant lateral deviation from the straight path regardless of free or fixed steering. The straightability is primarily affected based on the reaction of front tyres due to external disturbances either with free or fixed steering. The straightability is composed of;

a) Residual Pull;
b) Running Straight;

c) Torque Steer; and
d) Braking Straight.

4.2.1 *Residual Pull*

Residual pull is the lateral drift characteristic of a vehicle caused due to residual steering torque. It is subjectively or objectively assessed by the magnitude of lateral drift from straight path after about 100 m driving with free steering at constant speed (usually 100 kph). It confirms the proper design of a steering system, suspension setup and tyre matching, and their manufacturing uniformities. While long driving, a residual pull problem makes a driver feel tyred due to the residual steering torque. Furthermore, with free steering, it may cause an accident in the worst case.

4.2.2 *Running Straight*

Running straight is a straight-running ability without any drift, wander, or sloppiness with fixed steering at constant speed. It illustrates the design sensitivity of steering and suspension systems against road irregularity or wind disturbance. Its problem with long driving also makes a driver feel tyred due to continuous steering corrections.

4.2.3 *Torque Steer*

Torque steer is the lateral drift characteristic of a vehicle produced by an unbalance of traction torques between left and right driving wheels, when powering on in straight ahead with fixed steering. It is subjectively evaluated with the lateral drifting motion of the vehicle moving to an adjacent lane with full power on and back to the original lane with power off.

4.2.4 *Braking Straight*

Braking straight is a straight-braking ability without any disturbance of vehicle attitude or path, when a vehicle instantaneously stops completely. It is subjectively assessed by the deviation of vehicle attitude or path during full braking with hands-on steering. No deviation of vehicle attitude or path is pursued for good braking straight.

4.3 Steerability and its Sub-Attributes

The steerability is a steering capability to achieve intended steering reactions with preferred effort and better comfort of steering. The response of the front tyres against a series of steering applications and the following-up capability of the rear tyres against the behaviour of the front tyres determine the steerability, controllability, and stability.

The major aims of steering behaviour to be achieved are;
a) Comfort;
b) Agility, and
c) Precision.

The steering behaviour is represented by steerability categorized in eight characteristics such as:

a) On-centre feel;
b) Steering response;
c) Linearity;
d) Steering precision;
e) Steering angle;
f) Steering addition;
g) Steering effort, and
h) Returnability.

The steerability is subjectively assessed with steering handwheel torque and vehicle path as output in response to an input of steering handwheel angle. Depending on the zone of a steering input, the steerability (*see* Fig. 2).

On-center feel, linearity, and steering addition are mild transient steering characteristics. On the other hand, all others are transient characteristics.

4.3.1 *On-Center Feel*

On-center feel is a comprehensive perception on

a) Steering torque and
b) Vehicle path change in response to a very slow steering input at and around the center of steering.

Fig. 2 presents the on-center steering torque represented by
a) friction;
b) hollow band
c) compliance, and
d) steering feedback.

The vehicle path change (or vehicle turn) is perceived against steering handwheel angle to assess:

a) Dead band and
b) Steering gain (*see* Fig. 2).

The on-center feel must be clear and exact; otherwise, a driver feels nervous. Since the desirable magnitude of the on-center steering torque is dependent on each customer, it is one of the important items determining a vehicle concept.

