

CEMP-ET Engineer Technical Letter 1110-3-393	Department of the Army U.S. Army Corps of Engineers Washington, DC 20314-1000	ETL 1110-3-393 28 October 1988
	Engineering and Design DESIGN OF SURFACED AREAS	
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DEPARTMENT OF THE ARMY  
U.S. Army Corps of Engineers  
Washington, D.C. 20314-1000

ETL 1110-3-393

Engineer Technical  
Letter 1110-3-393

28 October 1988

Engineering and Design  
DESIGN OF SURFACED AREAS

1. Purpose. This letter updates surface area design guidance.
2. Applicability. This letter is applicable to all HQUSACE elements and field operating activities (FOA) having Army and Air Force military construction design responsibility.
3. References.
  - a. AR 415-15.
  - b. ER 1110-345-100.
  - c. TM 5-818-2, AFM 88-6, Chap. 4.
  - d. TM 5-822-2, AFM 88-7, Chap. 5.
  - e. TM 5-824-1, AFM 88-6, Chap. 1.
  - f. TM 5-826-1, AFM 88-24, Chap. 1.
4. Background. The FOA have indicated that:
  - a. A designer is unclear as to the definitions of "surfaced area" and "types of surfaced areas" used in Corps of Engineers and Air Force guidance and criteria documents.
  - b. A designer needs additional guidance as to which document to use for the design of a specific surfaced area.
  - c. Clarification is needed as to which surface area type to use for a specific surface area and when to use paved shoulders.
  - d. Additional guidance on interior aircraft hangar pavement and interior heavy duty slab on grade when subjected to subgrade frost action has been requested.
  - e. Design requirements for the design vehicles for organizational vehicle parking and the design aircraft or aircraft mix for airfield pavement design need to be clarified.
  - f. It is unclear as to the surfaced area's design life.
5. Action to be Taken.
  - a. Enclosure 1 has definitions of "surfaced area" and "types of surfaced areas" which should be used to supplement the referenced guidance and criteria documents.
  - b. Enclosure 2 should be used for guidance as to which criteria document to use for a specific surface area design.

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c. Enclosure 3 provides guidance as to the specific "type of surface area" to be used. Enclosure 4 provides guidance on paved shoulder use.

d. For interior spaces which fall within a geographical area subject to subgrade frost action, the "reduced subgrade strength" and the "limited subgrade frost penetration" criteria in TM 5-818-2 should be used for the following:

- (1) All aircraft hangar pavements in heated or unheated areas.
- (2) All heavy duty slabs on grade in unheated areas.
- (3) All heavy duty slabs on grade in heated areas where exterior vehicle doors are present.

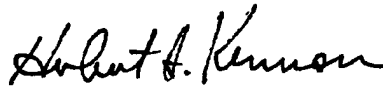
e. AR 415-15 requires the preparer of DD form 1391 provide design guidance "to meet the requirements of the installation". Since vehicle and aircraft assignments and operations are specific installation requirements, the design vehicles for organizational vehicle parking and the design aircraft or aircraft mix to be used in the design of surfaced areas should be identified in the DD Form 1391. The DD Form 1391 should also identify the anticipated number of passes for each aircraft type to use the surfaced area for the next 20 years.

g. Unless otherwise specifically stated in the DD Form 1391, pavement design lives for military construction shall be 20 years (TM 5-826-1) for airfield pavements and 25 years (TM 5-822-2) for all other pavements.

6. Discussion. The guidance contained in this letter will be incorporated in future revisions to AR 415-15, TM 5-822-2 and TM 5-824-1.

7. Implementation. This letter will have routine application as defined in paragraph 6c, ER 1110-345-100.

FOR THE DIRECTOR OF ENGINEERING AND CONSTRUCTION:



4 Encls

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## SURFACED AREA DEFINITIONS

1. Surfaced Area. Surfaced areas are designed and constructed to support and sustain traffic loading, or static loading, or recreational functions, or environmental conditions. These areas may consist of subgrade, subbase, base course, flexible pavement, rigid pavement, composite pavement, improved turfed areas, or stone protection. Surfaced areas do not include unimproved turfed areas, graded areas, heavy duty slabs on grade, or road tracks established by the passage of vehicles. Surfaced areas may be categorized as "improved turfed areas", "pavements", "slope protection", or "stabilized areas".

### 2. Types of Surface Areas.

a. Improved Turfed Area. Improved turfed areas are surfaced areas which have been turfed as a specific engineering requirement other than initial ground cover or architectural landscaping. In addition, these areas, if not maintained, may jeopardize the integrity of the original engineering intent. Slope protection, turf blocks and athletic fields are considered improved turfed areas.

b. Pavement. Pavement in military construction is defined as a surfaced area designed to carry loads from vehicles, aircraft, pedestrian traffic, open and covered storage areas, or to be used as an outside athletic court or as a playground. Pavement includes the entire pavement system structure above the subgrade. Pavement does not include enclosed floor slabs on grade, equipment pads, or building structural slabs, except that, all slabs on grade to support aircraft loadings, whether interior or exterior, are to be considered pavements.

c. Slope Protection. Slope protection is defined as a surfaced area designed to protect slopes from environmental conditions. Paved or lined drainage channels and swales are considered special types of slope protection.

d. Stabilized Area. Stabilized areas are areas which have been improved from their natural condition by mechanical compaction, with or without the addition of stabilizing agents such as cementitious materials, lime, fly ash, bitumin, other chemicals, or turf.

