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MILITARY SPECIFICATIONS

PLANNING TERRAIN ANALYSIS DATA BASE (PTADB) SCALE 1:250,000

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope.

a. This specification establishes the second edition of the military specification requirements for the Defense Mapping Agency's (DMA) Planning Terrain Analysis Data Base (PTADB) based on manual production and the capabilities of the **Interim Terrain Data (ITD)/Planning Interim Terrain Data (PITD)** production system.

b. The DMA Terrain Analysis Program is a dynamic program; consequently, this manual may not identify all necessary specifications encountered in the production of terrain analysis data bases. Supplementary instructions will need to be generated in areas that require modification of these specifications.

1.2 Purpose. Conformance to these specifications will assure uniformity of treatment among all mapping and charting elements engaged in a coordinated production and maintenance program for this product.

1.3 Security.

1.3.1 Security classification. The security classification of the products generated by the use of these specifications will be the lowest category practicable. When it is necessary to assign a security classification to the product, it will be accomplished in accordance with established national security procedures.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Director, Defense Mapping Agency, ATTN: PR, 8613 Lee Highway, Fairfax, VA. 22031-2137 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A **AREA MCGT**

1.4 Applicability

a. These specifications apply to all PTADBs produced by the Defense Mapping Agency and those produced for the Defense Mapping Agency as a result of either government contract or unit tasking. They are not applicable to rapid-response products.

b. For rapid-response products, the lineweights, length of dashes and spaces, and other dimensions shown in the specifications column of Appendix B - Symbols may be approximated. Lines may be delineated by fine, medium, or heavy lines and the overlays freehand lettered.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the current Department of Defense Index of Specifications and Standards (DODISS) and the supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

MILITARY

MIL-I-89014	-	Interim Terrain Data (ITD)/Planning Interim Terrain Data (PITD)
MIL-J-89100	-	Joint Operations Graphics Series 1501A (Air) and 1501 (Ground) (JOG A/G).

STANDARDS

MILITARY

MIL-STD-129	-	Marking for Shipment and Storage
MIL-STD-2402	-	MC&G Symbology.
MIL-STD-600010	-	DMA Stock Number Bar Coding.

NORTH ATLANTIC TREATY ORGANIZATION (NATO) STANDARDIZATION AGREEMENTS (STANAG)

2251 MGD IGEO	-	Scope and Presentation of Military Geographic Information and Documentation.
2253 MGD IGEO	-	Military Geographic Documentation - Roads and Road Structures.
2254 MGD IGEO	-	Navigable Inland Waterways.
2256 MGD IGEO	-	Inland Hydrography.
2257 MGD IGEO	-	Railways.
2259 MGD IGEO	-	Terrain.
3992 IGEO	-	Terrain Analysis (AGeoP-1).

QUADRIPARTITE STANDARDIZATION AGREEMENTS

QSTAG 1038, Ed.1	-	Terrain Analysis

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Defense Printing Service Detachment Office at the following address: DODSSP - Customer Service, Standardization Documents Order Desk, 700 Robbins Avenue, Bldg. 4D, Philadelphia, PA 19111-5094).

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

a. "The Unified Soil Classification System", Corps of Engineers, U.S. Army Technical Memorandum No. 3-357, Vols. 1 and 3, March 1953 (Revised April 1960).

b. Technical Manual TM 5-530, Materials Testing, Departments of the Army, the Navy, and the Air Force, February 1971.

c. Soil Survey Staff, 1975, Soil Taxonomy: A Basic System for Making and Interpreting Soil Surveys, Agricultural Handbook No. 436, USDA, U.S. Government Printing Office, Washington, D.C.

d. Datums, Ellipsoids, Grids, and Grid Reference Systems, DMA TM 8358.1, DMA Stock No. DMATM83581TEXT. Available from the Defense Mapping Agency Combat Support Center, 6001 MacArthur Boulevard, Bethesda, MD 20816-5001.

2.2 Non-Government publications

This section is not applicable to this specification.

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated detail specifications, specification sheets, or MS standards) the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.3) in accordance with 4.3.

3.2 Accuracy.

3.2.1 Horizontal and vertical accuracy.

a. The horizontal and vertical accuracy of the PTADB overlays will normally be no better than the base to which they are keyed. As this accuracy is based on the accuracy of the original source materials and the production system constraints, there is often variation in the accuracy of 1:250,000 scale topographic maps. Therefore, current imagery will be used to update the accuracy of the base map files to show significant changes in alignment (features displaced by more than 2mm or 500 meters ground distance from their current file positions), feature characteristics, new features, and/or relative position of features to each other.

b. Usually the keyed base will be a DMA or co-producer 1:250,000 topographic map or photo image product; however, in some instances 1:250,000 scale topographic maps are not available and enlarged smaller scale maps or photomosaics will be used as bases. These bases may be significantly less accurate than a 1:250,000 scale topographic map.

3.2.2 Displaced symbols. Feature symbols which are displaced as a result of hard copy output are excluded from the accuracy requirements as stated in paragraph 3.1.1a. above. However, all displaced symbols must maintain their correct relative position in regard to other feature symbols.

3.2.3 Vertical stacking.

a. Thematic overlays shall be prepared such that when the overlays of a given geographic area (the data base set of PTADB overlays for a particular base map or sheet) are registered together (combined/stacked), their features shall bear the same geographic relationship (correct positional relationship and compatibility) to each other that exists in the source from which they were originally acquired.

b. Features that are common (e.g., Common Open Water, Common Urban Areas) to two or more overlays of a given sheet shall be exactly aligned.

c. All overlays shall contain full neatlines, with a line weight of 0.30 mm (0.012 in.), registered to the coverage of the base map without bleeding edges. The neatlines of two or more overlays of a given sheet shall exactly align when vertically stacked using the Universal Punch Registration System.

3.3 Datum.

3.3.1 Horizontal datum. Horizontal Datum shall be the same as the base map to which the PTADB thematic overlays are keyed. Most of the time this will be the current World Geodetic System - 1984 (WGS 84), or a local datum from DMA TM 8358.1, when no conversion to WGS 84 exists.

3.3.2 Vertical datum. Vertical Datum (most often Mean Sea Level) shall be the same as the base map to which the PTADB thematic overlays are keyed.

3.4 Continuity (adjoining data set and chart match).

a. All thematic overlays shall be edge-matched between sheets within a project area and with sheets in other surrounding, current and previous project areas. Edge-matched PTADBs shall form a continuous data base with no gaps or overlaps between adjacent overlays. Features crossing overlay boundaries shall be continuous, i.e., a feature's geographic position which is located on an overlay boundary is common to all adjacent overlays.

b. When new PTADB data sets or sheets are produced using more current sources and adjacent sheets are not updated, exceptions to paragraph a. above can occur - the feature on the ground has changed (e.g. new road), or when the mismatch is due to different PTADB specifications. All information shall be matched with adjoining data sets or overlays as best possible. In achieving match, however, no errors of position shall be introduced into new production, nor shall any factual errors be made in an attempt to tie adjoining areas. In these cases, the new PTADB

production shall show the later date information and there may be a discontinuity along an overlay boundary.

3.5 Series. The series number for any given PTADB overlay is identified by the use of the series number of the base map to which it is keyed followed by the letters "PTA". These letters are the standard PTADB series identification. The complete series number type size, style, and positioning are as shown in Appendix A, Style Sheets, and as described in 3.11.4.5, Margin Data.

3.6 Scale. The PTADB shall be produced at 1:250,000 scale.

3.7 PTADB design. The PTADB is a product developed to satisfy the armed services requirements for planning terrain analysis data. It is produced either manually or from the PITD digital data base for a particular area as a set of six or more single subject thematic overlays on stable base material.

3.7.1 PTADB thematic design. The thematic overlays are designed to register (herein referred to as "keyed to") to the reproduction material of the standard 1:250,000 scale topographic map or sheet, or its digital representation, covering the same area. The six main PTADB thematic subjects are: Surface Configuration (Slope), Vegetation, Surface Materials, Surface Drainage, Transportation, and Obstacles. Additional Transportation, Bridge Information Table, Surface Roughness Overlay(s), and/or large scale (1:50,000) insets may be produced, if overlay congestion or space limitation problems occur. In arid areas, the three additional Water Resources Overlays of Existing Water Supply Facilities, Ground Water Potential and Characteristics, and Surface Water may be required. These additional large scale (1:50,000) insets of cartographically crowded areas and/or the Water Resources Overlays in arid areas **shall be made only as directed by specific supplemental project or sheet instructions**.

3.7.2 Overlay format.

a. PTADB overlays are formatted: (1) as shown on the style sheets, Appendix A; (2) with marginal data as prescribed in paragraph 3.11, Marginal Information; (3) with legends as shown in Appendix D; and (4) with symbology as illustrated in Appendix B and MIL-STD-2402, MC&G Symbology, Appendix A.

b. The legends for each thematic overlay (See Appendix D, Legends Appendix) will normally be the same for all sheets in the project and shall include all categories found in the project area whether or not they appear on an individual sheet.

3.7.3 Overlay limits and insets. The PTADB overlays shall be positioned to the corner geographic coordinates of the base map to which they are keyed. Insets on the base map shall be shown in the same way and in the same position on the PTADB overlays. The additional corner ticks shall be shown as per the base map.

3.7.4 Neatlines. Cartographic detail within the PTADB overlays shall not extend beyond the neatline (which is duplicated on each of the overlays) of the base map to which they are keyed. Features which cross the neatline shall be truncated exactly at the neatline, with the remaining portion of the feature portrayed on the adjoining sheet.

3.7.5 Registration. All PTADB overlays, both initial and final, shall be punch registered using the Universal Punch Registration System.

3.8 Size and dimensions.

3.8.1 Map and overlay sheet sizes. Refer to Appendix C, Size Limits for 1:250,000 Map Sheet, for overall dimensions of map and overlay sheets.

3.8.2 Unit of measure.

a. The Unit of Measure for the PTADB is Metric; however, both English and Metric Units are provided in Appendices A, B, and C of this specification.

b. Specification measurements are normally given at reproduction scale, i.e., 1:250,000.

3.8.3 Minimum sizes.

a. With the exception of the Surface Drainage and Transportation Overlays, the minimum size polygon shown for most of the features on the other PTADB overlays shall have an areal extent of at least 80 square millimeters (mm^2) at map scale (5,000,000 square meters (m^2) ground area) with a minimum width greater than or equal to 2mm (500m ground distance). For the Surface Drainage Overlay, most of the non-flowing water features shall have a minimum size polygon of 40 mm^2 (2,500,000 m^2 ground area), while flowing water minimum polygons are normally 2.84 mm^2 (177,500 m^2 ground areas). For the Transportation Overlay, the minimum size polygon shown is 8 mm^2 (500,000 m^2 ground area). The smallest polygons shown are on the Vegetation Overlay, where significant vegetation in arid areas have an areal extent of at least 2 mm^2 (125,000 m^2 ground area) with a minimum width of at least 1mm (250m ground distance). For long narrow polygons, straight or curved, the length is the centerline distance measured from one end to the other. (See Figure 1).

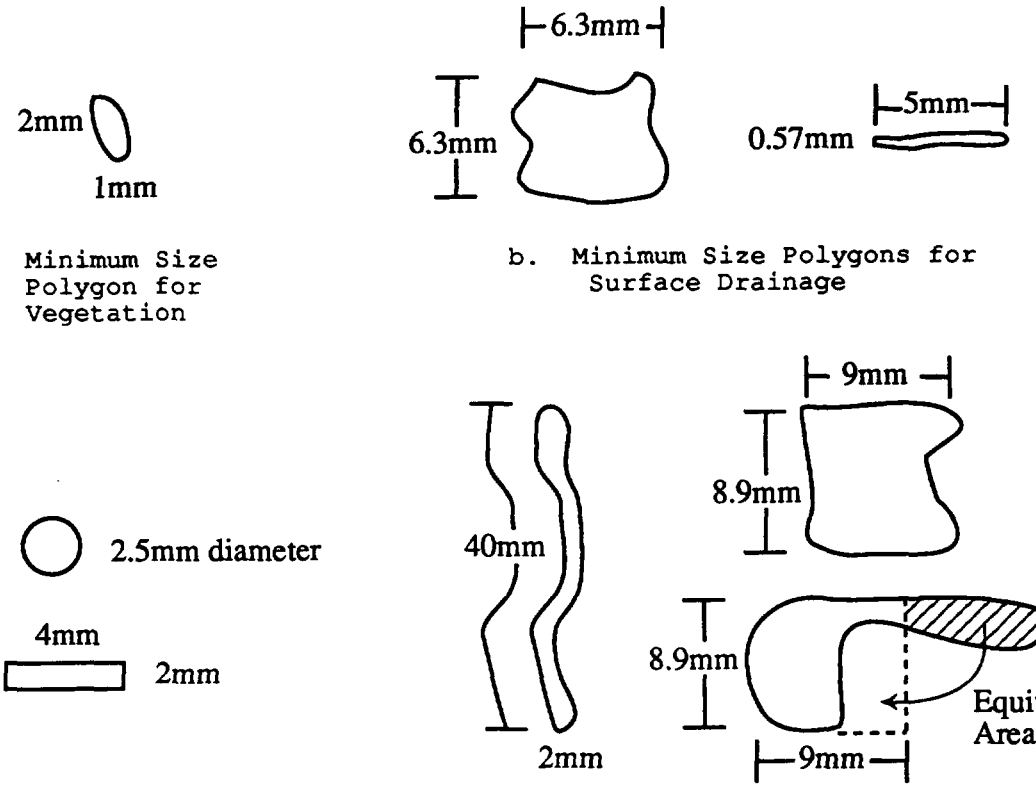
b. The minimum lengths shown vary with different thematics, but in general range from no minimum length to 5mm (1250m ground distance). Normally, all features less than 2mm (500m ground distance) in length are treated as point features, whereas those equal to or greater than 2mm (500m ground distance) are considered linear features.

3.8.4 Linework.

a. All interior information must fall within the neatlines. All linework that intersects the neatline or other areal features must terminate precisely at the neatline or other areal feature. Gaps and tails at line intersections are not acceptable.

b. Lines used to outline areal features on the Surface Configuration, Vegetation and Surface Materials Overlays shall have a lineweight of 0.30mm (0.012 inches).

c. Most of the linework, symbols, data information holders, etc., on the Surface Drainage, Transportation, Obstacles, Existing Water Supply Facilities, Surface Water Resources, and Ground Water Resources Overlays shall also have a lineweight of 0.30mm (0.012 inches). Leader lines (sometimes, if attached to an



a. Minimum Size Polygon for Vegetation

b. Minimum Size Polygons for Surface Drainage

c. Minimum Size Polygons for Transportation

d. Minimum Size Polygons for most other PTADB Features

FIGURE 1. Minimum size polygons (not to scale).

arrowhead, referred to as arrow shafts) are the major exception; all leader lines (no matter on which overlay they appear) shall have a lineweight of 0.20mm (0.008 inches). The thinner lineweight makes the leader lines easily distinguishable from the regular feature symbology, such as roads and straight line stream segments. Refer to paragraph 3.22 and MIL-STD-2402, Symbology, for additional information.

3.9 Projection. PTADB overlays shall use the same projection as the base map or sheet to which they are keyed.

3.10 Reference system. The PTADB does not require the application of any grid reference system. The grid as positioned on the base map is used when needed.

3.11 Margin Data.

3.11.1 Positioning. The margin space available will vary in size (width) depending upon the size of the geographic area encompassed by the base map. Preferably, all marginal data contained on each overlay shall be positioned between the work limits and the neatlines.

3.11.2 Style sheets.

a. Appendix A, Style Sheets, provides guidance on the design, composition, and location of all marginal information, as well as on the positioning, type size, and type style. In addition all items are referenced to their paragraph/subparagraph number in this section.

b. Legends, notes, and diagrams that require tailoring are indicated by shading and/or accompanying notation on the style sheets. Other notes shall be added as necessary for each overlay.

c. The location of marginal data shown in the style sheets represents the preferred positioning of the marginal items. If exact positioning of long or large items (long names, lengthy translations, additional legend notes, etc.) causes items to touch or overlap, they may be displaced or relocated as necessary to present a pleasing appearance, while keeping with the general setup of the style sheets. When marginal data cannot be effectively re-positioned and the interior of the overlay includes expanses of open space (open water, large single code regional areas, otherwise blank areas, etc.) selected PTADB specific marginal items (legend tables, miscellaneous notes, etc.) may be positioned therein. Nevertheless, all marginal data shall be positioned within the work limits.

3.11.3 Marginal information for thematic overlays from reproduction material or equivalent digital data set(s).

a. The following border information shall be shown on the final overlays as per the PTADB Style Sheet, Appendix A, and is obtained from either a duplicate negative of the culture plate(s) of the reproduction material of the 1:250,000 scale topographic base map or the digital data set(s) supporting its generation:

(1) Scale
(2) Sheet Name
(3) Country
(4) Series Number
(5) Sheet Number
(6) Edition Number
(7) Identification Box
(8) Corner Geographic Coordinates
(9) Publisher's Note (if published by the same agency or military command producing the PTADB)
(10) Location or Adjoining Sheets Diagram
(11) Bar Scale
(12) Neatline
(13) Copyright Note (if available and published by U.S. Government agency claiming copyright)

b. All other information on the culture negative is deleted.

3.11.4 Other marginal information to be added to thematic overlays. Additional marginal information to be added to the reproduction negative (if not already contained therein) includes:

3.11.4.1 User's note. The User's Note (as stated below) placed just above the copyright note in the lower right corner:

USERS SHOULD REFER CORRECTIONS, ADDITIONS, AND COMMENTS FOR IMPROVING THIS PRODUCT TO: DIRECTOR, DEFENSE MAPPING AGENCY, ATTN: PR, 8613 LEE HIGHWAY, FAIRFAX, VA. 22031-2137

3.11.4.2 Keyed to statement. The words "Keyed to" shall be placed immediately to the left of the word "EDITION" and should have approximately the same size letters as "EDITION".

3.11.4.3 Publisher's note.

a. If the PTADB is produced by a different agency or military command than that which published the topographic base map, its publisher's note shall replace the original note. This note, in 8 point capital and lower case letters (C/L), will be placed in the same location as the original and will have the following format:

Prepared and published by ...(agency or military command name)

b. As an example, the publisher's note for DMA produced PTADB's is:

Prepared and published by the Defense Mapping Agency

3.11.4.4 Compilation note. The following compilation note, as stated below, shall be added below the Publisher's Note and should have approximately the same type size and style as the Publisher's Note:

Compiled in (year) from best available and most current source materials. Feature information and placement on overlays will take precedence over that on the topographic map.

3.11.4.5 PTADB series identifier. The letters "PTA" shall be added following the Series Number as a part of the Series Number and should have approximately the same size letters as the Series Number. This is the standard PTADB series identifier.

3.11.4.6 Copyright note. DMA products may be copyrighted in the name of the U.S. Government in foreign countries that are signatories to the Universal Copyright Convention. To claim this protection, if not already obtained from base map reproduction materials or digital data sets, the copyright note (as stated below) shall be placed right justified between the User's Note and bar code, in the lower right corner. If space is not available between the User's Note and bar code, copyright notice may be placed to the left and on line with the User's Note:

© COPYRIGHT (YEAR) BY THE UNITED STATES GOVERNMENT
NO COPYRIGHT CLAIMED UNDER TITLE 17 U.S.C.

3.11.5 Additional marginal information to be added to individual thematic overlays. Additional marginal information will be added to each of the final overlays as follows:

3.11.5.1 Legend(s).

a. Sample legends are shown in Appendix D for all thematic overlays. Legends can be reduced in size to fit available space, as long as information remains legible.

b. Legends shall be shown in the south and/or west margins, depending on space limitations. The Obstacles Legend should be positioned at the top of the west margin legend within the limits shown on the PTADB Overlays Style Sheet, Appendix A.

3.11.5.2 Classification. Classification (N/A if unclassified), with related notes and guidance, is added to each thematic overlay as required.

a. When a security classification is required, it shall be positioned in the upper left and lower right areas of the overlay margin, centered as much as possible, as indicated on the style sheets in Appendix A.

b. Any Special Handling Note or Down Grading Note, when required, shall be shown in accordance with current established policy and wording, and positioned in the lower right margin below the security classification.

c. On unclassified overlays, the following note shall be used in place of the security classification marking:

> **LIMITED DISTRIBUTION**: Distribution authorized to the Department of Defense, U.S. DoD contractors and to U.S. Government Agencies supporting DoD functions (by authority of the Director, Defense Mapping Agency 30 May 1990). Other requests shall be referred to Headquarters, DMA, ATTN: TIM. Destroy as "For Official Use Only."

3.11.5.3 Overlay headings (top and bottom of overlay).

a. Overlay headings shall appear on final overlays as all caps or a combination of caps and lower case as illustrated below. The heading at the top left of the overlay will be a single line as indicated below. The heading at the bottom right of the overlay will either be one or two lines. The second line, if needed, will consist of any heading information in parentheses. Overlay headings are as follows:

SURFACE CONFIGURATION (Slope)
VEGETATION
SURFACE MATERIALS
SURFACE DRAINAGE
TRANSPORTATION
TRANSPORTATION (Roads)
TRANSPORTATION
(Railroads and Airfields)
BRIDGE INFORMATION TABLE
OBSTACLES

WATER RESOURCES
(Existing Water Supply Facilities)
WATER RESOURCES
(Ground Water Potential and Characteristics)
WATER RESOURCES (Surface Water)

b. If the overlay is a large scale enlargement of a cartographically crowded area, the word "Inset" shall follow the title. If two or more overlays with the same title are produced, such as two Bridge Information Tables, they shall be consecutively numbered within parentheses following the title. To the extent possible, numbering shall follow the same positional progression as the bridge numbering schema, upper left to lower right, (see 3.12.9.2.1).

3.11.5.4 DMA bar code/stock number block.

3.11.5.4.1 Positioning and use of bar code/stock number block. The DMA bar code/stock number block is located horizontally on the south work limit, below the copyright note, right justified. The bar code/stock number block is shown as two lines. The top line is the bar code itself. This is a machine readable encoding of the overlay's stock and edition numbers, which are printed in human readable interpretation (HRI) just below it. The bar code serves as an automated identification and inventory control tool for the DMA Combat Support Center. It conforms to the requirements of the DMA Automated Distribution Management System (DADMS) and MIL-STD-600010.

3.11.5.4.2 Minimum dimensions. As per MIL-STD-2402, the minimum sizes for the contents of the bar code/stock number block are:

a. Bar code height - 6.35mm (.25in)
b. Space between bar code and HRI - 0.25mm (.01in)
c. Text "DMA STOCK NO." - 1.8mm (.07in)
d. HRI stock number height - 3.175mm (.125in)
e. Text "ED. NO." - 1.8mm (.07in)
f. HRI edition number height - 3.175mm (.125in)
g. Minimum margin below HRI - 1.524mm (.06in)
h. Quiet zone before and after bar code - 6.35mm (.25in)
i. Space between parts of bar code - 12.7mm (.5in)

3.11.5.4.3 Bar code content. The bar code begins with a start code followed by the stock number, stop code, minimum 12.7mm (0.5in) space, start code, edition number of three digits, ending with a stop code. See Figure 2 for an example bar code block.

Figure 2. Example DMA bar code block for a PTADB vegetation overlay

3.11.5.4.4 DMA stock number. The DMA Stock Number is limited to 15 characters and is composed of four parts:

a. Series Number of the topographic map to which the overlay is keyed. Five-character Series Numbers do not show the fifth character (e.g., 1501S becomes 1501).

b. Letter D denoting non-lithographic product series shall be the fifth character.

c. Sheet Number of topographic map to which overlay is keyed. Sheet numbers for multiple sheet blocks shall use only the first block number (e.g., NQ 3,4 Sheet 12 becomes NQ0312, and NQ 23,24 Sheet 8 becomes NQ2308).

d. Identification code for the specific terrain factor overlay:

T01 Surface Configuration (Slope)
T04 Surface Materials
T07 Surface Drainage
T10 Obstacles
T13 Transportation
T14 Transportation Inset
T16 Transportation (Bridge Information Table)
T17 Transportation (Bridge Information Table) Inset
T19 Transportation (Roads)
T20 Transportation (Roads) Inset
T22 Transportation (Railroads and Airfields)
T23 Transportation (Railroads and Airfields) Inset
T25 Vegetation
T35 Water Resources (Existing Water Supply Facilities)
T36 Water Resources (Ground Water Potential and Characteristics)
T37 Water Resources (Surface Water)

e. Large scale insets are normally produced only over areas of dense transportation detail, such as compacted transportation corridors or crammed urban areas. Except for their individual identification numbers (as above), they use the stock numbers of their smaller scale parent sheet, but are keyed to the 1:50,000 scale topographic base map(s) corresponding to their area of coverage, or, if not available, the next best source with a scale of 1:100,000 or larger. On the PTADB overlay, the area of the larger scale inset overlay will be outlined with a dashed line (Symbol 107) and labelled with the following note in 10 point Univers capital and lower case (C/l) letters:

See (Inset Overlay Title) for (Sheet Name),
(Series Name and Scale), Series (Series Number), Sheet (Sheet Number)

3.11.5.4.5 Further information on bar code/stock number block. For more information about the DMA bar code/stock number block refer to MIL-STD-600010.

3.11.6 Marginal information for Bridge Information Table. The following represents the marginal information portrayed on a Bridge Information Table. Refer to Appendix A, Style Sheets, for the Bridge Information Table format.

3.11.6.1 Title. (As stated below) - 24 pt. capital letters (Caps):

BRIDGE INFORMATION TABLE

3.11.6.2 Country name and scale. - As on base map.

3.11.6.3 Classification. (As needed) - 24 pt. Caps. Other classification markings and or notes (As needed) - 12 pt. Caps. Limited distribution note (as per 3.11.5.2c) - 6 pt. capital and lower case letters (C/l).

3.11.6.4 Sheet name. - As on base map.

3.11.6.5 Sheet number. - As on base map.

3.11.6.6 Publisher's note. (As stated below or as per 3.11.4.3)- 8 pt. C/l or as on base map:

> Prepared and published by ...(agency or military command name)

3.11.6.7 Compilation note. (As stated below)- 8 pt. C/l or as on base map:

> Compiled in (year) from best available and most current source materials. Feature information and positional accuracy on the overlays will take precedence over that on the topographic base.

3.11.6.8 Abbreviations and acronyms. (If necessary, these may be divided into two or more columns across the bottom margin of the Bridge Information Table) - 10 pt. C/l:

NOTES:BCC = Bypass Condition Category
OHC = Overhead Clearance
WTW = Width of Travelled Way
UBC = Underbridge Clearance
U = Unlimited Clearance
R = Restricted Clearance
Y = One Way Traffic
YA = Two Way Traffic

CODES:BCC Codes: E = Easy, D = Difficult, I = Impossible.
Construction Material Codes: C = Concrete, W = Wood,
S = Stone, ST = Steel, M = Stone/Brick/Masonry,
RC = Reinforced Concrete, PC = Prestressed Concrete,
O = Other.

3.11.6.9 User's note. (As stated below) - 6 pt. Caps:

USERS SHOULD REFER CORRECTIONS, ADDITIONS, AND COMMENTS FOR IMPROVING THIS PRODUCT TO: DIRECTOR, DEFENSE MAPPING AGENCY, ATTN: PR, 8613 LEE HIGHWAY, FAIRFAX, VA. 22031-2137

3.11.6.10 DMA bar code/stock number block. As per paragraph 3.11.5.4 above.

3.11.6.11 Word "Accompanies". The word "Accompanies" is inserted in front of Series Number - 10 pt C/l.

3.11.6.12 Series number. - As on base map.

3.11.6.13 PTADB series identifier. Standard PTADB series identifier letters "PTA" following Series Number - Approximately same size as the Series Number on base map.

