CRITERIA & STANDARDS FOR TACTICAL AIRFIELDS

THIRD EDITION

SUPREME HEADQUARTERS ALLIED POWERS EUROPE
SHAPE CRITERIA AND STANDARDS
FOR TACTICAL AIRFIELDS
THIRD EDITION

Preamble

1. The airfields planned for the use of the tactical air forces under the control of SACEUR have been divided into the following categories:

a. Main Airfields - These are fields for permanent occupation in peacetime. They should have operational facilities to a standard adequate to develop full use of their war combat potential. Housing shall be provided by bilateral agreement between the user nation and the host nation.

b. Deployment Airfields - These are fields which will not be occupied in their entirety in peacetime by the nation to whom allotted, but which must be immediately available at the outbreak of war for use and occupation by units redeployed from their peacetime locations. They should have substantially the same standards of operational facilities as a main airfield. Peacetime housing accommodation will be provided for a maintenance party of 100 men. The balance of the housing required in peacetime, e.g., for a squadron in rotation, and in wartime for 2,900 personnel will be on a field basis, of which only essential utilities and camp structures should be provided in peace.

c. Alternative Airfields - These are fields for use as accommodation for wartime reinforcement, for alternative use if main or redeployment airfields are out of action and to give tactical flexibility. The housing accommodation to be provided at these fields will be for a maintenance party of 50 men.

2. The criteria and standards for tactical air force airfields are presented in this document as follows:

a. Table No. 1 lists the minimum standard facilities to be provided for each particular type of field. Facilities desired by a user nation in excess of these standards shall be provided by the user nation or through bilateral agreement with the host government. All necessary land for standard items and user nation facilities will be provided by the host nation.

b. Appendix A gives details of the required criteria for construction of the standard facilities listed in Table No. 1.

c. Annexes 1, 2 and 3 present schematically details of the approach zones, glide paths and clearance areas as applied to standard airfields.

d. Annex 4 indicates graphically the maximum and minimum grades both longitudinal and transverse which are applicable to standard airfields.

3. If, because of local conditions of terrain or climate, existing facilities or surrounding built-up areas, or special intended use of the proposed airfield, deviations from the criteria and standards cited in paragraph 2 above appear necessary, the appropriate subordinate command of SHAPE should be furnished with complete details of the proposed deviations. The proposals of the host country will be reviewed by the allied subordinate commands concerned, and coordinated with the user nation when appropriate, in reaching a decision as to whether the requested deviations are operationally acceptable. Operational acceptability should be determined prior to initiation of any NATO-common infrastructure construction which deviates from the standards cited in paragraph 2 above.

4. In addition to the foregoing required criteria and standards, this document also presents certain SHAPE suggested guidance as follows:
a. Appendix B gives information on items such as general specifications for construction, layout, concealment and protection.

b. Annex 5 is a schematic diagram of a typical airfield based on the standard installations listed in Table No. 1. It is intended as a graphical presentation of how each of the items of the standards might be provided on an average airfield, but is specifically not intended to be adopted in entirety at any one site.

5. It is emphasized that, while Appendix B and Annex 5 do not give mandatory criteria and standards, they do present what SHAPE considers to be desirable solutions to some of the problems encountered in airfield construction. Nations are urged to make maximum use of these suggestions, to the extent consistent with avoiding stereotyped layouts by a rigid application of Annex 5.

6. Technical guidance on the design and construction of airfield pavements and airfield utilities systems and on such other technical matters as may prove necessary will be disseminated by the experts of the NAC international staff.

7. This Third Edition of the Criteria and Standards for Tactical Airfields contains certain statements and requirements not explicitly set forth in the original version. These differences consist either of more detailed explanations of the meaning and intent of the original statement of the standards or of approved or SHAPE recommended changes. Where construction of an item has been completed according to an operationally acceptable interpretation of the original version of the standards, it is not intended that work be reinitiated to bring that item into strict conformance with additions or revisions to standards. However, where construction progress has not yet committed the constructing nation to facilities which deviate from these standards, plans and construction details are required to be modified in accordance with these standards as now amplified or revised.
SHAPE STANDARDS

STANDARD MINIMUM OPERATIONAL REQUIREMENTS FOR TACTICAL AIRFIELDS - (TABLE NO. 1)

All items must be considered together with the relevant notes contained in Appendix A, which follows.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>FACILITIES</th>
<th>MAIN AIRFIELDS</th>
<th>REDEPLOYMENT AIRFIELDS</th>
<th>ALTERNATIVE AIRFIELDS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>A</strong></td>
<td><strong>B</strong></td>
<td><strong>C</strong></td>
</tr>
<tr>
<td>1.</td>
<td>Runway. (See Appendix A, pages 11-13)</td>
<td>2440 metres long</td>
<td>2440 metres long</td>
<td>2440 metres long</td>
</tr>
<tr>
<td></td>
<td></td>
<td>45 metres wide</td>
<td>45 metres wide</td>
<td>45 metres wide</td>
</tr>
<tr>
<td>2.</td>
<td>Parallel Taxiway. (See Appendix A, pages 13-14)</td>
<td>2440 metres long</td>
<td>2440 metres long</td>
<td>2440 metres long</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22.5 metres wide</td>
<td>22.5 metres wide</td>
<td>22.5 metres wide</td>
</tr>
<tr>
<td>3.</td>
<td>Taxitracks (See Appendix A, pages 14-15)</td>
<td>15 metres wide</td>
<td>15 metres wide</td>
<td>15 metres wide</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Length as required</td>
<td>Length as required</td>
<td>Length as required</td>
</tr>
<tr>
<td>4.</td>
<td>Dispersal Hardstands. (See Appendix A, page 15)</td>
<td>48 double hardstands</td>
<td>48 double hardstands</td>
<td>48 double hardstands</td>
</tr>
<tr>
<td>5.</td>
<td>Alert Platforms. (See Appendix A, page 16)</td>
<td>For 12 aircraft at each end of runway</td>
<td>For 12 aircraft at each end of runway</td>
<td>For 12 aircraft at each end of runway</td>
</tr>
<tr>
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<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>6.</td>
<td>Aprons for Inspection and Maintenance for Aircraft. (See Appendix A, page 16)</td>
<td>11,700 square metres</td>
<td>11,700 square metres</td>
<td>Nil</td>
</tr>
</tbody>
</table>
| 7. | Internal Roads. (See Appendix A, pages 16-17)  
Single track - 3 metres wide minimum  
Double track - 5.5 metres wide minimum | As required; 51,100 square metres maximum as NATO-common infrastructure. | As required | As required |
| 8. | Airfield Lighting. (See Appendix A, pages 17-18)  
Permanently installed or transportable high and low intensity system required. | Permanently installed or transportable high and low intensity system required. | Permanently installed or transportable high and low intensity system required. |   |
(See Appendix A, page 19) | 300 KVA | 300 KVA | Nil |
| 10. | Aircraft Fuel Underground Storage;  
a. Aviation Gasoline  
(See Appendix A, page 19) | 190,000 litres  
1,500,000 litres | 190,000 litres  
1,500,000 litres | 75,000 litres  
760,000 litres  
Dispersed over not less than 2 locations. |
|   | b. Jet Fuel  
(See Appendix A, page 19) | Dispersed over not less than 3 locations | Dispersed over not less than 3 locations |   |
| 11. | Lubricating Oil Storage  
Paved area for drums  
12 metres by 24 metres | Paved area for drums  
12 metres by 24 metres | Paved area for drums  
12 metres by 24 metres  
jerricans (Item 12)  
12 metres by 24 metres |
<p>| 12. | Motor Fuel Underground Storage and Dispensing Facilities. (See Appendix A, page 20) | 76,000 litres and dispensing facilities | 76,000 litres and dispensing facilities | jerricans |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>13.</td>
<td>Water Tanks (storage only): either overhead surface or underground; for domestic consumption; connected to mains on airfield.</td>
<td>475,000 litres</td>
<td>228,000 litres</td>
<td>114,000 litres</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Covered and Blastproof</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Open Concrete Hardstands Revetted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>a. Control Tower. (See Appendix A, page 21)</td>
<td>Required</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td></td>
<td>b. Meteorological Building</td>
<td>95 square metres usable space</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>16.</td>
<td>Wing Operations Building</td>
<td>140 square metres usable space</td>
<td>232 square metres usable space including meteorological and flying control offices.</td>
<td>140 square metres usable space including meteorological and flying control offices.</td>
</tr>
<tr>
<td>17.</td>
<td>Squadron Operations Rooms (including crew rest and locker rooms)</td>
<td>Minimum of 3 buildings totalling 560 square metres usable space</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------------------------------------</td>
<td>-----</td>
<td>-----</td>
<td>------------------</td>
</tr>
<tr>
<td>18.</td>
<td>Wing Headquarters</td>
<td></td>
<td></td>
<td>374 square metres</td>
</tr>
<tr>
<td>19.</td>
<td>Hangars, minimum clear door opening 30 metres wide by 6.1 metres high. (See Appendix A, page 21)</td>
<td></td>
<td></td>
<td>5,600 square metres</td>
</tr>
<tr>
<td>20.</td>
<td>Storage or Warehouse Buildings</td>
<td></td>
<td></td>
<td>1,870 square metres</td>
</tr>
<tr>
<td>21.</td>
<td>Maintenance Shops (including parachute stores)</td>
<td></td>
<td></td>
<td>2,500 square metres</td>
</tr>
<tr>
<td>22.</td>
<td>Technical Shops</td>
<td></td>
<td></td>
<td>935 square metres</td>
</tr>
<tr>
<td>23.</td>
<td>Motor Vehicle Maintenance Shop</td>
<td></td>
<td></td>
<td>935 square metres</td>
</tr>
<tr>
<td>24.</td>
<td>Crash and Fire Station</td>
<td></td>
<td></td>
<td>232 square metres</td>
</tr>
<tr>
<td>25.</td>
<td>Motor Pool Hardstands</td>
<td></td>
<td></td>
<td>1,870 square metres</td>
</tr>
</tbody>
</table>

