

PART IV
STAFF REF DATA

STAFF COLLEGE
SOs' HANDBOOK 1968

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PART IV - STAFF REF DATA

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FD ENGR PLANNING TIMES
SOME TYPICAL TASKS

Serial (a)	Task Gp (b)	Task (c)	Planning Times (d)	Eqpt (e)
1.	Rds and tracks	Filling in gp of 3 mined craters	Sect - 2 hrs	Med wheeled or crawler tractor and tippers
		Const 25 ft hy girder overbr	Sect - 1 hr	Crane
2.	Gap crossing - fd sqn	Stream or craters - 30 ft (incl mine clearing) - 100 ft	Sect - 1 hr	Med girder br
3.	Gap crossing - armd engr sqn	Stream or craters - 20 ft 45 ft 75 ft	TP - 2 hrs AVRE fascine Centurion brlaver - 3-5 mins Centurion APK - 3-5 mins	Med girder br
4.	Dmls	Culverts or gp of 3 craters	Sect - 2 hrs (incl mining)	1 x 4-ton load of explosive and mines per 8 tasks
		Br (producing 50-100 ft gap) (Not reinforced concrete)	Sect - 6 hrs (deliberate method)	1 x 4-ton load explosives and mines per br
5.	Fd deffs	Assistance with CPs and RAPs	Sect - 1 hr (rapid method)	1 x 4-ton load explosives and mines per br
		Digging in tks	One fd sqn plant tp per bde gp for 24 hrs	Med and lt wheeled tractors and compressors
6.	Minelaying: a. Density one anti-tk and at least one anti-pers mine per m of front. b. 5 x 4-ton loads of mines per 1,000 m.	Mech minelaying - hedged farmland open heath Laying by hand - buried Surface laying by hand Nuisance mining Booby trapping	TP - 200 m per hr TP - 3-400 m per hr TP - 80-80 m per hr TP - 2-300 m per hr Sect - 1 tdt per hr	Med crawler tractor and mech minelayer
7.	Rooting and mining	Tarmac rd track	Sect - 1 tdt per hr	
8.	Breaching minefields	By hand 8 yd lane - 120 yds deep By Giant Viper - 200 yds deep 8 yd lane - 400 yds deep Marking and improving lane for wheeled vehs	Sect - 1 km per hr Sect - 2 km per hr TP - 5-6 hrs Sqn - 8-12 hrs One Viper - 10 mins Two Vipers - 20 mins TP - 2-3 hrs	Hy crawler tractor and rooter Hy crawler tractor and rooter Incl final checks at firing pt

Notes:

- For periods of 3-4 days a working day can be taken as 15 hrs. Over 4 days this should be reduced to 10 hrs.
- In reality ests of time, lab and resources are made after detailed recee. They will vary greatly for every task.
- Detailed recee is seldom possible on Staff College exercises. It will therefore be assumed that these planning times are the ests given by the CRE, Fd Sqn Comd, etc unless otherwise stated.
- When planning engineer work time must be allowed for travel between tasks.

RAFTS AND BRS - PLANNING DATA

Note: The planning data given below will be used in Staff College exs. The notes on the previous page should be read before using the data.

TABLE A - RAFTS

Serial	Type	Carriage	Const Party	Const Time		Capacity Loads/Hr/400' gap		Remarks
				Day	Ni	Day	Ni	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
1.	Inf C1 2 Aslt Raft	One raft/ 1 x 3-ton veh	Sect	½ hr	½ hr	10	8	Helptbl
2.	C1 12 Lt Raft	4 x 3-ton vehs and tlrs	One tp	1 hr	1½ hrs	6	4	} Crane required for pre-assembly
3.	C1 30 Lt Raft	5 x 3-ton vehs and tlrs	One tp	1½ hrs	2 hrs	6	4	
4.	C1 80 Hy Ferry	4 x 10-ton vehs and tlrs and 2 x 3-ton vehs	One tp (with 2 dozers)	1-2 hrs	2-4 hrs	12	10	
5.	C1 8 M2	One unit	M2 crews	15 mins	20 mins	12	10	Crane required in peacetime
6.	C1 30 M2	Two units	M2 crews	20 mins	25 mins	12	10	
7.	C1 50/60 M2	Three units	M2 crews	25 mins	30 mins	12	10	

Note: Capacity figures are based on a water gap of approx 250 ft.

TABLE B - FLOATING BRS

Serial	Type	Load C1	Span (sample)	Tpt Required (excl res ept)	Building Party (excl approaches)	Planning Data			
						Const Time in hrs (excl approaches) (See Note 1)		Tfc Capacity vehs/hr	
						Day	Ni	Op	L of C
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
1.	LFB	30	410 ft	20 x 3-ton vehs and tlrs	One fd sqn	3-4	4-6	150	300
2.	HFB	80	400 ft	25 x 10-ton vehs and tlrs	One fd sqn	3-5	5-7	150	300
3.	M2	60	336 ft	12 units	M2 crews	1	1½	150	300

TABLE C - FIXED BRS

1.	MGB	16	72 ft	3 x 3-ton vehs and 2 x tlrs	One sect	1	1½	150	300
2.	MGB	30	48 ft	2 x 3-ton vehs and 1 x tlr	One sect	½	1	150	300
3.	MGB	60	100 ft	6 x 3-ton vehs and 5 x tlrs	One tp	1	1½	150	300
4.	EWBB	30	80 ft	14 x 3-ton vehs and tlrs	One tp	7	11	150	300
5.	EWBB	80	150 ft	48 x 3-ton vehs and tlrs	One fd sqn	30	60	150	300
6.	HGB	100	100 ft	21 x 3-ton vehs and tlrs	One tp	5	8	150	300
7.	HGB	100	187 ft 6 ins	60 x 3-ton vehs	One tp	12	18	150	300

RAFTS AND BRIDGES
NOTES ON PLANNING DATA

1. Work on Approaches. Party and time depend entirely on the ground. In practice work may take longer than the const of the br or raft. As an est for br exercises, assume one sect on approaches with plant if nec for the same time as it takes to build the br. Rafts usually carry tks or a limited number of wheels and may not need so much engr effort on approaches as do brs.

2. Planning Figures. The times and capacities given will be used for Staff College exercises. All timings have been improved on in trg, but there are many circumstances which may prolong them in practice, eg tac factors such as en ground or air interference, tech factors such as amount of prep work required, and bad weather. The CRE must take these into account when advising his Div Comd.

3. Br Const Times. The time required for const is not directly proportional to the length of a br, eg the ends of a br take longer to assemble than a central floating sect. For planning purposes brs approx half the length of those given in Annex A to Precis Engr 5 should be assumed to take at least $\frac{1}{2}$ of the time quoted.

4. Times for Day and Ni. When a task spreads over ni and day, the planning time must be est as something between the two figures quoted.

5. Veh Capacity. A br veh capacity is difficult to assess because it is a compound of many factors:

- a. The capacity of the br itself will depend on its design and const.
- b. The capacity of the approaches may well be less than that of the br because of their relatively poor quality.
- c. During an aslt, the speed with which vehs can be brought fwd from assy areas and dispersed on the far side will almost invariably be less than the theoretical capacity of the br and its approaches.
- d. For L of C running or fol up after the aslt, en air activity may well reduce the flow of vehs laid down in mov orders to a figure well below the theoretical capacity.

6. In the table on next page two veh capacity figures are given:

- a. 300 vph. This is a fair average figure dictated by the tech limitations of the br and its approaches. But see 5.d. above; it may not always be possible to use a br to this extent.
- b. 150 vph. This assumes vehs crossing at 6 mph and 70 yds apart. In addition it assumes that the t/c org of the aslt crossing can cope with the move of vehs through the aslt area at that rate.

7. Raft Loads. The fol typical loads should be assumed for exercise planning purposes:

- | | |
|-----------------------------------|---|
| a. Cl 2 Inf Aslt Raft | - 4-ton veh and tlr or 4-ton veh and Wombat. |
| b. Cl 8 M2 and Cl 12 Lt Raft | - two 4-ton vehs or any single veh and tlr below cl 8 or 12 respectively. |
| c. Cl 30 M2 and Lt Raft | - two 3-ton vehs or smaller or one veh larger than 3-ton provided cl does not exceed cl 30. |
| d. Cl 50/60 M2 and Cl 80 Hy Ferry | - one tk or 3 APCs or any six wheeled vehs. Capacity in loads/hr halved with APCs and vehs. |

8. Trackway. Cl 30 trackway and Cl 60 access mat details are given below:

- a. Cl 30 Trackway
- 150 ft carried on special 3-ton veh and can be laid and secured by $\frac{1}{2}$ sect in 5 mins.
- b. Cl 60 Access Mat
- 40 ft roll can be carried by lt wheeled tractor and can be laid by $\frac{1}{2}$ sect in 3 mins.

PREP AND MARKING OF LANDING STRIPS/LANDING PTS

HELs

Dimensions

1. The size of a landing site will depend on the number of landing pts within it, and the type of ac which are to use them. The figures given rep the normal min for a single landing pt:
 - a. Lt Hells (Army). Diameter cleared to ground level 15 yds, extra width of 5 yds cleared to 2 ft giving overall diameter of 25 yds.
 - b. Single Rotor Hells. 30 yds to ground level, 10 yds to 2 ft giving overall diameter of 50 yds.
 - c. Twin Rotor Hells. 40 yds to ground level, 5 yds to 2 ft giving overall diameter of 50 yds.
 - d. All Hells by Ni. 60 yds to ground level, 20 yds to 2 ft giving overall diameter of 100 yds.

Ground

2. The ground should be relatively level and the slope should not exceed 7° by day or 5° for ni landings.
3. The surface should be sufficiently firm to allow a loaded 4-ton truck (if lt hells are being used) or a loaded 3-ton truck (for RAF hells) to stop and start without sinking in.
4. The surface must be free from potholes, tree stumps or any loose items which could be blown up into the rotor blades.

Approaches - landing pts

5. For normal op, angles of approach must not be greater than 30° measured from the outer edge of the central cleared area. By ni this angle of approach must not be greater than 10° .
6. In an emergency, an obstruction angle of 45° by day can be accepted for lightly laden hells.

Landing site and landing pt markings

7. Fluorescent panels should be used to mark and identify landing sites. Panels must be pegged securely so that they cannot blow up into the rotors. Landing pts are normally marked with a letter "H" which must be displaced by at least 10 metres from the centre of the landing pt.
8. A man with a fluorescent panel draped round his waist, standing at the upwind side of the area with his back to the wind and arms extended upwards makes a good emergency marker.
9. Details of night landing aids for helicopters are contained in the supplement to the Manual of Joint Warfare Vol III (JSP3).
10. An altn ni landing method is for two 4-ton vehs to be placed 40 yds apart and 40 yds downwind of the landing pt with their headlt beams intersecting at the centre of the landing pt. (This method is not suitable for Belvederes but is the method used by Army hells in an emergency.)

FIXED WING AC

Dimensions of Strip

1. The amount of usable ground needed for a landing strip will vary with the type of ac which is to op from it, the altitude and the ambient temperature. 10% should be added to the length for each 1,000 ft above Mean Sea Level.

Approaches

2. The approaches should be clear of all obstructions. If trees or other obs are in the way and cannot be removed, the touchdown pt must not be nearer the base of the obs than a distance in yds found by multiplying the height of the obs in ft by three.

Surface

3. Recce of the surface should be made on foot and the fol conditions should be met:

- a. The ground should be reasonably level. Slight undulation is acceptable.
 - b. The max slopes acceptable are 1 in 50 laterally and 1 in 30 lengthways.
 - c. The surface must be free of potholes, large stones and sharp ridges.
 - d. The ground must be firm. Meadowland or mown hayfids are usually the best.
4. A quick fd check to determine whether the surface is satisfactory is carried out by driving a 4-ton veh over it at 40 mph. If this gives a smooth ride, then the surface is all right.

