

Dec 5, 1997

FROM: HQ AFCESA/CES
139 Barnes Drive Suite 1
Tyndall AFB FL 32403-5319

SUBJECT: **Engineering Technical Letter (ETL) 97-18 (Change 1): Guide
Specification for Airfield and Roadway Marking**

1. Purpose. This ETL provides a guide specification which may be incorporated into contract documents for airfield and roadway marking.

2. Application: All Air Force activities, Corps of Engineers, and Navy organizations responsible for preparation of contract documents for U.S. Air Force bases.

2.1. Authority: AFPD 32-10, *Air Force Installations and Facilities*, and AFI 32-1023, *Design and Construction Standards and Execution of Facility Construction Projects*.

2.2. Effective Date: Immediately.

~~**2.3. Expiration:** Five years from date of issue.~~

2.4. Ultimate Recipients: Organizations developing contract documents for marking Air Force pavements.

2.5. Coordination: Civil Engineer functional staff, Air Force Major Commands (MAJCOMs); Air Force Flight Standards Agency (AFFSA); and Air Force Center for Environmental Excellence (AFCEE).

3. Referenced Publications. See Attachment 1.

4. Requirements. See Attachment 1.

5. Point Of Contact. Mr. Michael D. Ates, HQ AFCESA/CESC, DSN 523-6351, commercial (850) 283-6351, Internet atesm@afcesa.af.mil.

William G. Schauz, Colonel, USAF
Director of Technical Support

2 Atch
1. Guide Specification for Airfield and
Roadway Marking
2. Distribution List

APPROVED FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED.

GUIDE SPECIFICATION

AIRFIELD AND ROADWAY MARKING

NOTE: Delete notes, explanations, or elective guidance enclosed by parentheses or bordered by dotted lines before publishing this document as a project specification. Coordinate other deviations from this guide specification with the MAJCOM Pavements Engineer prior to advertising a request for bids.

NOTE: The use of the name or mark of any specific manufacturer, commercial product, commodity, or service in this publication does not imply endorsement by the Air Force.

1. SCOPE.

1.1. Description of Work. The work specified by this section consists of furnishing all labor, equipment, tools, appliances, transportation, materials, and quality control reports required to prepare and mark the ((airfield) (and) (roadway)) pavements on (_____ AFB __) as shown in the contract drawings and as otherwise specified herein. The ((airfield) (and) (roadway)) marking must be completed without damage to pavement surface, joints, joint and crack seals, or any other government property.

1.2. Determination of Compliance. Compliance with specifications for pavement marking materials shall be determined by laboratory analysis as described in paragraph 3.1. Compliance with requirements for proper installation and placement of markings shall be as stated in Section 8, Quality Control.

1.3. Escorts and Interpreters. The Contractor shall provide escorts and interpreters in overseas locations, or where the workforce is comprised primarily of non-English-speaking workers.

2. REFERENCED PUBLICATIONS.

2.1. Federal Specifications:

- TT-P-1952D, *Paint, Traffic and Airfield Marking, Waterborne*, 7 Jan 94
- TT-B-1325C, *Beads (Glass Spheres) Retroreflective*, 1 Jun 93

2.2. Air Force:

- AFI 32-1042, *Standards for Marking Airfields*

NOTE: This Air Force Instruction gives the specific requirements for marking USAF runways and taxiways, names the material specifications that can be used to obtain environmentally acceptable products for marking airfield pavements, and indicates who must accomplish the various tasks associated with this responsibility. This document will be replaced by AFJMAN 32-1015, *Airfield, Heliport, and Roadway Marking*.

- AFMAN 32-1076, *Visual Air Navigation Systems*
- ETL 94-1, *Standard Airfield Pavement Marking Schemes*

2.3. Federal Aviation Administration (FAA):

- FAA Advisory Circular (AC) 150/5370-2C, *Operational Safety on Airports During Construction*, 1984

NOTE: The following reference applies if the guide specification is to be used on a civil airfield and the markings must comply with FAA requirements.