3.11.6.14 Type size within body of Bridge Information Table. All information and data within the Bridge Information Table is 8 pt. C/l.

3.11.6.15 Copyright note. As per section 3.11.4.6 above.

3.11.7 Multilingual marginal information. Some NATO and other countries have international map standardization agreements or bilateral cooperative mapping arrangements with DMA and the U.S. which dictate the use of multilingual marginal information on materials produced over their countries. When this is the case for PTADB's, the language or languages to be shown, in addition to English, shall be identified in supplementary instructions for the project. As a minimum, the items listed below shall be translated:

a. Marginal information headings (bar scale, adjoining sheets, etc.), notes (publisher's, compilation, etc.), and all sheet identifiers, except sheet name and bar code.

b. All legend items on the individual overlays of the PTADB set.

c. When required, the security classification notes.

3.12 Culture. This section provides specification guidance for the production of the PTADB Transportation Overlay.

3.12.1 General transportation information.

a. The symbols and attributes on this thematic overlay represent selected transportation features over which troops and supplies can be moved during a military operation.

b. Transportation legend categories are shown in Appendix D, Transportation Legend. Symbology for depiction of transportation features are shown in Appendix B, General Symbols and Transportation Symbols.

c. All attribute or measured data for transportation features derived from the imagery will be rounded to the nearest half meter (0.5m). If confirming collateral data is available showing a greater degree of precision, this real data will be used in their proper positions in the various transportation symbols, data information holders, and tables requiring the attributes.

d. If associated properties for an object can not be determined from the various source materials, their related attributes called for in the various transportation feature symbols, data information holders and tables are left blank. These data omissions will be updated later as data becomes available.

3.12.2 Number of transportation thematic overlays. The transportation thematic can be portrayed as one to three overlays:

a. The most common portrayal is to symbolize the roads, railroads, and airfields on one overlay and to have the Bridge Information Table as a second, separate overlay.

b. If the transportation features are extremely dense or the thematic becomes cluttered with excessive coding (for example: along a high density corridor), the roads can be portrayed on one overlay, with railroads and airfields on another overlay, and the Bridge Information Table on a third overlay.

c. If space permits, all the information can be combined onto a single overlay. This is rare, except for coastal sheets that have only a few bridges and large expanses of common open water. In these cases a short Bridge Information Table, tailored to the number of bridges on the overlay and wholly contained within the neatlines, may be placed in the common open water area. If room is available, and there are five or less bridges, the bridge information table may even be placed in the margin of the overlay along with the other marginalia.

3.12.3 Approximate alignment. Sections of linear transportation features which can not be accurately positioned on the overlay are labelled "approximate alignment". Lettering should be read left to right and be above the line segment. This condition usually occurs through heavily wooded or desert areas, or when field reconnaissance discovers new features not shown in the collateral source materials or on the aerial photography. Since tracks are subject to shifts in alignment, they shall not require the "approximate alignment" label.

3.12.4 Road classification. The classification for the road network consists of five categories which generally correspond to those on a 1:250,000 scale topographic map. The number of roads shown is dependent upon whether the area is inside or outside of urban areas.

3.12.4.1 Roads inside urban areas. Inside the urban areas only major through routes which serve as traffic corridors to other places shall be shown. If possible, the depiction of major through routes should avoid existing or potential bottlenecks and hazards such as residential streets, side roads, dead ends, narrow or twisting streets, steep gradients, sharp curves, narrow (< 5m wide) and/or weak (< 60 MLC - non main battle tank supportable) bridges, and roads passing under or through overhead obstructions. (Note that in Figure 3 the urban area is shown for illustrative purposes only. Urban areas are not shown on the Transportation Overlay(s)).

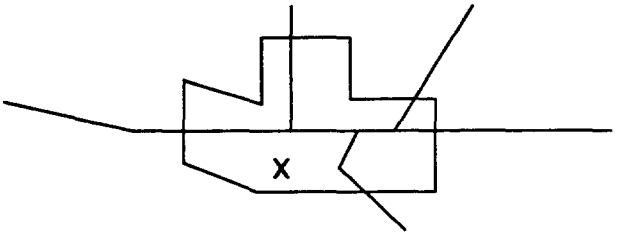


FIGURE 3. Roads in urban areas.

3.12.4.2 Roads outside urban areas.

3.12.4.2.1 Selection of representative road pattern. The number of roads shown outside the urban areas depends on the number, density, and type of roads found in a specific geographic area. If the road network is numerous and/or dense, emphasis is placed on depicting the major (all weather) roads. Conversely, if the road network is sparse, emphasis is also placed on depicting minor or lower level road categories, such as fair weather roads and tracks. The road network shown must cover the entire Transportation Overlay with a representative pattern of the various road classes found in the area, from all weather roads to at least a sampling of the connecting minor roads, if indeed, such do exist. The final road network links together all major transportation routes, transfer points (airfields, ports, railheads, etc.), urban areas, and military facilities.

3.12.4.2.2 Rules for selection of representative road pattern. Roads are normally shown in a hierarchical order of categories from all weather, hard surface, dual lane highways to tracks (see order and definitions in 3.12.4.3 below).

a. All built-up areas, as portrayed on the Vegetation Overlay, should be connected to the main transportation network by at least one road (in order of hierarchical preference) leading to another urban area, transportation feature, or military base. See Figure 4a.

b. No point should be more than 60mm (15,000m ground distance) from a depicted road, if indeed a road does exist that close to the point. Along edges and in corners adjacent product or map sheet areas are checked to determine if a road is within 60mm. See Figure 4b.

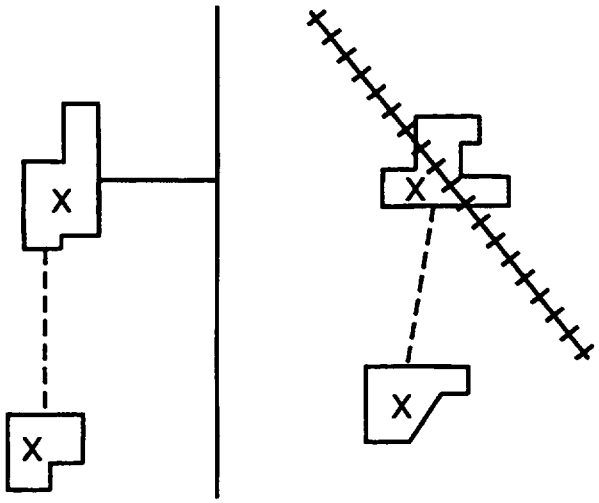
c. Minor roads which run parallel to, or nearly parallel to, or closely approximating major routes at a distance of less than 10mm will not be shown, unless such parallel road sections are necessary to show connections to other roads. See Figure 4c.

d. Outside of the built-up areas, average road density should be at least one road per 3600 square millimeters. Where necessary, intersecting and connecting minor roads should be shown between higher category roads. See Figure 5d.

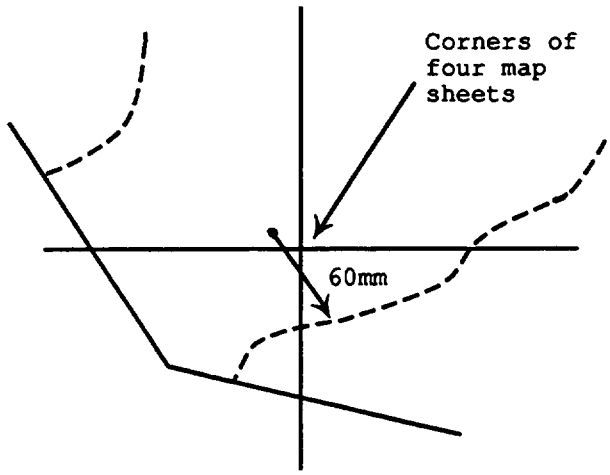
3.12.4.3 Road network categories and classification descriptions.

a. **All Weather, Hard Surface, Dual or Divided Highway/Road** (Symbol 600) - A waterproof surface having adequate drainage and only slightly affected by precipitation or temperature fluctuations (i.e., rain, snow, cold, thaw, and heat). These roads are designed to carry heavy traffic and are passable throughout the year to a volume of traffic never appreciably less than its maximum dry weather capacity. Rarely is this road type closed by weather effects other than snow blockage or floods. The two sides of the dual/divided roads are usually divided from each other by a grass median strip or by a concrete or steel barrier. Road surface/construction materials: concrete, bituminous (asphaltic) concrete (bituminous plant mix), paving brick or stone, or bituminous surface on paving brick or stone.

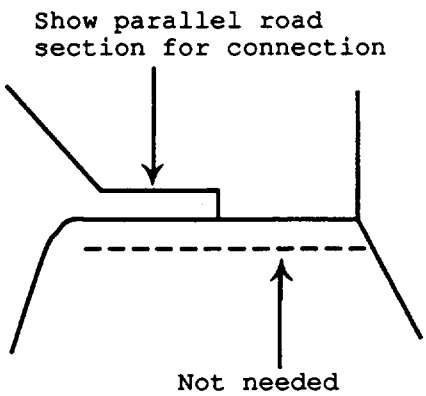
b. **All Weather, Hard Surface Highway/Road** (Symbol 601) - A waterproof surface having adequate drainage and only slightly affected by precipitation or temperature fluctuations. These roads are designed to carry heavy traffic. With



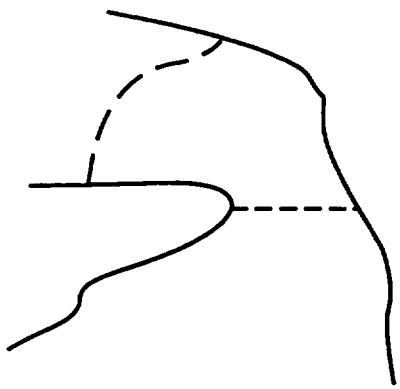
a. Built-up Areas Connected to the Transportation Net.



b. All Points within 60mm of a Road.



c. Treatment of Paralleling Minor Roads.



d. Minor Roads Connecting Major Roads.

FIGURE 4. Additional road rules.

reasonable maintenance they are passable throughout the year to a volume of traffic never appreciably less than its maximum dry weather capacity. Rarely is this road type closed by weather effects other than snow blockage or floods. Road surface/ construction materials: concrete, bituminous (asphaltic) concrete (bituminous plant mix), paving brick or stone, bituminous surface on paving brick or stone, bitumen penetrated macadam, or waterbound macadam with superficial asphalt or tar cover.

c. **All Weather, Loose Surface Road** (symbol 602) - The road surface is not waterproof but graded and drained; it is considerably affected by precipitation and temperature fluctuations. These roads are designed to carry light traffic in all weather, and are kept open in bad weather to a volume of traffic considerably

less than its maximum dry-weather capacity. Traffic may be halted for short periods of time. Heavy traffic use during adverse weather conditions may cause complete collapse. Road surface/construction materials: waterbound macadam, crushed rock or coral, gravel or broken stone and cinders, or oil treated gravel.

d. **Fair Weather, Loose Surface Road** (Symbol 603) - The road surface is not waterproof but it is usually graded. These roads are designed to carry light traffic in dry weather only. They quickly become impassable in adverse weather conditions and cannot be kept open to normal traffic by maintenance short of major construction. Traffic may be brought to a halt for long periods of time. Includes logging, corduroy and firelane roads. Road surface/construction materials: natural or stabilized soil, sand, clay, shell, cinders, disintegrated granite, rock, or other select material.

e. **Track** (Symbol 604) - A roadbed (greater than 1.8 meters wide) that is normally created by wheeled vehicle use (mostly carts) over a natural travelled way. Generally no road grading or construction designs are used in its development. Rarely is this road type maintained; therefore, its alignment is liable to shift position from year to year. Winter roads and caravan routes are included within this classification.

3.12.4.4 Road enhancements. Many roads have surface and feature enhancements such as cuts, fills, culverts, bridges, levelling and clearing, shaping (for drainage), ditches, and additional non-local surface and subgrade materials added (e.g. gravel, shells, oil, cinders, paving, etc.) to facilitate and ease their use. Generally, the best and most numerous enhancements are found on and along the dual lane divided highways and decrease in number, type, degree and quality in hierarchical order down to tracks. For instance, while major highways have enhancements which allow speeds almost to the maximum capabilities of vehicles, tracks have few enhancements, must avoid obstacles (mud holes, large rocks and trees, cliffs, hydrographic features, etc.), are composed of the surficial material over which they lay, rarely have any engineering improvements, follow the slope of the land, have low loading capabilities, and basically are unusable for military movement in bad weather. However, there are exceptions, such as some "scenic" trails and/or tow paths along canals, where tracks have numerous improvements and could be used for rapid movement of personnel and small vehicles during good weather.

3.12.5 Depiction of roads.

3.12.5.1 Road segmentation.

a. On the Transportation thematic a road segment is defined as an individual section of any road symbol which carries the same classification and attribute characteristics throughout its length.

b. Individual road segments are formed at road junctions (intersections), points of symbology change, and road width change symbols (Symbol 606) indicating road characteristic changes. The correct positioning of road width change markers is illustrated in Figure 5.

c. Railroads crossing roads do not create additional road segments; individual road segments are not formed.

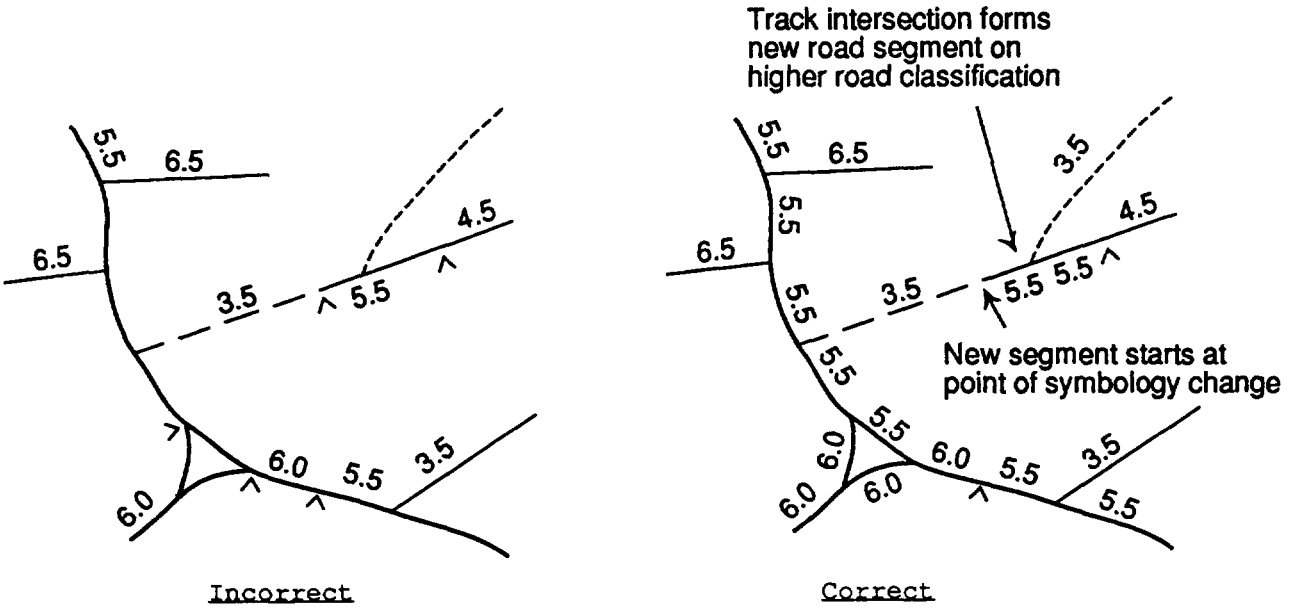


FIGURE 5. Correct positioning of road width change symbols.

d. Point features associated with road segments, such as sharp curves, drop gates, etc., do not affect road segments; individual road segments are not formed.

e. Bridges, tunnels, and other features that roads pass over or through do not affect road segments as long as the road has the same classification and attributes on both sides. If they are different at each end of the feature, the higher road classification, consistent with the design and structural characteristics of the feature, is considered to cross over or through the feature and then change on the other side.

f. A road intersection is defined as an at grade crossing, meeting, or junction of two or more roads. Roads overpassing or underpassing other roads on bridges (or elevated structures) or through tunnels do not affect road segments. Additional road segments are not formed, unless the classification and/or attributes are different on each side of the feature.

3.12.5.2. Short road segments.

a. Short road segments are those less than 10.0mm (2500m ground distance) in length and comprising less than 50 percent of the length between road intersections or terminus points, that differ in classification or width from the rest of the road. While they are not depicted separately, they can have important implications for military operations and planning.

b. Short road segments, as defined in paragraph a. above, narrower than 4 meters on the ground, shall be annotated with an associated constriction symbol (Symbol 607), as described in 3.12.5.4.

c. Where a stretch of road or road section 10mm (2500m ground distance) or less long contains two or more short segments, the lowest classification and

width of the various segments is applied to the entire stretch. New segments will be formed as necessary.

3.12.5.3 **Roadway width** (decimal numeric value).

a. The roadway width is the total width of road surface available for vehicular travel, commonly referred to as the minimum width of the travelled way. This measurement does **not** include shoulder or road median measurements. Each road segment is assigned a corresponding roadway width measurement in meters. The roadway width measurement will always be given as a decimal number.

b. The preferred positioning of the numeric value is parallel to, above, and near the center of the road segment, reading left to right. Substantially long road segments will be labelled with more than one roadway width measurement. For each 150mm or part there of, one width measurement shall be given. On long road segments, width measurements shall be evenly spaced between intersections. However, the numeric values on long road segments may be moved up to 30mm from their calculated positions to more horizontal locations. Arrowheaded leader lines are used if the road width values must be offset. If the value is offset it should be placed as close to the road as possible and parallel to the center tangent of the southern neatline.

c. **Roadway width change** symbols (Symbol 606) are used to indicate the point where a roadway width changes without either a classification (symbology) change or an intersection to break the segments. Preferred positioning is below the road, but in congested areas, the road width change symbol may be inverted and shown above the road.

3.12.5.4 **Road constriction** (Symbol 607).

a. Any point along a road segment where the road width narrows to less than 4 meters ground distance is considered to be a road constriction. This may occur at any point along a road segment.

(1) If the constriction is less than 2mm (500m ground distance) in length, it is depicted with the triangles of the associated road constriction symbol (Symbol 607) opposing each other.

(2) If the constriction is between 2mm (500m ground distance) and less than 10mm (2500m ground distance), it is depicted with the triangles of the constriction symbol (Symbol 607) offset to the beginning and end of the section from each other.

b. The preferred placement of the road constriction width measurement is adjacent to the lower right side of lowest triangle and parallel to the center tangent of the southern neatline.

c. Constrictions are not shown on tracks.

3.12.5.5 **Steep grade** (also referred to as road gradient) (Symbol 609).

a. Steep gradients, or percent (%) slope, are depicted on the overlay when they exceed 7 percent along any given road travelled way, except tracks. The percent slope is the ratio of change in elevation (vertical distance) to horizontal

ground distance multiplied by 100. The gradient measurement is determined from the elevation of the road or at each end of the steep grade (usually the same as the contour lines on the topographic base map). However, steep road gradients must also take into consideration changes from the topographic ground level caused by cuts and fills.

b. The double arrowhead portion of the gradient symbol shall always be parallel to the road and point in the uphill direction.

c. Steep grades can be symbolized in one of three ways depending on their length, as shown in Appendix B, Symbol 609.

(1) If less than 2mm (500 meter ground distance) long, it will be considered a point feature with a single leaderline extending from between the two triangles to the feature's location on the Transportation Overlay.

(2) If between 2mm (500 meter ground distance) and 4.3mm (1075 meter ground distance) long, it will be considered a linear feature with a leader line from each end of the symbol pointing to its corresponding position on the road.

(3) If the length of the steep gradient is longer than 4.3mm (1075 meters ground distance), a tail (line portion of the symbol) shall be used to approximate the length and alignment of that portion of the steep grade not covered by the arrowheads.

d. Steep grades are not shown on tracks.

3.12.5.6 **Sharp curves** (Symbol 610).

a. Any continuous section of a road with a radius of curvature of equal to or less than 30 meters shall be shown as a sharp curve, regardless of the presence or absence of other intersecting road segments. Angles formed as the result of the intersection of two or more roads of any classification are not considered as sharp curves.

b. Preferred positioning of the sharp curve symbol is on the convex side of the curve, parallel to the center tangent of the southern neatline, with a leader line extending from one corner of the symbol to the location of the sharp curve along the road segment, as illustrated in Figure 6a.

c. Sharp curves do not define new road segments.

d. Where multiple sharp curves exist within 5mm (1250m ground distance) of each other, the following aggregation symbology shall be used:

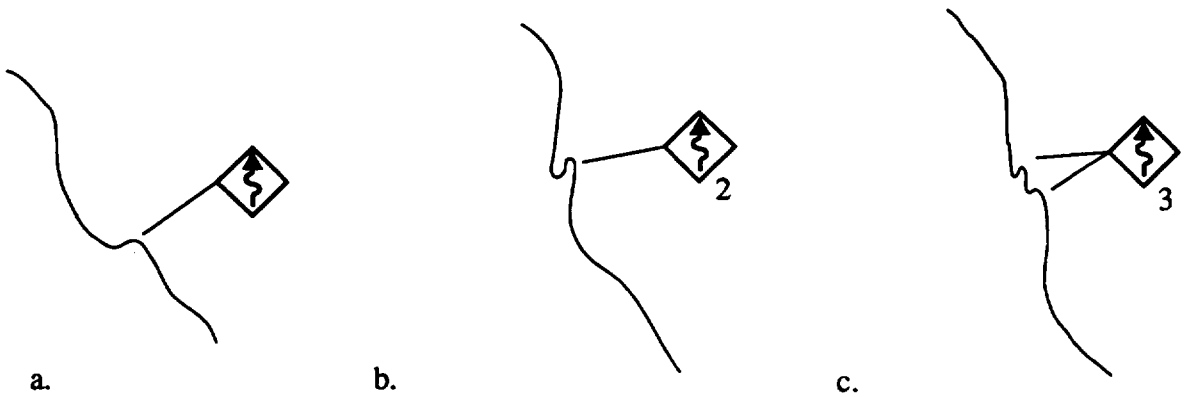
(1) If two or more consecutive sharp curves occur along a road section within 2mm (500m ground distance) of each other and there are no other sharp curves within 5mm (1250m ground distance) of these, a numeric value, indicating the number of sharp curves is placed on the right side of the lower corner of the symbol. A single leader line is used. See Figure 6b.

(2) If two or more (a series of) consecutive sharp curves occur along a road section with none of them more than 5mm (1250m ground distance) apart, a double set of leader lines from one corner of the diamond symbol will be used to

indicate the section with the aggregated curves. See Figure 6c. A numeric value indicating the number of curves is used the same way as in the paragraph above.

e. If multiple sharp curves are more than 5mm (1250m ground distance) apart separate individual and/or aggregate symbols must be used.

f. Sharp curves are not shown on tracks.



a. Single Sharp Curve

b. Multiple Sharp Curves within 500m of each other.

c. Multiple Sharp Curves within 1250m of each other.

FIGURE 6. Depiction of sharp curves.

3.12.5.7 **On-route ford** (Symbol 611).

a. A ford is a shallow location in a water body (e.g., stream or open water area) where the physical characteristics of the current, bottom, and approaches permit the crossing of personnel and/or vehicles.

b. All fords along roads portrayed on the Transportation Overlay shall be shown. Fords along routes not selected as part of the portrayed transportation network shall be shown on the Surface Drainage Overlay as off-route fords (see 3.13.5.1.2).

c. Fords crossing intermittent or ephemeral streams shall be shown. These streams normally flow only briefly, but sometimes violently as upstream precipitation causes a torrent of rapidly rising and subsiding water to race down the stream channel. On projects where this occurs the following warning note will be added to the legend:

"Roads through intermittent or ephemeral streams are subject to flash flooding."

d. Roads running along the beds of intermittent or ephemeral streams shall be shown as usual.

e. The symbol for fords is the word "Ford" placed either adjacent to the fording site and parallel to the south neatline or, if longer than 6mm (1500m ground distance), parallel to a dashed line indicating the route of the ford through the water body. Where two or more on-route fords occur close together with none of

them more than 5mm (1250m gd) apart, a numeric value and double set of leader lines indicating their number and location may be used (similar to sharp curves).

3.12.6 Classification and depiction of railroads.

3.12.6.1 Track structure and classification. All railroad tracks are classified and symbolized as to track gauge, number of tracks, and electrification status. Using these criteria, 12 operational track types can be classified and symbolized, as shown in Appendix B and summarized in Appendix D.

3.12.6.1.1 Track gauge.

a. Track gauge is the perpendicular distance between the inside of the rails from one inner railhead face to the other measured at a point 5/8 inch below the top of the rail. Track gauges are categorized and depicted on the Transportation Overlay as either narrow, normal, or broad. Normal track gauge is defined as the gauge utilized by the majority of mainline railroad tracks found in a particular country. Any gauge which is greater than the normal gauge is defined as broad gauge. Broad gauge is depicted on the overlay by placing the term "broad" parallel to the railroad track alignment (Symbol 617). Narrow gauge track (Symbol 616) is defined as any track smaller than the normal track.

b. Track gauge is country specific. For example, standard gauge, which is defined as 4 feet 8 1/2 inches between the rails, is the normal gauge in the United States, while in the USSR the normal gauge is 5 feet between the rails. Thus, in the USSR standard gauge railroads would be classified as narrow and in the United States the 5 foot gauge would be classified as broad. Therefore, only within country comparisons and classifications of track gauge are made.

c. If known, the actual sizes of the normal, broad, and narrow gauges will be stated in a legend note.

3.12.6.1.2 Number of tracks. A distinction is shown between single track railroads and multiple track railroads. A single track railroad has one set of tracks on the railway bed; whereas a multiple track railroad has two or more sets of parallel tracks on the same railway bed. Railroad yards, sidings, spurs, and passing tracks are not considered in determining the number of tracks. Any gauge railroad may be multiple tracked.

3.12.6.1.3 **Electrification** (symbol 618).

a. An electrified railroad receives electrical power for engine locomotion relayed through either an electrified wire suspended on overhead poles and pantographs or an electrified third rail along side the track.

b. Any gauge railroad may be electrified.

c. Electrified railroads are symbolized using two dots placed over every other cross tick or set of cross ticks in each track symbol (Symbol 618).

3.12.6.2 Track usage categories, classification and depiction.

3.12.6.2.1 **Main line tracks** (Symbols 614 - 617, with or without electrification). Main line tracks form the major linkage of the railway network

between built-up areas, transportation transfer points, and military facilities. To be considered as a main line, the track or set of multiple tracks must extend for a distance of at least 20mm (5000m ground distance).

3.12.6.2.2 **Passing tracks** (Symbol 621).

a. A passing track is a section of track that diverges from and runs parallel to the main track with switching connections at both ends. Passing tracks allow for the meeting and passage of trains along a single (usually) main track. Passing tracks generally have no buildings or loading/storage facilities associated with them.

b. The length of a passing track is designed to handle the temporary pullover of full length trains. Therefore, a passing track is not shown unless its length is greater than or equal to 1.12mm (280m ground distance). The ground length in meters immediately follows the offset "PT" letters.

c. As many railroads have a dense network of tracks fanning out into small passing tracks, sidings, and yards, full portrayal of these features would serve only to clutter the Transportation Overlay. Therefore, in order to maintain legibility of features on this overlay, in areas of dense detail, multiple parallel passing tracks coming off the same mainline tracks(s) within 2mm (500m ground distance) of each other may be combined into the same symbol. In this case, the cumulative track length of the combined passing tracks shall follow the "PT" letters.

d. Passing tracks (single or combined) with a physical size of less than 10mm (2500m ground distance) long are shown as point features, with a leader line indicating their location along the main track. Those greater than or equal to 10mm (2500m ground distance) long are shown as linear features.

