AIRFD LAYOUT AND DESIGN
FUNDAMENTAL REQR

1. **The Role of the Airfd**. The various components which may be needed on an airfd have been briefly Disc in Sec 6, and is apparent that those to be provided in any particular case will vary, not only with the tac sit and the time and materials aval for constr, but also with the role of the airfd and the type of aircraft which are to use it.

Broadly speaking, airfds can be divided into four main types, based upon the class of ac concerned but reqr and layout are further affected by the anticipated pd of use. The four main cat of ac are:

a. Med bombers.
b. Light bombers.
c. Fighters.
d. Coastal and tpt ac.

Cl of Airfds

2. **Temp Emergency Airfd (One Month).** Hastily constr airstrips are normally reqd during active op, sited as near to fwd grd positions as is tac poss, so that close-sp ac do not have to return to their parent airfd in order to refuel and re-arm. Ac are not usually accommodated on this type of airfd and the min prac reqr may therefore, be:

a. One flight-strip (landing-lane, shoulders, over-run and app funnels).
b. Emergency landing strip.
c. One quick-return taxi-track, with an ORP at the junc with the runway.
d. Hardstandings or apron (for dispersal, ASP or refueling and re-arming).

A specimen layout is shown is diag in Fig.

3. **Temp Min Op Airfd (Six Months).** This is the normal cl of airfds intended for tac use, other than the temp strips ref to in Para 2. It incl temp airfds for use either by fighters and fighter-bombers or by tpt ac. The essential difference is these two types is that fighters and fighter-bombers are often based on a temp airfd, reqr accn and dispersals for up to one wing of ac, with ltd svc and admin facilities, whereas tpt ac are not usually so based, and use the temp ac only for unloading stores and perhaps refueling before returning to base.

The actual reqr for a six-month airfd, therefore, vary somewhat widely, but the most probable essentials are:

a. One fight-strip.
b. Emergency landing strip.
c. Quick-return and run-off taxi-tr.
d. Hardstanding or aprons for ORPs, ASPs, refueling, re-arming or unloading.
e. Min parking areas and dispersals.
f. Perimeter tr.
g. Min storage for:

(1) Fuel and oil.
(2) Ammo.
(3) Bombs.

h. Essential sanitary arrangements and water-sup.

Two specimen layouts, showing min reqr, are represented diag in Fig.

4. **Temp Full Op Airfd (Two Yrs).** Semi-perm airfds are usually estb only in the base area of a theatre of ops, where they are likely to remain in use for the duration of the war, or at least throughout the ops in the theatre concerned. They may reqr for the accn of any type of ac. The component parts reqr will incl all those listed in Para 3 above, but the scale will usually be more ext and complete, while admin accn, wksp and storage will often be in the form of hutments or other semi-perm bldg. The reqr of any base airfd will normally be spec in detail by the RAF.

SEQ OF FIRST PRI TASKS

1. **Co-op with the RAF**. The great imp of manual understanding and confidence between air crews and airfd engrs has already been stressed in Sec 7, Para 12. The need for prac coop is probably never more essential than in the early stages of development of tac airfds, for the inexperienced engr may regard as unreasonable the legitimate dmd of pilots, while flying pers may not appreciate the tech difficulties that will arise if they insist upon too high a std of facilities at the outset.

The fundamental reqr discussed in Sec 35 may all justly be regarded as being first pri tasks, but it will, none the less, often be poss to agree upon a prog of constr by stages which will enable ac to op with a min of delay, while ensuring that the build-up of facilities is achieved as rapidly as poss.

