SECTION 2

MINEFIELD BREACHING CALCULATION

0201. **Introduction**. Time required for minefield breaching depends on factors like time of the day, equipment available, characteristics of the minefield etc. An estimated timeline has been worked out empirically for hand breaching method basing on few assumptions. This time should not be followed rigidly as it will vary on nature of ground, enemy interference etc.

0202. **Composition of Minefield Breaching Team**. There are a few assumptions to be made before calculating the time for hand breaching. They are as follows:

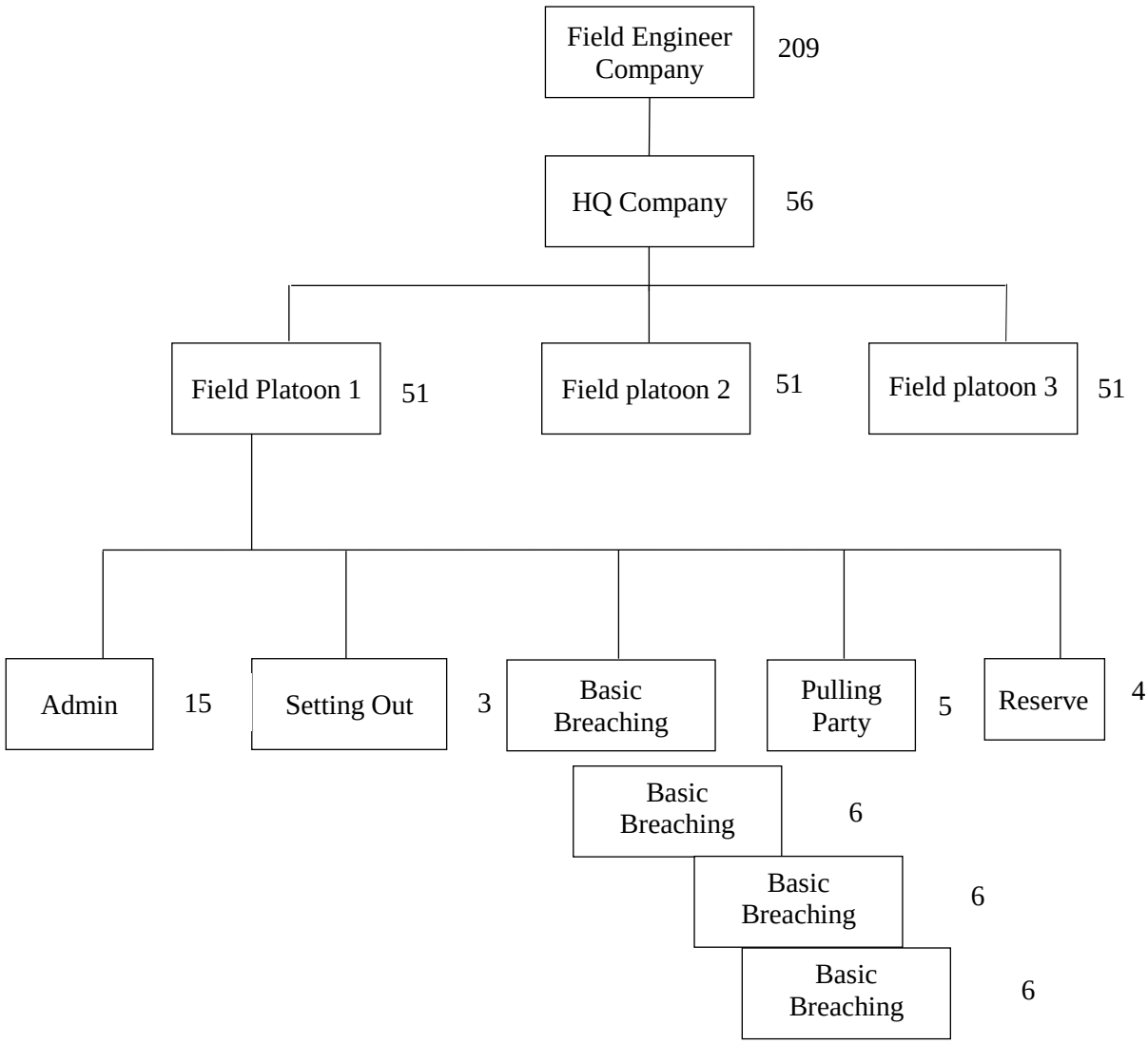
a. The men are fresh and of average proficiency.
b. There is no enemy interference.
c. The weather is reasonable.
b. Stores do not have to be carried more than 200 yards.

