111 AIRFIELD PAVEMENTS - RUNWAYS (Includes Runway/Fixed Wing, Runway/Rotary Wing, and Helicopter Landing Pad).

See NAVFAC P-80.3, Airfield Safety Clearances, for runway clear zone criteria.

111 10 RUNWAY/FIXED WING (SY)

Description. Runways are paved surfaces for the landing and takeoff of aircraft. The number of runways required is determined by the expected traffic density, airfield mission, operational procedures and environmental factors. Runway orientation is determined from analysis of wind data, terrain, noise levels to be generated and local development planning. See NAVFAC DM-21.1 for wind rose analysis and design criteria.

Criteria. The following standards apply to fixed wing runways at all Navy and Marine Corps air installations, including outlying fields, unless specifically noted otherwise. Deviation from these standards must be approved by the Naval Air Systems Command.

Runway Width. The standard width for all runways constructed prior to June 1981 is 200 feet. For runways planned after June 1981, the standard width shall be 200 feet for all class B runways and 75 feet for class A runways except those class A runways where T-34 and T-44 aircraft are operated by the Naval Air Training Command. In this case, the runway width shall be increased to 200 feet in order to simulate the runway conditions found at fleet stations. (See 110 introduction for explanation of class A and B Standards.)

Length. The maximum planned length of a runway shall be long enough to accommodate a selected critical aircraft in takeoff and landing operations under stipulated load and environmental conditions. The critical aircraft for a station is defined as one which:

1. Is or will be assigned to the installation or is to be supported by the installation in accordance with the mission assigned by the major claimant/CNO.

2. Requires the longest takeoff ground run or landing roll of those aircraft meeting the above stipulation.

Critical Aircraft. The basic takeoff ground run or landing roll for the critical aircraft can be obtained from the pertinent NATOPS (Naval Air Training and Operating Procedures Standardization) Manual. The basic takeoff ground run (TGR) in most cases is the controlling characteristic. Basic TGR is defined as the distance the aircraft requires to lift off at a given gross weight on a level runway, at sea level (Barometric pressure 29.92 inches Hq.) with 59 degrees (F) ambient temperature and under conditions of zero wind. The weight to be used, and the consequent basic takeoff ground run, should be the one that corresponds to the probable mission that the aircraft will fly. The basis for the selected TGR should be indicated along with the runway requirement calculation.

Basic Length and Correction Factors. The planned runway length for an aircraft is the basic takeoff ground run or landing roll (whichever governs) of the critical aircraft, corrected for nonstandard conditions of altitude, temperature, and effective gradient, and with an appropriate safety factor applied. (Additional corrections are to be applied to crosswind runways and runways used by T-34 aircraft for basic training.) The safety factor allows for variation in pilot techniques, runway surface conditions, wind, minor mechanical difficulties, and psychological factors. Correction and safety factors are applied as follows:

1. Altitude. Increase basic runway length by 1.1 percent for each 100 feet the site is above sea level. See Table 111 10 for altitude correction factors.

2. Temperature. Increase above result by 0.66 percent for each degree F the anticipated mean high temperature is above 59 degrees F. The mean highest temperature is defined as the average of the highest temperature recorded each day during the month which has the highest average daily maximum temperature. See Table 111 10 for temperature correction factors.

3. Safety Factor. Multiply the above result by 1.6 for all runways except those at Air Training Command air installations where a safety factor of 2.0 shall be applied.

4. Effective Gradient. Increase the above result by 10 percent for each 1 percent of effective gradient. Effective gradient is the maximum difference in elevation along the centerline of the runway divided by the runway length and expressed as a percent.

5. Round off. Final runway length is the result of the foregoing calculations rounded off to the next higher 100 feet.

6. Basic Training Runways. At basic training runways used by T-34 aircraft, 1000 feet shall be added to the computed runway requirement. The additional runway length is required to practice precautionary emergency landings.

7. See the example computation at the end of category Code 111-10.

Crosswind Runway. The foregoing discussion applies to the primary runway. When the primary runway provides less than 95 percent wind coverage (that is, when a 15-knot crosswind component occurs more than 5 percent of the time), it becomes necessary to consider a crosswind runway. Justification based on wind data and operational needs is required before planning action is taken. In those cases where a crosswind runway is authorized for planning, the length is computed as for the primary runway with the exception that the takeoff ground run (or landing roll) is reduced by 20 percent. This accounts for headwinds, 15 knots or more, which normally will be encountered on the crosswind runway. If operational conditions, wind data, or runway configuration are such as to indicate that a headwind other than 15 knots should be planned for, then the NATOPS Manual for the critical aircraft should be consulted, and the appropriate takeoff ground run computed.

Runway separations/clearances. See NAVFAC P-80.3, Airfield Safety Clearances, for guidelines for determining obstructions to air navigation and the definition of airfield imaginary surfaces. The following lateral separations are required between runways and other airfield pavements. Deviations from criteria require a waiver from the Naval Air Systems Command unless specifically exempted from waiver per NAVFAC P-80.3.

