Report No. RR-7

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Computer Laboratory
Research Division
Research and Engineering Directorate

D I G I T A L C O M P U T E R P R O G R A M

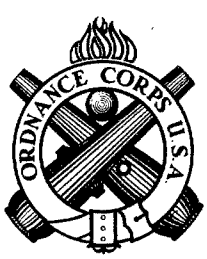
F O R

W H E E L E D V E H I C L E M O B I L I T Y C O M P U T A T I O N

by

Alexander Edwards

January 1960



Contract No. DA-20-089-ORD-39246

Project No. 5510.11.270

D/A Project No. 5W72-01-001

Reviewed Fred Paddock

Approved S K Zuller

Ordnance Tank-Automotive Command
Detroit Arsenal
Center Line, Michigan

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Reviewed Fred Bradley

Approved S M Keller

Ordnance Tank-Automotive Command
Detroit Arsenal
Center Line, Michigan

ABSTRACT

A general computer program was written for the Electrodata 204 Digital Computer to permit rapid solution of wheeled vehicle mobility performance in accordance with the theory and procedure practiced by OTAC Land Locomotion Laboratory.

Curves of sinkage and drawbar pull versus mud and snow soil consistency values were plotted of various sized tires for preliminary design guidance.

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LIST OF ILLUSTRATIONS (Cont'd)

PROJECT TITLE: DIGITAL COMPUTER PROGRAM FOR WHEELED VEHICLE COMPUTATION

INTRODUCTION:

The Land Locomotion Laboratory of the Ordnance Tank-Automotive Command has established the essential parameters governing wheeled vehicle mobility on soft soil terrain, resulting in a definitive method of calculating mobility performance.

Determination of vehicle mobility is now possible by application of the Land Locomotion Laboratory research, but the solution is lengthy and the procedure complex.

This report presents a high-speed computation method programmed for a digital computer system possessing 4,000 words of drum storage, 800,000 words of magnetic tape storage, floating point procedure, and flexowriter printout.

OBJECT:

Provide a general computer program for calculating wheeled vehicle mobility using the Electrodata 204 Digital Computer; describe vehicle mobility in terms of drawbar pull, depth of sinkage, and soil parameters for various terrain conditions.

SUMMARY:

The computer program outlined in this report for computing wheeled vehicle mobility is based on the theory and method described by M. G. Bekker in "Theory of Land Locomotion."

The factors essential to the program are represented by the following expressions and relationships:

Drawbar Pull	$DP = H - R_c$
Tractive Effort	$H = blc + W \tan \phi$
Compaction Resistance	$R_c = \frac{bkz^{n+1}}{n+1}$
Length of Ground Contact Area	$L = 2\sqrt{z\ (D - z)}$
Sinkage	$z = \left[\frac{3W}{bk(3-n)\sqrt{D}}\right]^{\frac{2}{2n+1}}$
Soil Factor	$k = \frac{k_c}{b} + k_\phi$

The required vehicle and soil data necessary for the evaluation of vehicle mobility performance are as follows:

b = tire width, inches

D = tire diameter, inches

W = maximum load, lbs.

k_c = "cohesive" modulus of deformation

k_ϕ = "frictional" modulus of deformation

n = sinkage exponent

c = coefficient of internal soil cohesion

$\tan \phi$ = tangent of the angle of internal soil friction

Established values for k_c, k_ϕ, n, c, and $\tan \phi$ in various soil conditions are listed in Appendix A.

CONCLUSIONS AND RESULTS:

The digital computing machine procedure for computing "Wheeled Vehicle Mobility" requires approximately 1/2 man-hour of operation to complete one vehicle analysis. This results in a time saved ratio of 8 to 1 over conventional computing methods. The ratio increases to over 100 to 1 when a great number of vehicle studies are required.

Curves of sinkage and drawbar pull versus mud and snow soil factors were plotted of various sized tires in Appendix B for preliminary design guidance.

DIGITAL COMPUTER PROGRAM:

1. Program Statements Nomenclature:

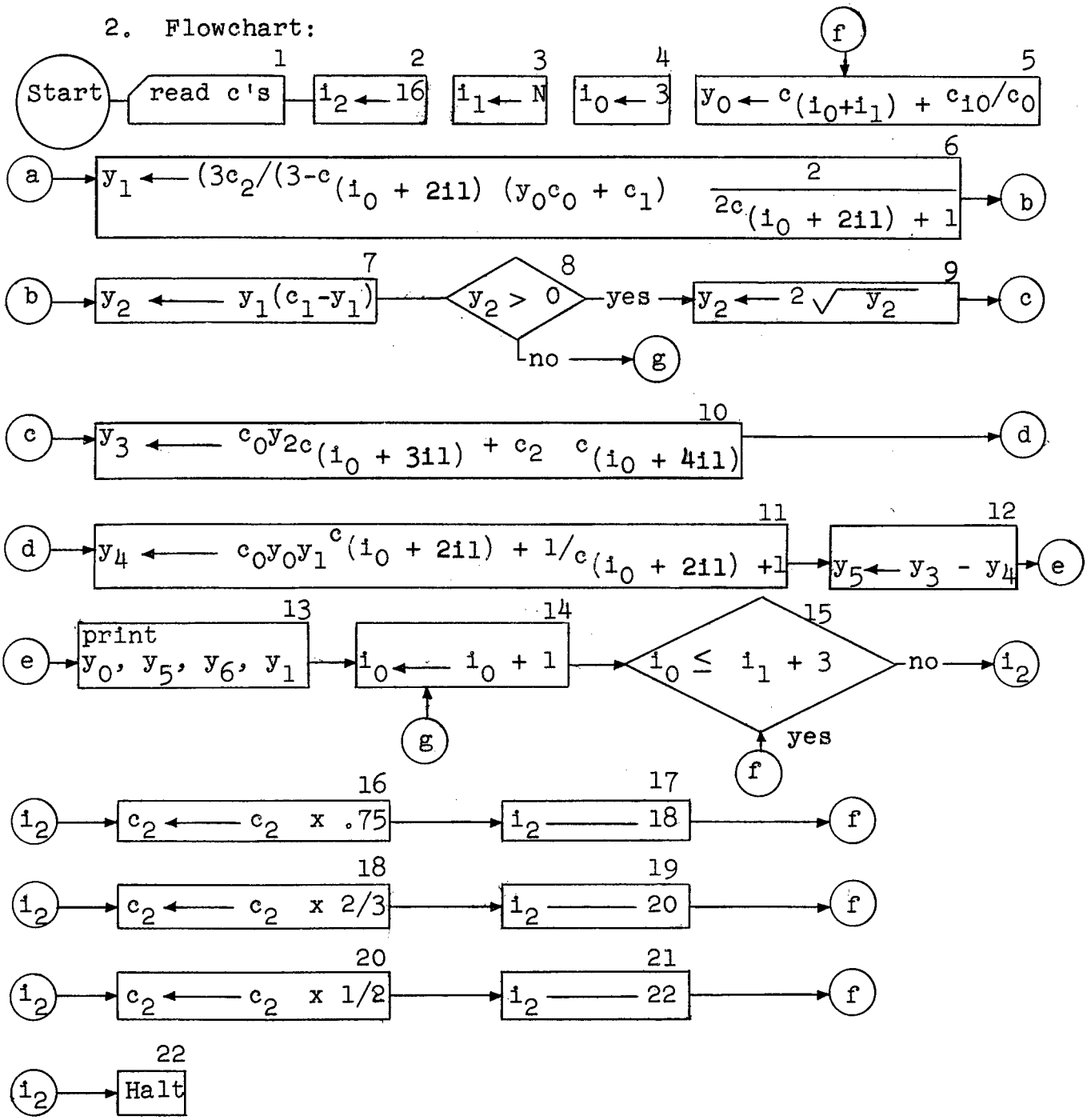
$c_0 = b$	i_1 = number of sets of parameters
$c_1 = D$	$y_0 = k$
$c_2 = W$	$y_1 = Z$
$c_{i0} = k_c$'s	$y_2 = L$
$c_{(i_0 + i_1)} = k_\phi$'s	$y_3 = H$

$c_{(i_0 + 2i1)}$ = n's $\quad y_4 = R_c$

$c_{(i_0 + 3i1)}$ = c's $\quad y_5 = DP$

$c_{(i_0 + 4i1)}$ = tanϕ's $\quad y_6 = DP/W$

2. Flowchart:



3. Input Data:

4 0000 00 0000

i = number of sets of parameters

4 0000 00 0009

0009 b

0010 D

0011 W

k_{c1}

k_{c2}

.

.

k_{ci}

$k_{\phi 1}$

$k_{\phi 2}$

.

.

$k_{\phi 1}$

n_1

n_2

.

.

.

n_i

c_1

c_2

.

.

.

c_i

$(\tan \phi)_1$

.

.

.

$(\tan \phi)_i$

6 0000 30 0120

4. Operating the Program:

1. Turn high speed tape "ON".
2. Turn magnetic tape #2 "ON" with the Compiler tape occupying #2.
3. Read in program tape.
4. Read in data tape. (Program starts automatically and punches results on high-speed punch).

5. Output:

The output is in the following form:

b	D	W	k_{c1}	k_ϕ	n_1	c_1	$(\tan \phi)_1$
k_1	$(DP)_1$	$(DP/W)_1$	z_1				
b	D	W	k_{c2}	$k_{\phi 2}$	n_2	c_2	$(\tan \phi)_2$
k_2	$(DP)_2$	$(DP/W)_2$	z_2				
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
b	D	W	k_{ci}	$k_{\phi i}$	n_i	c_i	$(\tan \phi)_i$
k_i	$(DP)_i$	$(DP/W)_i$	z_i				

6. Detail Printout of Compiled Program:

The following is a detail printout of the compiled program[1]:

```
i0  0000        base address of i0          REMARKS
y0  0003        base address of y
c0  0009        base address of c
s0  0070        base address of s
b0  0120        base address of b

 006 e  01  3560  0562      Page turning routine

 209 e  06  3440  0486      10^x routine

 207 e  04  3360  0482      log10 x routine

 200 e  04  3280  0463      square root routine

 005 e  03  3220  0554      Print out routine

 099 e  01  3200  0460      Fixed point error routine

f.p.a.e 18  3580  0501      Floating Point routine

0si2=14  f                  Set index for parameters

 0120  + 0000 64 7019
 0121  + 0000 02 0002

1si1=3   f                  Set index for parameters

 0122  + 0000 64 7018
 0123  + 0000 02 0001

2e"5e,7054,c0,c1,c2,ci1,c(i1+i0),c(i1+2xi0),c(i1+3xi0),c(i1+4xi0)
   "    f  Print out b, D, W, kci, kØi, ni, ci, and (tan Ø)i

 0124  + 0000 64 0000
 0125  + 0000 60 7017
 0126  + 0000 15 7028
 0127  + 3000 21 3200
 0128  + 0000 74 0001
 0129  + 2000 29 3200
 0130  + 0000 02 6002
 0131  + 0000 72 6002
 0132  - 0000 64 0009
 0133  + 0000 02 3960
```

[1] See "The Purdue Compiler Handbook"

```
0134  + 0000 64 0000
0135  + 0000 60 7018
0136  + 0000 30 0140
0137  + 0000 00 0004
0138  + 0000 00 0003
0139  + 0000 00 0014

0140  + 0000 15 7042
0141  + 3000 21 3200
0142  + 0000 74 0001
0143  + 2000 29 3200
0144  + 0000 02 6002
0145  + 0000 72 6002
0146  - 0000 64 0009
0147  + 0000 02 3961
0148  + 0000 64 0000
0149  + 0000 60 7019
0150  + 0000 15 7052
0151  + 3000 21 3200
0152  + 0000 74 0001
0153  + 2000 29 3200
0154  + 0000 02 6002
0155  + 0000 72 6002
0156  - 0000 64 0009
0157  + 0000 02 3962
0158  + 0000 30 0160
0159  + 0000 00 0002

0160  + 0000 64 0000
0161  + 0000 74 0001
0162  + 2000 29 3200
0163  + 0000 02 6002
0164  + 0000 72 6002
0165  - 0000 64 0009
0166  + 0000 02 3963
0167  + 0000 72 0001
0168  - 0000 64 0009
0169  + 0000 02 3964
0170  + 0000 64 0011
0171  + 0000 02 3965
0172  + 0000 64 0010
0173  + 0000 02 3966
0174  + 0000 64 0009
0175  + 0000 02 3967
0176  + 0000 64 7019
0177  + 0900 21 3220
0178  + 0000 30 0180
0179  + 0000 00 7054
```

REMARKS

3sy0=c(i0+i1)+ci1/c0 f

$$k = \frac{\frac{k}{c}}{b} + k_{\emptyset}$$

```
0180  + 0000 64 0009
0181  + 0000 72 0001
0182  + 0000 02 6000
0183  - 0000 64 0009
0184  + 6000 21 3596
0185  + 0000 02 6000
0186  + 0000 64 0001
0187  + 0000 74 0000
0188  + 2000 29 3200
0189  + 0000 02 6001
0190  + 0000 72 6001
0191  - 0000 64 0009
0192  + 6000 21 3580
0193  + 0000 02 0003
```

REMARKS

```
4sy1=((3.xc2)/((3.-c(i1+2xi0))xy0xc0x"200e,c1"))*(2./((2.xc(i1+2x
                                                    i0))+1.))f
```

$$z = \left[\frac{3W}{bk(3-n)D}\right]\frac{2}{2n+1}$$

```
0194  + 0000 64 7019
0195  + 0000 02 6002
0196  + 0000 64 0000
0197  + 0000 30 0200
0198  - 0640 00 0009
0199  + 5110 00 0000

0200  + 0000 60 7019
0201  + 0000 15 7003
0202  + 3000 21 3200
0203  + 0000 74 0001
0204  + 2000 29 3200
0205  + 0000 02 6004
0206  + 0000 72 6004
0207  - 0000 64 0009
0208  + 7018 21 3600
0209  + 6002 21 3580
0210  + 0000 02 6001
0211  + 0000 64 7018
0212  + 6001 21 3596
0213  + 0000 02 6000
0214  + 0000 64 0010
0215  + 0100 21 3280
0216  + 0009 21 3600
0217  + 0000 30 0220
0218  + 5120 00 0000
0219  + 0000 00 0002

0220  + 0003 21 3600
0221  + 0000 02 6002
0222  + 0000 64 0000
0223  + 0000 60 7019
0224  + 0000 15 7026
```

```
0225  + 3000 21 3200
0226  + 0000 74 0001
0227  + 2000 29 3200
0228  + 0000 02 6004
0229  + 0000 72 6004
0230  - 0000 64 0009
0231  + 0000 02 6003
0232  + 0000 64 7018
0233  + 6003 21 3584
0234  + 6002 21 3600
0235  + 0000 02 6001
0236  + 0000 64 0011
0237  + 0000 30 0240
0238  + 5130 00 0000
0239  + 0000 00 0002

0240  + 7019 21 3600
0241  + 6001 21 3596
0242  + 0000 21 3360
0243  + 6000 21 3600
0244  + 0000 21 3440
0245  + 0000 02 0004
```

25sy2=y1x(c1-y1) f z (D-z)

```
0246  + 0000 64 0004
0247  + 0000 02 6001
0248  + 0000 64 0010
0249  + 6001 21 3584
0250  + 0004 21 3600
0251  + 0000 02 0005
```

26rg27,ry2/=0. f One space if z(D-z)<0, if z(D-z)>0, go to Statement 5

```
0252  + 0000 64 7018
0253  + 0000 02 6000
0254  + 0000 64 0005
0255  + 6000 21 3584
0256  + 0000 15 0440
0257  + 0000 30 0260
0258  - 0000 00 0000
0259  + 5130 00 0000

0260  + 0000 73 7019
0261  + 0000 28 7063
0262  + 0000 20 0097
```

5sy2=2.x"200e,y2" f L = $2\sqrt{z\ (D-z)}$

```
0263  + 0000 64 0005
0264  + 0100 21 3280
```


REMARKS

```
0265  + 7018 21 3600                    REMARKS
0266  + 0000 02 0005
```

```
6sy3=(c0xy2xc(i1+3xi0))+(c2xc(i1+4xi0))f
```

$H = bLc + W \tan \phi$

```
0267  + 0000 64 0000
0268  + 0000 60 7017
0269  + 0000 15 7071
0270  + 3000 21 3200
0271  + 0000 74 0001
0272  + 2000 29 3200
0273  + 0000 02 6002
0274  + 0000 72 6002
0275  - 0000 64 0009
0276  + 0000 30 0280
0277  + 0000 00 0004
0278  + 5120 00 0000
0279  - 0000 00 0000

0280  + 0011 21 3600
0281  + 0000 02 6000
0282  + 0000 64 0000
0283  + 0000 60 7019
0284  + 0000 15 7086
0285  + 3000 21 3200
0286  + 0000 74 0001
0287  + 2000 29 3200
0288  + 0000 02 6002
0289  + 0000 72 6002
0290  - 0000 64 0009
0291  + 0005 21 360C
C292  + 0009 21 3600
0293  + 6000 21 3580
0294  + 0000 02 0006
```

```
7sy4=c0xy0x(y1*(c(i1+2xi0)+1.))/(c(i1+2xi0)
                                +1.)  f
```

$$R_c = \frac{bk\ z^{n+1}}{n+1}$$

```
0295  + 0000 64 7018
0296  + 0000 02 6001
0297  + 0000 30 0300
0298  + 5110 00 0000
0299  + 0000 00 0003

0300  + 0000 64 0000
0301  + 0000 60 7019
0302  + 0000 15 7004
0303  + 3000 21 3200
0304  + 0000 74 0001
0305  + 2000 29 3200
0306  + 0000 02 6002
0307  + 0000 72 6002
```

```
0308  - 0000 64 0009
0309  + 6001 21 3580
0310  + 0000 02 6000
0311  + 0000 64 7018
0312  + 0000 02 6002
0313  + 0000 64 0000
0314  + 0000 60 7019
0315  + 0000 15 0442
0316  + 3000 21 3200
0317  + 0000 30 0320
0318  + 5110 00 0000
0319  + 0000 00 0002

0320  + 0000 74 0001
0321  + 2000 29 3200
0322  + 0000 02 6003
0323  + 0000 72 6003
0324  - 0000 64 0009
0325  + 6002 21 3580
0326  + 0000 02 6001
0327  + 0000 64 0004
0328  + 0000 21 3360
0329  + 6001 21 3600
0330  + 0000 21 3440
0331  + 6000 21 3596
0332  + 0003 21 3600
0333  + 0009 21 3600
0334  + 0000 02 0007

8sy3=y3-y4     f

0335  + 0000 64 0007
0336  + 0000 02 6000
0337  + 0000 64 0006
0338  + 6000 21 3584
0339  + 0000 30 0340

0340  + 0000 02 0006

9sy5=y3/c2     f

0341  + 0000 64 0011
0342  + 0000 02 6000
0343  + 0000 64 0006
0344  + 6000 21 3596
0345  + 0000 02 0008

10e"5e,7054,y0,y3,y5,y1"f

0346  + 0000 64 0004
0347  + 0000 02 3960
```

REMARKS

$DP = H - R_c$

$DP/W = \frac{H - R_c}{W}$

Print out k, DP, DP/W, z

```
0348  + 0000 64 0008                    REMARKS
0349  + 0000 02 3961
0350  + 0000 64 0006
0351  + 0000 02 3962
0352  + 0000 64 0003
0353  + 0000 02 3963
0354  + 0000 64 7019
0355  + 0500 21 3220

11si1=i1+1    f                         index j

0356  + 0000 64 7018
0357  + 0000 30 0360
0358  + 0000 00 0001
0359  + 0000 00 7054

0360  + 0000 74 0001
0361  + 2000 29 3200
0362  + 0000 02 0001

12rg2,ri1/(i0+3)   f  Go to statement 2 if j < i + 3, if
                      not go to Statement 13
0363  + 0000 64 7019
0364  + 0000 74 0000
0365  + 2000 29 3200
0366  + 0000 02 6000
0367  + 0000 64 0001
0368  + 0000 75 6000
0369  + 1000 29 3200
0370  + 0000 15 7074
0371  + 0000 73 7018
0372  + 0000 28 7074
0373  + 0000 20 0072

13gi2    f            Go to change of W value

0374  + 0000 72 0002
0375  - 0000 20 0070
0376  + 0000 30 0380
0377  + 0000 30 0360
0378  - 0000 00 0000
0379  + 0000 00 0003

14sc2=c2x.75  f       Set W = .75 W

0380  + 0000 64 7019
0381  + 0011 21 3600
0382  + 0000 02 0011

15si2=17 f            Set Switch
```

```
 0383  + 0000 64 7018
 0384  + 0000 02 0002
```

REMARKS

```
0e"6e,2" f
```

Two spaces

```
 0385  + 0000 64 7017
 0386  + 0100 21 3560
```

```
16g1f
```

Go to statement 1 for next calculation

```
 0387  + 0000 20 0071
```

```
17si2=20 f
```

Set switch for next W

```
 0388  + 0000 64 7016
 0389  + 0000 02 0002
```

```
18sc2=c2x2./3.f
```

Set .75W to .5W

```
 0390  + 0000 64 7015
 0391  + 0000 02 6000
 0392  + 0000 64 7014
 0393  + 0000 30 0400
 0394  + 5120 00 0000
 0395  + 5130 00 0000
 0396  + 0000 00 0020
 0397  + 0000 00 0002
 0398  + 0000 00 0017
 0399  + 5075 00 0000

 0400  + 6000 21 3596
 0401  + 0011 21 3600
 0402  + 0000 02 0011
```

```
0e"6e,2" f
```

Two spaces

```
 0403  + 0000 64 7019
 0404  + 0100 21 3560
```

```
19g1f
```

Go to statement 1 for next calculation

```
 0405  + 0000 20 0071
```

```
20sc2=c2x.5   f
```

Set .5W to .25W

```
 0406  + 0000 64 7018
 0407  + 0011 21 3600
 0408  + 0000 02 0011
```

```
0e"6e,2" f
```

Two spaces

```
0409  + 0000 64 7019                    REMARKS
0410  + 0100 21 3560

21s12=23 f              Set switch

0411  + 0000 64 7017
0412  + 0000 02 0002

22g1f                   Go to Statement 1 for next
                        calculation
0413  + 0000 20 0071

23e"6e,3"f              Three spaces

0414  + 0000 64 7016
0415  + 0000 30 0420
0416  + 0000 00 0003
0417  + 0000 00 0023
0418  + 5050 00 0000
0419  + 0000 00 0002

0420  + 0100 21 3560

24h f                   Stop Computing

0421  + 0000 08 0000

27e"6e,1"f              Turn page one time (indicating
                        negative sinkage)
0422  + 0000 64 7019
0423  + 0100 21 3560

28g11   f               Go to next calculation

0424  + 0000 20 0081
0425  + 0000 00 0000
0426  + 0000 00 0000
0427  + 0000 00 0000
0428  + 0000 00 0000
0429  + 0000 00 0000
0430  + 0000 00 0000
0431  + 0000 00 0000
0432  + 0000 00 0000
0433  + 0000 00 0000
0434  + 0000 00 0000
0435  + 0000 00 0000
0436  + 0000 00 0000
0437  + 0000 00 0000
0438  + 0000 00 0000
0439  + 0000 00 0001
```

block dict

REMARKS

```
0440  + 0000 37 0260
0441  + 0000 20 7062
0442  + 0000 30 0320
```

BACKGROUND INFORMATION:

The approach presented in this computer program considers the pneumatic tire of wheeled vehicles to be rigid and provides conservative results for most soil conditions.

For more information see Mobility Studies by M. G. Bekker, W. L. Harrison, Capt. R. A. Liston and Capt. L. S. Lodewick.

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APPENDIX A

ESTABLISHED SOIL VALUES FOR MUD (MICHIGAN SANDY LOAM) AND SNOW

APPENDIX A

ESTABLISHED SOIL VALUES FOR MUD (MICHIGAN SANDY LOAM) AND SNOW

Soil #1 Moisture 14%	Soil #2 Moisture 16%	Soil #3 Moisture 18%	Soil #4 Moisture 20%	Soil #5 Moisture 22%	Soil #6 Moisture 24%
$k_c = 17.5$	$k_c = 9.5$	$k_c = 6.5$	$k_c = 4.5$	$k_c = 3.3$	$k_c = 2.2$
$k_\phi = 6.6$	$k_\phi = 5.6$	$k_\phi = 4.7$	$k_\phi = 3.75$	$k_\phi = 2.8$	$k_\phi = 1.8$
$n = .53$	$n = .50$	$n = .47$	$n = .425$	$n = .39$	$n = .35$
$c = 1.6$	$c = 1.9$	$c = 2.05$	$c = 1.58$	$c = 1.05$	$c = .82$
$\tan\phi = .56$	$\tan\phi = .52$	$\tan\phi = .476$	$\tan\phi = .435$	$\tan\phi = .394$	$\tan\phi = .358$

