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A GROUP OF MOBILITY, SOIL, and terrain evaluation specialists of the U. S. Army Materiel Command, the U. S. Army Corps of Engineers, and associated consultants met at the U. S. Army Engineer Waterways Experiment Station (WES) in September 1964 to design a group of vehicles capable of operating in extremely soft soil conditions, and to develop a program of tests for evaluating these vehicles once fabricated. During this meeting, designated as Mobility Exercise A (MEXA) (1, 2)*, two wheeled and one tracked vehicles were designed, and subsequently Clark Equipment Co. fabricated three MEXA vehicles under contract. Shakedown tests were conducted at Houghton, Mich., in February 1967 (3), and upon their completion, an extensive field program (4) was conducted which focused primarily on tests on soft-soil terrain. The results of some of these tests and the evaluation of vehicle performance are the subjects of this paper.

*Numbers in parentheses designate References at end of paper.

In the concept phase, methods of design based on results of research studies at WES and at the U. S. Army Tank-Automotive Command (TACOM) were used to derive characteristics of vehicle traction components that would yield a desired vehicle performance. The final configuration of the three MEXA vehicles that evolved reflected chiefly the soft-soil requirements, although other performance factors were also considered in the design.

DESIGN CRITERIA

The vehicle design criteria were:

1. Ability to travel in a straight line on a soil strength of 25 rating cone index (RCI)** for 50 passes and on a 7 RCI for a single pass.

**RCI is the remolded soil strength effective under vehicle traffic, and is numerically equal to the product of the cone index and the remolding index for the same soil layer.

ABSTRACT

The results of field tests of MEXA two wheeled and one tracked vehicles on soft-soil terrain and evaluation of vehicle performance are described in this paper.

Design criteria are presented, and the systems used to meet these criteria—AMRB Mobility Index System, AMRB Numeric System for wheeled vehicles, and LLL Soil Value System—are described.

Test sites and procedure are also described, and VCI test results are detailed. Experimental test results of the MEXA vehicles are compared with the design criteria and predicted performance of the actual vehicles. Speed test results are also discussed, as is the performance of MEXA vehicles, articulated steering, and inching systems in soft soils.

2. Ability to maintain a speed of 5 mph in the minimum soil strength.

3. Ability to transport a payload of 5000 lb.

4. Maximum vehicle gross weight of 15,000 lb.

5. Provision of an unbroken cargo space consistent with current military packaging techniques.

6. Development of a design that demands a minimum of new components.

Minimum power of 15 hp/ton was established, unless the requirement to develop 5 mph at the design soil strength demanded additional power.

SYSTEMS USED TO MEET DESIGN REQUIREMENTS

The WES Army Mobility Research Branch (AMRB) mobility index (MI) system was used to design both wheeled and tracked vehicles capable of completing 50 straight-line passes on a soil with an RCI of 25. The AMRB numeric system was employed to design wheeled vehicles (only) for one pass on a soil with an RCI of 7. The Land Locomotion Laboratory (LLL) soil value system was used in determining both wheeled and tracked designs on the basis of a soil strength of 7 RCI. The three systems gave similar, but not identical, wheel and track dimensions for the specified conditions. The final designs were conservative, that is, the wheeled and tracks selected were slightly larger than those indicated to be necessary by the calculation procedures and by minimum ground clearance requirements.

AMRB MOBILITY INDEX SYSTEM - The two empirical formulas developed from numerous vehicle tests conducted in fine-grained soil for wheeled and tracked vehicles, respectively, were used to compute the minimum soil strength required for a vehicle to travel 50 passes in the same path. The formulas are generally similar. Both rely heavily on a contact pressure factor and both are influenced to a lesser extent by such factors as gross weight, clearance, engine horsepower, and transmission type. The formulas yield a MI which, in turn, is related by means of a curve (Fig. 1) to the vehicle cone index (VCI_{50}), the minimum soil strength in terms of RCI that will allow a vehicle to complete 50 passes.

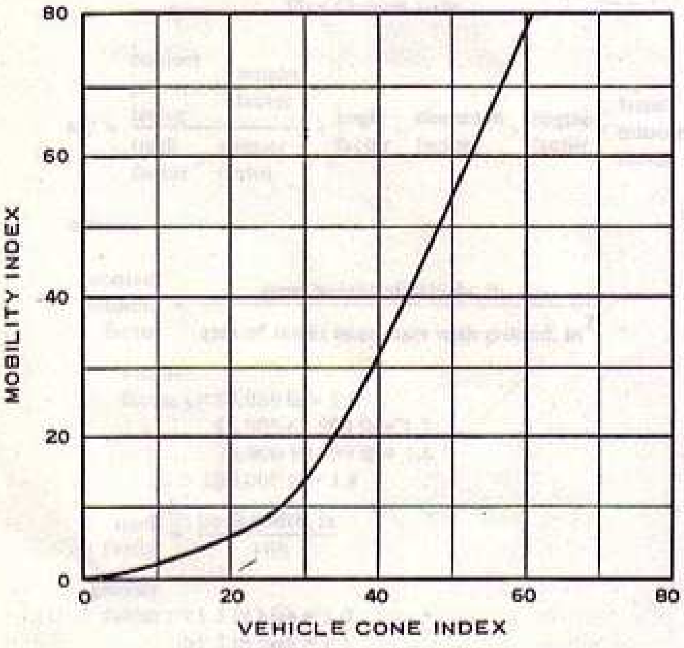

Fig. 1 - Mobility index versus vehicle cone index

Wheeled Vehicles - The MI formula used for wheeled vehicles* (all-wheel drive) operating in fine-grained soils is presented in Table 1.