- FAA AC 150/5340-1G, *Standards for Airport Markings*, 1994

2.4. United States Code (U.S.C.):

- 42 U.S.C. 6901, et seq., *Resource Conservation Recovery Act*
- 42 U.S.C. 9601, et seq., *Comprehensive Environmental Response, Compensation, and Liability Act*
- 49 U.S.C. 1801, et seq., *Hazardous Materials Transportation Act*

2.5. U.S. Department of Labor Occupational Safety and Health Administration (OSHA) Regulation:

- 29 CFR 1910, et seq., *Occupational Safety and Health Act*

2.6. Federal Highway Administration:

- The Manual on Uniform Traffic Control Devices, Part VI, *Traffic Controls for Street and Highway Construction, Maintenance, Utility and Emergency Operations*

3. MATERIALS AND EQUIPMENT.

3.1. Marking Materials. The Contractor shall submit samples of the paint and beads to be used in performance of the contract to an independent laboratory approved by the Contracting Officer (CO) or authorized representative. The laboratory analysis of the samples will determine compliance with the specifications cited below. At least 30 days prior to beginning work, the Contractor shall provide letters of compliance to the CO or authorized representative.

3.1.1. Paint Specification. Paint products shall meet the requirements of Federal Specification TT-P-1952D.

3.1.2. Bead Specification. Retroreflective media (beads) used to reflectorize pavement markings shall meet the requirements of Federal Specification TT-B-1325C, Type I, Low Index of Refraction, Gradation A, Course, Drop-on.

3.2. Equipment.

3.2.1. Marking Machinery. The equipment used for marking shall be mounted on pneumatic tires and shall be capable of applying lines of paint only, or paint and beads simultaneously, in widths of ((from) (102 mm (4 inches)) (to) (1 m (3 feet))) at a speed of at least 5 miles per hour. Equipment shall be sufficiently mobile and maneuverable to allow application of straight lines or curves in a true arc. It shall be adjustable to allow application of single lines of single colors or multiple lines (at least two) of different colors, at least 150 mm (6 inches) wide, and skip-lines in variable lengths at least 102 mm (4 inches) wide. All spray applicators and bead dispensers shall produce markings of uniform thickness, width, and appearance, with clean-cut edges, at the rate specified in paragraphs 8.1.1 and 8.1.2. The Contractor shall equip mobile marking equipment with a hand-operated spray applicator to mark areas that are otherwise inaccessible or provide separate equipment to apply legends and markings in spaces where large equipment cannot be manipulated.

3.2.2. Lighting. The Contractor shall furnish all lighting necessary for night operations at no cost to the Government. Lighting will be directed or shaded to prevent interference with aircraft, the air traffic control tower, and other base operations. The Contractor shall be capable of removing all lighting equipment from the runway within 15 minutes of notification of an emergency. Night work must be coordinated with the Airfield Manager and approved in advance by the CO or authorized representative. The Government reserves the right to accept or reject night work on the day following night activities by the Contractor.

3.2.3. Storage. The Contractor shall store equipment and materials only in areas approved by the CO or authorized representative.

3.3. Government Furnished Materials and Equipment.

3.3.1. Communications Equipment. The Government will furnish a radio to the Contractor for communication with the control tower during each work day. The Contractor shall assume responsibility for the radio and shall reimburse the Government for repair or replacement of the radio if it is lost, damaged, or destroyed.

3.3.2. Water. Water will be furnished at no cost to the Contractor from a fire hydrant designated by the CO or authorized representative and located within a reasonable proximity to the work area. The Contractor shall install a gate valve and a back-flow prevention device on the fire hydrant tap. The Contractor shall furnish all equipment, material, and labor required to obtain and deliver water from the designated fire hydrant to the work area(s).

4. WORK AREA PREPARATION.

4.1. Work Zones. The Contractor shall provide all temporary markings and traffic controls necessary to establish a safe and adequate work zone and to minimize (airfield (and) traffic) interruptions. Markings and controls must comply with the requirements of paragraph 7.2.1 and 7.2.2.

4.2. Surfaces.

4.2.1. Surface Inspection. Before marking begins, the Contractor shall inspect each general work area to determine the extent of cleaning required, document the results of the inspection, and clean each area as described below.

4.2.2. Surface Cleaning.

4.2.2.1. Removal of Surface Contamination. The Contractor shall use a solution of trisodium phosphate or other approved detergent or degreaser to clean pavement areas (such as intersections and parking lots, maintenance aprons, engine run-up areas, blast pads, and the threshold and rotation area of the runway) that reveal signs of surface contamination by fuel, oil, hydraulic fluid, or other contaminants that could inhibit the bond between the paint and the pavement. After cleaning, the area shall be thoroughly rinsed. The Contractor shall remove all curing compounds from rigid pavements by water blasting.

