

Minimum Performance Criteria for Emergency Steering of Wheeled Earthmoving Construction Machines — SAE J53

SAE Recommended Practice
Approved December 1978

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MINIMUM PERFORMANCE CRITERIA FOR EMERGENCY STEERING OF WHEELED EARTHMOVING CONSTRUCTION MACHINES—SAE J53

SAE Recommended Practice

Report of Off-Road Machinery Technical Committee approved December 1978. Rationale statement available.

1. Objective—This SAE Recommended Practice provides minimum performance and test criteria for the emergency steering of specified machines in the event of an engine or steering power source failure. This criteria shall enable machine manufacturers to uniformly evaluate emergency steering capability.

2. Scope—This recommended practice is specifically limited to tractor scrapers, wheel loaders, wheel tractors, graders, and dumpers (as defined in SAE J1116 (January, 1977) and J1057a (June, 1975)) which are designed to operate at a maximum rated speed in excess of 20.0 km/h (12.4 mph) and which employ power source(s) in addition to the operator control effort to effect machine steering.

3. Definitions

3.1 Steering System—The means by which the machine is controlled about the vertical axis.

3.2 Steering Power Source—The means for generating power to produce steering (e.g., pump, generator, etc.).

3.3 Steering Control Effort—The force exerted by the operator when steering the machine. For the steering wheel, this force is considered to be exerted at the rim.

3.4 Maximum Axle Spacing (MAS)—The centerline distance from the forward-most axle to the rear-most axle.

3.5 Tire Track Circle (TTC)—The outside diameter of the tire track when the machine is steered to its limit and run in a continuous path.

3.6 Failure—Sudden and complete loss of the engine or steering power source output.

4. Performance Criteria

4.1 In the event of failure of an engine or a steering power source, a means shall be provided to continue maintaining steering control of the machine. As a minimum, the machine must be capable of negotiating the appropriate test course shown in Fig. 1.

4.2 The normal means provided the operator for steering control, (e.g., wheel, switch, lever, pedal, etc.) of the machine will continue to be used in the event of an engine or a steering power source failure. Emergency steering capability after failure shall be provided without requiring a supplementary operator control function (e.g., turning a switch, pulling a knob, etc.).

4.3 Required steering wheel effort while negotiating the test courses must be within the acceptable range as specified by Fig. 3. All other means of control (switch, lever, pedal, etc.) must not exceed the force levels shown in the Controls Section of Military Equipment and Facilities, MIL-STD-1472.

4.4 A warning device indicating an engine or steering power source failure is required for machines which will not negotiate the Fig. 1 test course when using only operator muscular power within the limits of paragraph 4.3 and with no power assist devices. This warning device shall be audible and/or visual and shall actuate after failure. After actuation, the steering capability shall be at least the minimum amount required for one trip through the Fig. 1 test course.

A warning device is not required for machines which will negotiate the Fig. 1 test course when using only operator muscular power within the limits of paragraph 4.3 and with no power assist devices.

4.5 Emergency steering response, including any time delay introduced by an engine or a steering power source failure, must permit the machine to stay within the boundaries of the Fig. 2 test course.

4.6 Machines that have maximum rated speeds in excess of 20.0 km/h (12.4 mph) in reverse must have similar emergency steering capability (force, rate, and duration), in either forward or reverse direction and should be tested in the forward direction. Tests can be conducted in the reverse direction in addition to the forward direction if normal machine use dictates.

4.7 Machines having different steering performance in right and left hand turns must comply with the appropriate Test Courses shown on Figs. 1 and 2 and with a mirror image of Figs. 1 and 2.

5. Test Course

5.1 The test courses are to be constructed in accordance with Figs. 1 and 2 on a compacted or paved surface. A mirror image of either course may be used, provided the steering performance in right and left hand turns is equal.