0204. A group of troops with 36 ORs is normally employed to clear an 8 yards lane to a depth of 120 yards. For every additional 120 yards another group of 36ORs should be employed. The following table gives a suggested organization of breaching parties.

Table. Organization of Breaching Party

Serial	Party and Task	Strength		Remarks
		NCO	ORs	
1.	One Setting Out Party	1	2	
2.	Four Basic Breaching Parties	4	20	
3.	One Pulling Party	1	4	
4.	Reserve and Store men	-	4	
5.	Lane Marking, done by serial 1 and 2 after completion of their task	-	-	
6.	Track Maintenance done by all as they become available	-	-	
Total		6	30	

0205. Organization of a Field Engineer Company as Minefield breaching party is shown below:



0206. **Average Total Time**.The table below shows the average time to complete a 120 yards X 8 yards minefield lane (including setting out, detecting, neutralizing, pulling, marking etc).

Serial	Method ofSetting Out	Time Taken (hours)			Remarks
		By Day	Full Moon	Dark Night	
1	Using Baby Viper or Anti Mine Shoes	3	4	5	
2	Prodding, without Baby Viper or Anti Mine Shoes	4	5	6	

0207. **Time for Specific Task**.The table below gives the average time for specific tasks taken by particular parties in a breaching operation under full moon condition.

Serial	Task	Party	Extent of Task	Time (minutes)
1	Setting out guide tape	Setting Out Party (1,2)	90^X	60
2	Setting out cross tape	Do	8^X	10
3	Mine Detection	Breaching Party (1,5)	60^X	60
4	Pulling mines	Pulling Party (1,4)	3 mines	5

0208. **Example**.

a. **Given Data**.

(1) Breaching lane = 8 yards x 900 yards.
(2) Attached troops = 2 x Assault Pioneer Platoon.
(3) Last light = 1830 hours.
(4) First light = 0530 hours.
(5) Moon Condition=3rd Qtr 4th Day
(6) Execution day from D+1 day

b. **Assumptions**.

(1) The men are fresh and of average proficiency.
(2) There is no enemy interference.
(3) The Weatheris reasonable.
(4) Stores do not have to be carry more than 200^x.

c. **Assumed**.

(1) Total efficiency = 3x Engineer platoon+ 1 Engineer Platoon
= 4x Engineer Platoon.

[Efficiency of 1 assault pioneer platoon=Efficiency of ½ Engineer platoon]

(2) We assume that the previous task reqd 336 min to finish after last light on D+1 day. Then the breaching op will start.

(3) Time required for necessary organization and rest for breaching op = 1 hr 24 min.

d. **Setting Out Party**. The start time for setting out is (336 min + 1 hr 24 min) or 420 min or 7 hr later than last lt D+1 day. There will be 15 segments of each 60yards length and 8yardswidth. Workhour available= (11-7) = 4 hour.

Now,

(1) For setting box tape time reqr = 10 min

(2) For setting guide tape time reqr = $\frac{60}{90}$x60
= 40 min

So, for setting 1st segment time reqr= 40+10
= 50 min

(3) For setting cross tape time reqr = 10 min

(4) For setting guide tape time reqr = $\frac{60}{90}$x60
= 40 min

So, for setting upto2nd segment time reqr = 50+10+40
= 100 min.

(5) For setting cross tape, time reqr= 10 min.

(6) For setting guide tape, time reqr= $\frac{60}{90}$x60
= 40 min.

So, for setting upto3rd segment, time reqr = 100+10+40
= 150 min.

(7) For setting cross tape time reqr= 10 min.

(8) For setting guide tape time reqr= $\frac{60}{90}$x60
= 40 min

So, for setting upto4th segment time reqr = 150+10+40
= 200 min.

(9) For setting crossing tape time reqr= 10 min.Since 30 min left after this, so this party will start after next day last light.

(10) Dark hour = 5 x 52 =260 min.

(11) For setting guide tape time reqr= $\frac{60}{90}$x60 x $\frac{5}{6}$
= 48 min

So, for setting upto5thsegment time reqr = 200+10+48
= 258 min.

(12) For setting cross tape, time reqr= 10x$\frac{6}{5}$
= 12 min

(13) For setting guide tape time reqr= $\frac{60}{90}$x60 x $\frac{5}{6}$
= 48 min

For setting upto6thsegment time reqr= 258+12+48
= 318 min.