Note: All areas are in square metres.
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>26.</td>
<td>Dispersal Huts (See Appendix A, page 22)</td>
<td>Maximum of 4 totalling 94 square metres usable space</td>
</tr>
<tr>
<td>27a.</td>
<td>Communications Building</td>
<td>200 square metres usable space</td>
</tr>
<tr>
<td>27b.</td>
<td>Remote Transmitter Building</td>
<td>125 square metres usable space</td>
</tr>
<tr>
<td>28.</td>
<td>Communications System</td>
<td></td>
</tr>
<tr>
<td>28a.</td>
<td>Perimeter Cable</td>
<td>56 pairs; length as required. 56 pairs is an average for a normal airfield. In practice there will be some variation between individual airfields, but a maximum of 112 pairs should not be exceeded. Cable ducts to be provided in or adjacent to alert platforms and cables terminated at alert platforms for installation of telescrambler.</td>
</tr>
<tr>
<td>28b.</td>
<td>Main Outlet Cable (See Appendix A, page 23)</td>
<td>1 cable, 56 pairs, or equivalent in accordance with local engineering practice; length as required.</td>
</tr>
<tr>
<td>28c.</td>
<td>Main Telephone Switchboard (See Appendix A, page 23)</td>
<td>120 lines, 2 position installed, capable of being extended to 180 line, 3 position.</td>
</tr>
<tr>
<td>28d.</td>
<td>Base Telephone Distribution Cables</td>
<td>As required</td>
</tr>
<tr>
<td>28e.</td>
<td>Telephones</td>
<td>Each 150</td>
</tr>
<tr>
<td>28f.</td>
<td>Remote Control Cable</td>
<td>56 pairs; length as required</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>---</td>
<td>---------</td>
<td>------------------------</td>
</tr>
<tr>
<td>29</td>
<td>GCA Hardstand</td>
<td>Paved area 300 square metres. Runway to be ducted and 25-28-pair cable to be installed and terminated. Road for convoy vehicles to hardstand is required and included in Item 7.</td>
</tr>
<tr>
<td>30</td>
<td>Utilities. (See Appendix A, pages 23-24)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Water Supply On-Site Distribution System</td>
<td>As required, from airfield boundary (or on-site well pump outlet) to exterior walls of SHAPE standards buildings only. Distribution mains sufficiently large for fire-fighting and for accommodation buildings, up to a total airfield supply of 150 litres per man per day for 3000 personnel. On redeployment airfields distribution mains are required sufficiently large to allow for possible expansion to main airfields.</td>
</tr>
<tr>
<td></td>
<td>b. On-Site Electrical Distribution Systems and Sub-Stations.</td>
<td>As required, from incoming sub-station(s) at airfield distribution voltage to exterior walls of SHAPE standards buildings and to points of connection of airfield lighting, FAC and other standard facilities. Sub-station(s) provided by host nation, on-base transformers, cables and equipment to be sufficiently large for standard items and accommodation buildings based on a total airfield supply of 250 KVA. In the case of redeployment airfields (Column D) mains shall be sufficiently large to allow for possible expansion to main airfields.</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>---</td>
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<td>---</td>
</tr>
<tr>
<td>30</td>
<td>c. Sanitary Sewerage and Storm Water Collection</td>
<td>As required, from exterior walls of SHAPE standards buildings to airfield boundary or on-site point of disposal, excluding sewage treatment plants. Mains to be sufficiently large for standard items and accommodation buildings or up to a total airfield capacity for 3000 personnel at 150 litres per day each, and at redeployment airfields sufficiently large to allow for possible expansion to main airfields.</td>
</tr>
<tr>
<td>31</td>
<td>Access Road to Airfield Boundary (See Appendix A, page 24)</td>
<td>As required</td>
</tr>
<tr>
<td>32</td>
<td>Railroad Spur (if economically advantageous)</td>
<td>As required</td>
</tr>
<tr>
<td>34</td>
<td>Fencing, Gates and Observation Towers (See Appendix A, page 24)</td>
<td>Perimeter and security fencing and observation towers as required.</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>35.</td>
<td>Alert Warning System</td>
<td>Deleted</td>
</tr>
<tr>
<td>36.</td>
<td>Demolition Systems (See Appendix A, page 25)</td>
<td>Required to destroy fuel storage, ammunition and communications centre and render runway and parallel taxiway unusable.</td>
</tr>
<tr>
<td>37.</td>
<td>Personnel Housing. (See Appendix A, pages 25-27)</td>
<td>Nil (bilateral agreement between user and host nation). Host nation will provide land.</td>
</tr>
</tbody>
</table>

All necessary land for airfield installations will be provided by the host nation. Expansion potential is required for the development of alternative and redeployment fields to main airfields.
APPENDIX A

This appendix gives details of the required criteria for construction of the standard facilities listed in Table No. 1. If, because of local conditions of terrain or climate, existing facilities or surrounding build-up areas, or special intended use of the proposed airfield, deviations from these criteria appear necessary, the appropriate subordinate command of SHAPE should be furnished with complete details of the proposed deviations. The proposals of the host country will be reviewed by the allied subordinate commands concerned, and coordinated with the user nation when appropriate, in reaching a decision as to whether the requested deviations are operationally acceptable. Operational acceptability should be determined prior to initiation of any HARD-common infrastructure construction which deviates from these criteria.

Item 1 - Runway

(Suggested Guidance in Appendix B, pages 27 and 28)

1a. Load Bearing Capacity

(i) Alternative No. 1

English Units: single wheel loading - 20,000 pounds
   tire pressure - 150 pounds per square inch.

Metric Units: single wheel loading - 9.1 metric tons
   10.6 kilograms per square centimetre.

(ii) Alternative No. 2: LDG 30.

1b. Pavement. Portland Cement concrete except that middle CP may be asphaltic concrete.

1c. Dimensions

(i) Length: 2400 metres. Where an increase in runway length is considered necessary to allow for the effect of altitude and temperature on aircraft performance, the matter should be submitted to SHAPE for decision.

(ii) Width: 45 metres.

(iii) Shoulders: width 60 metres each side of runway, graded, compacted and rolled to prevent serious damage to aircraft due to occasional unavoidable passage over shoulders under any weather conditions and prepared to provide a dust-free surface. If the existing soil in the shoulder areas is not capable of being developed to the required load bearing capacity, suitable other soils must be introduced to provide the required stability and dust-free characteristics. In these circumstances it will be necessary to apply this special treatment to a strip 30 metres wide only adjacent to the runway. The outer 30 metres will be graded and compacted to the limit permitted by existing soils.
Appendix A

Item 1

(iv) Overruns: 92 metres long, 165 metres wide extending from each end of the runway, graded, compacted and rolled to prevent serious damage to aircraft due to occasional unavoidable overrun under any weather conditions and prepared to provide a dust-free surface. If the existing soil in these areas is not capable of being developed to the required load bearing capacity, suitable other soils must be introduced to provide the required stability and dust-free characteristics.

(v) End cleared zones: 183 metres long, 165 metres wide extending from the end of the runway overrun. Area to be cleared and rough graded, including filling of ditches, and prepared to provide a dust-free surface. The purpose of this area is to minimize damage to aircraft due to occasional unavoidable overrun, but the full load bearing capacity specified for the overrun is not required.

(vi) Runway location: in siting the runway a good overrun and end cleared zone for the runway is more important than a good end cleared zone for the parallel taxiway, as specified under Item 2 below.

1d. Clearances

(i) Lateral: runway centre line to centre line of parallel taxiway or to buildings, trees, parked aircraft or other above-ground obstacles to aircraft (except aircraft on alert platforms) 23 metres minimum (See Annexes 3 and 4). Drainage ditches outside shoulders, overruns and end cleared zones are acceptable within the 23-metre lateral clearance zones. Transverse grade of these lateral safety zones beyond the shoulders of the runway and within 23 metre clearance will not exceed 10% up or down. Runway centre line to centre line of taxitrack other than parallel taxiway: 140 metres minimum. These side clearances shall extend to include the overruns and cleared zones specified at ends of runway.