Marking the Strip

5. Army avn units in the fd will normally op from strips with the min of marking in order to help concealment of the strips. An easily removable "T" marking wind dir and touchdown should normally be sufficient. A marshaller could also be used standing with arms outstretched with his back to the wind facing the approaching ac.

6. Wind dir could also be indicated by either:

- a. A "T" in white with the bar of the "T" facing the dir from which the wind is blowing. The "T" should be sited at the downwind end of the strip and to the left*,
- or b. a smoke grenade in the same position as the "T" described above but placed so that the smoke does not obscure the approach line,
- or c. a windsock or flag positioned at the downwind end of the strip and well clear to the left.

Emergency Lighting for Ni Landings

7. If it is nec for an ac to land on a strip, at ni the fol lighting methods are acceptable:

- a. Two landrovers, 40 yds apart, with headlamp beams intersecting at the required touchdown pt. The vehs should face upwind away from the line of approach. A clearly visible lt must also be positioned at the far end of the strip to prevent overshooting,
 - or b. two lines of hurricane lamps or torches, 30 yds apart. Lt to be at least every 50 yds along the length of the strip.
8. Wind dir will be indicated by lts laid out in the form of a "T".*

*By day, wind dir can be indicated by a "T" of men each holding a white handkerchief. At ni, an illuminated "T" can be produced by men, each with a vertically held electric torch.

SIZE OF DZs FOR MEN AND EQPT

Width

1. As a gen rule a standard DZ for men or eqpt is 800 yds wide. A parallel DZ, ie where an ac drops eqpt to the side of a DZ on which men have been dropped, is usually about 1,200-1,400 yds wide.

Length (Approx)

2. Beverley with 60 parachutists.

40 men in lower freight compartment, 20 men in boom. The latter come down to lower compartment for drop. Two simultaneous sticks of 30.

$$30 \times 60 + 400 = 2,200 \text{ yds.}$$

3. Beverley in hv drop role only.

Undershoot (200 yds) + hv drop 2 platforms (700 yds) + overshoot (200 yds) = 1,100 yds.

4. Beverley in mixed hv drop and parachutist role.

Depending on individual ac and platform weights and centre of gravity factors, up to 20 parachutists can be dropped from the boom before two med stressed platforms or 3 x 8,000 lb sup platforms. Mixed pers and hv drop of 20 parachutists and two med stressed platforms require a DZ of 2,300 yds.

5. Argosy with 50 parachutists.

Two simultaneous sticks of 25.

$$25 \times 60 + 400 = 1,900 \text{ yds.}$$

6. Argosy in hv drop role.

The same length as for the Beverley in para 3.

7. C130 with 64 parachutists.

Two simultaneous sticks of 32.

$$32 \times 72 + 400 = 2,704 \text{ yds.}$$

8. The actual methods used for calculating DZ lengths are somewhat different and more complicated than the above, which can be used as a guide to the approximate length and width of DZ for Staff College ex purposes.

9. American ac have a standard dropping speed of 125-130 knots. Approx 72 yds per man is therefore allowed when calculating stick lengths.

Stores

10. DZs should be 1,000 x 100 yds, if possible in the dir of the prevailing wind. Much less may have to be accepted in difficult country.

11. There should be no obs to the approach of ac at dropping height (400-800 ft) within one to three, preferably three, miles of the DZ at either end.

12. The surfacing of the DZ and the ground on the downwind side of it should be as clear as possible to facilitate the rec of stores.

13. The DZ should be near a prominent landmark or otherwise easily loc from the air.

14. It should be free from en obsn and not exposed to en fire. There should be no danger to ac from our own arty or mortars. This is a real problem in the jungle where the lack of open spaces will often mean gun areas and DZs having to share the same clearing.

MOV PLANNING DATA

DEFINITIONS

1. Average Speed. The average number of miles travelled per hr calculated over the whole journey, excl specifically ordered long or short halts. Standard figures for planning purposes are:

	<u>Day</u>	<u>N1</u>
<u>Colms excl tks. tptrs. etc</u>		
Good rds	24 mph	12 mph
Twisty and hilly rds with good surface	21 mph	10 mph
Bad rds	18 mph	9 mph
<u>Colms incl all types of vehs</u>		
Good rds	12 mph	9 mph
Bad rds	7 mph	6 mph

2. Colms. A gp of at least ten vehs moving under a single comd on the same route.

3. Elms. Subdivisions of a large colm, each elm having its own comd.

4. Mov Number or Ident Serial Number. A number allotted to each colm for ident. Each elm is given an identifying ltr at the end of the number. For example, if a bn's colm of vehs has the mov number '3' its coys may be '3A', '3B', etc. In mov tables the heading 'mov number or ident serial number' may be abbreviated to 'serial'.

5. Density. Tfc density is the average number of vehs that occupy one mile or one kilometre of rd space; it is expressed as vehs per mile (vpm) or per kilometre (vpk)

6. Pass Time. The actual time between the moment the first veh of a colm or elm passes a given pt, and the moment when the last veh passes the same pt.

7. Extra Time Allowance. Within a colm or elm extra time, calculated at one min per 25 vehs, is always allotted over and above the exact pass time.

8. Gaps. Between elms and colms no standard times are prescribed. Time between elms and between colms will be determined by the staff ordering the move and are defined as gaps.

9. Running Time. The time taken by one veh to travel the total distance.

10. Time Taken to Complete a Move. This is the sum of:

- Running time.
- Total pass time (serial pass times plus any gaps ordered).
- Time spent on specifically ordered long or short halts.

11. Mov Credit. An allocation of time to a colm for a move over a controlled route.

12. Flow. The calculated number of vehs which pass a given pt in an hr at a given speed and density. This should never exceed capacity.

13. Capacity. The number of vehs which can physically pass a given pt in an hr. This can only be determined by obsn.

FORMULA

$$14. \text{Pass Time (in mins)} = \frac{\text{Number of vehs} \times 60}{\text{Density (vpm)} \times \text{average speed (mph)}} + \frac{\text{Number of vehs}}{25}$$

$$15. \text{Running Time} = \frac{\text{Distance (miles)}}{\text{Average speed (mph)}}$$

$$16. \text{Flow (vehs per hr)} = \text{average speed (mph)} \times \text{density (vpm)}.$$

$$17. \text{Length of Colm (in miles)} = \frac{\text{pass time (in mins)} \times \text{average speed (mph)}}{60}$$

18. Instead of using the formula the same results can be obtained by using the graph given in Annex Q to Chapter 5 of SD in the Fd.

VEH LOAD CLS

A Vehs				Tptrs	
Armd car	-	Saladin	12	Tractor and tlr unladen	40
APC	-	Saracen	12	Carrying Centurion or Chieftain	100
Scout car	-	Ferret	4	C Vehs	
SP	-	105-mm	20	Br crane	24
Tk	-	Centurion	60	Excavator truck mtd $\frac{1}{2}$ yd (shovel in travelling position)	24
Tk	-	Chieftain	60	Grader (average)	12
ARV	-	Centurion	50	Tractor crawler size 4	8
ARV	-	Chieftain	50	Angledozer size 2	20
AVRE	-	Centurion	60	Lt wheeled tractor (incl tlr)	12
Br layer	-	Centurion	70	Med and hy wheeled tractor	20
APC/Comd Veh	-	FV 432	16	Tptr RE plant 30-ton (laden)	60
GW launcher		Hornet	8		
B Vehs					
Truck $\frac{1}{2}$ -ton GS			2		
Truck $\frac{1}{2}$ -ton GS and $\frac{1}{2}$ ton tlr			3		
Truck 1-ton GS			8		
Truck 1-ton armd			8		
Truck 3-ton GS			8		
Truck 3-ton tipping			8		
Truck 5-ton (Stalwart)			16		
Truck 10-ton GS			20		
Rec veh med 6 x 6			12		
Amb car 3-ton			8		