(14) For setting crossing tape time reqr= 10 x $\frac{5}{6}$
= 12 min.

(15) For setting guide tape time reqr= $\frac{60}{90}$x60 x $\frac{5}{6}$
= 48 min

For setting upto7th segment time reqr= 318+12+48
= 378 min.

(16) For setting cross tape time reqr= 10 x $\frac{5}{6}$
= 12 min.

(17) For setting guide tape time reqr= $\frac{60}{90}$x60 x $\frac{5}{6}$
= 48 min.

For setting upto8th segment time reqr= 378+12+48
= 438 min.

(18) For setting crossing tape time reqr= 10 x $\frac{5}{6}$
= 12 min.

So dark hour left = 260-(48x4+12x4)
= 260- 240
= 20 min.

(19) In 20 min guide tape laid $= \frac{90}{60} \times 20\frac{5}{6}$
$= 25^x$

res $(60-25)^x$ on 35^x is laid in $= \frac{60}{90} \times 35$
$= 23.33$
$\cong$ 24 min.

For setting upto 9^{th} segment time reqr = (438+12 +20+24)
= 494 min.

(20) For setting x tape time reqr = 10 min.

(21) For setting guide tape time reqr $= \frac{60}{90} \times 60$
= 40 min.

For setting this segment (10^{th} segment) time reqr = 40+10 = 50 min.

(22) For setting, 11^{th}, 12^{th}, 13^{th}, 14^{th}, 15^{th} segment will reqr= (50x 5)
= 250 min.

So total time require upto 15^{th} segment = 15^{th}segment
= (494+50+250)
= 794 min

(23) For setting finishing tape time reqr =10 min
So, overall time reqr = 794 + 10
= 804 min by setting out party.

e. **Basic Breaching Party-1**. This party will start when setting out party will lay guide tape upto 20yards

Setting out party will go 20^x in $= \frac{60}{90} \times 20$
= 13.3

For easy calculation we will start often (10+15) minute of the setting out party = 25 min.

So wk time available = 7 hour-25 min.
= 3 hour 35 min.

(1) Breaching party will clear 60^x in 60 min.

(2) For breaching 2^{nd} segment time reqr= 60 min.

(3) For breaching 3^{rd} segment time reqr= 60 min.

(4) From 4^{th} segment time left = 3 hr 35 min - 3x 60 min.
= 35 min.

So, 4^{th} segment will be left for next day breaching

(5) Dark night = 5x 52
= 260 min.

(6) For breaching 4^{th} segment time reqr= 60 x $\frac{6}{5}$
= 72 min.

(7) For breaching 5^{th} and 6^{th} segment time reqr=72x 2=144 min.

Dark hour left = 260- (72+144)
= 44 min.

(8) In 44 min breaching can be done = 44x$\frac{5}{6}$
= 36.67
$\cong 36^{x}$

Left (60-36)yards or 24yards can be breached in= 24 x $\frac{60}{60}$
= 24 min.

7^{th} segment is completed with overalltime=(3x60+72+2x72+44+24)= 464 min.

(9) Night time left = 11 hr-(260 min+24 min)
= 11 hr-284 min
= 6 hr 16 min.

(10) Time reqr to breach 8^{th} segment = $\frac{60}{60}$ x 60
= 60 min

(11) Time reqrto breach 9^{th},10^{th},11^{th},12^{th},13^{th} segment = 5x60min
= 300 min

So, total time reqrto breach upto 13^{th} segment = (464+60+300)
= 824 min

Time left = 6 hr 16 min - 360 min
= 16 min.

So, 14^{th} segment will start from next day.

(12) Dark hour left = 6x52
= 312 min.

(13) Time reqrto breach 14^{th} segment = $\frac{60}{60}$ x 60x $\frac{6}{5}$
= 72 min.

Total time reqr= 824 + 72x 2
= 968 min
= 16 hr 8 min.

f. **Basic Breaching Party-2**. This party will start when BBP-1 will advance 20yards

Time require to breach $20^x = \frac{60}{60}$ x 20 = 20 min

So, it will start after (20+25) or 45 min of setting out party.

wk time available = 4 hr - 45 min
= 3 hr 15 min

(1) For breaching 2nd, 3rd segment time reqr= $\frac{60}{60}$ x 60
= 60 min

(2) For breaching 2nd, 3rd segment time reqr = $\{\frac{60}{60}$ x 60$\}$ x 2
= 120 min

(3) From 4th segment time left= 3 hr 15 min-(60+120) min
= 15 min
So 4th segment will start from next day

(4) When, Bulk Breaking Point -1 will breach 20^x next day they will start.