(ii) Approach zone glide slope: A cleared slope of 1:50 from end of cleared zone (1c(v)) above. Details of the approach zone and the area to be free of obstruction are specified in Annexes 1, 2 and 3. Note that the 1:50 slope from the end of the cleared zone has a starting point the elevation of which is the same as the runway end.

1e. Grades. (See Annex 4)

(i) Longitudinal: centre third 1% maximum up or down. End thirds maximum of 0.5% up or 1% down. Overrun and end cleared zone 1.5% maximum up or down. Distance between two successive changes of gradient (distance between intersections of tangents) will be not less than 300 metres. Rate of longitudinal change of gradient will be not more than 0.167% per 30 metres. Line of sight distances: 1,800 metres from 3 metres to 3 metres above runway minimum, and 900 metres from 1.5 metres to 1.5 metres above runway minimum.

(ii) Transverse: runway: 1.5%. Cases where deviations from this standard grade appear desirable are to be referred to SHAPE. Since the governing consideration in specifying a transverse grade of 1.5% is to insure proper drainage and avoid water standing on pavements as the result of slight irregularities in pavement, any request for acceptance of a reduced grade should demonstrate that the grade will be maintained with sufficient accuracy throughout to insure proper drainage.

Shoulders: 2% maximum and 1.5% minimum up or down. Wherever shoulders drain toward paved areas, adequate drains will be provided at the pavement edge to prevent water from shoulders draining over pavements. Depending on the relative cost of excavation and installations of drains at pavement edge, the most economical and practicable solution should be adopted.
These grades are to be extended the full length of overrun and end cleared zone. Where necessary for adequate drainage, the runway drainage system may be extended to include the overrun and end cleared zone.

**Item 2 - Parallel Taxiway**

(Suggested Guidance in Appendix B, page 28)

2a. **Layout.** One taxiway shall be constructed parallel to and on one side of the runway to serve as an emergency landing strip.

2b. **Load Bearing Capacity.** Same as for runway.

2c. **Pavement.**


   Alternative No. 2: Asphaltic concrete except for specific areas consisting of 240 metres at each end of taxiway and sections 100 metres long centred on the entrance of each taxitrack connection, which must be of Portland Cement Concrete. Design specifications and construction methods for asphaltic concrete pavement must receive prior approval of airfield experts of NAC international staff.

2d. **Dimensions.**

   (i) **Length:** 2440 metres. Cases where deviations from the standard length are considered necessary are to be referred to SHAPE for acceptance.

   (ii) **Width:** 22.5 metres.

   (iii) **Shoulders:** width 30 metres constructed in accordance with other criteria specified for shoulders under "Item 1-Runway" above.

   (iv) **End cleared zone:** SHAPE has recommended to Standing Group approval of the wording: "275 metres long and 32.5 metres wide at each end of the taxiway. Area to be cleared and rough graded, including filling of ditches. The purpose of this area is to minimize damage to aircraft due to occasional unavoidable overrun when the parallel taxiway must be used as an emergency runway, but the full load bearing capacity specified for the runway overrun is not required."

2e. **Clearances.**

   (i) **Lateral:** parallel taxiway centre line to centre line of runway or to buildings, trees, parked aircraft or other above-ground obstacles to aircraft (except aircraft on alert platforms) 213 metres minimum (See Annexes 3 and 4). Drainage ditches outside shoulders and end cleared zones are acceptable within the 213-metre lateral clearance zones. Transverse grade of these lateral safety zones beyond the shoulders of the parallel taxiway and within 213 metre clearance will not exceed a grade of 10% up or down. Parallel taxiway centre line to centre line of other taxitracks 140 metres minimum. SHAPE has recommended to Standing Group approval of the additional wording: "These side clearances shall extend to include the cleared zones specified at ends of the parallel taxiway."

2f. **End cleared zone:** SHAPE has recommended to Standing Group approval of the wording: "275 metres long and 32.5 metres wide at each end of the taxiway. Area to be cleared and rough graded, including filling of ditches. The purpose of this area is to minimize damage to aircraft due to occasional unavoidable overrun when the parallel taxiway must be used as an emergency runway, but the full load bearing capacity specified for the runway overrun is not required."
Appendix A

Items 2 and 3

(ii) Approach zone glide slope: SHAPE has recommended to Standing Group approval of the wording: "A cleared slope of 1:50 from the outer end of the end cleared zone, as specified for "Item 1-Runway" (See Annexes 1, 2 and 3)."

2f. Grades. (See Annex 4)

(i) Longitudinal: 2% maximum up or down for centre third; 1% maximum up or down for end thirds. SHAPE has recommended to Standing Group approval of the wording: "End cleared zone maximum of 1.5% up. Where natural terrain of end zone is below grade of 1.5% up, no earth moving should be undertaken except rough grading as necessary to provide a relatively smooth plane surface free of ditches, holes or other sharp changes in grade. Overall filling is not required." 

(ii) Transverse: 1.5%. Shoulders 3% maximum and 1.5% minimum up or down.

Item 3 - Taxitracks

(Suggested Guidance in Appendix B, page 28)

3a. Layout. SHAPE has recommended to Standing Group approval of following wording in accordance with the SHAPE view of minimum operational requirements:

"There will be at least four taxitrack connections between the runway and parallel taxiway. Two of these should be located at the ends of the runway, and the other two in between according to operational requirements at each particular airfield. Taxitracks from the runway or parallel taxiway to dispersals or other areas will coincide with the connecting taxitracks between runway and parallel taxiway.

"If aircraft are dispersed on the same side of the runway as the parallel taxiway a maximum of two taxitracks from the parallel taxiway to each group of dispersals will be included as part of NATO-common infrastructure.

"If aircraft are dispersed on the opposite side of the runway from the parallel taxiway, a maximum of two taxitrack connections from the runway to each group of dispersals will be included as part of NATO-common infrastructure.

"A single track to each group of dispersals will be acceptable depending on the type of dispersal grouping planned; e.g., if a loop-type dispersal area exists, only one taxitrack connection to the runway or parallel taxiway will be necessary."

3b. Load Bearing Capacity. Same as for runway.

3c. Pavement. Portland Cement Concrete.

3d. Dimensions

(i) Length: as required.

(ii) Width: 15 metres.

(iii) Shoulders: width 15 metres; constructed in accordance with other criteria specified for shoulders under "Item 1-Runway" above.

3e. Clearances. From taxitracks centre line to buildings, trees and ditches: 20 metres. Distance from edge of main feeder taxitrack to edge of dispersal hardstand or revetment: 30 metres minimum.
Appendix A

3f. Grades. (See Annex 4)

(i) Longitudinal: 3\% maximum up or down

(ii) Transverse: 2\% maximum; 1.5\% minimum. Shoulders 3\% maximum and 1.5\% minimum up or down.

3g. Curves and Intersections. Horizontal curves: radius on the centre line 76 metres minimum. Fillets at intersection with runway and parallel taxiway: internal radius 30 metres minimum. Fillets at intersections leading to hardstands: internal radius 10 metres minimum.

Item 4 - Dispersal Hardstands

(Suggested Guidance in Appendix B, pages 26 and 29)

4a. Number. 48 hardstands for two fighter aircraft each. Where existing single hardstands are otherwise acceptable, they may be used as part of the total required dispersal for 96 fighter aircraft.

4b. Load Bearing Capacity. Same as runway.


4d. Dimensions.

(i) Paved area: circular 37 metres diameter. If multi-sided construction is more economical, it may be used provided a circular area 37 metres in diameter is included therein.

(ii) Shoulders: 9 metres wide; constructed in accordance with other criteria specified for shoulders under "Item 1-Runway" above.

(iii) Spacing: 90 metres minimum centre to centre.

(iv) Layout: maximum number of unrevetted hardstands in a straight line in the same dispersal group: three (3). Any hardstand the centre of which is within 37 metres of a line connecting the centres of any other two hardstands is considered to be in the same straight line.

4e. Clearances. 12 metres from edge of hardstand, except that when revetments are provided, there shall be a minimum clearance of 3 metres between the edge of the hardstand pavement and the revetment. Distance from edge of main feeder taxitrack to edge of hardstand or revetment: 30 metres minimum.

4f. Grade. 1.5\%.

4g. Revetments. These may be provided for the protection of aircraft by the user nation, but are not part of NATO-common infrastructure. If built, they will comply with the clearance standards specified under Items 1, 2 and 4.
Appendix A

**Item 5 - Alert Platforms**

(Suggested guidance in Appendix B, page 29)

5a. **Layout.** Operational readiness platforms for 12 aircraft will be provided at each end of the runway. These platforms can be constructed by a widening of taxi tracks or runway ends and should be so arranged as to facilitate access to the runway to a maximum degree.

5b. **Load Bearing Capacity.** Same as for runway.

5c. **Pavement.** Portland Cement concrete.