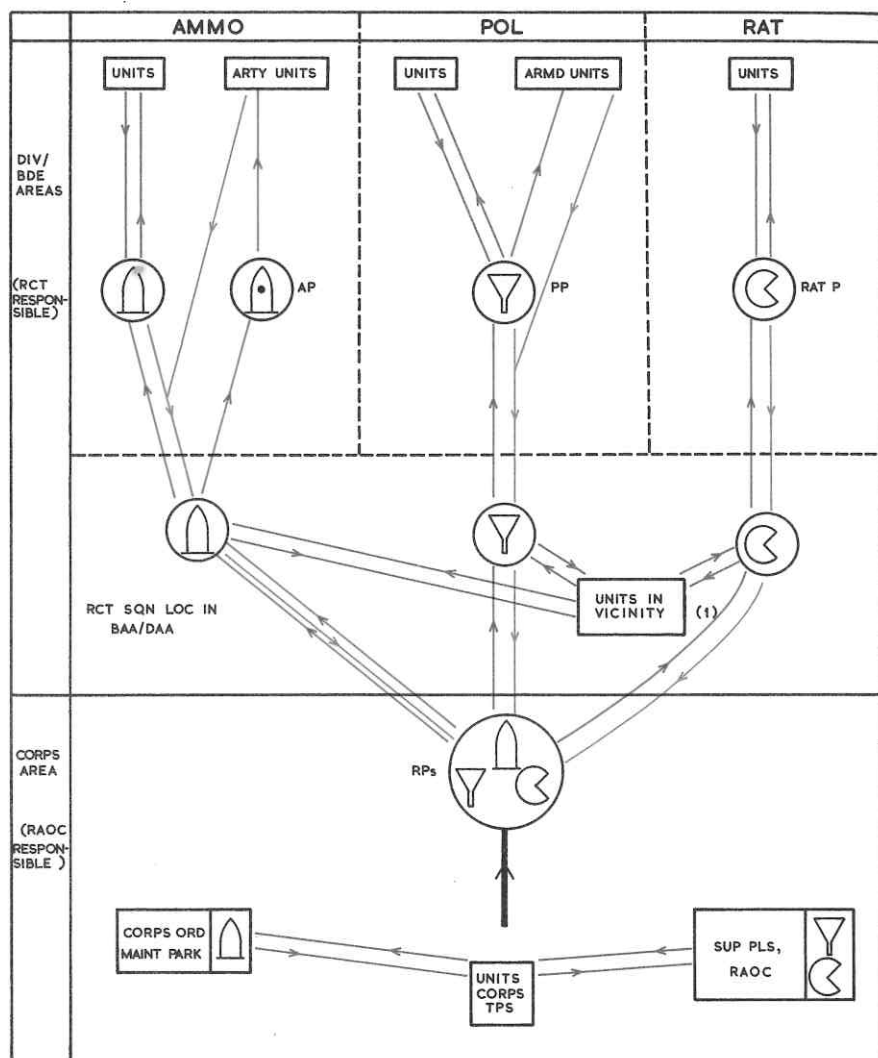
DEFINITIONS OF IMPORTANT ADMIN TERMS

1. Admin. The function of comd which deals with org, discipline and well-being of men and the mov and maint of men and materials. The term 'admin' is all-embracing; it includes logistics - the science of planning and carrying out the mov and maint of forces - with which instr at the Staff College is primarily concerned.
2. Admin Areas. Areas in which are loc admin units and echs. Although tpt may be temporarily off-loaded, an admin area differs from a MA in that the former does not normally hold stocks on the ground in excess of second line res.
3. Adv Base. A base loc in or near a theatre of ops when it is not possible to maintain the forces operating in the theatre directly from the main base. See Serial 17.
4. Air Log Sp. The maint of an army in the fd by air. (See Serial 14.)
5. Air Tpt Sp. Includes all forms of mov by air.
6. Composite Maintenance Group. A grouping of admin units or instls for convenience of comd and con.
7. Combat Res. Stocks of essential items held on the ground in the corps area, normally within reach of second line tpt and for use only in an emergency.
8. CommZ. The rear part of the theatre of ops (behind the CZ) which contains the L of C, estbs for sup and evac, and other agencies required for the immediate sp and maint of the fd force.
9. Continuous Running. The veh moves continuously over a route, being transferred from one dvr to another at intermediate stages.
10. C Sups. Ammo, POL and rat collectively.
11. DP. A pt at which C sups obtained by fmms from the RP are distributed to units.
12. L of C. All routes, land, water and air, which connect an operating mil force with its sp areas, and along which men and materials move.
13. Maint. All sup, repair and pers replacement action taken to keep a theatre or force in a condition to carry out its msn.
14. Daily Maint. The day-to-day sup of items which are in constant demand by forces in action, ie C sups, the routine evac of cas and rec and repair of eqpt.
15. MAs. Areas in which res are held on the ground for the maint of the forces in the fd and to meet any emergency.
16. Main Base. A large area containing the complex org which gathers together, holds and issues the men and material needed to maintain the activities of armed forces engaged in war.
17. Operating Stocks. These are stocks 'in the pipeline' and are needed to cover the inevitable time delays between indenting, provisioning, transporting and distributing items from the base or sp area to the issuing unit. Having them avoids broaching res stocks for purposes other than those for which they are held. Operating stocks are expressed in terms of 'days maint' for the force.
18. Rat. Collective term for all foodstuffs and material used for unit hygiene.
19. Repair Pools. Pools of eqpt such as vehs, guns and radios which are provided to allow immediate replacement of unserviceable but repairable eqpt evac to REME wksp. Res and operating stocks are not intended to cover these requirements. Repair pools are expressed in percentages of total unit holding of eqpt.
20. Res Stocks. The quantity of stocks required to be held to insure against op emergencies, unforeseen increases in consumption and expenditure, and delays or losses in transit. Res are expressed in terms of number of days maint for the force.

DEFINITIONS OF IMPORTANT ADMIN TERMS (CONT)

21. RP. An area in which a limited tonnage of C sups (and other requirements) is stocked on the ground within daily range of second line tpt.
22. Sp Area. Those areas which contain sources of manpower, industrial potential, food and raw materials. Sp areas of such importance that they are essential to our war effort are known as "main sp areas". The UK, Canada, Australia are examples from the 1939-45 war. The term minor sp area is also used.
23. Theatre Stocks. The total of items not in present use in the theatre. They are the sum of res stocks, operating stocks and repair pools.
24. Through Running. The dvr takes his veh through the whole distance of a route, from source to destination.
25. Tpt - First Line. Unit tpt, the admin echs of which take over C sups and other stores from second line tpt at DPs.
26. Tpt - Second Line. RCT tpt allotted for the maint of formations and units in the fwd areas.

GEN SYSTEM OF MAINT IN THE CZ

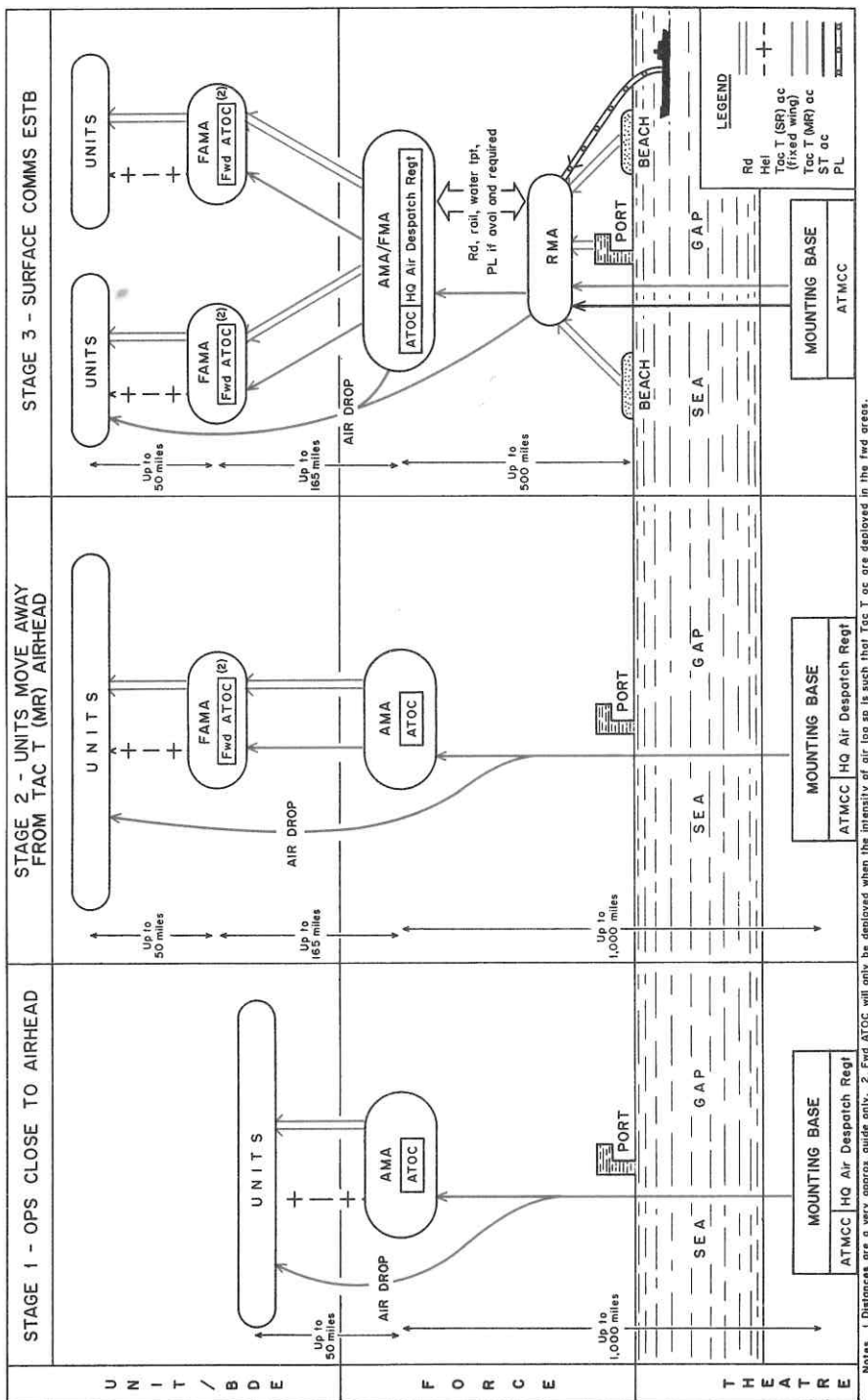


NOTE. (1) UNITS IN VICINITY, INCL B ECHS, MAY COLLECT REQUIREMENTS FROM DP's ESTB IN, OR CLOSE TO, NEAREST RCT SQN LOC.

LEGEND

UNIT (FIRST LINE) TPT _____
 SECOND LINE TPT FULL _____
 SECOND LINE TPT EMPTY _____
 FORCE TPT FROM FMA _____

A SYSTEM OF AIR LOG SP



[illegible]

COMPARISON OF THE UK AND US ADMIN SVC RESPONSIBILITIES

Task	UK Svcs	US Cl of Sup	US Svcs
<u>Procurement and Storage</u>			
Ammo)		V	Ord Corps
Vehs)		II or IV	Ord Corps, Corps of Engrs
All electrical and)		II or IV	Primarily Ord Corps, Corps
mech eqpt)	RAOC		of Engrs and Sig Corps
Clothing)		II)
POL)		III) QM Corps
Rat)		I)
<u>Distr to Units</u>			
Rat, POL, ammo	RCT	I, III, V	QM Corps, Tn Corps and Ord Corps
Vehs (except tks)	RAOC	II or IV	Ord Corps, Corps of Engrs
Tks	RAOC, RAC	II or IV	Ord Corps
<u>Repair and Rec</u>	REME	-	Each svc and Ord Corps
<u>Cas. Care and Evac</u>	RAMC, RCT	-	Army Med Svc
<u>Tn</u>			
Rd	RCT)
Rail, ports, waterways	RCT) Tn Corps
<u>Fire</u>	RAOC		Corps of Engrs

CORPS ADMIN UNITS

Svc	Unit	Remarks
(a)	(b)	(c)
<u>RAC</u>	Corps delivery sqn Fwd delivery sqn	
<u>Engr</u>	One engr bde - Two corps engr regts Corps fd park sqn	Although an arm, engrs carry out many Q tasks.
<u>Tpt</u>	Corps tps regt RCT	Normally consists of four sqns, equipped with 3-ton, 10-ton and tipper vehs, an amb sqn, and cars for the use of Corps HQ.
	Sqns	To provide the second line lift for corps arm'd and arty units and to carry the balance of second line scales for divs that cannot be carried by their organic units. HQ tpt regts are provided on the scale of one per four tpt sqns.
<u>Med</u>	CCSs FDSs FSTs Med pl Fd hygiene sect Fwd med eqpt dep Specialist teams Fd dental teams	One per three bdes. One per three bdes.
<u>Ord</u>	Corps tps OFF Corps ord maint park RP coys Wksp stores sects GM pl Kitting pl	One per div, one for corps tps and two in res. Att REME wksp. Att to corps delivery sqn.
<u>EME</u>	Med wksp Corps tps wksp Corps rec coy Electronic wksp Engr C veh wksp Engr eqpt wksp Ac wksp Tpt sqn wksp Amph engr sqn wksp Hy AD regt wksp Lt AD regt.wksp Med regt wksp Hy regt wksp Msl regt wksp Loc regt wksp Att LADs	One per arm'd bde and one per three inf bdes. (One lt rec pl per arm'd bde. (One lt rec pl per two inf bdes.))))) One for each parent unit.)))) eg Arm'd car regt LAD, arm'd engr sqn LAD
<u>Pro</u>	Corps pro coy	
<u>Pay</u>	Fwd base pay office Fd cash office	
<u>Postal and Courier</u>	Corps PCCU	
<u>Edn</u>	News sheet teams	
<u>Rft</u>	Corps rft unit	Of up to nine rft sub-units, each holding rfts for inf bdes or corps tps.

COMMZ ADMIN UNITS

Note: The fol pages list the principal kinds of admin svc unit which may be found in the commZ. The list is a formidable one, but it is most unlikely that all these units will be required in a theatre of war. The size and shape of the admin sp in a theatre of war must be tailored to the requirements of the force, taking into account the type and likely duration of ops and local resources avail.

Svc	Unit	Remarks
(a)	(b)	(c)
<u>Engr</u>	<u>Fd and Wks Units</u> Corps engr regt Specialist teams RE <u>Resources Units*</u> Wksp and park sqn Stores sqn Engr procurement team <u>Svy Units</u> Fd svy sqn Topo sqn <u>Postal Unit</u> Base PCCU	Normally only to be found in the commZ during the early stages of an op. Specialist teams RE may be one of the fol: Construction, Rd Recce and Construction, Railway Construction, Bulk Petroleum, Power Station Repair and Operation, Well Drilling, Public Utilities, Engineer Procurement, Bomb Disposal
<u>Tpt</u>	<u>Tpt Units</u> HQ regt RCT HQ sqn RCT Tk tptr sqn Petrol tpt sqn Amb sqn Br regt Pack tpt sqn Adv wpns sp regt	Can comd up to 4 sqns. Comds 2-4 tps. Contain 2-4 tps, each of 16 task vehs.) Contain 2-4 tps, each of 20 task) vehs. Contains two br sqns and one tipper sqn. Contains 2-4 tps, each of 72 animals. Contains sp sqn and del sqn.