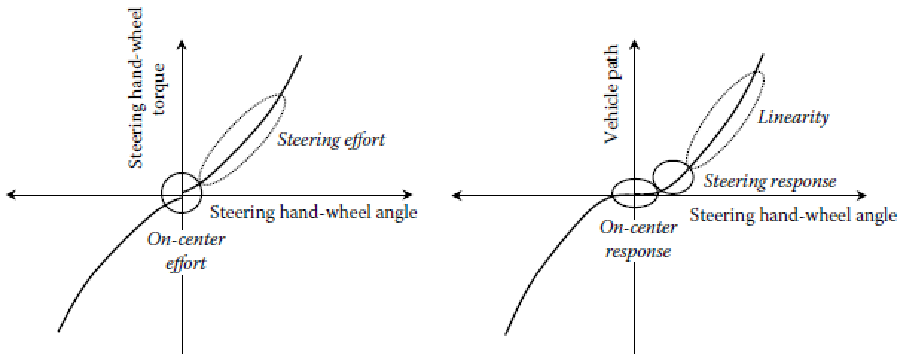

FIG 2 STEERING HANDWHEEL TORQUE AND VEHICLE PATH SPECIFYING STEERABILITY

The steering friction is initial steering torque at the center of steering. In principle, the least steering friction is desirable. However, it is practically not easy to be achieved. With a little steering application from the steering center, the hollow band is sensed as the band of steering looseness caused due to no steering torque generation in addition to the friction. No hollow band is generally pursued. Otherwise, the steering effort is felt just loose around the steering center with a hollow band. In case the hollow band is significantly big, it causes too much time delay of steering response with consequent sudden vehicle path change.

The compliance is assessed with the perception of progressive steering movement against a continuous and smooth incremental steering application from the steering center. The ideal target of this perception is just like the feeling of spring compression. A proper mechanical terminology for this property should be “stiffness.” However, “compliance” may be traditionally used to express the perceptual feeling of the compression.

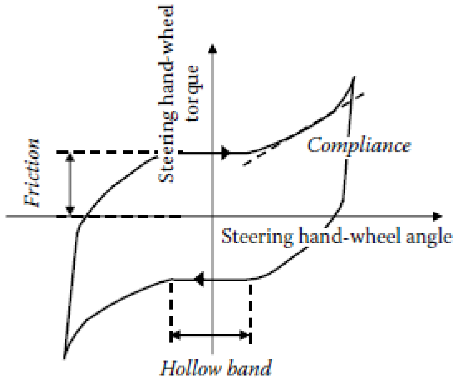

FIG. 3 ON-CENTER STEERING TORQUE

The dead band is just the band of no vehicle path reaction generated in response to a miniature steering application from the steering center. When no dead band exists, steering corrections are always required corresponding to road irregularity and wind change. It bothers a driver to do so at every instant. On the other hand, a big dead band provokes too much time delay of steering response. It consequently produces rapid vehicle path change, which gets on a driver's nerves.

The steering gain represents a perceptual measure of an output-to-input ratio. It is assessed depending on how big the initial path change of a vehicle is generated from the steering center. It requires a proper degree of the sharpness of the vehicle path change (or vehicle turn) depending on a driver's preference, that is, not too big or not too small. The steering feedback is feedback information transferred to a steering handwheel from tyres through a steering system. In the case of good steering feedback characteristics, a driver can feel an interaction between tyres and road surface. Then, it helps the driver to predict upcoming road condition. In practice, it is not easy to achieve a great level of the steering feedback characteristic.

4.3.2 *Steering Response*

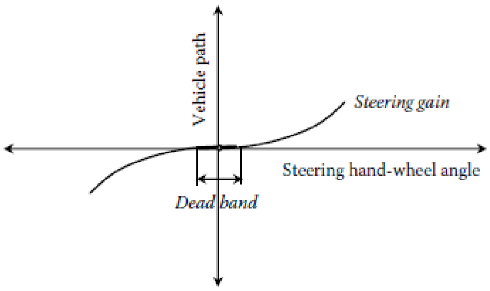

FIG. 4 ON CENTER STEERING RESPONSE

Steering response is an overall subjective measure of time-dependent vehicle path change against a transient steering input. (*see* Fig. 5) the vehicle path versus steering handwheel angle containing (a) time delay and (b) steering gain. Both time delay and steering gain represent the subjective quality of agility of the vehicle path change in time.