5d. **Dimensions.**

(i) Paved area: platforms at runway ends should be approximately 30 metres by 200 metres, excluding area of adjacent taxi track or runway, or equivalent to 6,000 square metres minimum at each end of the runway, or a total area not to exceed 12,000 square metres.

(ii) Shoulders: 9 metres wide; constructed in accordance with the other criteria specified for shoulders under "Item 1 - Runway" above.

5e. **Clearances.** Since these are for aircraft requiring quick take-off, normal clearances are waived for aircraft stationary on these areas.

5f. **Grades.**

(i) Longitudinal: same as other pavements to which platforms abut or 1.5% maximum if platforms are separate.

(ii) Transverse: 1.5%.

**Item 6 - Aprons for Inspection and Maintenance of Aircraft**

(Suggested Guidance in Appendix B, page 29)

6a. **Load Bearing Capacity.** Same as for runway.

6b. **Pavement.** Portland Cement concrete.

6c. **Total Area.** 11,700 square metres minimum. Individual dimensions as required by assigned usage.

6d. **Grades.** Maximum in any direction 1.5%. A grade of 1.5% will be provided in at least one direction for the purpose of drainage.

**Item 7 - Internal Roads**

(Suggested Guidance in Appendix B, page 29)

a. **Layout.** To be laid where necessary on the site. The 51,100 square metres maximum as NATO common infrastructure includes roads to communications sites and to the GCA hardstand and incidental motor vehicle parking areas,
but does not include the access road beyond the airfield boundary or motor pool hardstands (Item 25).

b. **Load Bearing Capacity**.

   English Units: single axle load - 11,000 pounds minimum.
   Metric Units: single axle load - 5 metric tons minimum.

c. **Width**.

   Single track: 3 metres minimum.
   Double track: 5.5 metres minimum.

**Item 8 - Airfield Lighting**

e. **Airfield Lighting** (Other than Approach Lighting).

   The detailed criteria are contained in STANAG 3061, a complete copy of which follows on the next 3 pages.
STANAG 3061

SPECIFICATION FOR LAY-OUT OF PERMANENT AND MOBILE AIRFIELD LIGHTING (OTHER THAN APPROACH LIGHTING)

OBJECT

To standardise the following aspects of Airfield Lighting:

(a) Main Instrument Runway
(b) Threshold Lighting
(c) Lighting of Subsidiary Runways
(d) Threshold Lighting for Subsidiary Runways
(e) Taxiway Lighting
(f) Lighting of Obstacles
(g) Lighting of Ancillary Indicators
(h) Crash Landing Strips
(i) Lighting of Runways on Temporary Airfield

REFERENCES

S.A. 3039/52. Working Party report to Air Board.

EFFECTIVE DATE

National Ratifying References

Belgium - JCS/3.5/10 dated 1st. December, 1952.
Denmark - E.K. 21.11.7-1 dated 9th June, 1952.
Italy - S.M.N. 10024/II dated 28th November, 1952.
Norway - H-1411/V dated 14th June, 1952.
Portugal - 830/457, Pr. 795.452 dated 8th May, 1952.
United Kingdom - S.214/3061/STAN dated 26th June, 1952.

SUPPLEMENTS

Supplements to the agreement may be proposed at any time by any of the participants and will be processed in the same manner as the basic agreement.

EXTENSION OF AGREEMENT TO OTHER NATIONS

This agreement may be extended to other Nations becoming part of the North Atlantic Treaty Organisation.

AGREEMENT

The provisions stated on the following pages (four in number) have been approved in accordance with the terms stated above by the countries listed, and no departure will be made from this agreement without prior consultation with, or in emergency, notification to, the Military Agency for Standardisation.

FOR THE MILITARY AGENCY FOR STANDARDISATION

17th December, 1952

3061-1

(G.R. Moore)
Captain (S) (EN)
Senior Secretary
DETAILS OF AGREEMENT

Specification for lay-out of permanent and mobile airfield lighting (other than approach lighting).

3061. Main instrument runway (width 150 ft – 180 ft)

(a) High intensity lighting to be used.

(i) Uni-directional for both directions or bi-directional light fittings to be installed.

(ii) For that direction intended for instrument approaches, the longitudinal spacing of the fittings is to be 100 ft. (30 metres) or 200 ft. (60 metres), the recommended spacing being 100 feet (30 metres).

From the other direction, the spacing may conform to that recommended for subsidiary runways.

(iii) White incandescent lights along the complete length of the runway. However, if experience or local conditions call for it a caution zone should be marked out on the further part of the runway either by fixing yellow screens on the lights along that part of the runway, or by a caution bar consisting of yellow aviation lights on entry into the caution zone. Where such a caution zone is marked out it will have a length of 730 metres + 30 metres (2,400 feet + 100 feet) measured from the end of the runway.

(b) Recommended luminous intensities.

(i) Lights presenting horizontal divergencies and intensities as follows:

- $\pm 3^\circ$ - 20,000 candles obtainable.
- $\pm 5^\circ$ - 5,000 candles obtainable.
- Outside of $\pm 25^\circ$ minimum light possible.

(ii) Vertical divergencies with the same luminous intensities as in (i) above may be less than the values for horizontal divergencies.

(iii) The minimum acceptable intensity characteristics are:

- $\pm 3^\circ$ divergence - 10,000 candles.
- $\pm 5^\circ$ divergence - 2,500 candles.

(c) Flush or elevated light fittings are acceptable. Where elevated light fittings are installed they should be located at not greater than 4½ metres (15 feet) from the edge of the runway and the fittings themselves should be as light and as frangible as possible with an overall height above the ground not exceeding 18 inches.

(d) The following stages of brilliancy are required:

- 100% - 10% - 1% - .1% - .03% approximately.

Step .03% being that stage of lighting required for night flying under good visibility conditions.
(e) **Electrical Supply**

(i) The lights will be divided among several circuits in order to ensure a measure of safety. In particular, this separate connection may be achieved by the user of "inter-leaved circuits", or by the use of one independent circuit for each section of the runway. The circuits to the sections are to follow different paths from the sources.

(ii) In the case of main supply breakdown current is to be supplied by a standby generator.

(f) Remote control from the Tower is to be provided plus the possibility of control direct from the Transformer Stations.

3061-2. **Threshold Lighting**

(a) Threshold lights at each end of the runway are to be coloured aviation green. (See DANSISH reservation on this sub-paragraph at end of Agreement).

(b) Light Fittings will be uni-directional or bi-directional so that lights are available for landing in both directions.

(c) Threshold lights should have an intensity of the same order as the runway lights. The maximum intensity should not be less than 1,000 candles in green light.

(d) Threshold lighting to be installed in such a manner that it does not form an obstruction to aircraft leaving readiness platforms or for aircraft landing or taking off.

3061-3. **Lighting of Subsidiary Runways - Low Intensity Lighting**

(a) Lighting of subsidiary runways is not compulsory.

(b) Requirements for the lighting of subsidiary runways where installed are:

   (i) The runway lights may be uni-directional, bi-directional or semi-directional. If semi-directional they should be so constructed that by the addition of a screen it is possible either to convert them to the bi-directional type or to cut off the light in a cone having a vertical axis. The angle subtended by the cone will depend on weather conditions and the type of aircraft to be operated from the airfield.

   (ii) Longitudinal spacing shall be 200 feet (60 metres) or 300 feet (90 metres).

   (iii) White incandescent lights along the complete length of the runway. However, if experience or local conditions call for it, a caution zone should be marked out on the further part of the runway either by fixing yellow screens on the lights along that part of the runway, or by a caution bar consisting of yellow aviation lights on entry into the caution zone. Where such a caution zone is marked out it will have a length of 730 metres ± 30 metres (2,400 feet ± 100 feet) measured from the end of the runway.
(iv) Lights will show at least 50 candles and a dimming device must be provided which will allow for dimming down to 5 candles at maximum dimming.

Threshold Lighting for Subsidiary Runways

(a) Threshold lighting for subsidiary runways is not compulsory but when a subsidiary runway is lighted, threshold lighting is required at both ends.

Where installed, colour will be aviation green at both ends of the runway.

Light fittings must be uni-directional or bi-directional.

Fittings will be installed in such a manner that they do not form obstacles for aircraft leaving readiness aprons or for aircraft landing or taking off.

(b) Angle of approach indicators:

Are not indispensable. If installed, these indicators must have the characteristics corresponding to ICAO standards.

Taxiway Lighting

(a) Fittings to have a maximum longitudinal spacing on the straight of 65 metres (220 feet) with a recommended spacing of 50 metres (170 feet). On curves, spacing has to be reduced according to the radius of curve, and the actual appearance of the row of lights on the spot. The recommended spacing on curves is \( D = \frac{r}{3.46} \) (where \( r \) equals the radius of the curved edge which the lights mark and \( D \) the required spacing) when measurement is in feet and \( D = \frac{1.91}{r} \) when metric measurement is used.