* Future undecided

COMMZ ADMIN UNITS (CONT)

Svc	Unit	Remarks
(a)	(b)	(c)
<u>Tpt</u> (cont)	<u>Air Units</u> Flts RCT <u>Air Despatch Units</u> RHQ air despatch regt Air despatch sqn <u>Maritime Units</u> Amphibian sqn Maritime sqn Hovercraft sqn LCT sqn Port sqn <u>MC Units</u> MC sqn	These are theatre flts equipped with fixed wing ac. In BAOR the flt has both fixed wing ac and helos.)) Allotted as required.) Contain 2-3 tps, each of 16 task vehs. Normally contains 3 flotillas. Contain 2 tps each of 2 hovercraft. Up to 4 x LCT Mk VIII. Contains lighterage tps and freight handling tps as nec.
<u>Med</u>	Fd amb FDS CCS Fd hygiene pl FST Neuro surgical team Maxillo-facial team Ear, nose and throat team Ophthalmic Team Special treatment team (VD) Chest surgical team Burns team Blood sup unit Mob pathological lab Fd dental centre Malaria con coy Mob malaria fd lab Base malaria fd lab Gen hosp Amb train	One per force. One per force. As required. As required. One per force. One per force. One per force. One per force. One per force. As required. As required. As required. One per force. To provide cover of one dental offr per 2,000 men. One per force) One per force) in malarious One per force) area only Provided on an agreed bed percentage of the force. On a scale of 2 per corps plus 20% res.

COMMZ ADMIN UNITS (CONT)

Svc	Unit	Remarks
(a)	(b)	(c)
<u>Med</u> (cont)	Hosp ship Base med eqpt dep Central pathology lab Port det RAMC Med pl for amb sqn	Special provision if required. One per 150,000 tps. One per force. One per PTF. As required.
<u>Org</u>	<u>Comd Units</u> HQ RAOC HQ Coy RAOC <u>Rat Units</u> Sup pl Fd bakery pl <u>POL Units</u> Petroleum pl <u>Stores Units</u> Fwd stores dep Rear stores dep Boat stores dep Bulk stores pl Detail stores pl <u>Veh Units</u> Fwd veh dep Rear veh dep Veh kitting pl Veh pl	Comds 2 or more coys. Comds 2 to 5 different functional pls. Consists of 4 sects. A, B and C sects can each: a. issue 1,000 rat per day, or, b. hold up to 400 tons of rats with bulk receipts of 15 tons and bulk issues of 15 tons per day, or, c. hold 1,000 tons of packed POL, receive 50 tons and issue 50 tons per day, or, d. undertake transit functions at one pt for a load of 70 tons per day. D sect operates cold storage facilities at one pt to provide fresh rats for 20,000 men. Consists of 3 sects. Each sect can bake 2,600 lbs of bread in an 8 hr shift. Consists of 3 sects. Each sect can op in: a. a PL role maintaining 25 miles of PL with 3 pumping stas, or, b. a bulk storage role controlling up to 8,000 tons of bulk fuel with receipts of 400 tons and issues of 400 tons daily, or, c. a filling role packing 30 tons a day and filling 480 vehs a day.) Provide MT, gen and tech stores, clothing) and necessities. This pl can: a. carry out transit tasks at two entry pts, b. put stores into stock, c. issue 20 tons a day, d. deal with returned stores, e. administer a res of 10,000 items. Provides second line backing for those units not capable of being supported by the organic OFF.) Provide A, B and C vehs, towed eqpts and) guns. Provides veh kits. Att to force del sqn RAC. Transit tasks - plus the receipt storage and issue of A, B and C vehs.

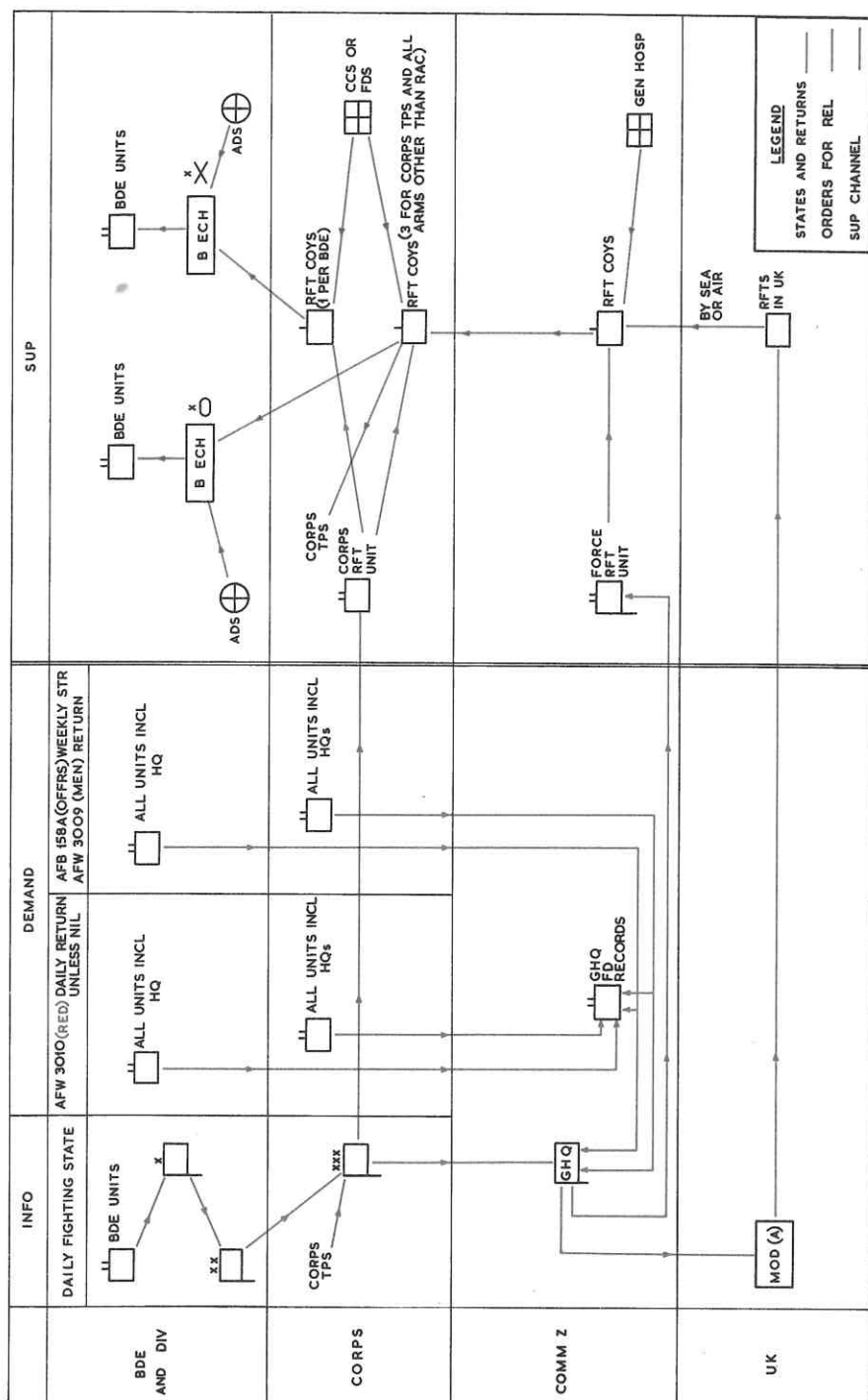
CMMZ ADMIN UNITS (CONT)

Svc	Unit	Remarks
(a)	(b)	(c)
<u>Ord</u> (cont)	<u>Ammo Units</u>	
	Fwd ammo dep	} Provides all natures of ammo. Consists of 4 sects. Each sect can: a. receive and issue 100 tons per day through one transit pl, or, b. hold 1,500 tons of ammo.
	Rear ammo dep	
	Ammo pl	
	<u>Air Log Sp Units</u>	
	Para hy drop coy	a. provides hy drop platforms and fits them into ac, b. rips platforms required for the re-sup role.
	<u>Fire Fighting Units</u>	
	Army fire coy	Likely to be one in the FMA and one in the RMA.
	Indep army fire bde	Likely to be one in each small port or beach area.
	<u>Secondary Task Units</u>	
	Local purchase pl	Obtains stores by local purchase.
	Laundry pl	One per hosp or stores dep handling returned clothing.
	Bath pl	One per hosp.
	Printing pl	Loc near force HQ.

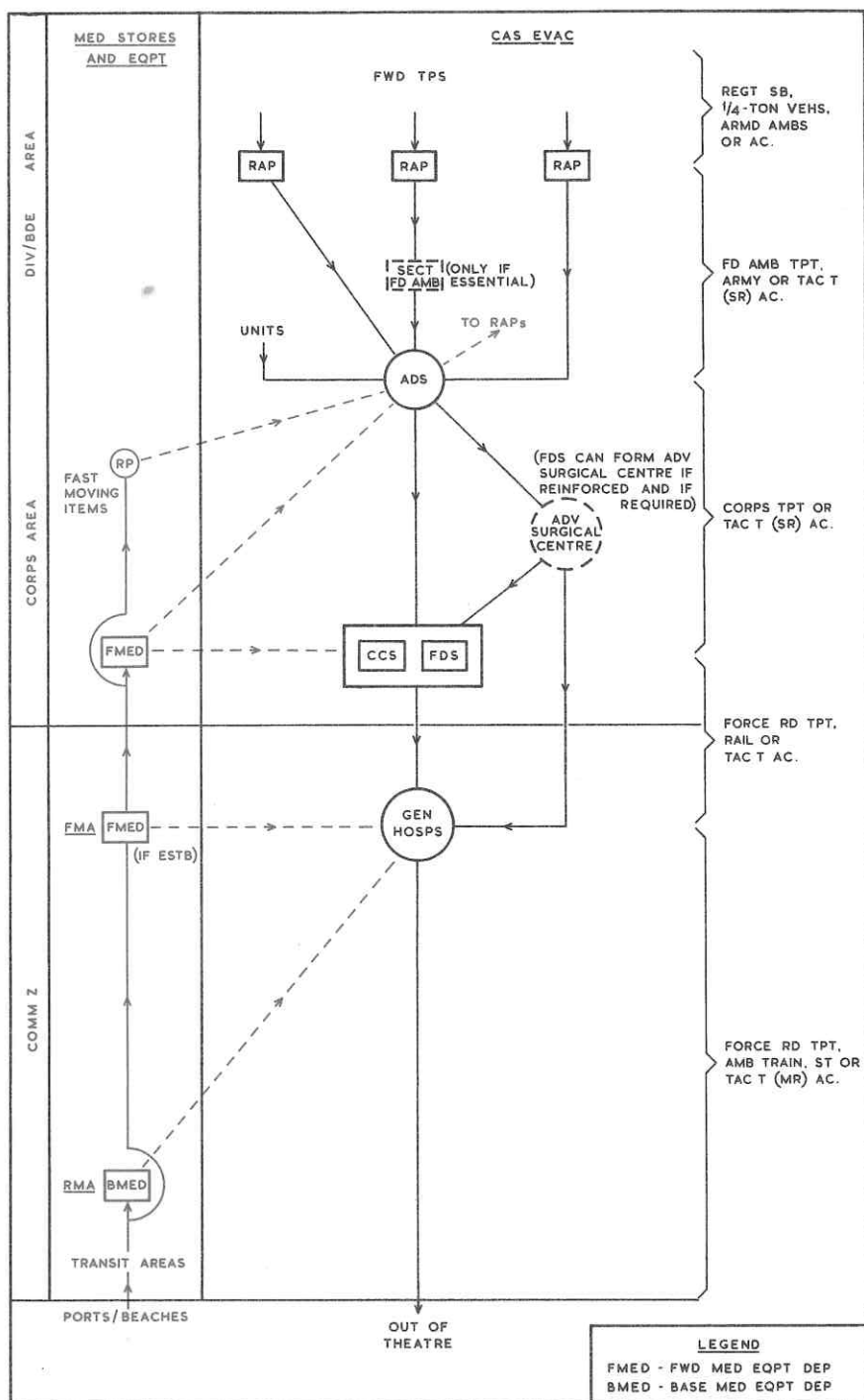
COMMZ ADMIN UNITS (CONT)