5.2 The test courses shall not exceed 1 1/2% grade in any direction.

6. Test Procedures

6.1 Test Machine Specifications

6.1.1 All component parameters related to emergency steering capability shall be within the manufacturer's specifications. Machines with optional tire sizes should be tested with the arrangement which requires the greatest amount of steering. This is normally represented by the smallest tire track circle,

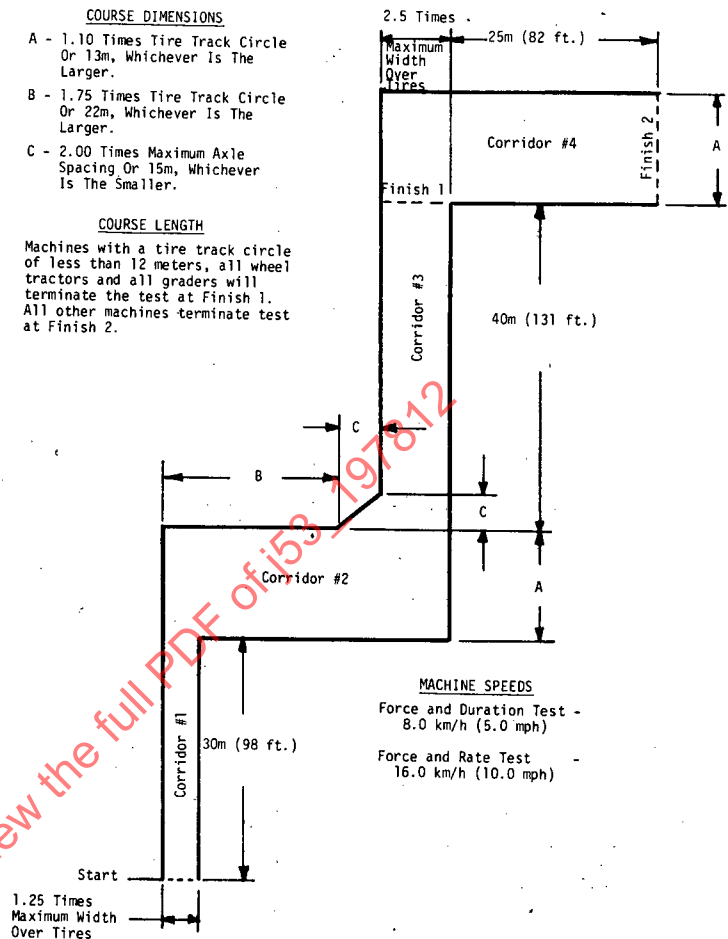


FIG. 1—EMERGENCY STEERING FORCE, RATE, AND DURATION TEST COURSE

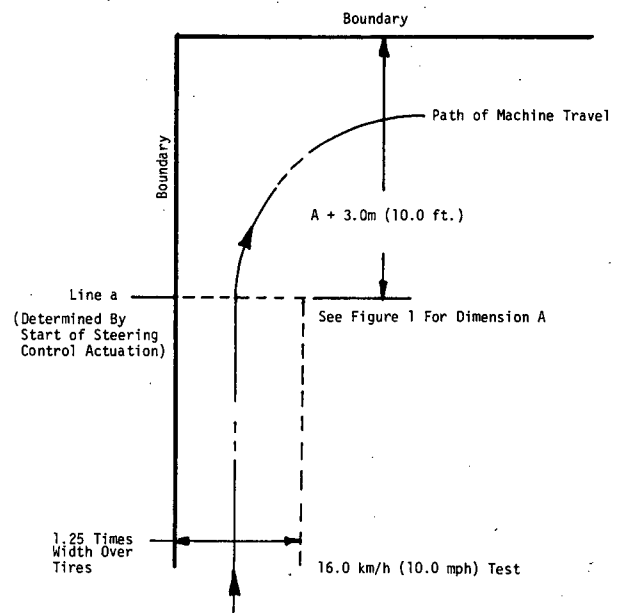


FIG. 2—EMERGENCY STEERING RESPONSE TEST COURSE