(b) Colour of lights: the two sides of a taxi-track have to be lit by different colours. Colours will be blue and aviation yellow. (The blue lights define the inner edge while the yellow define the outer edge of the track). (See UNITED STATES reservation on this subparagraph at end of Agreement).

Lighting of Obstacles.

Lights having characteristics as recommended by ICAO Annex 14 to the Chicago Convention, Part 5, Chapter 3, Part 3.3.3.

Fixed light.

Colour: aviation red.

Brilliance: more than 10 candles.

Lighting of Ancillary Indicators.

(a) No illuminated windsock

(b) No illuminated "m" in the signals square.
(c) No other lights in the signal square.

(d) Marshalling points on the taxiway: Where a marshalling point exists on the taxiway, it is to be indicated by a double blue light on the inner edge of the taxiway approximately 75 metres (250 feet) from the edge of the runway.

3061-8. Crash Landing Strips

Not to be lit by permanent installation.

3061-9. Lighting of Runway on Temporary Airfield

When a lighting system is installed on a temporary airfield, this system will be such that the terms of STANAG 3061 can be progressively applied. The interval between lights will always be in multiples of 100 feet (30 metres).

RESERVATIONS

The following reservations have been made to the Agreement recorded on the preceding four pages.

RESERVATION I

Paragraph 2(a)

DENMARK reserves the right to introduce red threshold lights for the far end of the runway.

RESERVATION II

Paragraph 5(b)

In order "to provide conformity with ICAO standards and to allow for the present U.S. practice of using blue lights only on taxiways" the United States prefers the following revised wording of this sub-paragraph and reserves the right to adhere to the reserved text:

"(b) Colour of Lights:

The two edges of a taxiway may be lit by blue lights on both edges or blue on one edge and yellow on the other. Colours will be aviation blue and aviation yellow. (These two colours are used and insofar as practicable, the blue lights shall define the "--- closer to the runway while yellow lights define the farthest or outer edge)."

RESERVATION III

United Kingdom

Reserves the right not to provide threshold lighting at either end of subsidiary runways.
b. Airfield Approach Lighting.

The detailed criteria are contained in STANAG 3081, a complete copy of which follows on the next 5 pages:
STANAG 3081

AERIAL APPROACH LIGHTING

OBJECT OF AGREEMENT

To standardise Airfield Approach Lighting on NATO Military Airfields.

Related Documents

MAS(AIR)(51)6, dated 19th July, 1951 - Method of Work of the Air Board.
MAS(AIR)(52)107, dated 7th November, 1952 - Draft STANAG 3081.

Effective Date

24th April, 1953

(Note 1: The effective date is the date upon which the Details of Agreement become binding upon participating nations).}

National Ratifying References

Belgium JCS/790/40, dated 16th December, 1952.
Denmark 6.420.11, dated 14th January, 1953.
France * No. 358 EMU/FA/G/T/EC, dated 24th April, 1953.
Greece MAS HE/300/03, dated 26th January, 1953.
Italy SMD. No. 401257/8, dated 23rd February, 1953.
Norway LOK/1-1441, dated 3rd December, 1952.
Portugal Reply not yet received.
Turkey Reply not yet received.
United Kingdom UKSD/4053/AAB/2, dated 16th January, 1953.

(* - See pages 4 and 5 for reservations).

(Note 2: Ratification means that official agreement has been given by the nations concerned to the conditions of the STANAG).

Supplements

Supplements to the agreement may be proposed at any time by any of the participants and will be processed in the same manner as the basic agreement.

Extension of Agreement to other Nations

This agreement may be extended to other Nations becoming part of the North Atlantic Treaty Organisation.

Agreement

The provisions stated on the following four pages have been approved in accordance with the terms stated above by the countries listed, and no departure will be made from this agreement with the exceptions of the reservations made on Pages 4 and 5 without prior consultation with, or in emergency, notification to, the Military Agency for Standardisation.

FOR THE MILITARY AGENCY FOR STANDARDISATION

G. E. KOGERS
Captain (G) R.N.,
Senior Secretary

3081-1
SEECIgIGmqM FOR IAX-OOT OF AUtFIEm AFEBOACE LIGHTING

Approach to that direction of the main runway intended for instrument approaches

(a) High intensity approach lighting is to be used.

(i) A centre-line and five cross-bar (C15 B) approach lighting system is to be installed.

(ii) Sub-paragraphs (b) and (c) below set out the recommended layout and tolerances. Moderate divergencies from these recommendations will not be critical so long as the essential pattern is maintained.

(iii) Where site conditions render the installation of the full pattern impracticable a shortened form of the system should be provided.

(b) The centre-line

(i) A centre-line on the extension of the axis of the runway with an overall length of 900 metres (3,000 feet). The centre-line of the system to extend up to the runway threshold.

(ii) Fittings to be spaced at a nominal distance of 100 feet (30 metres) apart.

(iii) The first portion, extending 450 metres (1,500 feet) from the runway threshold, is to consist of a single light fittings and the remaining 450 metres (1,500 feet) is to consist of a double light fittings with each light spaced 1½ metres (5 feet) apart transversely. One single row of lights over the overall length will meet the minimum requirement. Where double fittings are installed they should be turned away from the centre line at an angle of approximately 7½°.

(iv) The fittings; the fittings will consist of uni-directional incandescent white lights. The following intensity characteristics are recommended:

\[ \pm 7.5^\circ \] divergence in the horizontal plane - 20,000 candles

\[ \pm 12.5^\circ \] divergence in the horizontal plane - 5,000 candles

Outside these divergencies there should be as little light as possible. Beam spread in the vertical plane may be less than that specified for the horizontal plane.

(v) Stages of brilliance required:

100% - 10% - 1% - .1% - .035% (approximately).

(vi) Gradient. It is desirable that as much of the system as is practicable is to be installed at runway level. The layout and gradient tolerances recommended are set out on the attached drawing.
(c) (i) The crossbars are to be sited symmetrically about the axis of the runway and are to subtend an angle of approximately 3° at the point of origin. The point of origin of the system is to be located 300 metres (1,000 feet) from the associated threshold measured along the runway centre-line. When the longitudinal spacing between the bars is 150 metres (500 feet), the lights are to be spaced at 3 metres (9 feet) lateral intervals. The outside lights of the cross-bars will in all cases lie on the V lines which includes an angle of 3° at the point of origin. The number of lights on the bars will be:

1st bar - 2 x 4  
2nd bar - 2 x 5  
3rd bar - 2 x 6  
4th bar - 2 x 7  
5th bar - 2 x 8

(ii) The characteristics of the fittings and the stages of brilliance required are to be identical to that of the centre line.

(iii) Cross-falls. The bars are to be kept on a horizontal plane where possible. No inclination tolerances are allowed on the 1st or 2nd bars from the threshold.

(iv) Tolerances in longitudinal spacing. If, in order to overcome obstacles with gradient differences cross-bars must have a different longitudinal spacing from that recommended, then the acceptable tolerances will be those which maintain a correct perspective of the approach system (height and dimensions have to be corrected accordingly).

(v) Direction of the beam of lights. The axis of the beams of all lights in the 3 outer cross-bars will be turned outwards to an angle of approximately 7½°. The axis of the beams of all the lights in the first 2 cross-bars will be parallel to the centre line.

(e) Electrical Supply of Approach lighting

The same method as that defined for the electrical supply to main instrument runways will be adopted taking into account the fact that the electric power may be supplied from a single source.

(f) Control

Remote control from the Tower is to be provided plus the possibility of control direct from the transformer stations.

2. Subsidiary approach at the opposite end of the main runway.

(a) Approach lighting is not compulsory.

(i) Where approach lighting is installed it is to consist of a minimum of a centre-line with a single light fittings giving an intensity suitable for use with the runway lighting.

3. Approach lighting for subsidiary runways. (The subsidiary approach to the main runway is covered under paragraph 2 above).

(a) Low intensity lighting.
(i) Approach lighting to subsidiary runways is not compulsory.

(ii) Where the subsidiary runway is lit the direction of the landing shall be indicated by a visual sign which will be one of the two following means:

   a. A centre-line which may be reduced to a minimum of 2 white lights on the approach, the lights being uni or omni-directional according to the runway lights, with a brilliancy of at least 50 candles.

   b. A portable illuminated T to the port side when viewed from the approach and near the down wind end of the runway.

Lighting System on the Approach of a Temporary Airfield.

The installation of a lighting system on the approach of a temporary airfield is not compulsory.

Where such a lighting system is considered necessary it shall be installed in accordance with the principles of the fixed system.

RESERVATIONS

The following reservations have been made to the agreement recorded on the preceding three (3) pages:

RESERVATION I

Canada

Canada approves STANAG 3061 (for European Airfields) with the following minor reservations:

(i) Reference para 1(b)(v). The RCAF reserves the right to use brilliancy stages of 100%, 25%, 5%, 1% and 0.2%. These stages give a wider selection and indications are that the minimum of 0.2% is not too bright under clear conditions.