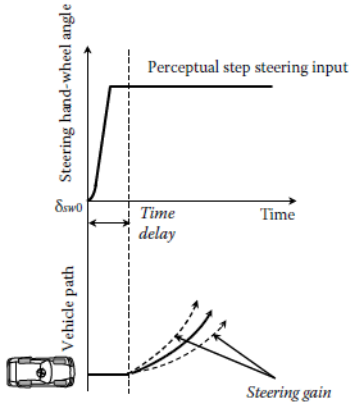

FIG. 5 OFF CENTER STEERING RESPONSE

The steering response is assessed while off-center steering both in straight ahead and in a turn. The time delay is just a time lag until the first movement of directional change of the vehicle path. Less time delay is usually felt better. The steering gain represents a subjective measure of steering response how fast the initial movement of direction change is developed after its start of generation. It requires a proper degree of the sharpness of the vehicle path change depending on a driver's preference, that is, not too fast or not too slow.

4.3.3 *Linearity*

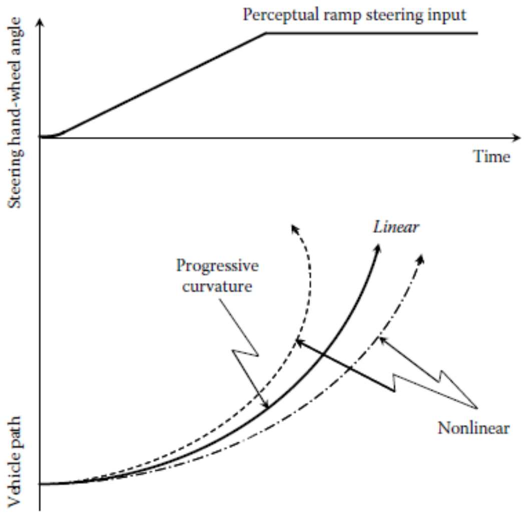

FIG. 6 LINEARITY

Linearity is a perceptual impression on the linearity characteristic of trajectory of vehicle path in response to a gradually incremental steering input. (*see* Fig. 6) the profile of vehicle path to describe the linear tendency of steering gain. Any change of vehicle attitude is additionally perceived.

Good linearity characteristic requires the linearly progressive change of the vehicle path against the gradually incremental steering input. In addition, it is naturally required constant vehicle attitude. When there exists any disturbance of the vehicle path or attitude, in other words, it is assessed badly.

4.3.4 *Steering Precision*

Steering precision is an overall subjective impression on how accurately a vehicle follows an intended path with a series of steering manoeuvres. While path following, the easiness to control the vehicle also affects subjective rating. It is usually evaluated as the characteristic of precision or line trace when path following in a handling circuit. In addition, it is judged with the accuracy of lane changing and severe lane changing.

4.3.5 *Steering Angle*

Steering angle is a subjective evaluation of an output-to-input ratio. It is assessed by the amount of steering application to get the same path. In general, the smaller the angle, the better. The steering angle is evaluated while off-center steering both in straight ahead and in a turn.

4.3.6 *Steering Addition*

Steering addition is a perceptual indicator of additional grip produced when an extra steering input is applied at grip limit in a turn. In this situation, some path change is subjectively assessed. An understeer behaved vehicle usually requires better steering addition characteristic to come back to the intended path in a corner safely. In general, the more additional grip, the better.

4.3.7 *Steering Effort*

Steering effort is a subjective measure of steering handwheel torque required to change the direction of vehicle path., it should not be too loose or too tight but appropriate for the best comfort. The steering effort is assessed through off-center steering both in straight ahead and in a turn.

4.3.8 *Returnability*

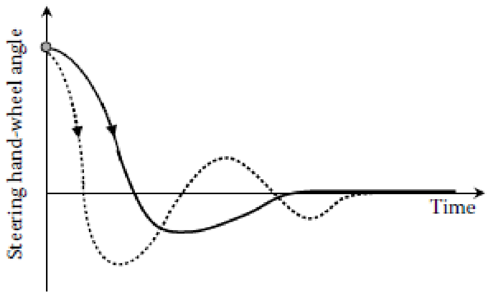

FIG 7 STEERING RETURNABILITY

Returnability is a perceptual evaluation of quickness and precision of steering handwheel movement returning to its neutral position primarily just after a flick steering input is applied and immediately release It represents the ability of tyres to make the steering handwheel come back directly and smoothly to the steering center after flick steering as well as while exiting a corner. Less oscillation of the steering handwheel and the smoothness of its movement are desirable.

