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			Grade speed test	Stability
			Maximum grade	Tractive ability

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This document describes procedures for evaluating tracked vehicle performance on various longitudinal grades and side slopes. Gradeability and side slope performance provide a means for determining the adequacy of vehicle power, tractive ability, stability, control and power plant operational characteristics when negotiating longitudinal and side slopes.

Supersedes AD-A143 813 and AD-A178163

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U.S. ARMY TEST AND EVALUATION COMMAND
INTERNATIONAL TEST OPERATIONS PROCEDURE

AMSTE-RP-702-101
*International Test Operations Procedure (ITOP) 2-2-610(1) 21 May 1987
AD No.

TRACKED VEHICLE GRADEABILITY AND SIDE-SLOPE PERFORMANCE

NOTE: This International Test Operations Procedure (ITOP) is the result of agreement among France, Germany, the United Kingdom, and the United States, 19 September 1986. Any ratifying nation may issue supplemental testing information to amplify or clarify these procedures, but in no case will such information contravene the provisions of this ITOP. Any changes to this ITOP require the approval of all ratifying nations. If a ratifying nation must deviate from a provision of this ITOP due to constraints such as available facilities, national regulations, instrumentation accuracies, etc., the test methods used will be described in the test report. However, such deviation may cause nonacceptance of test data by other nations.

1. SCOPE. This document describes procedures for evaluating tracked-vehicle performance on various longitudinal grades and side slopes. Gradeability and side-slope performance provide a means for determining the adequacy of vehicle power, tractive ability, stability, control and power-plant operational characteristics when negotiating longitudinal and side slopes.

*This ITOP supersedes ITOP 2-2-610(1) dated 20 March 1987.
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2. FACILITIES AND INSTRUMENTATION.

2.1 Facilities.

a. Grades, allowing sufficient traction, up to 60%

b. Side slopes, allowing sufficient traction, up to 40%

c. Skip rings or wireless data-coupling devices as required (driveline torque measurements)

2.2 Instrumentation.

DEVICES FOR MEASUREMENT OF:	PERMISSIBLE ERROR OF MEASUREMENT* (under stated test conditions)
a. Vehicle speed	± 0.2km/hr (para 4.1.2, grade speed test) ± 2.0km/hr (para 4.2, side-slope performance)
b. Engine and drive-shaft speeds	± 1% of maximum speed
c. Pressure	± 1.0% full scale
d. Drive-shaft torque	± 2% of reading

*The permissible error of measurement for instrumentation is the two-sigma value for a normal distribution; thus, the stated errors should not be exceeded in more than one measurement of 20.

3. REQUIRED TEST CONDITIONS.

3.1 Test Vehicle. Enure that:

a. The vehicle is loaded with normal payload or combat weight, unless otherwise specified.

b. Maintenance and service operations have been performed to ensure that the vehicle is operating within specifications. Give particular attention to the engine, transmission, running gear, and braking system.

c. Reference fuels and lubricants as specified by relevant NATO authority (after ratification) have been used. Until NATO agreement is ratified, developer-specified petroleum, oil, and lubricants (POL) will be used.

d. Engine and transmission have the specified minimum oil level.

e. The vehicle tracks are in good condtion and properly adjusted and maintained during testing.

f. Fuel is at the maximum level.

g. Normal operating temperatures of fluids and components are reached before starting the test.

3.2 Test Course. Course conditions must be clear and dry throughout the test.

4. TEST PROCEDURES.

4.1 Gradeability.

4.1.1 Maximum Grade Test.

a. Drive the vehicle up the maximum required grade in forward gear. Come to a full stop; apply the brakes, and place the transmission in neutral to check the holding ability of the brakes. The parking brakes (with the engine off) and the service brakes must be able to hold the vehicle independent of each other.

b. Let the engine idle for not less than 2 minutes. Shut off the engine, and then restart the engine after 2 minutes.

c. Repeat the procedure in paragraph 4.1.1b for the auxiliary engine, as required.

d. Engage the transmission; increase the throttle; release the brakes, and determine the ability of the vehicle to continue up the slope.

e. Repeat the procedures in paragraphs 4.1.1a through 4.1.1d with the vehicle driving up the slope in reverse gear.

f. As required, repeat the procedures in paragraphs 4.1.1a (forward and reverse directions) and 4.1.1d (forward direction) with trailer on the maximum slope for which this configuration is designed.

4.1.2 Grade Speed Test.

a. Maximum sustained forward speed.

(1) Bring the vehicle to maximum slope speed.

(2) Conduct the necessary trials to ensure the use of the optimum gear (or range) as well as representative results.

(3) Repeat the above procedure on each required grade.

b. Maximum sustained reverse speed (as required). Repeat the procedures in paragraph 4.1.2a with the vehicle transmission in reverse gear.

4.2 Side-slope Performance.

a. Drive the vehicle over the horizontal length of the specified side slope at a speed of approximately 5km/hr. Check steering control by running a sine-wave pattern.

b. Repeat the procedure in paragraph 4.2a at speeds of approximately 10 and 15km/hr, if possible.

c. Repeat the procedures in paragraphs 4.2a and 4.2b in the opposite direction.

d. Stop the vehicle, and let the engine idle for not less than 2 minutes. Shut off the engine, and restart the engine after 2 minutes.

e. Repeat the procedure in paragraph 4.2d with the vehicle headed in the opposite direction.

f. When applicable, repeat the procedure in paragraph 4.2d for the auxiliary engine.

5. DATA REQUIRED.

5.1 Gradeability.

5.1.1 Maximum Grade Test.

a. Gradient and type of surface.

b. Engine speed.

c. Fuel and oil pressures.

d. Gear (or range).

e. Vehicle weight.

f. Observations concerning:

(1) Idle and restart capability.

(2) Holding ability of the brake systems.

(3) Fluid leakage.

(4) Security of payloads, tools, etc.

5.1.2 Grade Speed Test.

a. Gradient and type of surface.

b. Vehicle speed.

c. Engine speed.

d. Gear (or range).

e. Vehicle weight.

f. Drive-shaft torque (as required).

g. Drive-shaft speed (as required).

5.2 Side-slope Performance.

a. Gradient and type of surface.

b. Vehicle speed.

c. Engine speed.

d. Fuel and oil pressures.

e. Observations concerning:

(1) Steering control.

(2) Idle and restart capability.

(3) Fluid leakage.

(4) Security of payloads, tools, etc.

6. PRESENTATION OF DATA.

a. Table of results.

b. Report of observations of incidents.

Recommended changes to this publication should be forwarded to: Commander, U.S. Army Test and Evaluation Command, ATTN: AMSTE-TC-M, Aberdeen Proving Ground, MD 21005-5055; Bundesamt fuer Wehrtechnik und Beschaffung (BWB), AT III 2, 5400 Koblenz, West Germany; H/TE RARDE(CH), ATTN: M/TD TE2, Chobham Lane, Chertsey, Surrey, England; and Direction des Armements Terrestres, Caserne Sully, DAT/AI/RE, 92211 Saint-Cloud Cedex, France. Technical information may be obtained from the preparing activity: Commander, U.S. Army Combat Systems Test Activity, ATTN: STECS-AD, Aberdeen Proving Ground, MD 21005-5059. Additional copies are available from the Defense Technical Information Center, Cameron Station, Alexandria, VA 22304-6145. This document is identified by the accession number (AD No.) printed on the first page.