(ii) Reference para 1(c)(i). As opposed to the specified number of lights on the cross-bars, the RCAF reserves the right to use a spacing of 9, 13, 15, 17 and 21. This is an increase in the number of lights specified in the STANAG, and, in the opinion of the RCAF, will give a more even spacing of the lights.

(iii) Reference para 1(c)(v). The RCAF is now investigating settings from approximately 5° to 7¾° and therefore reserves decision on this item at this time.

RESERVATION II

RANSE

The centre-line for the first 300 metres (1,000 feet) outward from the runway threshold will be replaced by two parallel rows of red lights. These lights will face the direction of landing and will be spaced every 30 metres (100 feet): 3 lights on the left, 1 light on the right.
RESERVATION III

UNITED STATES OF AMERICA

(a) The centreline for the first 1,000 feet outward from the runway threshold may be replaced by a parallel row system of lights. The lights used to form the parallel row should be at a fixed distance from the axis of the runway and shall be unique by reason of configuration and colour so that they are unmistakable from any other lights or lighting used in the approach and runway lighting facilities.

(b) The outer 2,000 feet of the centreline and cross-bar system may be deleted wholly or in part where such installation is impractical by reasons of terrain and/or procurement of real estate.
Appendix A

Items 9 and 10

Item 9 - Standby Electric Power Supply

(Suggested Guidance in Appendix B, Page 29)

300 KVA will be provided at main and redeployment airfields for emergency (standby) electric power for communications facilities, runway lighting, FOL installations and other essential services. This emergency power supply will be provided by a minimum of 3 generators.

Item 10 - Aircraft Fuel Underground Storage

10a. Dispersal

(i) At main and redeployment airfields fuel storage must be dispersed over not less than three locations with minimum distance between storage locations of 500 metres.

(ii) At alternative airfields storage must be dispersed over not less than two locations with a minimum distance between storage locations of 500 metres.

(iii) Individual tanks should not exceed 400,000 litres capacity.

(iv) In order that damage to one tank will not jeopardize the safety of adjacent tanks in the same group, individual tanks in a group will be separated by a minimum distance of 2 metres between shells.

10b. Filling and Dispensing

(i) Tanks within each dispersed group will be interconnected to facilitate filling and dispensing.

(ii) A separate dispensing facility for each grade or type of fuel storage at each location, complete with pumping and other ancillary equipment, will be provided at each group of tanks.

(iii) Dispensing facilities for aircraft fuels will have a minimum capacity of 1900 litres per minute at each dispensing unit.

10c. Defuelling. Defuelling facilities, complete with pumps and necessary piping, are required in each of three squadron areas. This requirement is not to be construed as increasing the capacity of NATO-common infrastructure underground fuel storage specified in Table No. 1.

10d. Protection of Fuel Against Contamination. Pipe fittings, pumps and other ancillary equipment shall be of a type and material that will not deteriorate by chemical reaction with the components of the fuel they accommodate. All necessary precautions will be taken to avoid contamination when more than one grade or type of fuel is handled.

10e. Safety. Design and construction shall take account of all handling risks pertinent to the properties of liquid fuel.
Dispensing and refilling facilities including pumps and other ancillary equipment will be provided. A minimum of two dispensing hydrants will be provided for dispensing motor fuel and these shall have a minimum capacity of 50 litres per minute each.

Item 13

Nil.

Item 14 - Ammunition Storage

14a. Covered and Blastproof. There are several acceptable methods of designing structures to fulfill this requirement. Functions of the structure are:

(i) To protect stored ammunition from strafing and flying objects by means of cover, preferably of earth over an arched or domed reinforced concrete structure.

(ii) To protect against the effects of blast from nearby exploding bombs through heavily mounded earth on the sides.

(iii) To protect other critical areas, such as other stored ammunition, operational structures and parked aircraft, by designing the structure so that the directional effect of any structural weakness will be away from these other areas.

(iv) To protect the structure from lightning, as required in the locality, through lightning rods which, together with other metal parts, such as reinforcing steel, are tied into a permanent ground with a heavy copper wire.

(v) To minimize risk of sparking by following standard national practice for this purpose in construction of floors. Normally, electrical fixtures will not be provided, but if desired, only explosion-proof fittings will be used.

14b. Open and Reveted Hardstands. The requirements for protection against blast and of other critical areas are the same for these hardstands as specified in 14a (ii) and (iii) above for covered and blastproof storage.

14c. Safety Clearances. Until a STANAG is published outlining ammunition storage safety clearances, the present explosives storage laws and regulations of the host or user nation are acceptable, it being understood that the more stringent requirements should apply. If additional guidance is desired, RAF or USAF criteria (which are similar) may be used.
Item 15 - Control Tower and Meteorological Building

15a. Location. The control tower shall be located to obtain maximum visibility of the runway, parallel taxiway and airfield approaches and good visibility of taxitracks and dispersals. Standard clearances will be maintained in relation to the runway and parallel taxiway.

15b. Size. The minimum size of the control room shall be 6 metres between parallel walls.

Item 16

Nil.

Item 17 - Squadron Operations Rooms

(Suggested Guidance in Appendix B, page 30)

Nil.

Item 18

Nil.

Item 19 - Hangars

(Suggested Guidance in Appendix B, page 30)

The minimum clear door opening for each hangar is 30 metres wide by 6.1 metres high. Where an airfield is designated as the station for a unit equipped with aircraft larger than fighter aircraft and appreciably larger hangar door openings are considered an operational requirement, the matter will be referred to SHAPE for decision.

Item 20 - Storage or Warehouse Buildings

(Suggested Guidance in Appendix B, page 30)

Nil.
Item 21 - Maintenance Shops
(Suggested Guidance in Appendix B, page 30)
Nil.

Item 22 - Technical Shops
(Suggested Guidance in Appendix B, page 30)
Nil.

Item 23 - Motor Vehicle Maintenance Shop
(Suggested Guidance in Appendix B, page 31)
Nil.

Item 24 - Crash and Fire Station
(Suggested Guidance in Appendix B, page 31)
Nil.

Item 25
Nil.

Item 26 - Dispersal Huts

One of these huts will be located in each of three dispersal areas to provide shelter close to dispersed aircraft for crews in readiness. If squadron operations buildings or squadron hangers with leantos are located in dispersal areas, the space specified for dispersal huts can be added to either of these buildings.

Item 27 - Communications Building and Remote Transmitter Building

Detailed criteria, including siting requirements, are being disseminated in a separate SHAPE document.
Appendix A

Item 28 - Communications

Detailed criteria are being disseminated in a separate SHAPE document.

By message DEF 92912 (TOSHEP M17) of 28 May 1953 Standing Group approved for main and redeployment airfields the standards listed in Table No. 1 for Item 28b. Main Outlet Cable and Item 28c. Main Telephone Switchboard, instead of the previously recommended standards of

28b. Main Outlet Cables

2 each 56-pair or 2 each TWA 8 quad, in accordance with local engineering practice, to provide alternate routing.

28c. Main Telephone Switchboard

200 line, extensible to 360 line. Of the order of 40 subscribers per operating position.

Regarding the SHAPE recommendation that, in cases where installation of the equipment provided in the earlier recommendations for these two items was already underway or completed, the whole of the larger installation should be authorized as NATO-common infrastructure, Standing Group stated in DEF 939810 (STAHLO 278) of 26 May 1953 that the SHAPE recommendations should be considered in light of the financial implications and recommended that the SHAPE proposals be referred to the Infrastructure Payments and Progress Committee, NAC, for detailed examination. The matter is still under consideration by the Committee.

Item 29 - GCA Hardstand

Detailed criteria are being disseminated in a separate SHAPE document.

Item 30 - Utilities

(Suggested Guidance in Appendix B, page 31)

The host nation will provide:

30a. Water Supply. Potable water at the airfield boundary or on-site pump outlet in sufficient quantity for 3,000 men at 150 litres per man per day at main and redeployment airfields, and for the maintenance party of 50 men at alternative airfields. Water shall be under sufficient pressure at the airfield boundary or at the on-site well head pump outlet for domestic and fire fighting use.

30b. Electric Power. A minimum of 860 KVA electric power at main and redeployment airfields and 250 KVA electric power at alternative airfields to the main incoming sub-station(s) at the supply voltage. The main incoming sub-station(s) including transformers and switching gear to the airfield distribution voltage are a host nation responsibility.
30c. Sewage. Treatment facilities for sanitary sewage and any disposal required beyond the boundary fence for sanitary sewage and storm water. Treatment design will be based on 3000 men at 150 litres per man per day for main and redeployment airfields and 50 men at 150 litres per man per day at alternative airfields. When individual septic tanks at isolated buildings are more economical than long connecting mains to the central sanitary sewage system, these tanks shall be provided as part of NATO-common infrastructure.

Item 31 - Access Road

31a. Load Bearing Capacity
   English units: single axle load - 11,000 pounds minimum.
   Metric units: single axle load - 5 metric tons minimum.

31b. Width: 5.5 metres minimum.

Item 32 - Nil.

Item 33 - Signal Communications to Long-Lines Network

This item is now included under Item 28. Detailed criteria are being disseminated in a separate SHAPE document.