4.4 Controllability and its Sub-Attributes

During any vehicle manoeuvre, easiness to control a vehicle in following an intended path is the controllability. Controllability is a psychological assessment of easiness to control a vehicle in following an intended path in a handling circuit or while lane changing. This capability is basically dependent on the grip capabilities of front and rear axles as well as a grip balance between them. The controllability is composed of its five characteristics such as:

a) balance FA/RA;
b) power-off reaction;
c) grip limit;
d) controllability at limit.

4.4.1 *Balance FA/RA*

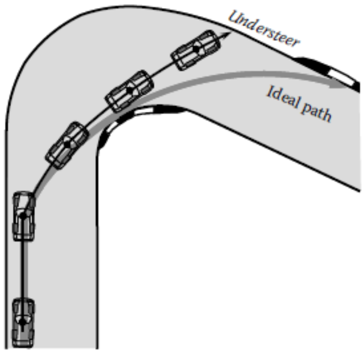

FIG. 8 TRANSIENT UNDERSTEER

Balance FA/RA is an abbreviation of a balance between front axle grip and rear axle grip. In practice, it stands for a balance between transient understeer and transient oversteer. Through various handling tests, the worst (or maximum) levels of the understeer and oversteer are perceptually evaluated. Then, the balance FA/RA is assessed based on an overall impression on these levels. (*see* Fig. 8 and 9), the transient understeer and transient oversteer are subjectively assessed in a turn.

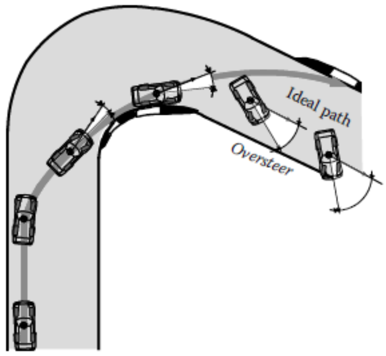

FIG. 9 OVERSTEER

Both their ideal targets are just steady-state neutral steer to exactly follow an ideal vehicle path with desirable vehicle attitude relatively aligned along the vehicle path in a turn. In other words, the less understeer or oversteer closed to the neutral steer, the better. The vehicle path and attitude are exclusively dependent on the levels of front axle grip and rear axle grip relative to each other.

The transient understeer is a perceptual measurement of front axle grip in a turn. Bigger understeer indicates less front axle grip that provides less capability to precisely follow an ideal vehicle path. It is subjectively assessed as smaller or bigger understeer primarily depending on a smaller or bigger resultant turn, respectively.

Each test engineer makes his or her own subjective rating by comparing his or her perceptual vehicle path against his or her own reference value, that is, the vehicle path of the neutral steer.

Similar to the transient understeer, the transient oversteer is a perceptual barometer of rear axle grip in a turn. Bigger oversteer stands for less rear axle grip that induces more slip at a rear axle. Then, it produces outward sway and then bigger vehicle attitude relatively away from vehicle moving direction in a turn. It is subjectively assessed bigger oversteer by estimating driver’s perceptual vehicle nose-in attitude relative to his or her own reference value representing the neutral steer.

Big oversteer is normally not desirable, because it is more difficult for a normal driver to control a vehicle having a big oversteer tendency.

4.4.2 *Power-Off Reaction*

Power-off reaction is a criterion of grip loss of a rear axle caused due to an instantaneous load transfer from the rear axle to a front axle while powering off immediately just after full powering on with fixed steering in a turn. The sudden load shift results in an impulsive increase and a simultaneous decrease of cornering forces at the front and rear axles, respectively.

The change of cornering forces does quickly increase a yaw moment momentarily producing more vehicle nose-in attitude. The power-off reaction steer is defined to generally describe the quickness of steer variation from the transient understeer to the transient oversteer. In practice, the power-off reaction steer is subjectively assessed with a driver's perceptual vehicle nose-in attitude change with respect to a time interval from full power on to instantaneous power off. The levels of the understeer and oversteer are additionally evaluated. For better power-off reaction, (a) a slow and smooth power-off reaction steer as well as (b) small transient understeer and (c) small transient oversteer is desirable. It is easy to control a vehicle conducting better power-off reaction behaviour.