SNOW

$k_c = 3.6$

$k_\phi = .3$

$n = 1.02$

$c = .18$

$\tan\phi = .3288$

APPENDIX B

CURVES OF DRAWBAR PULL AND SINKAGE VERSUS SOIL CONSISTENCY AND SNOW CONSISTENCY VALUES

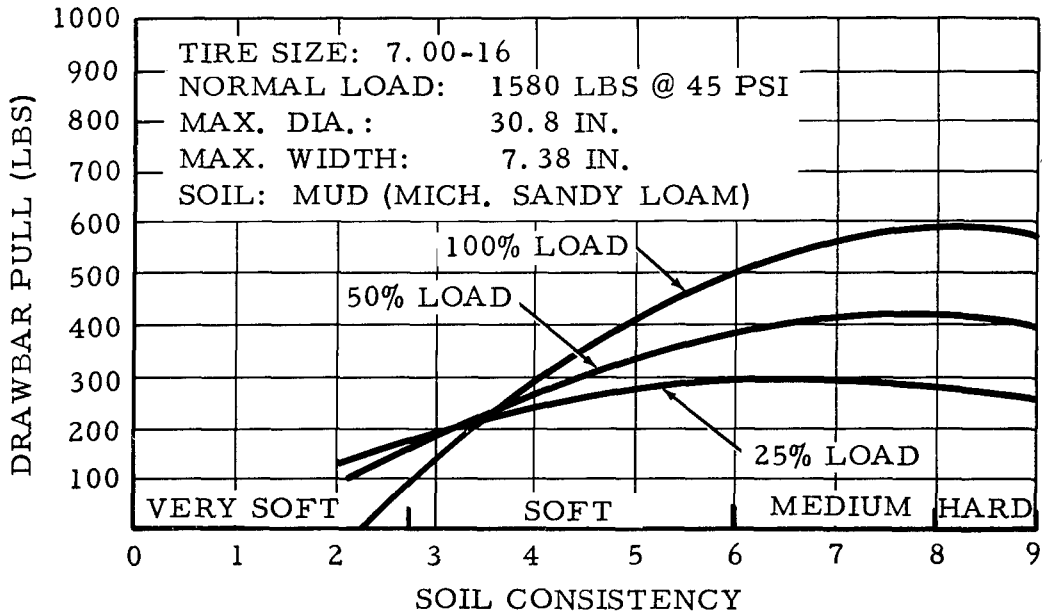

FIGURE B1. DRAWBAR PULL VS. SOIL CONSISTENCY, 7.00-16 TIRE

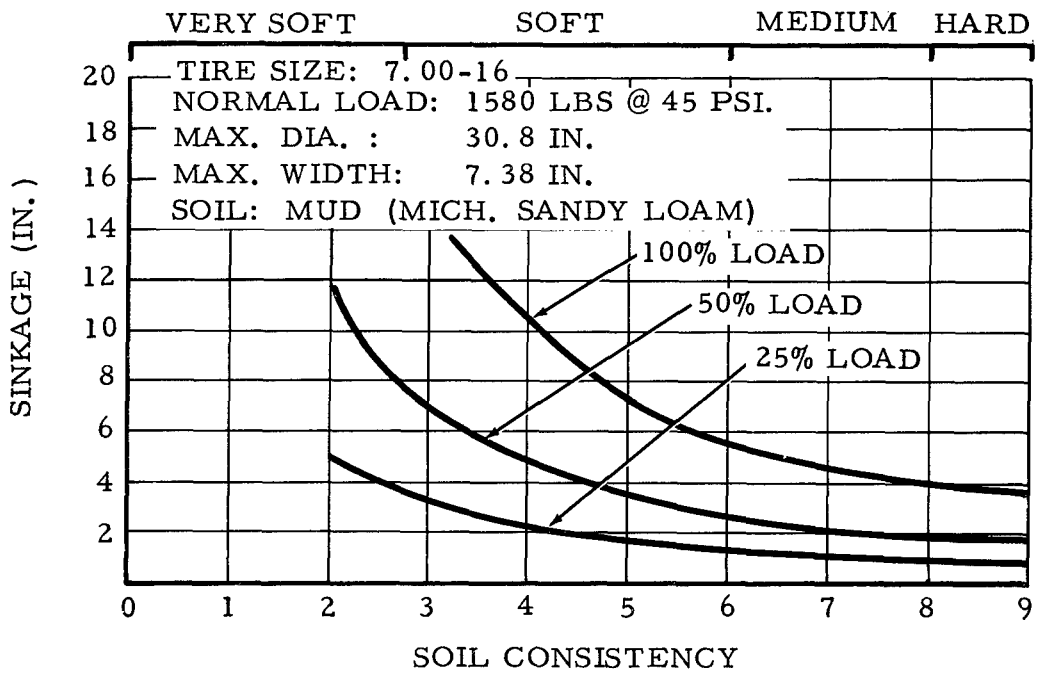

FIGURE B2. SINKAGE VS. SOIL CONSISTENCY, 7.00-16 TIRE

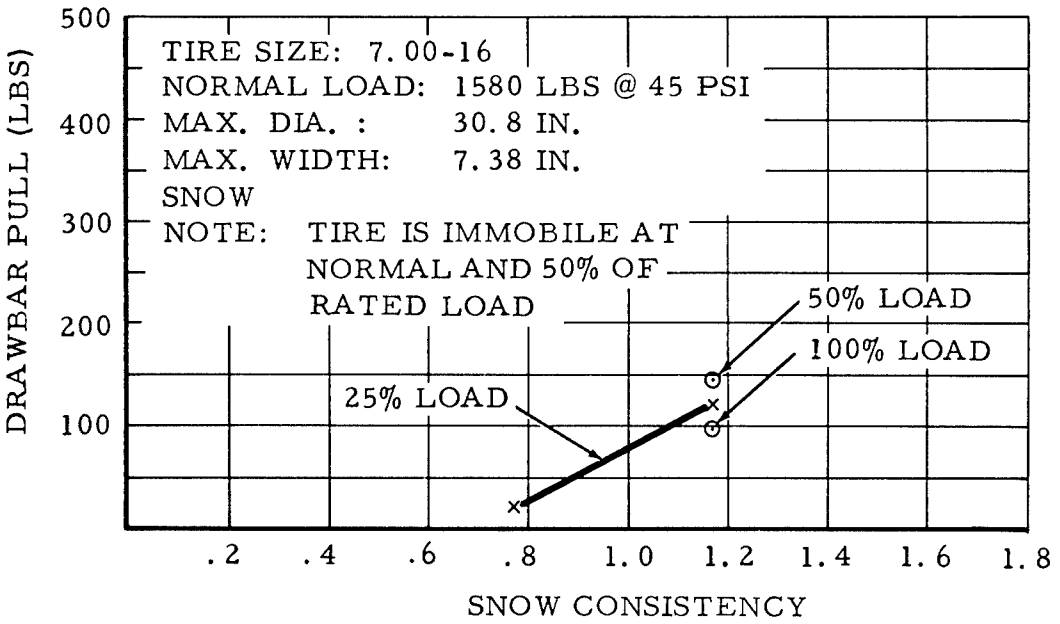

FIGURE B3. DRAWBAR PULL VS SNOW CONSISTENCY, 7.00-16 TIRE

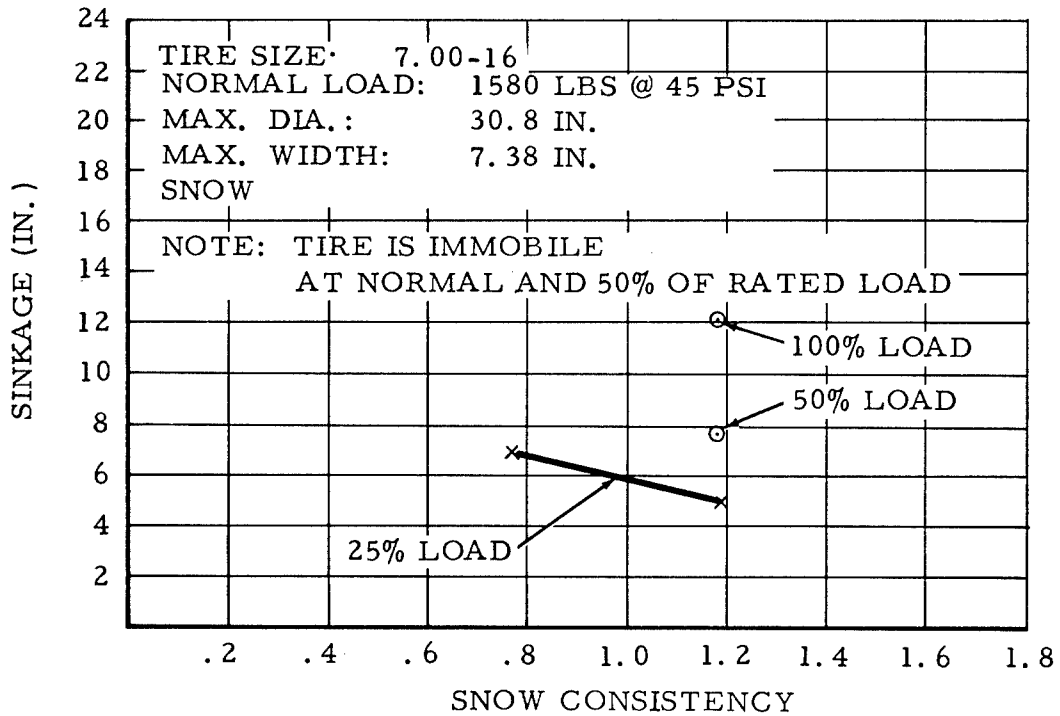

FIGURE B4. SINKAGE VS. SNOW CONSISTENCY, 7.00-16 TIRE

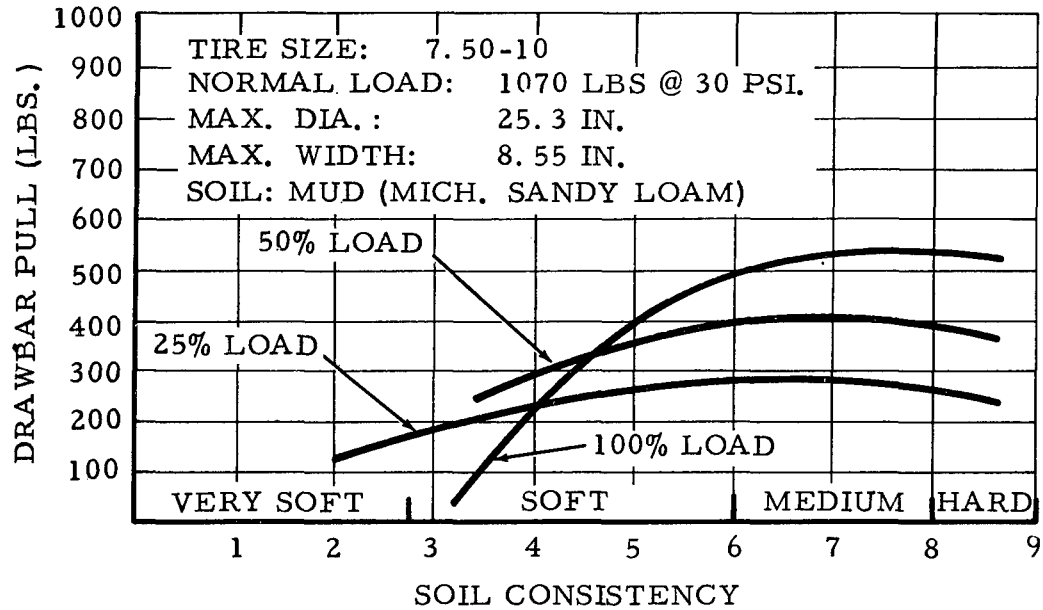

FIGURE B5. DRAWBAR PULL VS. SOIL CONSISTENCY, 7.50-10 TIRE

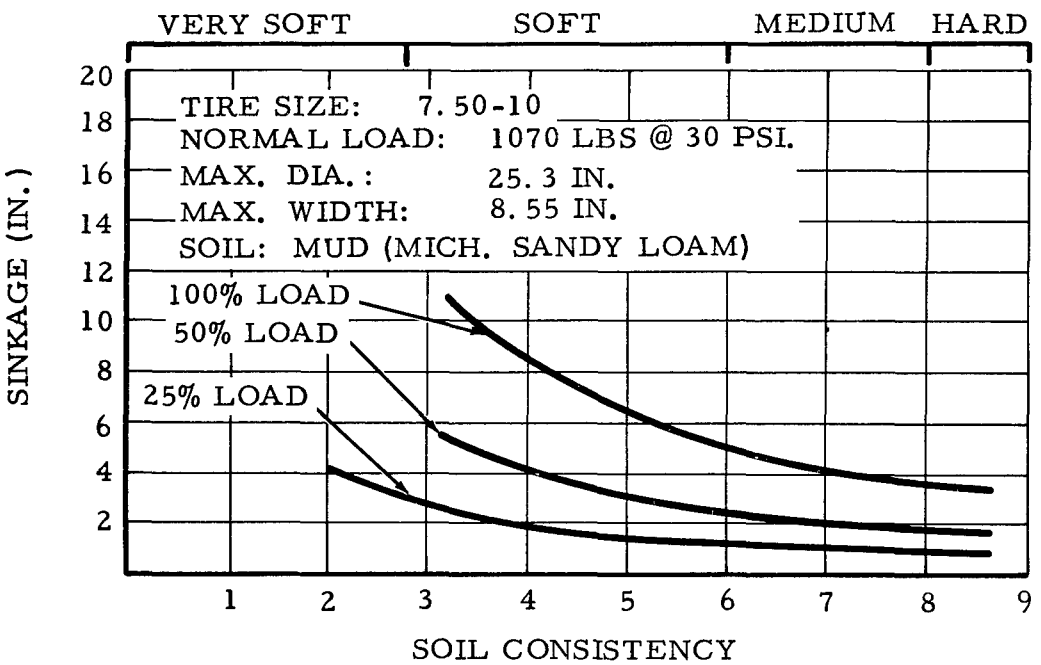

FIGURE B6. SINKAGE VS. SOIL CONSISTENCY, 7.50-10 TIRE

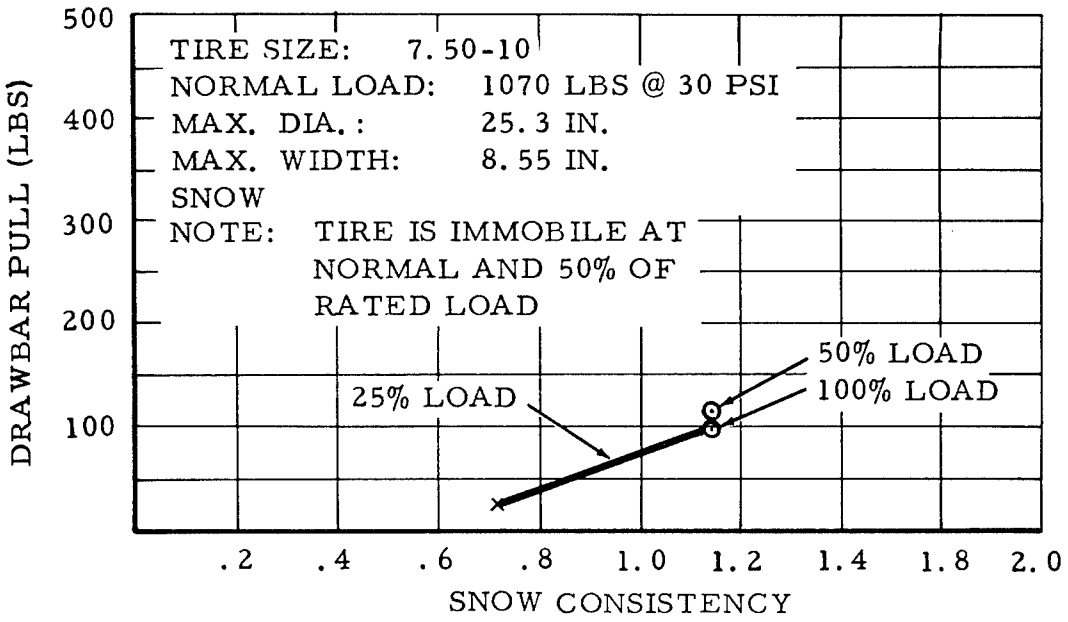

FIGURE B7. DRAWBAR PULL VS. SNOW CONSISTENCY, 7.50-10 TIRE

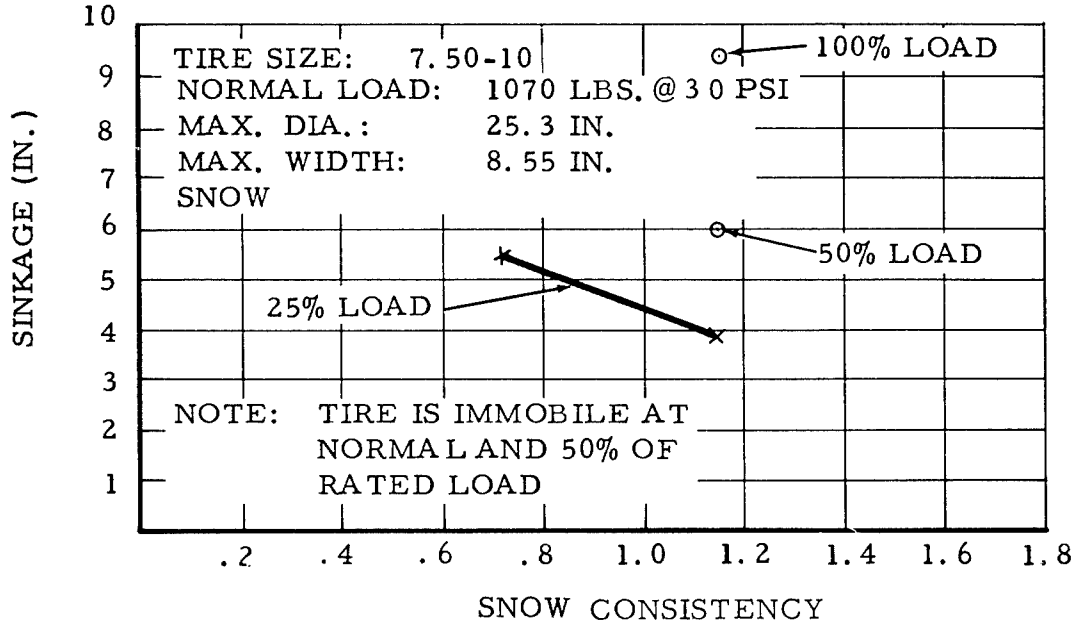

FIGURE B8. SINKAGE VS. SNOW CONSISTENCY, 7.50-10 TIRE

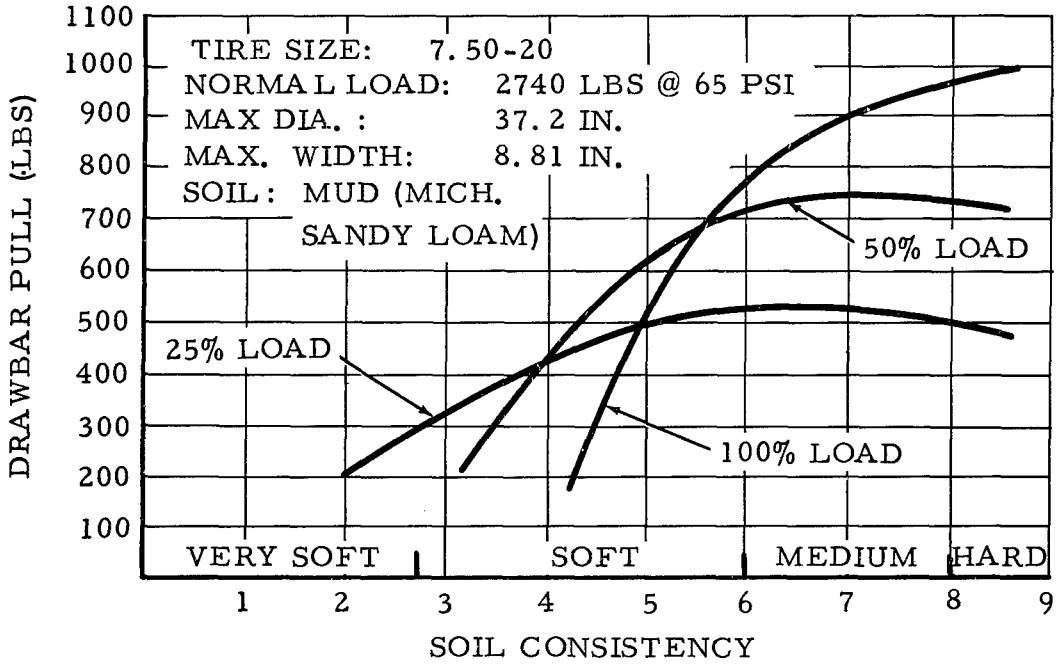

FIGURE B9. DRAWBAR PULL VS. SOIL CONSISTENCY, 7.50-20 TIRE

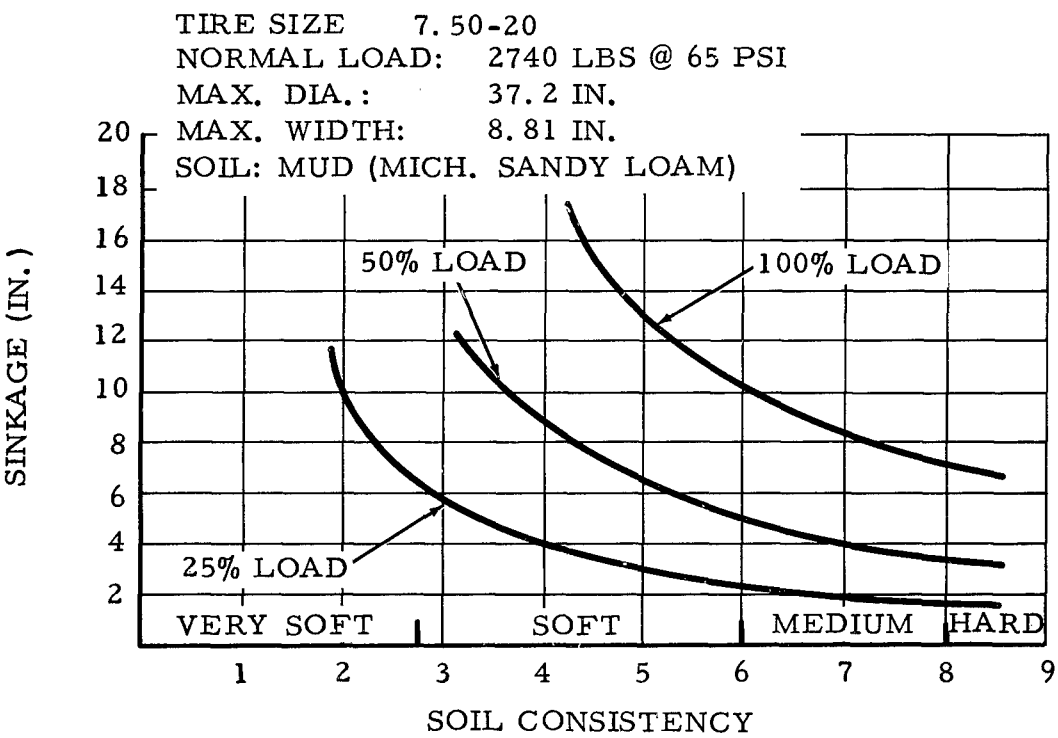

FIGURE B10. SINKAGE VS. SOIL CONSISTENCY, 7.50-20 TIRE

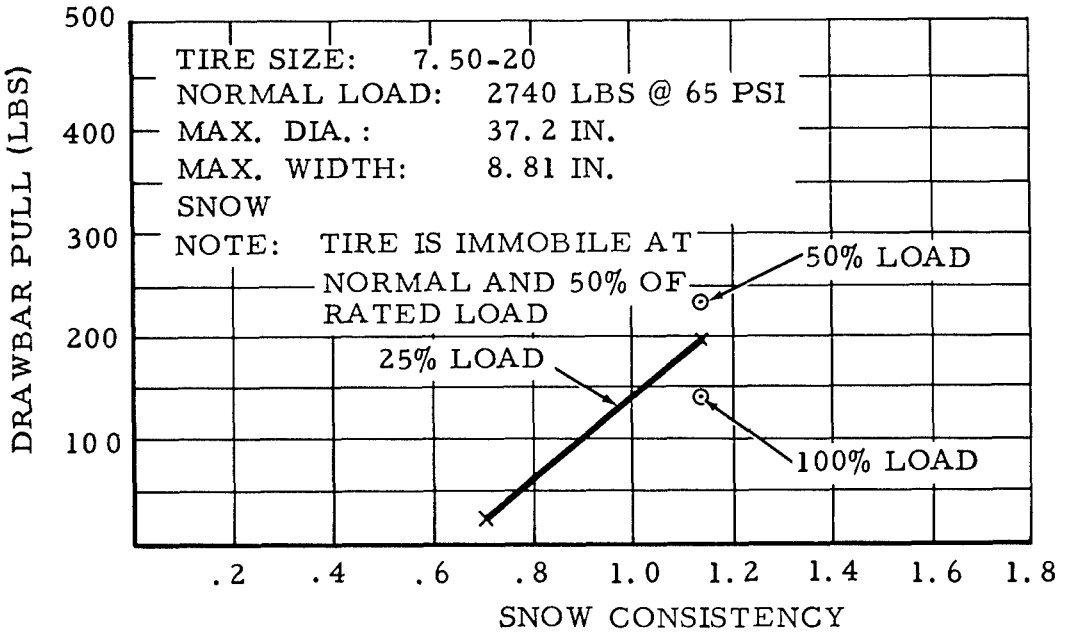

FIGURE B11. DRAWBAR PULL VS. SNOW CONSISTENCY, 7.50-20 TIRE

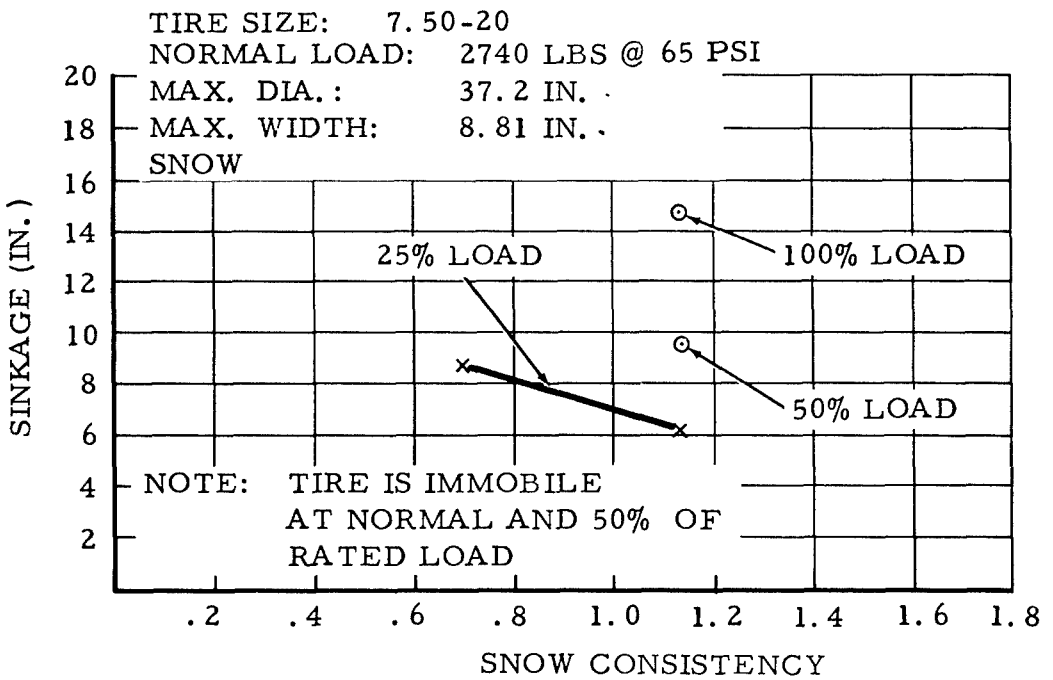

FIGURE B12. SINKAGE VS. SNOW CONSISTENCY, 7.50-20 TIRE

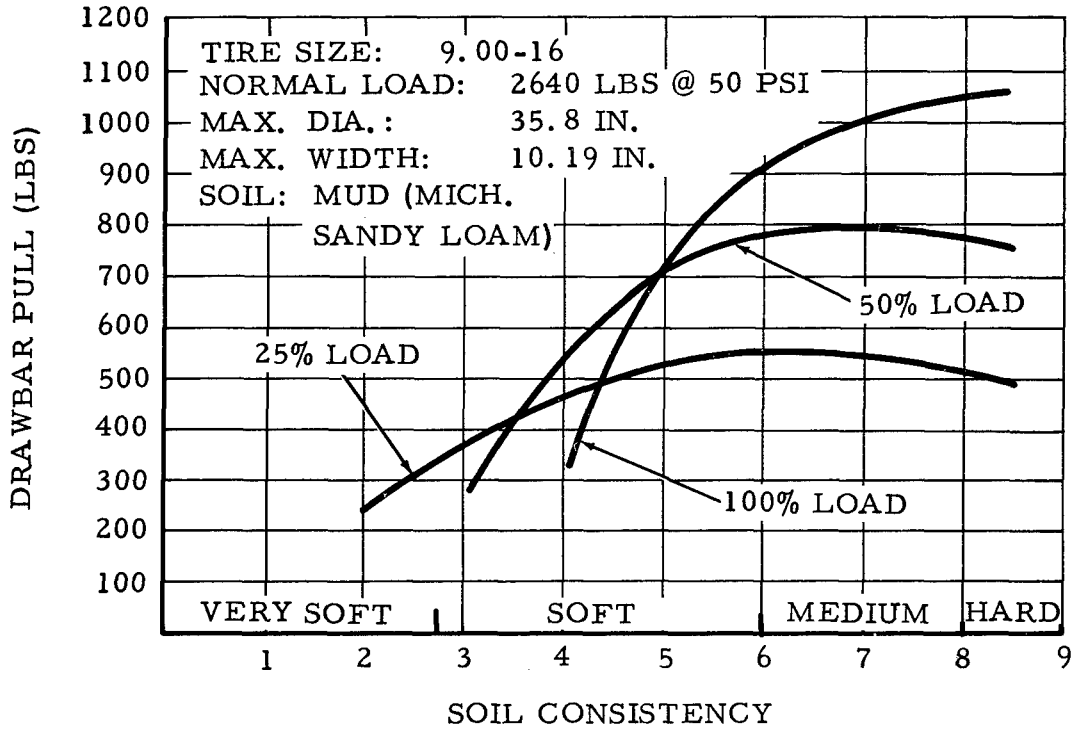

FIGURE B13. DRAWBAR PULL VS. SOIL CONSISTENCY, 9.00-16 TIRE

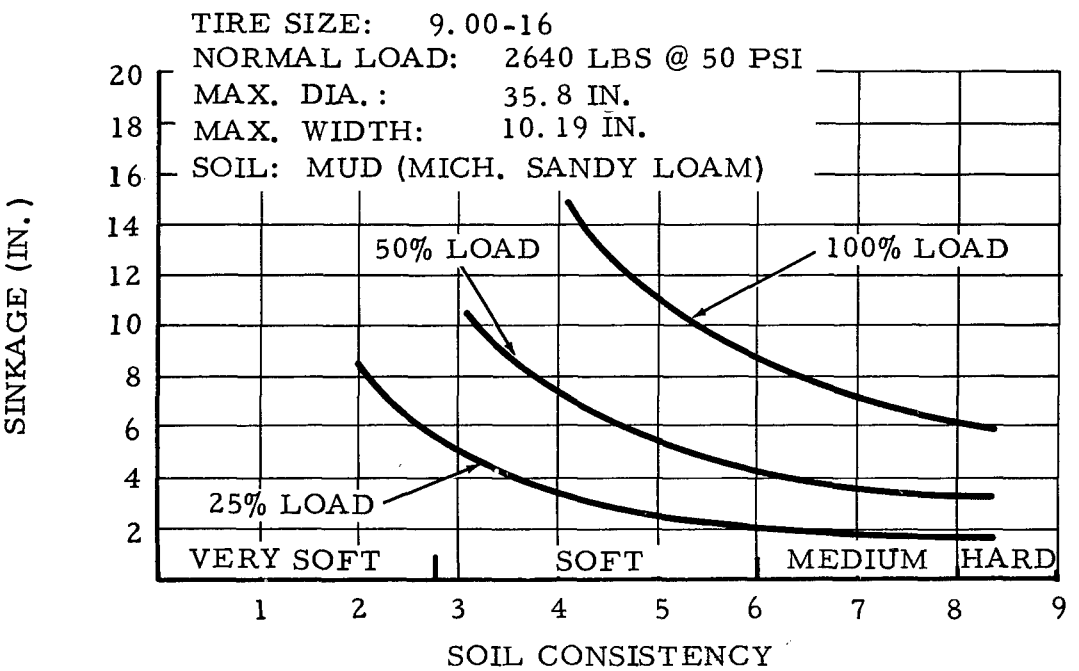

FIGURE B14. SINKAGE VS. SOIL CONSISTENCY, 9.00-16 TIRE

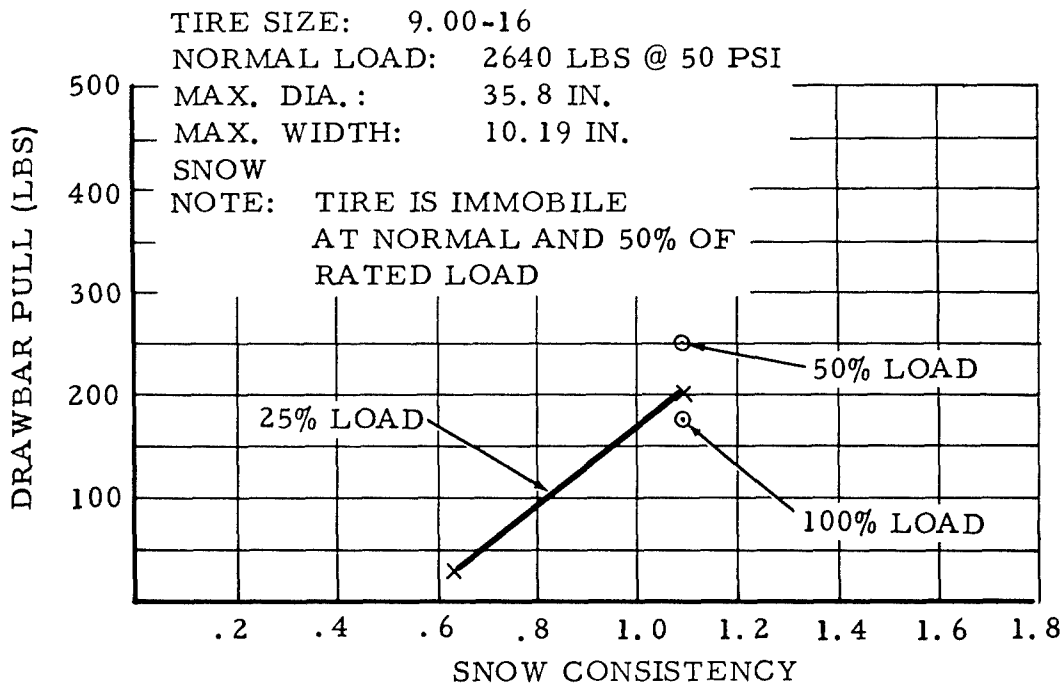

FIGURE B15. DRAWBAR PULL VS. SNOW CONSISTENCY, 9.00-16 TIRE

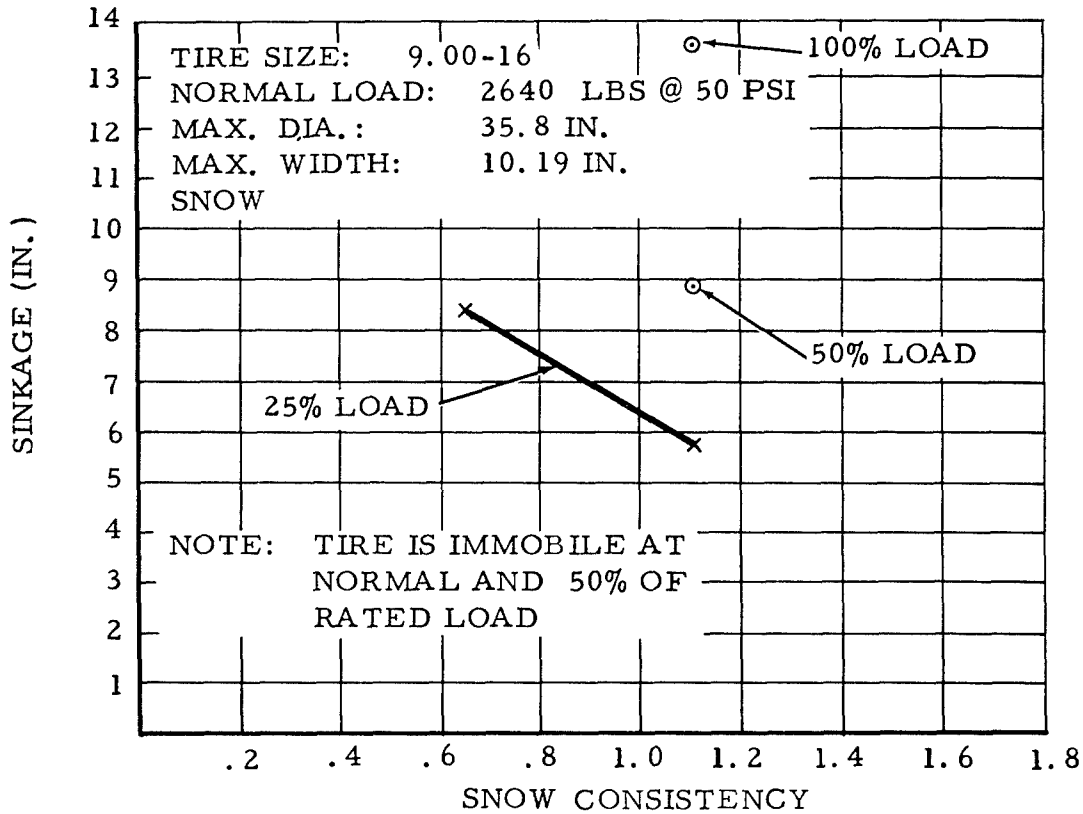