Item 34 - Fencing, Gates and Observation Towers

(Suggested Guidance in Appendix B, page 32)

34a. Perimeter Fencing. Required to keep farm animals from entering operational and flying areas and to deter trespassing by unauthorized personnel.

34b. Security Fencing. Required for ammunition and POL storage areas of main and redeployment airfields. SHAPE has recommended to Standing Group that this fencing be required for alternative airfields also.

Item 35 - Alert Warning System

This item has been deleted by Standing Group as a minimum operational requirement. If required, it is to be provided by the user nation.
Item 36 - Demolition Systems

(Suggested Guidance in Appendix B, pages 32 and 33)

36a. Item 1-Runway and Item 2-Parallel Taxiway. SHAPE has recommended to Standing Group approval of the following wording in accordance with the SHAPE view of minimum requirements: "Means of demolition at 100 metre intervals throughout the entire length required."


Item 37 - Personnel Housing

(Suggested Guidance in Appendix B, pages 33 and 34)


<table>
<thead>
<tr>
<th>Item</th>
<th>Redeployment For 100 men</th>
<th>Alternative For 50 men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mess Hall</td>
<td>74 square metres</td>
<td>37 square metres</td>
</tr>
<tr>
<td>Kitchen, food preparation and storage</td>
<td>56 square metres</td>
<td>47 square metres</td>
</tr>
<tr>
<td>Company offices and storage</td>
<td>37 square metres</td>
<td>29 square metres</td>
</tr>
<tr>
<td>Technical Stores</td>
<td>Nil</td>
<td>56 square metres</td>
</tr>
<tr>
<td>Company storage, total for two rooms</td>
<td>37 square metres</td>
<td>28 square metres</td>
</tr>
<tr>
<td>Recreation room</td>
<td>56 square metres</td>
<td>37 square metres</td>
</tr>
<tr>
<td>Officers Living Accommodation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mess</td>
<td>29 square metres</td>
<td>19 square metres</td>
</tr>
<tr>
<td>Sleeping</td>
<td>13 square metres net for each officer; for total of 4 officers.</td>
<td>13 square metres net for each officer; for total of 2 officers.</td>
</tr>
<tr>
<td>Bath with shower</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>W.C.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Urinal</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Wash basins</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>
### Appendix A

#### NCO's Living Accommodation

<table>
<thead>
<tr>
<th>Service</th>
<th>Mess and recreation as annex to men's mess</th>
<th>Sleeping</th>
<th>Wash basins</th>
<th>Bath with shower</th>
<th>W.C.</th>
<th>Urinal</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCOs</td>
<td>37 square metres</td>
<td>9 square metres net for each NCO; for total of 10 NCOs.</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>for total of 5 NCOs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Men's Living Accommodation

<table>
<thead>
<tr>
<th>Service</th>
<th>6 square metres per man</th>
<th>6 square metres per man</th>
</tr>
</thead>
<tbody>
<tr>
<td>Showers</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Bath</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Wash basins</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>W.C. seats</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Urinals</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

---

37b. Minimum Scales of Accommodation for Camp Structures on Redeployment Airfields. Except for the maintenance party of 100 men, peacetime housing will not be provided. In war the wing will be accommodated in tentage. The following scale of camp structures will be built in peacetime in the camp area:

1. **Kitchens:** 0.5 square metre per man.
2. **Ablutions:** 8 metres of trough type wash facilities for each 100 men.
3. **Showers:** 5%
4. **Drying room:** 1 square metre for each 10 men; to be heated by boiler in shower room.
5. **Urinals:** 3 metres of urinal trough per 100 men.
6. **Latrines:** 5% of complement.
7. **Incinerators:** 1 per squadron camp area; 2 in the headquarters area.
APPENDIX B

This appendix presents SHAPE suggested guidance on certain features of planning and construction of tactical air force airfields. While not mandatory criteria and standards, these recommendations constitute what SHAPE considers to be desirable solutions to some of the problems encountered in airfield construction. Nations are urged to make maximum use of these suggestions.

Item 1 - Runway

1a. Load Bearing Capacity. Technical guidance on the design of airfield pavements will be disseminated by the airfield experts of the NAC international staff. This guidance will cover safety factors and will take account of the need to use greater safety factors in the design of other airfield pavements than for the center part of the runway and parts of the parallel taxiway between taxiway intersections.

1b. Pavement. Prior to using water mix cement other than Portland Cement, as may be standard practice in certain districts, the airfield experts of the NAC international staff should be consulted. Their instructions should be complied with in the use of such other water mix cements.

1c. Drainage. The requirement for a transverse grade of 1.5% is based on the minimum grade for effective drainage. In the ordinary case, this grade should be applied transversely in opposite directions from the centre line of the runway to give a crown so that drainage is to both edges of the runway. However, on sites with natural drainage transverse to the runway center-line, a crowned runway may involve excessive earth work or a costly drainage system, and in these cases the same transverse grade across the full runway width may prove more economical. Based on the same considerations it may prove desirable to have an up-hill shoulder drained toward the runway. This solution is acceptable provided adequate drains are installed at the edge of the pavement to prevent water from the shoulder draining across the pavement and carrying with it dirt and other dangerous debris. Drains constructed on the edge of aircraft pavements should be capable of supporting aircraft, should be designed to prevent entrance of water beneath the pavement and should not obstruct passage from the runway to shoulders in the event of accidental overruns.

1d. Shoulders, Overruns and End Cleared Zones. In addition to providing a surface with adequate bearing capacity, these areas must be free of dust. To prevent dust, these surfaces might be treated so as to support a dense growth of grass. Where necessary, a minimum thickness of 10 centimetres of top soil planted with a hardy variety of grass is recommended. When grass growing is impracticable, soil stabilization may be necessary to achieve a dust-free surface. Either bituminous material or Portland Cement may be required for stabilization depending on local soil conditions.

1e. Concealment. Camouflage has not been included as a standard airfield requirement, but effective measures to conceal airfield pavements are of great importance. Experiments are in progress on the toning down of airfield pavements, and SHAPE will take an active interest in the dissemination and exchange of the latest information on toning down resulting from investigations by NATO nations and SHAPE subordinate commands.
1f. Grades. When large amounts of earthwork are involved in meeting the prescribed longitudinal grades and appreciable savings can be achieved by slight variations from these grades, consideration will be given to approval of deviations from standards which are adequately justified on economic grounds and are operationally acceptable to the allied air commander concerned.

**Item 2 - Parallel Taxiway**


2b. Other suggestions for runway construction apply equally to the parallel taxiway.

**Item 3 - Taxitracks**

See Item 1 - Runway, subparagraph 1a, page 27.

**Item 4 - Dispersal Hardstands**


4b. Layout. The planning of dispersal areas should be based on the following considerations:

(i) Convenience of take-off: The squadron dispersals should be located close to the ends of the runway, but outside the clearance zones, and should be so sited so as to permit a short, uninterrupted run to the alert platforms. This should be achieved by oblique connections from hardstands to the main feeder taxitrack, absence of sharp bends in taxitracks and preferably two routes to the runway.

(ii) Number of hardstands per dispersal area: each dispersal area should preferably include 12 double hardstands. Local conditions may, however, dictate building of three groups of 16 hardstands.

(iii) Safety: protection of hardstands by revetments should be adopted wherever possible and particularly where surplus excavated material is produced during the construction of the hardstands.

(iv) Concealment: dispersals should not be arranged in standardized or symmetrical geometrical patterns which will present a stereotyped target to enemy aircraft. Hardstands should be located irregularly to blend as much as possible into the terrain and take advantage of natural concealment.

4c. Revetments. Jet blast and noise have introduced new problems in the design and construction of revetments. The search for economical designs which are satisfactory from all standpoints and do not require excessive maintenance has proved very difficult. Furthermore, standardization of revetment design is neither practicable nor desirable since varying conditions may make the most desirable solutions significantly different from one airfield to another. SHAPE will take an active interest in the dissemination and exchange of information on satisfactory revetment design.
resulting from investigations by NATO nations and SHAPE subordinate commands.

**Item 5 - Alert Platforms**

5a. **Load Bearing Capacity.** See Item 1 - Runway, page 27.

5b. **Layout.** Although the first alternative alert platform shown in Annex 5 has been constructed on some airfields where IDF aircraft are stationed, the second and third alternative alert platforms shown in Annex 5 are considered more desirable for SHAPE airfields since these alternatives are suitable not only for IDF missions but also for other aircraft and give appreciably greater clearance from the runway.

**Item 6 - Aprone for Inspection and Maintenance of Aircraft**

See Item 1 - Runway, subparagraph 1a, page 27.

**Item 7 - Internal Roads**

The load bearing capacity and widths prescribed in Appendix A are minimum. They do not preclude construction of stronger and wider roads, which should be built whenever required to provide for anticipated traffic. In general, road construction will be best carried out in accordance with local practice, modified as necessary to satisfy the needs of the user nation.

**Item 8**

Nil.