In applying the wheeled-vehicle formula, the following assumptions were made: gross weight is 15,000 lb, no chains

*The MI formula used herein differs slightly from that given in the reference.

Table 1 - MI Formula for Wheeled Vehicles Operating in Fine-Grained Soils

$$\text{MI} = \left(\frac{\text{contact pressure factor} \times \text{weight factor}}{\text{tire factor} \times \text{grouser factor}} + \text{wheel load factor} - \text{clearance factor} \right) \times \text{engine factor} \times \text{transmission factor}$$

where:

$$\text{contact pressure factor} = \frac{\text{gross weight, lb}}{\text{tire width, in} \times \frac{\text{outside diameter of tire, in}}{2} \times \text{number of tires}}$$

weight factor =

Weight range, lb: gross vehicle wt, lb / number of axles	Weight Factor Equations
<2000	Y = 0.553X
2000-13,500	Y = 0.033X + 1.050
13,501-20,000	Y = 0.142X − 0.420
>20,000	Y = 0.278X − 3.115

$$X = \frac{\text{gross vehicle wt, kips}}{\text{number of axles}} \qquad Y = \text{weight factor}$$

$$\text{tire factor} = \frac{10 + \text{tire width, in}}{100}$$

grouser factor = 1.05 (with chains); 1.00 (without chains)

$$\text{wheel load factor} = \frac{\text{gross weight, kips}}{\text{number of wheels (duals as one)}}$$

$$\text{clearance factor} = \frac{\text{clearance, in}}{10}$$

engine factor = <10 hp/ton = 1.00; >10 hp/ton = 1.05

transmission factor = 1.00 (hydraulic); 1.05 (mechanical)

$$\text{mobility index} = \frac{(1) \times (2)}{(3) \times (4)} + (5) - (6) \times (7) \times (8)$$

or other traction devices are employed, wheels are single (not dual), the engine horsepower is greater than 10/ton, clearance is equal to OD of tire divided by three, and the transmission is a hydraulic type.

Tracked Vehicles - The MI formula used for tracked vehicles operating in fine-grained soils is presented in Table 2.

The assumptions made in applying the tracked-vehicle formula were as follows: gross weight is 15,000 lb, grousers on the tracks are less than 1 in high, number of bogie wheels per side equals (track length/30) + 1, clearance is 20 in, engine horsepower is greater than 10/ton, and transmission is a hydraulic type. No special credit was given in the calculation for the advantages accruing from steering by articulation. In applying the results to articulated vehicles, the required track length was taken as the total length for the two tracks (one on each unit) on a side.

AMRB NUMERIC SYSTEM FOR WHEELED VEHICLES - The results of tests in the AMRB test facilities with single tires ranging 14-41 in in diamter, on soft clay soil varying in strength from 10-60 cone index (CI), indicate that the performance of these tires, in terms of net drawbar pull at any given slip (P_{slip}) and towed force (P_T) developed on the first pass, can be related to a numeric involving wheel load (W), CI, tire width (b), tire diameter (d), and deflection (Δ). The AMRB numeric system was used to determine the tire dimension that would yield a value of zero drawbar pull on a soil strength of 7 RCI (see relation in Fig. 2).

LLL SOIL VALUE SYSTEM - Because of the limited time available in the exercise, a simplified version of the LLL soil value system was employed to determine the tire and track dimensions that would yield acceptable values of vehicle sinkage and positive drawbar pull on the stipulated soil conditions. At a later date, however, the results were checked against the results of a more complex computerized program. In the simplified version, the effects of tire and track slip and tire deformation on vehicle sinkage (and thus on motion resistance) and traction were neglected by the relations used.

To obtain LLL soil values that were comparable to a soil with an RCI of 7, the method developed by LLL for conversion of soil values to CI was used. The soil selected by applying this method was LLL soil No. 6 which has the following values.

1. c (cohesion) = 0.82 lb/in^2
2. k_c = 2.2 lb/in^{n+1}
3. k_ϕ = 1 lb/in^{n+2}
4. k_b = 1(dimensionless)
5. k_θ = 1 (dimensionless)
6. n = 0.35 (dimensionless)
7. γ (soil density) = 0.06 lb/in^3
8. ϕ (angle of internal friction) = 19.7 deg

Vehicle sinkage was considered the limiting criterion in the selection of adequate tire and track sizes. The maximum values of sinkage were taken as a sinkage equal to one-third the wheel diameter for wheeled vehicles and 15 in for the tracked vehicle.