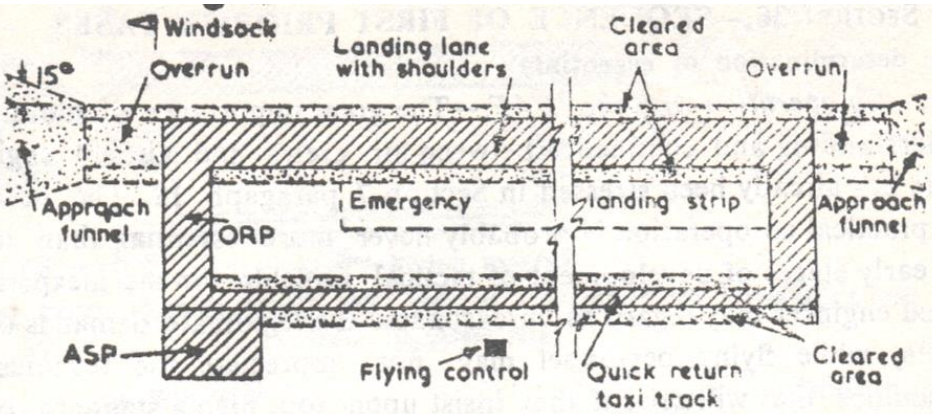
2. **Constr by Stages**. An example of constr by stage is shown diag in Fig 28. It is emphasized that this is merely an example, since flying reqr, time limits, site conditions and resources aval will vary mat and must be fully considered when formulating the plan.

a. In this example the first stage is to contruct an emergency landing strip which, in good weather conditions and with suitable soil, may involve little more than clearing and perhaps light su-grading. Soil impv and some from of prefabricated su will, however, often be needed.

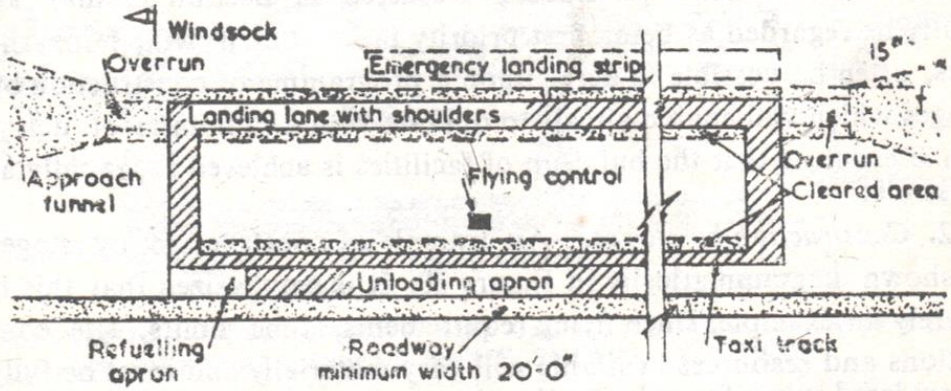
b. For the second stage (Fig 28(a) a quick return taxi-tr is added, incorporating an ASP is constr at one end and an over-run is provided at the other.

c. The third stage (Fig 28(b) is the constr of a properly designed runway or landing lane of full reqr dimensions, parallel to the original strip, which becomes the emergency or crashlanding strip when the new runway is taken into use addl taxi-tr are needed, and an ORP should also be provided at the other end of the runway.

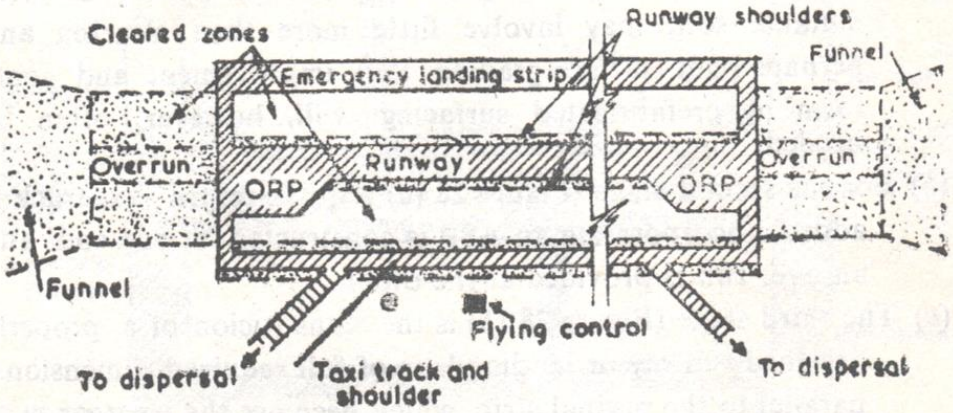
d. The fourth stage (Fig 23(c) is the dev of he layout to the full std reqr for a temp airfd for fighters or fighter-bombers. This will usually mean the duplication of the taxi-tr sys and the provision of addl svc platforms. Other essential facilities, not shown in the diag, will be reqr at this stage incl proper arrangements for the dispersal of ac, dumps for fuel, ammo and bombs, access routes to all airfds components, and accn and camp svc.