Time reqrto breach 20yards= 20x $\frac{6}{5}$
=24 min

(5) Dark hr left = (260-24) = 236 min

(6) Time reqrto breach 4thsegment = 60 x $\frac{6}{5}$= 72 min.

(7) Time reqrto breach 5th and 6th segment= 72x 2 = 144 min.

(8) In 20 min, breaching done = 20x $\frac{5}{6}$
= 16.67
≅16 yards

Left (60-16)yards or 44yardsbreached in=44 x $\frac{60}{60}$= 44 min

7th segment is completed at (30x60+24+72+2x72+20+44)
=484 min
Ni time left =11 hr - (260+44) min
= 5 hr 56 min.

(9) Time reqrto breach 8th, 9th, 10th, 11th, 12th Segment
= 60 x 5 min
= 300 min.

Time left = 5 hr 56 min - 300 min
= 56 min.

So, the wk will start from next day from 13th segment

So, Time reqrto breach 13th, 14th 15th segment
= ($\frac{60}{60}$ x 60 x $\frac{6}{5}$) x 3
= 72x 3 = 216 min.

So total time reqr = 484+300+216= 1000 min.
= 16 hour 40 min.

g. **Basic Breaching Party-3**. This party will start when Bulk Breaking Point -2 will advance 20^x, Time reqr to breach $20^x = \frac{60}{60} \times 20 = 20$ min.

So, this party will start often = (45+20) = 65 min of setting out party.

wk time available = 4 hrs - 65 min.
= 175 min.

(1) Time reqrto breach 1^{st} and 2^{nd} segment = $(\frac{60}{60} \times 60) \times 2 = 120$ min.
Time left = 175 - 120 = 55 min
So, 3rd segment branching will start from next day.

(2) Darkhraval = 5x 52 = 260 min.

(3) Time reqrto breach 3rd, 4th, 5th, segment is = $(60 \times \frac{6}{5}) \times 3$
= 72 x 3
= 216 min
Dark hour left = (260-216) = 44 min.

(4) In 44 min, breaching done = $44 \times \frac{5}{6}$
= 36.67
$\cong 36^x$

(5) Left $(60-36)^x$ or 24^x is breached in = 24 min.
6th segment completed by = 2x60 + 3x 72+ 44 +24= 404 min.
Night time left = 11 hr - (260+24)
= 6 hr 16 min.

(6) Time reqrto breach, 7th, 8th, 9th, 10th,
11^{th} and 12^{th}segment = 60x6
= 360 min.
Time left = 6 hrs 16 min -360 min.
= 16 min.
So, the 13^{th} segment will start from next day.

(7) Time to go Bulk Breaking Point -2, $20^x = 20 \times \frac{6}{5}$
= 24 min.
So 13th segment will start from total work,
(404 + 360 +24) = 788 min

(8) Time reqrto breach 13^{th}, 14^{th} and 15^{th} segment = $60 \times \frac{6}{5} \times 3 = 216$ min

(9) Total time require = 1004 min or 16 hr 44 min

h. **Basic Breaching Party-4**. This party will start when Bulk Breaking Point -3 will advance upto 20^x, Time reqrto advance $20^x = \frac{60}{60}$ x 20 = 20 min.

This party will start after (65+20) = 85 min of setting out party.

wk time available = 4 hr - 85 min
= 155 min

(1) Time reqrto breach 1st and second segment $=\frac{60}{60}$ x 60 x 2=120 min.
Time left = 155-120 = 35 min
So, 3rd segment will start from next day

(2) Dark night available = 5x52 = 260 min.

(3) Time reqrto advance 20^x of Bulk Breaking Point -3 = $20\ \frac{6}{5}$= 24 min.

(4) Time require to breach 3rd, 4th and 5th segment = (60x $\frac{6}{5}$) x 3

= 72x 3 = 216 min.

Dark night left = 260- (216+24) min= 20 min.

(5) In 20 min breaching done = 20x $\frac{5}{6}$= 16.67≅ 16^x

(6) left $(60\text{-}16)^x$ or 44^x is breached in $\frac{60}{60}$ x 44 min.
6th segment completed by = 2x 60 + 3x 72 + 44 + 20 +24 = 424 min.
Night time left = 11 hour - (200+44)
= 11 min– 5hour 4 min= 5 hour 56 min.