1. Parallel Runways. A minimum of 1000 feet is required between centerlines of parallel runways. The separation shall be increased to 4300 feet if simultaneous Instrument Flight Rule (IFR) operations are to be flown from the parallel runways.

2. Parallel Taxiway. A minimum of 500 feet is required between the centerline of a runway and the centerline of a parallel taxiway. (Note: Aircraft using the parallel taxiway are under the direction of the air control tower and therefore are not considered an obstruction even though the taxiway lies within the runway primary surface.)

3. Parking Apron. The edge of a parking apron, including its peripheral taxilane, shall be sited outside the runway primary surface. Aircraft shall be parked such that they do not penetrate the 7:l transitional surface.

4. Any Object. Objects shall be sited outside the runway primary surface and such that they do not penetrate the 7:l transitional surface or other imaginary surfaces defined in NAVFAC P-80.3.

EXAMPLE COMPUTATION

The following is an illustrative example of the runway length computation:

GIVEN:

Patrol Plane Air Station	-	P-3C is critical aircraft
Elevation of Site	-	300 feet above mean sea level
Mean Highest Temperature	-	70 degrees (F)
Effective Runway Gradient	-	0.8%

From aircraft performance curves, basic length is found to be determined by takeoff distance. TGR (P-3C) = 4,700 feet.

*Altitude Correction	$\frac{300}{100}$ x 1.1% = 3.3%
	4,700 x 1.033 = 4,855 feet
*Temperature Correction	(70-59) x 0.66% = 7.26%
	4,855 x 1.0726 = 5,207
Safety Factor Correction	5,207 x 1.6 = 8,331
Effective Gradient	0.8 x 10% = 8% increase
	8,331 x 1.08 = 8,997

Round off = 9,000 feet.

*(Table 111 10 may be used when temperature and altitude data are available).

TABLE 111 10
Runway Temperature and Altitude Corrections

Installation	Elevation (Ft)	Mean Highest daily temp. hottest month (Deg. F)	Altitude Correction Factor	Temperature Correction Factor
Adak, NAVSTA	17	56	1.0019	0.9802
Agana, NAS	277	87	1.0305	1.1848
Alameda, NAS	16	74	1.0018	1.0990
Argentia, NAVSTA	51	65	1.0056	1.0396
Atlanta, NAS	1068	87	1.1175	1.1848
Atsugi, NAS	185	87	1.0204	1.1848
Barbers Point, NAS	34	85	1.0037	1.1716
Barking Sands	14	88	1.0015	1.1914
Beaufort, MCAS	38	92	1.0042	1.2178
Bermuda, NAS	12	85	1.0013	1.1716
Brunswick, NAS	75	78	1.0083	1.1254
Cecil Field, NAS	80	92	1.0088	1.2178
Chase Field, NAS	190	95	1.0209	1.2376
Cherry Point, MCAS	29	92	1.0032	1.2178
China Lake, NWC	2283	102	1.2511	1.2838
Corpus Christi, NAS	19	90	1.0021	1.2046
Cubi Point, NAS	55	93	1.0061	1.2244
Dallas, NAS	495	97	1.0545	1.2508
El Centro, NAS	-43	105	0.9953	1.3036
El Toro, MCAS	380	82	1.0418	1.1518
Fallon, NAS	3934	93	1.4327	1.2244
Futema, MCAS	240	89	1.0264	1.1980
Glenview, NAS	653	86	1.0718	1.1782
Glynco, NAS	25	91	1.0028	1.2112
Guantanamo Bay, NAS	45	89	1.0050	1.1980
Iwakuni, MCAS	5	88	1.0006	1.1914
Jacksonville, NAS	22	92	1.0024	1.2178
Warminster, NADC	375	85	1.0412	1.1716
Kaneohe, MCAS	18	83	1.0020	1.1584
Keflavik, NAVSTA	168	55	1.0185	0.9736
Key West, NAS	6	90	1.0007	1.2046
Kingsville, NAS	50	93	1.0055	1.2244
Kodiak, NAVSTA	77	60	1.0085	1.0066
Lajes, NAF	182	76	1.0200	1.1122
Lakehurst, NAEC	103	84	1.0113	1.1650

TABLE 111 10
Runway Temperature and Altitude Corrections (continued)