FIGURE B16. SINKAGE VS. SNOW CONSISTENCY, 9.00-16 TIRE

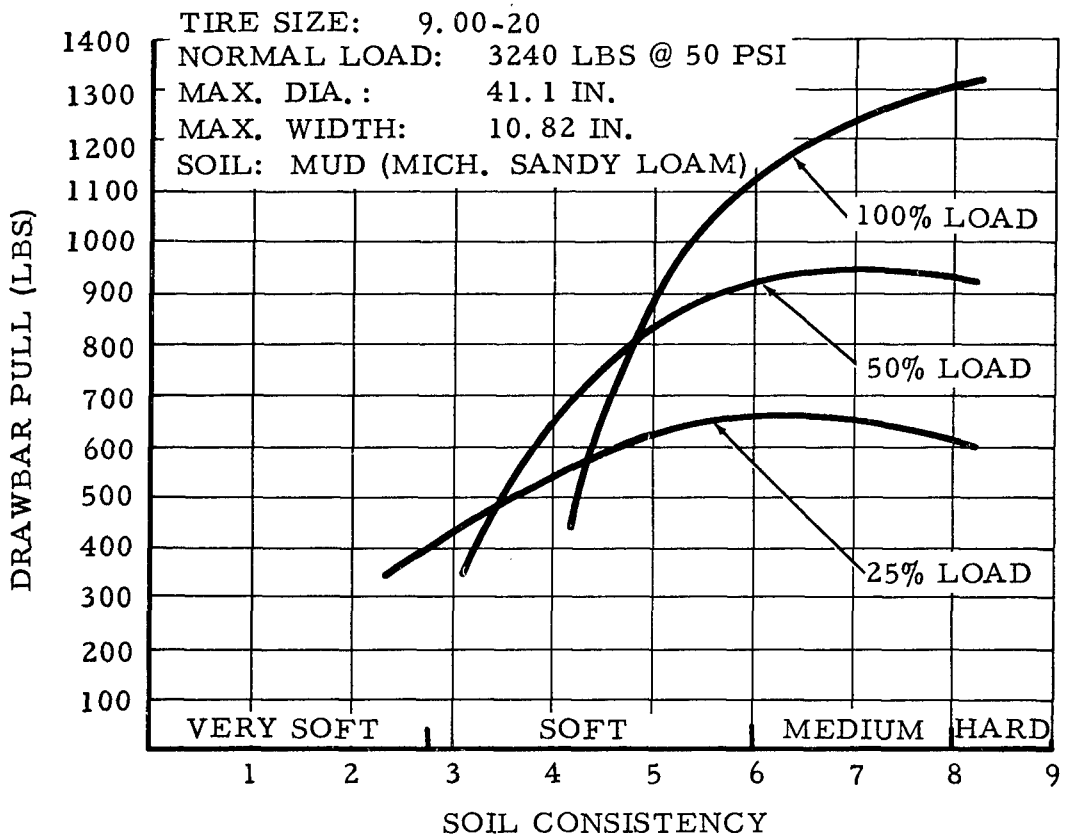

FIGURE B17. DRAWBAR PULL VS. SOIL CONSISTENCY, 9.00-20 TIRE

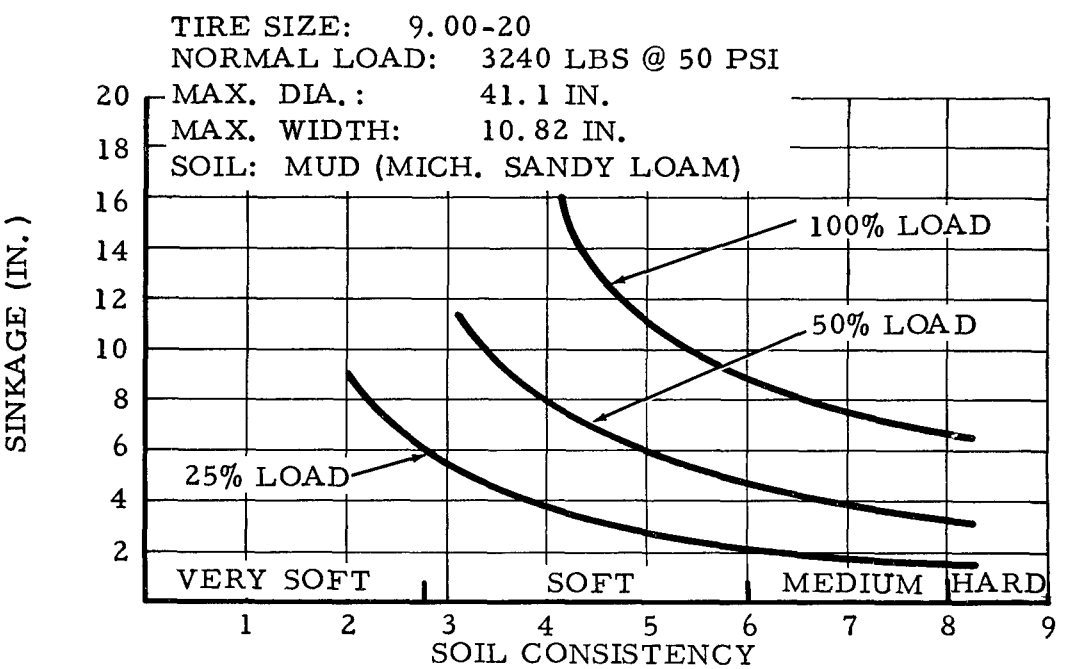

FIGURE B18. SINKAGE VS. SOIL CONSISTENCY, 9.00-20 TIRE

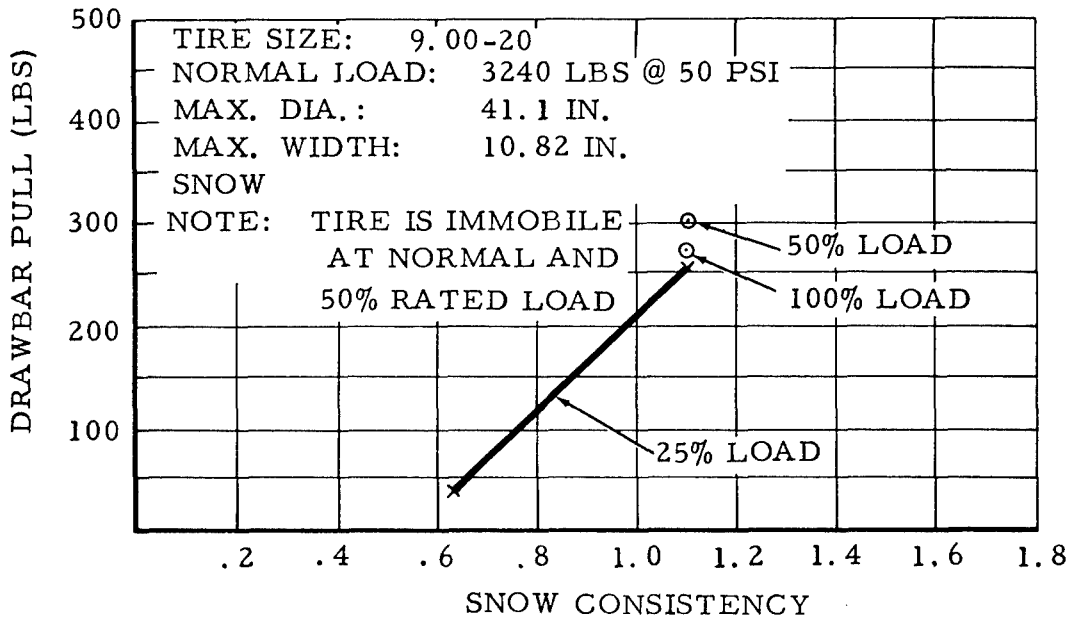

FIGURE B19. DRAWBAR PULL VS. SNOW CONSISTENCY, 9.00-20 TIRE

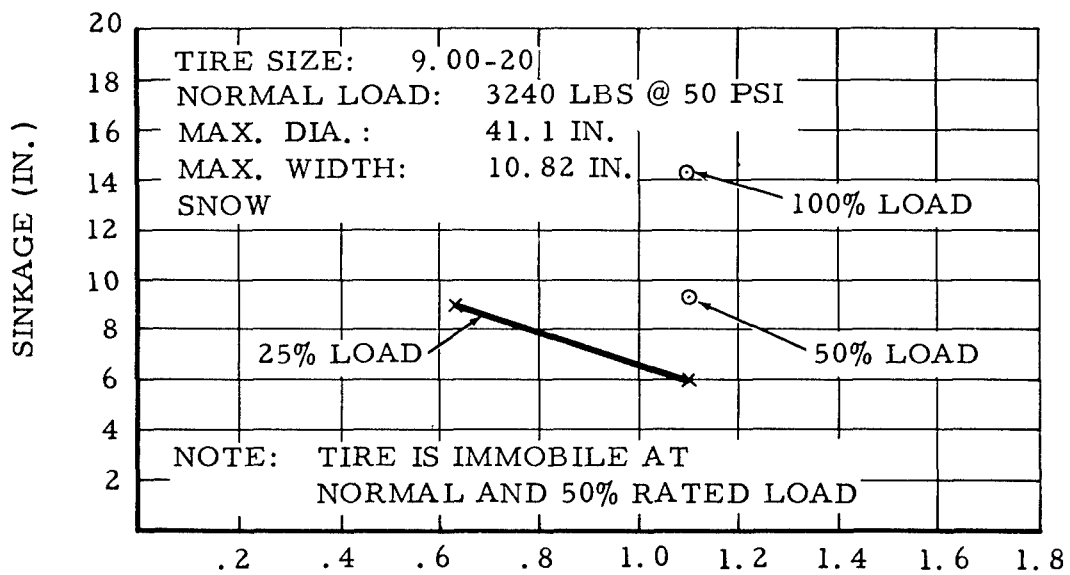

FIGURE B20. SINKAGE VS. SNOW CONSISTENCY, 9.00-20 TIRE

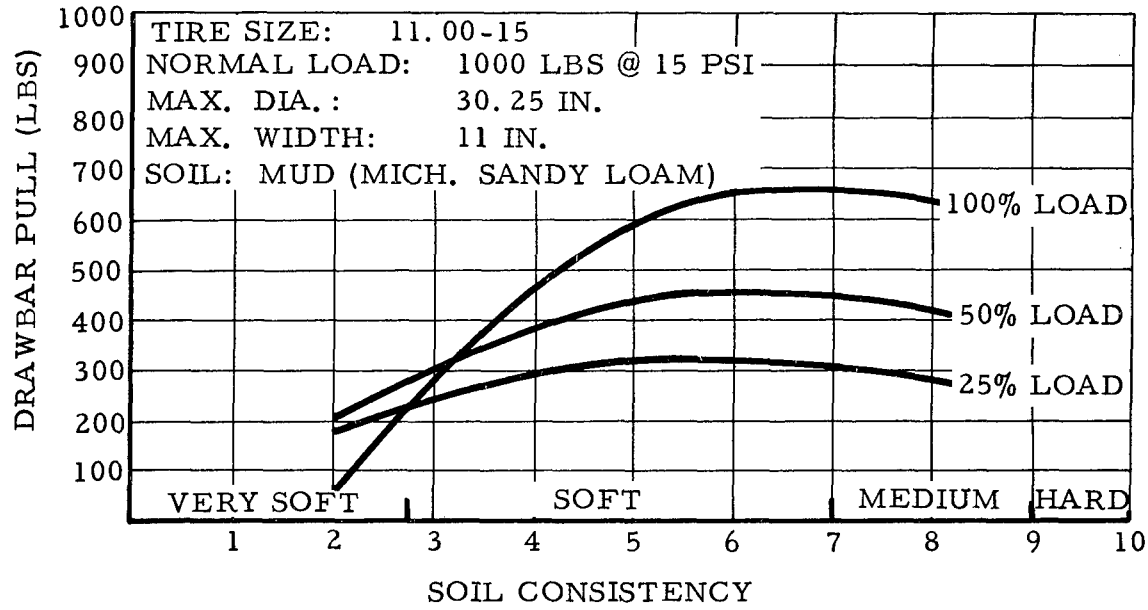

FIGURE B21. DRAWBAR PULL VS. SOIL CONSISTENCY, 11.00-15 TIRE

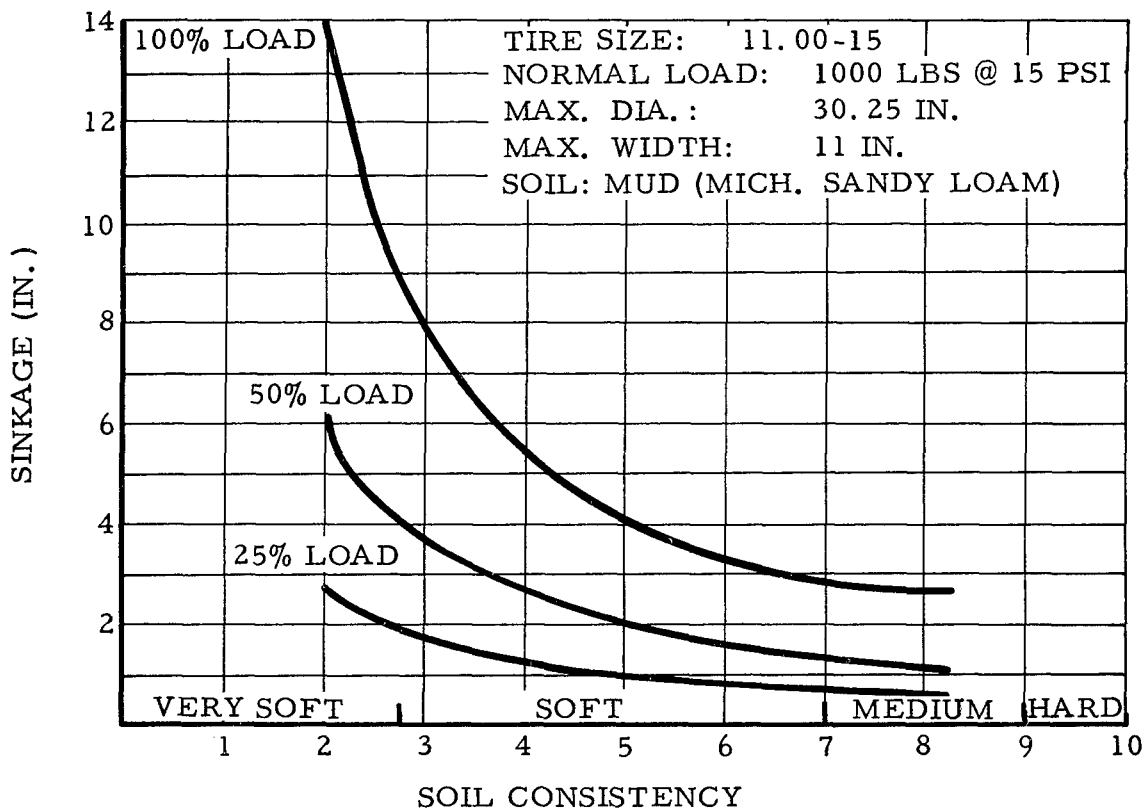

FIGURE B22. SINKAGE VS. SOIL CONSISTENCY, 11.00-15 TIRE

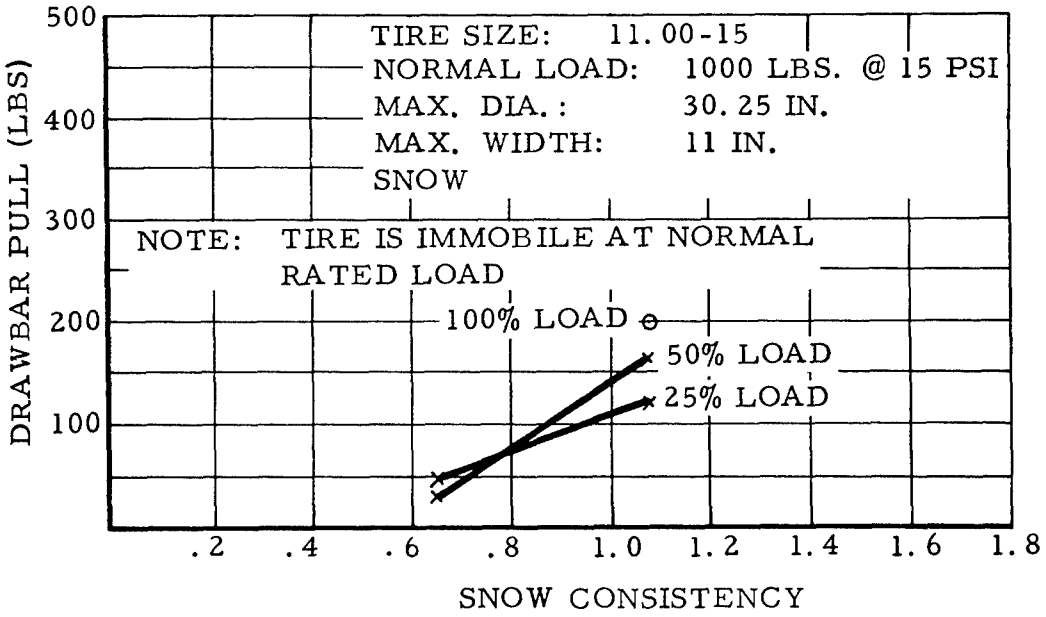

FIGURE B23. DRAWBAR PULL VS. SNOW CONSISTENCY, 11.00-15 TIRE

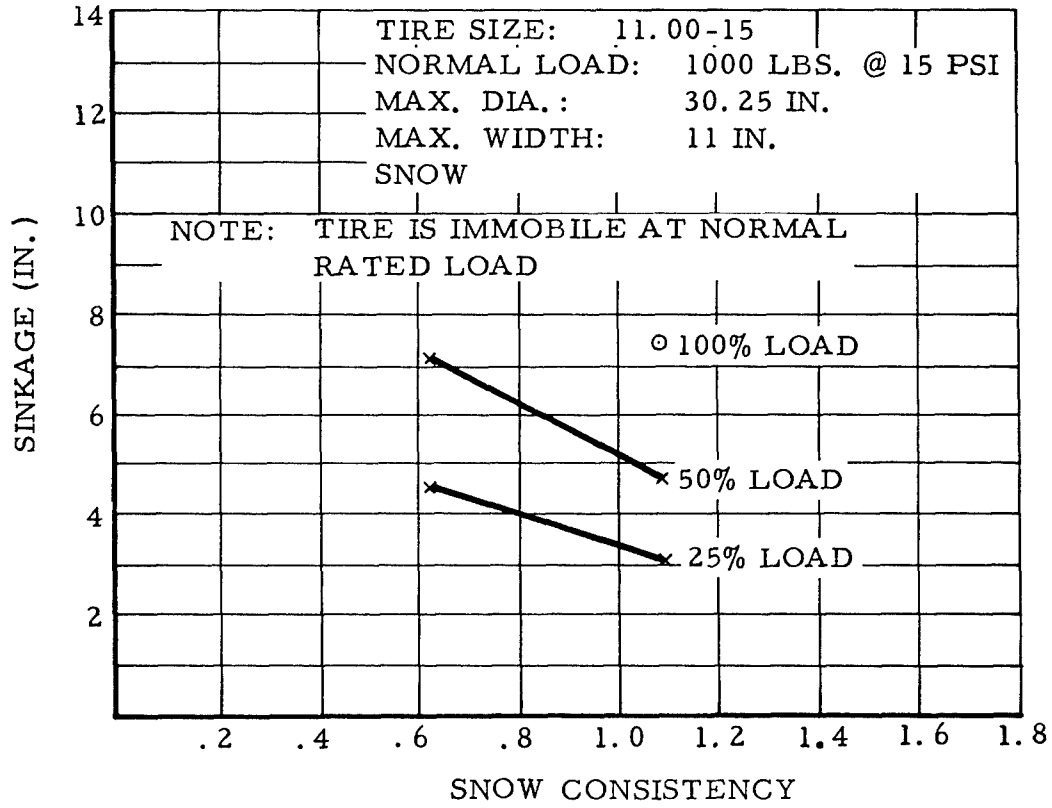

FIGURE B24. SINKAGE VS. SNOW CONSISTENCY, 11.00-15 TIRE

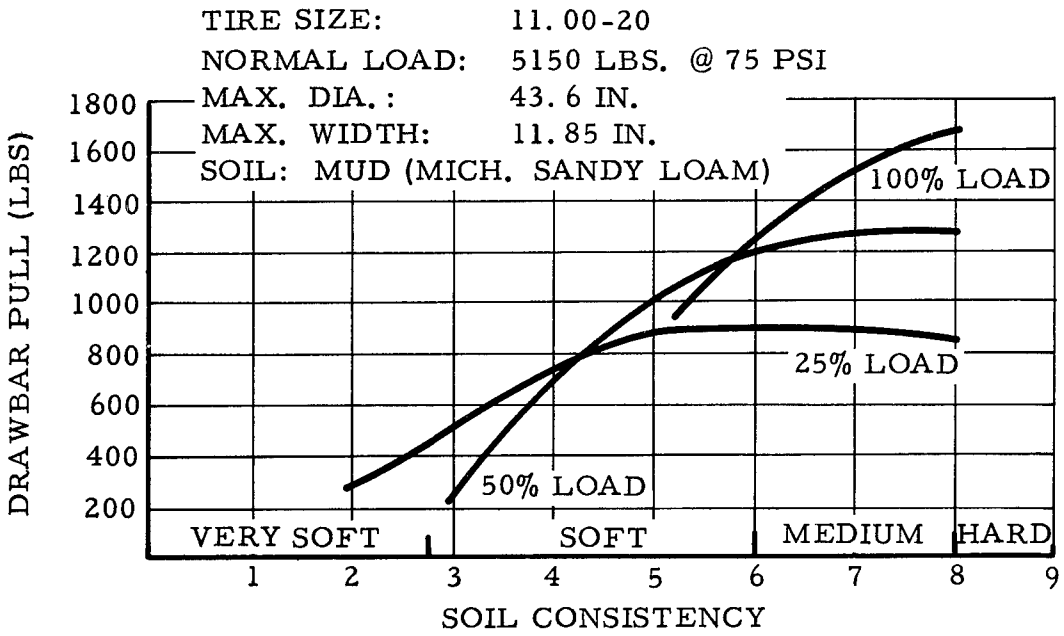

FIGURE B25. DRAWBAR PULL VS. SOIL CONSISTENCY, 11.00-20 TIRE

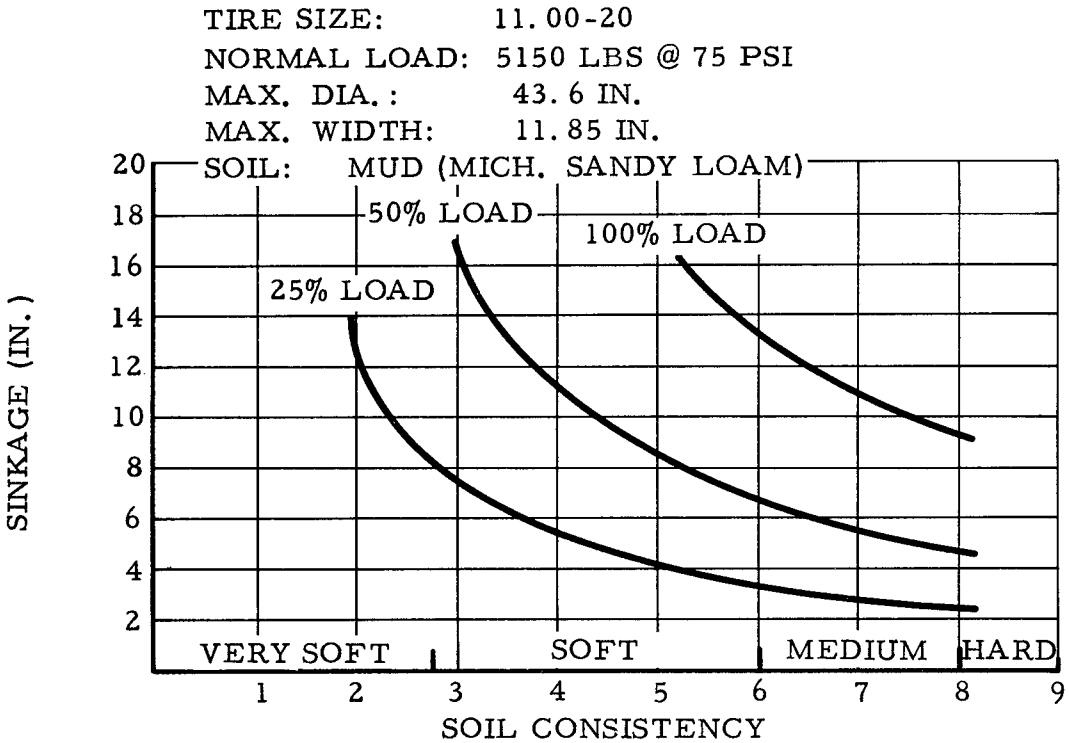

FIGURE B26. SINKAGE VS. SOIL CONSISTENCY, 11.00-20 TIRE

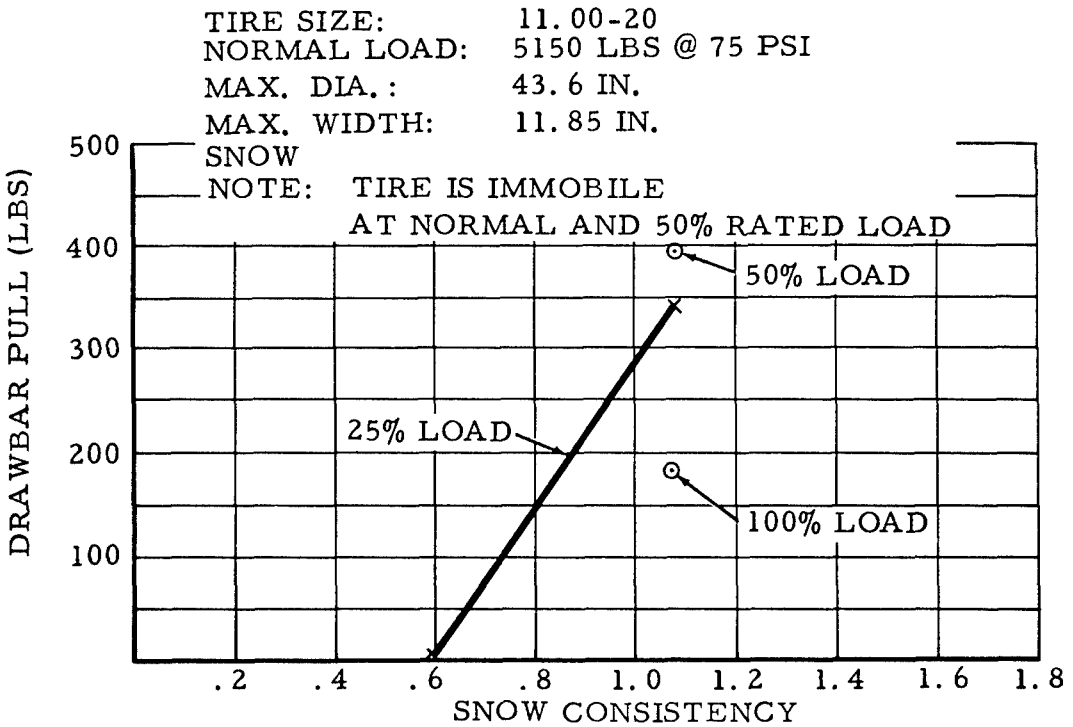

FIGURE B27. DRAWBAR PULL VS. SNOW CONSISTENCY, 11-00-20 TIRE

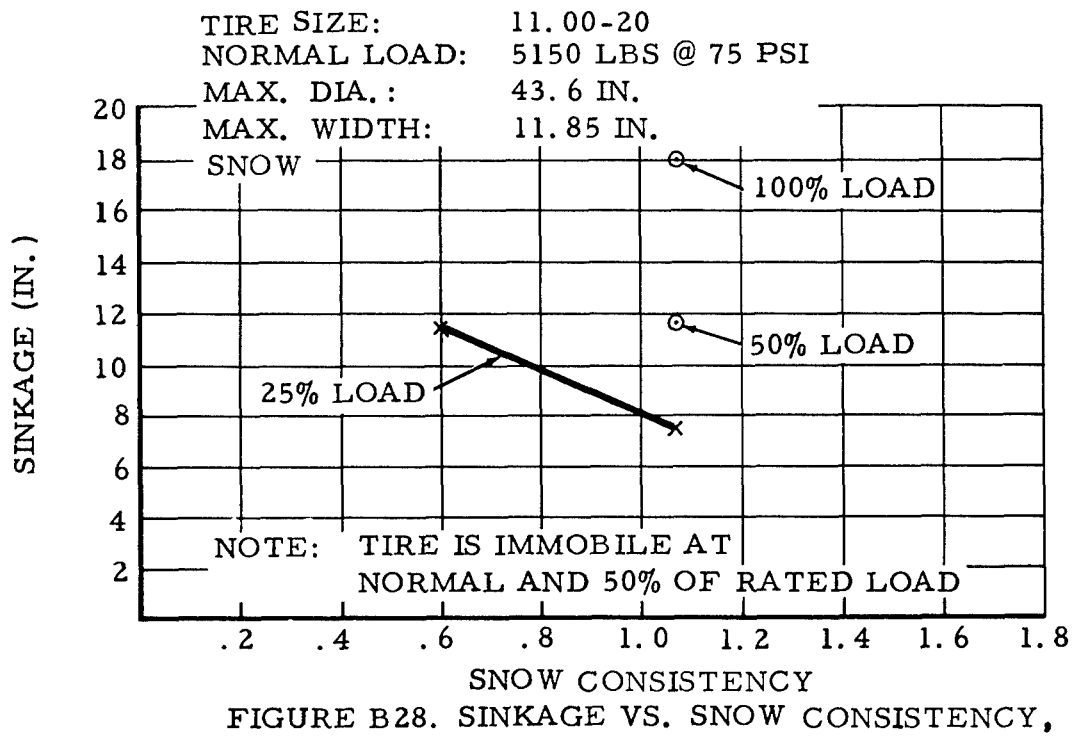

FIGURE B28. SINKAGE VS. SNOW CONSISTENCY, 11.00-20 TIRE

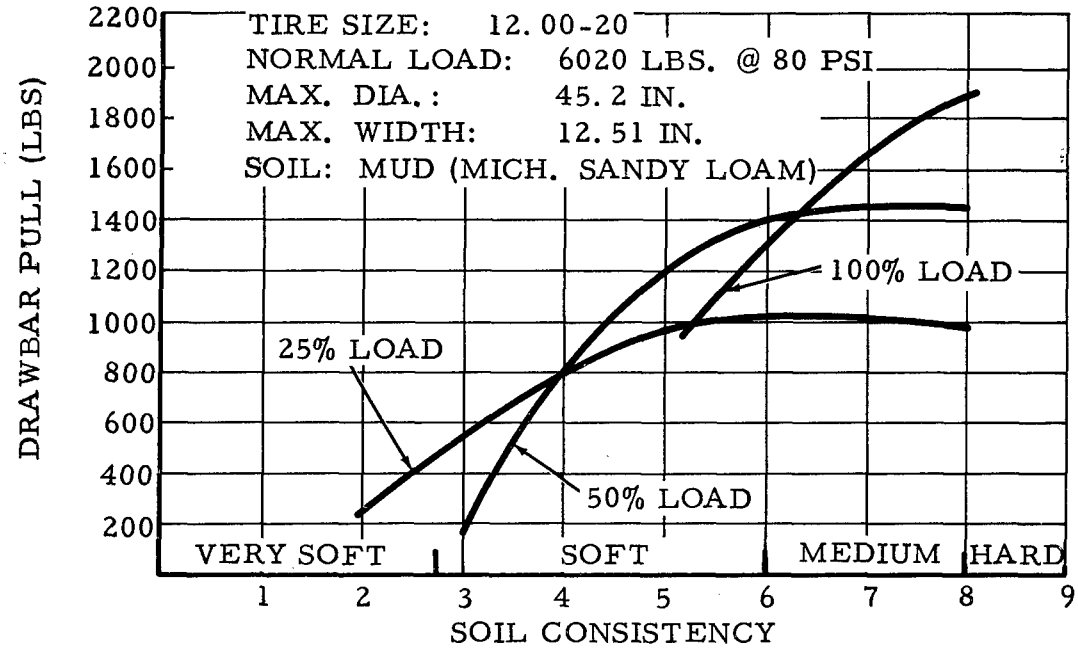

FIGURE B29. DRAWBAR PULL VS. SOIL CONSISTENCY, 12.00-20 TIRE

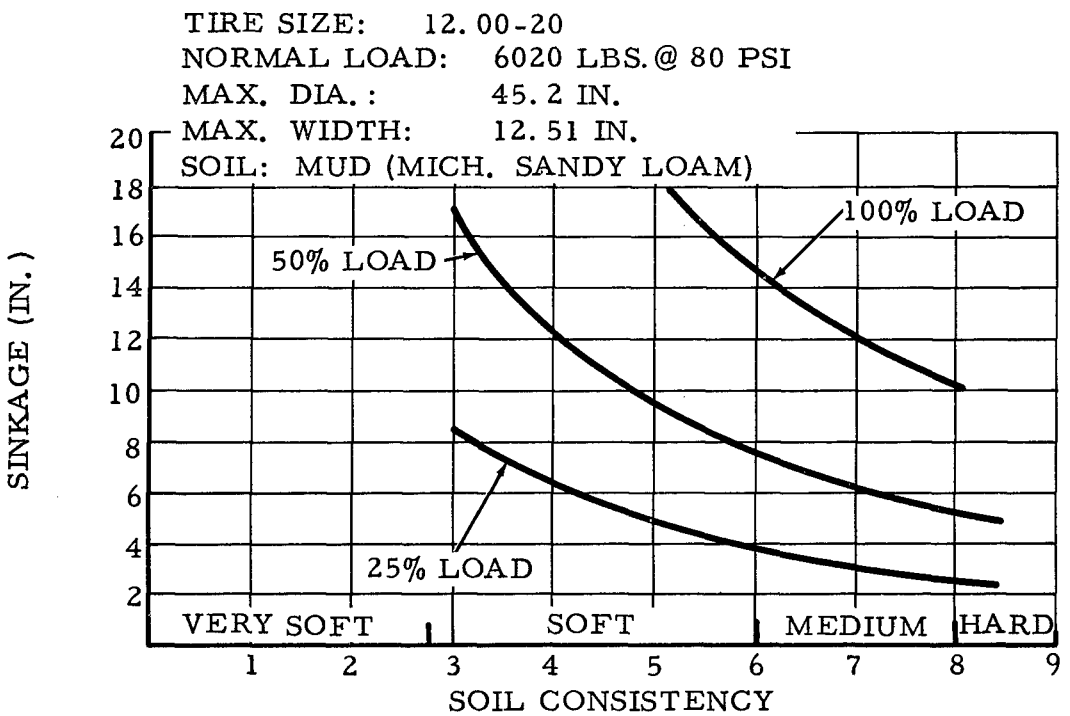

FIGURE B30. SINKAGE VS. SOIL CONSISTENCY, 12.00-20 TIRE

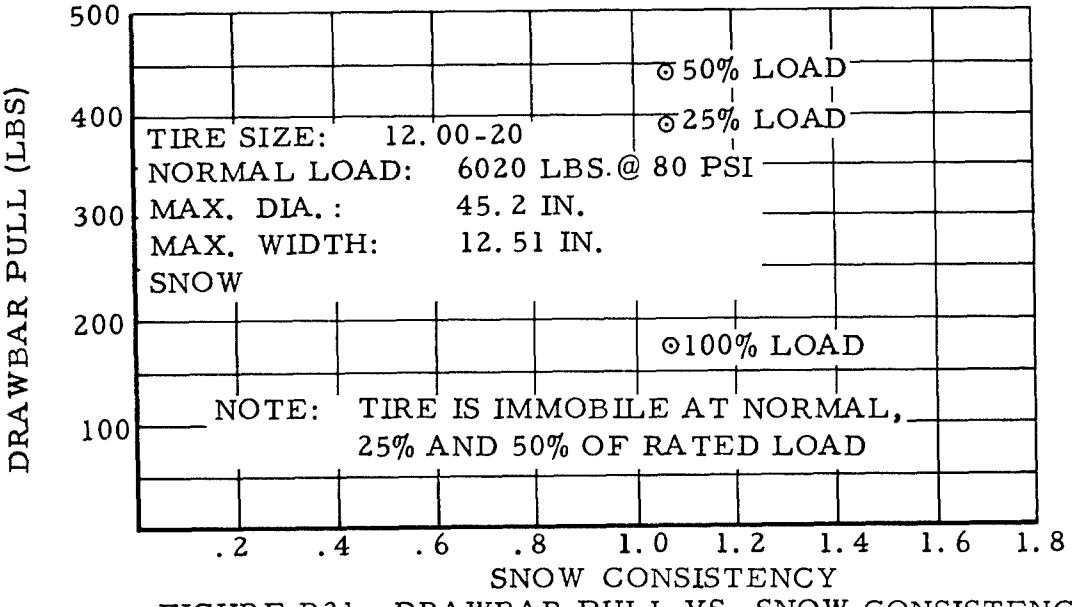

FIGURE B31. DRAWBAR PULL VS. SNOW CONSISTENCY, 12.00-20 TIRE

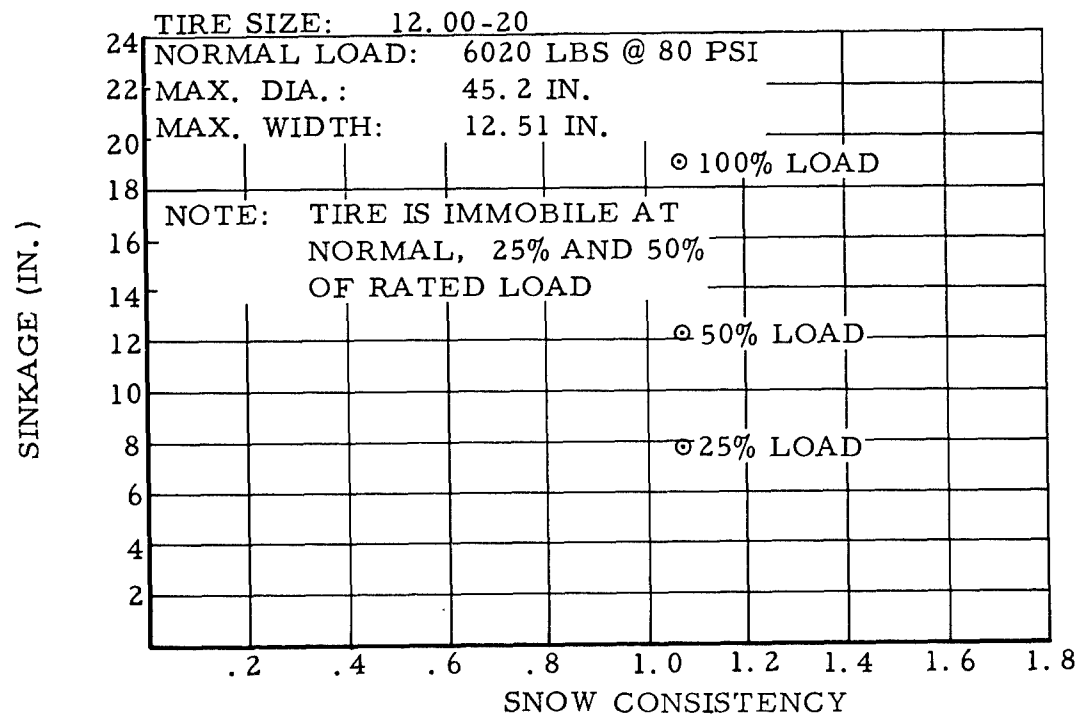

FIGURE B32. SINKAGE VS. SNOW CONSISTENCY, 12.00-20 TIRE

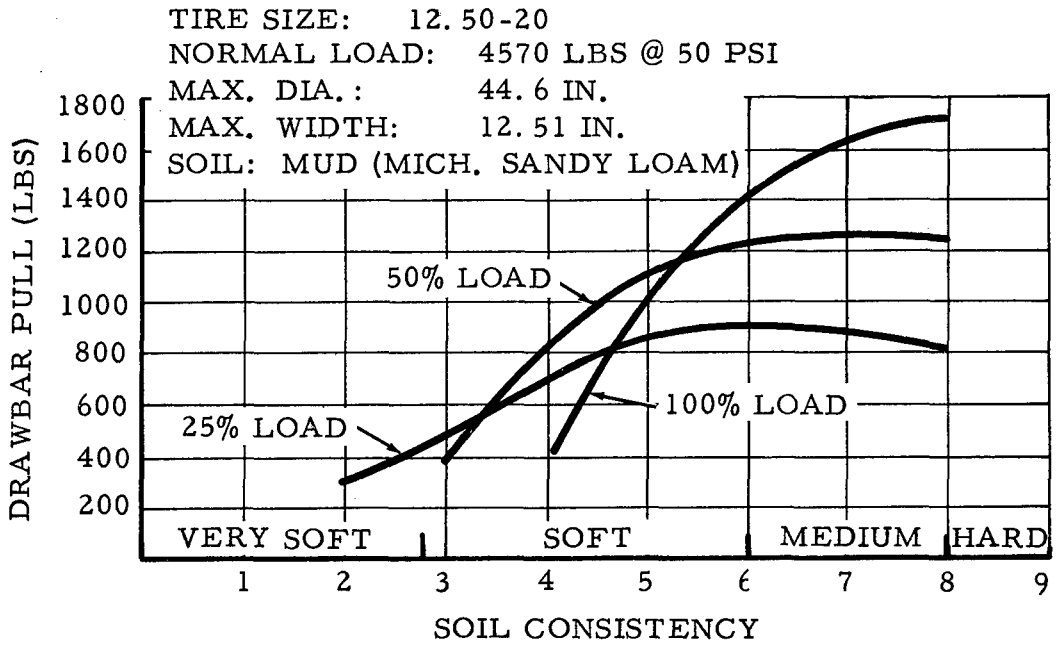

FIGURE B33. DRAWBAR PULL VS. SOIL CONSISTENCY, 12.50-20 TIRE