Sinkage - Sinkage (Z) in inches was computed for a wheel (rigid) from the equation

$$Z = \left(\frac{3W}{bk\sqrt{D}\,(3-n)}\right)^{\frac{2}{2n+1}} \qquad (1)$$

and for a track from the equation

$$Z = \left(\frac{(n+1)W}{Ak}\right)^{1/n} \qquad (2)$$

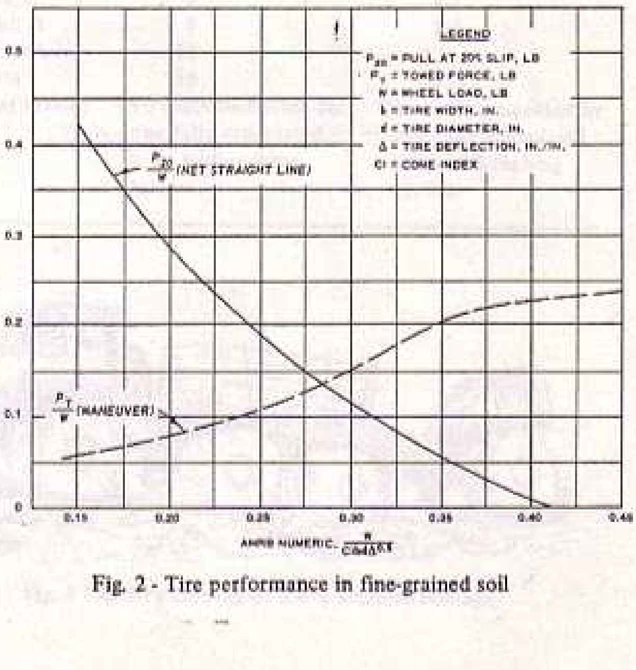

Fig. 2 - Tire performance in fine-grained soil

Table 2 - MI Formula for Tracked Vehicles Operating in Fine-Grained Soils

$$MI = \left(\frac{\text{contact pressure factor} \times \text{weight factor}}{\text{track factor} \times \text{grouser factor}} + \text{bogie factor} - \text{clearance factor}\right) \times \text{engine factor} \times \text{transmission factor}$$

where:

$$\text{contact pressure factor} = \frac{\text{gross weight of vehicle, lb}}{\text{area of tracks in contact with ground, in}^2}$$

weight factor : <50,000 lb = 1.0
50,000-69,999 lb = 1.2
70,000-99,999 lb = 1.4
> 100,000 lb = 1.8

$$\text{track factor} = \frac{\text{track width, in}}{100}$$

grouser factor : <1.5 in high = 1.0
>1.5 in high = 1.1

where:

A = area, in^2; for a track, $A = b\ell$
b = wheel or track width, in
D = wheel dimater, in
$k = \frac{k_c}{b} + k_\phi$; k, k_c, and k_ϕ are soil values
ℓ = track length, in
n = soil value
W = wheel or track load, lb

Motion Resistance - Total motion resistance (R_T) in pounds is the sum of motion resistance caused by compaction (R_c) and motion resistance caused by bulldozing (R_b) where:

$$R_c = \frac{bk}{(n+1)} Z^{n+1}$$

$$R_b = b(2ZcK_b + \gamma Z^2 K_\theta)$$

c = cohesion, lb/in^2
γ = soil density, lb/in^3
K_b and K_θ = parameters related to the Terzaghi bearing capacity factors

Traction - Total traction (H) in pounds is the total horizontal thrust developed by a track or wheel and includes both net thrust (drawbar pull) and motion resistance. It is determined from the equation:

$$H = Ac + W \tan\theta \qquad (3)$$

where:

A = area, in^2; for a wheel, $A = b\sqrt{(D - Z)Z}$
ϕ = angle of internal friction

Drawbar Pull - Drawbar pull (DP) is the difference between traction and motion resistance and is computed according to the equation

$$DP = H - R_T \qquad (4)$$

COMPARISON OF VEHICLE CONCEPTS AND ACTUAL VEHICLES

Table 3 shows the major differences between the characteristics of the concepts and those of the actual vehicles (Figs. 3-6).

Table 3 - Vehicle Characteristics

MEXA 8 × 8	Design Concept	Actual Vehicle
Weight, lb	15,000	19,013
Tire size	53 × 37 – 10	48 × 31 – 16A
Length, ft	28.5	30
Width, ft	9.0	9.5
Height, ft	9.33	8.1
Clearance, in	18	12
Hp/ton	15	22.5
Steering system	Three units connected by two fully articulated joints with inching system	Three units connected by two fully articulated joints with inching system
MEXA 10 × 10		
Weight, lb	15,000	18,030
Tire size	42 × 40 – 10	42 × 40 – 16A
Length, ft	24.33	26.5
Width, ft	9	9.5
Height, ft	7.8	9.5
Clearance, in	15	11.5
Hp/ton	15	23.7
Steering system	Two units connected by one fully articulated joint with inching system	Two units connected by one fully articulated joint with inching system
MEXA track		
Weight, lb	15,000	19,680
Track size, in	22 × 165	20 × 189
Length, ft	28	29.5
Width, ft	8	8.1
Height, ft	8	8.5
Clearance, in	15	12
Hp/ton	15	21.7
Steering system	Two units connected by one fully articulated joint with inching system	Two units connected by one fully articulated joint with inching system