3.12.6.2.3 **Siding** (Symbol 622) and spur tracks.

a. Siding tracks are auxiliary tracks adjacent to the main track or spur and connected on one (dead-end siding) or both ends (double-ended siding). A siding is used for and generally has facilities for loading, unloading, or storage. Double-ended sidings without other facilities are treated and depicted on the Transportation Overlay as passing tracks, if they closely parallel the main track and their length is greater than or equal to 1.12mm (280m ground distance). Sidings are not shown unless their length is greater than or equal to 1.12mm (280m ground distance). The ground length in meters immediately follows the offset "ST" letters.

b. For the same reasons cited above, in areas of dense detail, multiple sidings coming off the same mainline track(s) within 2mm (500m ground distance) of each other may be combined into a single symbol. In this case, the cumulative track length of the combined sidings shall follow the "ST" letters.

c. Sidings (single or combined) with a physical size of less than 10mm (2500m ground distance) long are shown as point features, with a leader line indicating their location along the main tracks. Those greater than or equal to 10mm (2500m ground distance) long are shown as linear features.

d. Spur tracks are tracks which diverge from the main or branch line, over which no regular train service is maintained. Loading, unloading, maintenance,

storage and classification are not usually performed on a spur. They usually serve a siding or series of sidings some distance from the main track. Spur tracks between 1.12mm and 20mm (280m - 5000m ground distance) are depicted and treated as siding tracks on the Transportation Overlay. Spur tracks greater than 20mm (5000m ground distance) are treated as main line tracks.

3.12.6.2.4 **Railroad yards** (Symbol 623).

a. Railroad yards are a system of tracks within defined limits; they usually serve as the convergence point of two or more rail lines, but can occur along a single line. Associated features may include many rail lines, storage and handling facilities, passenger terminals, control towers, and/or roundhouses and marshalling and maintenance activities.

b. All railroad yards with a minimum separation of 2mm (500m ground distance) or more between consecutive yards are shown as separate features. On the transportation overlay, the outer tracks defining the boundary of the yard, any main tracks passing through the yard, and a representative pattern of interior tracks (maintaining a separation of 0.5mm between them) will be depicted.

c. The cumulative track length within the rail yard is measured. Only railroad yards with cumulative track lengths equal to or greater than 1.12mm (280m ground distance) are shown. If the main line runs adjacent or juxtaposed to or through the yard feature, it is not included as part of the yard's overall cumulative track length measurement. This ground length in meters immediately follows the offset letter "Y".

d. Railroad yards less than 10mm (2500m ground distance) long (physical size of feature, not cumulative track length) are shown as point features, with a leader line indicating their position along the main track(s). Those greater than or equal to 10mm (2500m ground distance) long, but less than 2mm (500m ground distance) wide, are shown as linear features. Those greater than or equal to 10mm (2500m ground distance), and greater than or equal to 2mm (500m ground distance) wide, are shown as areal features.

3.12.6.2.5 **Dismantled railroad** (Symbol 620). A dismantled railroad is a track system which is no longer in use as a consequence of the tracks and/or bridges being removed. This is the only railroad condition, apart from operational, which has its own symbol and thus does not need to be labelled.

3.12.6.2.6 Railroad under construction. A railroad under construction is one for which construction on the tracks and related features is actually underway. The under construction symbol (Symbol 103) is used the same way for all transportation features including railroads. (See 3.12.14.)

3.12.6.2.7 **Point of change** (Symbol 102). Point of change symbols are used to indicate points where track gauge, condition, or construction status changes, without a corresponding change in track line symbology.

3.12.7 Depiction of **bridges** (Symbols 626, 627, and 628).

3.12.7.1 General bridge definition. A bridge is a structure that carries a railroad or road over a depression, obstacle, drainage, or another transportation feature. A bridge that is completely supported by its two abutments (end supports)

is called a single-span bridge. A bridge that has one or more intermediate supports between the abutments is a multispan bridge.

3.12.7.2 Treatment of bridges on the transportation thematic. All bridges located along the portrayed transportation network (roads and railroads) that can be identified and measured on the imagery or derived from current collateral sources are included on the Transportation Overlay(s). Bridges less than or equal to 0.072mm (18m ground distance) are treated as point features and indicated with a small road or railroad bridge marker (Symbols 641 and 642, respectively), as appropriate. Bridges greater than 0.072mm (18m ground distance), but less than 2mm (500m ground distance) in length shall also be treated as point features and indicated, as appropriate, with either a road or railroad bridge information holder (Symbols 627 and 628, respectively). Whereas bridges greater than or equal to 2mm (500m ground distance) shall be treated as linear features and plotted to scale using a regular bridge symbol (Symbol 626), with a minimum size width, if necessary, and a true to scale length. Wider bridges will be plotted to scale in both length and width.

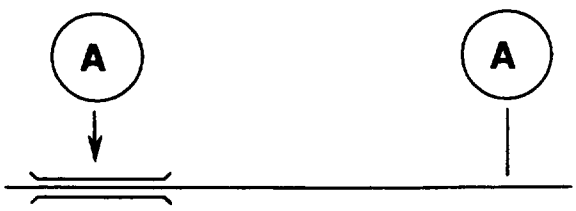
3.12.7.3 Bridge information holders.

a. While all bridges greater than or equal to 2mm (500m ground distance) use the same bridge symbol (Symbol 626), the feature attributes shown in their data information holders are different. All associated attributes measured from the imagery shall be shown, where appropriate, in the bridge information holders to the nearest half meter (0.5m). More precise measurements from field check (on-the-ground) measurements or collateral sources shall be shown, as appropriate, both in the bridge information holders and/or in the Bridge Information Table, as described in 3.12.8.

b. The characteristics and attributes covered in the bridge information holders are:

(1) Depicted in accordance with the Transportation Legend, Appendix D, Bridge Data,
(2) Symbolized as shown in Appendix B (Symbols 627 and 628), and
(3) Described in their corresponding paragraphs in the Bridge Information Table section, 3.12.8.

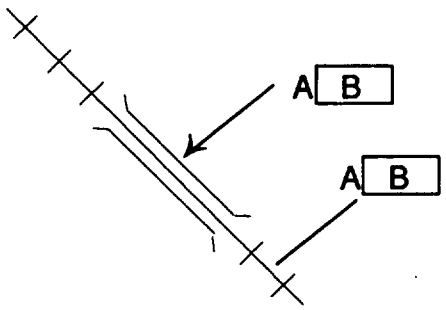
3.12.7.3.1 **Road bridge information holder** (Symbol 627). The symbol indicating the attribute placement for the Bridge Number in a small circle is illustrated in Figure 7. This bridge number correlates to that in the Bridge Information Table, which lists the known characteristics and attribute data about this road bridge.



A. Bridge Number

FIGURE 7. Attribute placement in road bridge information holder.

3.12.7.3.2 **Railroad bridge information holder** (Symbol 628). As illustrated in Figure 8, this symbol is a rectangle displaying the following two railroad bridge attributes: Overhead Clearance and Overall Bridge Length.



A. Overhead Clearance
B. Overall Bridge Length

FIGURE 8. Attribute placement in railroad bridge information holder.

3.12.7.4 Adjustments to bridge symbology in cartographically crowded areas. In congested areas or places where it is not cartographically possible to position the full bridge symbol without displacing other transportation features, the following adjustments (as shown in Figure 9) to the bridge symbology and/or its depiction will be made:

a. Bridge features in uncongested areas shall be plotted to scale or shown with their minimum size symbol (depends on width of the through passing symbol), with no adjustment in their symbology, see Figure 9a.

b. Bridge wingticks on the congested side may be omitted, as illustrated in Figure 9b.

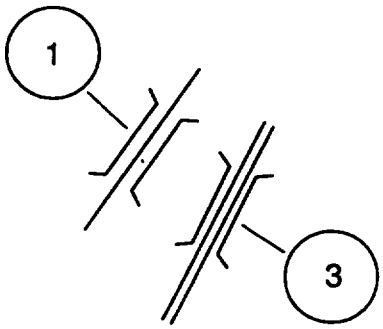
c. Where twin or more bridges are closely parallel to each other, a single line without wing ticks may be used to represent the adjacent bridge sides between them. See Figure 9c.

d. If the gap width between bridges does not allow even a single line for the bridge sides (0.25mm gap between bridge sides and transportation feature[s] is not possible), a single bridge symbol will represent all of the bridges. In this case, in order to indicate twin bridges, separate bridge information holders shall be used on each side of the bridge symbol. See Figure 9d(1). Closely spaced, parallel, multiple bridges along any transportation corridor (road and/or railroad, regardless of whether the road itself is a divided highway) are each given a separate bridge number. In this case, a single leader line with each of the bridge information holders shown in order from the northern most downward to the southern most (or west to east, if vertical) may be used. See Figure 9d(2).

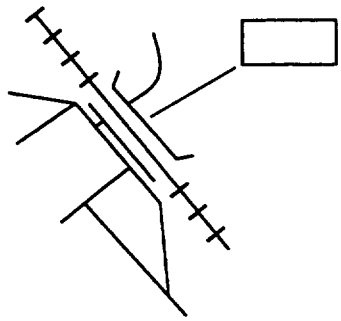
e. If cartographically necessary, an entire bridge symbol may be omitted. However, in congested areas, if the feature going under the bridge is also on the thematic overlay, it will be gapped with a 0.25mm space on each side of the overpassing feature to maintain the integrity of the bridging relationship. A bridge information holder leader line shall point to the bridge's location. See Figure 9e.

f. Where consecutive bridges along a transportation route are so closely spaced that the bridge symbol wingticks will overlap, the wingticks maybe omitted. See Figure 9f.

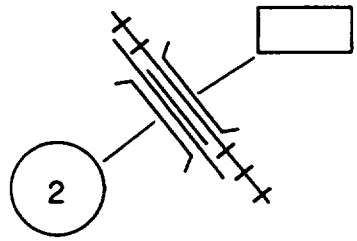
g. If consecutive bridges are within 2mm (500 meters ground distance) of each other, a single bridge symbol with separate bridge information holders pointing to their separate midpoints will be used. See Figure 9g.



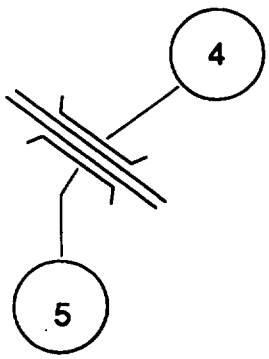
a. Regular Bridge Symbols.



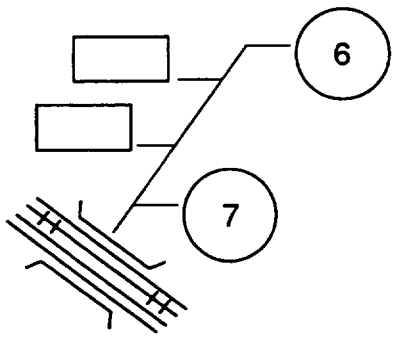
b. Omission of Wingticks on Congested Side.



c. Single Line Representing Two Bridge Sides.

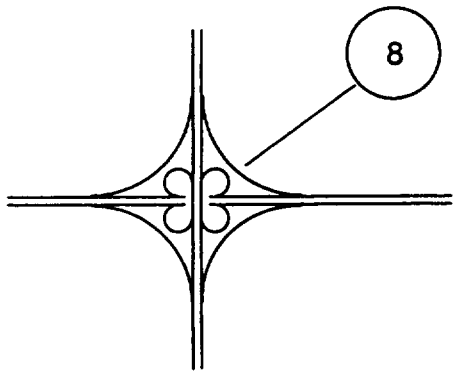


(1). Twin Bridges on Narrowly Spaced Dual Highway.

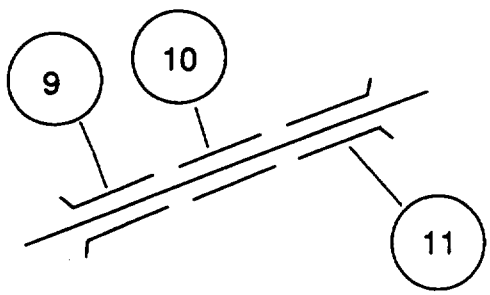


(2). Closely Spaced Multiple Parallel Bridges.

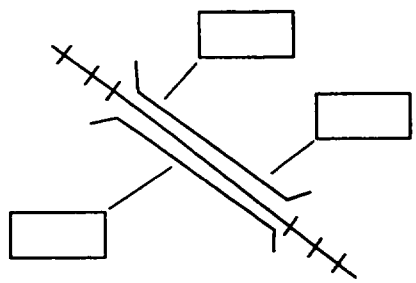
d. Closely Spaced Parallel Bridges.



e. Congested Area with Bridge Symbol No. 8 Omitted.



f. Clipped Wingtips on Closely Spaced Bridges.



g. Bridges within 500 meters of each other

FIGURE 9. Depiction of bridges in congested areas.

3.12.8 Bridge Information Table

3.12.8.1 Use of the Bridge Information Table.

a. The Bridge Information Table (BIT, Appendix A) is a systematic arrangement of road bridge data in sequential number order. A BIT is required whenever road bridges are identified on a corresponding Transportation Overlay.

b. The BIT is normally produced as a separate overlay which supplements the bridge data shown on the Transportation Overlay(s). It carries the same bridge numbers, plus additional data, as the road bridge information holders. Data measured from the imagery is recorded to the nearest half meter (0.5m) increment; however, if more precise data from ground truth measurements or collateral sources are available, they will be shown in the BIT.

c. If space is available (usually large common open water areas - which are blank on the Transportation Overlay(s)), the BIT may be placed directly on the Transportation Overlay. Generally the BIT is placed within the neatline; however if it is small enough (five or less bridges), it may be placed outside the neatline in the margin in close proximity to the Transportation Legend. In either case, no part of the BIT may be positioned across the neatline.

d. If the Transportation thematic is produced with separate overlays for roads and railroads (with airfields) and space is available, the BIT may be placed individually on the Transportation (Roads) overlay. The rules for placement on the individual overlays are the same as specified in paragraphs b. and c. above.

e. If no road bridges are found on the Transportation Overlay, a Bridge Information Table will not be produced. A special note shall be added to the Transportation Overlay(s) to alert the user that such a table does not exist for this set of PTADB overlays. The special note will read as follows:

NOTE: Since no road bridges were identified along the road network shown on this sheet, a Bridge Information Table has **not** been produced.

3.12.8.2 Bridge Information Table attributes. The Bridge Information Table (BIT) will include the following road bridge attributes and characteristics.

3.12.8.2.1 Bridge number.

a. All road bridges on the Transportation Overlay are given a unique bridge number. Numbering is consecutive and begins with road bridge number one in the northwest grid square of the UTM reference system and proceeds from left to right to the neatline on the east side of the overlay. The numbering continues consecutively in the same way starting back at the west neatline of the next line of UTM grid squares below those previously completed, as shown in Figure 10.

b. These bridge numbers will be placed inside their respective circles, and in the Transportation Legend (Appendix D) correspond to the letter "A" under Road Bridge Information Holder.

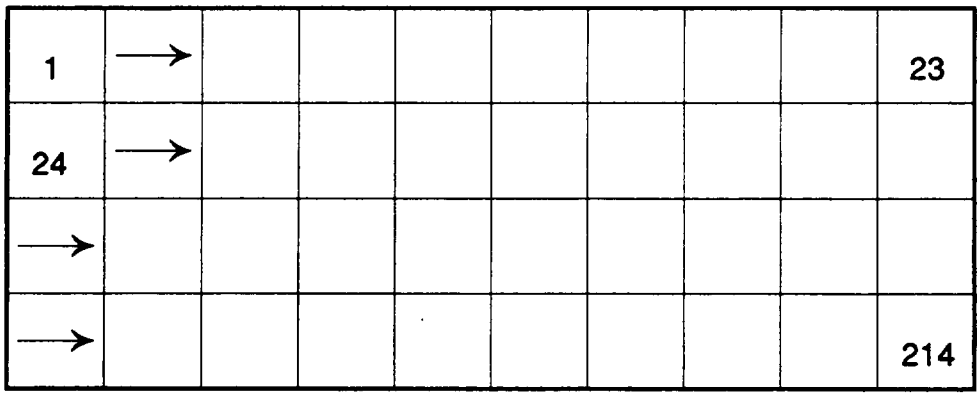


FIGURE 10. Example of the bridge numbering system.

3.12.8.2.2 Universal Transverse Mercator (UTM) reference. The UTM reference is a six digit alphanumeric coordinate designation that locates the bridge site within a specific 1,000 meter grid square. The coordinates are obtained from a topographic map by starting in the south-west corner and moving to the right to read the Easting coordinate and then moving up to read the Northing coordinate (Army rule is to read coordinates "Right-up"). Each of the coordinates are recorded starting with the 100,000 meter UTM square identification letters, then the 10,000 meter number, and ending with the 1,000 meter number. For example, a recording of AB1234 would equal a UTM coordinate reading of the AB 100,000 meter square at the 12,000 meter Easting and 34,000 meter Northing within it on the interior of the map sheet. Note that on 1:250,000 scale topographic maps the 10,000 meter numbers (the 11 and 3 in this example) are enlarged for easy reference, while the 1 million and 100,000 meter numbers in the margin are in small print and are not needed for reference inside the map sheet. The 1,000 meter numbers (the 3 and 4 in this case) are read from a 1:250,000 grid scale.

3.12.8.2.3 Military load classification.

a. The military load classification (MLC) represents the carrying capacity of a bridge measured in short tons. Military load classification values are calculated in part from the stringers under the bridges; therefore, they will be taken from field calculated or collateral source information only. When MLC data is not available, the data entry space shall be left blank.

b. If available, the MLC will be listed for one and two way traffic for both wheeled and tracked vehicles. If the MLC is not known, but a civilian load classification is available, the latter will be shown in the BIT within parentheses.

3.12.8.2.4 Width of travelled way (Used by road bridges only).

a. For road bridges this is referred to as the roadway width and is measured horizontally from the inner side of one curb or guardrail to the other. This clear distance measurement is made perpendicular to the bridge length centerline. See Figure 11.

b. When the roadway of a bridge has a road divider or barrier, usually of concrete or metal construction, the travelled way width measurement of the bridge shall not include the width of the barrier. See Figure 12.

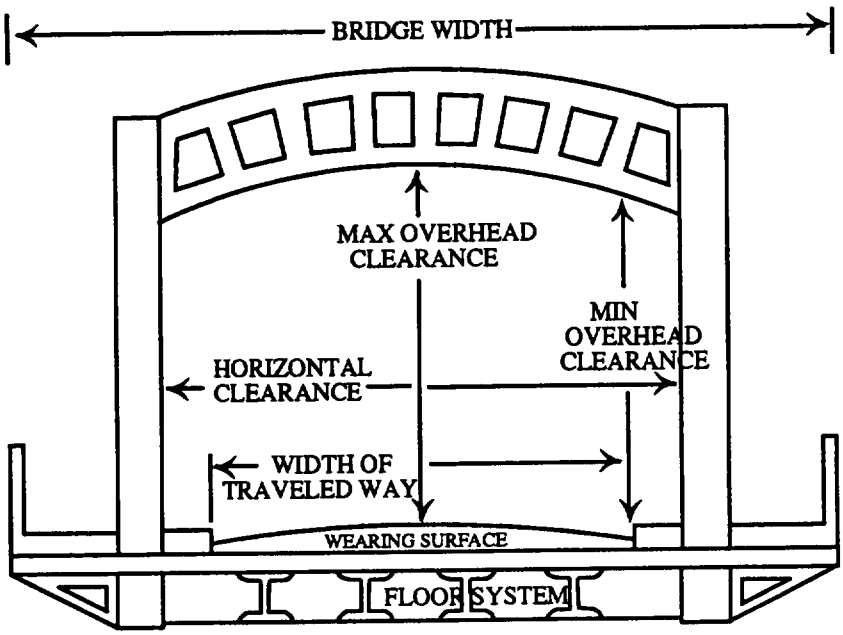


FIGURE 11. Bridge cross section nomenclature.

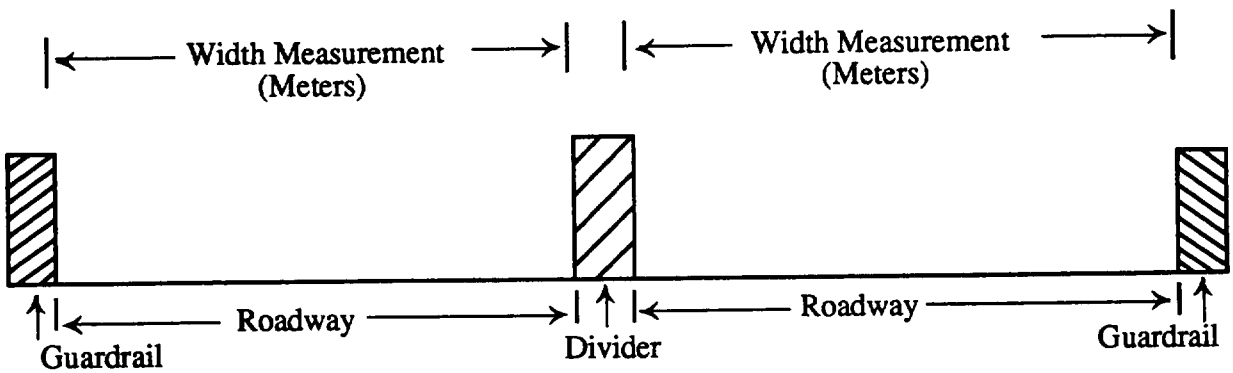


FIGURE 12. Bridges with dividers or barriers.

c. If the roadways on a road bridge are separated with a road divider or barrier, they will be recorded in the Bridge Information Table as illustrated in Figure 13. For unequally divided roadways on bridges, record the width of the northern most (or west, if vertical) lane(s) first, with a coma separating it from the width of the other lane(s).

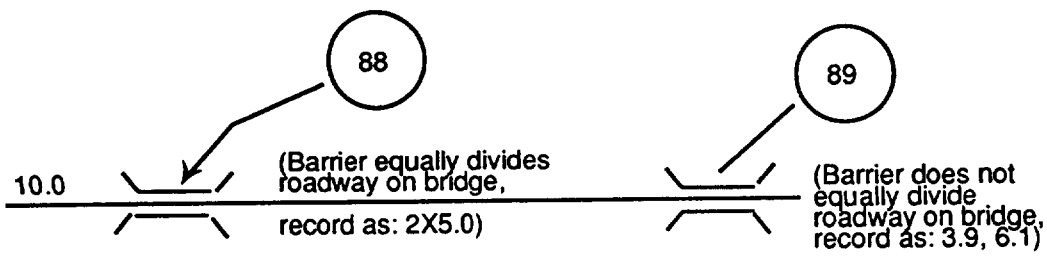


FIGURE 13. Bridge width measurement.

3.12.8.2.5 Overhead clearance.

a. Certain bridge types (through truss, suspension, cantilever, through arch and others) usually have some manner of overhead support which may cause an obstruction to certain military equipment and vehicles. Overhead clearance is defined as the least distance (shown in meters) between the transport surface and any obstruction vertically above it. If there is no obstruction, the letter (U) for unlimited clearance is used. If an overhead obstruction exists, but the distance is unknown, the letter "R" for restricted clearance shall be used.

b. The transport surface is defined as the travelled way surface for road bridges and the trackbed or track trestle supports for railroad bridges.

c. In the Transportation Legend, Appendix D, the overhead clearance corresponds to the letter "A" under the Railroad Bridge Data. (See 3.12.7.3.2).

3.12.8.2.6 Number of spans. This is the total number of spans in a bridge. A span is that section of a bridge which (1) reaches from the intersection with the abutment on one side to the abutment on the other side (a single span bridge), (2) reaches from the abutment on one side to the center of an intermediate support, or (3) reaches from the center of one intermediate support to another.

3.12.8.2.7 Span construction material. This is a letter code listing of the known predominant construction material of the individual spans. If some spans are known to be predominantly of one material and other spans another material, both materials of span construction will be listed. See Figure 14, Sample Span Information Section of Bridge Information Table. The eight basic span construction materials recognized and their code letters are listed below:

	SPANS			
Bridge Number	Construc. Material	Lengths (m)	No. of Spans	Comments
5	C ST	6x29, 2x20 5x25, 1x8	14	(All span lengths known)
6	W	3x50 (49.5)	5	(Two span lengths unknown)
7		30, 18		(Total number of spans unknown)
8				(Nothing known about any spans)
9	C	2x(10.5),(15.6)	15	(Only three bearing to bearing span lengths known)

FIGURE 14. Sample span information section of bridge information table.

Construction material of span		BIT code letter
a.	Concrete	(C)
b.	Prestressed Concrete	(PC)
c.	Reinforced Concrete	(RC)

d.	Steel	(ST)
e.	Stone	(S)
f.	Stone/Masonry/Brick	(M)
g.	Wood	(W)
h.	Other	(O)

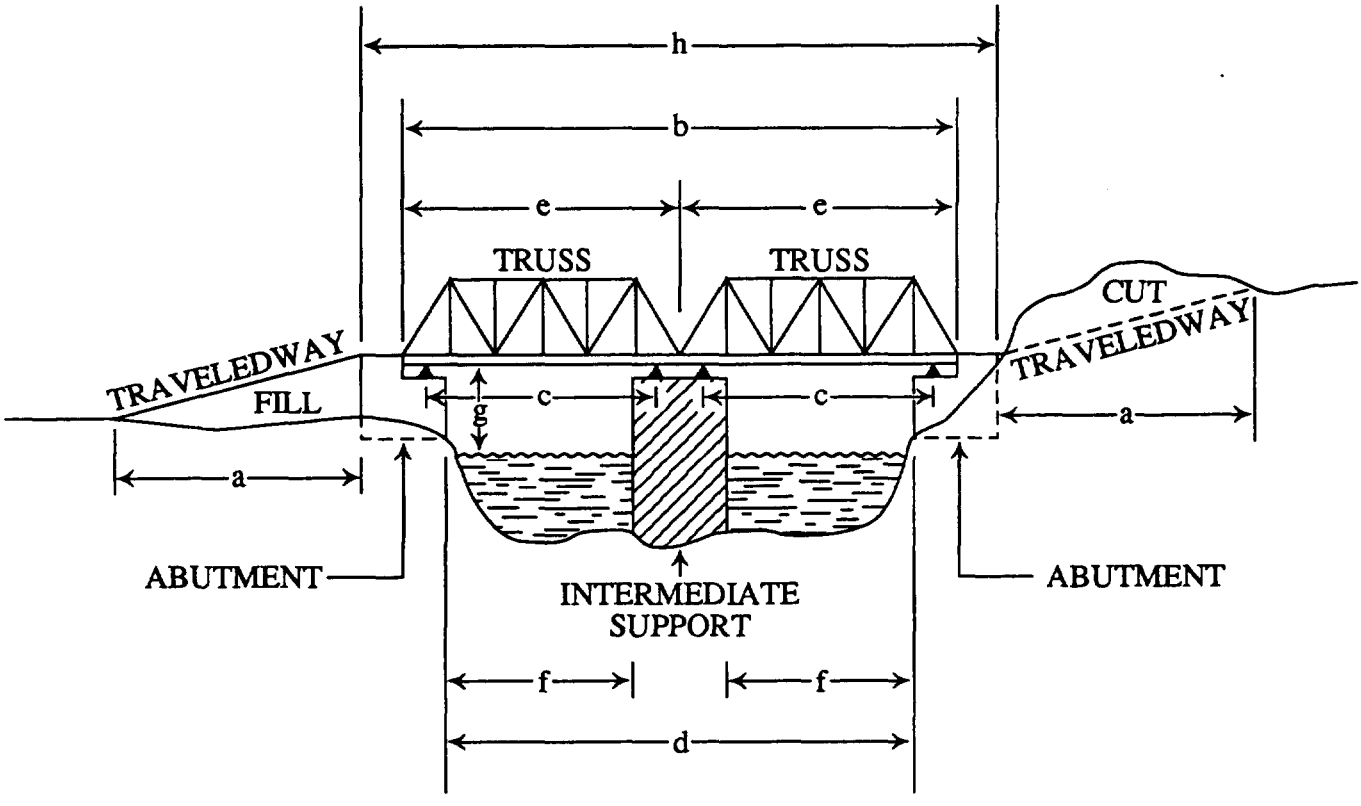
3.12.8.2.8. Span length (number of spans of specific lengths).

a. Span length is the bridge centerline distance from the intersection point of the load carrying spanning members or surface with end plate(s) at the end wall/dam on the abutment at one end to: (see Figures 15 and 16)

(1) The other end point - for single span bridges,

(2) The center of the first adjacent intermediate support - for the end spans of a multi-span bridge, or

(3) The center of one support to the center of the next - for the inner spans of a multi-span bridge.