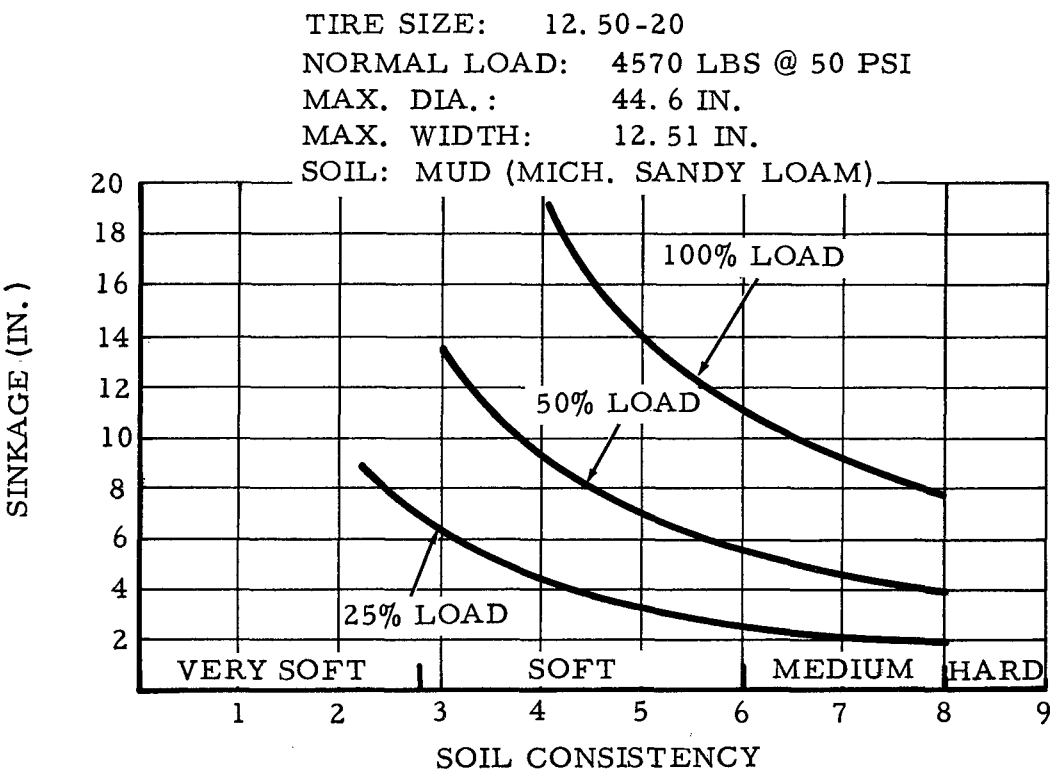

FIGURE B34. SINKAGE VS. SOIL CONSISTENCY, 12.50-20 TIRE

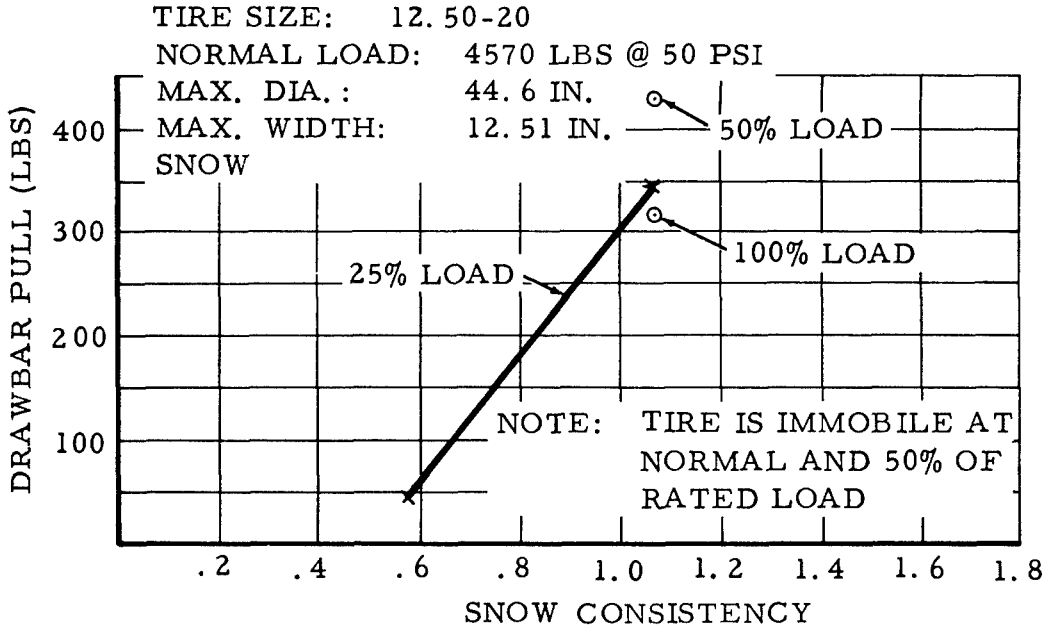

FIGURE B35. DRAWBAR PULL VS. SNOW CONSISTENCY, 12.50-20 TIRE

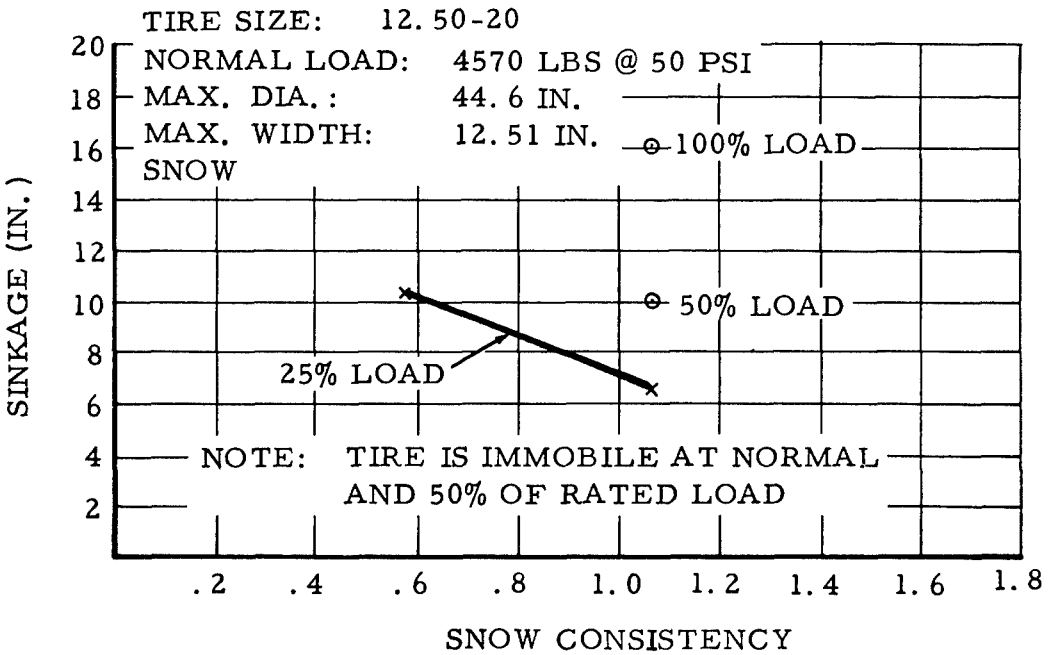

FIGURE B36. SINKAGE VS. SNOW CONSISTENCY, 12.50-20 TIRE

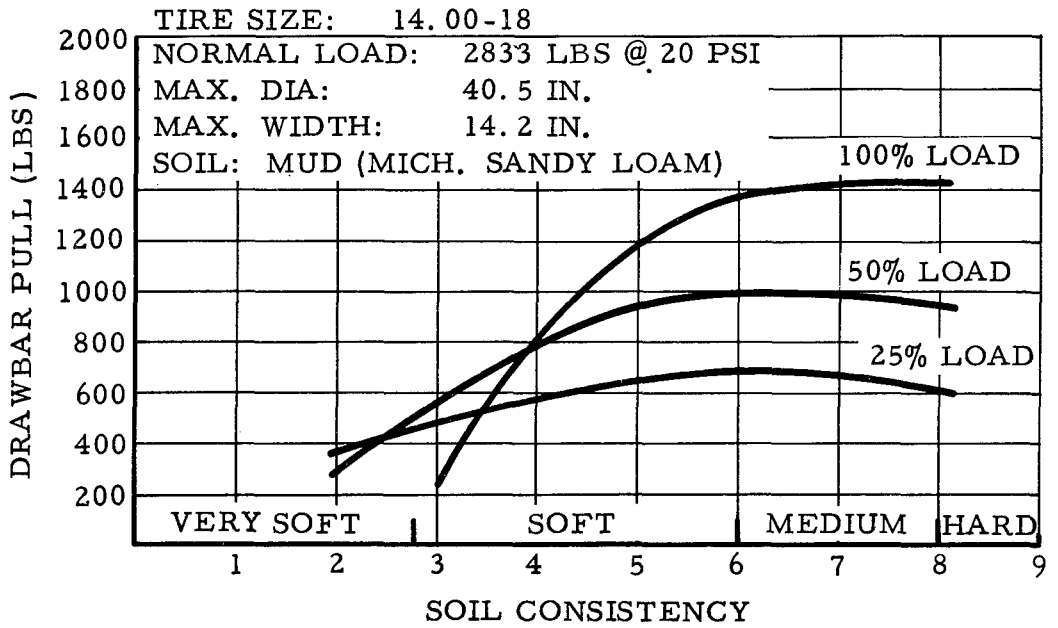

FIGURE B37. DRAWBAR PULL VS. SOIL CONSISTENCY, 14.00-18 TIRE

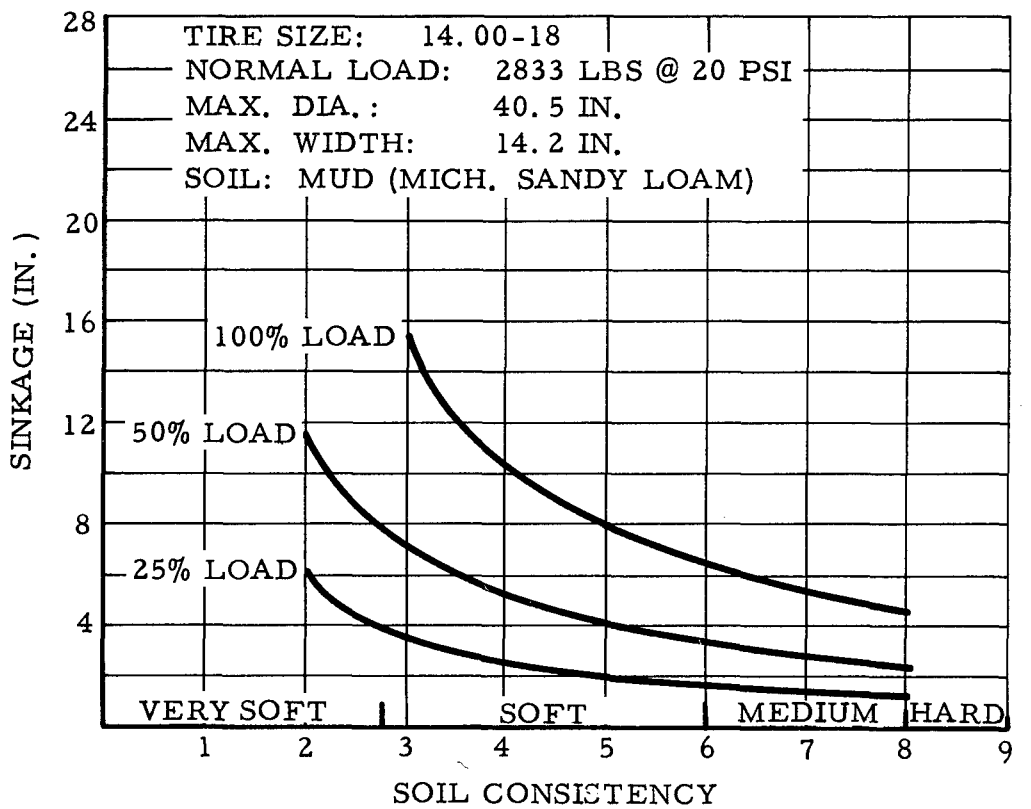

FIGURE B38. SINKAGE VS. SOIL CONSISTENCY, 14.00-18 TIRE

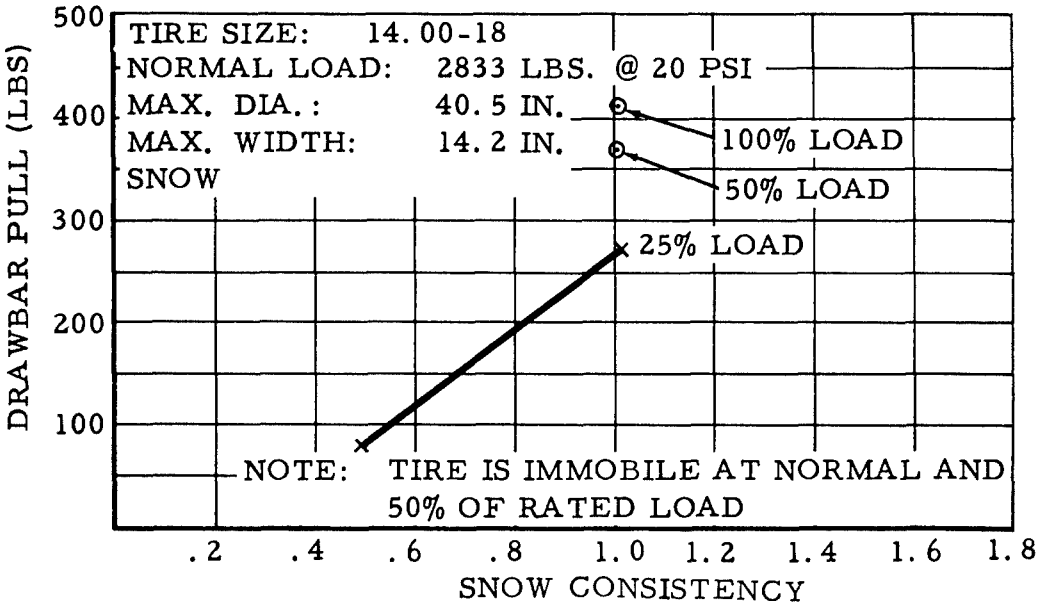

FIGURE B39. DRAWBAR PULL VS. SNOW CONSISTENCY, 14.00-18 TIRE

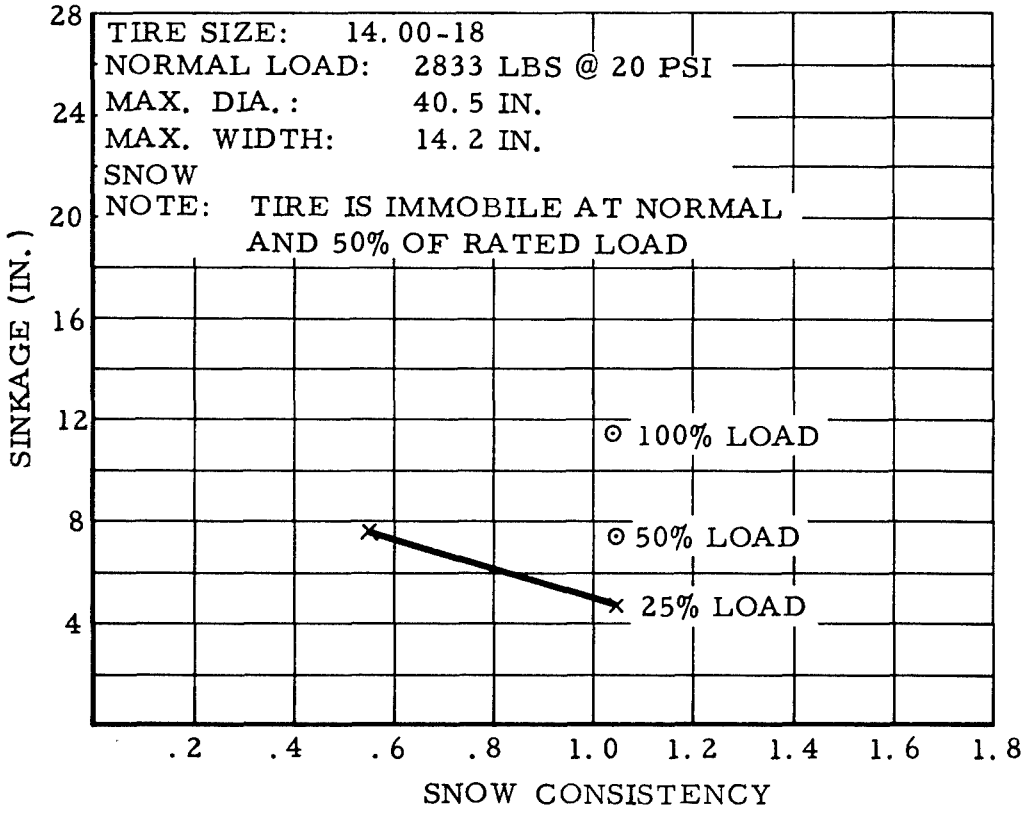

FIGURE B40. SINKAGE VS. SNOW CONSISTENCY, 14.00-18 TIRE

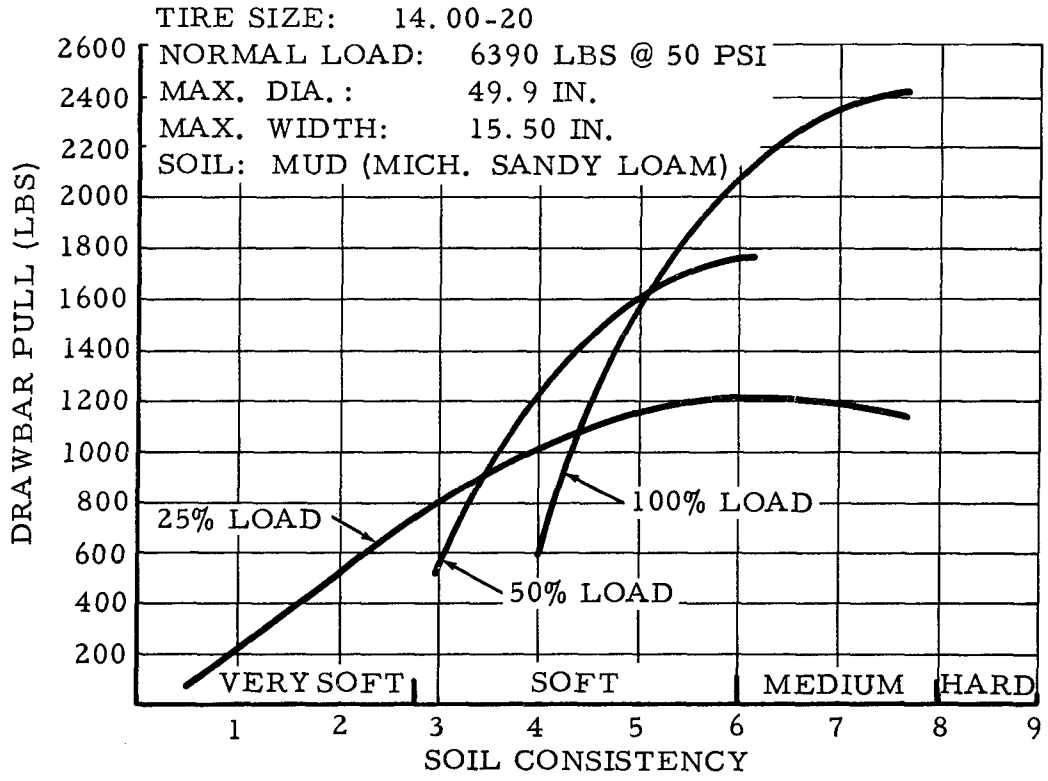

FIGURE B41. DRAWBAR PULL VS. SOIL CONSISTENCY, 14.00-20 TIRE

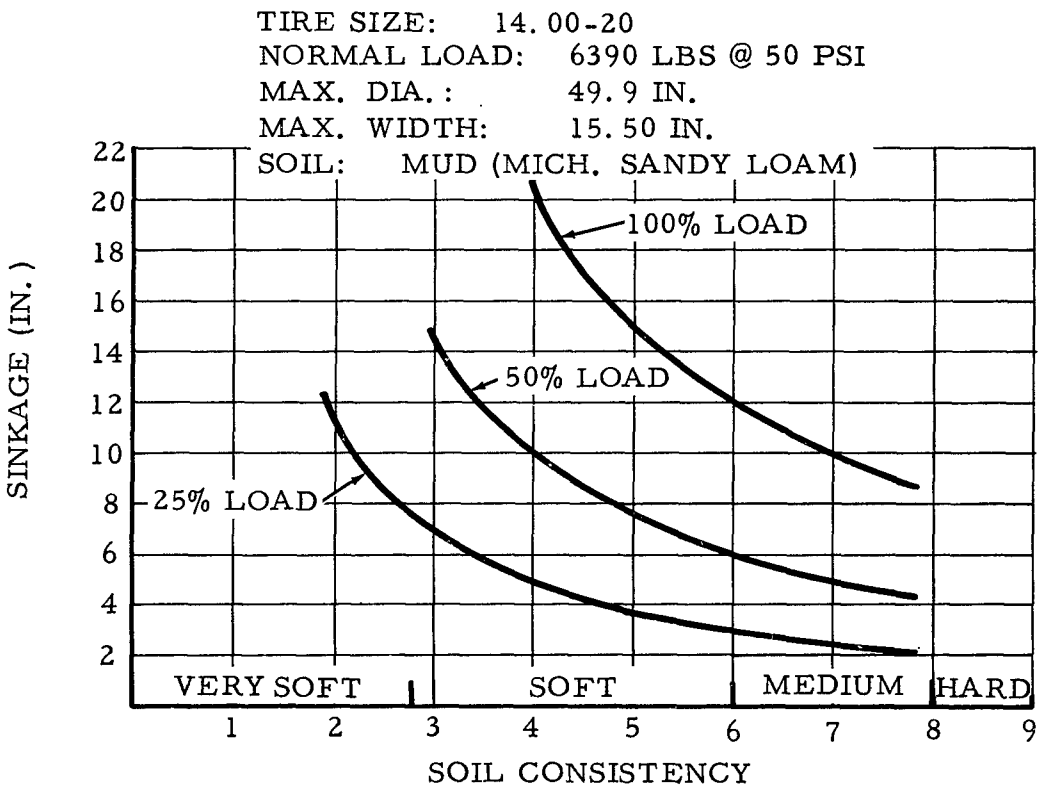

FIGURE B42. SINKAGE VS. SOIL CONSISTENCY, 14.00-20 TIRE

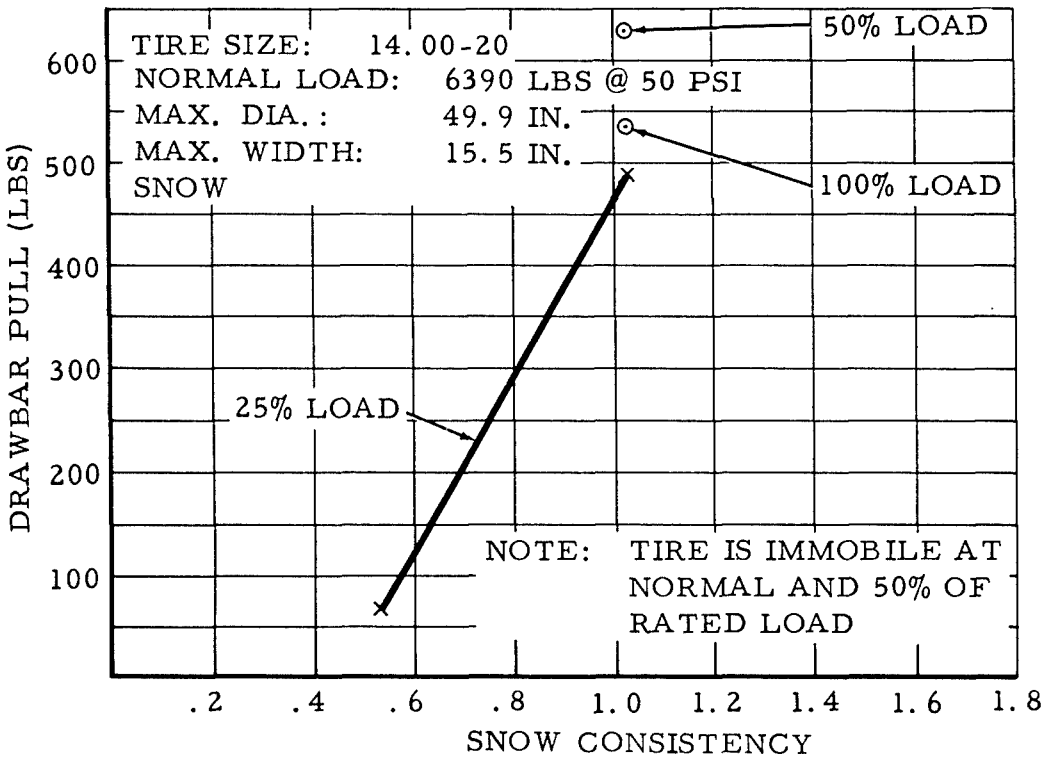

FIGURE B43. DRAWBAR PULL VS. SNOW CONSISTENCY, 14.00-20 TIRE

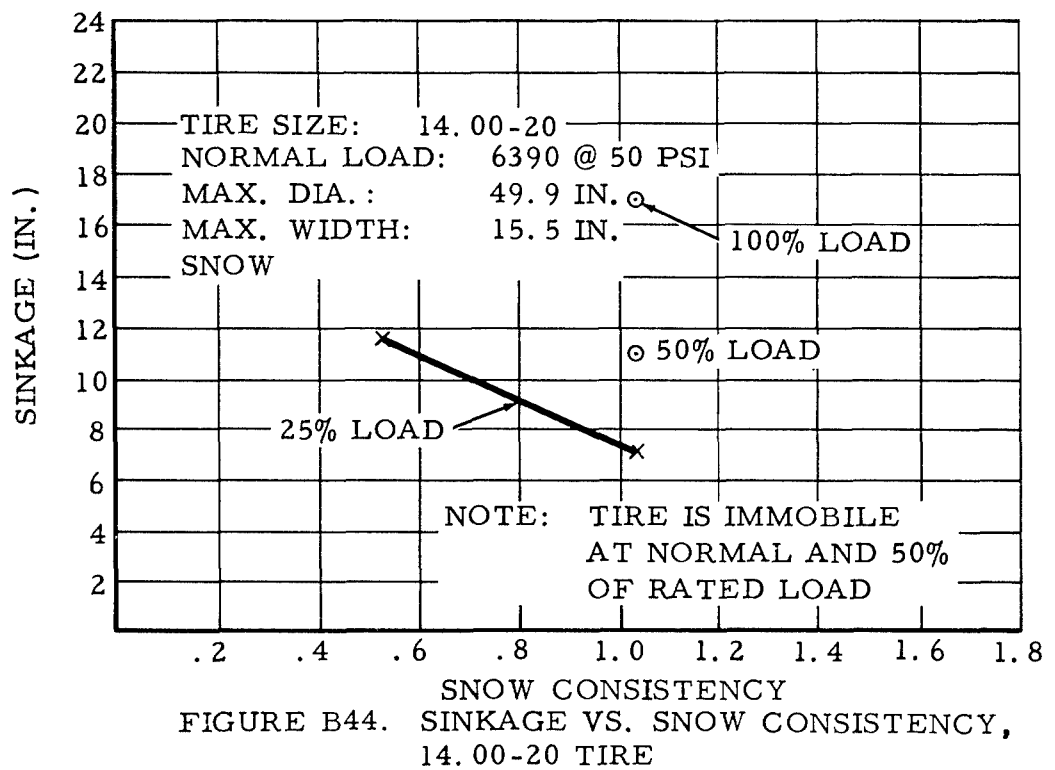

FIGURE B44. SINKAGE VS. SNOW CONSISTENCY, 14.00-20 TIRE

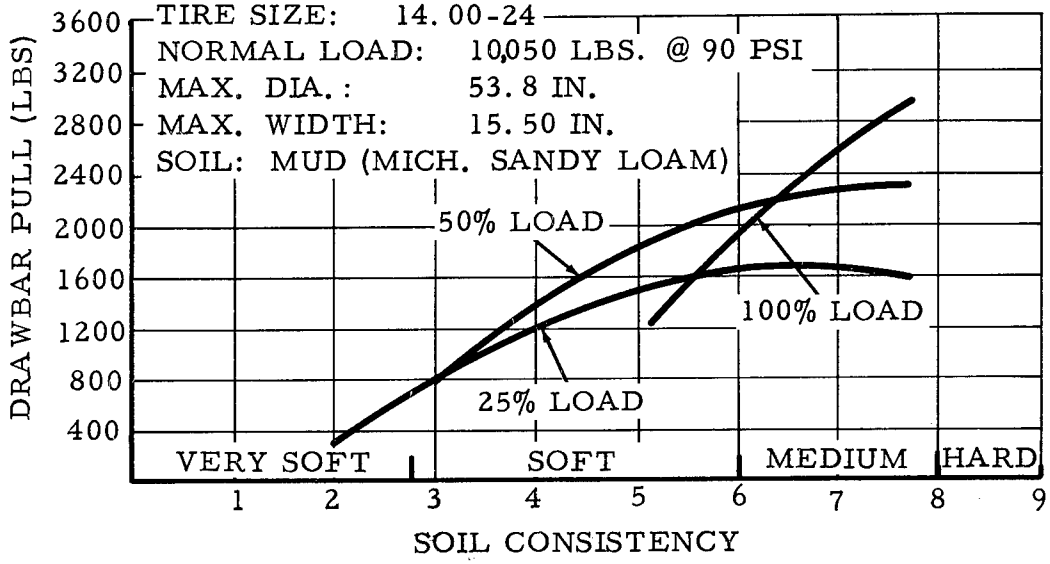

FIGURE B45. DRAWBAR PULL VS. SOIL CONSISTENCY, 14.00-24 TIRE

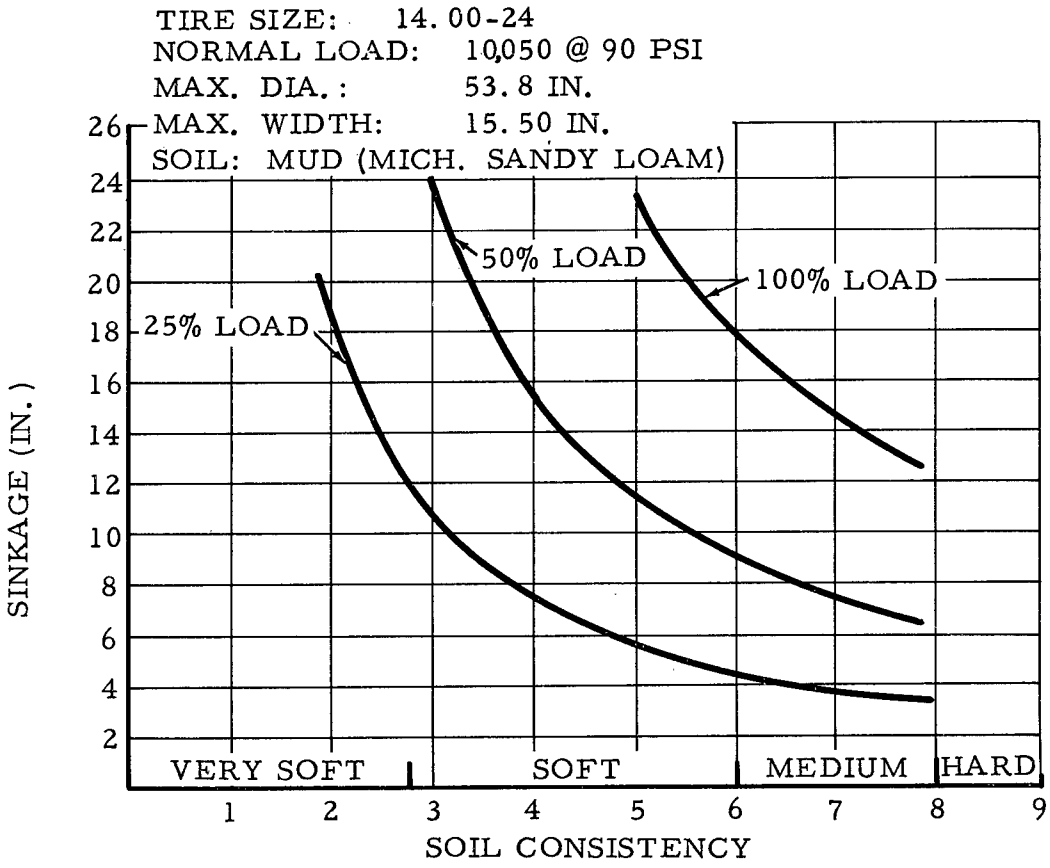

FIGURE B46. SINKAGE VS. SOIL CONSISTENCY, 14.00-24 TIRE

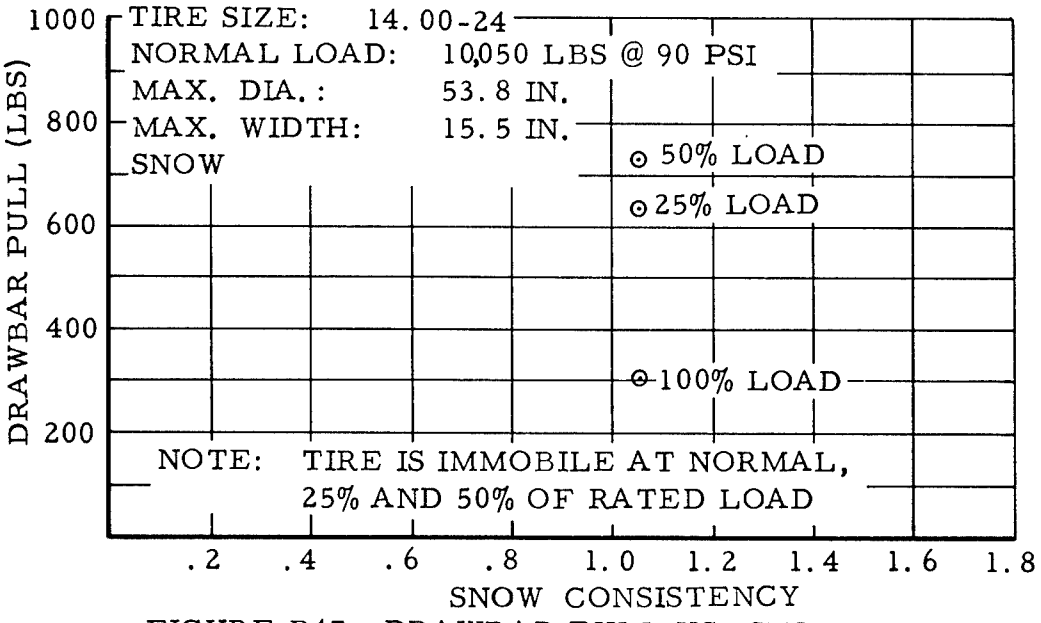

FIGURE B47. DRAWBAR PULL VS. SNOW CONSISTENCY, 14.00-24 TIRE

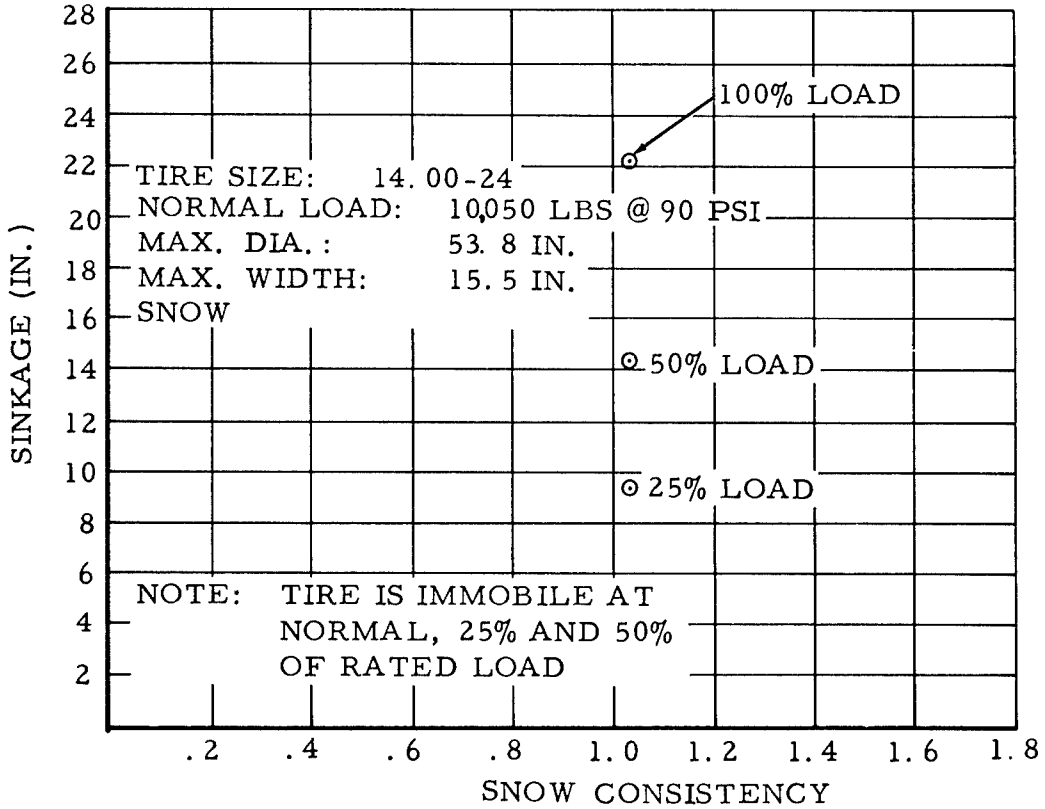

FIGURE B48 SINKAGE VS. SNOW CONSISTENCY, 14.00-24 TIRE

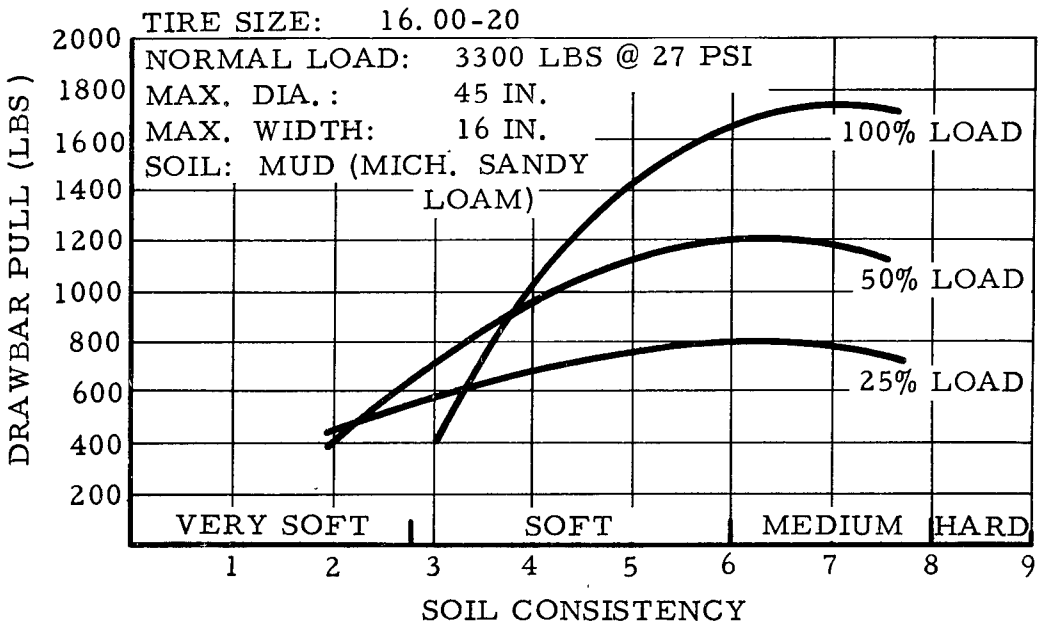

FIGURE B49. DRAWBAR PULL VS. SOIL CONSISTENCY, 16.00-20 TIRE

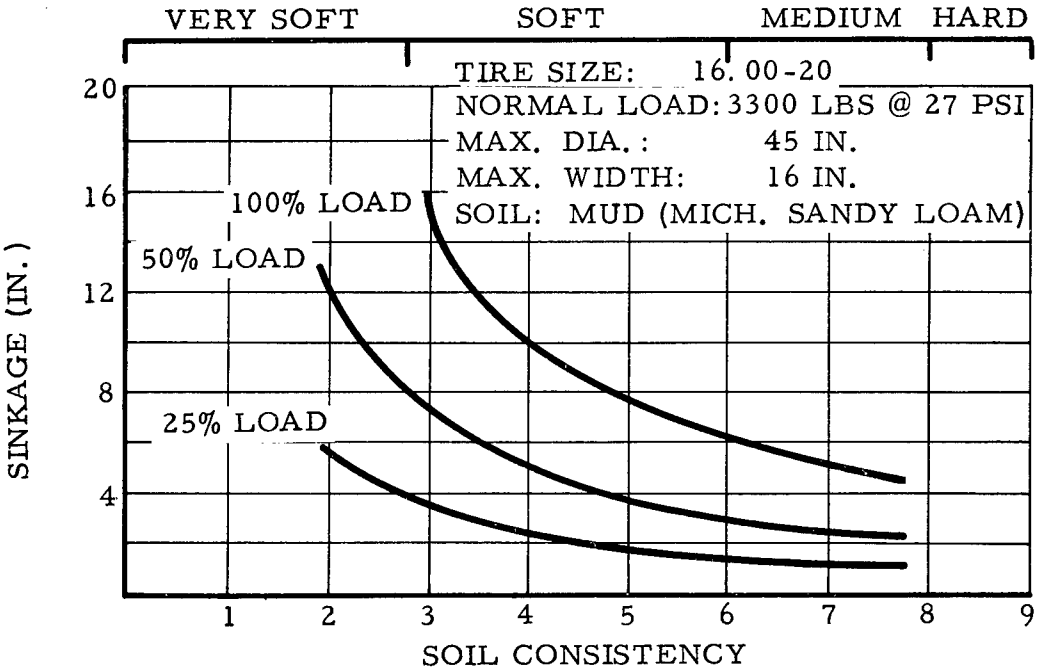

FIGURE B50. SINKAGE VS. SOIL CONSISTENCY, 16.00-20 TIRE