4.4.3 *Grip Limit*

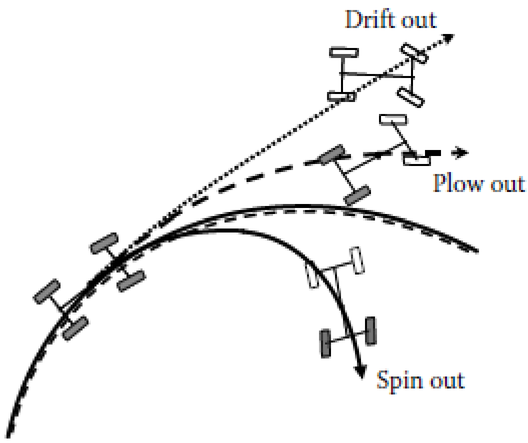

FIG. 10 GRIP LIMIT

Grip limit represents the attainable maximum speed in still controlling a vehicle in lane changing or cornering. It is assessed by the speed limit to be achievable at the worst situation. This grip limit is dependent on not only the grip capabilities (or cornering forces) of front and rear axles but also their grip balance.

(*see* Fig. 10) the cornering forces of the front and rear axles should be more progressive but without their sudden drops beyond the slip angle causing the grip limit for better predictability. Figure presents three different cases of limit-grip behavior depending on the limits of cornering grip such as:

a) plow out;
b) spin out, and
c) drift out.

The plow out or spin out is caused due to the yaw moment of unbalanced cornering forces at front and rear axles. Specifically speaking, the plow out or spin out does wholly depend on the less grip of the front and rear axles relative to each other, respectively. In case the cornering forces are ideally well balanced, a vehicle does not get either plow out or spin out. It eventually gets drift out at a little higher grip limit that depends on the overall cornering grip of the vehicle.

4.4.4 *Controllability at Limit*

Controllability at limit is an overall impression on how easy it is to control a vehicle at grip limit. It is ideally preferable to have flat limit grip without its sudden drop so that in advance a driver can prepare for the next situation. As slip angle increases, in practice, eventually the limit grip decreases. Some tyres behave little oversteer at the grip limit, and it may be easy for a specially trained driver to control a vehicle with them.

4.5 Stability and its Sub-Attributes

The stability is the vehicle behaviour convergence characteristic back to a steady state after a certain dynamic excitation. The comfortability is the ride comfort characteristic of a vehicle running over uncomfortable, uneven, or irregular roads. The roll and pitch motions of a sprung mass are also critical factors to affect the stability as well as the controllability.

During severe handling manoeuvre beyond grip limit, a vehicle may get into an unstable condition. Stability is an ability to make the vehicle come back to a next stable turn or lane change. It is represented by its six characteristics such as:

a) yaw stability;
b) rear axle stability;
c) roll stability;
d) braking stability
e) rollover stability, and
f) bump steer.

4.5.1 *Yaw Stability*

Yaw stability is an ability to keep down the yaw oscillation of a vehicle. The yaw oscillation is principally generated due to an unbalance of the lateral compliances between front and rear axles. In case the roll compliances of front and rear axles are unbalanced with their lateral compliances, the yaw oscillation may be also produced. For instance, if vehicle body roll motion has some phase lag behind vehicle path change, the yaw instability also occurred. Depending on yaw damping, the cycle number of the yaw oscillation is determined. The fewer the cycles, the better. In practice, the yaw stability is assessed primarily using a perceptual measurement of the oscillation of vehicle path.

4.5.2 *Rear Axle Stability*

Rear axle stability is an ability to restrict the sideslip oscillation of a vehicle. This oscillation has occurred due to the lack of rear axle grip relative to front axle grip. For good rear axle stability, the magnitude of the sideslip oscillation should be small enough. In addition, it should be easy to recover., The rear axle stability is evaluated mainly through perceptually measuring the oscillation of vehicle attitude.