(a) DIAGRAM OF SPECIMEN LAYOUT FOR A TEMPORARY EMERGENCY AIRFIELD.



(b) DIAGRAM SHOWING MINIMUM REQUIREMENTS FOR A TEMPORARY AIRFIELD FOR TRANSPORT AIRCRAFT TEMPORARY MINIMUM OPERATIONAL AIRFIELD.



(c) DIAGRAM OF A SPECIMEN LAYOUT FOR A TEMPORARY MINIMUM OPERATIONAL AIRFIELD FOR FIGHTERS

Flg 27.—Diagrams showing fundamental requirements of tactical airfields

3. Contingent Reqr. When concentrating upon the needs of the RAF, and endeavouring to devise a plan which will satisfy their reqr within the time limit for each stage of the wk, there is sometimes a tendency to overlook, or at least to minimize, the essential dmd of the constr tps. In the fwd are in particular, sy measures must be arranged and this may mean the constr of def wk and poss a reduction of the manpower aval for constr wk. Though accn in the early stage will almost invariably be in bivouac, water sup and hyn and likely to reqr some attn. and labour.

a. On some sites a considerable constr task may be involved in the provision of access routes to the site, for use by constr veh and plant.

b. In the prep of any plan, the first duty of the engr is to ensure that the labour and resources nec for its fulfilment can be made aval at the chosen site and can be properly maint there.

Typical Order of Constr-Pri

4. While it is imposs to lay down a std order of pri for airfd constr, since reqr and condition will vary from site to site, the fol list is given as a guide in planning the constr of an airfd to be fuilt as a straightforward tasks:

a. Sy arrangements and bivouac accn for the constr tps, incl water sup and essential sanitation.
b. Access route to the site, for the use of constr veh and plan and for subsequent dev as a meint route to the finished airfd.
c. Flight-strip.
d. App zones.
e. Mk and con.
f. Emergency (crash-landing) strip.
g. Taxi-tr, with ORPs as reqr.
h. ASPs or refueling and re-arming apron as reqr.
j. Dispersal areas with hardstandings.
k. Bomb, ammo and fuel dumps (Temp arrangements may be needed at an earlier stage).
l. Svc rds or trs to be various airfd components.
m. Addl camp svc (water, sanitary, veh parks).

SECOND AND THIRD PRI TASKS

1. Gen. First pri constr is planned solely to provide the fundamental reqr which will enable ac to op effectively. The Cap of the airfd is, however, restricted if only minimum facilities are aval, and efficiency will also be impaired, especially over a protracted pd. To increase both Cap and efficiency, some elaboration of the initial layout will always be called for. The addl wk may involve:

a. Ext or duplicating first pri constr.
b. Impv.
c. Providing addl facilities.

2. **Second Pri Tasks.** The wk undertaken in this cat is normally aimed to dev max efficiency (incl some increase in Cap) from the basic components constr under first pri. Example of probable tasks are:

a. Ext of dispersal areas.
b. Provision of ASPs and repair and svc facilities.
c. Constr of extra taxi-tr for quick return and clearing of the fight-strip.
d. Fmn of addl access and svc rd.
e. Laying out veh parks and svc bays.
g. Eracting essential op and admin bldgs..

3. **Third Pri Tasks.** If an airfds is to remain in op for more than a few wks, it is probable that some spl accn or components will be called for, and that various comparatively minor impv will be found desirable.

a. Such dmd are likely to arise in the lt of actual experience of op from the airfd. Even though it may be difficult to undertake further wk because of other commitments, it is the duty of the engineer to make every effort to meet these dmd, since it is vital that pilots should have confidence in their grd org and should feel sure that everything poss is being done to remove flying hazards, to reduce the risk of accident and to impv the efficiency of svc and dispersal.

b. While some of these tasks may be within the powers of maint parties and it must never be forgotten that maint must start as soon as flying op begin there will be others which dmd a larger scale constr effort. These are classed as third pri tasks. They may incl:

(1) Minor impv to op facilities.
(2) Provision of spl components or accn.
(3) Provision of desirable admin accn.

c. Larger-scale constr wk may also be nec by the progress of op. The constr of addl flight-strips, for example, may be undertaken at the third pri stage.