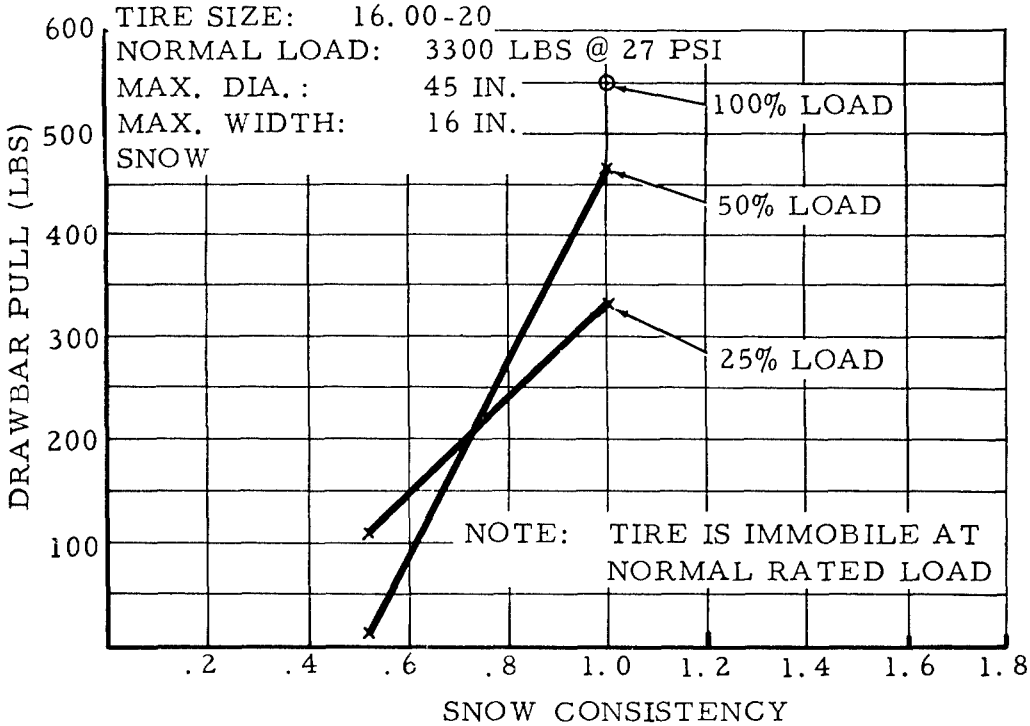

FIGURE B51. DRAWBAR PULL VS. SNOW CONSISTENCY, 16.00-20 TIRE

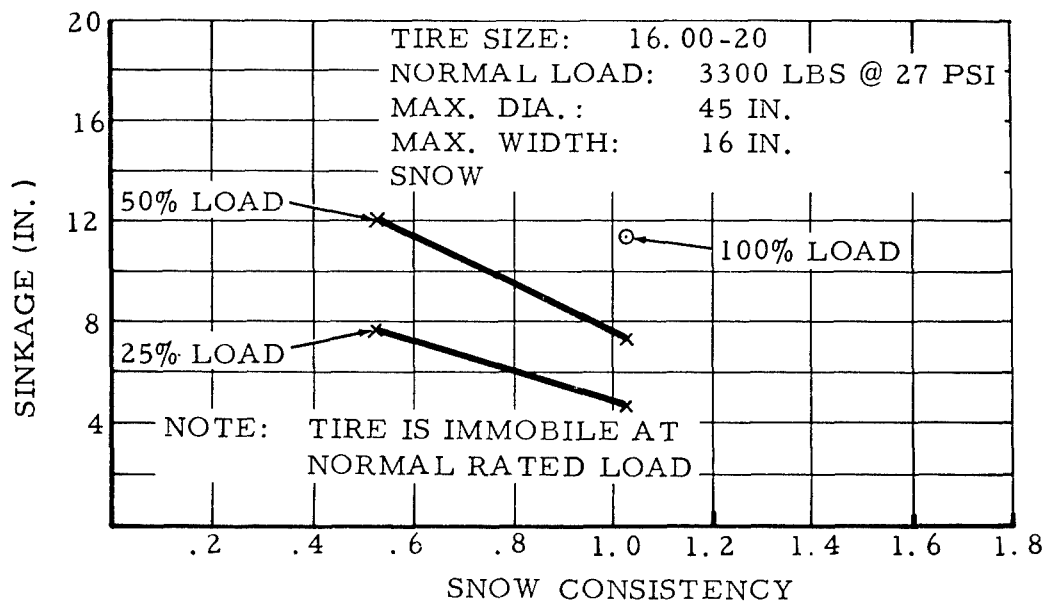

FIGURE B52. SINKAGE VS. SNOW CONSISTENCY, 16.00-20 TIRE

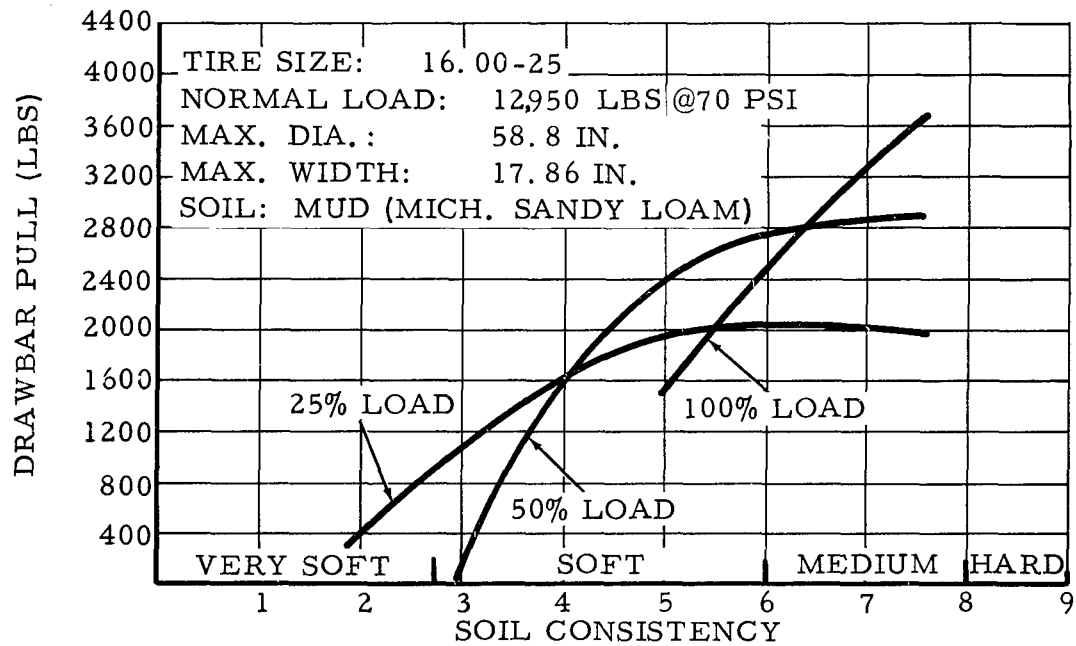

FIGURE B53. DRAWBAR PULL VS. SOIL CONSISTENCY, 16.00-25 TIRE

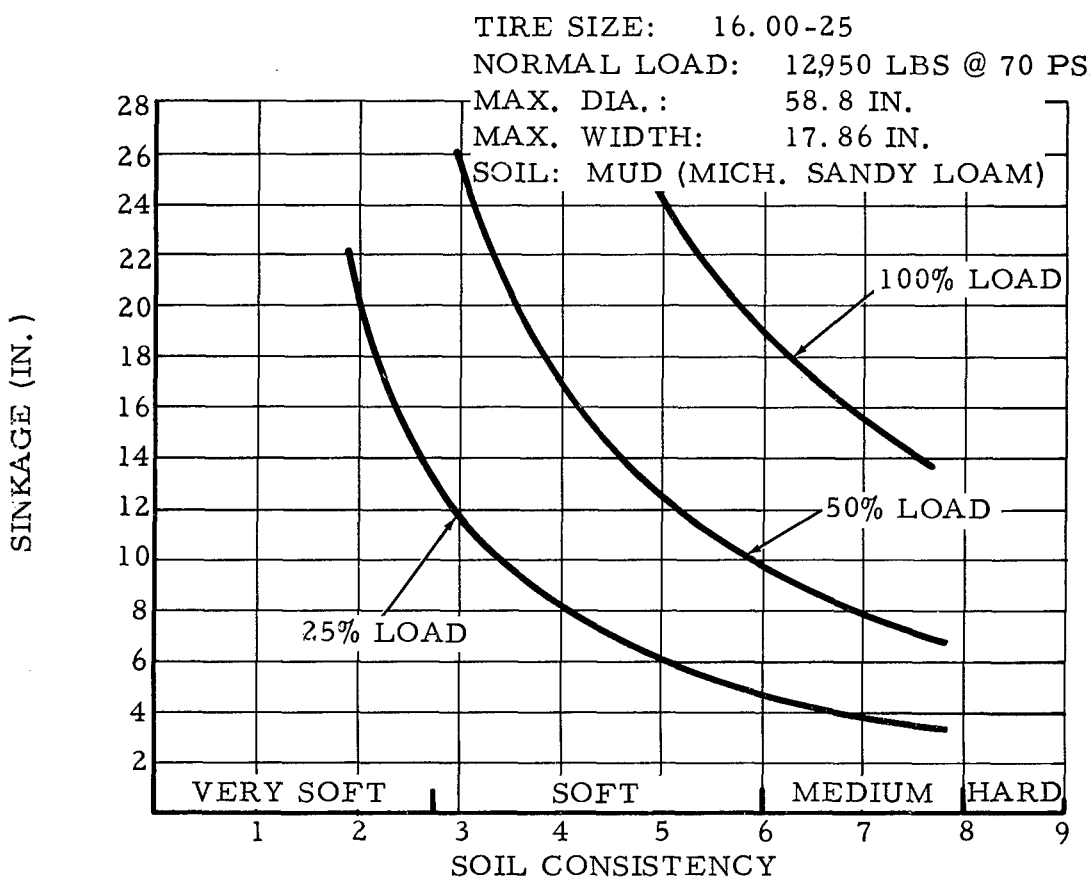

FIGURE B54. SINKAGE VS. SOIL CONSISTENCY, 16.00-25 TIRE

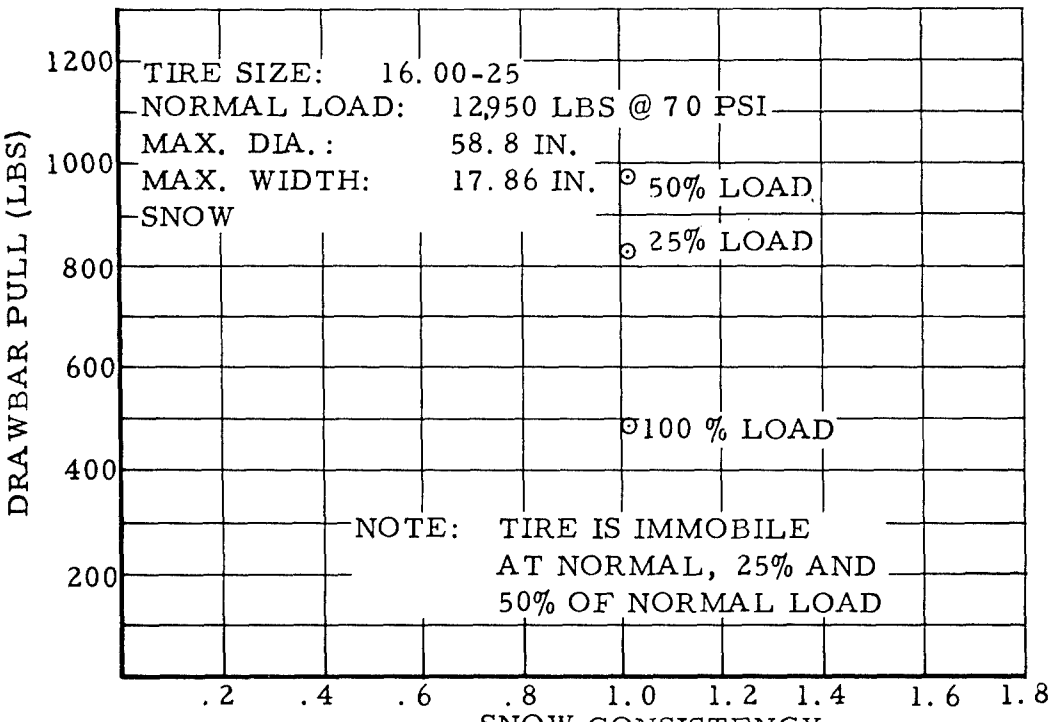

FIGURE B55. DRAWBAR PULL VS. SNOW CONSISTENCY, 16.00-25 TIRE

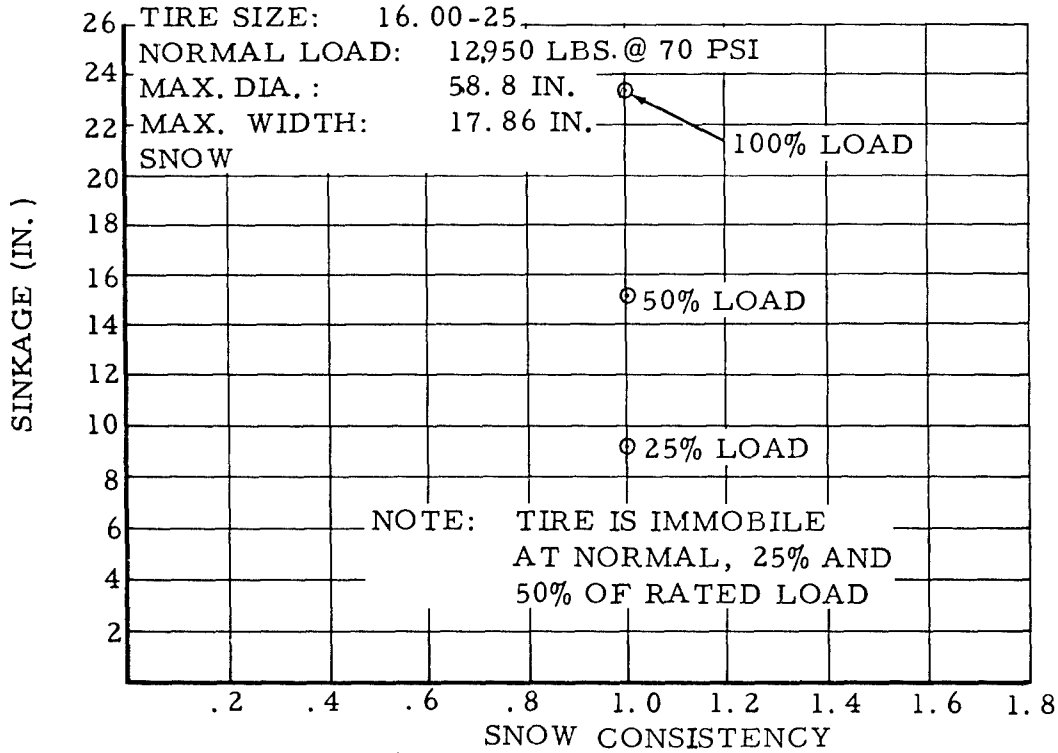

FIGURE B56. SINKAGE VS. SNOW CONSISTENCY, 16.00-25 TIRE

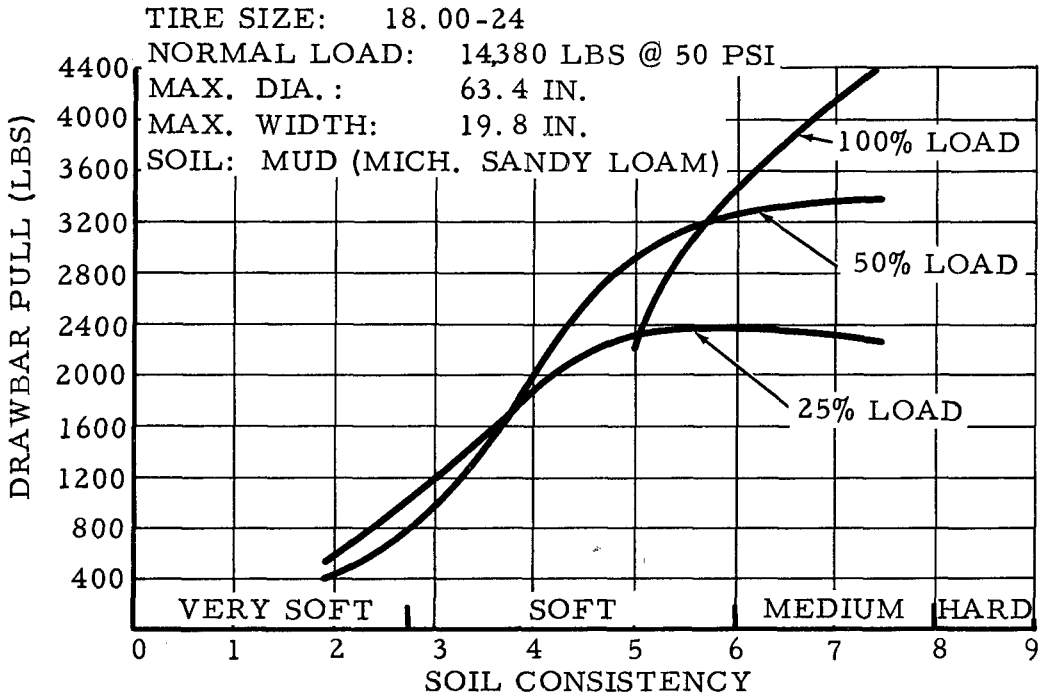

FIGURE B57. DRAWBAR PULL VS. SOIL CONSISTENCY, 18.00-24 TIRE

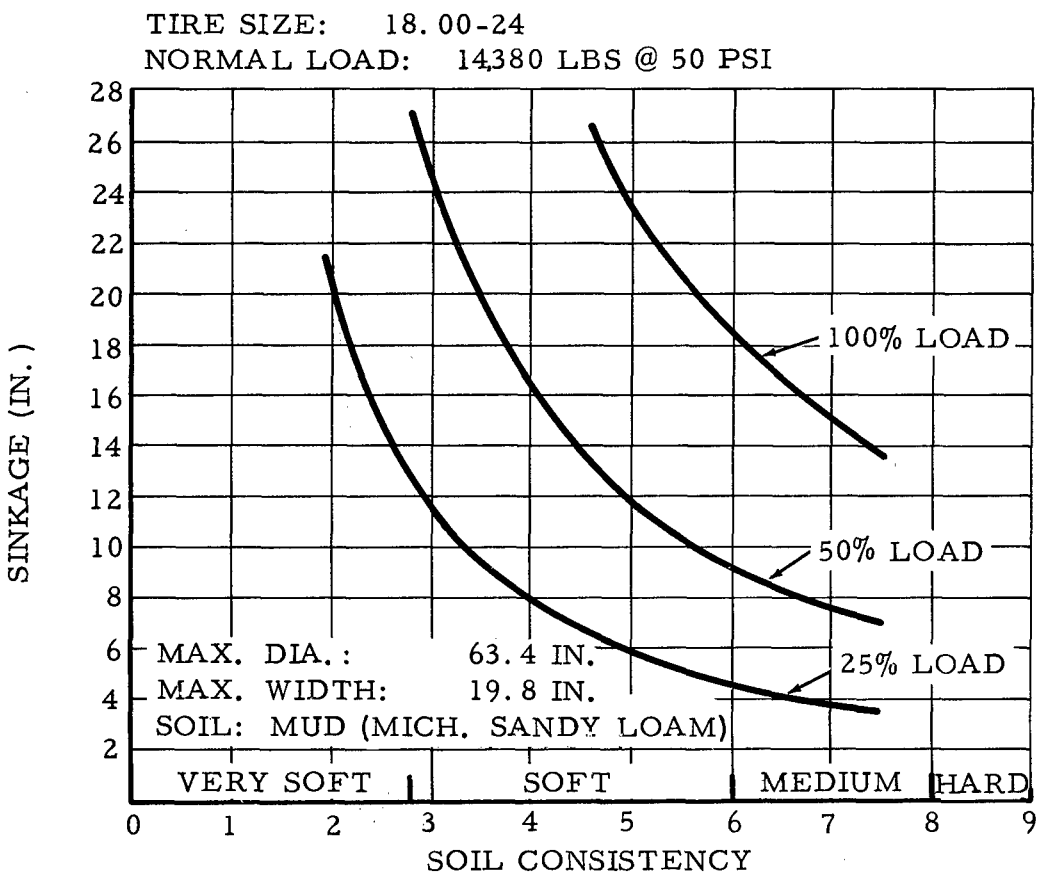

FIGURE B58. SINKAGE VS. SOIL CONSISTENCY, 18.00-24 TIRE

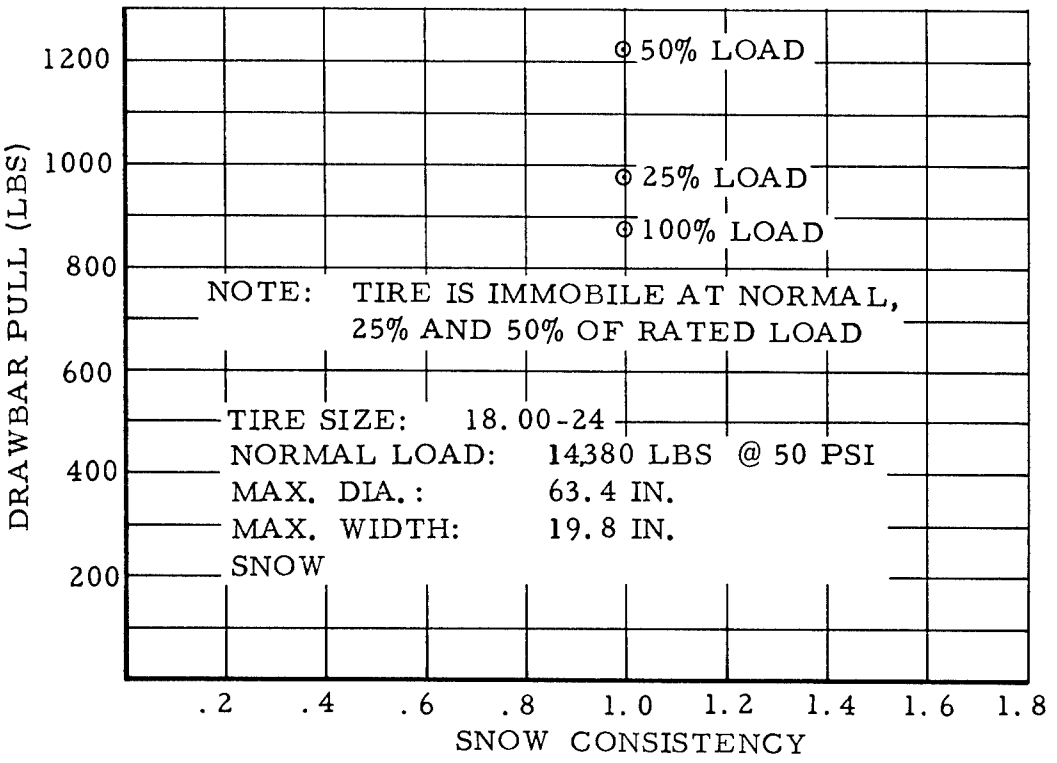

FIGURE B59. DRAWBAR PULL VS. SNOW CONSISTENCY, 18.00-24 TIRE

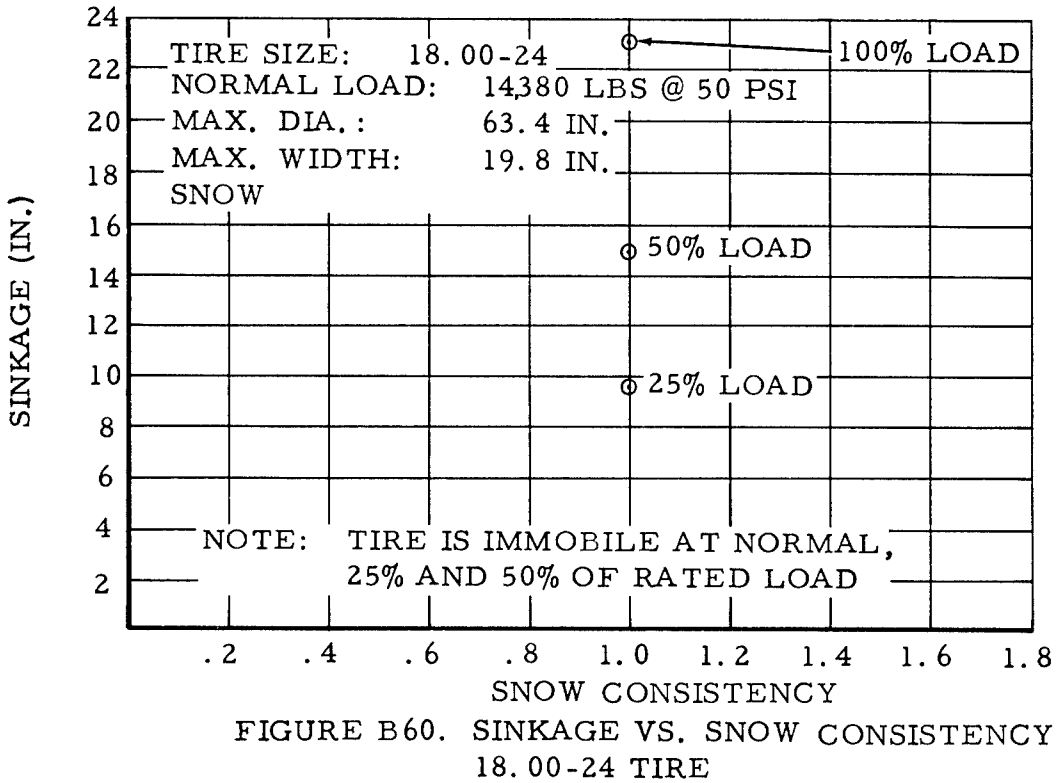

FIGURE B60. SINKAGE VS. SNOW CONSISTENCY, 18.00-24 TIRE

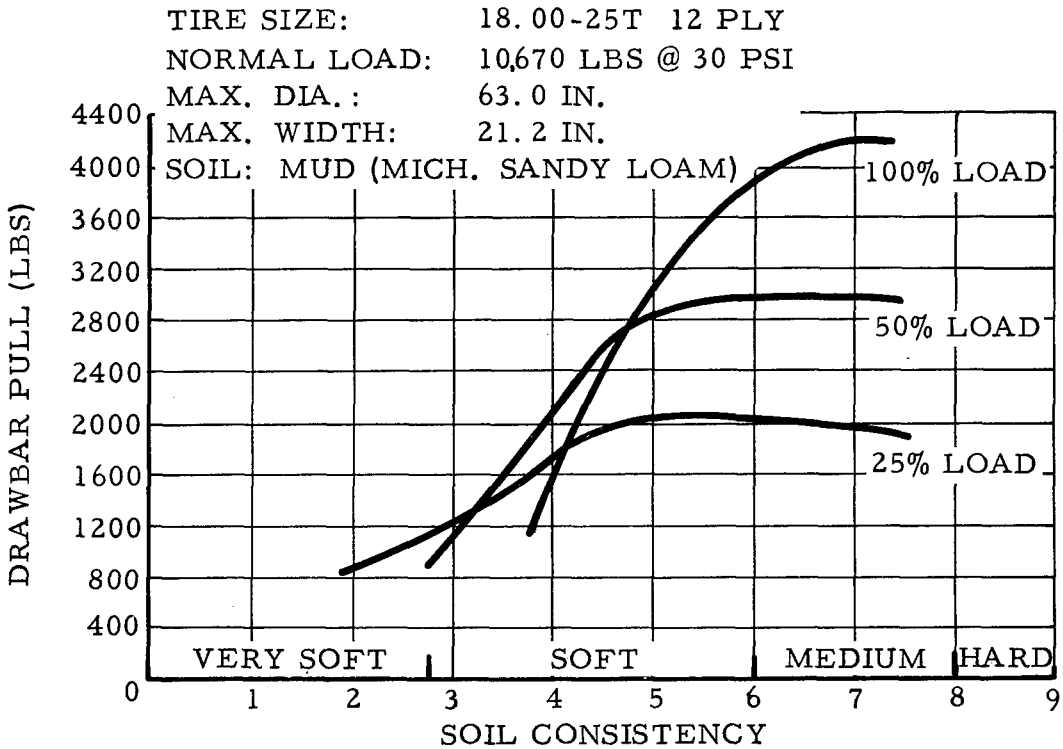

FIGURE B61. DRAWBAR PULL VS. SOIL CONSISTENCY, 18.00-25T, 12 PLY TIRE

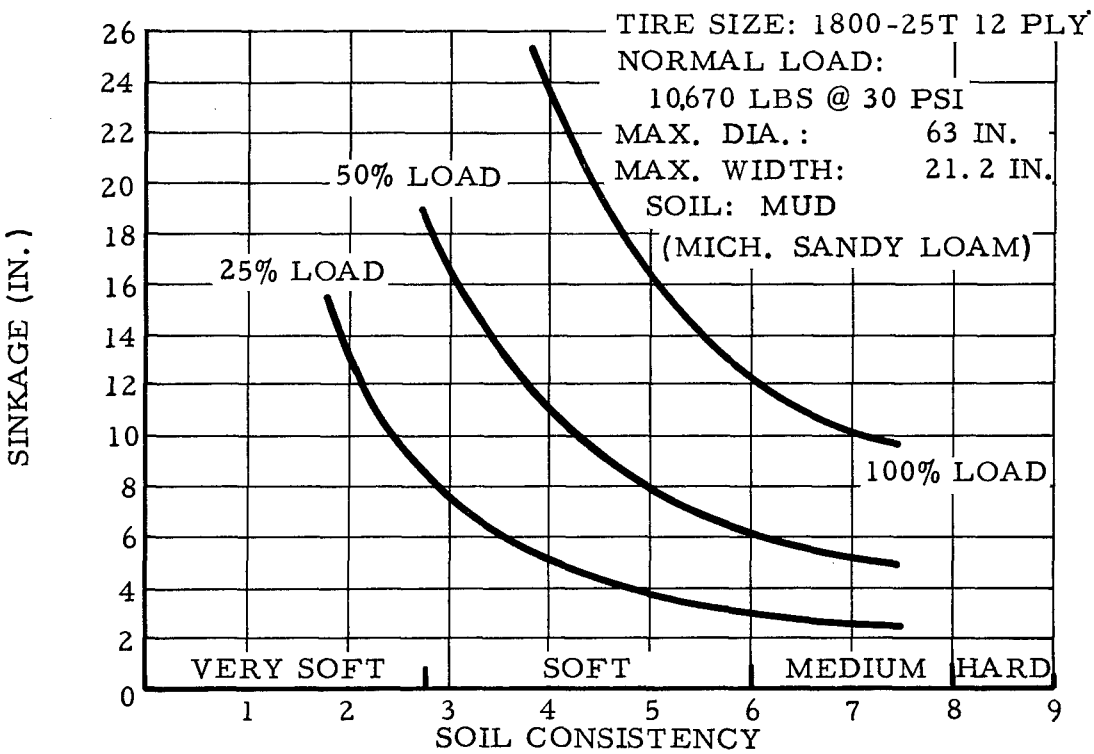

FIGURE B62. SINKAGE VS. SOIL CONSISTENCY, 18.00-25T, 12 PLY TIRE

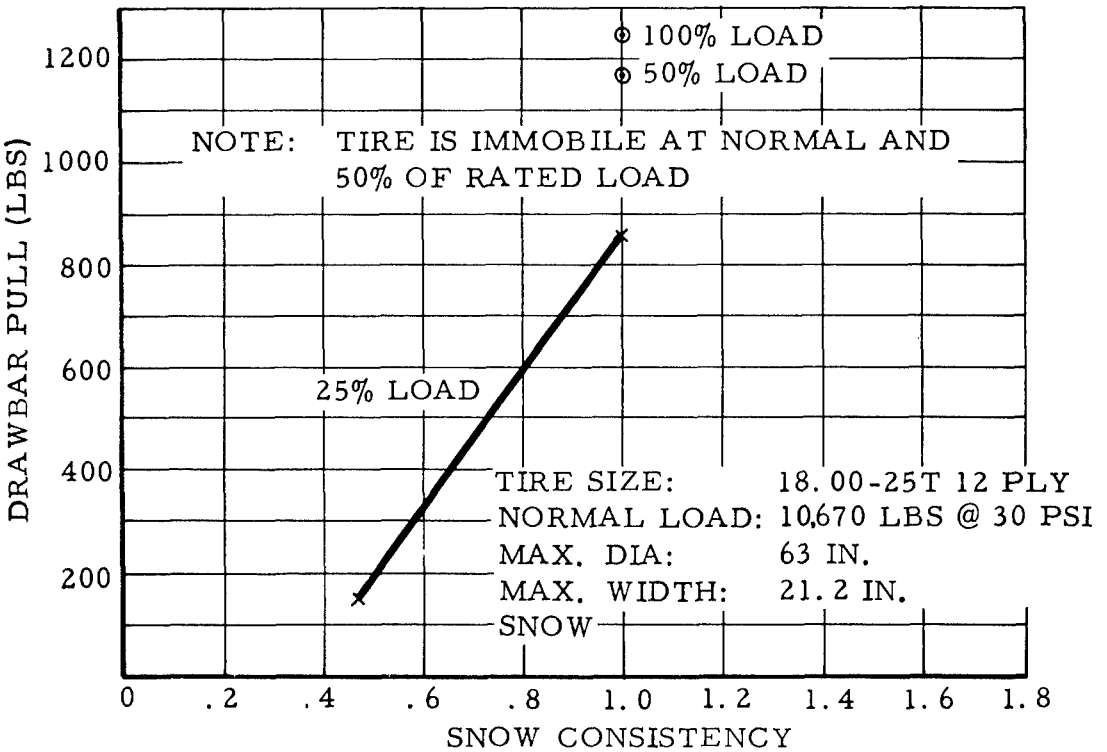

FIGURE B63. DRAWBAR PULL VS. SNOW CONSISTENCY, 18.00-25T, 12 PLY TIRE

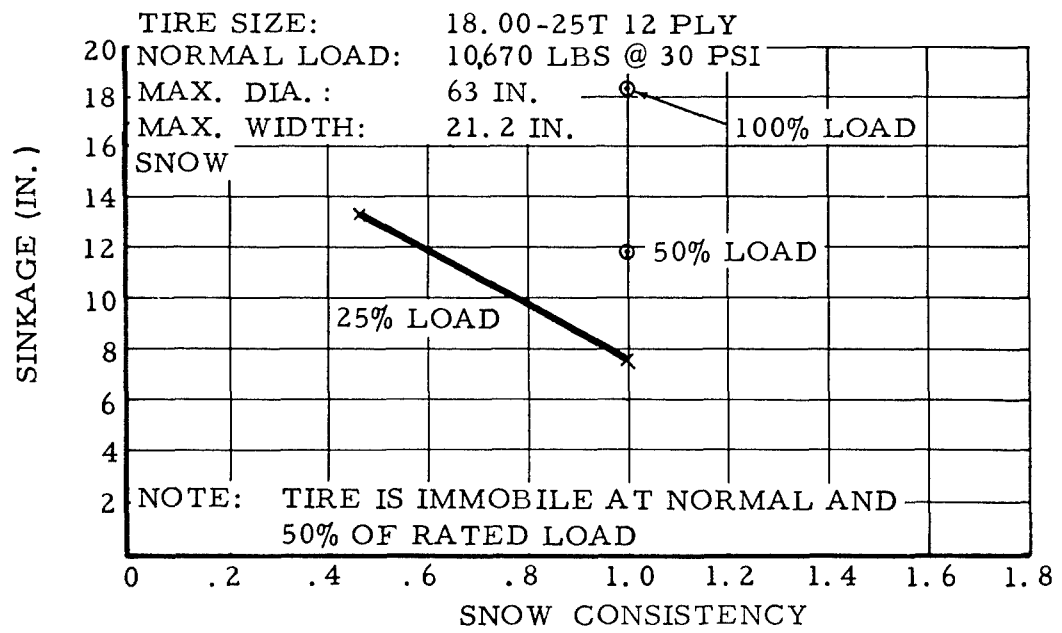

FIGURE B64. SINKAGE VS. SNOW CONSISTENCY, 18.00-25T, 12 PLY TIRE

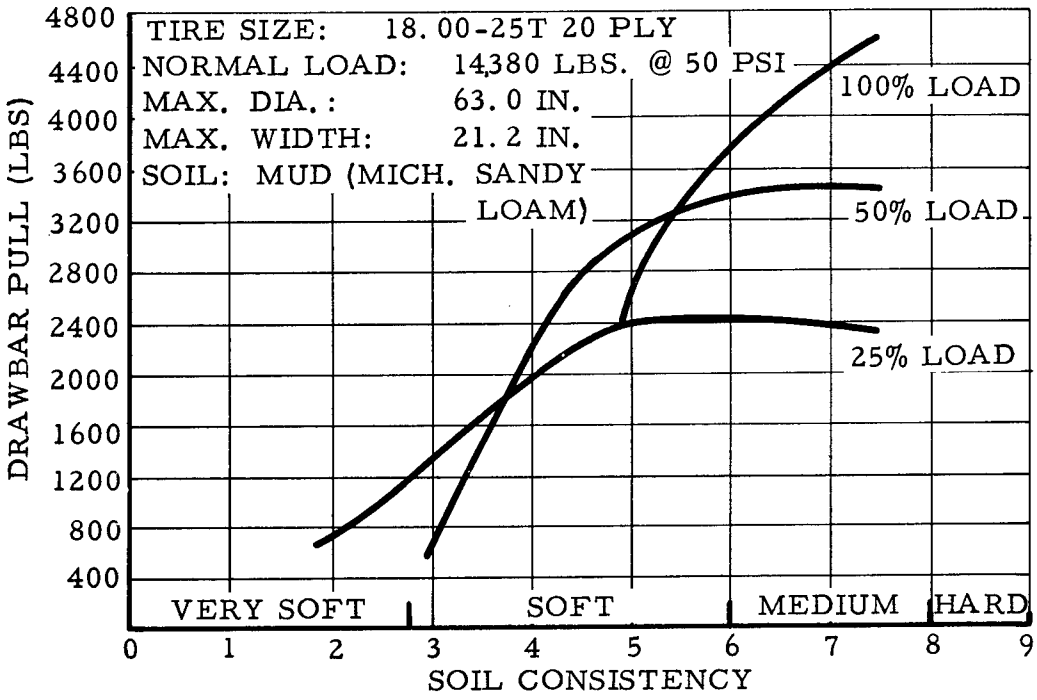

FIGURE B65. DRAWBAR PULL VS. SOIL CONSISTENCY, 1800-25T, 20 PLY TIRE

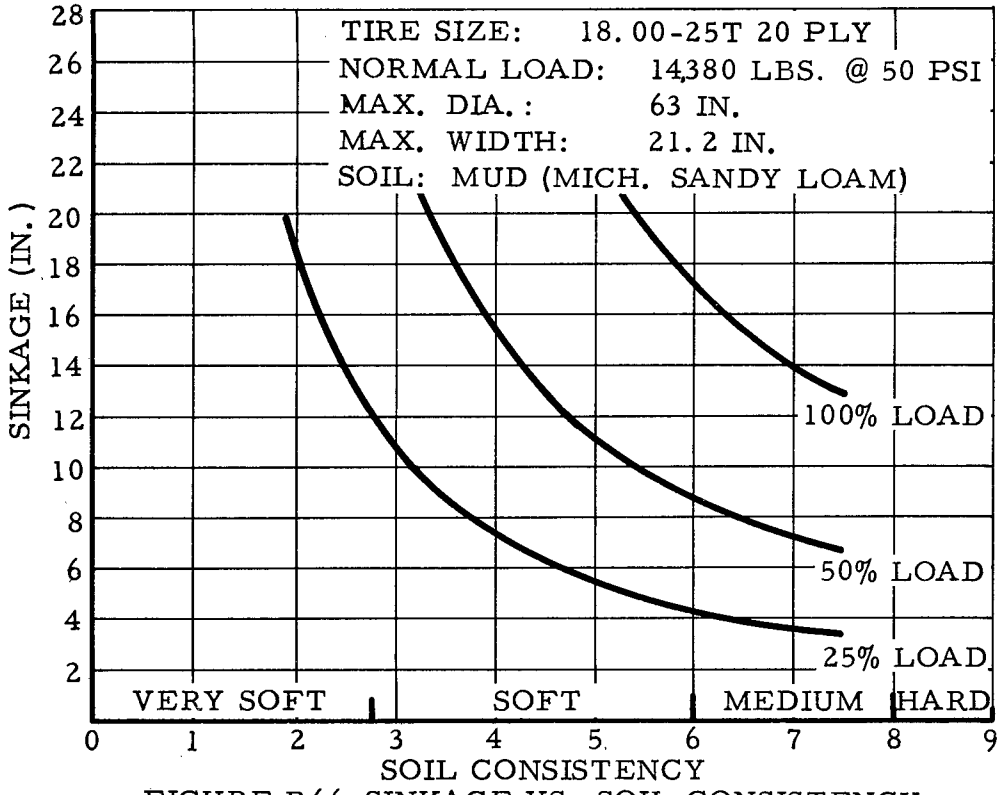

FIGURE B66. SINKAGE VS. SOIL CONSISTENCY, 18.00-25T, 20 PLY TIRE

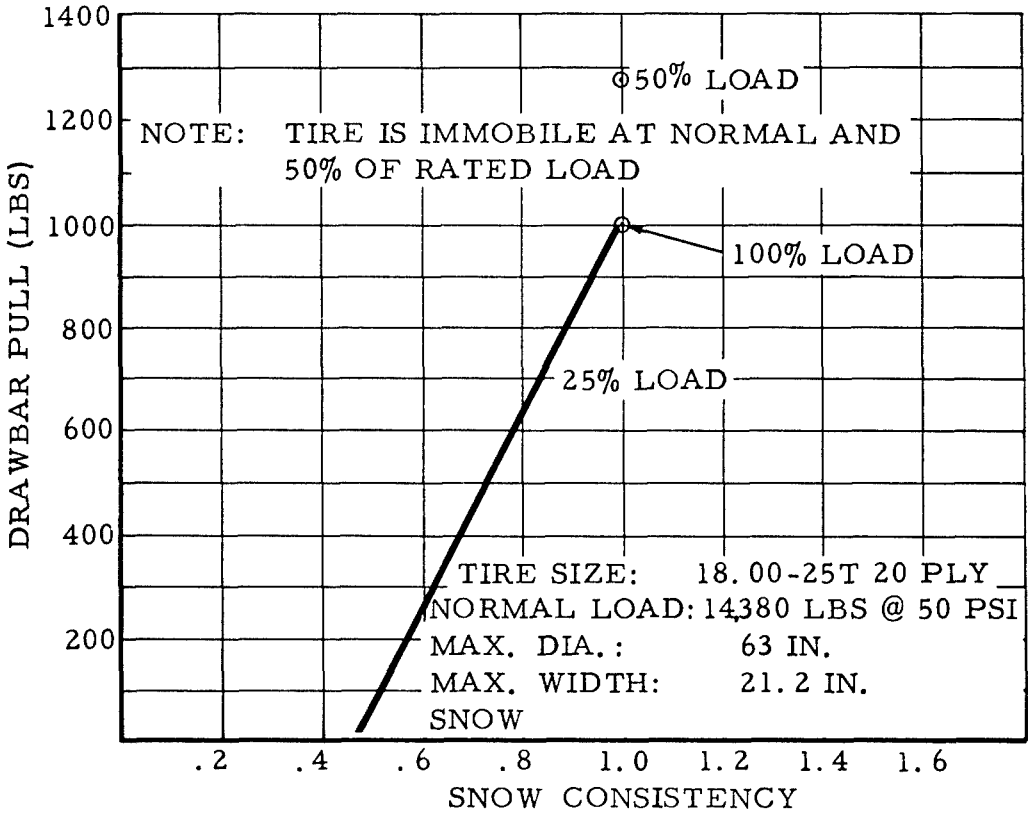