Installation	Elevation (Ft)	Mean Highest daily temp. hottest month (Deg. F)	Altitude Correction Factor	Temperature Correction Factor
Lemoore, NAS	237	100	1.0261	1.2706
Mayport, NAVSTA	14	88	1.0015	1.1914
Memphis, NAS	322	94	1.0354	1.2310
Meridian, NAS	317	92	1.0349	1.2178
Midway, NAVSTA	10	84	1.0011	1.1650
Miramar, NAS	477	80	1.0525	1.1386
Moffett Fld., NAS	34	74	1.0037	1.0990
Monterey, NAF	164	67	1.0180	1.0528
Naha, NAF	14	89	1.0015	1.1980
Naples, NAF	289	88	1.0318	1.1914
New Orleans, NAS	3	91	1.0003	1.2112
New River, MCAS(H)	24	88	1.0026	1.1914
North Is., NAS	26	73	1.0029	1.0924
Norfolk, NAS	16	86	1.0018	1.1782
Oceana, NAS	22	86	1.0024	1.1782
Orange Grove, ALF	243	98	1.0267	1.2574
Patuxent River, NAS	38	87	1.0042	1.1848
Pensacola, NAS	30	87	1.0033	1.1848
Point Mugu, NAS	12	73	1.0013	1.0924
Quantico, MCAS	12	36	1.0013	1.1782
Quonset Pt., NAS	21	80	1.0023	1.1386
Imp. Beach, NAS	23	78	1.0025	1.1254
Roos. Roads, NAVSTA	18	88	1.0020	1.1914
Rota, NAVSTA	20	85	1.0022	1.1716
San Clemente, ALF	181	69	1.0199	1.0660
Sangley Pt., NAVSTA	8	92	1.0009	1.2178
Saufley Fld., NAS	85	90	1.0094	1.2046
Sigonella, NAF	77	95	1.0085	1.2376
So. Weymouth, NAS	161	82	1.0177	1.1518
Tustin, MCAS(H)	54	86	1.0059	1.1782
Whidbey Is., NAS	47	69	1.0052	1.0660
Whiting Fld. (North)	200	90	1.0220	1.2046
Whiting Fld. (South)	178	90	1.0196	1.2046
Willow Grove, NAS	361	85	1.0397	1.1716
Yuma, MCAS	213	107	1.0234	1.3168

111 15 RUNWAY/ROTAKY WING (SY)

Description. Runways/rotary wing are prepared surfaces for the landing and takeoff of helicopters. For planning purposes, helicopter landing/takeoff surfaces greater than 400 feet in length shall be considered d runway. Pavements equal to or less than 400 feet in length and-width (or diameter-) shall be classified as category code 111 20, Helicopter Landing Pad. See NAVFAC DM-21.1 for design criteria and NAVFAC P-80.3 for airfield safety clearances.

Criteria.

1. Width. The standard width for helicopter runways is 75 feet except that a 100 foot width shall be provided at those runways which support CH-53 (or any helicopter with rotor diameter greater than 70 feet).

2. Length. The basic runway length is 450 feet corrected for elevation and temperature.

a. Altitude correct ion. Increase the runway length by 10 percent for each 1000 feet the runway elevation is above 2000 feet Mean Sea Level (MSL).

b. Temperature Correction. Increase the runway Length by 4.0 percent for each 10°F that the average daily maximum temperature for the hottest month is above 59°F.

The basic runway described above is designed to support normal takeoff and landing operations and may be increased in length when training exercises are to be conducted from the runway. Due to the multiple missions assigned to helicopters and the flexibility of their operating methods, standard size training pavements are difficult to define. However, a 1000 foot long runway (no temperature and altitude correction is applied) is considered sufficient to conduct proficiency training and autorotation exercises for most Navy air installations. Where multiple touchdowns points are provided on a single runway, the touchdown points shall be spaced a minimum of 400 feet center to center. Multiple runway configurations that may be planned include parallel runways (parallel VFR runways shall have a minimum at 200 feet separation centerline to centerline) or arranging three runways as each side of a triangle.

For runways designed for Instrument Flight Rule (IFR) operations, the runway design must take into account the Ground Control Approach (GCA) system to be used and the number of instrumented touchdown points required. For example, two touchdown points located at opposite ends of a 1000 foot runway could be served by a single GCA located on a turn table offset near the mid point of the runway.

Aircraft Safety Clearances. The location of objects adjacent to helicopter runways is governed by the runway primary surface, transitional surface, and approach/departure surface. These surfaces differ for IFR and VFR operations and are defined in NAVFAC P-80.3, Airfield Safety Clearances. Also see P-80.3 for takeoff safety zone criteria for VFR helicopter runways.

111 20 HELICOPTER LANDING PAD (SY)

Description. Helicopter landing pads are prepared areas for the vertical takeoff and landing of helicopters. The pad is designed to accommodate only one helicopter at d time. The pad may service a hospital, administrative activity, command headquarters or other installations which require helicopter cargo or passenger service. Helipads may be planned at fixed wing air installations, but only if air traffic density or safety requirements preclude the use of the fixed wing runways by helicopters. See NAVFAC DM 21.1 for design criteria.

Criteria. The standard helicopter landing pad is 100 feet by 100 feet (1100 square yards) for both Visual Flight Rule (VFR) and Instrument Flight Rule (IFR) operations. The size may be modified to accommodate specific training or mission requirements, individual justification must be provided. Where more than one helicopter is to be at the pad location at one time, a connecting taxiway and parking apron is required.

Airfield Safety Clearances. The location of objects adjacent to a helicopter landing pad is governed by the helipad's primary surface, take off safety zone, transitional surface and approach departure surface. These surfaces differ for IFR and VFR operations and are defined in NAVFAC P-80.3, Airfield Safety Clearances.