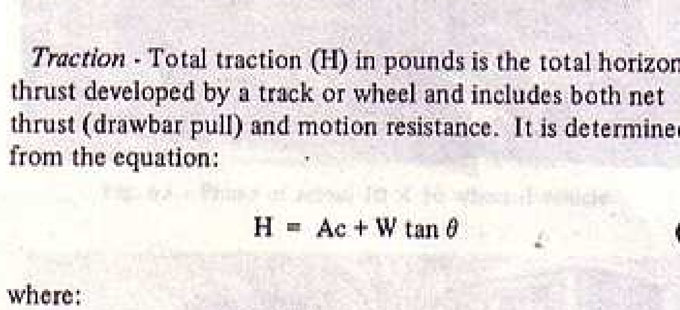

Fig. 3 - Artist's drawing of 10 × 10 wheeled concept

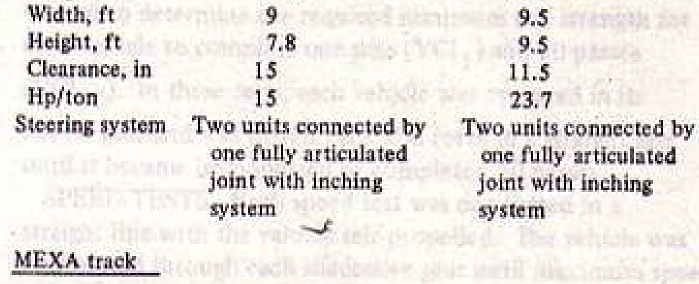

Fig. 4 - Artist's drawing of 8 × 8 wheeled concept

The most significant difference between the design concepts and the actual vehicles was in the overall weights. Analysis early in the fabrication stages indicated that the requirement of maximum vehicle gross weight of 15,000 lb with a payload of 5000 lb could not be met. All areas of design were reexamined, which resulted in extensive use of aluminum in the chassis and cabs. However, much of the vehicle weight was in the power train components and could not be reduced without the risk of mechanical failure.

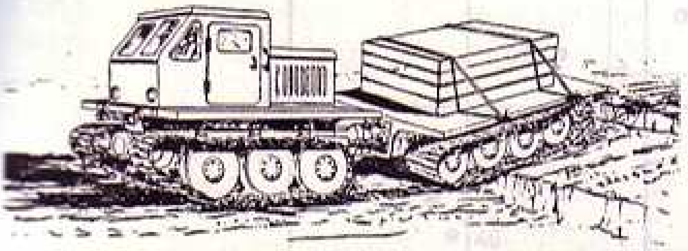

Fig. 5 - Artist's drawing of tracked concept

Fig. 6A - Photo of actual 10 × 10 wheeled vehicle

Fig. 6B - Photo of actual 8 × 8 wheeled vehicle

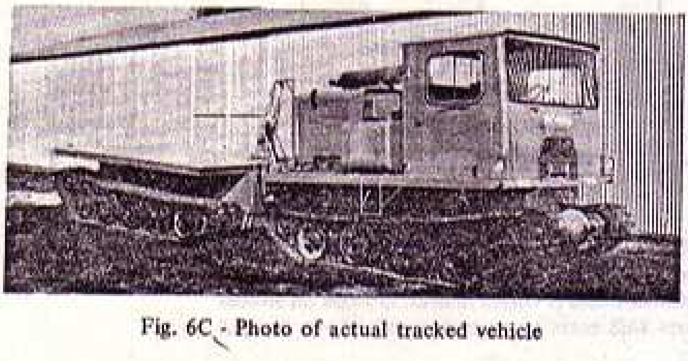

Fig. 6C - Photo of actual tracked vehicle

TEST SITES

Primary requirements in the selection of the test sites were that they be of the same general soil type (clay) with the range of strength necessary to evaluate the performance of the vehicles, and that they be large enough to accommodate several tests. Several sites were reconnoitered and evaluated, and two sites at Vicksburg, Miss., and eight near Fallon, Nev., were selected.

One of the Vicksburg sites was a soft, fat clay (CH), relatively level, recent hydraulic fill; the other was in an old riverbed about 18 miles northeast of Vicksburg where the soil was relatively soft, fat clay (CH). Four test sites were established at Carson Sink, a large, flat, barren playa located about 20 miles northeast of Fallon, Nev.; the soil classified as lean clay (CL). The other four sites were established on Four Mile Flat, a barren playa about 20 miles southeast of Fallon; the soil classified as fat clay (CH).

TEST PROCEDURES

Before each test, a lane large enough to accommodate the particular test was staked out, and a sufficient number of CI and bevameter measurements were made to determine the average soil strength.

VCI DETERMINATION - Self-propelled tests were conducted to determine the required minimum soil strength for each vehicle to complete one pass (VCI_1) and 50 passes (VCI_{50}). In these tests, each vehicle was operated in its lowest gear and was driven back and forth in a straight line until it became immobilized or completed 50 passes.

SPEED TESTS - Each speed test was conducted in a straight line with the vehicle self-propelled. The vehicle was accelerated through each successive gear until maximum speed was attained.

VCI TEST RESULTS

A total of 45 VCI tests were conducted with the MEXA vehicles. The experimental test results of the MEXA vehicles were compared with the design criteria and the predicted performance of the actual vehicles.

VCI_{50} -

MEXA 10 × 10 - Seven VCI tests were used to determine VCI_{50} for the MEXA 10 × 10. Tests results are plotted in Fig. 7A. On a RCI of 15, the vehicle was considered to be immobilized on the 47th pass (item 48). On an RCI of 19, although immobilization appeared to be imminent on the 50th pass, the test was continued through 54 passes without immobilization (item 54). On an RCI of 22, 50 passes were completed without difficulty (Items 50 and 53). From the results of these tests, the experimental VCI_{50} for the MEXA 10 × 10 was established at 18.