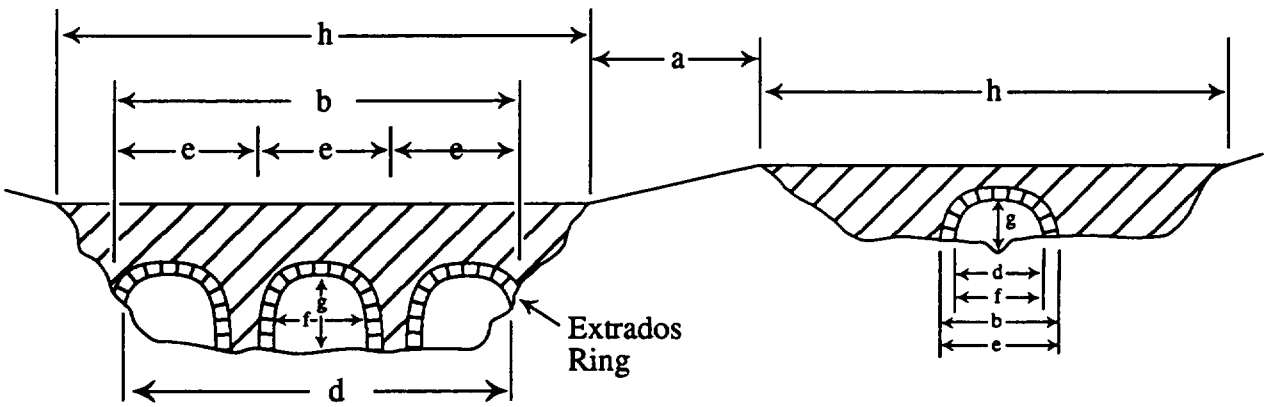
a = Approach
b = Overall Bridge Length
c = Span length, Bearing to Bearing
d = Length Abutment to Abutment
e = Span Length
f = Under Bridge Horizontal Clearance
g = Under Bridge Clearance
h = Overall Length of Built Structure

FIGURE 15. Bridge side view nomenclature.

b. This is the length of material which must be replaced if a span is removed. The sum of the span lengths equals the overall bridge length. See item "e" (span length) in Figure 15, Bridge Side View Nomenclature. This span length is the one most often generated from the sources available to produce the PTADB.

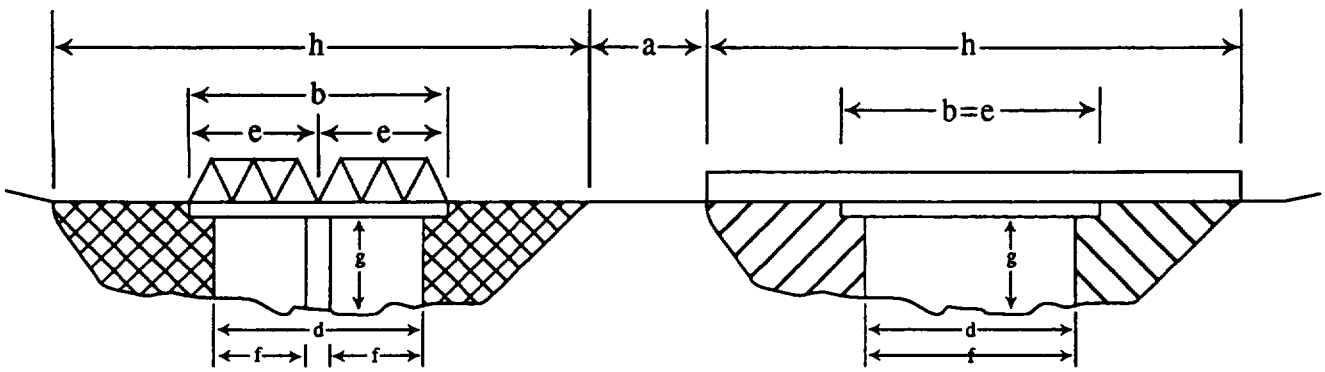
c. Some engineers prefer and report the bearing to bearing length of spans. This figure is used to calculate the military load classification. It is not usually available in the collateral sources and can only be collected by field check methods. If known, it shall be shown in parentheses immediately following the span length measurement or in parentheses by itself, if the span length measurement is not known. This length corresponds to item "c" (span length, bearing to bearing) in Figure 15, Bridge Side View Nomenclature.

d. For arch bridges, the span length includes the outer edges of any extrados ring(s). See Figure 16.



a. Closed Spandrel, Arch Bridge

b. Base Filled, Closed Spandrel, Single Arch Bridge.



c. Base Filled, Double Span

d. Base Filled, Single Span Beam/Girder/Slab Bridge with Concrete Guardrail/Sides

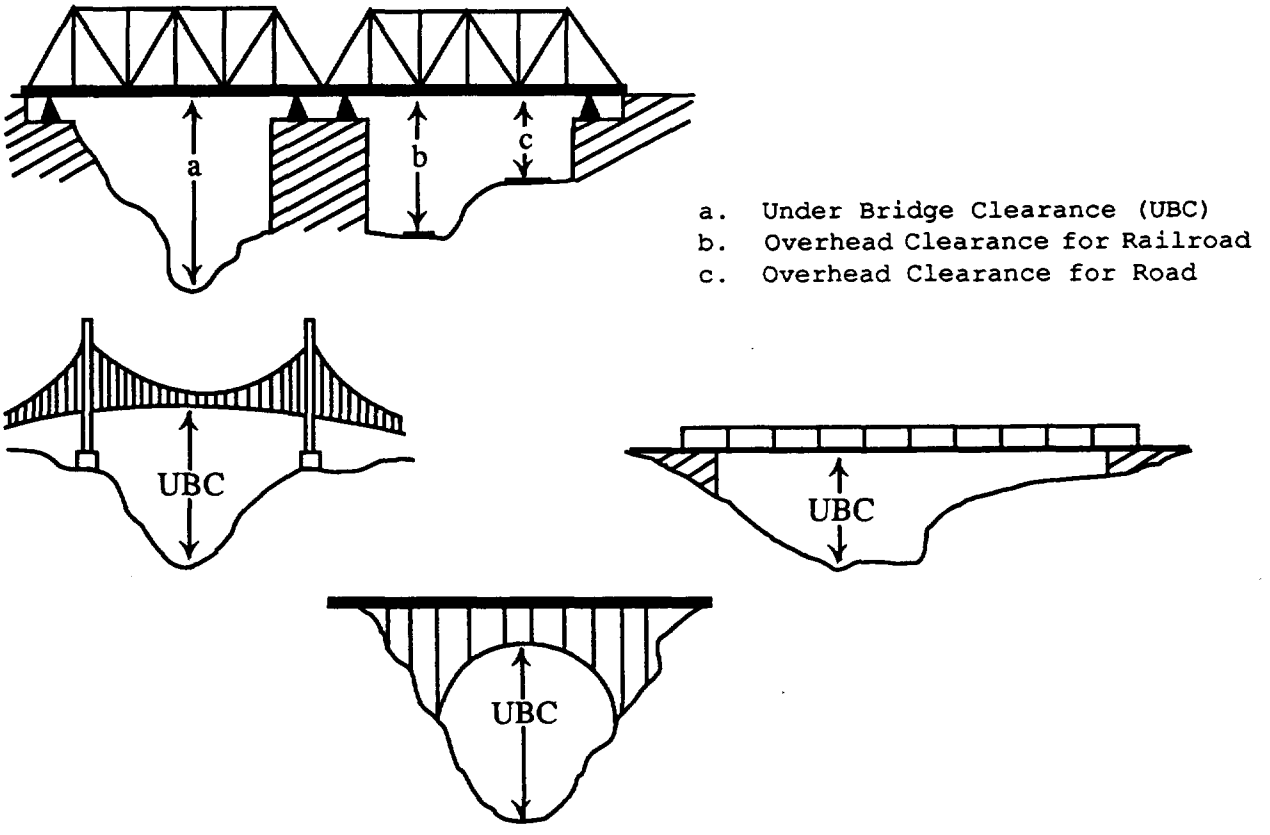
FIGURE 16. Examples of structure and bridge length differences.

e. Where several spans with the same construction material and/or lengths are found on a single bridge, they are grouped together as shown in Figure 14.

f. In the span length column the first number of the a x b sets represents the number of spans made of the same material with a length of b. Note that the known spans might not make up the total number of spans in the bridge. If information is not known, those spaces are left blank in the table. In certain cases information might be available for certain spans but their total number is not known.

g. Where known span lengths do not repeat, the data can be listed with commas without the a x b format.

3.12.8.2.9 Underbridge clearance. The underbridge clearance is the maximum distance from the bottom of the bridge superstructure to the water, land, or transportation feature below. The measurement is obtained from field check measurements or collateral sources. See Figure 17.



a. Under Bridge Clearance (UBC)
b. Overhead Clearance for Railroad
c. Overhead Clearance for Road

FIGURE 17. Examples of underbridge clearance (UBC).

3.12.8.2.10 Bridge bypass potential.

a. A bridge bypass is a local detour along a specific route enabling traffic to avoid or circumvent an obstructed or destroyed bridge. The bridge bypass potential (also referred to as the bypass condition category) is used both as an indication of the level of engineering effort needed to prepare a site for a military unit to cross the bridged obstacle (stream, gully, ravine, sunken road, etc.) and

as an estimate of the ability of an individual vehicle to cross the obstacle. The vehicle selected for estimating the bypass potential is a large wheeled vehicle, such as the US 2.5 ton, M-35A2, M36, or M211 truck (or NATO equivalent).

b. The probable detour or bypass site must be located within an area which extends no further than a 2km radial distance from each side of the specified bridge. Bridges at any distance from the bridge receiving the bypass code **are not** considered in determining the bypass classification.

c. The following factors and conditions are considered when evaluating the bridge bypass potential:

(1) Site Drainage Characteristics:
- (a) Bank heights and gradients
- (b) Water velocity and depth
- (c) Bottom materials
- (d) Existing fords
- (e) Denseness of vegetation along banks

(2) Off-route Approaches:
- (a) Roughness of surface expression (e.g., the presence of boulders or incised gullies, etc.)
- (b) Wet or soft ground (State of the Ground or soil moisture)
- (c) Vegetative cover (Agriculture, forest, etc.)
- (d) Presence and closeness of approaches
- (e) Other off-road approach conditions to site

(3) On Route Approaches:
- (a) Closeness to site
- (b) Type of road
- (c) Fords
- (d) Other on route approach conditions to site

d. The three bypass potential categories and their codes are listed below:

(1) Bypass Easy (Code E) - The obstacle can be crossed within the 2km vicinity of the bridge without work to improve the bypass or crossing site. Reaching the bypass site must be easy. The surrounding terrain must be conducive to obstacle free travel either by road or cross-country movement.

(2) Bypass Difficult (Code D) - The obstacle can be crossed within the 2km vicinity of the bridge, but effort or work is required for preparing the bypass or crossing site and/or the surrounding terrain is difficult to traverse either by road or cross-country movement.

(3) Bypass Impossible (Code I) - The obstacle can only be crossed if repair to an existing bridge or construction of a new bridge is accomplished, or the bypass site is impossible to reach either by road or cross-country movement.

3.12.8.2.11 Bridge lengths.

a. On most bridges two distinct lengths can be identified. First the overall length of the structure built to carry the transportation feature and second, the overall bridge length of the material actually carrying the transport

surface over the crossed feature. On many older bridges these lengths will be or nearly be the same, but on many newer bridges they tend to be quite different. See Figures 15 and 16.

b. Overall Structure Length - The length of the man-made structure built to carry the transportation feature, including abutments, base fills, and extensions of the side walls. Approaches and other similar earth or gravel filled rises are excluded. The measurement is made along the centerline of the structure from where it meets the ground surface at one end to the other. This length corresponds to item "h" in Figure 15, Bridge Side View Nomenclature.

c. Overall Bridge Length (length shown in BIT).

(1) The overall length of a bridge is the distance between the extreme end points of the spanning structure at the end walls/dams on the abutments. This measurement is taken along the bridge centerline, and does not include the length of the bridge approaches. Normally, it is slightly longer than the distance between abutments, see Figure 15.

(a) For road bridges the overall bridge length is the length of the bridge's travelled way surface supporting stringers, decking, or material (mostly slab and arch bridges) with end plates measured from the point where the bridge tread surface intersects with the roadway wearing surface at each end. This measurement is taken along the bridge centerline and does not include the length of the bridge approaches. It is slightly longer than the distance between abutments, see Figure 15.

(b) For railroad bridges the overall bridge length is the length of the bridge's track bed supporting stringers, decking, or material (mostly slab and arch bridges) with end plates measured between the points of intersection with the abutments. The value corresponds to "B" in the Railroad Bridge Information Holder section of the Transportation Legend, Appendix D.

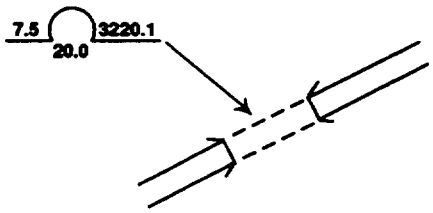
(2) For many bridge types, such as closed spandrel arch or base filled bridges, there is no clear distinction between approaches, abutments, base fills, and/or spanning members or materials. While some of these have very clearly distinguished spans and overall length of spans, they also have associated sides, guardwalls, filled bases, abutments, etc., which extend beyond the actual spans. Since for terrain analysis purposes the ability to open gap or cross over an obstacle with proper clearances below is the most important reason for a bridge, only the open gapped distance, including any extrados ring(s), or length of crossing span(s) will be used as the overall bridge length. See the examples in Figure 16 (the letter codes are the same as those in Figure 15). Note that for these bridges, the overall length of the built structure usually will be much greater than the overall bridge length.

3.12.9 Depiction of **tunnels** (Symbols 631 and 632).

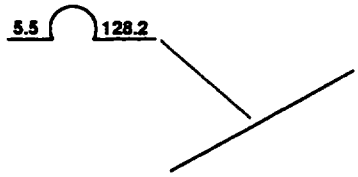
3.12.9.1 Definition and general use of tunnels.

a. A tunnel is a structure which allows horizontal or nearly horizontal passage of a transportation feature through or under an obstacle or obstruction. (See Figure 18.) Tunnels can be either lined with concrete, masonry blocks, or metal to strengthen the structure and prevent the falling of loose materials and

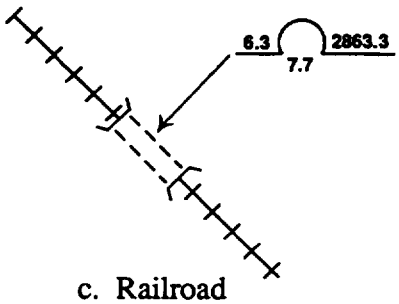
the seepage of water or they can be cut through solid rock with no lining. At the portals or entrance/exit points some sort of facing is usually erected.



a. Dual Lane Highway



b. Road/Highway



c. Railroad

FIGURE 18. Examples of tunnels.

b. All tunnels along the portrayed transportation network (roads and railroads) that can be identified on the imagery or derived from current collateral sources are included on the Transportation Overlay. Tunnels less than 2mm (500m ground distance) in length shall be treated as point features and indicated with a tunnel information holder (Symbol 632); whereas tunnels greater than or equal to 2mm (500m ground distance) will be treated as linear features and plotted "to scale" using a regular tunnel symbol (Symbol 632), with a minimum size width, if necessary, and a true "to scale" length. Wider linear tunnels will be plotted "to scale" in both length and width.

c. Since no distinction is made for the type of feature carried through a tunnel (road or railroad), all linear tunnels use the same tunnel symbol (Symbol 631) and display the same attributes in their tunnel information holder (Symbol 632). All associated attributes measured from imagery will be shown in the tunnel information holders to the nearest half meter (0.5m). If available, more precise measurements from field check (on-the-ground) measurements or collateral sources shall be shown instead.

d. The tunnel symbol suppresses the road or railroad symbols where they are coincident. The transportation feature going through the tunnel is not shown, even though the data base holds them for feature continuity.

3.12.9.2 Tunnel attributes. The characteristics covered in the tunnel information holders are depicted in accordance with the Transportation Legend, Appendix D, and symbolized as shown in Appendix B. Tunnels are assigned attribute measurement values or codes for (1) Height Clearance, (2) Width Clearance, and (3) Length.

3.12.9.2.1 Height or overhead clearance. The height or overhead clearance is the maximum vertical distance between the top of the transport surface and the highest part of the tunnel ceiling. For road tunnels the transport surface is the travelled way surface; for railroad tunnels it is the track bed or track supporting members. This height measurement is normally taken at the tunnel portal or opening. The height value corresponds to "A" in the transportation legend, (Tunnel Data). See Appendix D.

3.12.9.2.2 Width or horizontal clearance. The width or horizontal clearance is the minimum usable width of the tunnel bore measured above the transport surface horizontally from the inner side of one wall, guardrail, or raised walkway to the other. The measurement is made perpendicular to the tunnel length centerline. The width value corresponds to "B" in the transportation legend, (Tunnel Data). See Appendix D.

3.12.9.2.3 Tunnel length. Tunnel length is measured along the centerline of the tunnel's longitudinal axis from portal to portal or from one tunnel opening to the next. The value corresponds to "C" in the transportation legend, (Tunnel Data). See Appendix D.

3.12.10 Depiction of drop gates.

3.12.10.1 Definition and use of drop gates.

a. A dropgate is a massive assemblage of material, usually in the form of concrete logs or blocks, positioned alongside or over a transportation route (road or railroad) as a potential barrier to an advancing enemy ground force. They are generally tied into large fortified embankments on both sides of the transportation route to form part of a continuous defensive line when activated. The supports holding the material in place are rather thin so they can easily be removed by an explosive charge, causing the material to fall onto the transportation route forming the desired barrier.

b. All dropgates associated with the portrayed transportation network that can be identified on the imagery or derived from either field check data or collateral sources are included on the thematic overlay(s). All dropgates are treated as point features and depicted in accordance with the legend, Appendix D, and symbolized as shown in Appendix B.

3.12.10.2 Dropgate types. Two types of dropgates are distinguished from each other (See Figure 19):

a. **Side Dropgates** (Symbol 635) - Side dropgates occur where the material is positioned above and to one or both sides of the transportation route. When activated, the material, usually concrete logs, rolls and/or slides onto the transportation surface in a huge pile, where it prevents any further advance by the enemy without detouring around the blockage.

b. **Overhead Dropgates** (Symbol 636) - Overhead dropgates are usually massive concrete blocks placed directly over the transportation route. When activated they fall onto the transport surface, effectively blocking the passageway.

a. Along Railroads b. Along Roads

FIGURE 19. Depiction of dropgates.

3.12.11 Depiction of **ferries** (Symbol 612).

a. Ferrying sites are locations where human or vehicular traffic and cargo are conveyed across a river or other water barrier by a floating vehicle (e.g., a boat or barge) which is called a ferry.

b. All ferry routes along roads and railroads depicted on the Transportation Overlay shall be shown. Ferry routes along roads not portrayed as part of the transportation pattern will be omitted.

c. Road and railroad ferries are distinguished from each other solely by the type of transportation routes using them; however, no distinction will be made between passenger and freight ferries, or ferry types (cable, current-operated or powered ferries).

d. The symbol for ferries is the word "Ferry" placed either parallel to the center tangent of the southern neatline or parallel and above the center of the dashed line indicating the route of the ferry through the water body, if longer than 6mm (1500m ground distance). See Appendixes B and D.

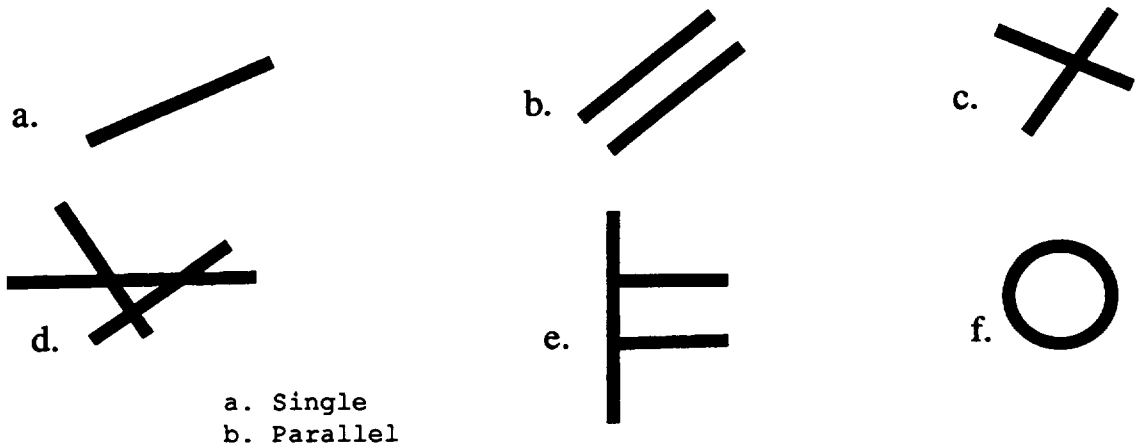
3.12.12 Depiction of **airport/airfield runways** (Symbol 638).

3.12.12.1 Treatment of runways.

a. All commercial, private and military airport/airfield runways are included as features for depiction. Runway orientations and patterns shall be depicted to scale the same as they actually exist on the ground (See Figure 20).

b. All runways that can be identified on the imagery or derived from current collateral sources are included on the Transportation Overlay. All runways are treated as linear features with a minimum length of greater than 2mm (500m ground distance) in length with a minimum width of 1mm (250m ground distance). Normally, the length of runways is plotted "to scale"; whereas the width is plotted "to scale" only if greater than 1mm (250m ground distance) wide.

c. All associated runway attribute values measured from imagery shall be shown to the nearest half meter (0.5m). If available, more precise measurements from field check (on-the-ground) measurements or collateral sources shall be shown instead. Taxiways, overruns, and stopway areas are not included in the measure-



a. Single
b. Parallel
c. Dual Offset
d. Triple
e. Parallel and Offset
f. Circular or Areal (Landing Area)
(Usually grass with no defined direction of approach)

FIGURE 20. Runway orientations and patterns.

ments. The latter two are areas extending beyond the usable runways which are designed for emergency use only and whose substructure will not support the normal landing of aircraft.

3.12.12.2 Runway attributes. The three types of data shown for runways are depicted in accordance with the legend, Appendix D, and symbolized as shown in Appendix B. Runways are depicted with the true orientation of their longest axis and are assigned attribute measurement values or codes for (1) Runway length, (2) Runway width, and (3) Runway paving status.

3.12.12.2.1 Runway length.

a. For paved and marked runways, the length is taken from between the outer edges of the threshold markers at each end of the runway. A runway threshold is the designated beginning of the runway that is available and suitable for the landing of aircraft.

b. For paved but unmarked runways, the length is still only that portion of the runway that is available and suitable for the landing of aircraft. Overruns and stopway areas are not included.

c. The length of unpaved (usually grass covered) runways may include the runway overruns, unless imagery, field check data, or current collateral data provides more precise information that excludes them.

d. The measurement is made along the runway centerline and corresponds to "A" in the Airfield/Airport Runway Data Section of the Transportation legend, Appendix D.

3.12.12.2.2 Runway width. The runway width measurement is taken perpendicular to the length centerline from one edge to the other. It corresponds to "B" in the Airfield/Airport Information Data section of the legend.

3.12.12.2.3 Runway paving status and orientation.

a. If the runway is hard surfaced, it is symbolized by the letter "H"; or if it is loose, unpaved, or grassy the runway is symbolized by the letter "L". These codes correspond to "C" in the Airfield/Airport Runway Data section of the legend.

b. The symbolized runway orientation (direction of the longitudinal axis) of the mapped feature shall exactly match that of the actual runway on the ground. Thus the rectangular runway symbol (Symbol 638) must be shown in the same alignment as the actual runway.

3.12.12.3 Airport/airfield operational status.

3.12.12.3.1 Operational. Unless otherwise indicated, all airport and airfields associated with the depicted runways shall be considered operational (in use) and labelling as such is not required.

3.12.12.3.2 Non-operational labelling. If the airport/airfield or its runways are not operational, it shall be labelled below the paving status code with one of the following descriptive terms:

a. "Abandoned" - airport facilities and runway(s) still in existence but not in use, minimal effort required to restore to operational status.

b. "Non-operational" - facilities and runway(s) not in condition for landings and takeoffs, minor repairs are necessary before field can be made operational again.

c. "UC" - Under construction, special case, see 3.12.15 and Symbol 103.

3.12.13 **Landing area** (Symbol 640). Landing areas are place used for landing aircraft where there is no clearly defined direction of approach and/or runway(s), the planes land in a big areal field (usually circular or rectangular in shape). This feature is rare, and is normally associated only with natural earth surface materials, such as grass, bare ground, etc. Like runways, 3.12.13.2, length and width are attributed.

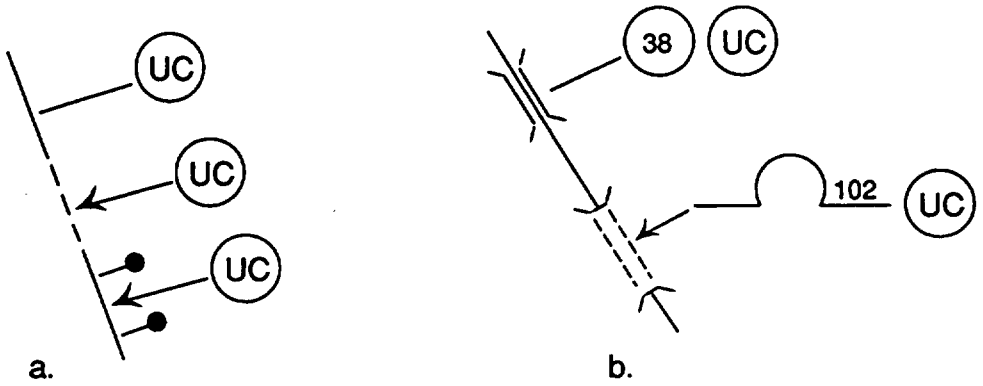
3.12.14 Depiction of **features under construction**. (Symbol 103).

3.12.14.1 Definition of features under construction. Features designated as under construction are those for which construction is actually underway. The under construction symbol is used to indicate which point or linear feature or segment is being built or rebuilt. Point of change symbols (Symbol 102) are used to show the extent or length of linear or areal features under construction.

3.12.14.2 Use of features under construction. The under construction symbol can be used in a number of ways:

a. All unidentified features which are under construction along a transportation route are symbolized with a circled "UC" (Symbol 103) and leader line pointing to the center of the point or linear segment. See Figure 21a. Unknown (neither identified or classified) linear segments shall be shown with a dashed line, using the fair weather, loose surface, road symbol (Symbol 603).

b. All features under construction which can be identified and classified shall be depicted with their standard symbol and a circled "UC" (Symbol 103) placed to the right of the feature symbol or data information holder. See Figure 21b.



a. Use of "UC" symbol for unclassified features under construction.
b. Use of "UC" symbol for classified features under construction.

