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Describes procedures for determining power losses attributable to the suspension system and running gear of wheeled vehicles, and the braking effect available for descending grades, by measuring vehicular resistance to towing forces.

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WHEELED VEHICLE TOWING RESISTANCE

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1. SCOPE. This document describes procedures for determining power losses attributable to the running gear and suspension system of wheeled vehicles, and the braking effect available for descending grades, by measuring vehicular resistance to towing forces.

2. FACILITIES AND INSTRUMENTATION.

2.1 Facilities.

<u>Item</u>	<u>Requirement</u>
Mobile field dynamometer	To provide towing force
Test course	Paved, level, straight road (gradient not to exceed $\pm 1\%$)

*This TOP supersedes TOP 2-2-605, 25 June 1980.

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2.2 Instrumentation.

<u>Devices for Measuring:</u>	<u>Permissible Error of Measuring Device:</u>
Towing force	$\pm 1\%$ of reading
Vehicle speed	± 0.2 km/hr
Time	± 0.1 second
Weight	$\pm 0.5\%$ of reading
Tire pressure	$\pm 1\%$ full scale

3. REQUIRED TEST CONDITIONS.

3.1 Test Vehicle. Ensure that:

- a. The vehicle is loaded with its normal payload or combat weight, unless otherwise specified.
- b. Maintenance and service operations have been performed so that the vehicle is operating within specifications. Give particular attention to the suspension and running gear, including brakes and wheel bearings.
- c. Specified grades and quantities of lubricants have been used.
- d. The vehicle tires are in good condition (6 mm minimum tread depth) with specified inflation pressures properly maintained during testing.
- e. Manufacturer's recommendations have been followed for towing the vehicle (propeller shafts removed, etc.).
- f. Normal operating temperatures of vehicle fluids and components are reached before testing begins.

3.2 Test Course.

- a. Test roadway must be paved and straight.
- b. Course conditions must be clear and dry throughout the test.
- c. The grade shall not exceed $\pm 1\%$.
- d. Wind speed shall not exceed 10 km/hr.

4. TEST PROCEDURES.

4.1 Towing Method (Preferred Method).

- a. Place the transmission in neutral; keep engine running in vehicles with automatic transmission.
- b. Tow the vehicle at reasonable increments of speed (increments not to exceed 10 km/hr) over as much of the speed range as possible. Measure the towing resistance by means of a calibrated force-measuring device while maintaining vehicle speeds as stable as possible.
- c. Repeat the above procedure while towing the vehicle in the opposite direction to negate the effect of wind conditions (values are averaged).

4.2 Deceleration Method.

- a. Determine vehicle weight using platform scales or load cell.
- b. Accelerate the vehicle to its maximum sustained speed, place the transmission in neutral, and allow the vehicle to coast to a stop.
- c. Measure vehicle speed and time throughout the coastdown.
- d. Compute average deceleration and towing forces for incremental vehicle speeds as follow:

$$F = Ma = W/g \times V/t$$

where:

- F = Towing force.
W = Vehicle weight.
g = Acceleration of gravity.
V = Velocity increment.
t = Time increment.

- e. Repeat the above procedure with the vehicle moving in the opposite direction of travel to negate the effect of wind conditions (values are averaged).

4.3 Braking Effect (Optional Test).

If it is required to determine the braking effect that is available for descending grades, follow the procedures in paragraph 4.1 or 4.2 with the engine idling and the transmission in pertinent gear ranges.

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4.4 Power Losses.

Calculate power losses (from towing force versus vehicle speed graph) as follows:

$$kW = \frac{kN \times km/hr}{3.6} \quad hp = \frac{lb \times mph}{375}$$

5. DATA REQUIRED.

- a. Towing force.
- b. Vehicle speed.
- c. Time (for deceleration method).
- d. Vehicle weight.
- e. Tire pressures.
- f. Towing configuration.
- g. Gear or range (if required).
- h. Vehicle power absorption.
- i. Meteorological data (for background information).

6. PRESENTATION OF DATA.

- a. Graphical presentation of towing force versus vehicle speed (indicate method used to determine towing forces).
- b. Graphical presentation of towing power (power loss) versus vehicle speed.

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