MEXA 8 × 8 - Eight VCI tests were used to determine the VCI_{50} for the MEXA 8 × 8. Tests results are shown in Fig.

3. Examination of the data shows that the MEXA 8 X 8 became immobilized (item 61) on an RCI of 20 on the 36th pass, it had no difficulty completing 50 passes on an RCI of 21 (item 66), and it had extreme difficulty completing 50 passes on an RCI of 22 (item 60). Therefore, the separation point between go and no-go for 50 passes was placed at an RCI of 23, that is, $VCI_{50} = 23$.

MEXA Track - Data from six tests were used to determine the VCI_{50} for the MEXA track, Fig. 7C. Three tests re-

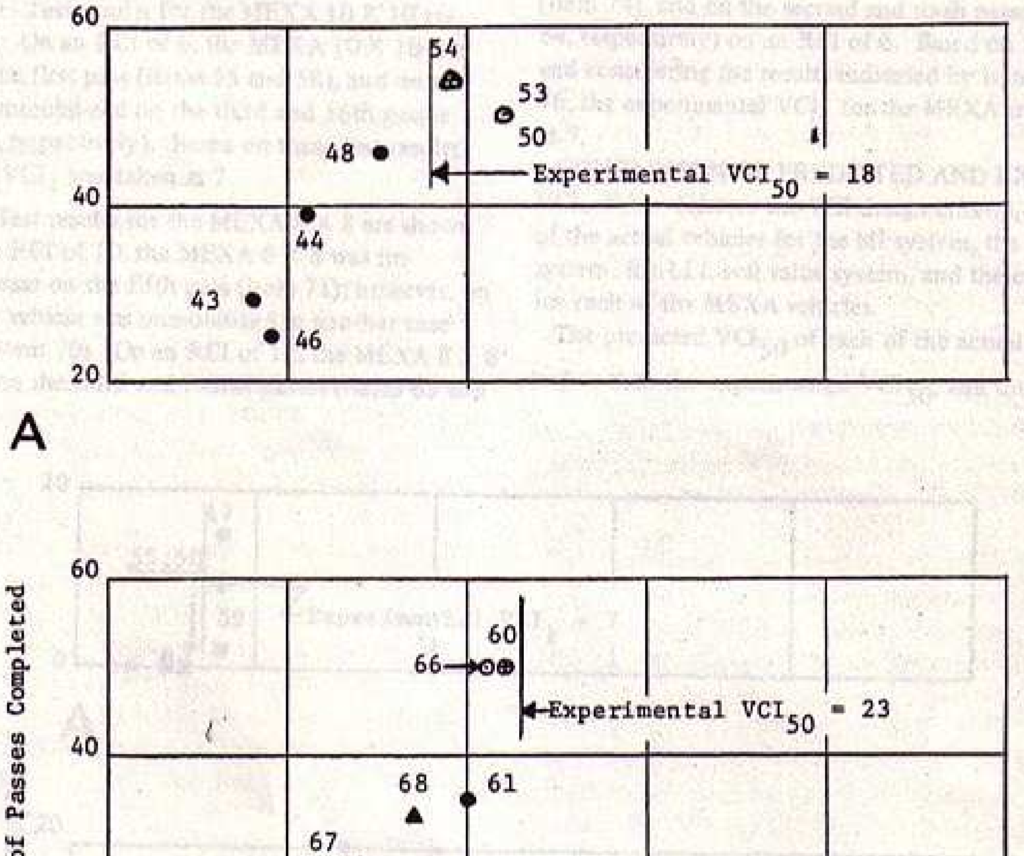

Fig. 7 - Experimental VCI–50 pass criteria. A–MEXA 10 × 10, 18,030 lb; B–MEXA 8 × 8, 19,013 lb; C–MEXA track, 19,680 lb. Note: Numbers near plotted points are item numbers; open symbols denote no immobilization; closed symbols denote immobilization; + in symbol denotes difficult "go." Legend: o = Vicksburg tests, △ = Carson Sink tests, □ = Four Mile Flat tests

ulted in immobilizations and three in completion of 50 passes. On an RCI of 20, the MEXA track was immobilized on the 44th pass (item 81). On RCIs of 19 and 20, the vehicle had considerable difficulty completing 50 passes (items 83 and 86). On an RCI of 19, 50 passes were completed without difficulty (item 82).

VCI_1 -

MEXA 10 × 10 - Test results for the MEXA 10 × 10 are shown in Fig. 8A. On an RCI of 6, the MEXA 10 × 10 was immobilized on the first pass (items 55 and 58), and on an RCI of 8, it was immobilized on the third and 16th passes (items 59 and 47, respectively). Based on these test results, the experimental VCI_1 was taken as 7.

MEXA 8 × 8 - Test results for the MEXA 8 × 8 are shown in Fig. 8B. On an RCI of 10, the MEXA 8 × 8 was immobilized in one case on the fifth pass (item 71); however, on this same RCI the vehicle was immobilized in another case on the first pass (item 70). On an RCI of 12, the MEXA 8 × 8 was immobilized on the third and fourth passes (items 63 and 73, respectively). Consideration was also given to the immobilization on the 11th pass on an RCI of 13 (item 62). Based on these test results, the experimental VCI_1 for the MEXA 8 × 8 was 11.