Svc	Unit	Remarks
(a)	(b)	(c)
<u>BME</u>	CommZ wksp	Can provide 3 servicing stas on MSRs in commZ.
	Force Tps wksp	Limited war only.
	Telecomms wksp	One per force.
		One per commZ sig regt.
	Reclamation unit	Con veh cannibalisation.
	<u>Army rec coy</u> comprising:	
	HQ	One per force.
	Hy sect	One per armd bde.
		One per corps for commZ.
	Lt sect	One per two inf bdes.
		One per corps for commZ.
	<u>Adv base wksp</u> comprising:	
	HQ adv base wksp	One per force in limited war if required
	Wksp coys	Only deployed if ops are protracted and will use local facilities.
	Port wksp	One per port.
	Base wksp	One per force in limited war (if required).
	<u>Beach wksp</u> comprising) As required for PTF.)
	Beach repair pl	
	Beach rec pl	
	Att wksp and LADs	
	Ac wksp	Provides fwd dets with fd formations.

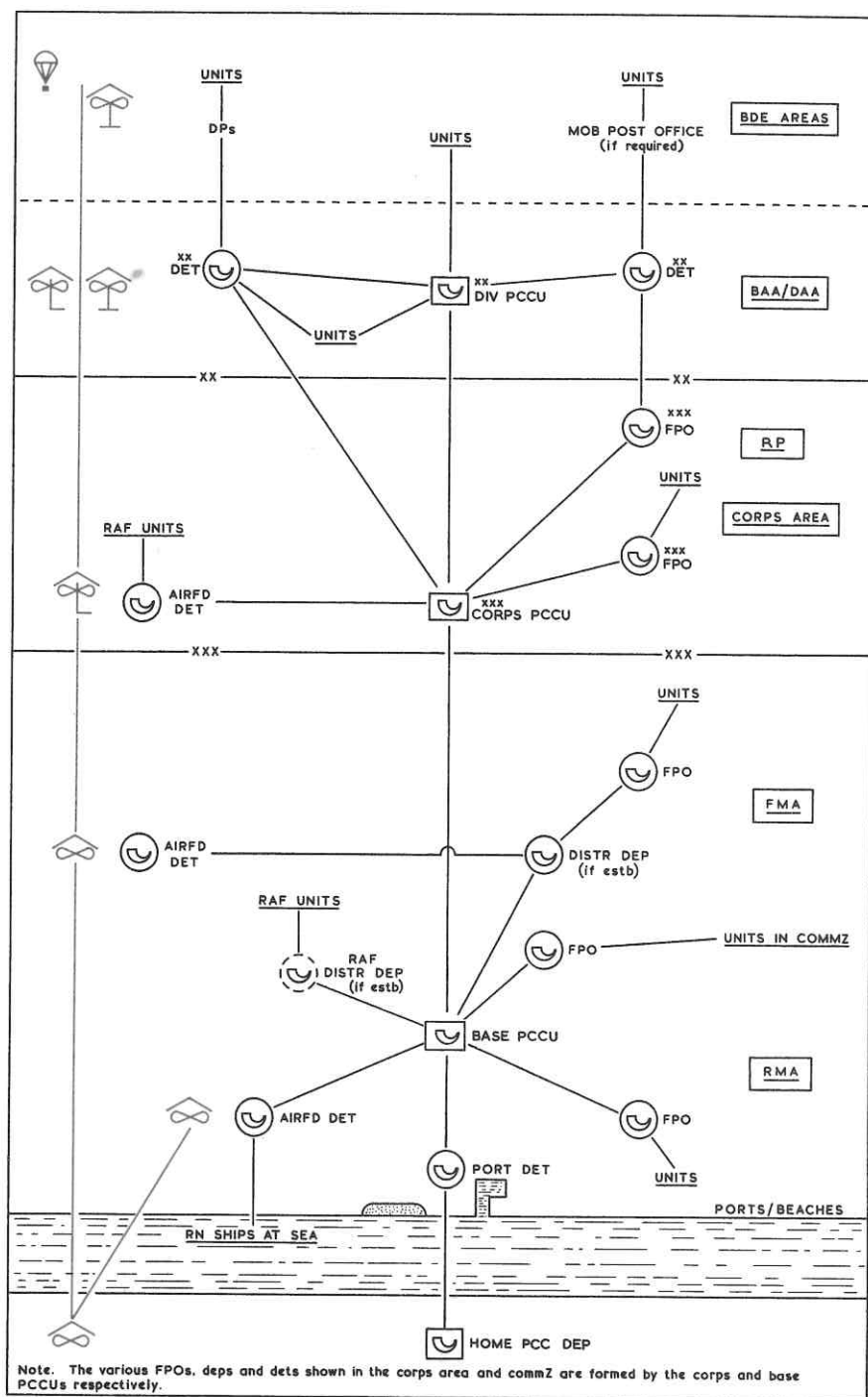
MANPOWER RFTS



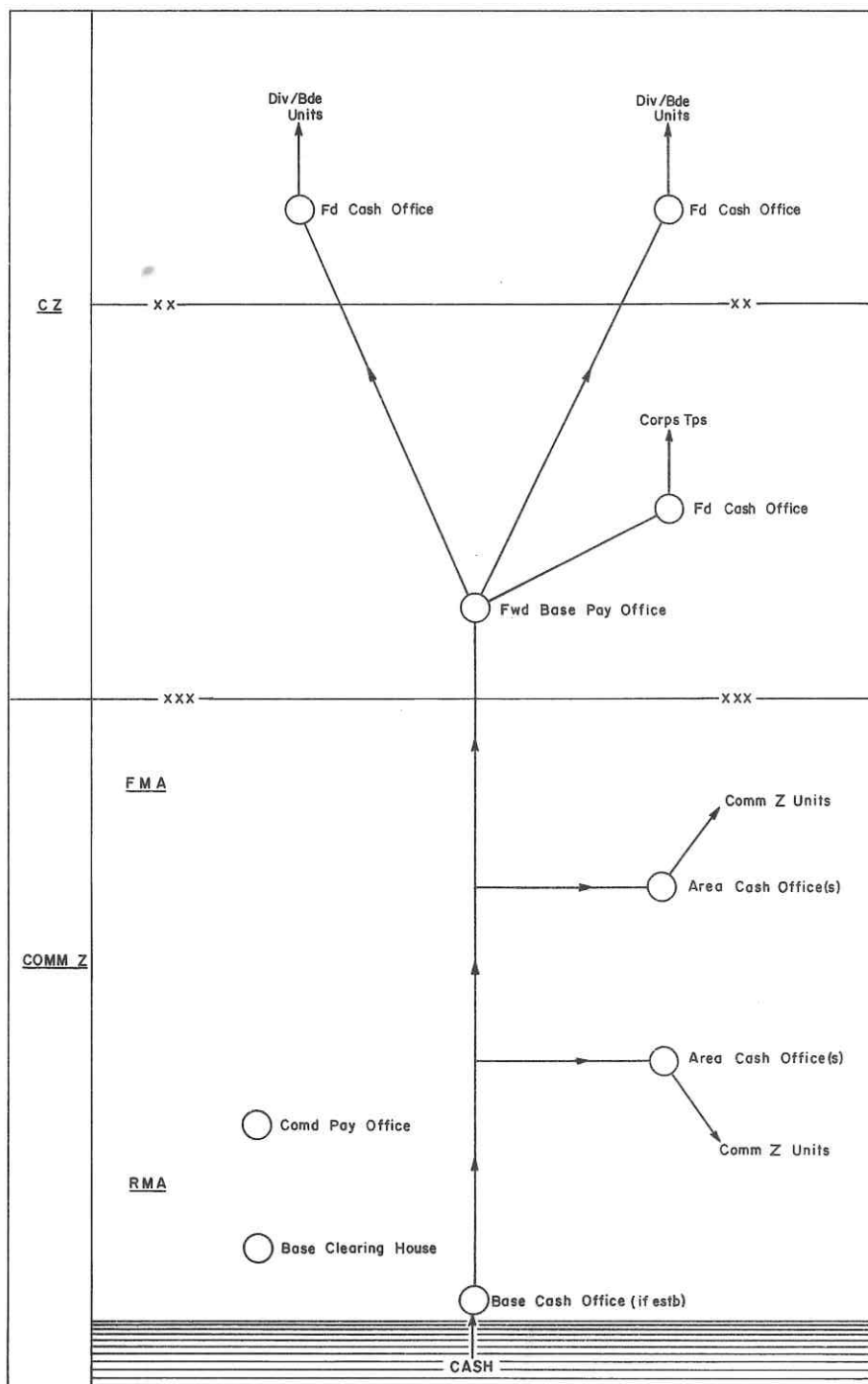
MED EVAC AND SUP OF MED EQPT



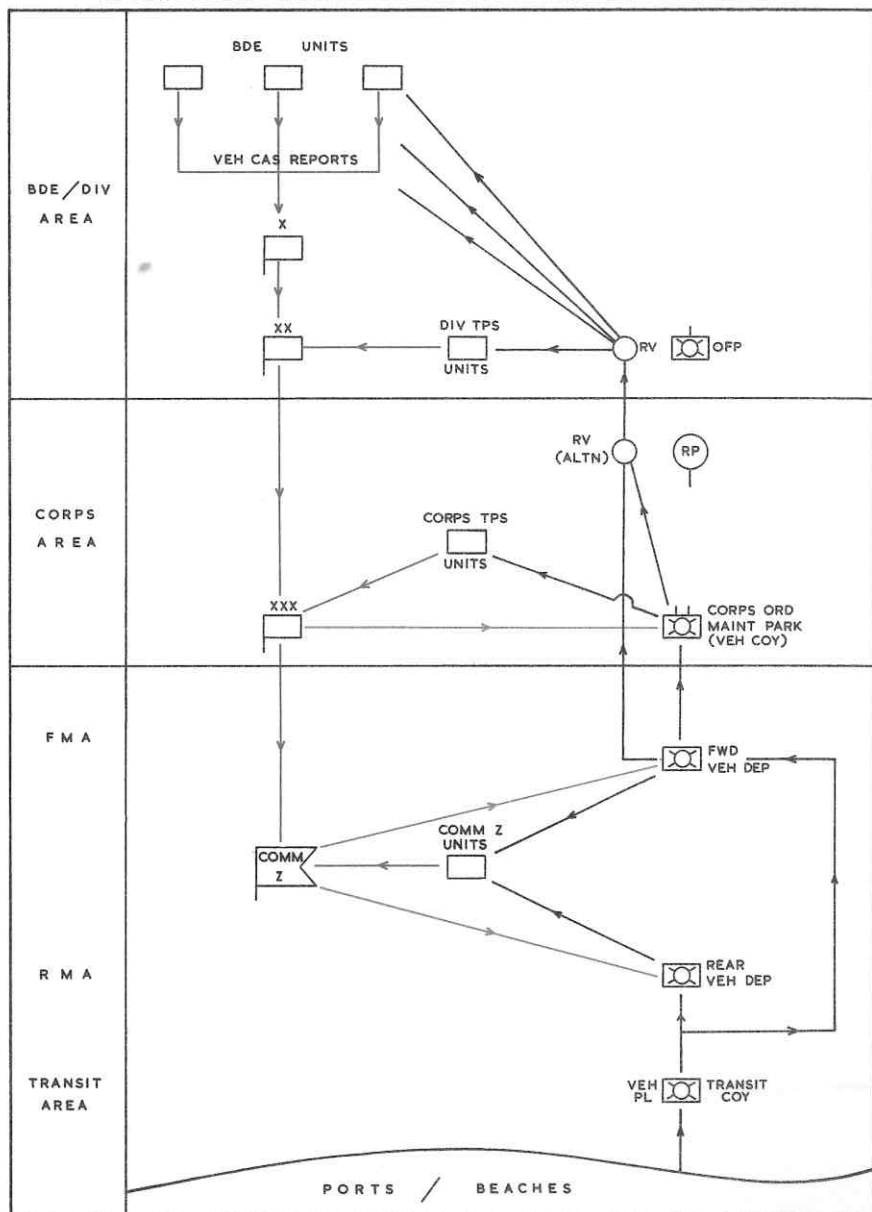
PCC IN THE FD



PAY SVCS IN THE FD



SUP OF A VEHs (OTHER THAN VIA ARMD REPLACEMENT ORG), TOWED EQPTS, B AND C (NON-RE) VEHs



