

# SURFACE VEHICLE RECOMMENDED PRACTICE

**SAE** J688

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## Truck Ability Prediction Procedure

1. **Scope**—The procedure has been developed to provide a practical method for the prediction of truck performance using accepted data. It is designed to help anyone concerned with the problem of truck selection.

By following directions, it is possible to determine the necessary information for intelligent truck selection without being concerned with the origin or derivation of the complex factors involved. With readily available specifications of a truck, information provided in the tables, and a minimum of calculation, it is possible to predict:

- The performance obtainable from a truck of given characteristics under given operating conditions.
- The characteristics required in a truck to meet different performance requirements under given operating conditions.

This report comprises a procedure form and 10 tables of data. A complete explanation of the truck ability prediction procedure is contained in SAE Technical Report HS-82, Truck Ability-Prediction Procedure. Part 1 of HS-82 contains, in addition to the procedure form and tables, work sheets and an example. Part 2 demonstrates by practical examples how to obtain some of the answers other than grade ability, and presents a detailed procedure for computing instantaneous acceleration and the time or distance required to accelerate between specified limits of speed. Part 3 gives terminology, the fundamental relations, and the formulas which form the basis for the procedure, a discussion of the reliability of factors and methods, and presents a method for evaluating the effect of wind on air resistance.

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TABLE 1—TIRE FACTOR

| Tubeless<br>Tire Size | Conventional<br>Tire Size | Ply<br>Rating | Tire<br>Factor <sup>(1)</sup> |
|-----------------------|---------------------------|---------------|-------------------------------|
| 6.00-16               | 6.00-16                   | 6             | 12.40                         |
| 6.50-16               | 6.50-16                   | 6             | 11.85                         |
| 7-17.5                | 7.00-15, 7.00-16          | 6             | 11.75                         |
| 7-17.5                | 7.00-15, 7.00-16          | 8             | 11.75                         |
| 7-22.5                | 6.50-20                   | 6             | 10.15                         |
| 7-22.5                | 6.50-20, 7.00-20          | 8             | 10.15                         |
| 8-17.5                | 7.00-16, 7.50-15, 7.50-16 | 6             | 11.45                         |
| 8-17.5                | 7.00-16, 7.50-15, 7.50-16 | 8             | 11.45                         |
| 8-19.5                | 7.00-17, 7.50-17          | 6             | 10.50                         |
| 8-19.5                | 7.00-17, 7.50-17          | 8             | 10.50                         |
| 8-22.5                | 7.50-20                   | 8             | 9.50                          |
| 8-22.5                | 7.50-20                   | 10            | 9.50                          |
| 9-22.5                | 8.25-20                   | 10            | 9.20                          |
| 9-22.5                | 8.25-20                   | 12            | 9.20                          |
| 10-22.5               | 9.00-20                   | 10            | 8.80                          |
| 10-22.5               | 9.00-20                   | 12            | 8.80                          |
| 11-22.5               | 10.00-20                  | 12            | 8.55                          |
| 11-22.5               | 10.00-20                  | 14            | 8.55                          |
| 11-24.5               | 10.00-22                  | 12            | 8.15                          |
| 12.00-21              | 12.00-20                  | 14            | 8.05                          |
| 12.00-25              | 12.00-24                  | 14            | 7.35                          |
| 12-22.5               | 11.00-20                  | 12            | 8.30                          |
| 12-22.5               | 11.00-20                  | 14            | 8.30                          |
| 12-24.5               | 11.00-22                  | 12            | 7.90                          |
| 12-24.5               | 11.00-22                  | 14            | 7.90                          |
| 13.00-21              | 13.00-20                  | 16            | 7.75                          |
| 13.00-25              | 13.00-24                  | 16            | 7.10                          |
| 14.00-21              | 14.00-20                  | 16            | 7.35                          |
| 14.00-24              | 14.00-24                  | 16            | 6.75                          |

1. Tire Factor =  $\frac{168}{\text{Loaded Radius}}$

TABLE 2—ALTITUDE FACTOR (FOR NET HP CORRECTION)

| Altitude, ft | Altitude Factor | Altitude, ft | Altitude Factor |
|--------------|-----------------|--------------|-----------------|
| 0            | 1.00            | 8000         | 0.68            |
| 1000         | 0.96            | 9000         | 0.64            |
| 2000         | 0.92            | 10 000       | 0.60            |
| 3000         | 0.88            | 11 000       | 0.56            |
| 4000         | 0.84            | 12 000       | 0.52            |
| 5000         | 0.80            | 13 000       | 0.48            |
| 6000         | 0.76            | 14 000       | 0.44            |
| 7000         | 0.72            | 15 000       | 0.40            |

PROCEDURE FORM FOR DETERMINING GRADE ABILITY  
AT A GIVEN ROAD SPEED AND EQUIVALENT ACCELERATION RATE

Data Pertaining to Vehicle and Conditions of Operation

- Vehicle identification [Make, model and type of vehicle(s)]
- Vehicle overall maximum dimensions (a) Height \_\_\_\_\_ ft (b) Width \_\_\_\_\_ ft
- Total gross weight in thousand lb \_\_\_\_\_
- Manufacturer's maximum gross vehicle weight rating for power unit in pounds \_\_\_\_\_
- Gear ratios (a) Transmission \_\_\_\_\_ (b) Auxiliary transmission \_\_\_\_\_ (c) Axle \_\_\_\_\_  
(d) Total gear reduction \_\_\_\_\_
- Tire size (driving wheels) \_\_\_\_\_
- Net engine power at sea level (a) \_\_\_\_\_ hp at (b) \_\_\_\_\_ rpm engine speed
- Altitude \_\_\_\_\_ ft
- Road surface type and condition \_\_\_\_\_

PROCEDURE

| Steps                                                                                                                  | Procedure                                                                        | Value |
|------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-------|
| 1. Apparent road speed in mph <sup>(1)</sup>                                                                           | (Item 7b)<br>Item 5d) x (Tire Factor, Table 1)                                   |       |
| 2. Net engine to corrected for altitude                                                                                | (Altitude Factor, Table 2) x (Item 7a)                                           |       |
| 3. Rolling resistance hp                                                                                               | (Rolling Factor, Table 3) x (Item 3)                                             |       |
| 4. Air resistance hp                                                                                                   | (Area Factor, Table 4) x (Velocity Factor, Table 5) x (Altitude Factor, Table 6) |       |
| 5. Chassis Friction hp                                                                                                 | (Chassis Factor, Table 7)                                                        |       |
| 6. Level Road hp                                                                                                       | Sum of values 3, 4, and 5                                                        |       |
| 7. Reserve hp <sup>(2)</sup>                                                                                           | (Value 2) minus (Value 6)                                                        |       |
| 8. Grade resistance hp per 1000 lb weight                                                                              | $\frac{(\text{Value 7})}{(\text{Item 3})}$                                       |       |
| 9. Grade ability on Class 1 roads (good) <sup>(3)</sup>                                                                | (Value 8) x (Grade factor, Table 8A)                                             |       |
| 10. Grade deduction for road type and condition                                                                        | (Road factor, Table 9)                                                           |       |
| 11. Net grade ability at apparent road speed <sup>(2)</sup>                                                            | (Value 9) minus (Value 10)                                                       |       |
| 12. Approximate acceleration rate on level at apparent road speed in mph per sec (total gear reduction less than 10.0) | $(0.2) \times (\text{Value 11})$                                                 |       |

- Apparent road speed can be attained under given conditions only if sufficient net hp is available.
- If this value is negative, the net hp is insufficient to attain apparent road speed.
- Correct value using Table 8A if 20% or above.