MEXA Track - The relation of RCI to the number of passes completed by the MEXA track is shown in Fig. 8C. The vehicle was immobilized on the first pass on an RCI of 5 (item 74), and on the second and sixth passes (items 77 and 84, respectively) on an RCI of 6. Based on these results and considering the results indicated by items 78, 75, and 76, the experimental VCI_1 for the MEXA track was placed at 7.

COMPARISON OF PREDICTED AND EXPERIMENTAL VCI - Table 4 shows the VCI design criteria, predicted VCIs of the actual vehicles for the MI system, the WES numeric system, the LLL soil value system, and the experimental VCI for each of the MEXA vehicles.

The predicted VCI_{50} of each of the actual vehicles is higher than the experimental VCI_{50}, and thus conservative

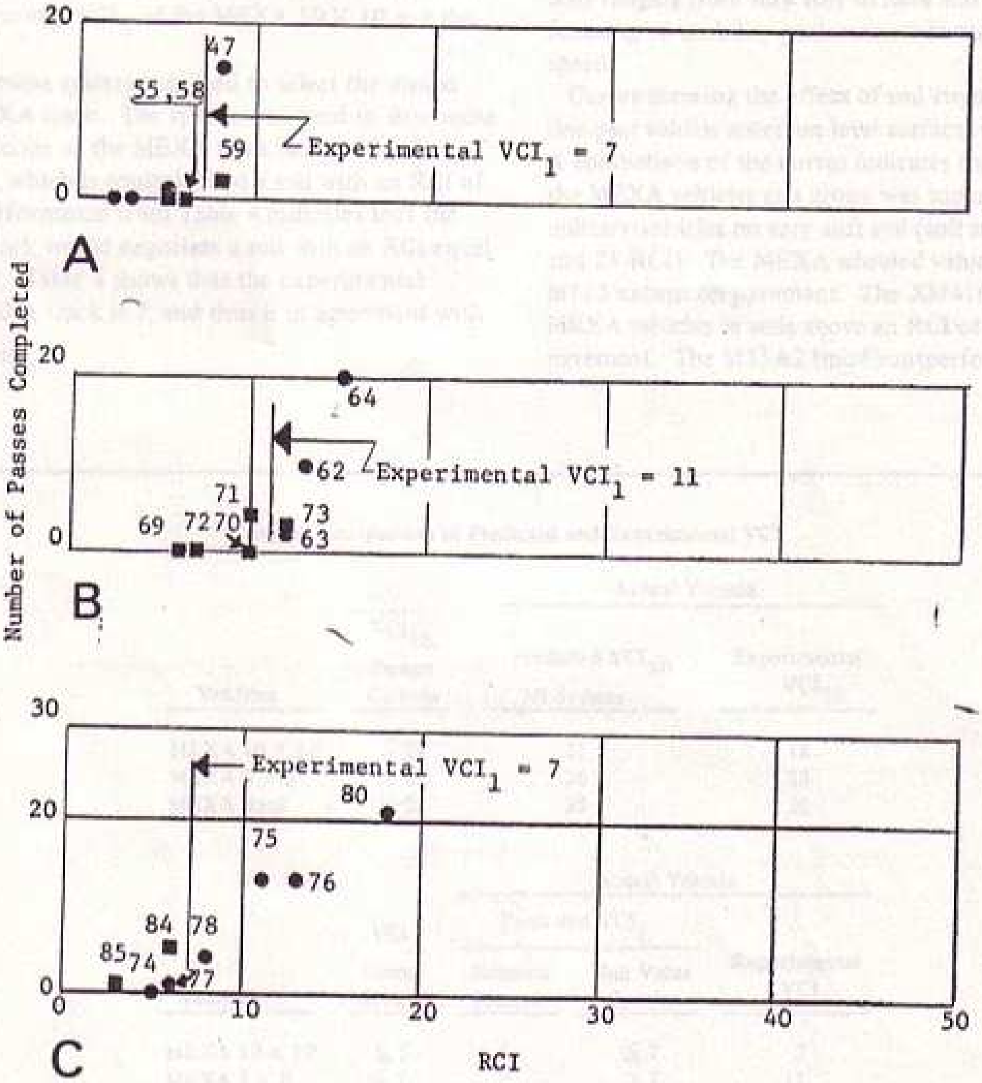

Fig. 8 - Experimental VCI—one pass criteria. A—MEXA 10 × 10, 18,030 lb; B—MEXA 8 × 8, 19,013 lb; C—MEXA track, 19,680 lb. Note: Numbers near plotted points are item numbers. Legend: o = Vicksburg tests, △ = Carson Sink tests, □ = Four Mile Flat tests

for the MEXA vehicles, The data show that although some modifications in vehicle characteristics had to be made from concept phase to fabrication phase, the experimental VCI_{50} of the MEXA vehicles still met the design criteria of $VCI_{50} \leqq 25$.

The VCI_1 for the wheeled vehicles predicted by the WES numeric system is slightly less than the experimental VCI_1. The data show that the experimental VCI_1 for the MEXA 10 × 10 met the design criteria and the MEXA 8 × 8 did not. However, it was known in the fabrication phase that the MEXA 8 × 8 would not meet the design criteria because of modifications in vehicle characteristics that were required.