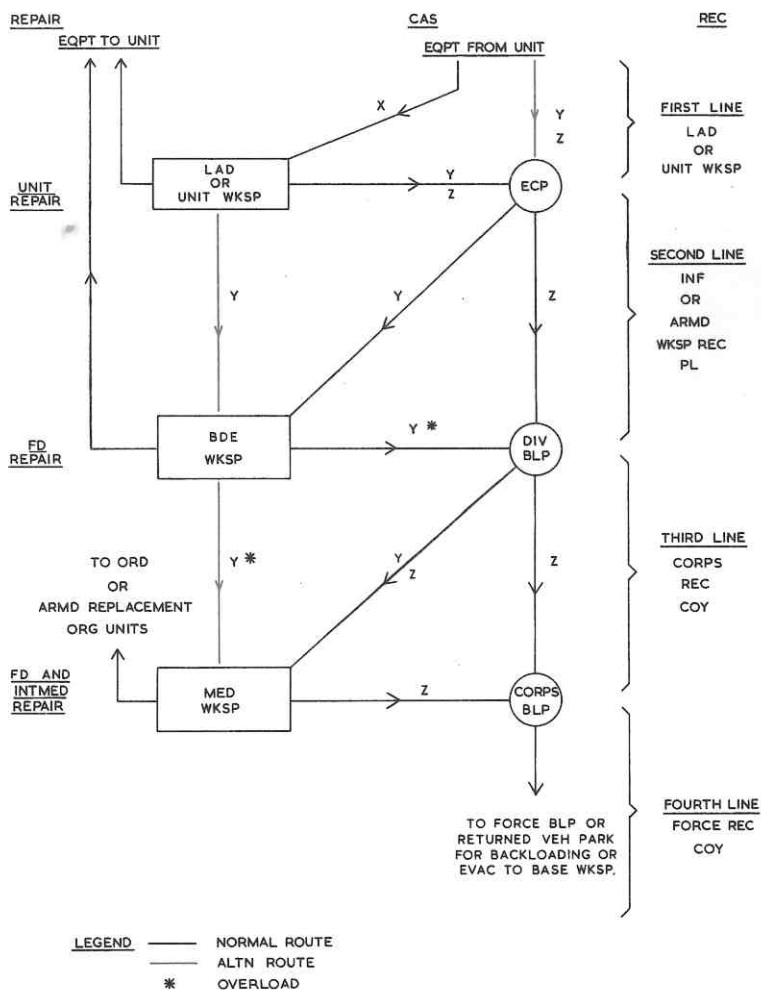
NOTES. 1. Vehs will be driven fwd by RAOC dvrs from the FMA to the OFP (or altn to a RV near the RP) from where unit dvrs will collect.

2. Occasionally unit dvrs may collect from the veh coy in the Corps Ord Maint Park.

LEGEND

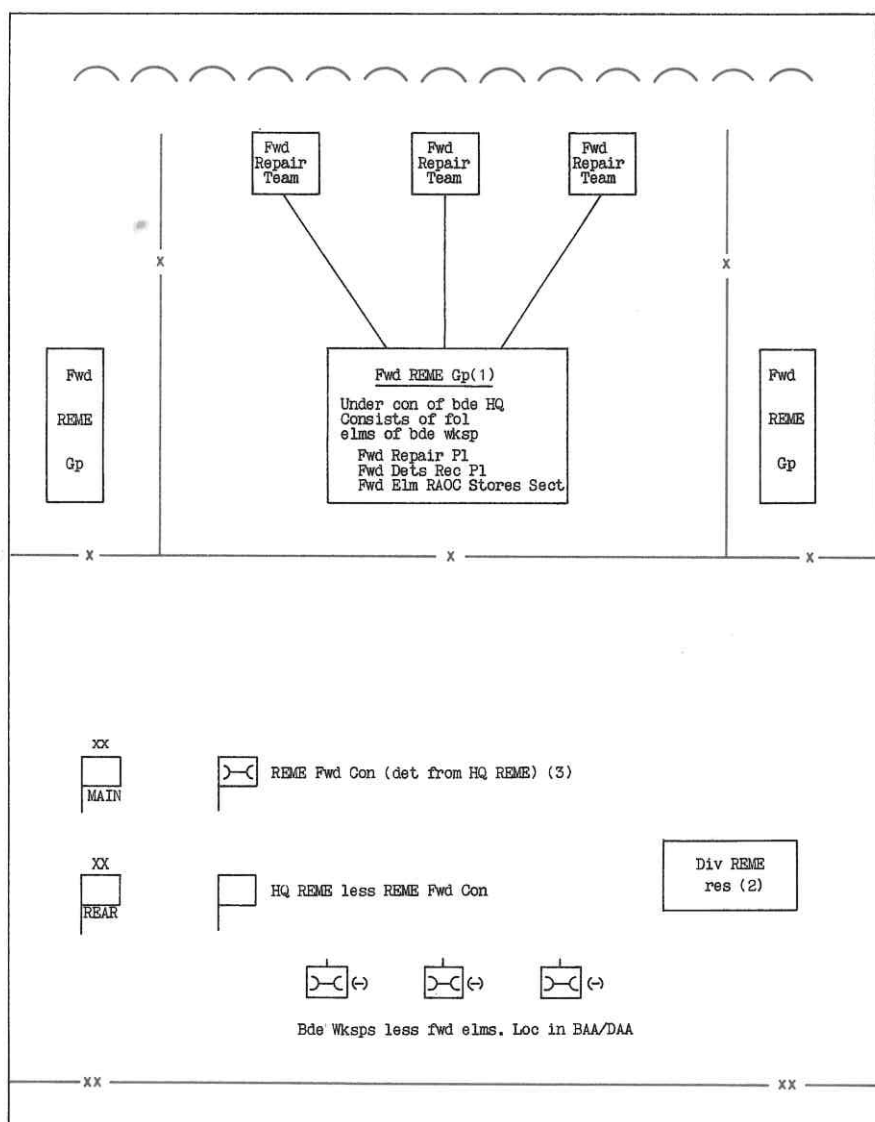
DEMAND _____
REL _____
SUP _____

STAGES OF VEH AND EQPT REPAIR AND REC



- NOTES**
1. THE USE OF THE FWD REME GP IS NOT SHEWN.
 2. WHEN EQPT IS BACKLOADED BEHIND SECOND LINE WKSPS, IT IS STRUCK OFF UNIT CHARGE AND REPLACED.
 3. CAS CL:
 - X - CAN BE MADE SERVICEABLE BY UNIT REPAIRS, IE BY LAD OR UNIT TRADESMEN.
 - Y - CAN BE MADE SERVICEABLE BY FD REPAIRS, IE BY BDE WKSPS OR, IN THE CASE OF CORPS UNITS, BY MED WKSPS.
 - Z - CAN BE MADE SERVICEABLE BY INTMED OR BASE WKSPS, IE BY MED OR BASE WKSPS.
- BR-BEYOND REPAIR. SUCH EQPT MAY BE STRIPPED OF USEFUL SPARES AND SALVAGED OR DUMPED, PROVIDED AUTH TO DO SO IS GIVEN BY RAOC.

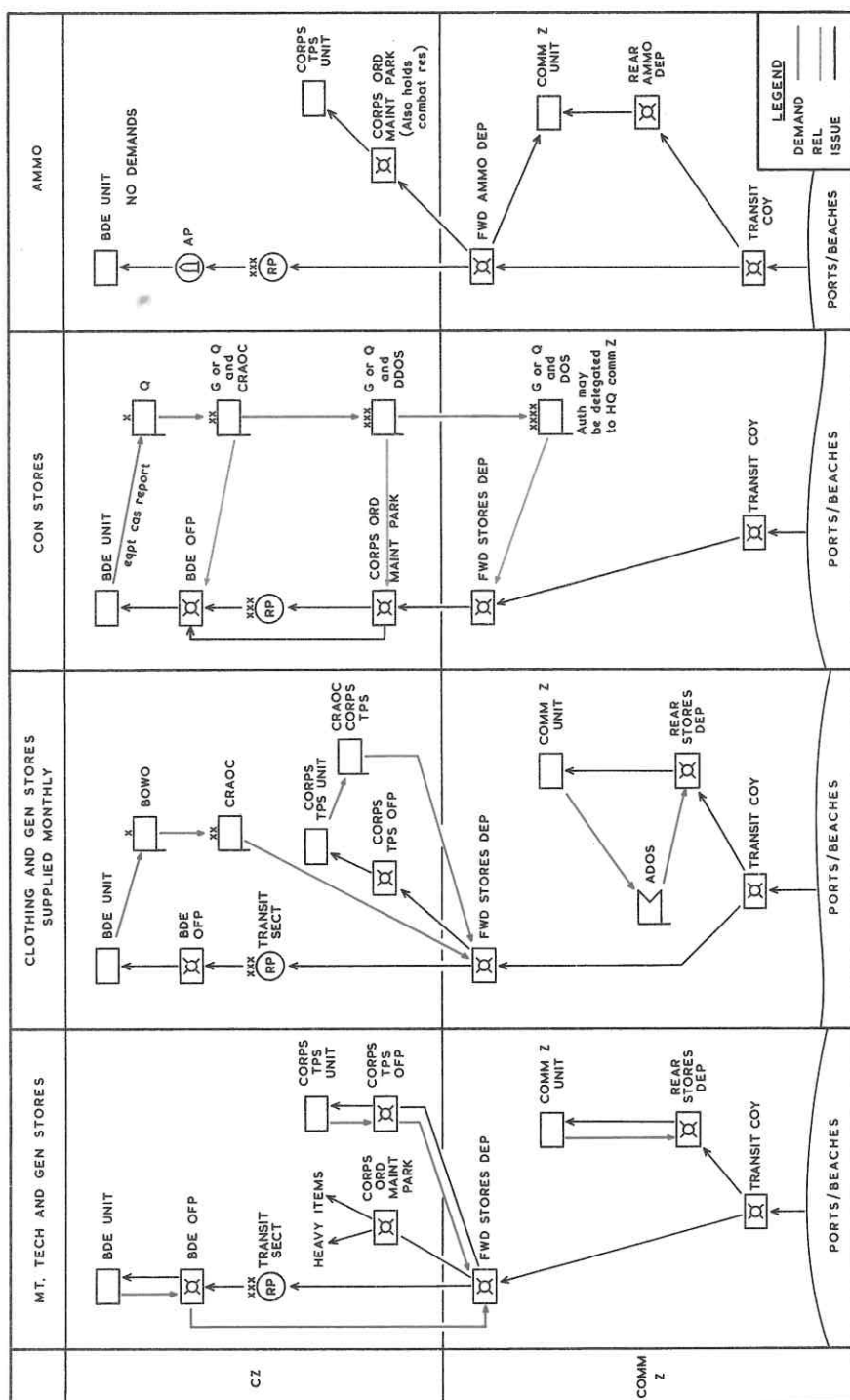
DIV REME LAYOUT UNDER CREME CENTRALISED CON



Notes:

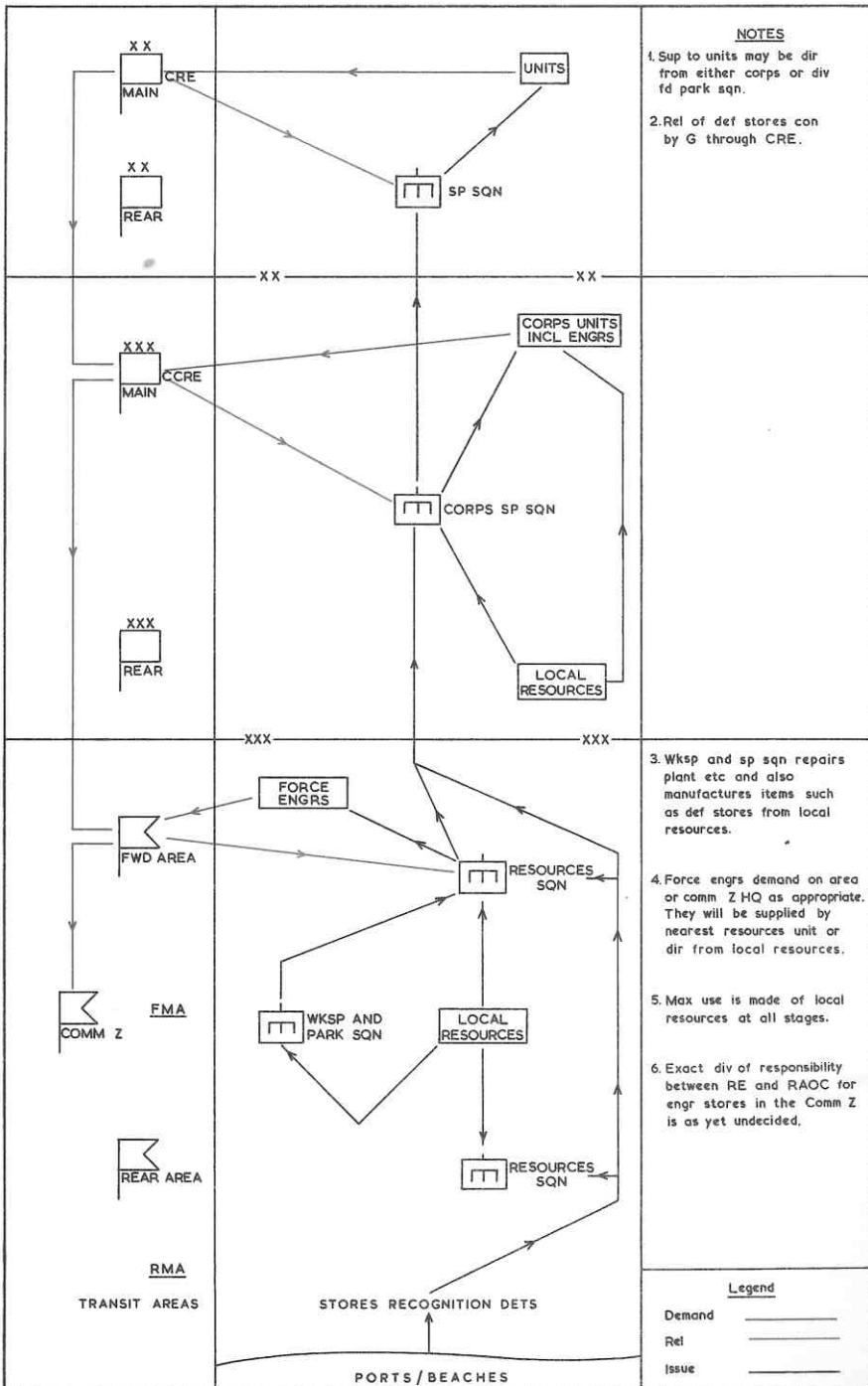
1. An inf wksp can provide six fwd repair teams, an armcd wksp thirteen
2. May be estb fwd of DAA consisting of rec vehs and possibly spare fwd repair teams. The latter however are normally with their parent wksp.
3. Estb when required.

SUP OF AMMO AND ORD STORES *



* This term does not incl rgt or POL

SUP OF ENGR STORES



SOME LOG PLANNING FACTORS

1. Accn For units, storage, hosps and wksp. Availability and suitability.
2. Air Tpt Air lift avail. Loc of airfds and capacity. Availability of air despatch units and cargo handling eqpt.
3. Ammo Est expenditure. Dispersal of stocks. Availability.
4. CA Evac, feeding, housing, med, clothing, mov, con of refugees. Effectiveness of civ govt. Security.
5. EME What repairs are to be done and where. Availability of spare parts and accn. Use of rds and railways for back-loading. Civ repair facilities.
6. Engr Stores Availability and loc of local resources. Tpt required.
7. Fire Any special fire risk in dep areas.
8. Lab Availability and reliability of civ lab.
9. Med Est of battle and non-battle cas. Method of evac and holding policy. Availability of accn for hosps. Special health dangers.
10. Nuclear Degree of nuclear threat to L of C.
11. Ord Loc of stockholding units and level of stocks. Method of tpt. Provision of special eqpt and clothing. Local purchase policy.
12. POL Local availability and method of handling. Est consumption incl AVGAS/AVTUR.
13. Ports Availability and capacity of ports. Civ lab.
14. PW Est of numbers. Policy for disposal. Policy for use of PW as lab.
15. RAF Requirements of rat, POL, ammo, lab.
16. Railways Availability, capacity and vulnerability. Operating pers.
17. Rat Local resources. Cold storage requirements.
18. Res Level of res stocks to be held and distr within theatre.
19. Rfts Numbers required, accn and trg facilities. Acclimatisation.
20. Rds Capacity and vulnerability.
21. Rd Tpt Requirement and distr. Availability of civ tpt.
22. TC Requirements. Effectiveness of civ police. Refugee con.
23. Water Est consumption. Availability and suitability of local resources.
24. Weather Effect on comms (particularly on air despatch ops), eqpt and health of tps.

SECOND LINE LOADING SCALES

1. Auth second line loading scales are meant to be used as a planning guide only, since in ops the actual loading of second line lpt rates are adjusted to meet changing tac and other requirements.
2. Second line loads are designed to maintain units and formations in action at 'normal' rates of expenditure for one day. These rates are expressed for rat in days, for POL in miles (at fuel in days), and for ammo in 'rounds per gun' (rpg).
3. A special table of scales to be used for Staff College exs is given below, and unless otherwise stated in ex instrs it will be assumed that second line lpt is loaded in the manner shown. The red Serials 1 and 11 are attms to 2 and 10.
4. The ammo rates in colm (d) of the table will be taken to be the 'normal' expenditure when in contact with the en. The rates of expenditure during periods of 'incense' and 'quiet' activity will be taken as being double and one half of the 'normal' rates respectively.
5. In some cases, the figure in the right hand sect of the tables representing single unit backing, does not tally with bde holdings shown on the left. This is because unit backing often works out a fraction of a 4 con load and the figures have been 'rounded off'.

Serial	Commodity	Planning Content of one 4-ton load	Expenditure Rate	Number of 4-ton loads held for:												
				Div Tps	Armd Bde (1)	Bde (APC) (2)	Ede (over-seas) (3)	Armd Regt	Armd Car Regt	Regt (105-mm pack)	Regt (105-mm)	Regt (155-mm SP)	Rd Sqn (APC)	Mech Bn	Air-trl Bn	Bde HO (AFC)
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)
1.	Pat	Pat	1 day	1	5	5	4	1	1	1	1	1	1	1	1	1
2.	Fresh Corp	1,250 (4)	1 day	4	4	5	4	1	1	1	1	1	1	1	1	1
3.	Pop (5)	1,700 (4)	40 (6)	43	28	11	6	11	1	1	1	2	1	4	1	1
4.	Packs	40 (6)	40 (7)	3	3	6	3	1	1	1	1	1	1	1	1	1
5.	Artillery	40 (7)	1 day (8)	1	2	1	1	1	1	1	1	1	1	1	1	1
6.	Misc (g)	900														
7.	Arms	rounds	156	24	24	12	9	14	1	1	1	1	1	1	1	1
8.	105-mm Abbot	116	100	-	-	-	-	-	-	-	-	-	-	-	-	-
9.	105-mm pack	156	70	-	-	-	-	-	-	-	-	-	-	-	-	-
10.	155-mm SP	71	20	42	24	12	9	14	1	1	1	1	1	1	1	1
11.	105-mm (tk)	102	20	-	28	14	9	14	1	1	1	1	1	1	1	1
12.	105-mm (tk)	72 (11)	20	-	42	14	9	14	1	1	1	1	1	1	1	1
13.	105-mm (tk)	88	12	-	1	3	4	4	1	1	1	1	1	2	2	2
14.	81-mm (mortar)	484	70	-	1	2	3	3	1	1	1	1	1	1	1	1
15.	Other Mines	150 (12)	-	1	11	9	8	8	3	5	1	2	2	2	2	2
16.	Mines anti-tk	150 (13)	-	-	2	2	2	2	2	2	2	2	2	2	2	2
17.	Mines anti-pers	5,060 (14)	-	-	2	2	2	2	2	2	2	2	2	2	2	2
18.	Explosives	Standard	-	-	2	2	2	2	2	2	2	2	2	2	2	2
TOTALS	(assuming comp ret and Centurion armd ret)	1933	7	122	88	64	25	8	28	14	22	1	10	7	3	3

1. Based on three¹/₂ Centurion armd regts, one 105-mm SF regt, one 105-mm SP regt, one mech bn and armd bde Hq.
2. Based on three¹/₂ mech bns, one Centurion armd regt, one 105-mm SF regt, one rd sqn (APC) and bde Hq.
3. Based on three¹/₂ APC and bde Hq.
4. Centurion armd regt, one 105-mm SF regt, one rd sqn and bde Hq.
5. Incl biscuits.
6. Incl 43¹/₂ lubricant elm.
7. Mixed running.
8. Rd running for B veps.
9. Planning figure is four actual flying hrs per day per sq.
10. Incl cooking, heating and generators.
11. An armd regt will be either Centurion (Serial 10) or Chieftain (Serial 11).
12. This includes the outer containers. If trials show that these can be discarded the figure will be 1-4.
13. Incl all inf ammo, less Wombat and 81-mm mortar and minor APV ammo.
14. For mines anti-tk Mk 7.
15. For mines anti-pers No 6.