GENERAL PRINCIPLES OF AIRFD LAYOUT

Intro

1. An airfd consists of a no of component parts, the dia and characteristics of which are governed by definite std, or spec. Similarly, the relative posn and spacing of these components are dictated by considerations of flying safety, efficiency of grd servicing and tactical expediency.

a. The evolution of ac is a cont process and the production of a new type may well affect the from which any particular component, or gp of components, should take. Ruling fig cvannot, therefore, be laid down for general application but suggested std are given, as a guide, in Appx F. Variations in these std are to be expected, either because of changes inac performance, because of climatic conditions or of ac types aval in a particular theatre or because of op nec. The actual std to be applied in a particular theatre, or in any ph of op, will be laid down by the RAF comd.

b. Local mod may radically affect the details of layout, the principles of which are Disc only in general terms in this sec.

2. The general layout is determined primarily by the siting of the flight-strip, which is the heart of the airfd. All other features and facilities are gp round it (Fig 29).

3. Loc. The flight-strip incl the whole of the runway (or landing lane), the shoulders, cleared zones and the over-run. In siting it, the reqr of the app funnels must also be taken into account.

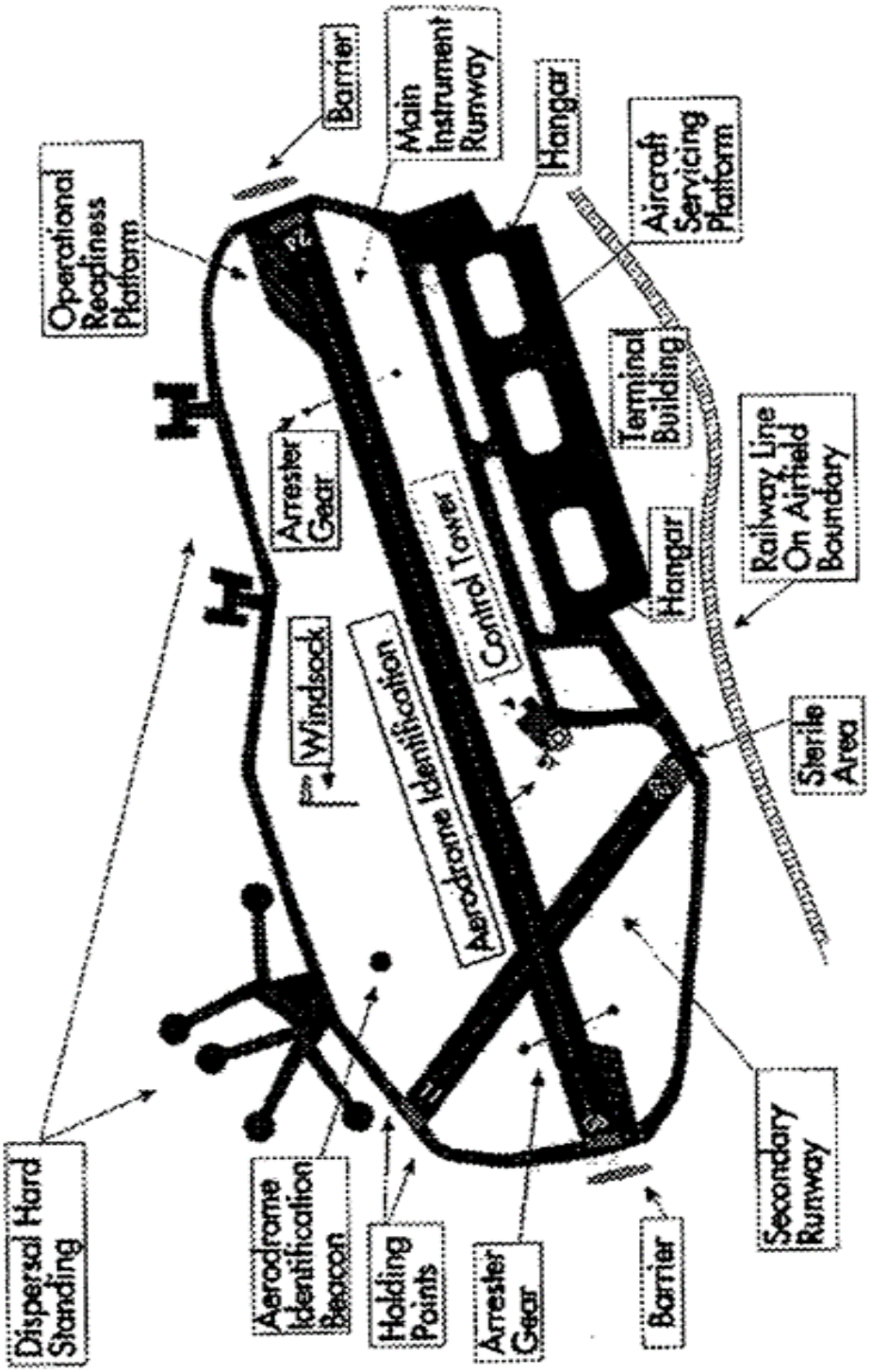
a. In fixing the exact location of the flight-strip two different aspects of the prob have to be considered and reconciled, the two sets of factors being flying reqr and engg considerations.