**Item 9 - Standby Electric Power Supply**

Standby electric power supply should be provided through generators dispersed at locations near their emergency loads.

**Items 10 - 16**

Nil.
Item 17 - Squadron Operations Rooms

These buildings will normally be located one in each of three squadron dispersal areas.

Item 18

Mil.

Item 19 - Hangars

Item 19 allows 5,600 square metres for hangars at main airfields only. Items 21 and 22 allow a total of 3,435 square metres for maintenance and technical shops. At main airfields it is desirable to have one maintenance hangar and three squadron hangars. To ensure workable hangar space the allowable hangar area may be supplemented by a portion of the allowable maintenance shop area. Maintenance and technical shops at main airfields may be built as single or multiple story leantos to the hangars.

Item 20 - Storage or Warehouse Buildings

Whether or not fixed shelving and storage bins are installed and the scale on which they are provided in storage or warehouse buildings should be based on established local practice for similar civil and military installations in the host country.

Item 21 - Maintenance Shops

and

Item 22 - Technical Shops

21a. The aircraft maintenance and technical shops may be constructed as single or multiple story leantos to the maintenance and/or other hangars. A portion of the allowable space may be added to the allowable hangar space to ensure workable hangar space.

21b. Whether or not fixed shelving, storage bins, racks or benches are installed and the scale on which they are provided in maintenance shops and technical shops should be based on established local practice for similar civil and military installations in the host country.
Item 23 - Motor Vehicle Maintenance Shop

Whether or not fixed shelving, storage bins, racks or benches are installed and the scale on which they are provided in the motor vehicle maintenance shop should be based on established local practice for similar civil installations in the host country.

Item 24 - Crash and Fire Station

It is important that this facility be located in an area where easy access to the runway is available at all times for immediate crash fire fighting. Good access to the remainder of the station should be available for normal fire fighting requirements.

30a. SHAPE has recommended that technical guidance on the design of the on-base electrical distribution system be disseminated by the airfield experts of the NAC International Staff.

30b. Depending upon the individual airfield layout, it may be desirable to construct the internal electric power distribution system in the form of a "ring main" in order to ensure the availability of power in the event of damage and during servicing and repair of the line.

30c. Central Heating. Where required by climatic conditions, central heating is an inherent part of the requirements for standard buildings and may be provided either from a central boiler house or by separate units in individual buildings, depending on local practice and economy. The same system may be used to heat both standard buildings and user nation requirements, it being understood that only so much of this system as is required for standard buildings is part of NATO-common infrastructure.

Item 25 - Utilities

MIL.
Item 34 - Fencing, Gates and Observation Towers

34a. Perimeter Fencing. The perimeter fencing requirement to exclude farm animals from operations and flying areas and to deter unauthorized trespassers may be met by the construction of a 5-strand barbed-wire or 1.5 metre animal-wire fence, with 3-strand barbed-wire overhang, on posts spaced approximately 4 metres apart.

34b. Security Fencing. The security fencing requirement for ammunition and POL storage areas may be met by a 2-metre-high chain link fence with 3-strand barbed-wire overhang. Whether or not security fencing is required for communications sites will depend on security conditions in the general area and the location of the sites with respect to other airfield installations.

34c. Gates. A bascule-type barrier gate may be included at the main airfield entrance. All other gates should be swing type.

Item 35

Nil.

Item 36 - Demolition Systems

36a. The method used for the demolition of airfield runways must give full consideration to the following factors.

(i) Air traffic must not be interrupted during either the preparation of the demolition system or the final placing of the explosive charge.

(ii) The preparatory work must be sufficiently solid not to be damaged by, or cause damage to aircraft.

(iii) The preparatory work must be waterproof or self-draining, protected against debris, and must not interfere with airfield drainage.

(iv) Quick charging with explosives must be possible in an emergency.

36b. It is recommended that charges be calculated so as to produce the greatest possible difficulty to repair efforts. In the case of concrete pavements, the effect can best be accomplished by breaking the surface into very large slabs and heaving these slabs to a height of about 1 metre so that considerable clearance work is required before repair work can be started. For this purpose, relatively "slow" explosive is desirable. The complete disintegration of the concrete slab is not essential nor even desirable, inasmuch as a trench blown by a heavy charge is relatively easy to sweep and repair.

36c. Of the methods devised to accomplish this, the most promising is the placing of water proof steel or cast iron pipe under the runway at approximately 100 metre intervals. At the proper time, the pipe can be loaded with explosive and subsequently fired. The exact diameter of the pipe appears unimportant, provided it is large enough to accept the explosive and the
loading means without force. The joints of the pipe must be flush inside. The depth of the pipe below the surface depends on the thickness of compacted base and on the height of the water table, the optimum solution being to place the pipe between the bottom of the heavy compacted layer and the top of the water table. If the water table is high, it may be necessary to place the pipe within the compacted base.

36d. Where the preparations for demolition can be made during the course of the pavement construction, the following scheme has been suggested: steel or cast iron pipes, with water tight joints, are placed under runway for the full width of the runway pavement. The two ends of the pipe are curved up to the airfield surface. To permit the rapid insertion of the charge, a wire cable is threaded through the pipe to be used as a pilot wire in pulling through the explosive charge. The two ends of the pipe are provided with water tight caps to which the ends of the pilot wire are secured by detachable fasteners. Unless two open ends of the pipe are provided, the placing of the explosive charge by threading it in from one end may prove impracticable, owing to slight variations in the level of the pipe joints caused by settlement. The use of manholes at each end of the pipe has also been suggested.

36e. Where the preparations for demolition must be made after the pavement construction has been completed, the following scheme was proven satisfactory in experiments conducted by the Engineers, Northern Army Group: a 4-inch (10-centimetre) diameter steel pipe, with screw joints was pushed under the pavement by means of a "Greenlee" Hydraulic Pipe Pusher. The pipe was pushed at a depth of approximately 4 feet and extended for 60 feet across the runway. The "Greenlee" Hydraulic Pipe Pusher, developed for the British Forces in World War II, proved satisfactory in soft soils, but normally requires the addition of a water jet in compacted soil. When the pipe is driven with an open end, it must be withdrawn afterward and waterproofing added to the end and joints. The explosive was introduced into the pipe by lashing it, together with a length of detonating cord, to flexible rods or to jointed pipes which were fed in from manholes located just off the runway. The size of the manhole depends on the method of loading adopted.

36f. Experiments carried out to date by the Engineers, Northern Army Group, show that, for a 12-inch (30.5 centimetre) concrete slab and a pipe at a depth of 4 feet (1.2 metres) below the surface, best results are obtained with a charge of 3 pound of trinitrotoluene (TNT) explosive per foot (.75 kilogram per metre). This charge broke the pavement into large pieces along a line of about 3 feet (1 metre) wide, heaved and cracked the concrete for about 10 feet (3 metres) on either side. Similar results were obtained on an 8-inch (20-centimetre) concrete slab with a pipe at a depth of 4 feet (1.2 metres) and a charge of 3/4 pound per foot (1.17 kilogram per metre).

Item 37 - Personnel Housing

37a. Concealment. Although camouflage has not been included as a standard airfield requirement, concealment must receive priority consideration in airfield planning. In general, careful use of existing terrain is far more economical and effective than artificial measures. The object should be to make the airfield as inconspicuous as possible from the air and to disperse facilities so as to minimize damage from bombs. Dispersal of buildings and other structures should not be conspicuously different from the pattern of adjacent communities or built-up areas. To the extent consistent with this objective, buildings should be dispersed on an irregular pattern, with 60 metres between buildings whenever possible. Double-story construction should be avoided, except when it is typical of the local area and airfield buildings will blend with surrounding built-up areas. Single-story construc-
tion should be used especially for vital buildings, which user nations may wish to protect with blast walls. Walls and roofs of buildings should not have a smooth reflecting surface and should be toned down in colour to blend with the landscape.

37b. Type of Construction. Construction will be normally of a temporary nature with a life of ten years, with the exception of those buildings which, for reasons of security or the nature of the equipment housed therein, may require a more permanent type of construction.
LIMITING CRITERIA

AIRFIELD APPROACH PATH

NOT TO SCALE

CONICAL SURFACE SLOPE

ALL DIMENSIONS ARE IN METERS
ALL ELEVATIONS ARE IN METERS ABOVE LEVEL OF AIRFIELD AS DATUM
AIRFIELD CLEARANCE CRITERIA

PLAN
LIMITING CRITERIA

NOTES
1. When no parallel runway is to be provided, the P/R of M/C of the approach area will be determined at 1:1000 along the normal direction, and to 400 ft. at the B/L. P/R of M/C at 1:1000 along the normal direction, and to 400 ft. at the B/L. P/R of M/C at

ALL DIMENSIONS ARE IN METRES.

ALL ELEVATIONS ARE IN METRES ABOVE LEVEL OF AIRFIELD AS GIVEN
SECTIONAL ELEVATION OF APPROACH FUNNEL LIMITING CRITERIA

NOT TO SCALE.