STANDARD APs

Standard APs in all Staff College exercises are assumed to hold one third of the second line scales for the units dependent upon that AP. The content of any AP can therefore be calculated from the table given on page 443. The fol are typical examples:

Serial	Type of Standard AP	Units/Formations being sp	Number of 4-ton loads
1.	All Natures AP (less mines and explosives)	Inf bde (overseas theatre) Armd bde (Centurion equipped)	12 22
2.	Arty AP	One regt 105 mm SP plus one regt 155 mm SP	14
3.	Other Natures AP (all natures less arty mines and explosives)	Inf bde (overseas theatre) Armd bde (Centurion equipped)	8 14

LOAD TABLES - AMMO

LOAD TABLES - AMMO
(THE FIGURES QUOTED ARE IN 4-TON LOADS)

Arty and Tk Wpns		Mortars, Grenades etc		SAA	
Wpn (a)	Number of complete rounds (b)	Wpn (c)	Number of complete rounds (d)	Wpn (e)	Number of complete rounds (f)
76-mm gun	212	2-in mortar	2,394	Browning .30 belt	112,000
20-pr gun	104	81-mm mortar	484	Rifle 7.62-mm	86,100
25-pr gun	190	3.5-in rkt	568	.303-in	77,400
105-mm pack	156	Carl Gustav	676	Pistol .380	179,100
105-mm SP (Abbot)	116	120-mm Wombat	88	9-mm	199,500
105-mm gun (tk)	{ 102 unracked 160 racked	Grenades M28	4,475	sig 1-in	24,840
120-mm gun (tk)	72*	36	4,476		
5.5-in gun	84	80	2,520		
155-mm how	71	83	3,104		
8-in how (HE)	34	94	5,508		
175-mm gun	40	Mines anti-tk Mk 7	150		
40-mm L70	864	anti-tk 1t non-metallic	420		
ET 316	36	anti-pers No 5	4,464		
		" No 6	5,060		
		" ground burst	12,228		
		" shrapnel	640		

Note: Where there are several natures of ammo, eg AP, HE, smoke etc, for an eqpt the heaviest item has been incl in this table. Several types of packing are also used. This table should therefore only be used as a guide.

* This includes the outer containers. If trials show these can be discarded the figure will be 124.

LOAD TABLES - POL., WATER, RAT, DEF STORES AND MISC

1. POL and Water.

Item	Container	Weight full (lbs)	per 4-ton Load	
			Number of Containers	Gals
MTGAS/AVGAS	4½ gal jerrican	43	208	936
	45 gal drum	396	21	945
DIESO/AVTUR/Oils	4½ gal jerrican	48½	184	828
	45 gal drum	453½	19	855
Oils	5 gal drum	50	179	895
Water	4½ gal jerrican	56	160	720
Empty	Jerrican	-	312	-

2. Rat.

Type	Number of Packs	Number of Rat per 4-ton Load
Comp 10 men packs (without biscuits)	213	2,130
" 5 " " " "	448	2,240
" 15 " (3 x 5 men liweight packs)	135	2,025
24 hr rat	1,680	1,680
Biscuit (22½ lb pack)	192	7,680
" (54 lb pack)	98	9,408
Fresh rat		1,250 approx

3. Wire Defs. One 4-ton load contains enough barbed wire and associated stores for 300 yds of Catwire fence or 500 yds of Low Wire Entanglement.

4. Misc. The fol are the max contents of a 4-ton load:

a. Blankets.

- (1) Machine baled - 1,750 blankets (70 bales)
- (2) Hand baled - 1,625 (65 bales)
- (3) Loose - 1,200

b. Sandbags - 16,000 sandbags (80 bales).

c. Anti-Gas Stores - personal eqpt for 700 men.

TPT PLANNING DATA

Veh Load Capacities

5. Certain vehs classed as 3-ton load carrs are capable of carrying 4 tons and, in some circumstances, 5 tons. For Staff College purposes the fol capacities will be assumed:

- a. 3-ton truck - load of 4 short tons.
- b. 10-ton truck - 8 short tons.
- c. Stalwart - 5 short tons.

Loading and Unloading Times

6. In practice these times will vary widely, but for Staff College exercises the fol times will be allowed for the turnround of each veh at each end of its journey. These times incl loading or unloading, harbouring, marshalling and refuelling.

- a. 3-ton truck - 2 hrs.
- b. 10-ton truck - 4 hrs.
- c. Stalwart - 2 hrs.

CALCULATION OF MAINT TONNAGES

1. Experience in World War II showed that the consumption of all types of commodity was roughly proportional to the number of men in the theatre of ops, and, for planning purposes, it was possible to express consumption in terms of 'pounds per man per day'. This sort of planning yardstick can only be applied to the theatre of ops as a whole. It is possible and nec to make much more accurate ests of consumption of particular formations and units, depending on the role they are to perform.

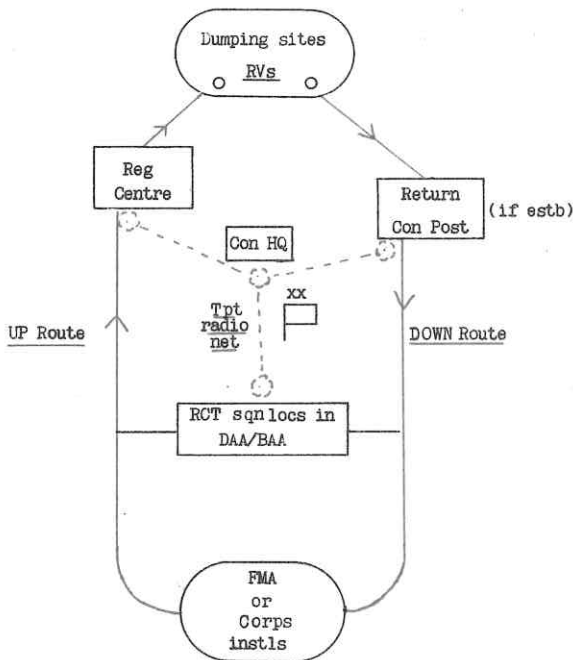
2. The table below is based on last war experience, modified in the lt of modern techniques. It must be tempered by common sense, eg, if the force is operating mainly on air log sp, the consumption of POL by the Army will be relatively small, while that of the RAF will be greater.

MAINT TONNAGES

Commodity	Lbs/man/day	
	Army (overall)	RAF (overall)
(a)	(b)	(c)
Rat	7	7
Ammo	15	14
Ord stores (ie excl vehs, POL, ammo and rat)	4	1.5
Vehs	2	0.5
Engr stores (incl those of ord origin)	10	13
Ac spares	1	13
Med, canteen, postal	1	1
TOTAL, dry cargo	40	50
Bulk POL	10	10
Ac fuel	2	120
TOTAL, POL	12	130
GRAND TOTALS	52	180

Note: The main variables are ammo, engr stores and POL and, in practice, more exact ests must be made if possible. In particular, the RAF and the AAC must be asked to make detailed ests of ac fuel consumption.

ORG AND CON OF DUMPING



FUNCTIONS AND RESPONSIBILITIES

Con 1. Responsibility - Q Staff. Detailed execution by tpt from formation HQ.

Org 2. Reg Centre estb on UP route in fwd area to:

- a. Coord guides to dumping sites.
- b. Reg flow to dumping sites and keep con HQ info of progress.

Composition would probably incl RCT offr, RA offr (if gun ammo being dumped), guides, pro for TC.

3. Return Con Post may be estb on DOWN route to con return of empty vehs. It will be manned by the RCT. Whenever possible will be combined with the Reg Centre.

4. Vehs will normally check in at their sqn loc in BAA/DAA on outward and return journey.

5. Dumping Sites. Bde units will be responsible for selection, marking and org of dumping sites and for the provision of guides, unloading parties and TC.

Comms

6. The programme will normally be con by the formation RCT (eg CRCT at div regt HQ) who will be in radio comm with the Reg Centre, return con post (if estb) and the sqns involved.

DUMPING CALCULATIONS AND EXAMPLES

Gen

1. A dumping problem is normally concerned with the solution of one of the following questions:

a. How long will it take to dump so many tons of stores with a given number of vehs?

OR b. How many vehs will be required to dump so many tons of stores within a given time?

2. There are two recognised ways of answering these questions:

a. By formula. This is suitable when large tonnages and many vehs are involved and when accuracy is less important than speed of calculation, eg for the stocking of a RP.

b. From first principles. This is the only method likely to give a sufficiently accurate answer for dumping problems at div and bde level.

Solution by Formula

3. The formula depends on averaging out the factors which affect the turnaround of vehs.

Number of vehs x round trips possible in avail time = Total number of veh loads moved

OR Number of vehs (V) x $\frac{\text{Total time avail (T)}}{\text{Time for one round trip (t)}}$ = Total number of veh loads (L)

ie $V \times \frac{T}{t} = L$ (A)

Now Time for round trip (t) = $\frac{\text{Mileage for round trip (M)}}{\text{Average speed (S)}} + \text{Delay for loading and unloading (D)}$

ie $t = \frac{M}{S} + D$ (B)

Combining equations (A) and (B)

$$V \times T = L \left(\frac{M}{S} + D \right)$$

$$\therefore V = \frac{L}{T} \left(\frac{M}{S} + D \right)$$

OR $T = \frac{L}{V} \left(\frac{M}{S} + D \right)$

4. A "safety factor" of 10% is added to the answer obtained by this formula.

5. An example is worked out on page 450.

Solution from First Principles

6. This method depends on examining in detail how long each journey will take and then tracing the mov of each colm or packet of vehs, or individual veh. The timings, stage by stage are then noted down or recorded pictorially on a simple graph. Both methods are illustrated on page 450. Many different types of graph can be used and experts usually design their own.

Completion of a Dumping Programme

7. If second line tpt is used for dumping, the programme is not complete until the vehs have been reloaded with their normal loads.

DUMPING CALCULATIONS - EXAMPLES

DATA	LIFT = 200 x 4-ton loads from A to B	PASS TIME	- Very small. Ignore	PROBLEM	How many 4-ton
DISTANCE	= 40 miles from A to B	REST AND SVC	- 4 hrs during daylight	VEHS AVAL	vehs are
SPEED	= 20 mph by day, 15 mph by ni	VEHS AVAL	- 0400 hrs D Day	LOADING TIMES	required?
FIRST LT	= 0400 hrs	COMPLETION TIME	- 2 hrs for loading, 2 hrs for unloading		
LAST LT	= 2000 hrs		- Program to be completed by 1600 hrs		
			- D + 1 (last veh unloaded at B)		

FIRST PRINCIPLES				FORMULA	
FIRST PRINCIPLES BY GRAPH					
				1. Loads (L) = 200 Miles (M) = 80	
				2. Time Avail (T).	
				Daylt (28 hrs less 4 hrs rest)	= 24 hrs
				N1	= 8 hrs
				3. Average Speed (S).	T = 32 hrs
				(24 hrs day x 20 mth) + (8 hrs ni x 15 mth)	
				S = $\frac{600}{32}$ = 19 mph	
				4. Loading/Unloading time per round trip (D) = 4 hrs.	
				5. Formula (Page 449):	
				$V = \frac{L}{T} \left(\frac{M}{S} + D \right)$	
				$\therefore V = \frac{200}{32} \left(\frac{80}{19} + 4 \right)$	
				$\therefore V = 6.25 \times 8.2 = 51$	
				51 + 10% safety factor = 56 x	
				4-ton vehs required.	

- Four loads per veh can be delivered at B within the 36 hrs aval. Therefore, $\frac{200}{4} = 50$ x 4-ton vehs will be required.
- In this case vehs would then return to unit where they would have their rest for D + 1. Sometimes it is nec to take into account the time required for return to unit and, in the case of second line tpt, reloading, in the time aval.