(1) Flying Reqr. A part from the std dia spec, the over-ruling factors are the orientation of the landing lane and the app-conditions, both as to length and width of the cleared area and as to the glide angle reqr for landing and take-off.

(2) Hitherto the orientation of a flight-strip has been based upon the prevailing wind in the loc, particular occurance. Modern ac with high take-off and landing speed are, however, little affected by cross-winds, provided that they have no following component, and one flight-strip which can be used in either dir is normally sufficient. Because of the greatly increased length of runway now reqr, orientation will often depend pri upon the shape of the grd and app-zone conditions.

(3) Suggested Fig for the app-zone are given in Appx F.

b. Engg Considerations. Although flying reqr must take pri in site selection, engg considerations may compel mod of the ideal op soln, since a small change of alignment or a slight variation in grade may cause a disproportionate effect upon the wk to be done, and hence upon the time reqr for completion.


Barrier
Main Instrument Runway
Hangar
Aircraft Servicing Platform
Operational Readiness Platform
Terminal Building
Arrester Gear
Railway Line On Airfield Boundary
Hangar
Windsock
Aerodrome Identification
Control Tower
Sterile Area
Dispersal Hard Standing
Aerodrome Identification Beacon
Holding Points
Arrester Gear
Barrier
Secondary Runway

c. The most imp engg factor, especially when time is limited, is the earthwk involved. The computation of earthwk is Disc in Chapter 10. The other ruling engg factor are soil characteristics (Chapter 9) and drainage (Chapter 15).

4. Tfc Cap. The no of ac which can op cont from one flight-strip depends to some extent upon the type of ac, as well as upon flying conditions, particularly as a visibility.

a. As a guide, one runway should normally be able to cater for the fol flying op, in good daylt conditions and if the ac are not of widely divergent types:

(1) 40 landings per hr.
(2) Upto 80 take-offs per hr.
(3) 25 landings and 25 take-offs in one hr.

b. If both fighters and bombers or tpt ac are reqr to op from the same ac, separate parallel runways should be provided whenever poss, and these should be not less than 300 feet apart from edge to edge, or 450 feet from cen to cen.

5. Alternative Runway. As stated in Para 3(a) above, meteorological conditions will not usually nec more than one flying-strip, though, as shown in Para 4 above, parallel runways may be needed if tfc is hy or if different types of ac use the same ac. For ac with comparatively low landing speeds, alternative runways may be called for when climatic conditions are subj to mk seasonal change, or in areas where freq storm winds occur or where there is a pronounced difference between day and at ni winds.