4.5.3 *Roll Stability*

Roll stability is an ability to depress the roll oscillation of a vehicle. The excessive roll oscillation is mainly due to an improper balance of the roll compliance of the vehicle. Both the magnitudes of roll oscillation and roll damping are important for roll stability.

4.5.4 *Braking Stability*

Braking stability is an ability to stop a vehicle without any disturbance of vehicle attitude or path while full braking in a turn. With bad braking stability, a vehicle stops with the misalignment of vehicle heading direction along an intended path. The braking stability is assessed by perceptually evaluating the disturbance(s) of the vehicle attitude and/or path.

4.5.5 *Rollover Stability*

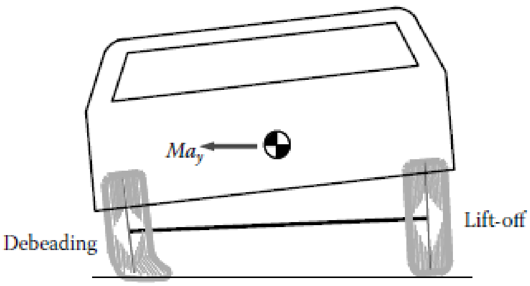

FIG. 11 DE-BEADING DURING SEVERE ROLL

Rollover stability is an ability to restrain a vehicle from its rollover motion (*see* Fig. 11). In general, the rollover gets into a fatal accident. Therefore, these days, it is a hot issue to automotive makers as well as tyre makers. In order to assess the rollover stability, both the debead of a tyre(s) from a rim(s) and the separation of a tyre(s) from road surface are subjectively or objectively checked through a series of specially designed rollover tests.

4.5.6 *Bump Steer*

While a vehicle is running over bumps, its toe is constantly changed due to the jounce and rebound of each front suspension. In this case, steer instability may occur. In that case, the vehicle cannot follow an indented path in a turn. Instead, the vehicle follows disturbed paths, and it requires continuous steering corrections to come back to the intended path. This steer instability is called bump steer.

5 ASSESSMENT RATING AND OBSERVATIONS NOTES

Evaluator can drive each vehicle to assess each attribute/sub-attribute for rating and record his qualitative observations, which can be useful for development purpose or overall impression of attribute rating. Rating scale for each attribute, sub attribute can be used as per Fig 12 is attached for suggested form for assessment. Sub attribute rating can be average out for overall attribute rating OR evaluator can rate overall attribute rating based on overall impression during assessment. Each evaluator can use this form for each vehicle. Overall rating of vehicle can be arrived by averaging the ratings of each evaluator’s attribute rating for specific vehicle.

ANNEX A
(*Clause* **5**)

SUBJECTIVE ASSESSMENT FORM

Date: Location:
Name of Evaluator: Vehicle Name/Details:

Subjective Assessment–Ride, Handling, Steering			
Parameter	**Rating**	**Comment**	**Over all rating**
Comfortability			
Primary Ride			
Secondary Ride			
Impact Ride			
Straight-ability			
Residual Pull			
Running straight			
Torque steer			
Braking straight			
Steerability			
On centre feel			
Steering response			
Linearity			
Steering precision			
Steering angle			
Steering addition			
Steering effort			
Returnability			
Controllability			
Balance FA/RA			
Power off reaction			
Grip Limit			
Controllability			
Stability			
Yaw Stability			
Rear axle stability			
Roll stability			
Braking stability			
Roll over stability			
Bump steer			

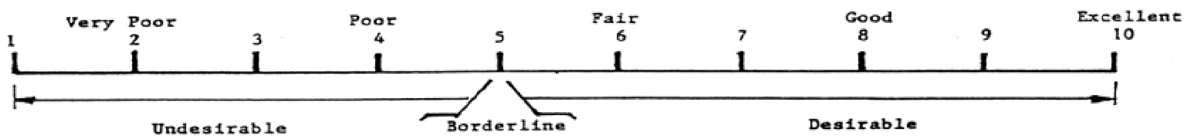

FIG. 12 SUBJECTIVE RATING SCALE

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION
WILL BE ADDED LATER