### 3. Types of Pavements.

a. Flexible Pavement. Flexible pavement generally consists of: a surface course containing mineral aggregates which are coated and cemented with an asphalt cement, or a modified asphalt

Enclosure 1

cement, or a tar; and one or more supporting base or subbase courses placed over a subgrade. The structural function of the pavement system is to support a load on the pavement surface, and transfer the load to the subgrade through shear forces without over stressing the subgrade or the internal strength of the pavement system layers. Although aggregate surfaced pavements, macadam pavements, precast concrete paving block pavements and brick pavements are not pavement systems with surface courses consisting of mineral aggregates coated and cemented with asphalt cement or modified asphalt cement, the mechanical properties of these pavements are classified as flexible pavement. Flexible pavement overlays placed directly over an existing flexible pavement are considered to be a flexible pavement.

b. Rigid Pavement. Rigid pavements generally consist of a mixture of hydraulic cementitious material, aggregates and water laid as a single course (slab) over a subgrade or base course. Rigid pavement transfers the load to the subgrade by bending or slab action through tensile forces as opposed to shear forces. Portland cement concrete pavement, roller compacted concrete pavement and reinforced concrete pavement are considered rigid pavements. Fully bonded rigid pavement overlays placed directly over a rigid pavement are considered a rigid pavement since the original pavement and the fully bonded overlay course act together as a single course (slab) and do not act independently.

c. Rehabilitated Pavement. Rehabilitated pavement consists of flexible overlaid pavements, rigid overlaid pavements, and composite pavements. Composite pavement is a pavement constructed out of both flexible pavement and rigid pavement, a rigid pavement constructed over a bound base, or a pavement constructed out of multiple independent rigid pavement layers.

4. Heavy Duty Slab on Grade. Heavy duty slabs on grade consist of concrete slabs which are enclosed by vertical walls and roofs. In addition, heavy duty slabs on grade are only those slabs which are designed to: (1) carry wheeled vehicle loadings or tracked vehicle loadings; or (2) support stored material or other heavy loads. Slabs on grade which support aircraft are not "heavy duty slabs on grade".

GUIDANCE AND CRITERIA DOCUMENTS  
TO BE USED FOR THE DESIGN OF SURFACED AREAS

1. References.

- a. CEGS 02234.
  - b. CEGS 02241.
  - c. ETL 1110-1-124.
  - d. ETL 1110-1-140.
  - e. ETL 1110-1-141.
  - f. ETL 1110-3-263.
  - g. ELT 1110-3-310.
  - h. ETL 1110-3-351.
  - 1. ETL 1110-3-381.
  - j. TM 5-802-1.
  - k. TM 5-803-7, AFR 88-14.
  - 1. TM 5-809-12, AFM 88-3, Chap. 15.
  - m. TM 5-818-2, AFM 88-6, Chap. 4.
  - n. TM 5-820-1, AFM 88-5, Chap. 1.
  - o. TM 5-820-2, AFM 88-5, Chap. 2.
  - p. TM 5-820-3, AFM 88-5, Chap. 3.
  - q. TM 5-820-4, AFM 88-5, Chap. 4.
  - r. TM 5-822-2, AFM 88-7, Chap. 5.
  - s. TM 5-822-4.
  - t. TM 5-822-8, AFM 88-6, Chap. 9.
  - u. TM 5-822-10, AFM 88-6, Chap. 6.
  - v. TM 5-823-4.
  - w. 49 FR 31528, Uniform Federal Accessibility Standards.
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2. The following criteria documents should be used to develop the design of surfaced areas:

- a. Roads and Streets:
  - (1) Structural Section . . . . . ETL 1110-1-140.
  - (2) Layout & Grading . . . . . TM 5-822-2.
- b. Walks . . . . . TM 5-822-2
- c. Open Storage Areas & Parking:
  - (1) Structural Section . . . . . ETL 1110-1-140.
  - (2) Layout & Grading . . . . . TM 5-822-2.
- d. Airfield Pavements:
  - (1) Structural Section . . . . . ETL 1110-3-381.
  - (2) Layout & Grading . . . . . TM 5-803-7.
- e. Aircraft Hangar Floors . . . . . ETL 1110-3-381.

3. The following criteria documents should be used as additional guidance on heavy duty slabs on grade:

- a. Basic Structural Section (non-frost) . TM 5-809-12.
- b. Additional Structural Criteria (frost) TM 5-818-2.