Planning Aspects and Siting of Other Airfd Components

6. **Flying Con.** Every airfd must have a con pt from which ac, either on the grd or airborne near the airfd, can be dir by the flying con offr.

a. In the early stages of op, a tr, hut or even a tent may serve as the con pt, but as air-tfc increase a properly designed con office or con tower will be dmd.

b. Siting is usually the resp of the RAF, but the fol are the main reqr:

(1) An unobs view of the whole flight-strip and of the ORPs.

(2) A good outlook in all directions and, if poss , a view of dispersal areas.

(3) Orientation should be aligned on a definite cardinal pt of the compass to simplify the loc, from bearing, of airborne ac. If poss the con offr should normally face North or North-East so as to avoid sun-glare.

(4) Loc should not be less than 300 ft from the runway cen-line, and set-back 125 ft from a taxi-tr.

The design of con pt is Disc in Sec 41.

7. **Taxi-Tracks**. The func of the taxi-tr is to provide rapid cir between dispersal areas (hardstanding), aprons (for parking, svc or marshaling), and the runway. The main obj is to keep the runway clear for take-offs and landing, and ac must, therefore, be able to reach the take-off end without X-ing the runway or taxi-ing along it. It is equally imp that ac which have landed should be able to get off the runway quickly.

Taxi-tr are therefore, of three main types.

a. Quick return taxi-tr, running roughly parallel to the runway, so that ac can mov dir from one end of the runway to the other without obstructing it.

b. Run-off taxi-tr, which like the runway to the quick return taxi-tr, so that ac making a short landing run can lve the runway at an intermediate pt, so as to clear it quickly.

c. Dispersal taxi-tr, leading from ORPs and quick return taxi-tr to the ac dispersal area.

It is always desirable that tax-tr should be provided on both side of the runway as soon as prac, so as to prevent congestion and to avoid hold-ups due to a mech breakdown or as a result of enemy air-attk, strafing damage or a dir hit a any pt of the taxi-tr. The provision of altn routes is ext, as the airfd is dev, by laying out taxi-tr on the loop principle.

The main loop comprises the quick return taxi-tr joining the two ends of the runway. Other loops are added as they are needed to accn the no of ac Alt to the airfd, each being sub-divided by run-off taxi-tr so that taxi-tr ac can be routed by different ways to avoid a block, or during repair and maint of the taxi-tr sys.

The design of taxi-tr is Disc in Sec 42.

8. **Aprons**. Aprons or platforms may be needed for a variety of purposes, and can conveniently be cl under three main cat:

a. Op readiness platforms.
b. Platforms used between sorties for purposes such as loading, unloading, re-equipment (fuel, bombs, ammo) and svc.
c. Parking aprons or hardstandings.

9. **Op Readiness Platforms (ORP)**. Jet ac need a place where they can await the order to take-off and from which they can become airborne with an absolute minimum of delay. ORPs are loc at both ends of the runway, and should be built to a spec at least as good as that of the runway itself.

a. Size depends upon the no of ac to be accn at one time, a usual scale being either eight or sixteen ac. Minimum dia may be taken as:

Length 1.25xwing span x No. of ac.

Width (excl taxi-tr) 1.5 x wing span.

Design is further Disc in Sec 43.

10. **Aircraft Servicing Platforms**. The siting of aprons and platforms for loading, re-eqpt or svc obviously depends upon the actual func and upon local conditions and reqr. No general scale of provision can be laid down.

a. The principles to be observed in planning and siting are:

(1) Access from the taxi-tr sys must be easy, but must not interfere with normal taxi-tr tfc.

(2) Loc should be fixed according to func, and so as to reduce delays and taxi-ing distances where nec, eg refueling and re-arming aprons should usually be alongside the quick return taxi-tr.

(3) Access by veh is often nec. Veh routes should not obs ac moving to the runway.

(4) The need for dispersion must be remembered.

(5) Su must be at least as good as the runway and heavier constr may be desirable. Protection against fuel and oil spillage is often nec.