FIGURE B67. DRAWBAR PULL VS. SNOW CONSISTENCY, 18.00-25T, 20 PLY TIRE

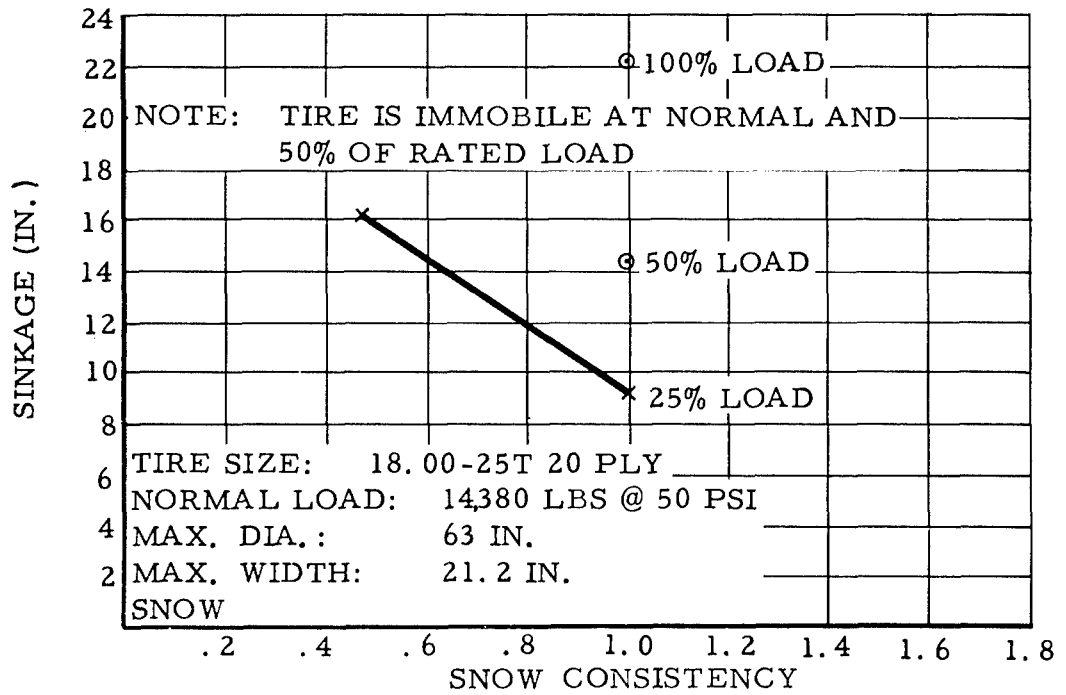

FIGURE B68. SINKAGE VS. SNOW CONSISTENCY, 18.00-25T, 20 PLY TIRE

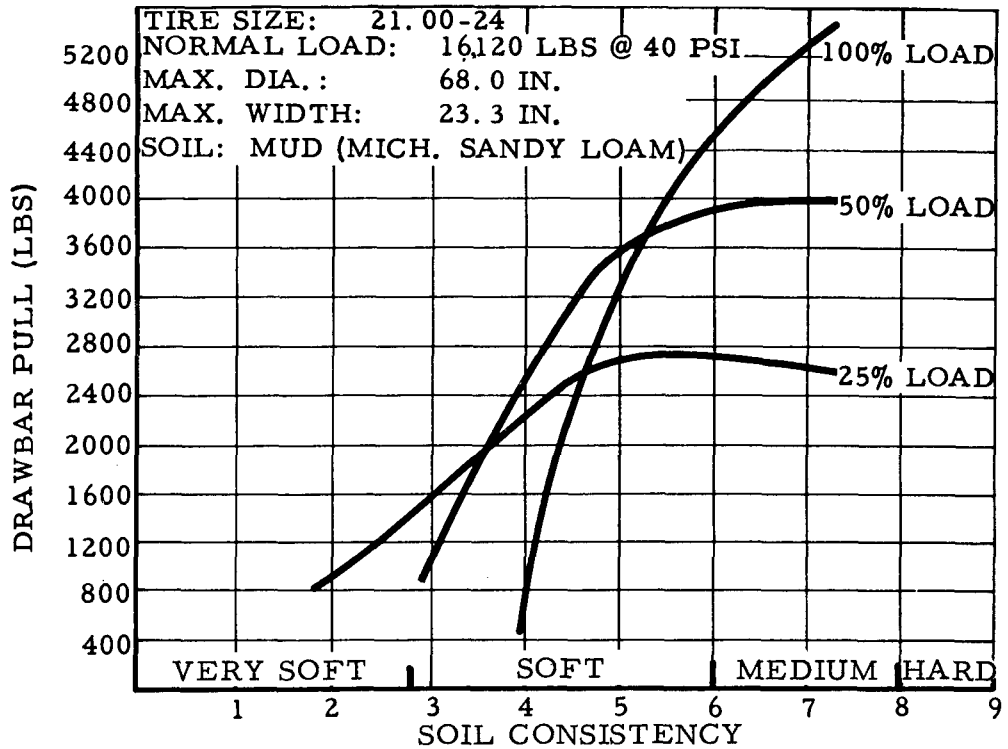

FIGURE B69. DRAWBAR PULL VS. SOIL CONSISTENCY, 21.00-24 TIRE

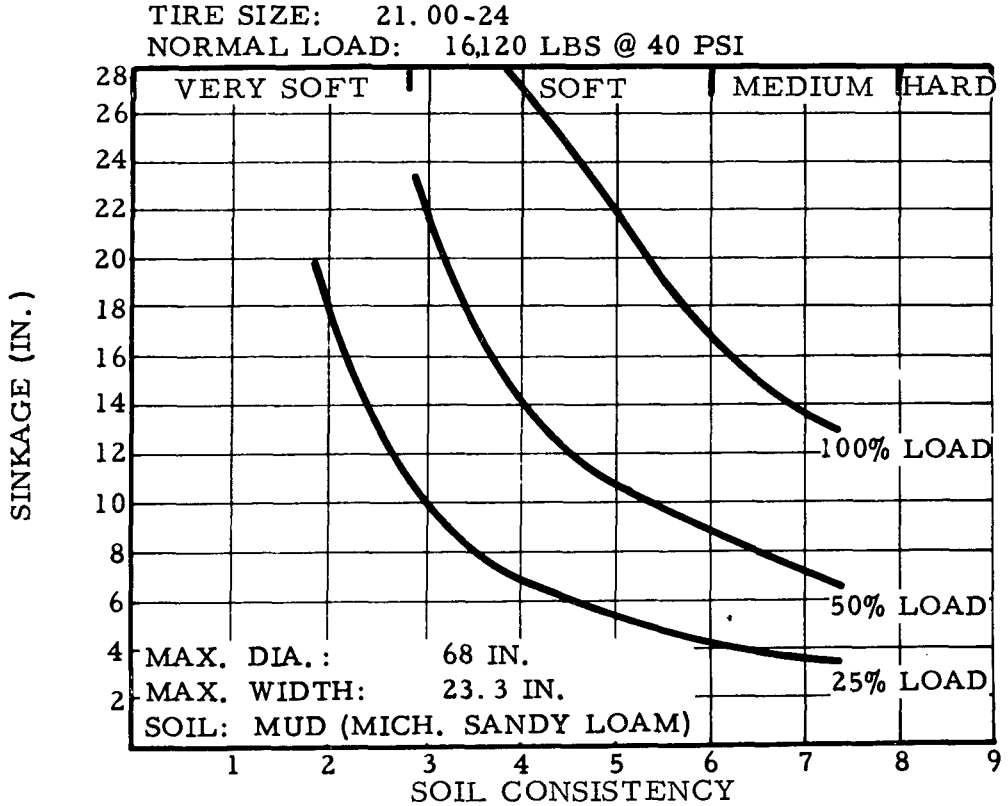

FIGURE B70. SINKAGE VS. SOIL CONSISTENCY, 21.00-24 TIRE

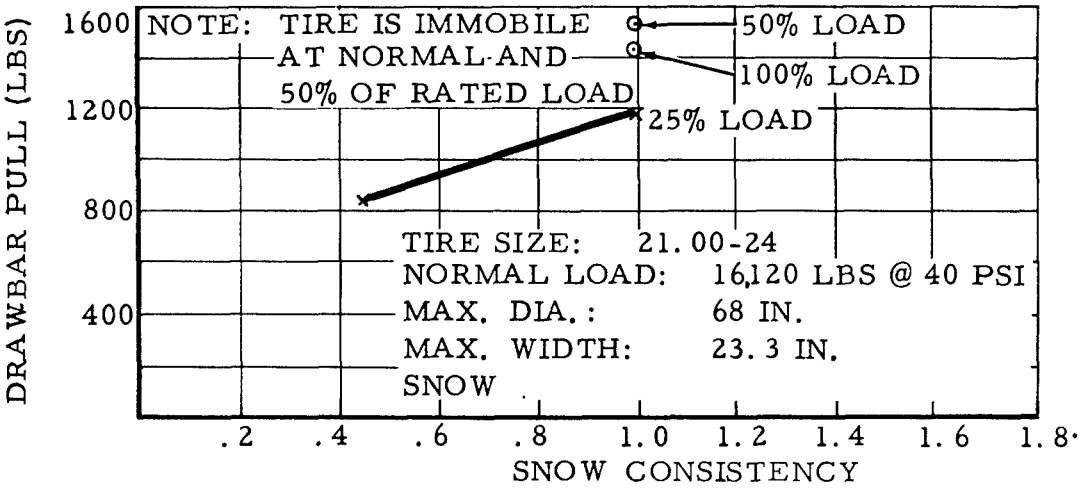

FIGURE B71. DRAWBAR PULL VS. SNOW CONSISTENCY, 21.00-24 TIRE

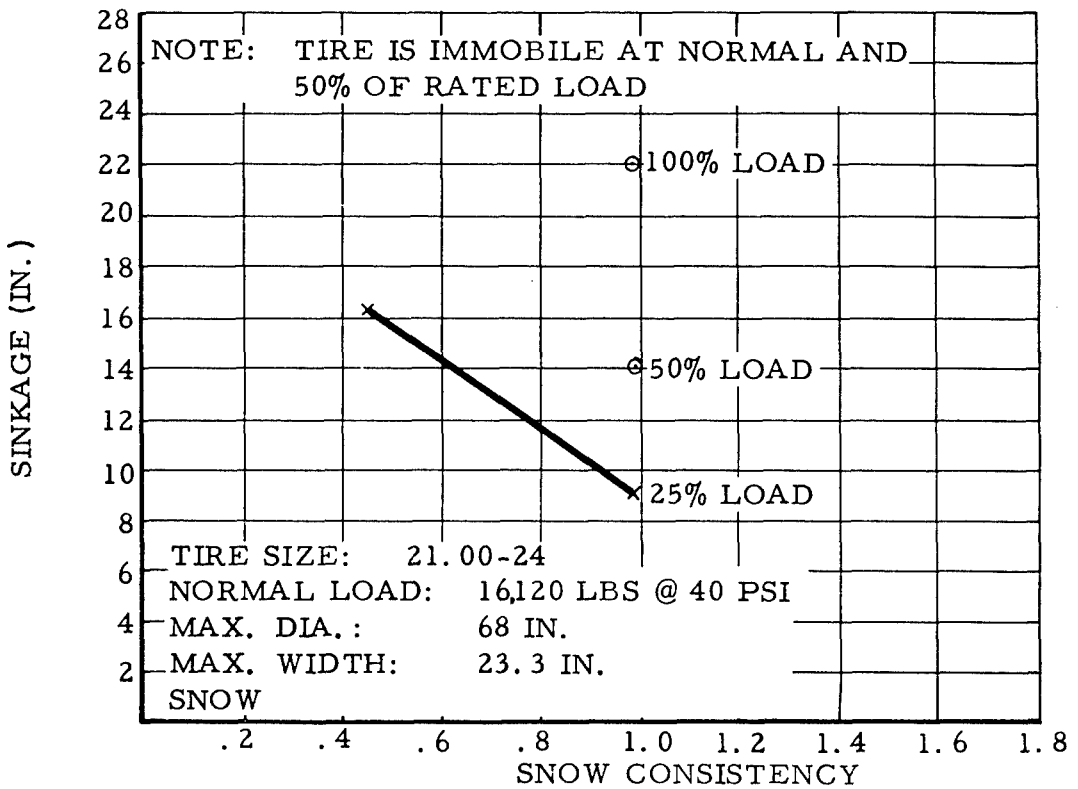

FIGURE B72. SINKAGE VS. SNOW CONSISTENCY, 21.00-24 TIRE

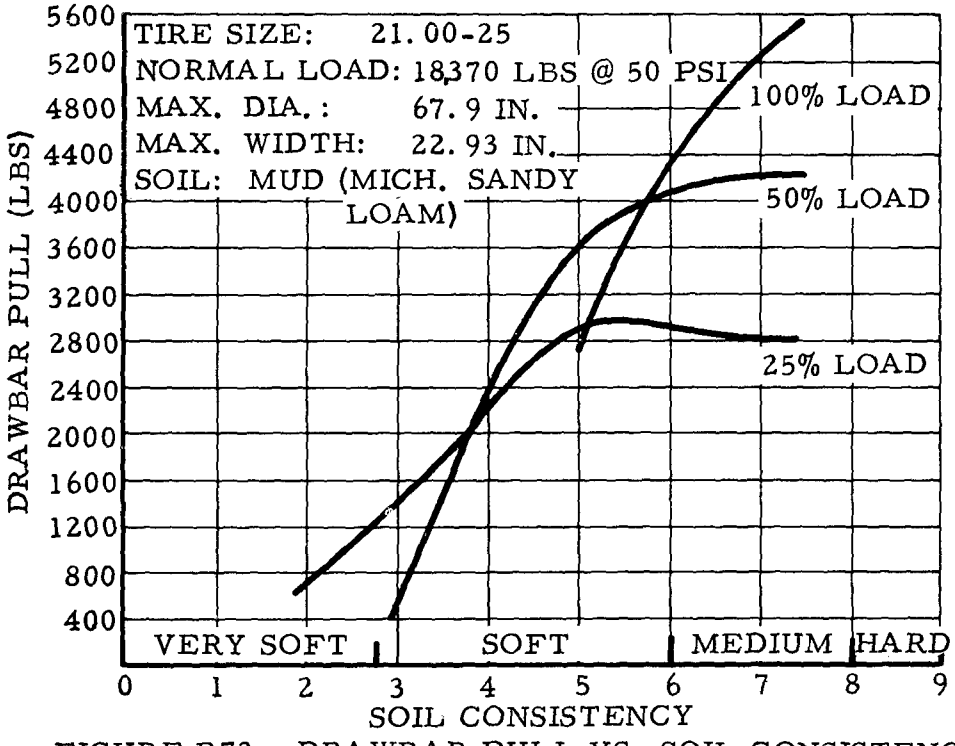

FIGURE B73. DRAWBAR PULL VS. SOIL CONSISTENCY, 21.00-25 TIRE

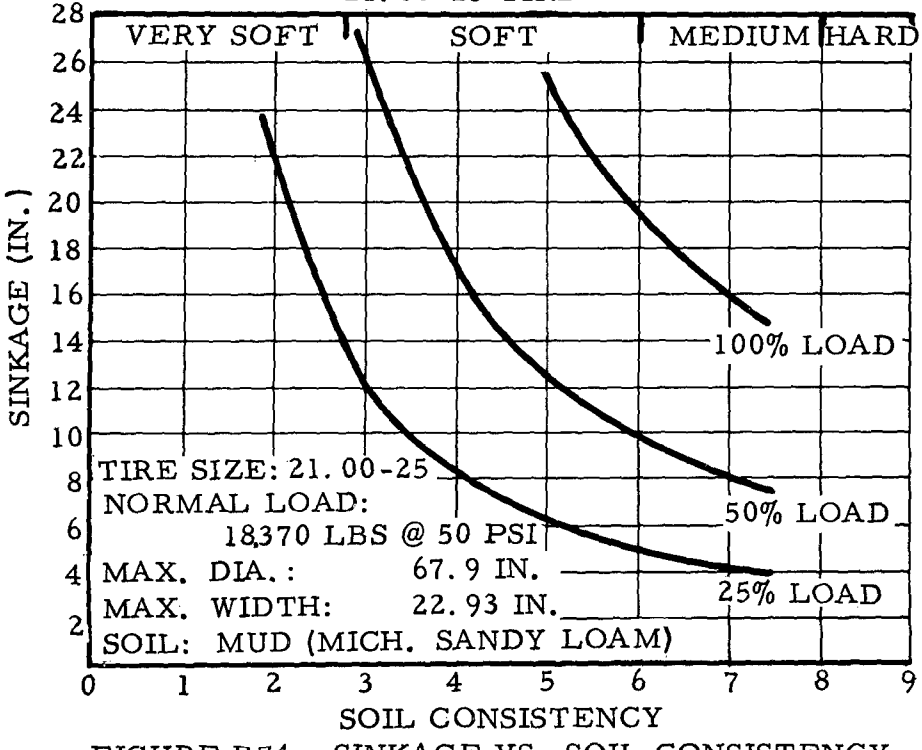

FIGURE B74. SINKAGE VS. SOIL CONSISTENCY, 21.00-25 TIRE

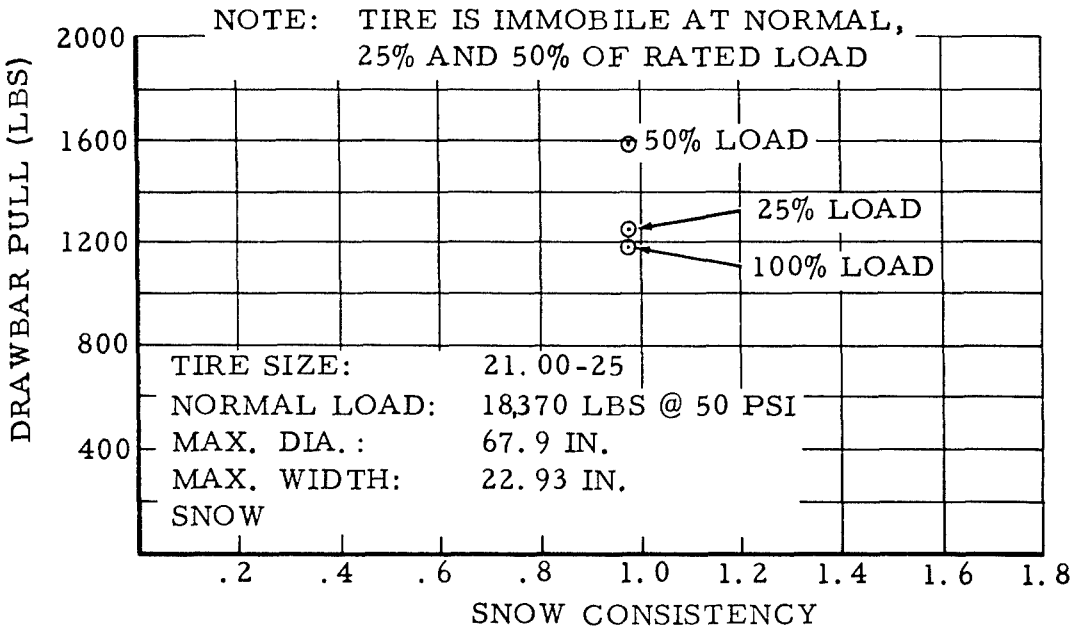

FIGURE B75. DRAWBAR PULL VS. SNOW CONSISTENCY, 21.00-25 TIRE

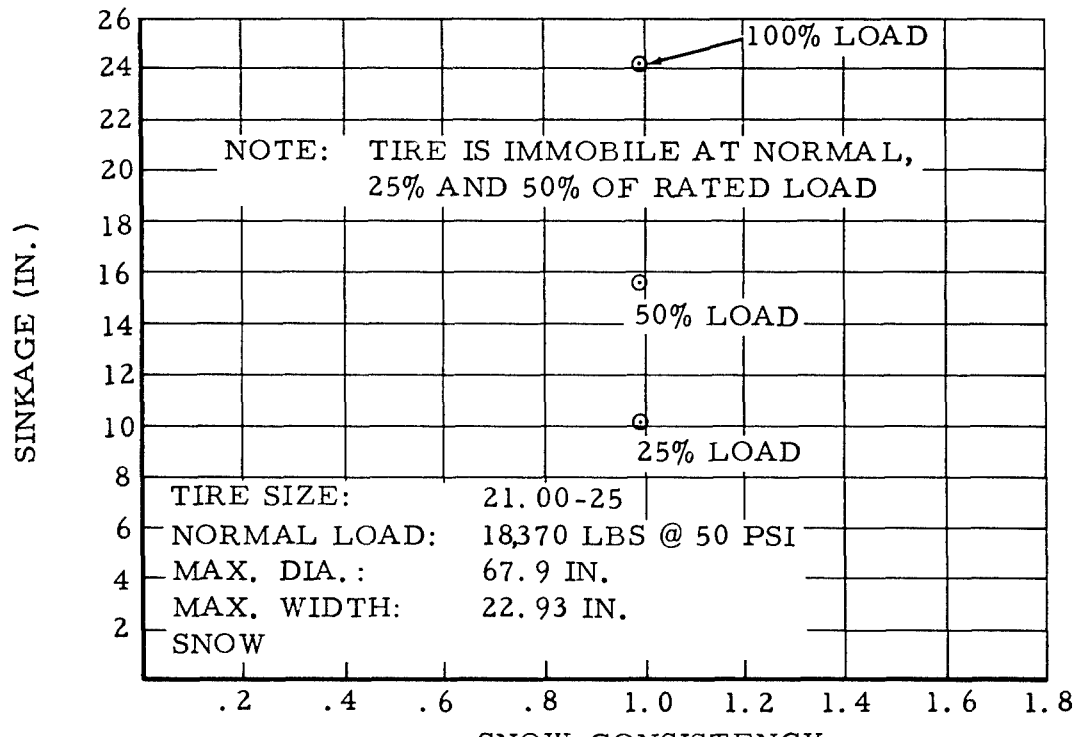

FIGURE B76. SINKAGE VS. SNOW CONSISTENCY, 21.00-25 TIRE

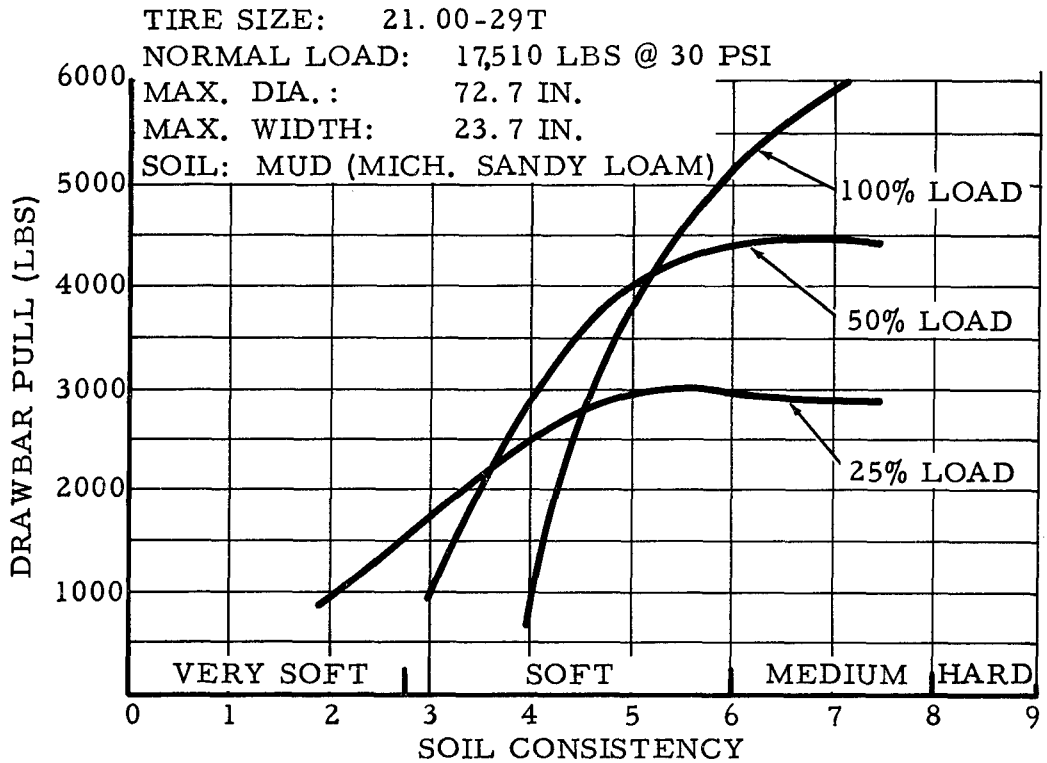

FIGURE B77. DRAWBAR PULL VS. SOIL CONSISTENCY, 21.00-29T TIRE

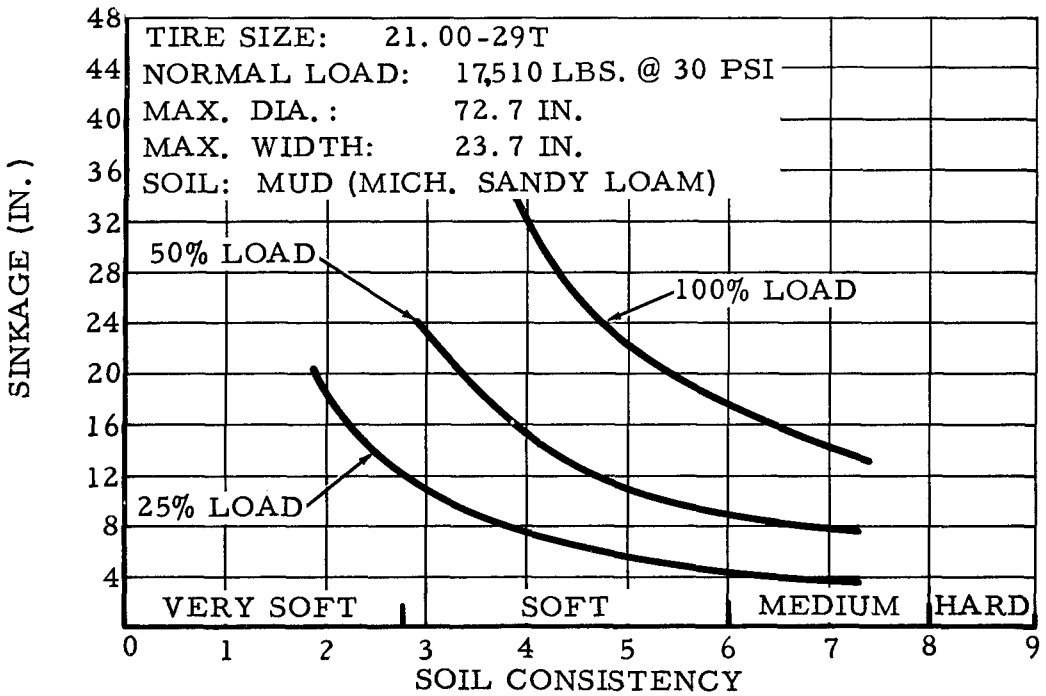

FIGURE B78. SINKAGE VS. SOIL CONSISTENCY, 21.00-29T TIRE

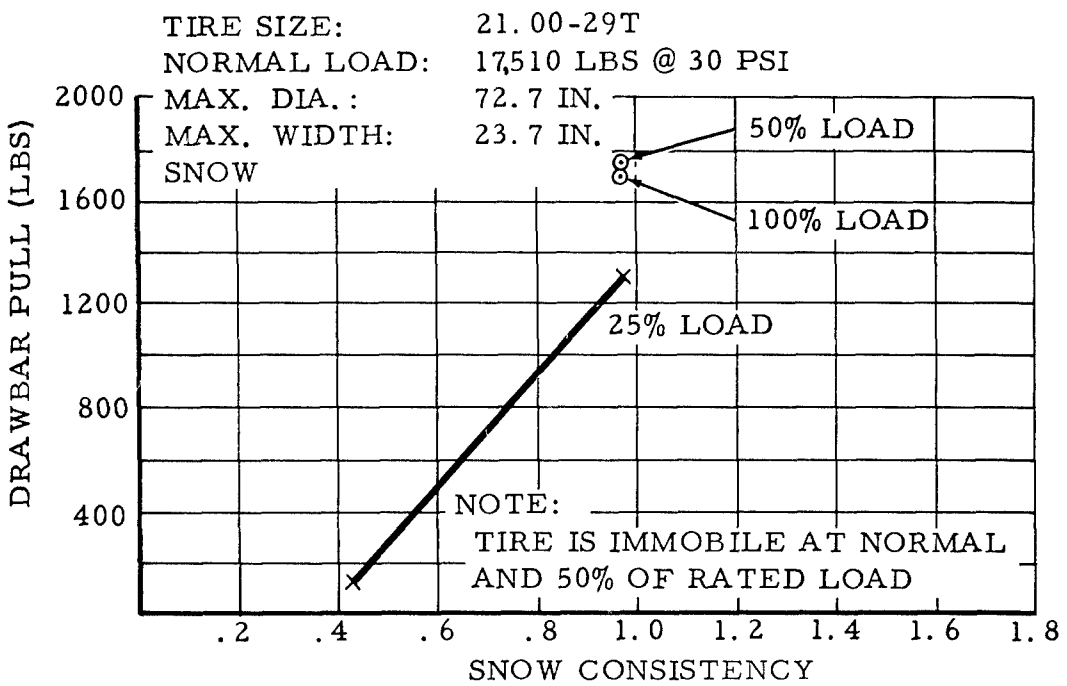

FIGURE B79. DRAWBAR PULL VS. SNOW CONSISTENCY, 21.00-29T TIRE

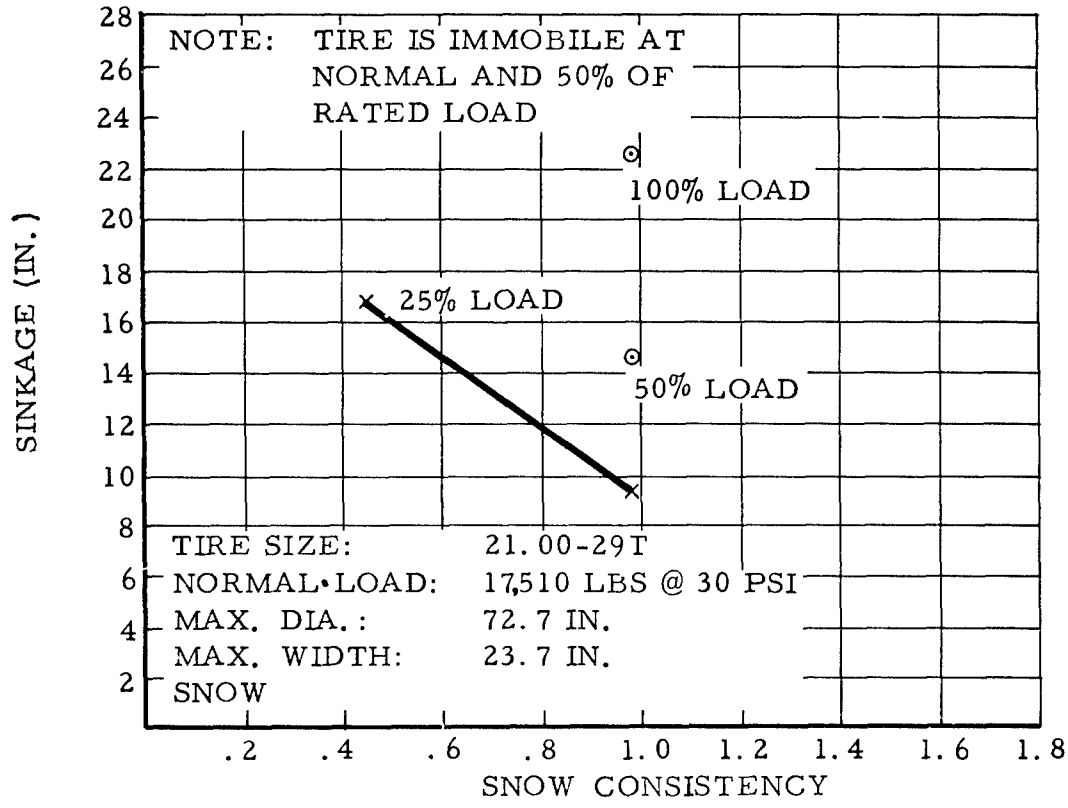

FIGURE B80. SINKAGE VS. SNOW CONSISTENCY, 21.00-29T TIRE

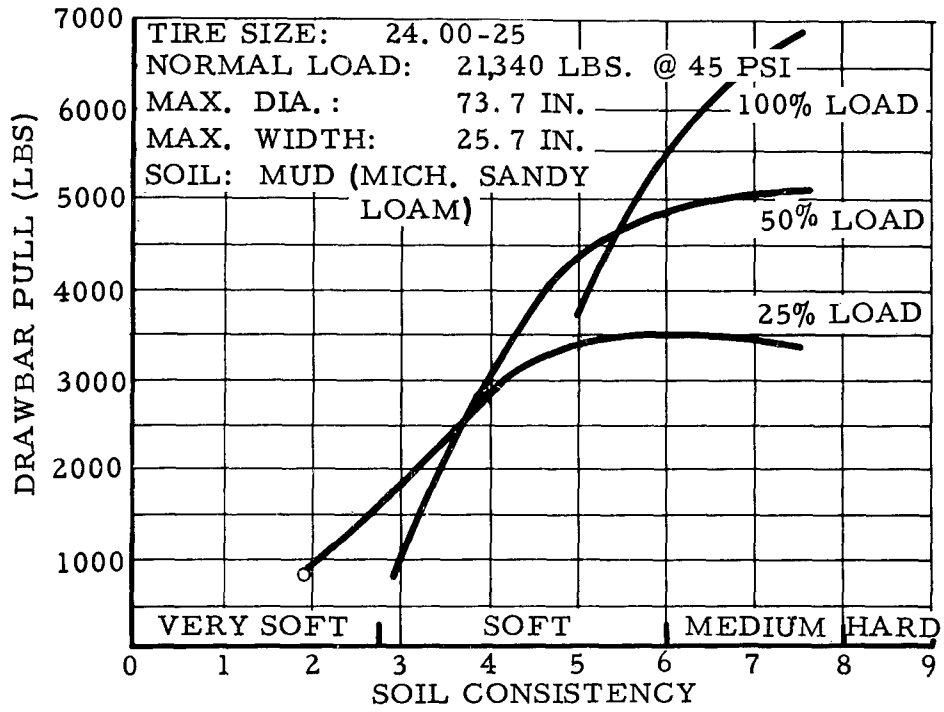

FIGURE B81. DRAWBAR PULL VS. SOIL CONSISTENCY, 24.00-25 TIRE

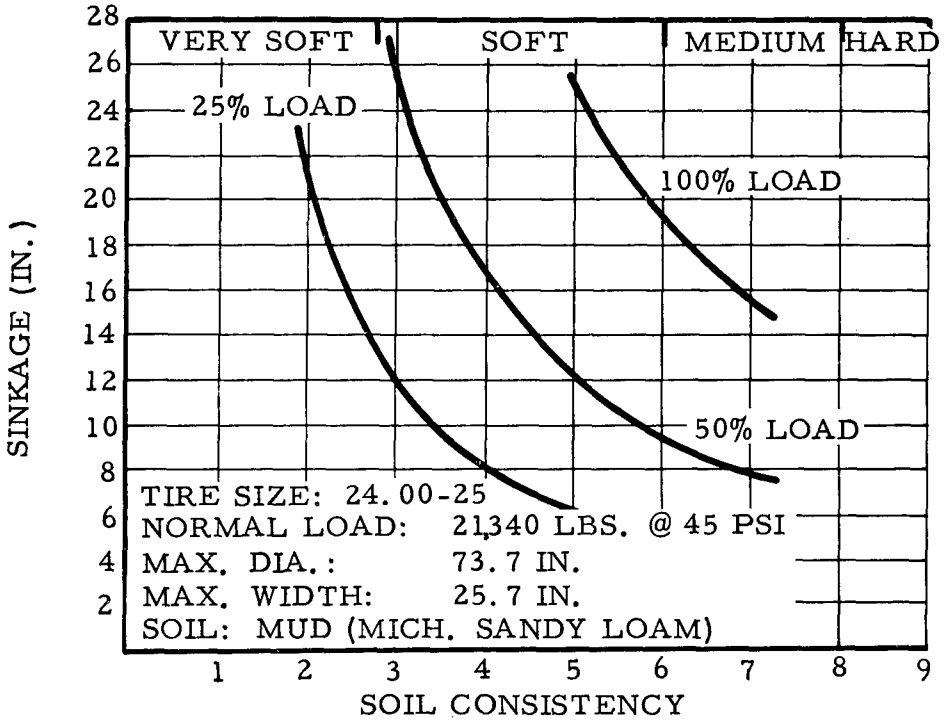

FIGURE B82. SINKAGE VS. SOIL CONSISTENCY, 24.00-25 TIRE

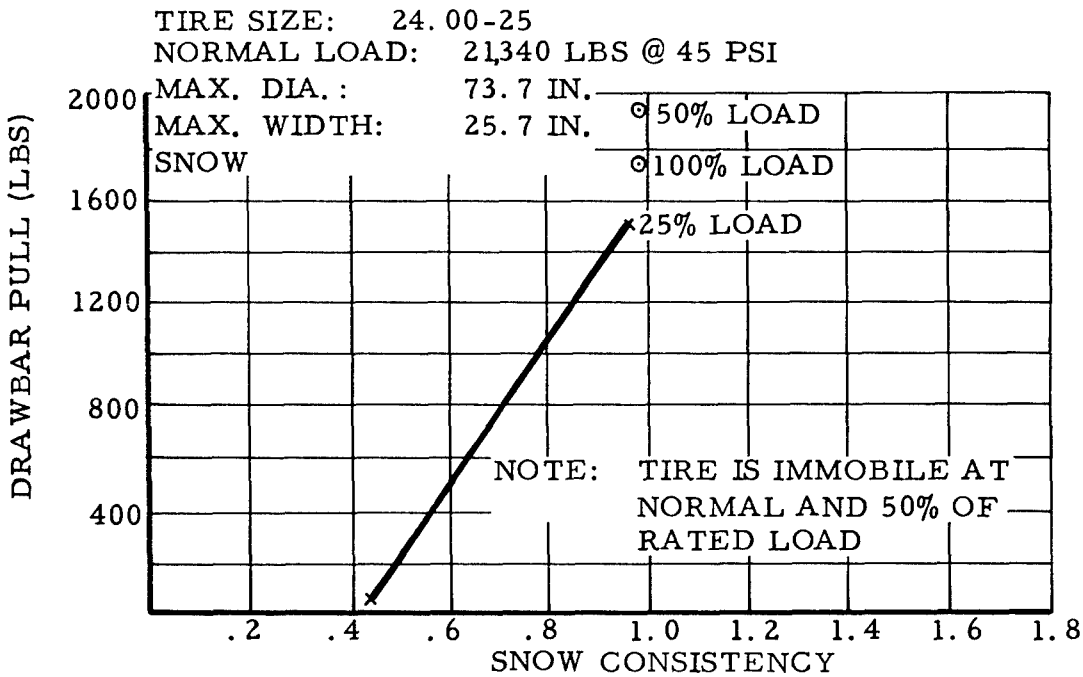

FIGURE B83. DRAWBAR PULL VS. SNOW CONSISTENCY, 24.00-25 TIRE

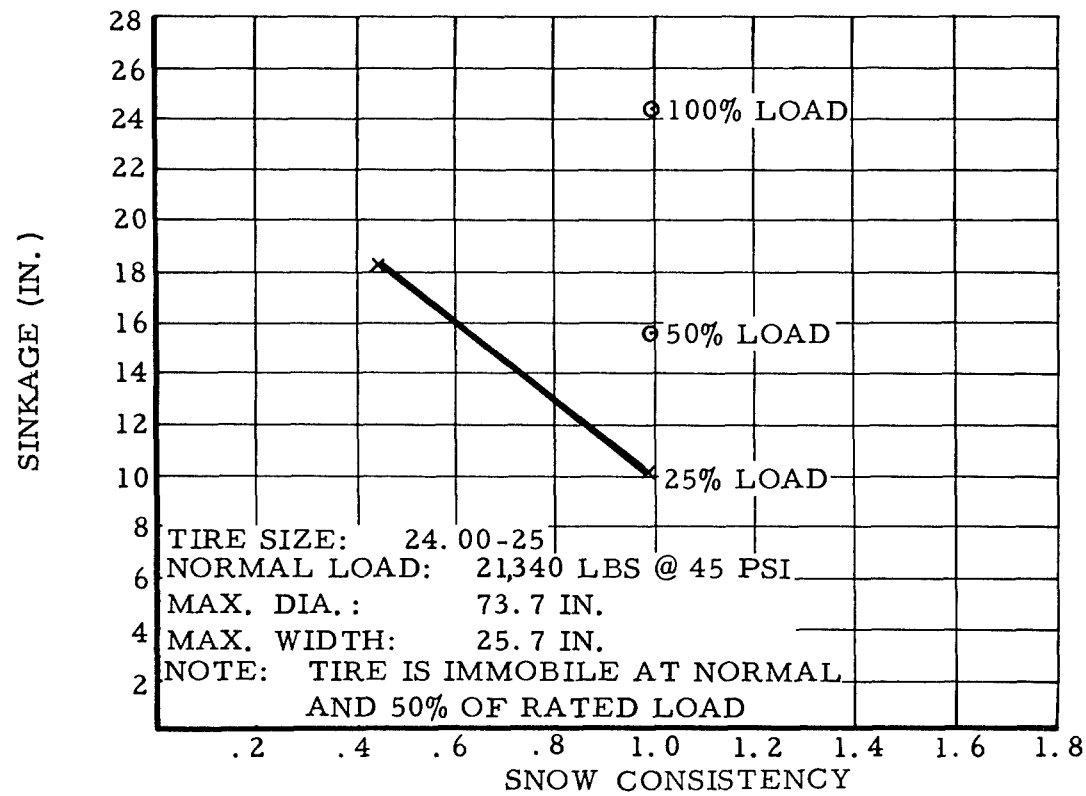