FIGURE 21. Use of under construction symbol for transportation features.

c. If the normal positioning of the data for an identified and classified linear segment is parallel to the transportation feature, such as road widths, then the circled "UC" symbol shall be placed parallel and behind any labelling on the represented feature, space permitting.

d. In areas with a high density of bridges where use of the circle "UC" symbol is cartographically infeasible, just the letters "UC" in 6 point bold condensed type may be added to the bridge information holders in the positions shown in Figure 22.

a. Roads b. Railroads

FIGURE 22. Use of "UC" with bridge information holders.

3.12.15 Miscellaneous transportation features.

a. In some geographic settings, unique transportation features may be encountered which constitute important current and potential factors of significance to military operations along the transportation network. In certain

environments and conditions such features as route segment vertical lifts, trails, overhead obstructions, restricted passages, snowsheds, canals, culverts, elevated transportation structures, etc. may play a critical role in on-route operations. When such an unique feature is encountered, appropriate symbols shall be designed to portray it; however, as some production systems can only handle a limited number of miscellaneous items on each of the thematic overlays, care must be taken to show only those that would have a major impact on military operations.

b. Unless specified below, depiction of these and or other similar features may require modification of the legend and/or symbology in order to provide unique symbology for the feature. Where possible, standard (as defined by this specification) letter or number transportation identification codes will be used. If the feature requires unique symbology, standard symbols from the Military Specifications for Joint Operations Graphics Series 1501A (Air) and 1501 (Ground) (JOG A/G), MIL-J-89100, and the Military Standard for MC&G Symbology, MIL-STD-2402, will be used to the maximum extent possible.

c. Appendix I defines and specifies the symbology to be used for most of the miscellaneous features (such as the transportation features listed in a. above) which have been occasionally added to the various thematic overlays since the first PTADB specifications (PS/3JB/020) were published in December 1982.

3.13 Hydrography. This section provides the basic guidance for the production of the Surface Drainage Overlay for the PTADB.

a. The symbols and attributes on this thematic overlay represent selected open drainage and drainage formed features which could be a hindrance to ground military operations.

b. All drainage features with a military gap width greater than 18 meters shown on the base map, as well as all other significant drainage features and/or changes found on later date imagery or collateral sources, shall be shown on this thematic overlay. Drainage channels greater than 18 meters that are not depicted on the base map shall be shown only if they are a significant hindrance to the cross-country movement of main battle tanks (bank heights > 1.5 meters, bank slopes > 60 percent, and military gap width > 2.77 meters).

3.13.1 General surface drainage information.

3.13.1.1 Surface drainage symbology. Symbology for Surface Drainage is shown in Appendix B.

3.13.1.2 Surface drainage legend.

a. Surface Drainage legend categories, notes, and coding scheme are shown in Appendix D.

b. The following diagrams and notes are to be included in the PTADB Surface Drainage legend:

(1) Note stating streams with gap widths less than or equal to 18 meters are omitted.

(2) Swamps and marshes location note.

(3) Underlined bank height code note indicating dense vegetation.

(4) Coding, accuracy, and availability note.

(5) Note indicating that bank heights and slopes are read facing downstream.

(6) A statement keying the overlay to a specific climatic season.

(7) Additional notes to explain abnormal or irregular situations that occur on the specific overlay.

3.13.2 Depiction of features common to the surface drainage and other specified thematic overlays.

3.13.2.1 **Common open water areas**. (Symbol 104, labelled "W").

3.13.2.1.1 Open water definition. An open water area is any perennial body of water (ocean, lake, pond, reservoir, stream, river, etc.) large enough to be shown as an areal feature on the Surface Drainage Overlay. To be classified as a common open water area, the feature must be large enough, as specified in the following sections, to be shown as an areal feature on the Surface Configuration (Slope), Surface Materials, and Vegetation Overlays.

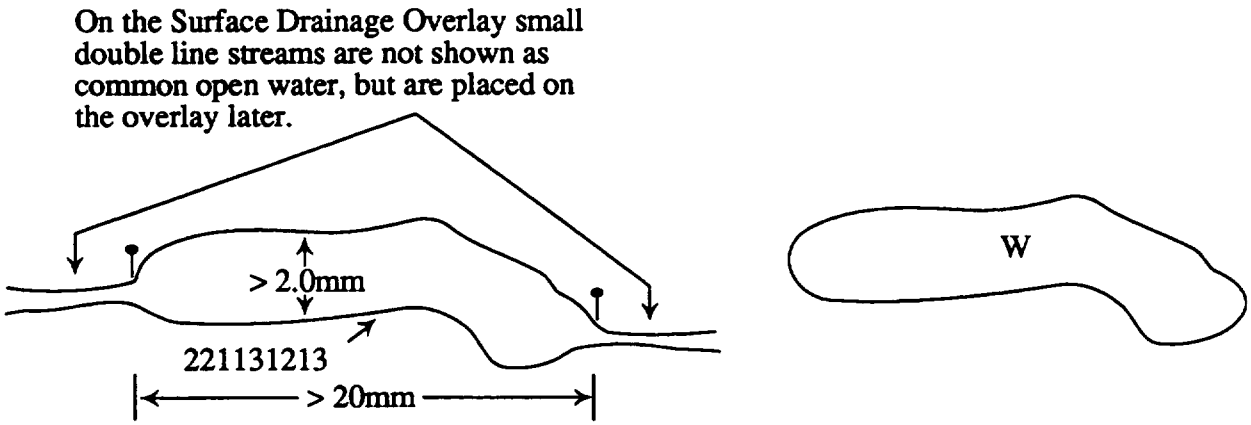
3.13.2.1.2 Depiction of common open water. The common open water areas depicted on the Surface Configuration (Slope), Surface Materials, and Vegetation Overlays will have identical outlines (line-for-line) with the common open water areas shown on the Surface Drainage Overlay.

3.13.2.1.3 Large rivers (streams), canals, channelized streams, aqueducts, and ditches.

a. Flowing water features such as rivers, canals, etc., with a perennial water width greater than 2.0mm (500m ground distance) and a length greater than 20mm (5000m ground distance) (40 square mm at map scale or 2,500,000 square meters ground area) also are shown on these overlays as common open water, see illustrations in Figure 23. These rivers, canals, etc. (with gap widths greater than 500 meters wide), are also classified and coded with the nine digit drainage coding system on the Surface Drainage Overlay only, as described in 3.13.4.4.

b. Rivers, canals, etc. with a perennial water gap width greater than 2.0mm (500m ground distance) but a length less than 20mm (5000m ground distance) emptying into an ocean or large body of water, are considered inlets. These are labelled as common open water, by incorporating them into the shorelines mentioned in 3.13.2.2.1. See Figure 24.

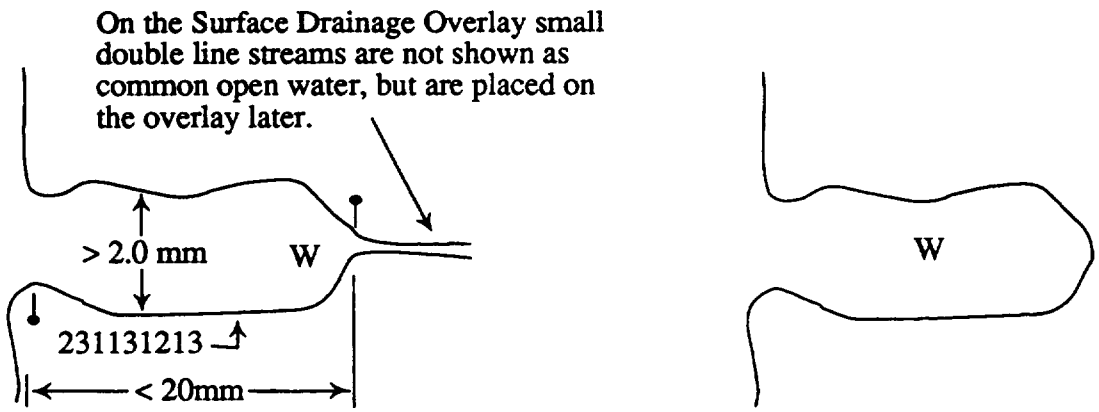
c. In order to prevent some perennial rivers, canals, channelized streams, aqueducts, and/or ditches from looking like a series of linear lakes on the Vegetation, Surface Materials (Soils), and Surface Configuration (Slope) Overlays, their common open water areas may be connected as continuous common open water areas (Figure 25), if they meet the following requirements:



a. Surface Drainage Overlay.

b. Surface Configuration, Surface Materials, and Vegetation Overlays.

FIGURE 23. Common open water, depiction of large rivers.



a. Surface Drainage Overlay.

b. Surface Configuration, Surface Materials, and Vegetation Overlays.

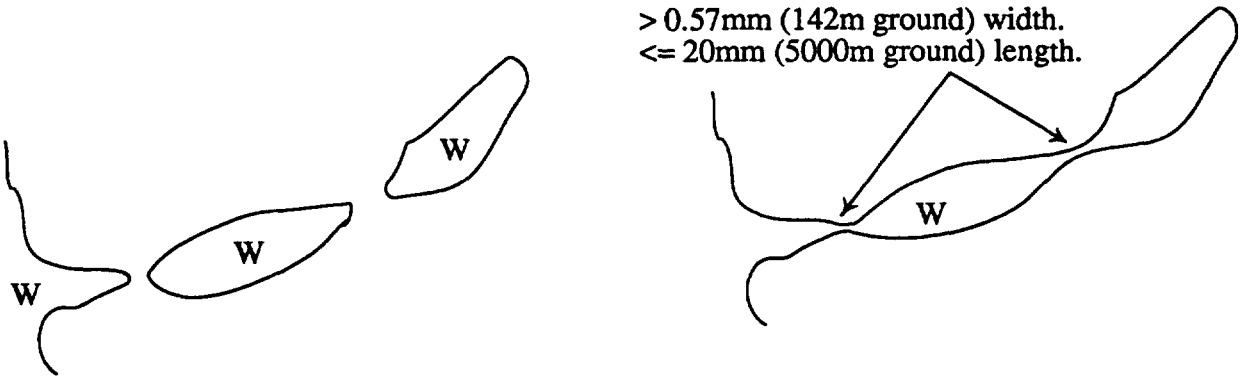
FIGURE 24. Common open water formed by a shoreline.

(1) The segments between the common open water areas have a perennial water gap width greater than 0.57mm (142m ground distance).

(2) The distance between the common open water areas is less than or equal to 20mm (5000m ground distance), as measured along the centerline of the drainage segment.

3.13.2.1.4 Large perennial lakes and reservoirs.

a. Perennial lakes and reservoirs are shown if they have an areal extent of at least 80 square millimeters (5,000,000 square meters ground area) with a minimum width greater than or equal to 2mm (500m ground distance).



a. Discontinuities in the depiction of a large river

b. Common open water shown as continuous

FIGURE 25. Rivers shown as continuous common open water.

b. The outline of lakes and reservoirs (common open water features) shall be depicted to the fullest extent, where cartographically possible, not including flowing streams, but including areas or narrow fingers which are smaller than the minimum size limitations, as shown in Figure 26.

FIGURE 26. Common open water features outlines. (Not to scale)

3.13.2.2 Other common features.

3.13.2.2.1 Coastal shorelines. Coastal shorelines shall be coincident with the base map unless significant changes have occurred. If there are significant changes, such as new port facilities or coastal land reclamation, these changes will be incorporated. A new shoreline based on the limits of land features at mean high water level shall be delineated.

3.13.2.2.2 Offshore and inland islands.

a. Offshore and inland islands are shown if they are both completely surrounded by common open water features and have an areal extent of at least 80 square millimeters (5,000,000 square meters ground area) with a minimum width greater than 2mm (500m ground distance).

b. All islands shown on the Surface Drainage thematic are actually areas of no water or "holes of no water" formed by the boundary of the common open water completely surrounding them.

3.13.2.3 Labelling of common open water areas. Common open water areas, excluding large rivers, are coded with a "W" on the Surface Drainage Overlay. Large

rivers on the Surface Drainage Overlay are coded with a nine digit code, as described in paragraph 3.13.4.4. All common open water areas, including large rivers, are coded with a "W" on the Surface Configuration (Slope), Vegetation, and Surface Materials Overlays.

3.13.3 Depiction of non-common open water features.

3.13.3.1 **Non-common open water areas** (Symbol 500).

3.13.3.1.1 Small open water areas. Small standing open water areas with an areal extent greater than or equal to 40 square millimeters (2,500,000 square meters ground area) and less than 80 square millimeters (5,000,000 square meters ground area) with a minimum width of at least 2mm (500 meter ground distance) are considered non-common open water areas and are only shown on the Surface Drainage Overlay, as illustrated in Figure 27. These perennial inland water areas are delineated at their normal stage of water prevailing during 6 or more months of the year. As non-common open water areas, they do not appear on any of the other thematic overlays.

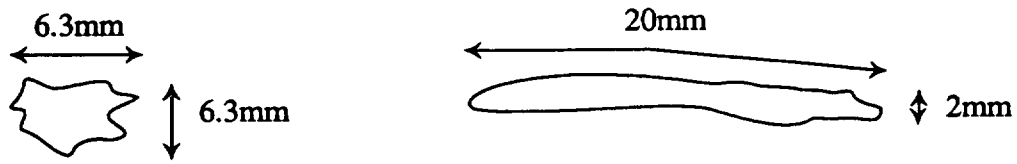


FIGURE 27. Minimum size of open water areas on drainage overlay.

3.13.3.1.2 Lakes, ponds and reservoirs.

a. Lake - An inland body of standing water of considerable size occupying a large depression in the Earth's surface which is too deep for non-subaqueous vegetation to take root completely across the expanse of water. The water may be fresh or saline, and may be used as a source of water.

b. Pond - A natural or man-made small inland body of standing water occupying a small depression. The water may be fresh or saline, and may be used as a source of water, settling basin, etc.

c. Reservoir - An artificial inland body of standing water, generally of considerable size, formed by impoundment behind a dam. They are used as a place for the storage and control of water. Water is withdrawn for irrigation, water supply, flood control, recreation, or hydroelectric power generation. All reservoirs meeting the minimum size inclusion conditions are considered open water features.

d. All perennial non-common open water areas are coded with a capital "W" on the Surface Drainage Overlay. These non-common open water areas do not appear on any of the other thematic overlays.

3.13.3.2 Non-common small islands.

a. Small offshore and inland islands are shown if they are completely surrounded by open water areas and have an areal extent of at least 40 square

millimeters (2,500,000 square meters ground area) with a minimum width greater than or equal to 2mm (500m ground distance) and are less than the minimum size for common islands.

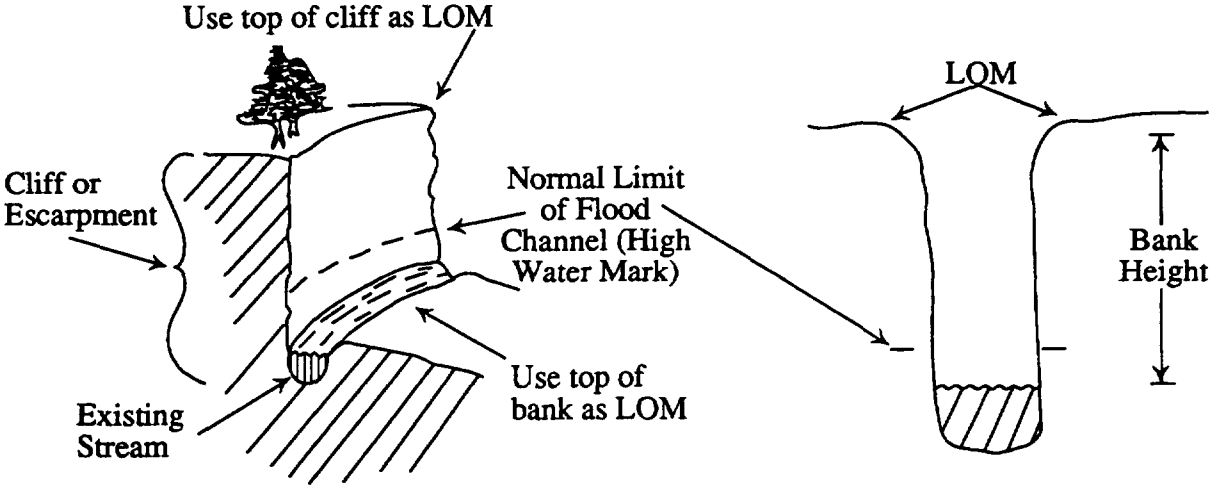
b. As with large islands, all small islands shown on this thematic overlay are actually areas of no water or "holes of no water" formed by the boundaries of the open water areas completely surrounding them. Islands formed by single line drainage channels are not considered in this category - they can be as small as the drainage pattern dictates.

3.13.4 Classification, depiction, and coding of flowing water and flowing water formed features. (This category includes Streams, Canals, Channelized Streams, Irrigation Canals, and Drainage Ditches)

3.13.4.1 Flowing water considerations. Consideration of flowing water features and their attributes (measurements) are limited to the extent of the present stream or canal channel within its existing normal limit of flood channel (high water mark).

a. If the existing bank is a direct result of cutting by the existing stream, such as cliffs on the convex side of a bend or curve in the stream channel or a canyon cut straight down by the action of the water, the attributes will be measured to the top of the bank, line of measurement (LOM), even if the LOM is above the normal flood or high water limit line. See the examples in Figure 28. Streams may be perennial or intermittent.

b. If these vertical or nearly vertical banks (between 80 and 90 degrees from the horizontal) are greater than 5 meters high, they will also be picked up on the Obstacles Overlay as escarpments.



a. One steep bank

b. Canyon/Gorge
Both banks steep

FIGURE 28. Stream cuts.

c. Bank slopes which are due to mountain erosion processes or slumped due to cave-ins or landslides filling in areas previously eroded by the existing or other stream regimens are not considered to be direct down-cutting by the present stream but are considered as gorges. See the illustration in Figure 29.

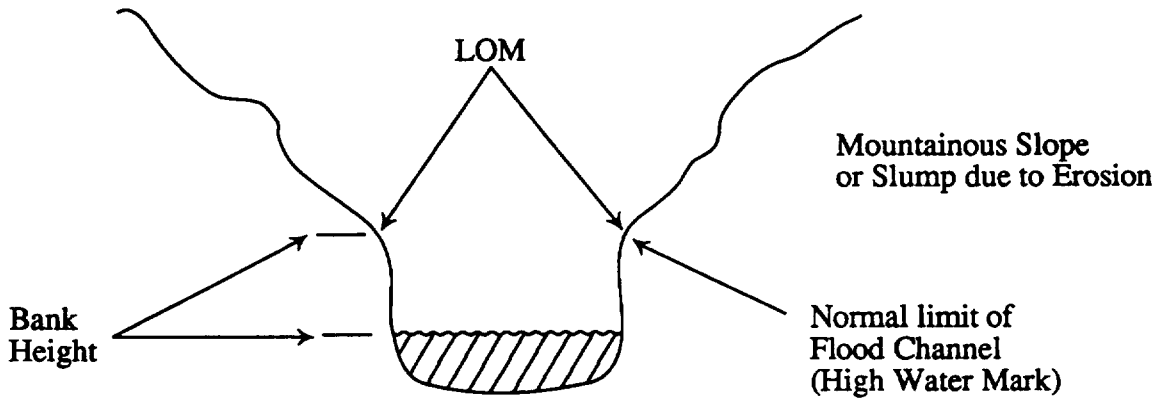


FIGURE 29. Streams within gorges in mountainous areas.

d. The normal case of a stream within its channel on a flood plain is shown in Figure 30. The inclined side of the natural terrace at the limit of the flood plain will be picked up on the Obstacles Overlay, if it meets the criteria for an obstacle.

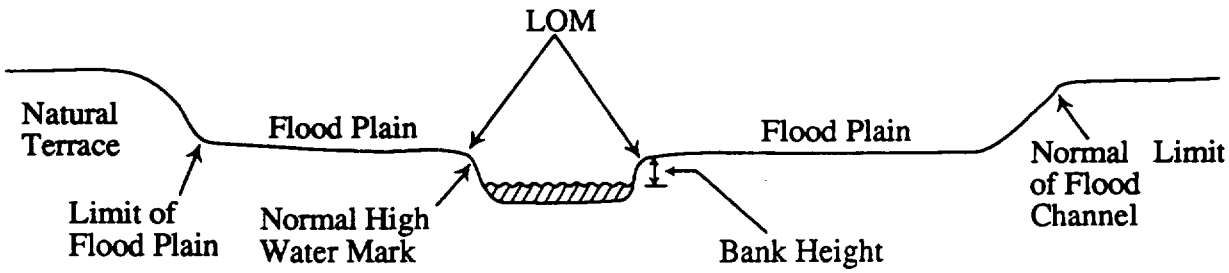


FIGURE 30. Normal case - stream channel within flood plain.

e. Figures 28, 29 and 30 illustrate the relationships between lines of measurement (LOM), bank heights, flood plain limits, and normal limit of flood channels to be used in these cases. These limitations have been imposed in order to prevent gap widths (bridging distances) from becoming abnormally large, especially in steep mountainous or incised canyon and ravine areas.

3.13.4.2 Military gap width.

a. Flowing water and flowing water formed drainage features are depicted on the Surface Drainage Overlay according to the distance of their military gap width. Military gap width is defined as the minimum horizontal bridging distance necessary to cross a water channel, perpendicular to the direction of water flow from bank to bank, measured at the first usable break in slope on each side of the channel above mean high water.

b. Usable banks are those accessible by military vehicles - small unusable ledges and cliffs are not considered usable breaks in slopes, as illustrated in Figure 31.

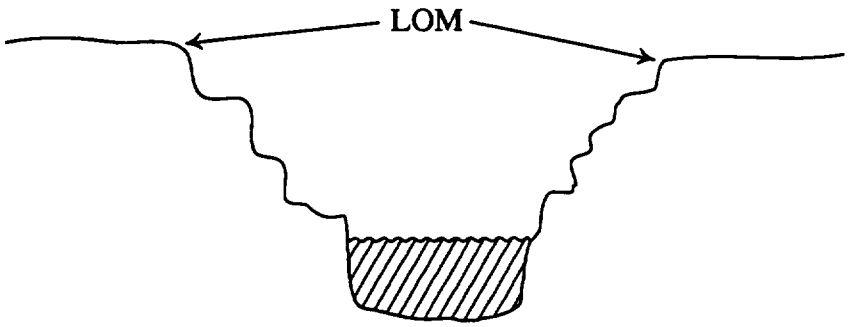


FIGURE 31. Depiction of small unusable ledges.

3.13.4.3 Flowing water features. The following features are depicted on the Surface Drainage overlay according to the distance of their military gap width:

a. **Stream/Canal/Channelized Stream/Aqueduct/Drainage Ditch with gap width > 18.0 meters and <= 142 meters** (Symbol 504).

b. **Stream/Canal/Etc. with gap width > 142 meters** (Double line drains) (Symbol 505).

3.13.4.4 Coding flowing water features. Each segment of the above flowing water and flowing water formed features is classified and coded whenever cartographically possible. Point of change symbols (Symbol 102) are used to indicate the limits of each segment based on feature characteristic changes (see 3.13.6) at non-intersection points. Segments are classified and coded with a nine-digit code. Each digit represents a feature characteristic as defined below:

3.13.4.4.1 First digit - 123456789 - drainage feature type. All flowing water formed features (stream channels) are classified into the following types:

Drainage Feature Type		First Digit Code
a.	Intermittent or Ephemeral Stream	1
b.	Perennial Stream	2
c.	Stream Subject to Tidal Fluctuations	3
d.	Canal/Channelized Stream/Aqueduct Irrigation Canal/Drainage Ditch	4
e.	Braided Stream	5
f.	Stream Channel In-Gorge	6

a. Stream - Any body of flowing water, great or small, moving under gravity flow to progressively lower levels in a relatively narrow but clearly defined channel on the surface of the ground. Especially such a body of water flowing in a natural channel.

(1) Intermittent or Ephemeral Stream (First digit is 1).

(a) Intermittent Stream - A stream or reach of a stream where the channel is below the water table for at least part of the year. It flows only when the available streamflow is fed by springs, a high water table, precipitation

or by some surface source, that is greater than the water losses from evaporation, seepage, or human withdrawal.

(b) Ephemeral Stream - A stream or reach of a stream where the channel is always above the water table. It flows only briefly as a direct result of precipitation in the immediate locality or by surface runoff from precipitation in areas further up the watershed.

(2) Perennial Stream (First Digit is a 2) - A stream or reach of a stream whose channel is almost always below the water table. It flows continuously throughout the year and is normally fed by both surface runoff and groundwater discharge.

(3) Stream Subject to Tidal Fluctuations (First digit is 3) - The portion of a stream or river which is influenced by the tide of the body of water into which it flows.

(4) Braided Stream (First digit is 5).

(a) A stream or portion of a stream that divides into an interlacing pattern of numerous, small, branching and reuniting, shallow water channels separated from each other by shifting branch islands or channel bars. These are highly susceptible to erosion and individual channels within the gap of the stream may shift from year to year. Braided streams may be perennial or intermittent.

(b) The gap width is taken as the bank to bank width across the entire braided stream flood channel, not just across the individual or larger interlacing channels which shift during floods within the braided portion. The entire gap width should be coded with the nine digit surface drainage code. Figure 32 illustrates the correct portrayal of braided streams on the Surface Drainage Overlay. If the banks are greater than 5 meters high they will also be picked up on the Obstacles Overlay.

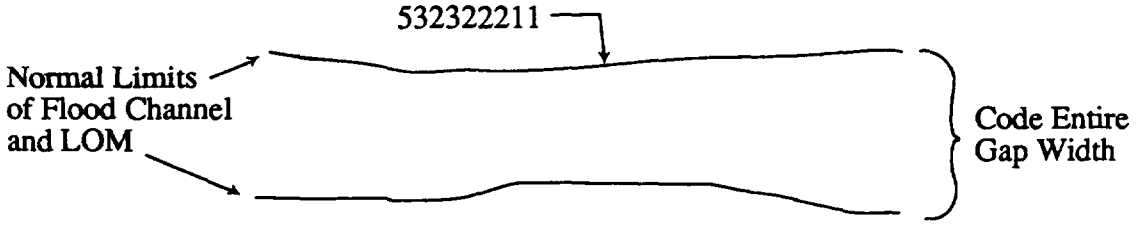


FIGURE 32. Portrayal of braided streams.

(5) Stream Channel In-Gorge (First digit is 6) - A stream or portion of a stream flowing through a deeply incised channel (deeper than 5.0 meters), generally small and narrow, with nearly vertical, commonly rocky, walls that come right down to the water channel or the flood plain which is too narrow (less than 4.0 meters wide) to permit any military movement along side the stream. Ground access to the edge of the stream is either by water or by climbing or being lowered down the gorge walls. See the example in Figure 28b.

b. Canal/Channelized Stream/Aqueduct/Irrigation Canal/Drainage Ditch (First digit is 4) - Water course channels, generally man-made, that are used to control the direction and quantity of water flow. They can have relatively steep, paved, riprapped, or natural bank slopes and uniform dimensions which cut through an inland area.

(1) Canal - A water course of relatively large dimensions, usually water filled, designed for navigation, drainage or irrigation by connecting two or more bodies of water. Water flow and depth can be controlled.

(2) Channelized Stream - A stream which has been straightened or modified from its base alignment by man as an aid to navigation or to increase the flow rate of a stream or for flood control.

(3) Aqueduct (Open or Covered, Artificial or Natural, Conduits) - These conduits carry large quantities of flowing water for either domestic or industrial water supply purposes. These features are usually constructed of earth, brick, stone, steel, or concrete and may be tunnelled through rock, elevated, built-up on the ground, at ground level, or below ground or in tunnels.