11. **Parking aprons**. Parking aprons are not normally used unless the likelihood of en air-attk is small, the normal method being to use dispersed hardstandings. The chief advtg of apron parking are that taxi-ing distances can be greatly reduced and that sy measures are simplified.

a. Parking aprons are normally sited on one side of a taxi-tr: siting on both sides may be nec, but the risk of collision is thereby increased, especially at ni.

12. **Dispersals and Hardstandings**. Parked or dispersed ac are accn on hardstandings, the constr and su of which are designed to carr the static and concentrated load, and to withstand the abrasion of turning and braking and the spillage of fuel and oil. Siting often entails a compromise between two conflicting requirements:

a. To avoid exce tax-ing (and taxi-tr constr) and to reduce delay, dispersals should be loc reasonably near the end of the runway, preferably the down-wind end. It should be noted that separate warming-up platforms for piston-engined ac are not now usually provided.

b. Dispersion and irregularity of pattern are desirable, both for concealment and for protection against air-attk.

Dispersal layout is impossible to std, as it inevitably depends upon local conditions and upon local decision as regards both spacing and type of hardstandings. Wherever poss advtg should be taken of grd features and natural cover, and hardstandings should always be staggered and spaced irregularly to avoid presenting an attractive target. They should be located close to taxi-tr, but sufficiently set back to avoid interference with specified taxi-tr clearance.

Various types of layout and altn designs of hardstanding are described in Sec 44.

13. **Storage**. Adequate provision will always be needed for the storage of fuel and oil, and of bombs and ammo. No hard and fast rules can be laid down either for qty reqr or for the scale or siting of the nec facilities. Reqr will usually increase as op proceed and it is likely that, while small dispersed dumps on and near the airfd will suffice in the early stages, considerable expansion and the provision of bulk storage will be needed at a later dt.

a. The principles to be borne in mind are:

a. Different types should be stored separately. For example, jet fuel, aviation gasoline and lubricants should be separated from each other, small arms ammo, unfazed bombs, rockets, incendiaries and pyrotechnics, fuzes and primers should be segregated.

b. Bulk storage must be sited at a safe distance from ac, runways and instl. Distances will be decided by the tech br concerned, depending upon the nature and qty of the mat.

c. Packed stocks and imm use dumps must be well dispersed and of limited size.

d. A proper rd net is essential to permit free cir by veh in all weathers. Rd used by bomb trailers reqr a min radius of 120 feet for all bends.

e. Protection is provided partly by dispersion and partly by constr.

f. Bulk stores of both petroleum fuels and expl should either be partially buried or be surrounded by earth embankment, cover is desirable for protection from dir rays of sun as well as for concealment, a barbed-wire perimeter fence should be erected for sy purposes.

g. The probability of future expansion must be considered.

Some Further Details of Storage Reqr are Given in Sec 45

14. **Veh Parks**. A considerable no of veh, of different cat, have to be accommodated in the vicinity of an op airfd. Planning is needed to secure proper dispersal, to avoid tfc congestion, and to ensure that veh are parked in the appropriate area.

a. Fire-fighting and rescue veh.

b. Fuel units and bomb tr or trailers.

c. Flight con veh.

d. Svc and maint units.

e. Constr plan and veh.

f. Unit tpt.

In general, parking areas for all veh other than fuel units and bomb trucks should be clear of the taxi-tr sys. All parking area should be of all-Wx constr.

15. **Camp and Admin Area**. Whether in bivouac, tented camp, hutments or more perm bldg, accn should be sited not less than 1,000 yrs from the flight-strip and should be clear of the app zones. On big airfd accn is often divided, so that pers live where they can reach the dispersal areas of their own units without undue travelling. Dispersion and concealment are imp, and water-sup, hyn and access routes must be properly planned.

Camp sites and tech accn are further dealt with in Sec 47.

16. **Access and Svc Rd**. Every airfd must be connected to the existing rd net, or an adjacent railhead or port, by at least one double-lane access rd. It op or svc airfd components are instl on both sides of the runway a perimeter rd or tr round the airfd should connect with the main access rd. Inter svc rd will also be reqr, to enable veh to get to dispersal areas and indl hardstandings, storage areas and issue pts, the camp and admin areas, and svc and maint instl. Access to the flying con pt is also imp, as pilots normally have to report there before take-off and after landing.