FIGURE B84. SINKAGE VS. SNOW CONSISTENCY, 24.00-25 TIRE

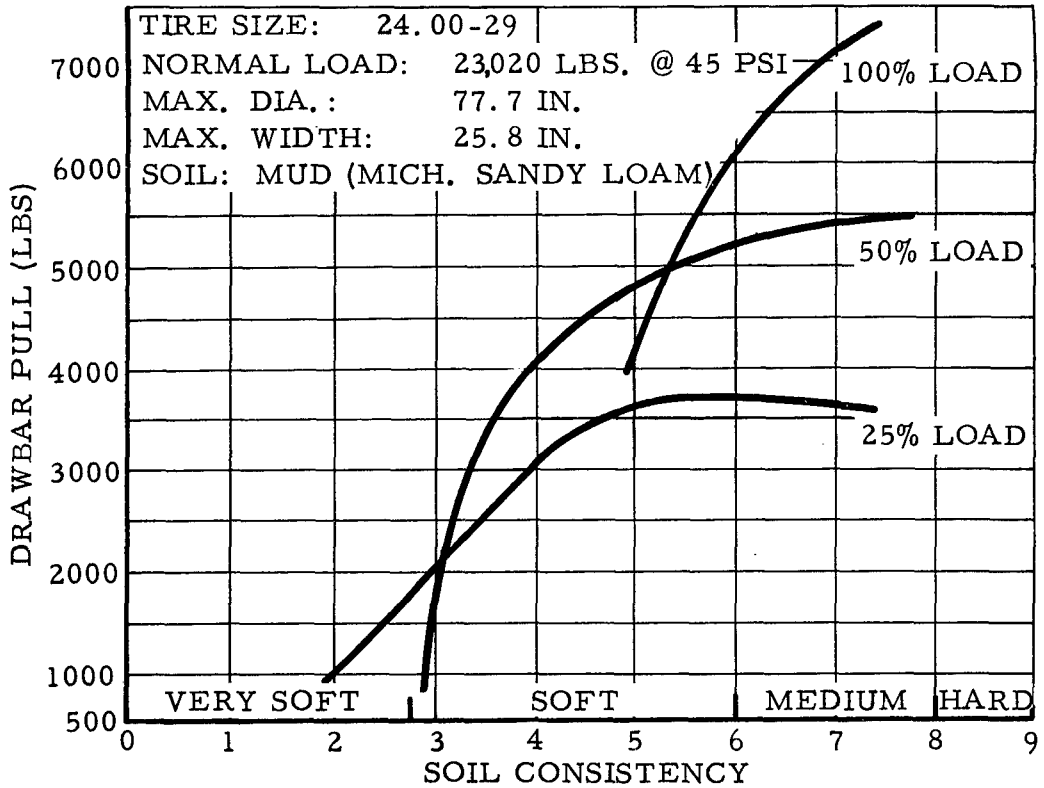

FIGURE B85. DRAWBAR PULL VS. SOIL CONSISTENCY, 24.00-29 TIRE

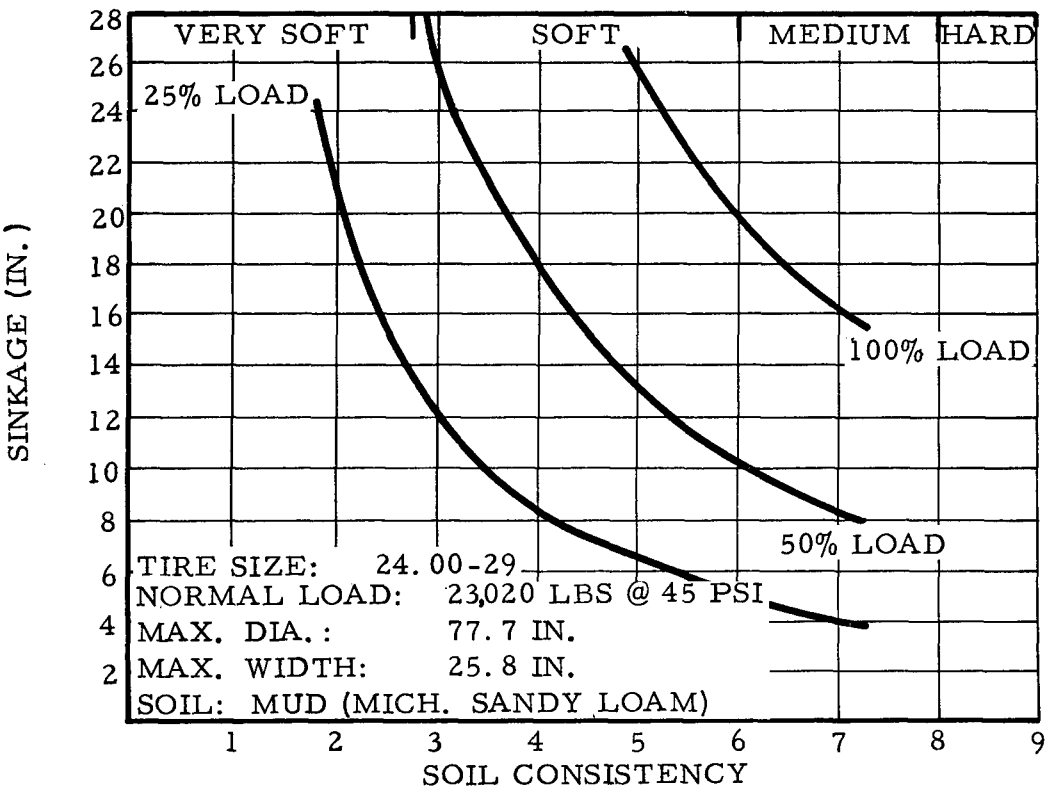

FIGURE B86. SINKAGE VS. SOIL CONSISTENCY, 24.00-29 TIRE

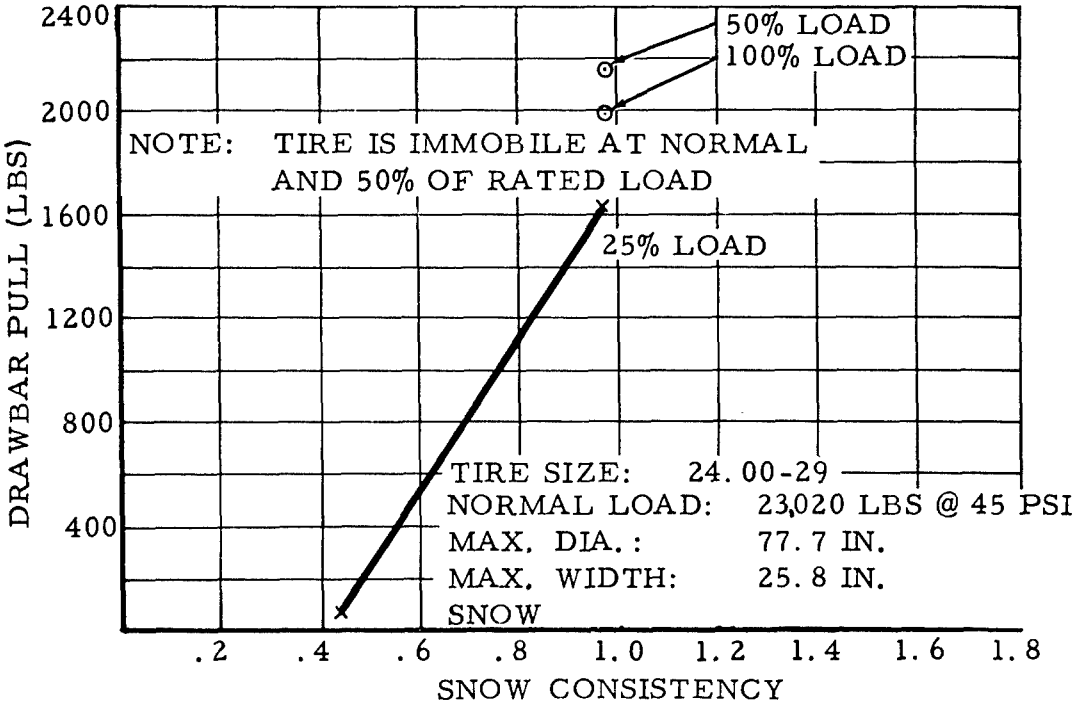

FIGURE B87. DRAWBAR PULL VS. SNOW CONSISTENCY, 24.00-29 TIRE

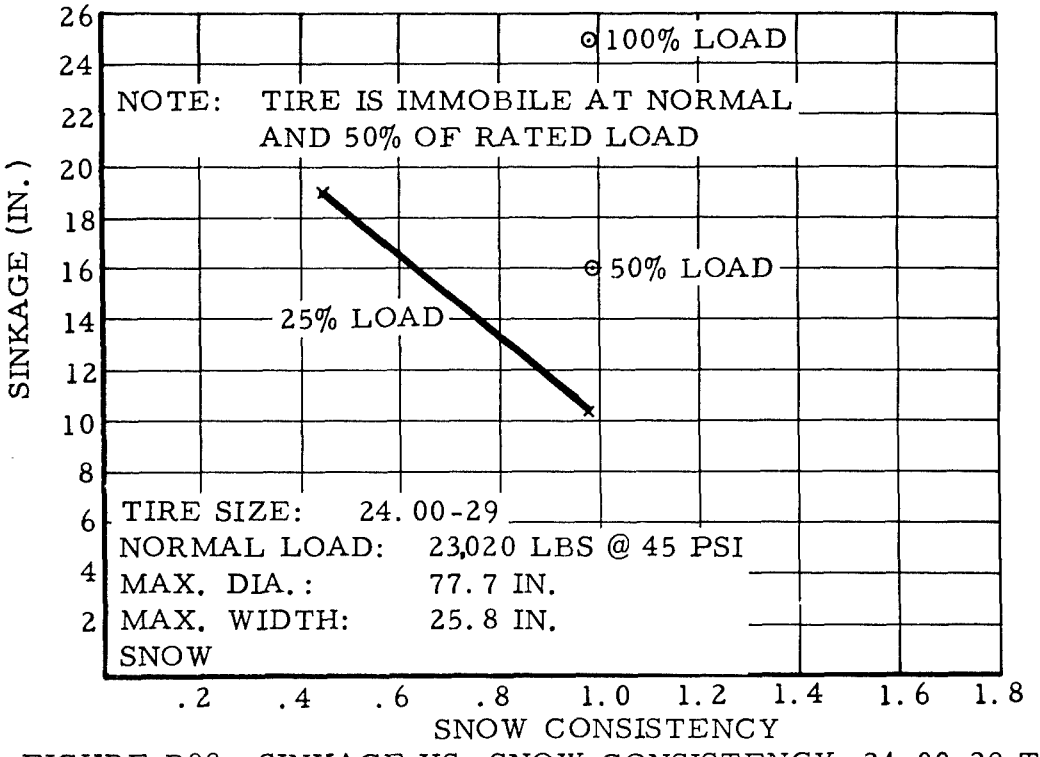

FIGURE B88. SINKAGE VS. SNOW CONSISTENCY, 24.00-29 TIRE

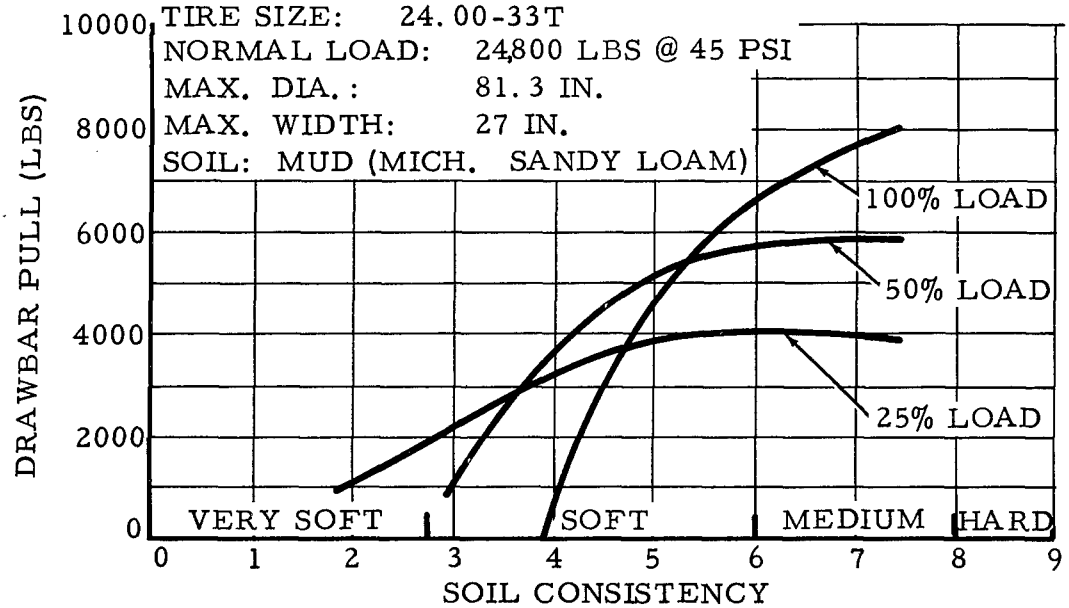

FIGURE 89. DRAWBAR PULL VS. SOIL CONSISTENCY, 24.00-33T TIRE

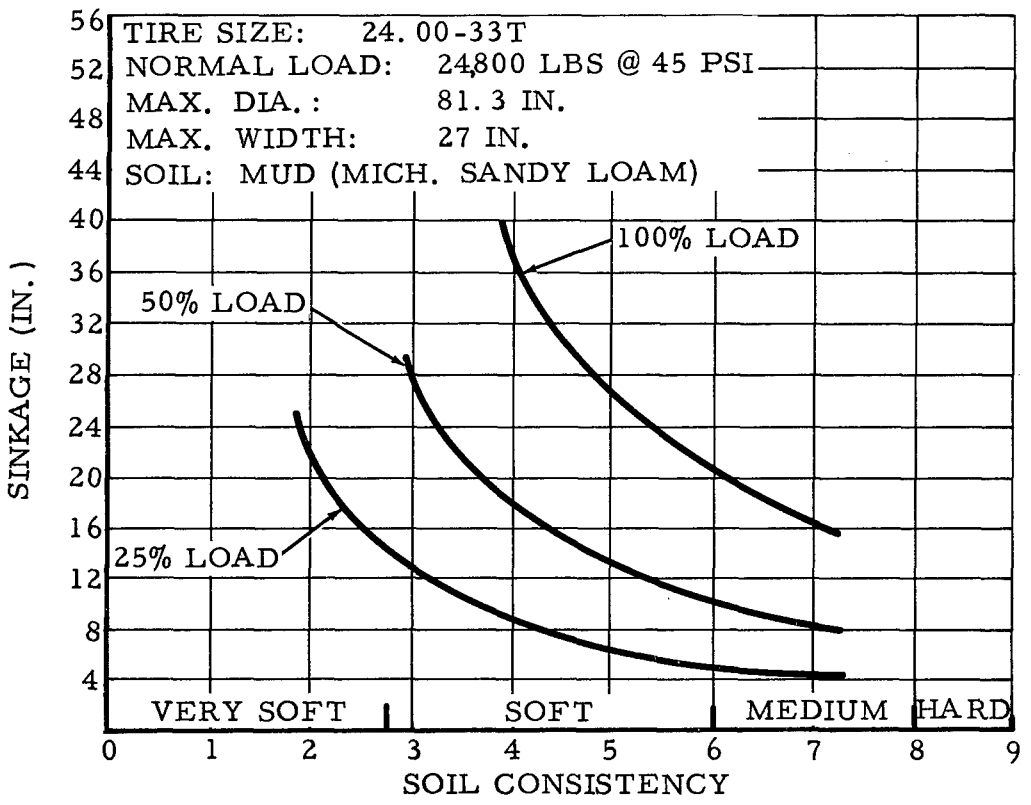

FIGURE B90. SINKAGE VS. SOIL CONSISTENCY, 24.00-33T TIRE

TIRE SIZE: 24.00-33T
NORMAL LOAD: 24,800 LBS @ 45 PSI
MAX. DIA.: 81.3 IN.
MAX. WIDTH: 27.0 IN.
SNOW
NOTE: TIRE IS IMMOBILE AT NORMAL AND 50% OF RATED LOAD

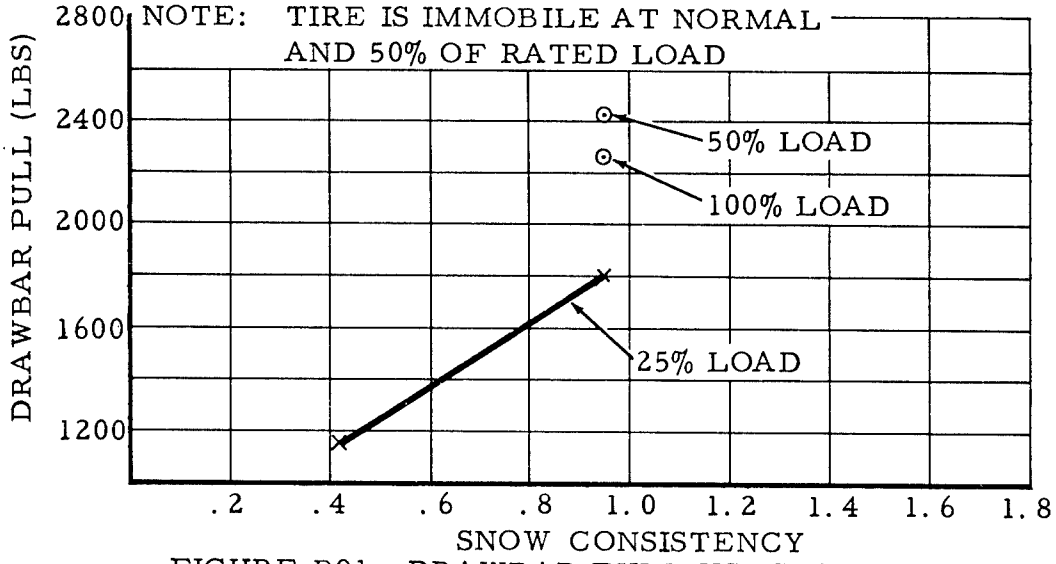

FIGURE B91. DRAWBAR PULL VS. SNOW CONSISTENCY, 24.00-33T TIRE

TIRE SIZE: 24.00-33T
NORMAL LOAD: 24,800 LBS @ 45 PSI.
MAX. DIA.: 81.3 IN.
MAX. WIDTH: 27 IN.
SNOW
NOTE: TIRE IS IMMOBILE AT NORMAL AND 50% OF RATED LOAD

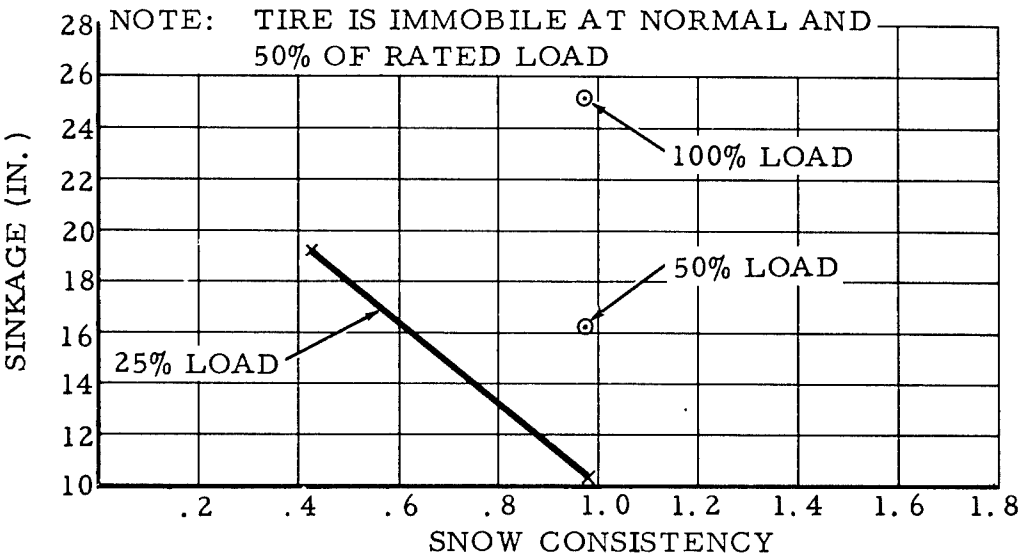

FIGURE B92. SINKAGE VS. SNOW CONSISTENCY, 24.00-33T TIRE

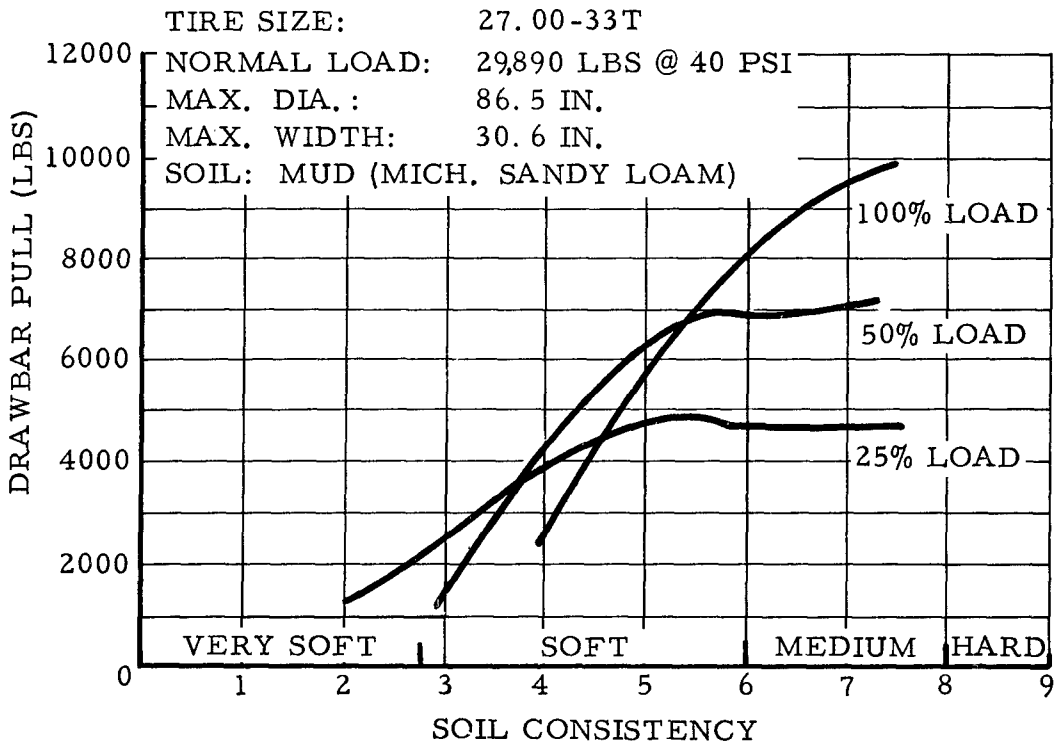

FIGURE B93. DRAWBAR PULL VS. SOIL CONSISTENCY, 27.00-33T TIRE

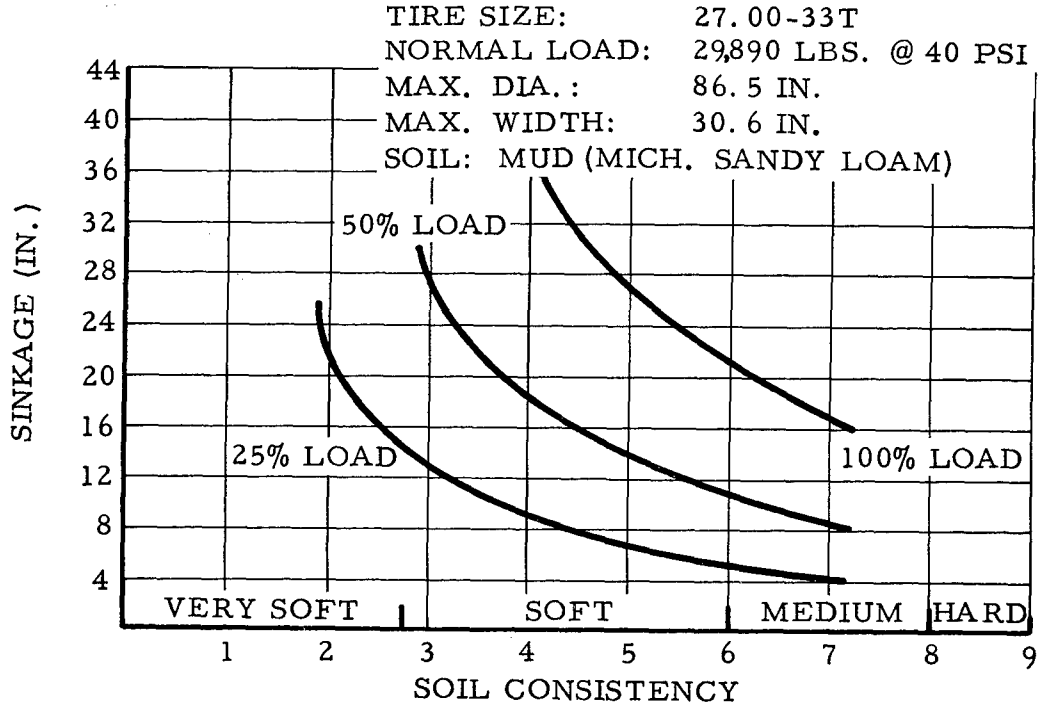

FIGURE B94. SINKAGE VS. SOIL CONSISTENCY, 27.00-33T TIRE

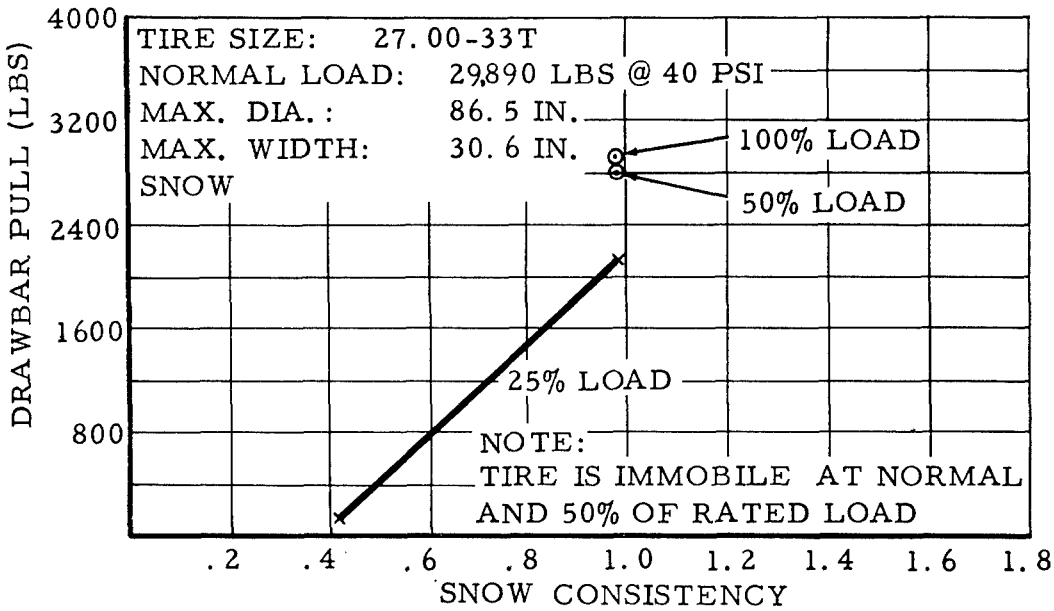

FIGURE B95. DRAWBAR PULL VS. SNOW CONSISTENCY, 27.00-33T TIRE

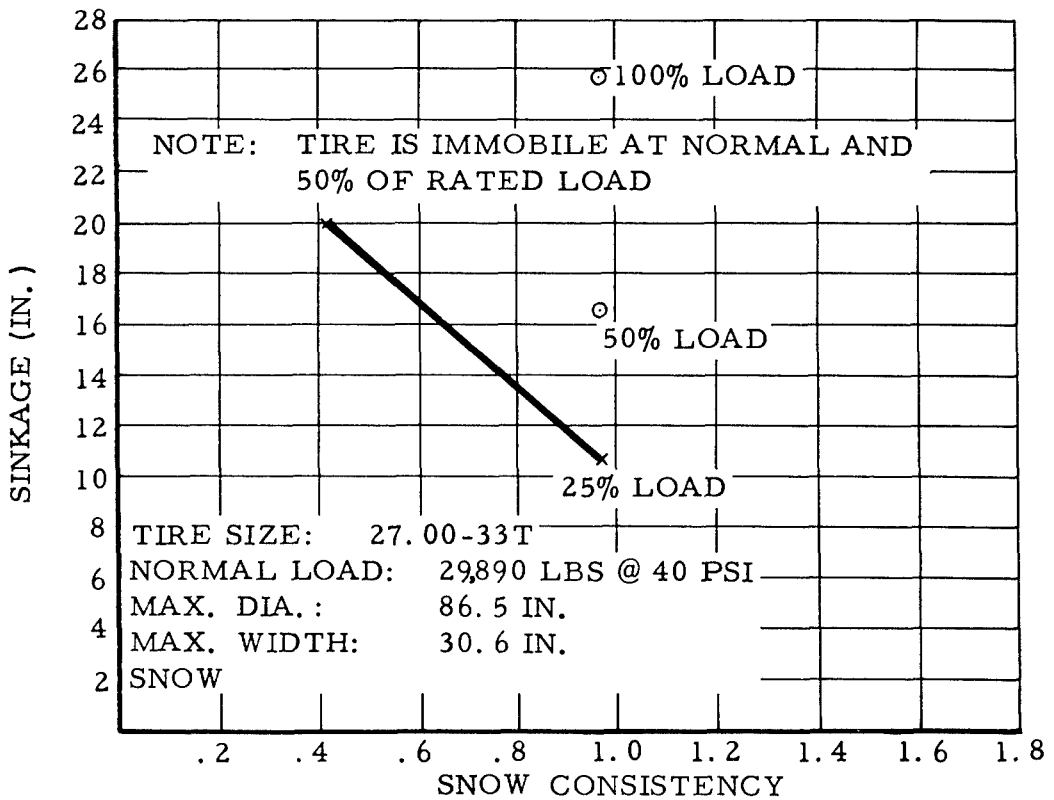

FIGURE B96. SINKAGE VS. SNOW CONSISTENCY, 27.00-33T TIRE

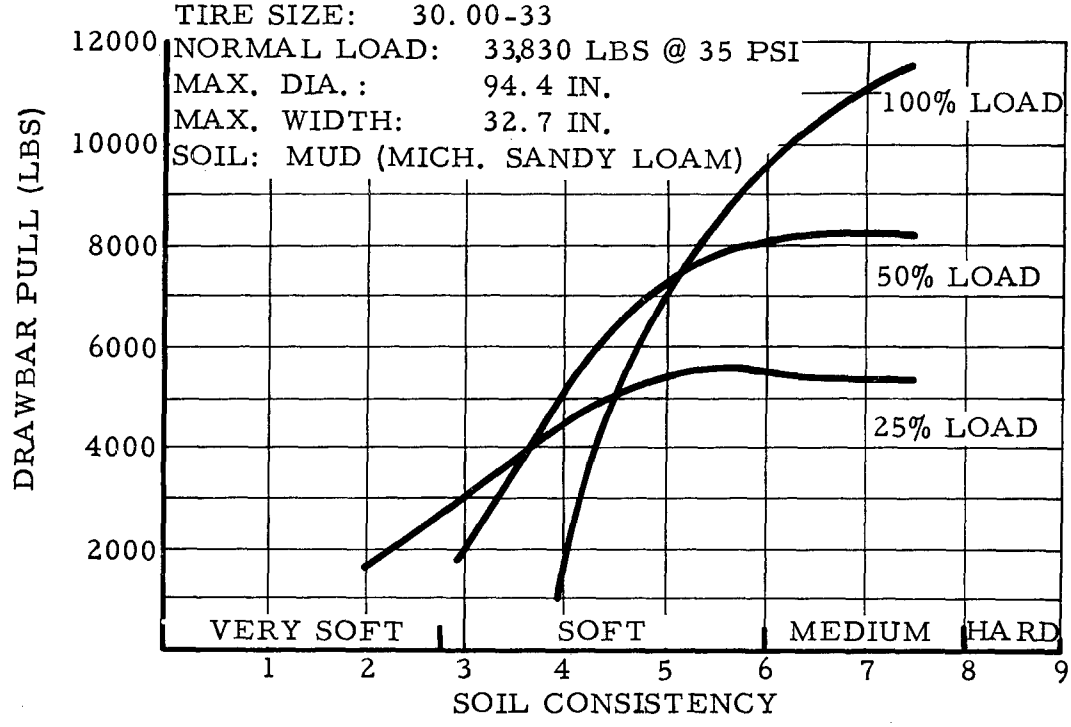

FIGURE B97. DRAWBAR PULL VS. SOIL CONSISTENCY, 30.00-33 TIRE

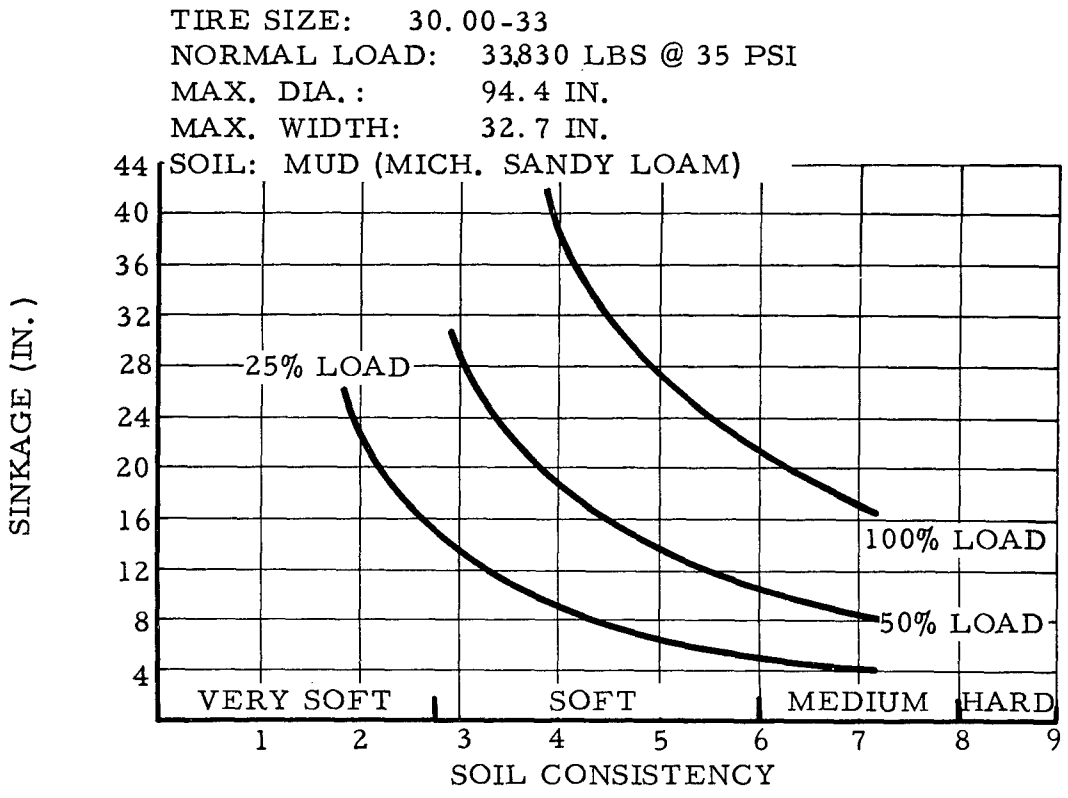