(7) Time require to breach 7th, 8th, 9th, 10th and 11th Segment
= 60x 5 =300 min.
Time left = 5 hr 56 min - 300 min
= 56 min.

So 12th Segment will start from next day
Upto 12th segment total work = (424 +300)
= 724 min.

(8) Time reqrto breach 12th, 13th, 14th, 15th Segment
= 60 x$\frac{6}{5}$ x 4 = 4x 72 = 288 min.
Total time reqr = (124+288) min
= 1012 min or 16 hr 52 min.

j. **Pulling Party**. This party will start when all breaching is done and start time is 288 min later than last light in D+ 4 day. Dark night available = 312 - 288 = 24 min

Number of mine = Frontage x Density
= 8x 5/3
= 13.33
≅ 14

In dark night,

5 minreqr to pull 3 mines x $\frac{5}{6}$

or, 24 minreqrto pull = 3x $\frac{5}{6}$ x $\frac{24}{5}$
= 12 mine

In moon lit night, 2 mineslitfed in = $\frac{5}{3}$ x 2
= 3.33
≅ 4 min

k. **Marking Lane**. Time require for 1 Platoon to mark 120^x is = 30 minutes so, time reqrfor 4 Platoon to mark 900^x = 30 x $\frac{900}{120}$ x $\frac{1}{4}$
= 5625
≅ 57 min

Time reqrupto (312+ 4+ 57)min or 375 min after last light D + 4 day.

0208. **Summary of Calculation.**

a. **Minefield Breaching.**

(1) Start Time. 1330 hours D+1Day
(2) Completion Time. 0043 hours D+4Day
(3) Transport Requirement. Integral.

0209. **Example Calculation (Second Method)**.

a. Given that,

(1)	Frontage	- 4000^{x}
(2)	Depth	- 360 ^{x}
(3)	Density	- 1 $\frac{1}{3}$
(4)	Mixed Strip	- 2
(5)	Troops Available	- 3 Engineer Platoon
(6)	Met Condition	- 2nd Quitter 6th day
(7)	Firstlight	- 0600 hour
(8)	Last light	- 1800 hour

b. We need to find out:

(1) Detail Calculation
(2) Store List
(3) WorkProgram

0210. **Summary.**

a.	Man Power	- 7x Section
b.	Time Reqr	- 12 hr 05 min

0211. **Store List**

a. Prismatic Compass
b. Short Prodder
c. Long Prodder
d. Mine Detector
e. Mine Marker
f. Safety Pin
g. Wire Cutter
h. Trip wire feeler
j. Reel of tape
k. White tape (Tracing Tape)
l. 8 yard White tape
m. Pliers
n. Pin for securing tape
p. Eye Protector
q. Fulcrum
r. Long Piquet-36
s. Light (Green, Yellow)
t. Concertina - 04 Coil

0212. **Detail Calculation.**

a. **For 120 yds.**

Serial	Party	Task	Time (minutes)	Time		Remarks
				From	To	
1.	Setting Out	Base Tape	10	1735	1745	
		Guide Tape to x tape - 60^{x}	40	1745	1825	
		X tape	10	1825	1835	
		Guide Tape to x tape - 120^{x}	40	1835	1915	
		X tape at 120^{x}	10	1915	1925	
2.	Basic Breaching Party (BBP-1)	Prodding 1^{st} Segment (60^{x})	60	1800	1900	
		Rest	10	1900	1910	
		Prodding 2^{nd} Segment (60^{x})	60	1910	2010	
3.	Bulk Breaking Point -2	Prodding (40^{x})	40	1820	1900	
		Rest	10	1900	1910	
		Prodding (60^{x})	60	1910	2010	
		Rest	10	2010	2020	
		Prodding (20^{x})	20	2020	2040	
4.	Bulk Breaking Point -3	Prodding (20^{x})	20	1840	1900	
		Rest	10	1900	1910	
		Prodding (60^{x})	60	1910	2010	
		Rest	10	2010	2020	
		Prodding (40^{x})	40	2100	2100	
5.	Bulk Breaking Point -4	Prodding (60^{x})	60	1910	2010	
		Rest	10	2010	2020	
		Prodding (60^{x})	60	2020	2120	