4.2.2.2. Cleaning Existing Markings. The Contractor shall clean the existing areas that are to be remarked and remove any loose or poorly bonded paint that would inhibit adhesion of the new marking to the pavement surface. Paint that is intact and bonded to the pavement does not have to be removed. The Contractor shall remove dust, dirt, peeling or poorly bonded paint, and granular surface deposits from all other pavement areas by sweeping, blowing with compressed air, and/or rinsing with pressurized water. Any areas exposed to rain or traffic after cleaning shall be cleaned again before marking.

4.2.2.3. Testing for Moisture. Pavement markings shall be applied to dry pavement only. The Contractor shall test the pavement surface for moisture before beginning work after each period of rainfall, fog, high humidity, or cleaning, or when the ambient temperature has fallen below the dew point. Do not commence marking until the pavement is sufficiently dry and the pavement condition has been approved by the CO or authorized representative. Employ the "plastic wrap method" to test the pavement for moisture as follows: Cover the pavement with a 300 mm by 300 mm (12 inch by 12 inch) section of clear plastic wrap and seal the edges with tape. After 15 minutes, examine the plastic wrap for any visible moisture accumulation inside the plastic. Do not begin marking operations until the test can be performed with no visible moisture accumulation inside the plastic wrap.

NOTE: For new pavements which require early painting, add the following paragraph(s).

4.2.2.4. Pretreatment for Early Painting. The Contractor shall pretreat new pavements in accordance with the following:

4.2.2.4.1. Pretreat rigid pavements that require early painting with an aqueous solution containing 3 percent phosphoric acid and 2 percent zinc chloride. Apply the solution to the areas to be marked.

4.2.2.4.2. For early painting of asphalt pavement systems, apply the paint and beads at half the normal application rate, followed by a second application at the normal rate after 30 days.

5. TEST STRIPE DEMONSTRATION. Before beginning work, the Contractor shall mark test stripes within the work area to demonstrate the proposed materials and equipment to be used for the contract. Apply separate test stripes in each of the line widths and configurations required in the contract, using the equipment proposed for the contract. Mark the test stripes long enough to determine the proper speed and operating pressures for the vehicle(s) and machinery, but not less than 15 meters (50 feet) long.

5.1. Demonstration of Application Rates. In applying the test stripes, the Contractor shall demonstrate the ability to comply with the application rates specified in paragraphs 8.1.1 and 8.1.2. Document the equipment speed and operating pressures required to meet the specified rates in each configuration of the equipment and provide a copy of the documentation to the CO or authorized representative before proceeding with the work.

5.2. Demonstration of Retroreflective Values. After the test stripes have cured to a “no-track” condition, the Contractor shall demonstrate compliance with the average retroreflective values specified in paragraph 8.2. Take a minimum of ten readings on each test stripe with a Mirolux 12 Retroreflectometer, or similar instrument with the same measuring geometry and direct readout in millicandelas per square meter per lux (mcd/m²/lx).

5.3. Demonstration of Level of Performance. The CO or authorized representative will be present at the test area to observe the result obtained on the test stripe and validate the operating parameters of the vehicle(s) and equipment. The application of test stripes shall be used to determine if the proposed methods and equipment can achieve the level of performance required for the contract. If accepted by the CO or authorized representative, the test stripe shall be the measure of performance required of the Contractor for the marking project. The Contractor shall not proceed with the work until the results of the test stripes are satisfactory to the CO or authorized representative.

6. OPERATIONS ON THE AIRFIELD.

6.1. Access to Controlled Zones. The Contractor shall perform all contracted work within the controlled zones of the base or the airfield. Coordinate access to or through the base with the CO or authorized representative. Coordinate access to or through the radio controlled zone of the airfield with the Chief of Airfield Management. When within the radio controlled zone of the airfield, the Contractor shall maintain continuous verbal and visual contact with the control tower. The Contractor shall verbally inform the control tower and the Chief of Airfield Management when the work has been completed and all equipment, personnel, and materials have been removed from the airfield.

6.2. Runway Operations. It is the intention of the Government to close the runway to all aircraft traffic while marking operations are ongoing. However, work may be interrupted to provide a runway for aircraft in an emergency or when a special or unscheduled mission is assigned. If the runway is needed for aircraft operations, the Contractor shall remove all equipment from the operational surfaces of the airfield and beyond the hold line within 15 minutes of notification to clear the runway. A scheduled landing or departure that has been identified to the Contractor prior to the start of the Contractor’s work shift shall not be considered an interruption.