(a) Only open channel (natural or man-made) streams, canals, aqueducts, ditches, etc., and covered drainage are shown and coded on the Surface Drainage overlay.

(b) Flumes, pipelines, penstocks, kanats, and similar closed or covered water supply features, whether elevated, on, or below ground level, are not shown on the Surface Drainage overlay. For arid areas, these will be covered in the Water Resources Overlay(s).

(4) Irrigation Canal - A normally small open channel, commonly with intermittent flow, carrying water to irrigate crops.

(5) Drainage Ditch - Normally a small, shallow, open waterway, channel, or trench constructed to control the direction of water flow and used for drainage.

3.13.4.4.2 Second digit - 123456789 - military gap width. The width of a stream, as defined in 3.13.4.2, measured horizontally from bank crest to bank crest, which may be at different heights. This measurement is independent of the width of water, due to the dynamic nature of flowing drains. Military gap width represents the minimum horizontal bridging distance necessary to cross a water channel perpendicular to the direction of water flow from bank to bank, measured at the first usable break in slope on each side of the channel above mean high water. See Figure 32. The following width categories based on military bridging capabilities are used:

	Gap Width (Bank to Bank) (m)	Second Digit Code
a.	>18 - 142	1
b.	>142 - 1000	2
c.	>1000	3

3.13.4.4.3 Third digit - 123456789 - bottom materials. Predominant material(s) of stream beds. The following categories are formed by grouping materials based on size using the Unified Soil Classification System:

	Bottom Material	Third Digit Code
a.	Clay and Silt	1
b.	Sand and Gravel	2
c.	Rocks and Boulders	3
d.	Bedrock	4
e.	Paved	5

3.13.4.4.4 Fourth and fifth digits - 123456789 - bank heights and stream bank vegetation.

a. Bank Heights - Both banks (right 4th digit, left 5th digit) of a stream are measured and classified in categories significant to stream crossing operations. Bank height is defined as the vertical distance between the mean water level of the channel and the top of the first usable break in slope, measured at the same point on the upper bank as the military gap width. Right or left bank is identified by facing down stream (in the direction of flow). If a bank is greater than 5 meters high, with a slope greater than 60 percent, the bank must also be picked up on the Obstacles Overlay as an escarpment or embankment, as appropriate. The following bank height categories are used for both the right and left banks:

	Bank Height (m)	Fourth and Fifth Digit Code
a.	<=1.0	1
b.	>1.0 - 5.0	2
c.	>5.0	3

b. Dense Vegetation - Dense vegetation is defined as being thick brush or closely spaced trees which prohibits vehicles from entering or exiting a drainage channel. Examples include a single line of trees or a hedgerow thick enough to stop vehicular movement through it or it may be a part of a forest area as shown on the Vegetation Overlay. When dense vegetation is located along either or both stream bank(s) for more than 50 percent of the segment length, it is indicated by underlining the 4th and/or 5th digit. (Example: 124332213).

3.13.4.4.5 Sixth and seventh digits - 123456789 - bank slope.

a. The slopes of both banks (right 6th digit, left 7th digit) of a stream are measured and classified into percentage categories significant to stream crossing operations. Bank slope is defined as the angle of incline between the horizontal surface of the mean water level of the channel where it touches the bank and the top of the first usable break in slope, measured at the same point on the upper bank as the military gap width. As with bank heights "right" or "left" is determined by facing downstream (in the direction of flow). The following bank slope categories are used for both right and left banks:

	Bank Slope (%)	Sixth and Seventh Digit Code
a.	<=60	1
b.	>60	2

b. If a greater slope category, with a height of more than 1.0 meters, exists within the confines of the average slope category for more than half the segment length, then that slope category code shall be used for the 6th or 7th digital code number, as applicable. See item 7a in Figure 33.

3.13.4.4.6 Eighth digit - 123456789 - water velocity, average. Water velocity, speed of the current, is a dynamic characteristic and is estimated in meters per second (m/sec) with only two categories. Wide fluctuations in velocity preclude more precise classification. Rarely is collateral data available on stream velocity. Therefore velocity is estimated from stream and basin characteristics such as gradient, width, basin size etc. Average velocity is defined as the velocity that would normally be expected at mean water levels exclusive of high water due to runoff or low water due to drought. The two categories of water velocity are coded:

	Water Velocity, Average (m/s)	Eighth Digit Code
a.	<=1.5	1
b.	>1.5	2

3.13.4.4.7 Ninth digit - 123456789 - water depth, average. Water depth for a stream segment is an estimated value in meters based on the characteristics of the stream. As with stream velocity, stream depths vary with flow and are estimated for normal flow at mean water levels. Three categories of water depth are coded:

	Water Depth, Average (m)	Ninth Digit Code
a.	<=1.2	1
b.	>1.2 - 2.4	2
c.	>2.4	3

3.13.4.5 Stream cross-section. The typical stream cross-section, shown in Figure 33, clarifies the meaning of each member of the nine digit surface drainage code described above. The illustration shows and identifies each position in the code.

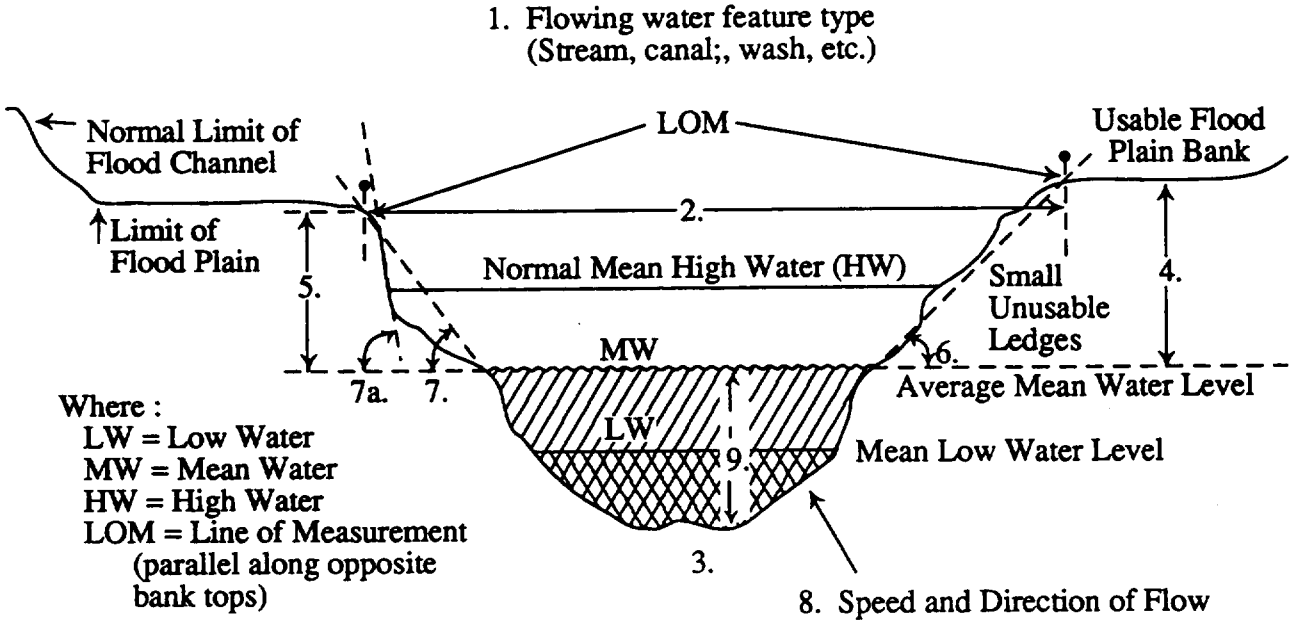
3.13.5 Depiction of the remaining surface drainage features.

3.13.5.1 List of remaining features. The following is a list of all remaining required features and their definitions to be shown on the Surface Drainage Overlay:

3.13.5.1.1 **Covered drainage** (Symbol 506).

a. A man-made drainage way (canal, irrigation ditch, aqueduct, etc.), completely covered over, connecting open drainage ways (including streams) at each end. Minimum length to be shown is 10mm (2500m ground distance) and minimum ground width is 18 meters. Small streams and culverts less than 18 meters wide passing under roads, railroads, etc. are not shown as covered drainage, nor are naturally disappearing streams.

b. Minimum length distance will be measured from one opening to the other, unless collateral data indicating the true covered distance is available. The same applies to the alignment of the covered drainage way, it is assumed to be straight or smoothly curved unless collateral data indicates otherwise.



Digit	Feature Characteristic	Digit	Feature Characteristic
1.	Drainage Feature Type	6.	Right Bank Slope
2.	Military Gap Width	7.	Left Bank Slope
3.	Bottom Materials	7a.	Qualifying steeper slope within average slope
4.	Right Bank Height		
5.	Left Bank Height	8.	Average Water Velocity
		9.	Average Water Depth

FIGURE 33. Nine digit surface drainage code feature characteristics.

c. Covered drainage is depicted and labelled as such with a dashed line segment to indicate where the segment begins and ends. (See Symbol 506.)

3.13.5.1.2 **Off-route fords** (Symbol 511).

a. Fords along minor roads that are not portrayed on the Transportation Overlay will be portrayed as off-route fords. These off-route fords, which are not associated with the depicted road network, offer potential military crossing points and are depicted on this thematic overlay, if they are shown on the base, are available from collateral sources, or are obvious on aerial photography.

b. These off-route fords usually have low inclined approaches in areas predominated by higher, more restrictive banks. Therefore, they are especially important along streams characterized by high (>= 1 meter), steep banks (greater than 60 percent), dense vegetation along one or both banks, or any combination of these attributes.

c. Since intermittent or ephemeral streams often flow primarily as flash rises and falls in water velocity and volume (like flash floods), in areas where non-selected transportation routes (roads) cross or run through them as off-route

fords, a warning note stating, "Fords subject to sudden changes in water levels", will be added to the legend notes.

3.13.5.1.3 **Float bridge/raft sites** (Symbol 512).

a. Prepared sites on each side of a stream, generally of considerable size, where the banks have been engineered to provide a graded approach with either natural earth materials or paved surfaces leading into the water. These sites allow float bridges to be built or vehicle rafting operations to be conducted with no further engineering effort to prepare the approaches to the stream. They appear similar to and at very low water levels may even be used as fords.

b. All float bridge/raft sites are depicted with an open triangle (Symbol 512) on each side of the stream.

c. Where sites on opposite banks are not directly across from each other (angled channel crossing), the triangles on each bank should still point perpendicular to the tangent of the bank at their site.

3.13.5.1.4 **Dams** (Symbols 513 & 514).

a. Dam - An artificial or natural barrier or wall across a stream. For example a dam could be constructed for one or more of the following purposes: creating a reservoir for water storage, diverting water into a conduit or channel, creating a hydraulic head for power generation, improving stream navigation, controlling floods, or creating a sediment catchment basin.

b. Along the drainage network shown on the Surface Drainage Overlay, only dams greater than or equal to 5 meters high are portrayed. They are shown with the regular dam symbol (Symbol 513) and an associated dam information holder (Symbol 514), which provides data on length along the crest, width across the crest, height (as measured vertically from the lowest point on the down stream side to the crest) and construction material. All associated attributes measured from imagery will be shown to the nearest half meter (0.5m). If available, more precise measurements from field check (on-the-ground) data or collateral sources shall be shown instead. Construction material is shown in the following categories:

Dam Information Holder Code	Construction Material
U	Unknown
C	Concrete
E	Earthwork
S	Stone

c. Along the drainage network not shown on this overlay (streams, rivers, canals, etc. with a gap width less than or equal to 18 meters), only dams meeting either or both of the following conditions shall be shown:

(1) The reservoir behind it is large enough to be portrayed as open water on this overlay, or

(2) The dam is greater than or equal to 20 meters in height (from base level to crest).

d. Dams wider (at their base level) or longer (along the crest) (in vertical view) than the minimum size symbol (1x4mm - 250x1000 meters ground distance) shall be plotted to scale in that dimemsion(s).

3.13.5.1.5 **Locks** (Symbols 516 & 517).

a. Lock - An enclosed structure in a canal, stream or dock with gates at each end and used to raise or lower boats and barges as they pass from one water level to another.

b. All locks are depicted with a lock symbol (Symbol 516) and the lock information holder (Symbol 517), which annotates the length and width. All associated attributes measured from imagery will be shown to the nearest half meter (0.5m). If available, more precise measurements from field check (on-the-ground) data or collateral sources shall be shown instead.

c. The points (closed gates) in the lock symbol face up-stream (the current or water pressure holds them shut). Any locks wider or longer than the minimum size symbol (1.5x4mm - 375x1000 meters ground distance) shall be plotted to scale.

d. Where a dam and lock combination occur adjacent to each other within the same gap width cross section, if necessary, the minimum size dam symbol will be displaced to its land side enough to allow the lock symbol to be correctly positioned (Figure 34). Any transportation features crossing this combination will be shown as a road or railroad (on the dam) and a bridge (over the lock) on the Transportation Overlay.

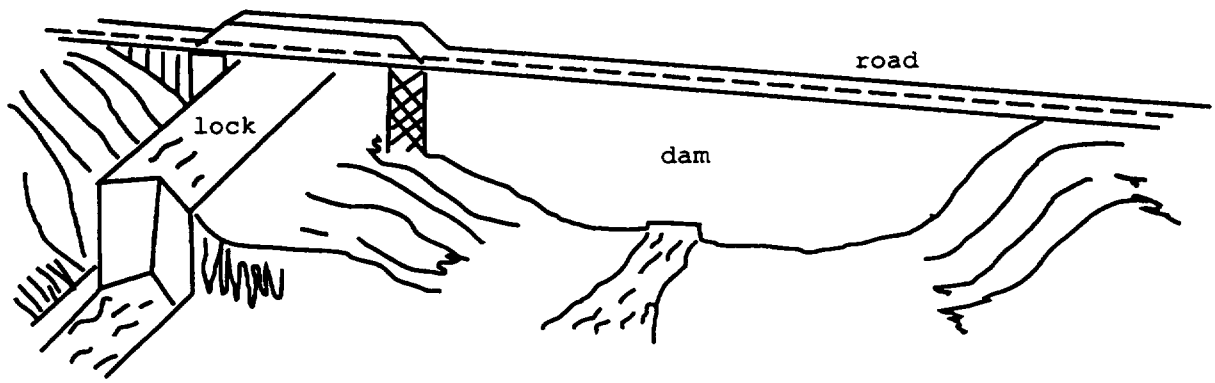


FIGURE 34. Road crossing over a dam and lock.

e. If two or more locks along a drainage segment are too close together (less than 4mm [1000m ground distance]) to show all locks, or if there are multiple locks at one point, only one lock symbol with a leader line connecting all lock information holders will be used, even if the measurements are the same for all locks. See Figure 35.

3.13.5.2 Additional features. Additional features will be handled as per 3.13.8, Miscellaneous Surface Drainage Features.

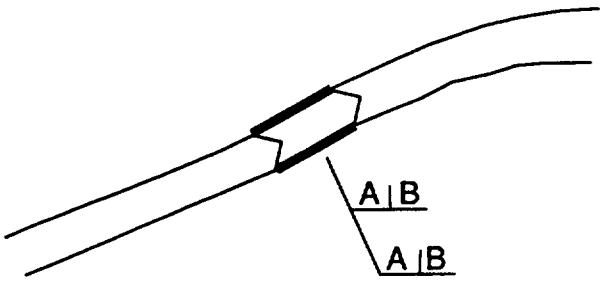


FIGURE 35. Multiple locks on a drainage segment.

3.13.6 Labelling surface drainage segments.

a. On the Surface Drainage Overlay, all flowing water surface drainage linear segments and double line streams shall be coded with a nine-digit code, except as noted in 3.13.7c. The drainage codes shall be positioned to indicate the proper classification without making the overlay cartographically illegible. An example of proper classification depiction is shown in Figure 36. Line stream segments without coding indicate standard codes as described in 3.13.4.5.

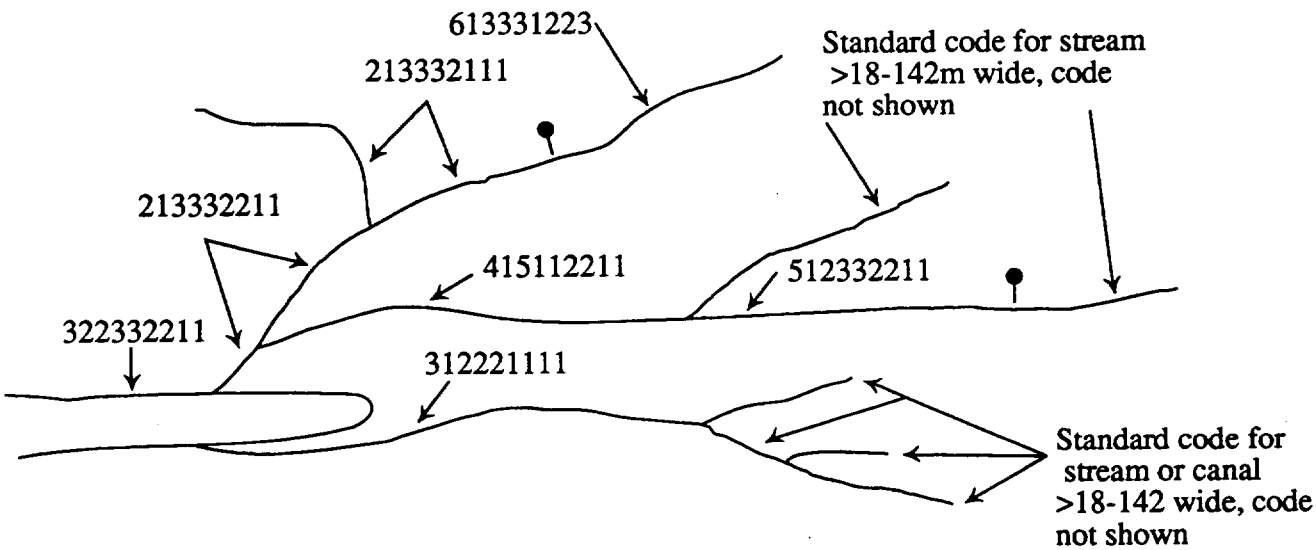


FIGURE 36. Stream segment labelling.

b. In order to improve legibility in crowded areas, one nine digit code may be used to identify multiple segments with the same characteristics by the use of multiple arrows, as illustrated in Figure 37. The number of arrows from a single nine digit code normally shall be limited to four, unless extreme density necessitates additional arrows.

c. Where crowding or the sheer density and extent of drainage features cartographically prevents the coding of small short segments, the following exception to the normal rules is allowed: If the non-coded segments are on a trunk

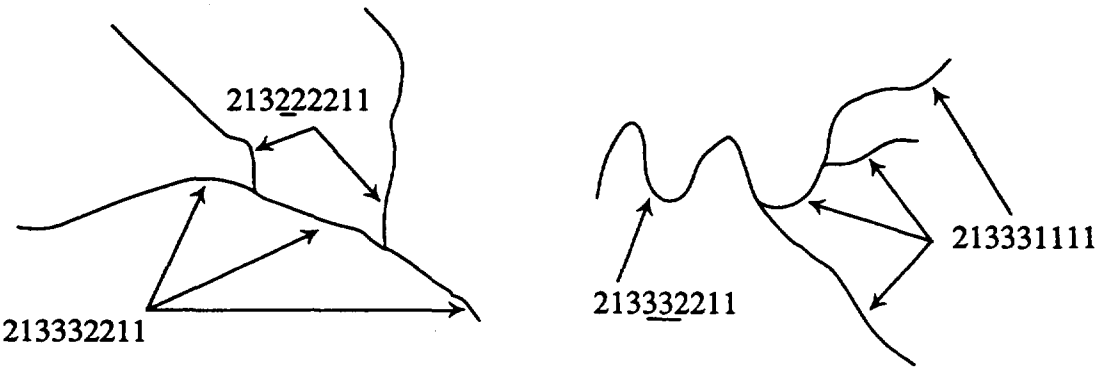


FIGURE 37. One code labelling multiple stream segments.

drainage line and lay between segments with the same code values, they will be ascertained to also carry the same code as the adjacent segments. See Figure 38

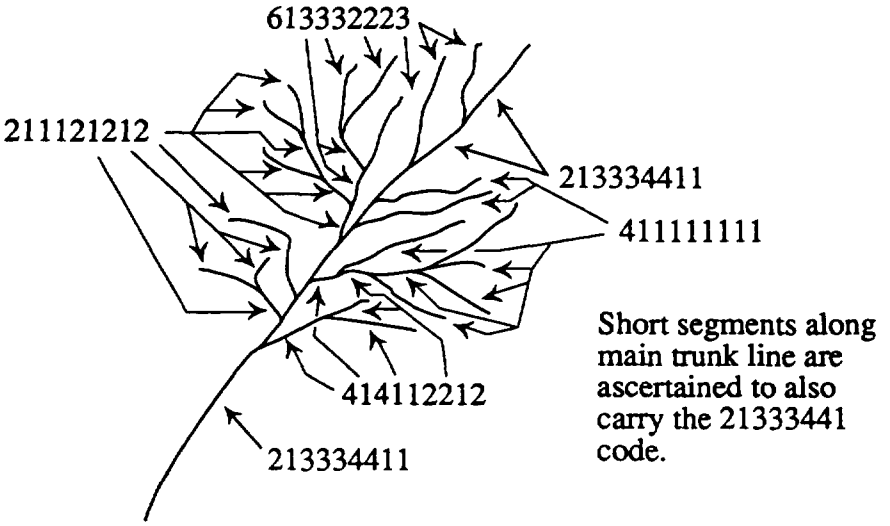


FIGURE 38. Labelling in cartographically crowded areas.

3.13.6.1 Labelling alignment. All codes, labels, descriptive notes, etc. on the Surface Drainage Overlay will read left to right and be placed parallel to the center tangent of the southern neatline.

3.13.7 Symbology and segmentation.

3.13.7.1 Symbol gap width. A gap of 0.25mm between symbols (including leader lines) and the lines of the surface drainage features will be maintained.

3.13.7.2 Segmentation.

a. On the surface drainage thematic a segment is defined as an individual section of any flowing water symbol which carries a single nine digit classification code and is bounded by a point of change symbol, junction of like symbology, or its own terminus point(s).

b. Individual segments for linear features are formed at stream junctions (intersections), points of symbology change, where linear segments flow into areal drainage features (open water or double line streams), point of change symbols indicating stream characteristic changes, and at any other symbol which by its portrayal breaks the drainage line and thereby causes a change in either the drainage classification or in one of the nine coded characteristics.

c. Individual segments for areal drainage features are formed at point of change symbols (indicating stream characteristic changes), where areal features begin or end in linear segments, and at any other symbol which by its portrayal breaks across the width of the drainage symbol and thereby causes a change in either the drainage classification or in one of the nine coded characteristics. Areal drainage features do not have to be individually segmented for linear drainage coming into them from the side (illustrated in Figure 39).

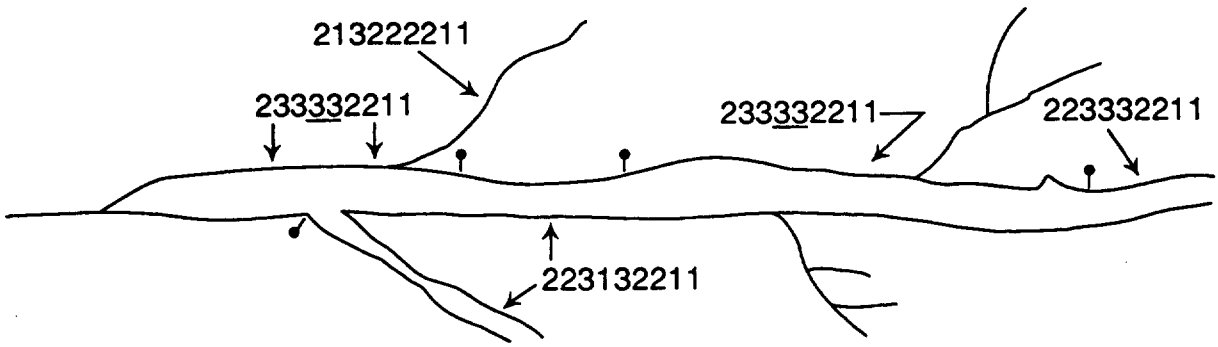
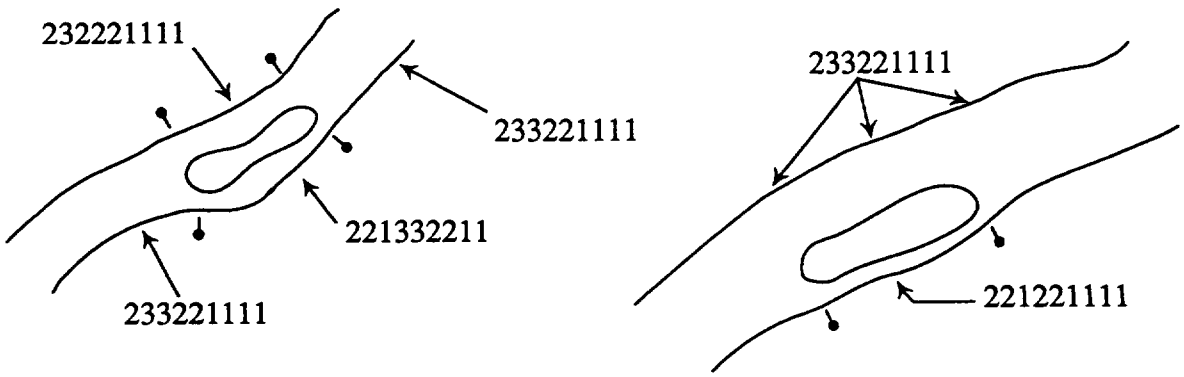


FIGURE 39. Segmentation and coding.

d. An island, larger than the minimum size (2mm by 20mm at map scale) located within a stream channel, shall cause the drainage symbol to be segmented and labelled as shown in Figure 40.



a. Both sides of the stream are divided into smaller segments.

b. Only one side of the stream is divided into a smaller segment.

FIGURE 40. Treatment of islands greater than minimum size.

e. A point of change symbol is needed only where there is no other boundary to mark a point of stream characteristic (code) change. The correct positioning for point of change markers is illustrated in Figure 41.

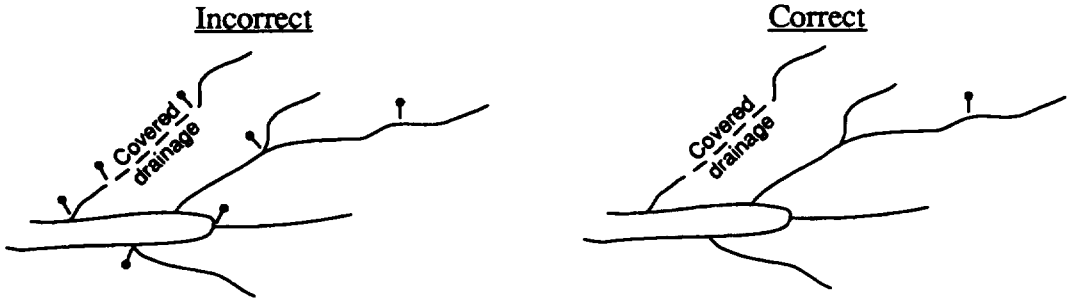


FIGURE 41. Correct positioning of point of change markers.

3.13.7.3 Drainage feature intersections.

a. Where covered drainage and/or features underconstruction intersect with either larger streams or canals or with the neatlines of a map sheet or product area, dashed lines or dots should touch in order to indicate the streams confluence point or to indicate that the feature extends onto the adjoining sheet or product area, as shown in Figure 42.