FIGURE B98. SINKAGE VS. SOIL CONSISTENCY, 30.00-33 TIRE

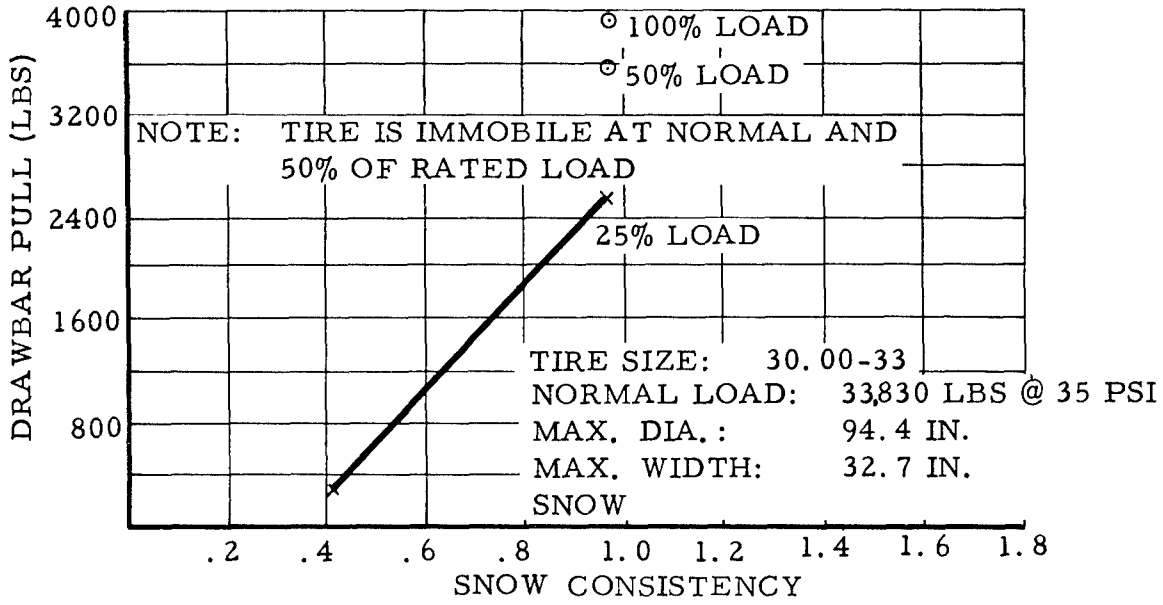

FIGURE B99. DRAWBAR PULL VS. SNOW CONSISTENCY, 30.00-33 TIRE

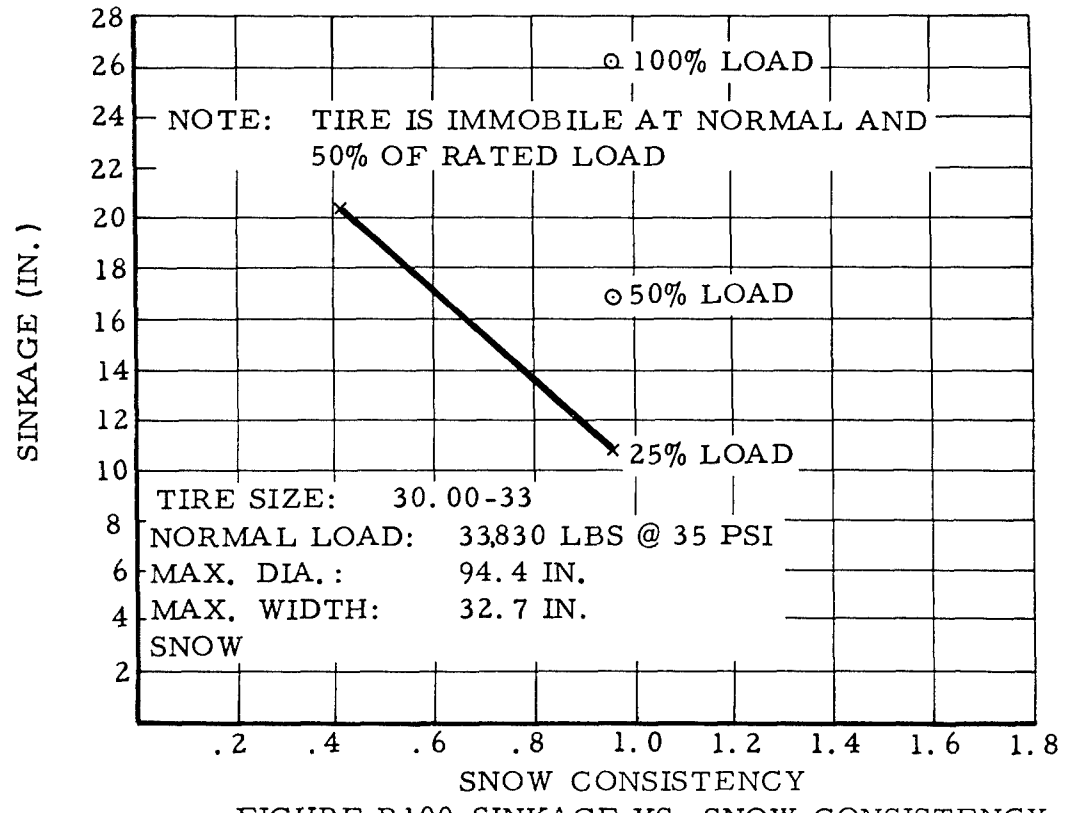

FIGURE B100. SINKAGE VS. SNOW CONSISTENCY, 30.00-33 TIRE

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DIGITAL COMPUTER PROGRAM FOR WHEELED VEHICLE MOBILITY COMPUTATION (U) - A. Edwards

Report No. RR-7, February, 1960, 68pp - Illus - Tables
Contract No. DA-20-089-ORD-39246, DA Proj. 5W72-01-001
ORD Proj. 5510.11.270 Unclassified Report

A general computer program was written for the Electrodata 204 Digital Computer to permit rapid solution of wheeled vehicle mobility performance in accordance with the theory and procedure practiced by OTAC Land Locomotion Laboratory.

Curves of sinkage and drawbar pull versus mud and snow soil consistencies were plotted of various sized tires for preliminary design guidance.

-UNCLASSIFIED-

1. DIGITAL COMPUTER
2. Contract No. DA-20-089-ORD-39246

AD _____ ACCESSION NO _____

Ordnance Tank-Automotive Command, Detroit Arsenal, Computer Laboratory, Center Line, Michigan
DIGITAL COMPUTER PROGRAM FOR WHEELED VEHICLE MOBILITY COMPUTATION (U) - A. Edwards

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ORD Proj. 5510.11.270 Unclassified Report

A general computer program was written for the Electrodata 204 Digital Computer to permit rapid solution of wheeled vehicle mobility performance in accordance with the theory and procedure practiced by OTAC Land Locomotion Laboratory.

Curves of sinkage and drawbar pull versus mud and snow soil consistencies were plotted of various sized tires for preliminary design guidance.

-UNCLASSIFIED-

1. DIGITAL COMPUTER
2. Contract No. DA-20-089-ORD-39246