6.3. Work Schedule. The Contractor must adhere to the preapproved schedule for execution of the work, weather permitting, as (runway (and) roadway) closures must be coordinated in advance. If Contractor’s schedule is delayed by weather conditions or mechanical equipment breakdown, the Contractor shall notify the CO or authorized representative, and a new work schedule will be established. The CO or authorized representative will coordinate the (runway (and) roadway) closure schedule with the using agencies.

6.4. Environmental Limitations.

6.4.1. Wind. Pavement marking will be suspended when wind conditions interfere with uniform application of pavement marking materials. All markings must be uniform in length and width, as defined in paragraph 8.3, with a clean cut-off at the ends and edges.

6.4.2. Temperature. Pavements can be marked only when both the pavement surface and air temperature are at least 7 °C (45 °F) and rising, and the pavement surface temperature is at least 2.7 °C (5 °F) above the dew point.

6.4.3. Moisture. Pavement marking must be suspended during rain or when the pavement surface is wet. Before resuming work, test the pavement surface for excess moisture using the plastic-wrap method described in paragraph 4.2.2.3.

6.5. The Contractor shall clean debris from the (runway (and) roadway) surface as the work proceeds.

7. METHOD OF OPERATION AND EXECUTION.

7.1. The Contractor shall conduct all marking operations in strict compliance with all local, state, and Federal environmental statutes and regulations, including, but not limited to, regulations promulgated under 29 C.F.R. 1910, et seq., 42 U.S.C. 6901, et seq.; and 42 U.S.C. 9601, et seq.

7.2. The Contractor shall provide all cones, barriers, lights, signs, placards, flags, and flagging personnel necessary to establish an adequate and safe work zone and control traffic in and around the work area until newly applied markings are dry. The Contractor shall establish and maintain work zones as necessary throughout the period of the contract, prominently identifying potential hazards and dangers to personnel and traffic in or near the work area.

7.2.1. As a minimum, the Contractor shall comply with the provisions of AFI 32-1042, ETL 94-1, AFI 32-1044 and FAA AC 150/5370-2 for temporary pavement closures on airfields.

7.2.2. When marking roads and streets, the Contractor shall comply with all state and local requirements and the provisions of Part VI, "Traffic Controls for Street and Highway Construction, Maintenance, Utility and Emergency Operations," of *The Manual on Uniform Traffic Control Devices*.

7.3. The Contractor shall remove all debris, waste, spillage, and by-products generated by the marking operations from the base and shall strictly comply with all applicable state, local, and Federal environmental statutes and regulations regarding disposal, including, but not limited to, regulations promulgated under 42 U.S.C. 6901, et seq.; 42 U.S.C. 9601, et seq.; and 49 U.S.C. 1801, et seq.

8. QUALITY CONTROL.

8.1. Application Rates.

8.1.1. Non-reflectorized Markings. The Contractor shall apply non-reflectorized paint at 0.310 to 0.360 millimeters (12 to 14 mils) wet film to cover 3 square meters, ± 0.15 square meters, per liter (121 ± 6 square feet per gallon).

8.1.2. Retroreflective Markings. The Contractor shall apply retroreflective paint as specified in 8.1.1. above, and beads at 3.5 to 4 kilograms (8 to 9 pounds) per 3.8 liters (1 gallon) of paint.

8.2. Retroreflectivity Levels. The Contractor shall collect and record readings for white and yellow retroreflective markings to ensure they provide a reasonable level of retroreflectivity for night operations. The minimum acceptable average for white markings will be 200 millicandelas per square meter per lux ($\text{mcd}/\text{m}^2/\text{lx}$) (measured with Mirolux 12 Retroreflectometer). The minimum acceptable average for yellow markings will be 175 millicandelas per square meter per lux ($\text{mcd}/\text{m}^2/\text{lx}$). The Contractor shall document a retroreflectivity reading for each 300 linear meters (1000 linear feet) marked. The reading shall be computed by averaging a minimum of 10 readings taken within the area at random locations. Areas not meeting the retroreflective requirements stated above shall be re-marked at the Contractor's expense.