b. **For Next 120^{x} (Depth 240^{x})**

Serial	Party	Task	Time (minutes)	Time		Remarks
				From	To	
6.	Setting Out (Same)	Rest	35	1925	2000	
		Laying Guide Tape from 120^{x} to 60^{x} front	40	2000	2040	
		X Tape at 180^{x}	10	2040	2050	
		Laying Guide tape up to 240^{x}	40	2050	2130	
		X tape at 240^{x}	10	2130	2140	
7.	Bulk Breaking Point -5	Prodding 60^{x}	60	2130	2230	
		Rest	10	2230	2240	
		Prodding 60^{x}	60	2240	2340	
8.	Bulk Breaking Point -6	Prodding 40^{x}	40	2150	2230	
		Rest	10	2230	2240	
		Prodding 60^{x}	60	2240	2340	
		Rest	10	2340	2350	
		Prodding 20^{x}	20	2350	0010	
9.	Bulk Breaking Point -7	Prodding 20^{x}	20	2210	2230	
		Rest	10	2230	2240	
		Prodding 60^{x}	60	2240	2340	
		Rest	10	2340	2350	
		Prodding 40^{x}	40	2350	0030	
10.	Bulk Breaking Point -8	Prodding 60^{x}	60	2240	2340	
		Rest	10	2340	2350	
		Prodding 60^{x}	60	2350	0050	

c. **For the Last 120^{x} (360^{x} Depth).**

Serial	Party	Task	Time (minutes)	Time		Remarks
				From	To	
11.	Setting Out (Same)	Rest	50	2140	2230	
		Guide Tape from 240^{x} to 300^{x}	40	2230	2310	
		Cross Tape	10	2310	2320	
		Guide tape from 300 to 360^{x}	40	2320	0000	
		X tape at 360^{x}	10	0000	0010	
12.	Bulk Breaking Point -9	Prodding 60^{x}	60	0100	0200	
		Rest	10	0200	0210	
		Prodding 60^{x}	60	0210	0310	
13.	Bulk Breaking Point -10	Prodding 40^{x}	40	0120	0200	
		Rest	10	0200	0210	
		Prodding 60^{x}	60	0210	0310	
		Rest	10	0310	0320	
		Prodding 20^{x}	20	0320	0340	
14.	Bulk Breaking Point -11	Prodding 20^{x}	10	0140	0200	
		Rest	10	0200	0210	
		Prodding 60^{x}	60	0210	0310	
		Rest	10	0310	0320	
		Prodding 40^{x}	40	0320	0400	
15.	Bulk Breaking Point -12	Prodding 60^{x}	60	0210	0310	
		Rest	10	0310	0320	
		Prodding 60^{x}	60	0320	0420	
16.	Pulling minutes	Pulling Atk Mines (4/3 x 8^{x}= 11 min)	20	0420	0440	
17.	Setting Out and Basic Breaching	Marking the lanes	90	0440	0610	

Time Reqr = 11hr 40min (From 1800 to 0540)

Again Setting out Starts = 1735 hr

Total time Reqr = (11hr 40 min+25 min)

= 12 hr 05 min

For Pulling Party,

Since density 1 $\frac{1}{3}$or$\frac{4}{3}$

Max mine in 8 yards = $\frac{4x8}{3}$

= 10.66

≅ 11

0213. **Store List.**

a. Prismatic Compass - 03 Nos

b. Short Prodder - 30 Nos

c. Trip Wine Feeler - 30 Nos

d. Wire Cutters - 150 Nos

e. Eye Protector - One Per man

f. Reel of Fish line - 30 Nos

g. Store for lane marking

(1) Long Picket

= {(2x $\frac{\text{depth}}{12.5}$)+2}+10%

= 65.56≅66

(2) Barbed Wire Coil

= $\frac{4x\text{Depth}}{100}$

= $\frac{4x360}{100}$

= 14.4

≅ 15

(3) Safe Lane Marker

$= \frac{2xDepth}{100}$

$= \frac{2x360}{100}$

= 7.2

≅ 8

(4) Green light = Yellow light

= No of safe lane Marker + 20%

= 8x1.2

= 9.6

≅ 10

(5) Concertina Coil

= 4 Coils

(6) Tape

$= \frac{4xDepth\ x\ 1.5}{50}$ + 10%

=47.52

≅ 48

(7) Minefield Marker

$= \frac{2xDepth}{50}$ + 10%

$= \frac{2x360}{50}$ x 1.1

= 16nos

0214-0300 Reserve.