After tire sizes for the MEXA wheeled vehicles were selected on the basis of the MI and numeric systems, calculations of the soil value equations were used to determine that the LLL system would yield acceptable values of sinkage and drawbar pull. According to Table 4, predicted performances from the LLL system indicate that the actual MEXA 10 × 10 would negotiate a soil equal to or less than an RCI of 7, whereas the actual MEXA 8 × 8 would not. The results are in agreement with the experimental VCI_1 of the MEXA 10 × 10 and the MEXA 8 × 8.

The LLL soil value system was used to select the dimensions of the MEXA track. The system was used to determine the track dimensions of the MEXA track using soil values of LLL, soil No. 6, which is equivalent to a soil with an RCI of 7. Predicted performance from Table 4 indicates that the actual MEXA track would negotiate a soil with an RCI equal to or less than 7. Table 4 shows that the experimental VCI_1 of the MEXA track is 7, and thus is in agreement with the design criteria.

SPEED TEST RESULTS

MAXIMUM SPEED AT VCI_1 - Maximum vehicle speed is plotted versus RCI in Fig. 9. A curve of best visual fit was drawn through the data points. The dashed portions of the curves were determined by extrapolating between the lowest RCI-maximum speed value and experimental VCI_1-1 plotted at zero speed for each vehicle. VCI_1-1 would be the soil strength that would cause immobilization. This curve extrapolation was necessary in order to obtain an approximate speed value for VCI_1. The curves show that the VCI_1 speed for all the MEXA vehicles was 2.5 mph. Thus, they did not meet the design criteria for speed at VCI_1, which was 5 mph.

MAXIMUM SPEED VERSUS RCI - During the course of the test program, it was agreed to place the MEXA vehicles in competition with three military vehicles, namely, the M35A2 (a 2-1/2 ton, wheeled, 6 × 6 truck), the XM410E1 (a 2-1/2 ton, wheeled, 8 × 8 truck), and the M113 (a 2-1/2 ton tracked vehicle). Comparison tests were conducted on soils ranging from very soft to hard and on a paved surface focusing on mobility performance in terms of maximum speed.

Curves showing the effect of soil strength on maximum one-pass vehicle speed on level surfaces are shown in Fig. 10. A comparison of the curves indicates that the performance of the MEXA vehicles as a group was superior to that of the military vehicles on very soft soil (soil strengths between 7 and 21 RCI). The MEXA wheeled vehicles outperformed the M113 except on pavement. The XM410E1 outperformed all MEXA vehicles in soils above an RCI of about 30 and on pavement. The M35A2 (mod) outperformed the MEXA

Table 4 - Comparison of Predicted and Experimental VCI

Vehicles	VCI_{50} Design Criteria	Actual Vehicle: Predicted VCI_{50} MI System	Actual Vehicle: Experimental VCI_{50}
MEXA 10 × 10	≦ 25	21	18
MEXA 8 × 8	≦ 25	26	23
MEXA track	≦ 25	29	21

Vehicles	VCI_1 Design Criteria	Actual Vehicle: Predicted VCI_1 Numeric System	Actual Vehicle: Predicted VCI_1 Soil Value System	Actual Vehicle: Experimental VCI_1
MEXA 10 × 10	≦ 7	6	≦ 7	7
MEXA 8 × 8	≦ 7	9	> 7	11
MEXA track	≦ 7	–	≦ 7	7