4. The following criteria documents should be used as additional guidance for pavements:

- a. Roller Compacted Concrete Pavement . . ETL 1110-1-141.
- b. Precast Paving Blocks . . . . . ETL 1110-3-310.
- c. Double Bituminous Surface Treatment . . ETL 1110-1-124.
- d. Design of All-Bituminous Concrete (ABC) . ETL 1110-3-263.
- d. Soil Stabilization . . . . . TM 5-822-4.
- e. Pavement Recycling . . . . . TM 5-822-10.
- f. Airfield Surface Drainage . . . . . TM 5-820-1.
- g. Airfield Drainage/Erosion Control . . . TM 5-820-3.

- h. Surface Drainage Other Than Airfields . TM 5-820-4.
- i. All Pavement Subdrainage . . . . . TM 5-820-2.
- j. Frost Design for Pavements . . . . . TM 5-818-2.
- k. Use of State or Local Specifications:
  - (1) Airfield Pavements . . . . . ETL 1110-3-351.
  - (2) Roads & Streets Hot Mix Pavement . ETL 1110-3-351.
  - (3) Roads & Streets Cold Mix Pavement TM 5-822-8.
  - (4) Roads & Streets Rigid Pavement . . ETL 1110-3-351.
  - (5) Tracked Vehicles Rigid Pavement . ETL 1110-3-351.
  - (6) Subbase Course . . . . . CEGS 02234.
  - (7) Stabilized Aggregate Base Course . CEGS 02241.
- l. Marking of Army Airfield Pavements . . TM 5-823-4.
- m. Handicapped Access & Parking . . . . . 49 FR 31528.
- n. Life Cycle Cost of Pavements . . . . . TM 5-802-1.

GUIDANCE TO BE USED FOR THE  
TYPES OF SURFACED AREAS

The following guidance should be used in selecting the "type of surface area" to be used:

a. Rigid pavements or composite pavements with a rigid overlay are required for: aprons adjacent to maintenance shops; building loading docks; fueling aprons; vehicle maintenance areas; pavements for all vehicles with non-pneumatic tires; open storage areas with materials having non-pneumatic loadings in excess of 200 psi (1375 ka); covered storage areas; all organizational vehicle parking; pavements supporting tracked vehicles; vehicle wash racks; aircraft wash racks; aircraft shelter taxitracks and aprons; aircraft alert pads; aircraft arm/disarm pads; aircraft compass calibration pads; aircraft parking apron; aircraft hazardous cargo pads; 1000 feet touch down pads at each end of a class B runway; primary taxiways on class B runways; 300 feet each side of the aircraft arresting cable; sustained operations of aircraft or vehicles with tire pressures in excess of 300 psi (2,063 ka); aircraft power check pads; aircraft warm-up pads; primary taxiways at ends of class B runways; hangar floors; hangar approach aprons; pavement intersections where C-141 or other similar aircraft/vehicles have a history of distorting flexible pavement; at all locations where any vehicle is refueled; and within 25 feet where any liquid oxygen (LOX) is stored, manufactured, piped or used. **(NOTE: organic materials explode on contact with LOX. Any organic material (asphalt, joint sealers) should be excluded from Lox paving for safety reasons. continuously reinforced rigid concrete pavement with no joint sealer or, expansion joint materials be provided within 25 feet (7.6 m) of any LOX storage, manufacturing, or piping structure.)**

b. Except for architectural or special operational requirements, all other pavements will have materials selected based upon life cycle cost analysis discussed in TM 5-802-1.

c. Precast paving blocks, although designed as a flexible pavement, may be used to replace rigid pavement for organizational vehicle parking and for low speed paved areas. Precast paving blocks pavements shall not be used for airfield pavements.

d. Roller Compacted Concrete Pavement (RCCP) is a rigid pavement and can be used as pavement except for runway and taxiway pavements and roads and streets with vehicle speeds in excess of 40 mph.

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## GUIDANCE FOR USE OF PAVED SHOULDERS

1. Paved shoulders should be provided for: aircraft alert pads; aprons for jet transports, cargo, or tankers; aircraft arm/disarm pads; aircraft hazardous cargo pads; jet blast deflectors; aircraft power check pads; runways used by C-5, E-4, and Boeing 747; taxiways at jet cargo, bomber, or jet tanker bases; aircraft warm-up pads; to support snow removal or special equipment; where airfield pavements are without vegetation; where necessary to protect shoulder areas against jet blasts.

2. As a minimum, paved shoulders shall be designed to support a load of 10,000 pounds (4,540 kilograms) imposed by a single wheel with a tire pressure of 100 psi (690 ka). For airfield pavements, the paved shoulder wearing surface shall consist of a 2 inch thick dense graded hot plant mixed asphalt cement concrete. For road and street pavements, the paved shoulder wearing surface shall consist of a double bituminous surface treatment.