8.3. Placement of Markings. The Contractor shall ensure that all markings are installed properly and placed in strict compliance with this specification and the contract drawings. The longitudinal edges of markings shall not vary from a straight line by more than 25 millimeters (1 inch) per 15 meters (50 feet). The overall dimensions of the markings shall not vary from the drawings by more than 5 percent. Any markings that are improperly placed or fail to meet the requirements of this specification will be removed and reinstalled at the Contractor's expense. Materials used for repairs shall be from the same lot and batch as those approved for the performance of the contract or shall be subjected to the same requirements and approved by the CO or authorized representative prior to beginning repairs.

9. DAMAGE REPAIR AND CLEANUP.

9.1. Protection and Cleanup. The Contractor shall protect all areas of pavement adjacent to the work area from splatter, splash, spills, and drips. Any disfigurement will be removed by the Contractor at the Contractor's expense. The Contractor shall remove completely all improperly placed or improperly applied markings and disfigurements without damage to the pavement, joints, and joint and crack seals. Obliterating the markings with paint will not be allowed unless the removal process leaves marking patterns that could mislead or confuse pilots or motorists. The Contractor and the CO or authorized representative shall jointly inspect the work area before marking operations commence. During this inspection, proper layout of new markings shall be verified and existing damage to the pavement systems, joints, and joint and crack seals shall be documented.

9.2. Pavement Damage Repair. The Contractor shall repair any damage to the pavement system, joints, joint and crack seals, or other Government property resulting from pavement marking. Repairs shall be made at the Contractor's expense using materials and methods approved by the CO or authorized representative and shall be completed within the contract performance period.

9.3. Excess Materials. Unused paint and beads shall remain the property of the Contractor and shall be recycled or disposed off base as specified in paragraph 7.3.

NOTE: Delete the following section when marking is part of a lump sum project.

10. PAYMENT. (To be used for unit prices.)

10.1. Measurement. The unit of measurement for pavement markings shall be the number of square meters of retroreflective and nonreflective markings applied by the Contractor and accepted by the CO or authorized representative.

10.2. Payment. The number of square meters marked by the Contractor and accepted by the CO or authorized representative will be paid for at the contract unit prices for retroreflective and non-reflective markings. Payment will constitute full compensation for all tests, labor, materials, tools, equipment, appliances, surface preparation, waste disposal, material certifications, documentation, and performance of all activities required to mark the areas designated in the plans.

10.3. Aircraft Traffic Interruptions. The Contractor shall specify on the bid schedule an hourly rate for aircraft traffic interruption. Time measurement for traffic interruptions shall begin with the notification to the Contractor to clear the runway and shall end ten minutes after the Contractor is notified that he can re-occupy the runway. The Contractor shall be paid for a minimum of one hour for each interruption. Interruptions longer than one hour shall be calculated on the half-hour: i.e., a delay of over one hour but less than one and one-half hours would be paid as one and one-half hours; a delay over one and one-half hours but less than two hours would be paid as two hours.

NOTE: Delete the following section when marking is included in a unit price project.

10. PAYMENT. (To be used for lump-sum contracts.)

10.1. Payment. Payment will constitute full compensation for all tests, labor, materials, tools, equipment, appliances, surface preparation, disposal of wastes, material certifications, documentation, and the performance of all activities required to mark the areas designated in the plans.

10.2. Aircraft Traffic Interruptions. The Contractor shall specify on the bid schedule an hourly rate for aircraft traffic interruption. Time measurement for traffic interruptions shall begin with the notification to the Contractor to clear the runway and shall end ten minutes after the Contractor is notified that he can re-occupy the runway. The Contractor shall be paid for a minimum of one hour for each interruption. Interruptions longer than one hour shall be calculated on the half hour: i.e., a delay of over one hour but less than one and one-half hours would be paid as one and one-half hours; a delay of over one and one-half hours but less than two hours would be paid as two hours.

DISTRIBUTION LIST

DEPARTMENT OF DEFENSE

Defense Commissary Service Director of Facilities Bldg 8400 Lackland AFB TX 78236-5000	(1)	Defense Technical Information Center ATTN: DTIC-FDA Alexandria VA 22034-6145	(1)
---	-----	---	-----

AAFES/ATTN: CFE PO Box 660320 Dallas TX 75266-0320	(1)		
--	-----	--	--

SPECIAL INTEREST ORGANIZATIONS

IHS (S. Carter) 15 Inverness Way East Stop A-111 Englewood CO 80112		Construction Criteria Database National Institute of Bldg Sciences 1201 L Street NW, Suite 400 Washington DC 20005	(1)
---	--	---	-----