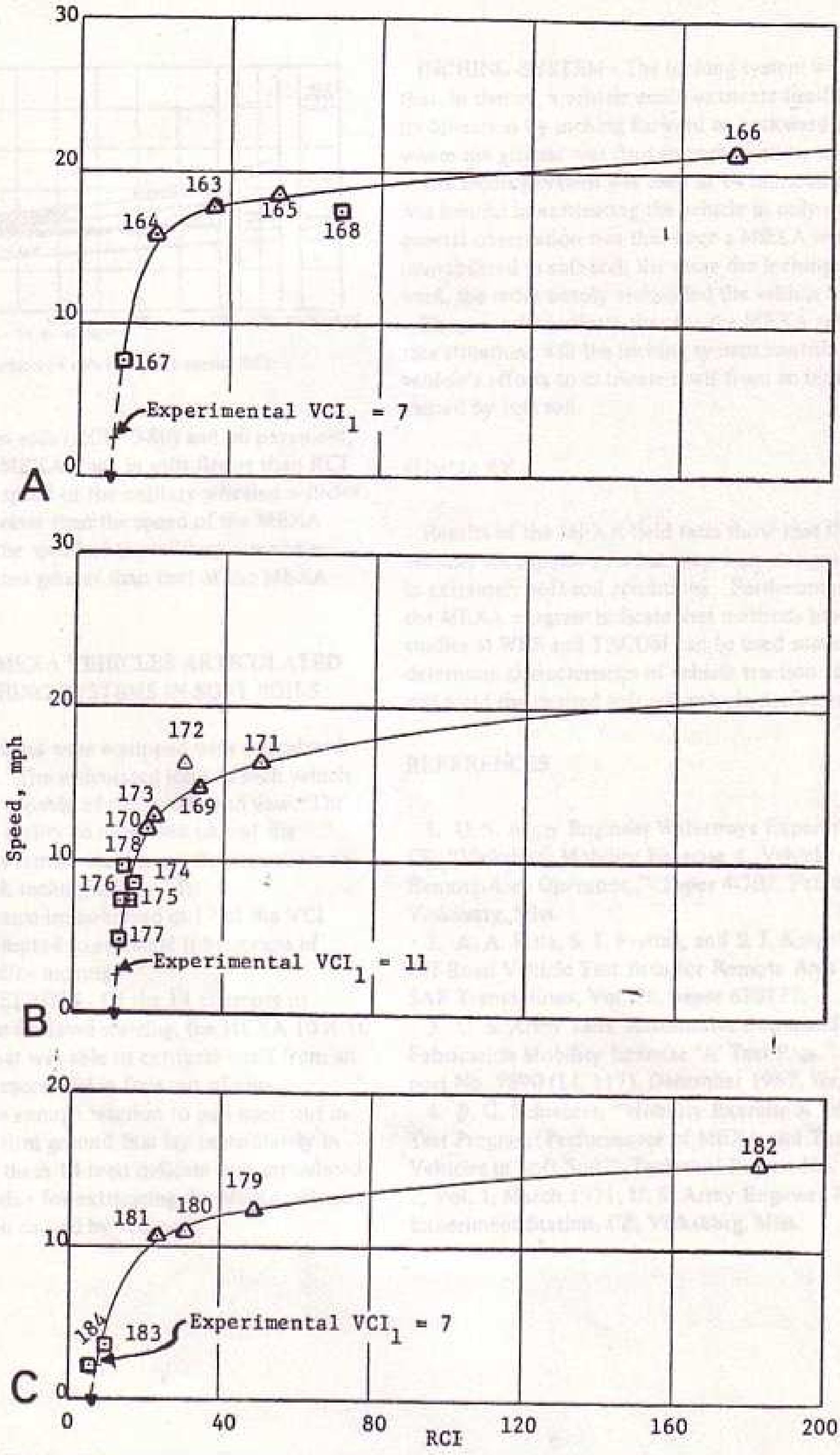

Fig. 9 - Vehicle speed versus RCI. A–MEXA 10 × 10, 18,030 lb; B–MEXA 8 × 8, 19,013 lb; C–MEXA track, 19,680 lb. Legend: △ = Carson Sink tests, □ = Four Mile Flat tests, ▼ = (experimental VCI$_1$) – 1

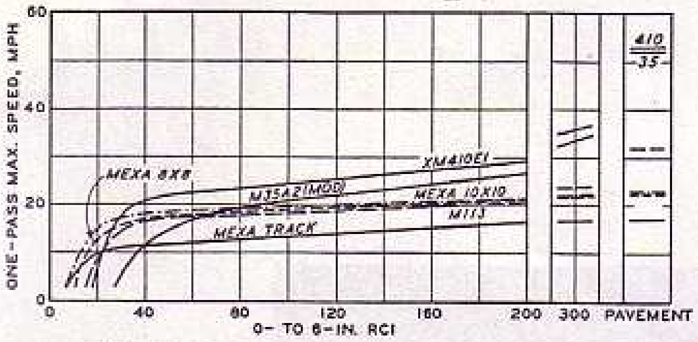

Fig. 10 - Comparison of vehicle speed versus RCI

wheeled vehicles in firm soils (RCI 70-80) and on pavement, and outperformed the MEXA track in soils firmer than RCI 40. On pavement, the speed of the military wheeled vehicles was about 2.5 times greater than the speed of the MEXA wheeled vehicles, and the speed of the military tracked vehicle was about two times greater than that of the MEXA track.

PERFORMANCE OF MEXA VEHICLES ARTICULATED STEERING AND INCHING SYSTEMS IN SOFT SOILS

The three MEXA vehicles were equipped with articulated and "inching" systems. The articulated joint in each vehicle is, in the free position, capable of roll, pitch, and yaw. The inching system has the ability to move one unit of the vehicle while the others remain stationary; the maximum extension distance of each inching unit is 2 ft.

After the vehicle became immobilized in 17 of the VCI tests, the operator attempted to extricate it by means of articulated steering and/or inching.

ARTICULATED STEERING - Of the 14 attempts to extricate a vehicle by articulated steering, the MEXA 10 X 10 was the only vehicle that was able to extricate itself from an immobilization, being successful in four out of nine attempts. It could gain enough traction to pull itself out in forward gear onto the firm ground that lay immediately in front of it. Results of these 14 tests indicate that articulated steering is of limited value for extricating the MEXA vehicles from an immobilization caused by soft soil.

INCHING SYSTEM - The inching system was designed so that, in theory, a vehicle could extricate itself from an immobilization by inching forward or backward to a position where the ground was firm enough to allow travel.

The inching system was used in 14 immobilizations, but was helpful in extricating the vehicle in only one. The general observation was that once a MEXA vehicle became immobilized in soft soil, the more the inching system was used, the more deeply embedded the vehicle became.

These results indicate that for the MEXA vehicle, only in rare situations will the inching system contribute to a vehicle's efforts to extricate itself from an immobilization caused by soft soil.

SUMMARY

Results of the MEXA field tests show that the MEXA vehicles are capable of what they were designed to do—operate in extremely soft-soil conditions. Furthermore, results of the MEXA program indicate that methods based on research studies at WES and TACOM can be used successfully to determine characteristics of vehicle traction components that will yield the desired soft-soil vehicle performance.

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