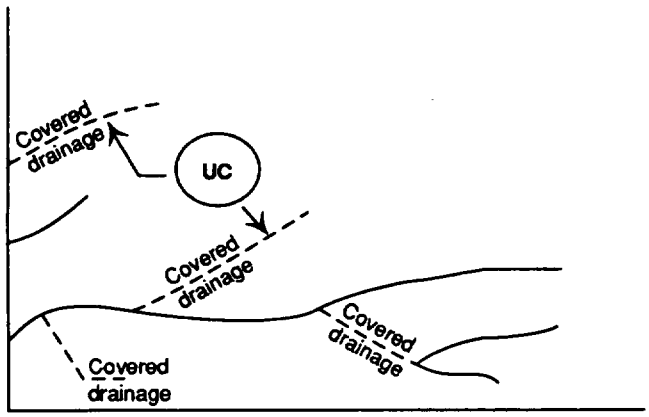


FIGURE 42. Drainage feature intersections.

b. Where the flowing water of a double line stream meets the standing water of an open water feature, point of change markers will be used to denote where the coded flowing water feature ends. A point of change symbol is not needed at the intersection of a single line stream or canal segment with an open water feature. Examples of these points can be seen in Figure 43.

3.13.8 Miscellaneous surface drainage features.

a. Additional surface drainage features may be encountered which are of major significance to military operations, especially river and channel crossings and/or landings. In some environments, features such as intermittent lakes, washes/wadis, anastomosing streams, elevated aqueducts, tidal flats, weirs, flood barrages, features under construction, etc. may be of operational and landmark

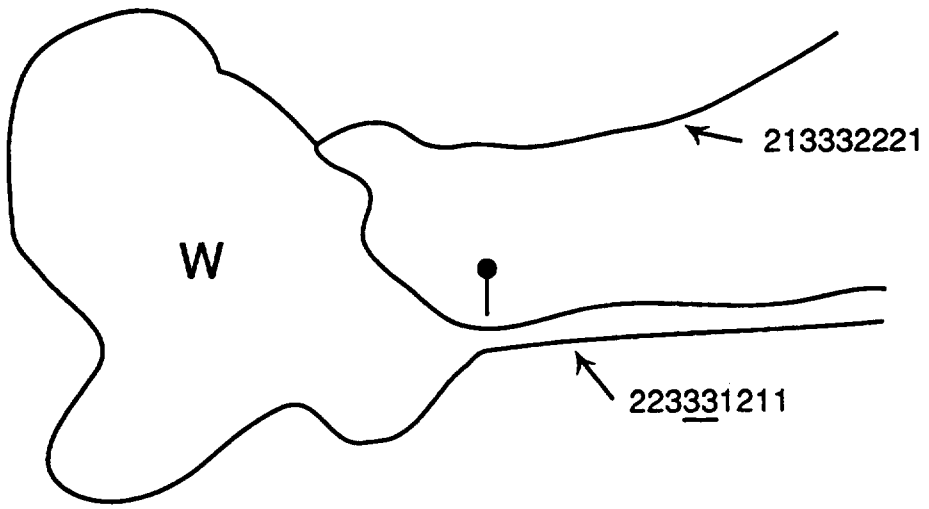


FIGURE 43. Treatment of intersections with open water.

significance. As some production systems can handle only a limited number of miscellaneous items on each of the thematic overlays, care must be taken to show only those that would have a major impact on military operations.

b. Unless specified otherwise in Appendix I, depiction of these and or other similar features may require modification of the legend and/or symbology in order to provide unique symbology of the feature. Where possible, standard (as defined by this specification) letter or number surface drainage polygon and linear identification codes will be used. If the feature requires unique symbology, standard symbols from the Military Specifications for 1:250,000 Joint Operations Graphics Series, 1501A (Air) and 1501 (Ground), MIL-J-89100, and the Military Standard for MC&G Symbology, MIL-STD-2402, will be used to the maximum extent possible.

c. Appendix I defines and specifies the symbology to be used for most of the miscellaneous features which have been occasionally used on the various thematic overlays, since the first edition PTADB specifications (PS/3JB/020) were published in December 1982.

3.13.9 Linear and areal extent.

a. Whereas surface drainage is represented by a linear overlay with some areal features, all points within the neatline are not assigned map unit codes.

b. Stream ends (tails) and single tributaries must be greater than or equal to 10mm (2500m ground distance) long or longer in order to be depicted.

c. Drainage segments between intersections may be as short as necessary.

d. For a stream to stand alone, where the stream does not flow into another stream, river, or body of water and has no tributaries flowing into it, the stream must be 10mm (2500m ground distance) long or longer, unless it is a significant feature. Then a drain of a lesser length may be shown. See Figure 44.

e. The minimum drainage segment length as created solely by changes in the nine digit characteristics code is 10mm (2500m ground distance).

f. While the nominal minimum size polygon for areal flowing water and flowing water formed features is only 5.6 square millimeters (355,000 square meters ground area) with a minimum gap width of 0.57 millimeters (142 meters ground distance) and 10 millimeter (2500 meters ground distance) length, other areal drainage features shall have an areal extent of at least 40 square millimeters (2,500,000 square meters ground area) with a minimum width of at least 2 millimeter (500m ground distance). As an example, an island smaller than minimum size (2x20mm) within a stream channel will not be shown on the Surface Drainage Overlay.

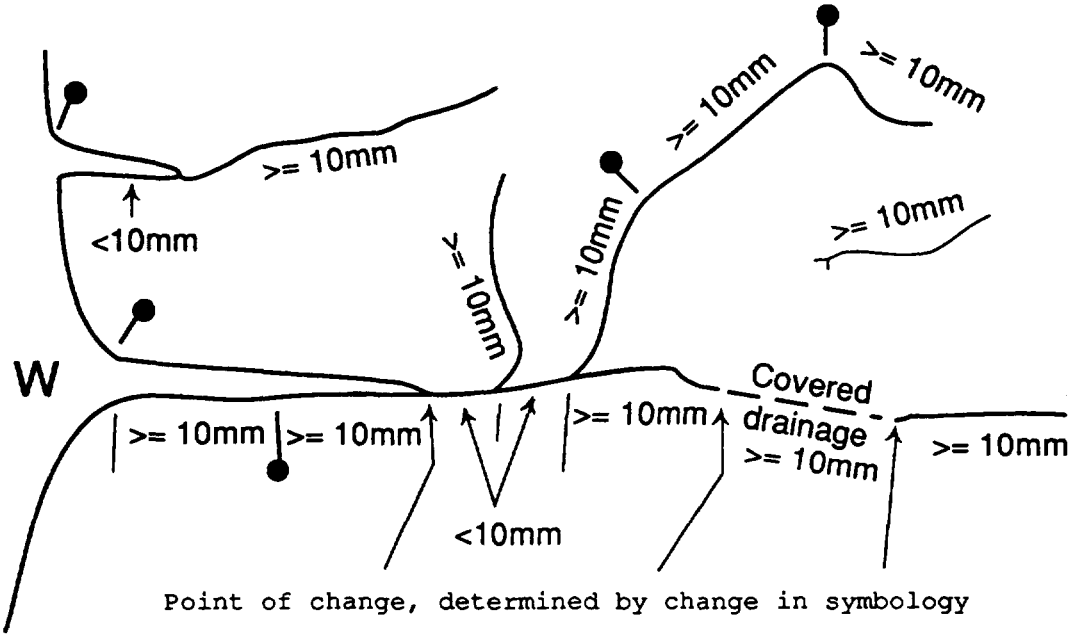


FIGURE 44. Minimum segment lengths.

3.14 Hypsography/Physiography. This section provides the basic guidance for the production of the Surface Configuration (Slope) Overlay for the PTADB.

3.14.1 General slope information.

a. The Surface Configuration Overlay portrays thematic mapping units (features) that delineate boundaries of homogeneous classes of ground surface slope ranges over the extent of the base map sheet.

b. Information shown on this overlay portrays the maximum slope of the surface at each point on the ground, expressed as percent slope (tangent of the slope angle x 100), rather than in degrees. Slope is defined as (1) ground whose surface forms an angle with the plane of the horizon (a natural or artificial incline) or (2) the degree or extent of deviation from the horizontal. Although there are an infinite number of slope values at a given point, the maximum slope is the critical limiting value for military operations. Some microrelief information affecting movement of vehicles or foot troops is depicted on the Obstacles Overlay. Additional microrelief information is provided via the surface roughness descriptors on the Surface Materials Overlay.

c. Components of the Surface Configuration (Slope) Overlay are:

1. Slope Percentage Categories
2. Naturally and/or Culturally Dissected Land
3. Common Open Water Areas

d. The components of the Surface Configuration Overlay are derived from a variety of sources including the map contour plate, base map, slope maps, or their digital file equivalents, and an examination of the imagery.

e. A sample legend with map unit codes for the Surface Configuration (Slope) categories is provided in Appendix D. The lettered map unit codes are standardized and remain the same for all projects.

3.14.2 Slope classification and coding.

3.14.2.1 Slope classification.

3.14.2.1.1 **Slope categories** (Symbol 104, labelled "A" to "F" as listed below). The following slope percentage categories are portrayed on the Surface Configuration (Slope) Overlay:

Map Unit Code	Slope (%) Category
A	0 - 3
B	> 3 - 10
C	>10 - 20
D	>20 - 30
E	>30 - 45
F	>45

3.14.2.1.2 **Naturally and/or culturally dissected land** (Code Y).

a. Naturally and/or culturally dissected land (0 to > 45%) is a special case slope category. It represents a collection of individual slope categories covering the full range from zero to greater than 45 percent, each of which alone is below the minimum portrayal size, but which collectively form an area large enough to be portrayed in this special category. The use of this category is strictly limited to those cases where it is the only way to properly represent a range of heterogeneous slope categories in a small area. Its areal extent will normally cover only a small fraction of the overlay.

b. Some of the geomorphic phenomena likely to display this type of surface include:

(1) Numerous, very close, very steep, sand dunes;
(2) Portions of badland areas;
(3) Areas of very closely spaced mine tailings or spoil piles and/or mining waste areas;
(4) Cuts from strip mining;
(5) Large quarries;
(6) Numerous sink holes in karst areas;

(7) Recent and non-weathered lava flows;
(8) Extremely dissected terrain with dense drainage patterns;
(9) Steep-sloped canyons;
(10) Knob and kettle and hummocky terrain

3.14.2.1.3 **Common Open Water** (Code W). Common open water areas, as defined in 3.13.2, are depicted on the Surface Configuration (Slope) Overlay. These features are obtained from the Surface Drainage Overlay and are coincident with the open water areal outlines (match line for line) depicted on the Surface Materials (Soils) and Vegetation Overlays.

3.14.2.2 Slope coding.

a. Ground surface areas characterized by closely spaced slope polygons that are within one code difference and are too small to be individually depicted shall be collectively symbolized and coded as illustrated in Figure 45.

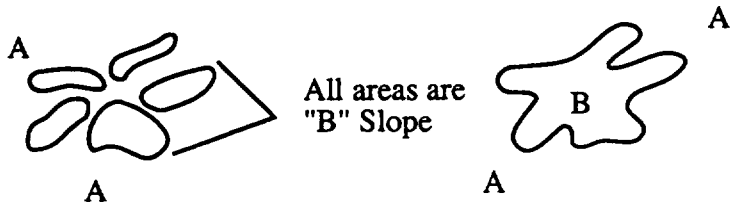


FIGURE 45. Slope coding of small areas differing by one code.

b. Ground surface areas characterized by closely spaced slope polygons that differ by two codes and are too small to be individually depicted shall be collectively symbolized and coded as illustrated in Figure 46.

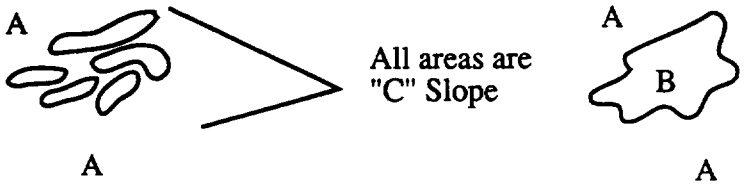


FIGURE 48. Slope coding of small areas differing by two codes.

c. Ground surface areas characterized by a variety of closely spaced slope polygons too small to be individually depicted shall be collectively symbolized and coded as illustrated in Figure 47.

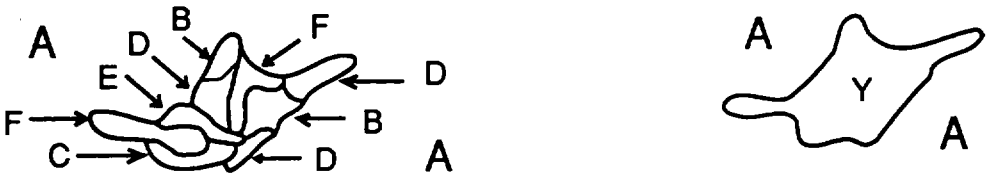


FIGURE 47. Slope coding of small areas with a variety of codes.

d. To clarify slope portrayal along shorelines at sea level, the measurement shall be made from the shoreline to the first contour line. This clarification shall be used only when classifying areas along sea coasts of extensive bodies of water, and not in relationship to lakes, ponds, reservoirs, large rivers, streams, canals, channelized streams and/or ditches.

3.14.3 Depiction of stream valleys and ridge lines.

3.14.3.1 Valleys.

a. Valleys with gently sloping floors or flood plains present some unique problems. Contour lines often do not depict a narrow valley accurately. However, they are important, because they may be the only avenues of approach into an area. The analyst should examine the source material and Surface Drainage Overlay.

b. If narrow valleys with smooth gently sloping floors or flood plains greater than or equal to 2mm (500m ground distance) wide exist, they shall be outlined on the overlay. As shown in Figure 48, these will normally be a slope category A (0 to 3%), with some B's, and an occasional C or D possible.

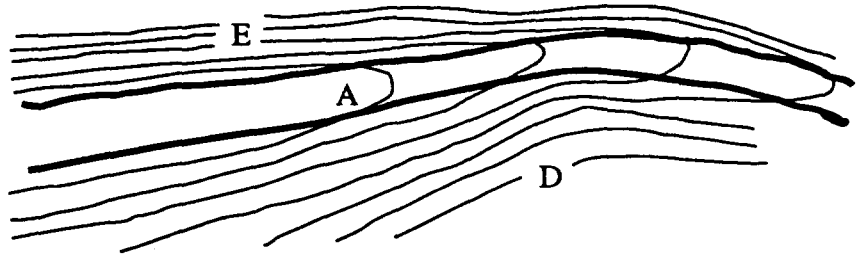
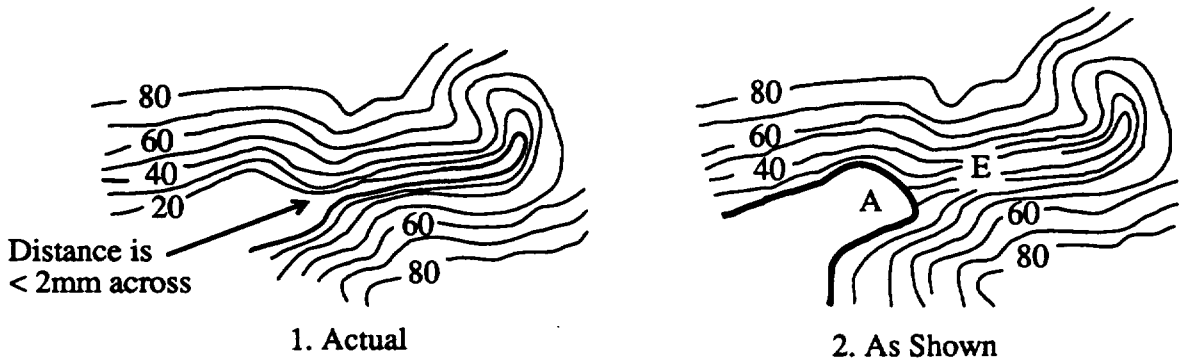


FIGURE 48. Narrow valleys with widths greater than or equal to 2mm (500m ground distance).

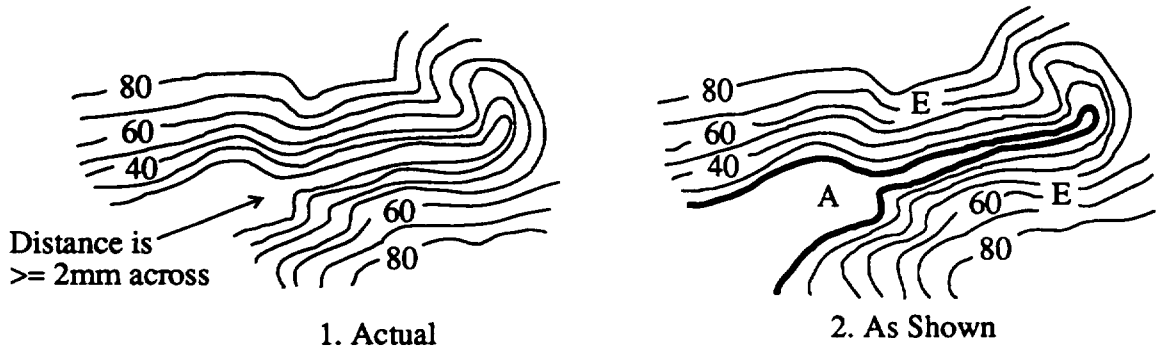
c. When the width narrows to less than 2mm (500m ground distance), the valley should be closed out and the remaining valley included with the categories derived by normal slope generation methods. See Figure 49a.

d. In situations where a valley feature extends into and terminates in a steep slope area, the feature shall be depicted to its fullest extent possible within the minimum size requirements, as long as it is at least 2mm (500m ground distance) wide. See Figure 49b.

e. In situations where a narrow connection exists between wider valley areas not more than 20mm (5000m ground distance) apart in length at map scale and narrows to less than 2mm (500m ground distance), but is still greater than 1mm (250m ground distance) in width at map scale, the connection can be made to show the continuous avenue of approach. See Figure 50a. Where the wider areas are greater than 20mm (5000m ground distance) apart in length at map scale and the narrow connection is less than 2mm (500m ground distance) but still greater than 1mm (250 m ground distance) in width at map scale, the connection shall be combined with the slope code for the higher side relief area. See Figure 50b.



a. Narrow Valley whose Width is < 2mm (500m ground distance).



b. Narrow Valley whose Width is >= 2mm (500m ground distance).

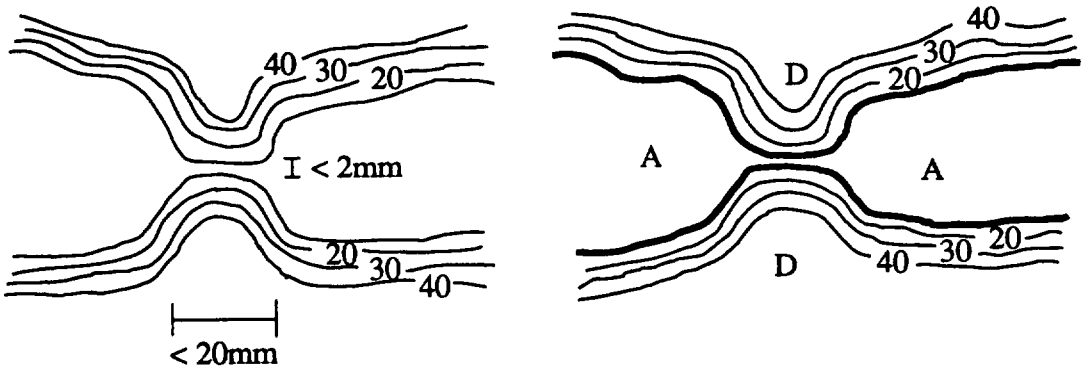
FIGURE 49. Coding narrow valleys.

3.14.3.2 Ridge lines.

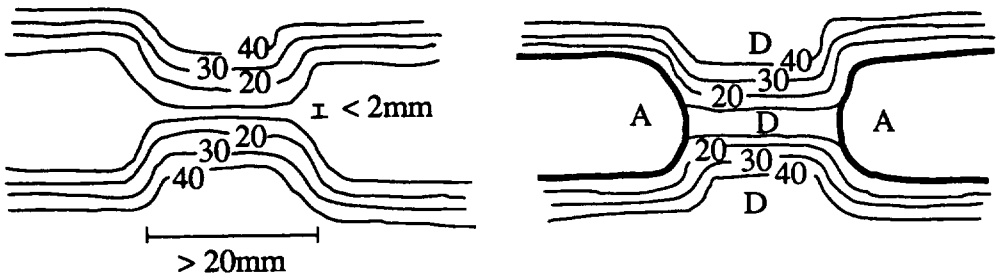
a. Hilltops with long, thin, flat to gently sloping ridgelines represent another unique problem area. Contour lines often do not depict the sharpness of ridgelines accurately. If the source materials show that the top is part of a long flat ridge line greater than or equal to 2mm (500m ground distance) wide and more than 100mm (25,000m ground distance) long and can be used as an avenue of approach, they shall be shown with a slope category A, with B's possible. While the minimum width specification is 2mm (500m ground distance), narrower connections less than 20mm long (5000m ground distance) may also be shown. See valley examples in Figure 50. Figure 51 shows examples of smooth usable stream valleys and ridgelines.

b. In situations where a saddle or pass forms a low point on a ridge or crest line (generally a divide between the heads of streams, flowing in opposite directions) less than 20mm (5000m ground distance) in length and less than 2mm (500m ground distance) in width at map scale, the slope shall be combined with the slope category depicting the two heads of streams. See the illustrated example in Figure 52.

c. In situations where a steep slope creates a sharp break in a relatively gentle slope between a valley floor and a saddle, the gentle or level slope code (Example: code A) shall be terminated at the break. See Figure 53.



a. Valley Connection <20mm in Length (<5000m ground distance and > 1mm to 2 mm in Width (>250m to 500m ground distance)



b. Valley Connection >= 20mm in Length (>=5000m ground distance) and >1mm to 2mm in Width (>250m to <500m ground distance).

FIGURE 50. Narrow connections between valleys.

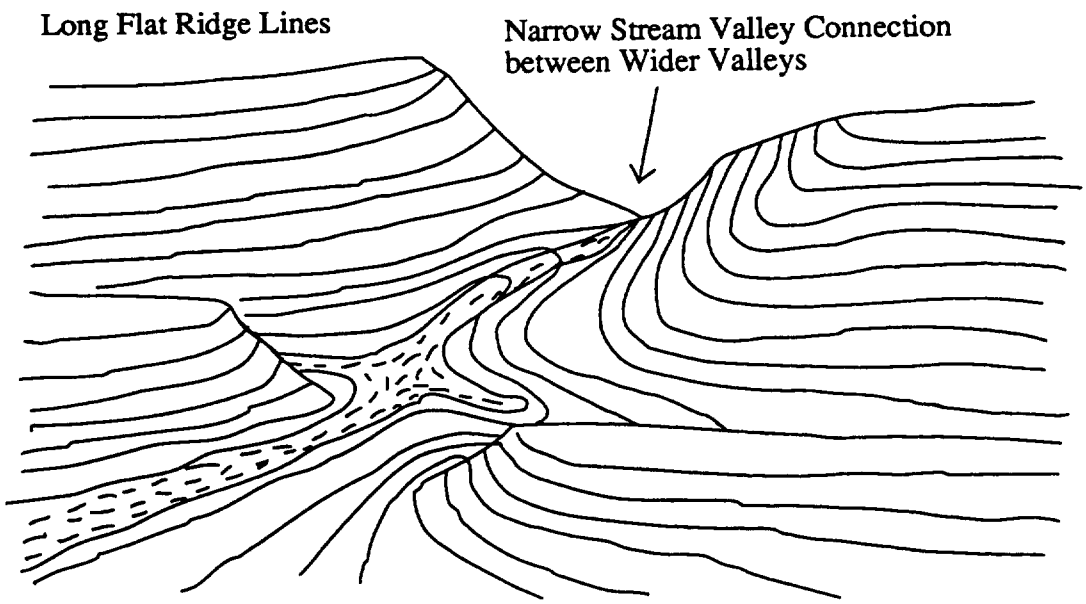


FIGURE 51. Smooth stream valleys and ridges.

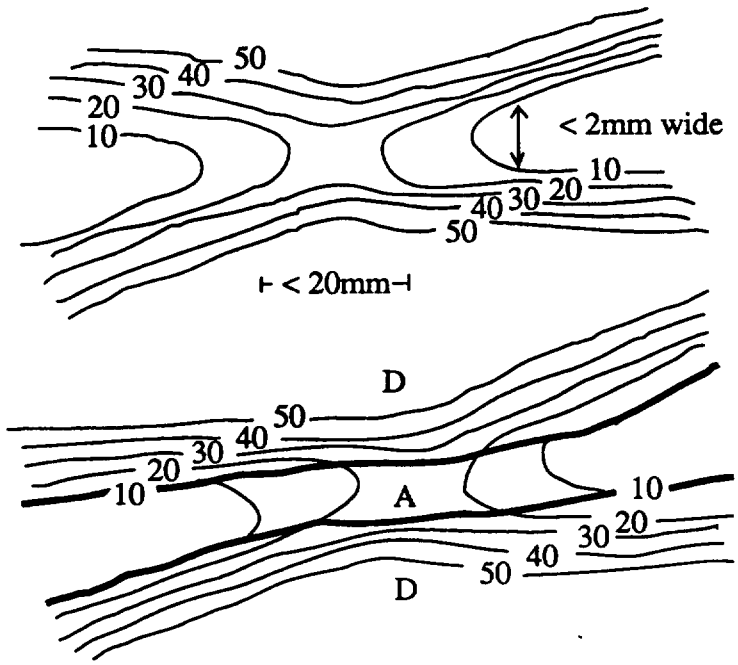


FIGURE 52. Depiction of saddle/pass.

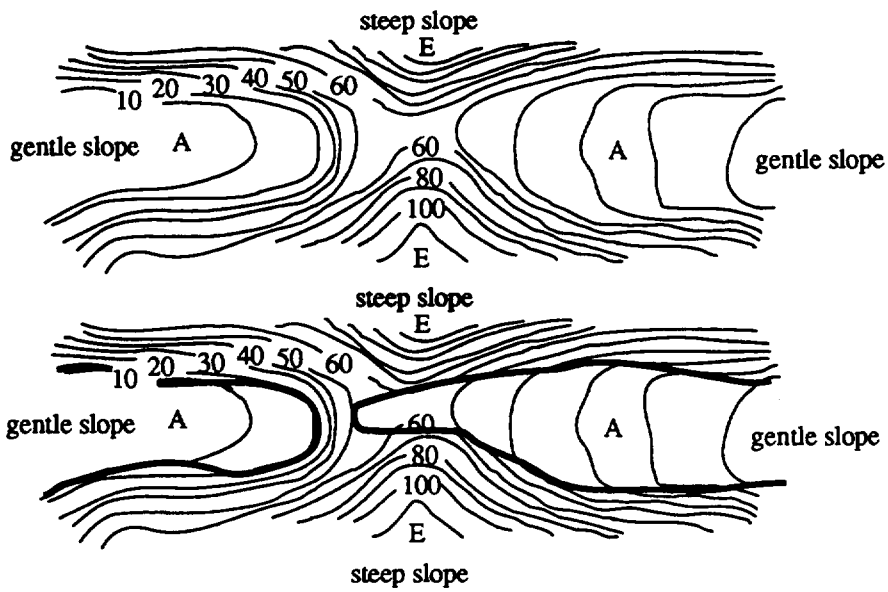


FIGURE 53. Depiction of saddle/pass with a steep slope.

3.14.4 Areal extent.

a. Whereas surface configuration is represented by an areal overlay, all points within the neatline must be assigned a map unit code. No slivers (gaps or overlaps) shall exist between map unit boundaries. Except for common open water streams, canals, etc., which have an areal extent of 40mm² (2,500,000m² ground area)

with a nominal perennial water gap width of 2mm (500m ground distance), the minimum size polygon shown shall have an areal extent of at least 80mm² (5,000,000m² ground area) with a minimum width greater than or equal to 2mm (500m ground distance).

b. Note that very steep (>60%), long (>10mm map or 2500m ground distance), narrow or thin (<2mm map or 500m ground distance) slopes should be shown as escarpments (with teeth pointing down hill) on the Obstacles Overlay, as depicted in Figure 54.

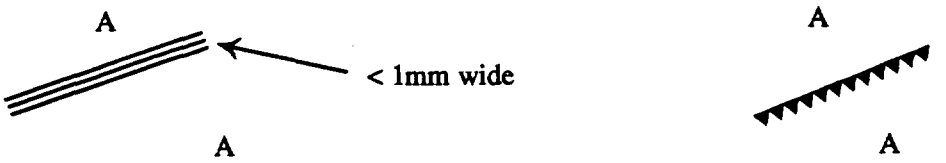


FIGURE 54. Depiction of steep, long, thin slopes as escarpments on the Obstacles overlay.

3.15 Vegetation. This section provides the basic guidance for the production of the Vegetation Overlay for the PTADB.

3.15.1 General vegetation information.

a. The Vegetation Overlay portrays thematic mapping units (features) that delineate boundaries of homogeneous classes of land cover and land use over the entire areal extent of the corresponding base map sheet.

b. Vegetation features shown include those which:

(1) Provide orientation
(2) Afford cover and concealment for troops, vehicles, or unattended ground sensors.
(3) Present obstacles to cross-country movement.
(4) Serve as landmarks.
(5) Provide other significant land use information with military significance.

c. Vegetation legend categories are shown in Appendix D.

3.15.2 Vegetation classification and coding.

3.15.2.1 Vegetation type.

3.15.2.1.1 Vegetation legend. Vegetation types are classified and coded with letters, or a combination of letters and numbers. A sample Vegetation Legend showing the classification scheme and map unit codes is given in Appendix D. Although the general legend and its set up is standardized, the entries in the Tree Spacing - Stem Diameter Table are tailored to each job and usually include those categories that may appear on any of the overlays within the project area.

3.15.2.1.2 **Vegetation categories**. (Symbol 104, labelled "A1 to "X" as listed below). The categories reflect similarities in military significance and not taxonomy. The following is a glossary of vegetation types to be shown and map unit codes used to represent them on the overlays. The alphanumeric map unit codes are standardized and remain the same for all projects.

a. Agriculture (Cropland) - Soil tilled for the growing of crops is considered land under cultivation. Ground left fallow on a seasonal basis is included in this category. Orchards/plantations/nurseries and vineyards are considered as separate categories.

(1) **Dry Crops** (code A1): Crops grown in moist or dry conditions that are generally free of other vegetation (except near fencelines or hedgerows). Included in this category are crops such as grains, tubers, legumes and vegetables.

(2) **Wet Crops** (code A2): Crops grown in a wet environment, usually flooded in the spring and kept saturated until harvest time. Small dikes or walls often enclose the area, such as a rice paddy.

(3) **Terraced Crops** (code A3): Raised areas of cropland supported by embankments or retaining walls. These crops, wet or dry, are generally found in small mountain valleys and on hillsides world wide, forming a step-like effect and are culturally related.

(4) **Shifting Cultivation** (code A4): The predominant vegetation is removed (by cutting, burning, etc.) and crops are planted in its place. In 2 - 3 growing seasons the soil nutrients are exhausted, the field abandoned, and secondary succession begins. The result is a mixed patchwork of small crop fields and small stands of young trees of differing heights scattered throughout the region. Individual polygons of crops and young trees, which are smaller than the minimum size criteria, shall be combined into one polygon consisting of shifting cultivation, which is coded A4. This type of extensive swidden agriculture, often referred to as "slash and burn agriculture", generally follows a 15 to 20 year cycle. It is found worldwide, but usually only in tropical and subtropical regions.

(5) **Agriculture with Scattered Woodlots** (code A5): Cropland is the predominant vegetation with 25 to 50 percent of the area covered with scattered small woodlots, none of which individually meet the minimum size requirements for portrayal separately. Woodlots are intermixed with cropland throughout the area. Large areas of open cropland next to A5 areas shall be portrayed as separate A1, A2, or A3 agricultural areas.

b. Brushland/Scrub - Brushland consists of woody plants with more than one stem. Brushland includes heath, shrubs, thickets, and other low growing multi-stemmed bushes. Scrub is usually vegetation dominated by shrubs and located in arid, semi-arid, or temperate areas. Scrub growth includes cactus, mesquite, sagebrush, chaparral, thickets, etc. This vegetation type is shown in two categories depending on the density of the plants. Dwarf trees less than five meters high at maturity, unless in orchards, will also be included in these areas.

(1) **Brushland/Scrub with open to medium spacing** (code B1): Areas where the plant density covers from 5 to 50 percent of the ground surface and is less than 5 meters high.

(2) **Brushland/Scrub with medium to dense spacing** (code B2): Areas where the plant density covers from 50 to 100 percent of the ground surface and is less than 5 meters high.

c. Forested Areas - This category has three divisions defined by the predominant tree type. A tree is defined as a perennial woody plant at least 5 meters in height at maturity, with a single stem and definite crown shape.

(1) **Evergreen/Coniferous Forest** (code C): More than 60 percent of the trees in the area retain their foliage throughout the year. In addition to evergreen/ coniferous trees, this category also includes broadleaf evergreen trees, such as Live Oak, Holly Oak, Cork Oak, and tropical broadleaf trees like Magnolia, Ebony, Mahogany, etc.

(2) **Deciduous Forest** (code D): More than 60 percent of the trees in the area lose their foliage seasonally. In addition to broadleaf deciduous trees, this category also includes deciduous conifers, such as Dawn, Redwood, and the Larch species.

(3) **Mixed Forest** (code E): Contains both evergreen/ coniferous and deciduous trees in proportions varying between 40 to 60 percent.

d. Commercially Treed Areas - These consist of areas of planned plantings of rows of evenly spaced perennial treed vegetation, generally free of underbrush and vines. These trees yield nuts, spices, fruits or other commercial products exclusive of timber. In some areas, general agriculture is carried on beneath and between the trees. A tree is defined as a perennial woody plant at least 5 meters in height at maturity, with a single stem and definite crown shape. Note that some orchards are now planted with dwarf trees, whereby a smaller mature height is maintained by a combination of pruning and root stock grafting which will stunt the trees' growth. This category has four divisions differentiated on the basis of leafing characteristics and habits, similar to the forested areas:

(1) **Evergreen/Coniferous Orchard/Plantation/Nursery** (code FC): More than 60 percent of the trees retain their foliage throughout the year. Both broadleaf and evergreen coniferous trees are included in this category.

(2) **Deciduous Orchard/Plantation/Nursery** (code FD): More than 60 percent of the trees in the area lose their foliage on a seasonal basis. This class includes both broadleaf and coniferous deciduous trees.

(3) **Mixed Orchard/Plantation/Nursery** (code FE): Contains both evergreen coniferous and deciduous trees in proportions varying between 40 to 60 percent.

(4) **Palm Orchard/Plantation/Nursery** (code FP): Plantings of normally evergreen trees with simple stems and a crown of large fan-shaped leaves found in tropical and subtropical climatic zones. Some of the better known products from these palm orchards, plantations, and nurseries include bananas, coconuts, oils, and dates.

e. Grasslands - Grasses include all kinds of non-woody plants.

(1) **Grassland, Pasture, Meadows** (code G1): A grassland is an extensive area of herbaceous plants consisting primarily of grass. In middle latitudes grasslands are often termed prairies (tall grass, greater than or equal to 1 meter) and steppe (short grass, less than 1 meter). Poorly drained grasslands are commonly called meadows.

(2) **Grassland with Scattered Trees** (code G2): Primarily a grassland with widely spaced, scattered trees (with a maximum canopy closure of 10 percent) and scrub growth intermixed throughout the area. An abandoned field reverting back to a forest, as well as a tropical savanna, would exemplify this category.

f. **Forest Clearing** (code H) - Areas where some or all of the forested vegetation has been removed by natural or man-made causes, such as logging areas and burns. Since vegetation or silviculture practices will quickly change these areas, this code should not be used if another code better describes the area.

g. Swamp - A low lying saturated area when compared to the regional topography, but it can exist on flat-lying areas created by certain geomorphic environments. Swamps are covered with shallow water all or most of the year, where accumulating dead vegetation does not rapidly decay. Vegetation mainly consists of hydrophyte trees and shrubs whose roots are adapted to wet conditions, with an open to very dense overhead canopy closure. Thus, the swamp code will have a digit depicting canopy closure. The most common swamps are mangrove, nipa, or cypress. The swamp category (code I) is subdivided into the following four separate swamp vegetation classes:

(1) **Evergreen/Coniferous Swamp** (code IC): A swamp area where more than 60 percent of the trees retain their foliage throughout the year. Of the various types of evergreen/coniferous swamps, nipa swamps are the best known. Some of their unique environmental characteristics include a dense growth of stemless palms found in tropical and semi-tropical tidal and brackish waters. It usually occurs farther inland than mangrove and forms strips in channels through which the tidal waters flow.

(2) **Deciduous Swamp** (code ID): A swamp area where more than 60 percent of the trees lose their leaves seasonally. Of the various types of deciduous swamps, the cypress swamp is the best known. It consists of large bald cypress trees (up to 30m high), mostly deciduous conifers, with buttressed trunks and vertical knees extending upward from submerged roots, and is mainly found in the southern U.S.

(3) **Mixed Swamp** (code IE): A swamp area which contains both evergreen/coniferous and deciduous trees in proportions varying between 40 to 60 percent.

(4) **Mangrove Swamp** (code IM): A separate swamp class with a dense growth of trees with tangled aerial roots usually found along seacoasts and banks of tidewater streams in tropical and semi-tropical areas.

h. **Bog/Marsh** (code J) - A bog is a permanently wet (either poorly drained or periodically flooded on a regular basis) area of soft, wet, spongy ground of peat characterized by the growth of sphagnum (peatmoss), herbaceous vegetation, and in some cases woody shrub vegetation on an accumulation of organic matter.

If numerous trees (greater than or equal to 5 percent canopy closure) are present, the bog shall be included in the swamp category. A marsh is a wet or periodically inundated region that is usually void of woody vegetation and generally characterized by grasses, sedges, reeds, and other herbaceous vegetation. Both tidal and non-tidal areas are included in this category.

i. **Wetlands** (code K) - Land subject to inundation (LSI)

(1) Wetlands are areas which may be temporarily covered with non-tidally influenced water on a periodic basis. These fluctuating inundations may be related to daily, seasonal, annual, or longer responses due to natural or man-induced stress or influences (i.e., reservoir control areas, salt evaporators, storm water runoff impoundments, storage ponds, etc., as well as areas subject to natural inundations as a result of periodic overflowing of a stream or body of water, heavy precipitation, snowmelt, etc.).

(2) Wetlands not categorized in the wet or terrace crops, swamp, bog/marsh, or bare ground codes shall be placed in this category.

(3) Since normal flood plains found alongside most streams are only inundated on an occasional basis by an extreme event (flooding), they are not considered in this case.

(4) Monsoonal seasonal stream variation

(a) In regions with monsoonal wet-dry seasonal variations, the area between the normal, dry season, non-monsoonal, stream channel and any embankments built to hold the monsoonal floods (see Figure 55) shall be categorized as wetlands (land subject to inundation) on the Vegetation Overlay, provided some other vegetation code, such as wet crops (code A2 - usually rice paddies in monsoonal areas), bog/marsh, swamp, bare ground, etc. does not better describe the vegetation situation in this area.

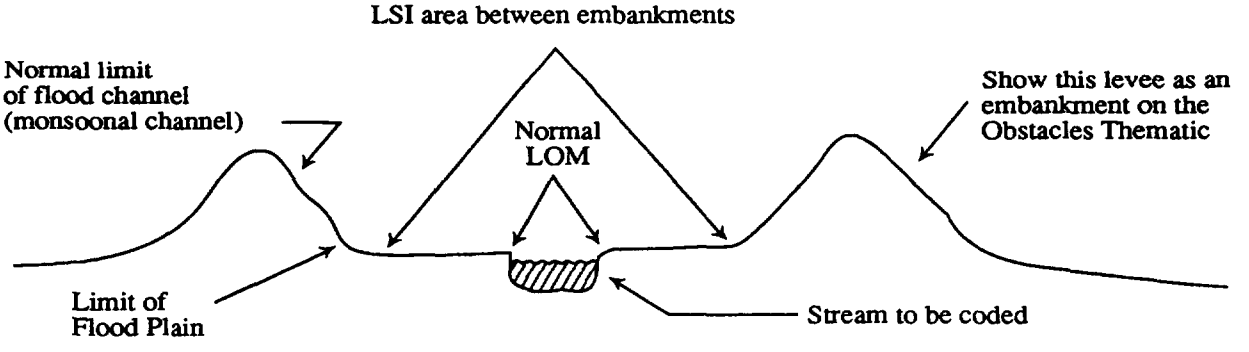


FIGURE 55. Monsoon area.

(b) If large and steep enough, the embankments shall be shown on the Obstacles Overlay. In these regions, the following clarification note shall be added to the Vegetation Overlay legend:

NOTE: LSI by monsoonal flooding is normally dry during the non-monsoonal season.

j. **Vineyards/Hops/Ginseng** (code L) - A vineyard is an area consisting of vines planted in a regularly spaced pattern, usually rows, generally 2 meters in height. Hops are a vine-like plant commonly found in Eurasia. Hops are planted in rows supported by poles and grow to heights of 3 to 4 meters. Ginseng is planted in areas that contain vertical protective structures up to 3 meters high. Also included in this category are tree nurseries with supported shading structures.

k. **Bamboo and Wild Cane** (code M) - A woody grass widely distributed in the tropics and subtropics with a height range of 3 to 30 meters and usually extremely dense. Sugar cane is also included in this category, in which case its name will appear in the descriptive title for code M within the vegetation legend.

l. **Bare Ground** (code N) - Permanently bare areas which contain little (less than 5 percent ground cover) or no vegetation, such as strip mines, sand dunes, beaches, lava flows, bare mountainous areas, etc.

m. **Common Open Water** (code W) - Bodies of water, both natural and man-made, such as rivers, lakes, reservoirs, etc., as defined in 3.13.2. The delineations of these features are coincident with those on the Surface Configuration and Surface Materials Overlays as derived from the Surface Drainage Overlay.

n. **Common Built-up Areas** (code X) - Man-made developments consisting of residential, commercial, industrial, and other areas, where the roads, paving, and buildings (roofs) cover approximately 30 percent or more of the available land area. Areas under construction, including subdivisions, if they meet the 30 percent criteria, shall be included in this category. Examples are villages, towns, cities, railroad yards, airports, etc. Developed areas with less than 30 percent built-up ground cover (such as suburban residential areas) will still allow cross-country movement and will **not** be shown on this thematic overlay. Built-up areas are often referred to as urban areas, and for terrain analysis purposes, they are treated as being the same.

3.15.2.2 Canopy closure.

a. Canopy closure is defined as the percentage (%) of the ground area covered by the tree crown area. Crown area is the area covered by the vertical projection of a tree crown to the horizontal plane. Canopy closure is normally computed only for the forested (C, D, E), orchard/plantation nursery (FC, FD, FE, and FP), and swamp (IC, ID, IE, and IM) areas. Canopy closure is normally classified into the following four categories (See Appendix D):

Map Unit Code	Canopy Closure Category (%)
1	0 - 25
2	>25 - 50
3	>50 - 75
4	>75 - 100

b. Canopy closure is given as the first numerical digit behind the C, D, E, FC, FD, FE, FP, IC, ID, IE, and IM codes.

c. Unless specified otherwise, canopy closure for all the other codes is assumed to be in the 0 to 25 percent category, except as listed below, and is not shown on the Vegetation overlay. These categories may be overridden by information from the collateral sources or aerial photography.

Vegetation Category	Defined Canopy Closure (% Summer)
A4	>50 - 75
A5	>25 - 50
M	>75 - 100
X	>25 - 50

d. Note that winter canopy closure is directly derivable from summer canopy closure, but not vice versa. As the PTADB is usually produced for the optimal climatic season for military operations, summer canopy closure is given directly on the overlay. For winter canopy closure, the Concealment-Aerial Detection Table (See Appendix H) is used to determine the conversions from summer to winter canopy closure. If winter is optimal and winter canopy closure is given on the overlay, this table will not in all cases yield the correct winter to summer conversions.

3.15.2.3 Height.

a. Height ranges for the Forested (codes C, D, and E) and Orchard/ Plantation/Nursery (codes FC, FD, FE, and FP) areas are given in meters and are usually divided into the following three categories:

Map Unit Code	Height (meters)
1	0 - 5
2	>5 - 20
3	>20

b. Height is given as the second numerical digit behind the vegetation type code.

c. Unless given individually, the height of all other vegetation codes, except the treed agricultural areas (codes A4 and A5 - will have blocks of different aged and heighted trees) and Swamps (codes IC, ID, IE, and IM - heights can vary considerably) are defined to be in the 0 to 5 meter height category.

d. If needed, height values may be used for any vegetation type, i.e., tall grasses, bamboo and wild cane, vineyards/hops/ginseng, agricultural areas (open or treed), etc. For mixed vegetation types, such as the treed agricultural types, the predominant height of the tallest vegetation species (most often trees) shall be given. If a height code is assigned, a canopy closure code (either computed or default) must also be used as the first numerical digit following the vegetation type code. Note that in some cases this will result in a vegetation code with one alphabetic character and three numeric values following it.

3.15.2.4 Undergrowth.

a. Undergrowth is defined as the vegetation layer beneath the forest canopy and above the forest floor. This layer normally consists of small woody and herbaceous plants, generally less than 5 meters in height. Undergrowth is

a major factor in determining intervisibility and mobility within wooded areas, and they can be either the same or quite different from summer to winter. Only the summer undergrowth condition is shown on the Vegetation Overlay.

b. The presence and density of undergrowth is normally given in two categories only for the forested areas; however, if required, these categories can be applied to any treed area. This information is generally collected in the field or from collateral sources:

(1) A solid line under a forest vegetation map unit indicates medium to dense undergrowth (greater than 50% ground coverage).

(2) No underline indicates sparse to medium (0 to 50 percent ground coverage) undergrowth, no undergrowth, or the presence and/or density of undergrowth is unknown.

c. The undergrowth underline symbol will be a straight line version of symbol 106 (_____).

3.15.2.5 Tree spacing/stem diameter table.

a. Tree spacing and stem diameter for the vegetation areas with tree heights are listed in a table. The purpose of this table is to supply vegetation data needed for the generation of cross-country movement and other synthesized products. This table is a separate part of the Vegetation Legend, Appendix D. An example is provided at the bottom of the table to aid in reading it.

b. Stem diameter is the diameter of a tree trunk at approximately 1.5 m or 4.5 feet on the high side (if on a hillside) above the surface of the ground (commonly referred to in most forest literature as the diameter at the breast height or dbh). For trees up to 2 meters high, the stem diameter should be measured at their mid-point between the ground and stem tip. Stem diameters are derived from collateral sources or from equations based on crown diameter and/or tree height, or, if available, from actual field measurements. In these specifications, stem diameter is the average diameter in centimeters of the trees within a coded area.

c. Tree spacing is the distance from the center of one tree to the center of the nearest adjacent tree. In these specifications, tree spacing is the average distance in meters between the centers of the trees within a coded area.

d. The Tree Spacing/Stem Diameter Table may be provided in any of the places listed below in order of preference:

(1) As part of the legend on the Vegetation Overlay.

(2) If space is available in a large single polygon (preferably large common open water areas, which are coded W on this thematic overlay), the table can be placed directly on the Vegetation Overlay. No part of the table may be positioned across the neatline or polygon boundaries.

(3) As a separate overlay, if required by space limitations.

3.15.2.6 Miscellaneous vegetation features.

a. Additional vegetation features may be encountered which are of landmark significance to military operations. In some geographic settings, features such as agriculture with scattered trees or rows of trees, ditch irrigation, tundra regions, isolated trees, small clumps of trees, golf courses, cemeteries, etc., may be of significance. Depiction of these or other similar features may require modification of the legend and/or symbology in order to provide unique symbology for the feature. Where possible, standard (as defined in this specification) letter or letter/number vegetation polygon identification codes will be used. If the feature requires unique symbology, standard symbols from the Military Specifications for 1:250,000 Scale Topographic Maps of Foreign Areas (MIL-T-89301) will be used to the maximum extent possible.

b. Tropical rainforests present a unique situation due to multiple canopy levels. The number of canopy levels can be represented by Roman Numerals I, II, or III corresponding to one, two, or three levels. These numbers will follow the height code, such as D43II, C33I, E42III, etc. On the ground the crown cover of the multiple canopies is usually thick enough to fit into the 75 to 100 percent crown closure category. The height code represents the highest canopy. The "type" category is generally mixed or coniferous/evergreen forest, since many of the trees are broadleaf evergreen species, i.e., mahogany, ebony, etc. In areas of thin jungle vegetation, canopy closure percentages are incorporated or combined together, as necessary.

c. For areas that contain a variety of vegetation categories which are below minimum size specifications, the recommended procedure is to group the area into the most restrictive category (i.e., most conservative in terms of movement and concealment).

3.15.3 Areal extent.

a. Whereas vegetation is represented by an areal overlay, all points within the neatline must be assigned a map unit code. No slivers (gaps or overlaps) shall exist between map unit boundaries. Except for streams, canals, etc. which have an areal extent of 40mm^2 (2,500,000m^2 ground area), normally the minimum size polygon shown will have an areal extent of at least 80mm^2 (5,000,000 m^2 ground area) with a minimum width greater than or equal to 2mm (500m ground distance).

b. Exceptions are made in areas containing sparse vegetation. In such cases, small clumps or narrow strips of vegetation which provide concealment or orientation or serve as landmark features, like desert oasis, are shown. Long thin strips of vegetation (<2mm wide), depending on their regional importance would either be omitted or shown as per 3.15.2.6 above. For these features, in arid areas, polygons down to only 2mm^2 in area (125,000m^2 ground area) may be shown.

3.16 Demarcation.

This section is not applicable to this specification.

3.17 Aeronautical.

This section is not applicable to this specification.

3.18 Names and labelling.

a. On the PTADB thematic overlays, features are normally identified by symbols and not by name(s). In the rare case that a miscellaneous or unique feature should need to be named on a thematic overlay, the name should be taken from the base map to which the thematic overlay is keyed.

b. Where no name appears on the base map, refer to MIL-J-89100, as well as MIL-STD-2402 and the DMA Standard Supporting Mark 90, Section 500 - Geographic Names, for proper naming and labelling of applicable features.

c. The following is a list of features which may not appear in the symbology or legend appendixes, but may at some time need to be named on the final product. Definitions for the following features may be found in the DMA Standard Supporting Mark 90, Section 500 - Geographic Names.

Feature Name	Proper Name Example
Banks	Outer Banks
Basin	Great Basin
Bay	Chesapeake Bay
Beach	Virginia Beach
Bench	
Bend	
Bluff	
Bottom	
Break	
Butte	
Canyon	Grand Canyon
Cape	Cape of Good Hope
Channel	English Channel
City	New York City
Cliff	
Corner	Tyson's Corner
Cove	
Crossing	
Desert	Sahara Desert
Dispersed Village	
Dome	
Everglade	Florida Everglades
Falls	
Flat(s)	
Forest	
Gap	
Gorge	
Gulch	
Gulf	Gulf of Mexico
Gut	
Hamlet	
Harbor	Boston Harbor
Head	
Highland	

Hill	
Hole	
Hollow	
Inlet	Hamilton Inlet
Island Chain	Hawaiian Islands
Junction	
Jungle	
Knob	
Knoll	
Lagoon	
Lake	
Lands	
Lookout	
Marina	
Mesa	
Mountain	
Mountain Range	Rocky Mountains
Narrows	
Neck	
Ocean	Atlantic Ocean
Park	Yellowstone National Park
Pass	
Passage	
Patch	
Peak	Pikes Peak
Plain	Great Plains
Plateau	Colorado Plateau
Point	
Pool	
Port	
Range	Coastal Range
Ravine	
Region	
Ridge	
River	
Roadstead	
Rock	
Sands	
Scattered Village	Comunidades of South America, Strevsudlung of Europe
Sea	Caribbean Sea
Sea Mount	
Shelf	
Shoals	
Sink	
Sound	Puget Sound
Spit	
Spring	
Spur	
Strait	
Summit	
Town	

Valley	Death Valley
Village	Greenwich Village
Wood	

d. Names on PTADBs shall be those approved by the U.S. Board of Geographic Names. Normally, U.S. maps of similar scale serve as a guide to features to be named. Individual features of a group are not labelled, instead the names of groups of features are shown (e.g., archipelago, mountain range, etc.).

3.19 Radar.

This section is not applicable to this specification.

3.20 Annotation.

This section is not applicable to this specification.

3.21 Special area.

This section is not applicable to this specification.

3.22 Symbology and type on the final thematic overlays. Symbology for the PTADB Overlays is shown in the Military Standard, MC&G Symbology, MIL-STD-2402, Appendix A. In this specification, example uses of symbology are shown in Appendix B, while examples of legends and tables are shown in Appendix D. Refer to the referenced Military Standards, as well as applicable section 3 paragraphs of this specification, for placement rules and inclusion conditions for the various PTADB thematic overlays. In cases of conflicting guidance, the Military Standards shall take precedence.

3.22.1 Symbology.

3.22.1.1 Symbols, lines, arrows and codes.

a. Symbols, lines, arrows and codes should not overlap or touch other codes, lines, arrows or symbols. Note that the former exception to this rule made for data information holders and offset symbols which have a leader line extending from them toward their location or located symbol on the map sheet (i.e., bridges, dams, locks, etc.) has been corrected to maintain a 0.25mm gap between the leader lines and these offset items. For examples, see illustrations in MIL-STD-2402, Appendix A, and herein, Appendix B.

b. Where cartographically possible, the minimum clearance between the codes, symbols, and linework of different features is 1.0mm (0.04 inches).

c. Leader lines (Symbol 100), arrowheads (Symbol 101) and point of change symbols (Symbol 102) shall end at their associated feature symbol or linework location with a gap of 0.25mm (0.01 inches).

d. Symbols and codes should not be broken to fit around other symbols, codes or linework.

3.22.1.2 Point of change symbol. Point of change (POC) markers (Symbol 102) indicate non-intersection locations where the characteristic of a linear or areal feature changes or to mark the position of multiple linear features in the same line segment. Point of change markers are not needed where one linear feature abuts another (the symbology change indicates the point of change) or at the intersection of linear features. Each segment will be individually identified.

3.22.1.3 Leader lines (Symbol 100).

3.22.1.3.1 Purpose and use of leader lines. Leader lines are used to link offset feature symbols, data, and data information holders with their actual feature locations and symbols. They are always used with data information holders and the drainage code, sharp curve, passing track, siding, yard, side drop and overhead drop symbols, as well as any symbols which must be offset from their normal position for map legibility. Leader lines may also be used with the steep gradient, ford and ferry symbols, as well as the feature under construction symbol.

3.22.1.3.2 Lineweight of leader lines. In order to differentiate leader lines from the standard linework and symbols, leader lines have a lineweight of 0.20mm (0.008 inches), whereas the standard linework and symbol lineweight is 0.30mm (0.012 inches).

3.22.1.3.3 Positioning of leader lines. Leader lines will maintain a gap of 0.25mm (0.01 in) between their end points or arrowheads and the lines and symbols to which they are pointing. While leader lines also maintain a gap of 0.25mm (0.01 in) between referenced data information holders and offset pictorial symbols, a gap of 1.0mm (0.04in) will be maintained between leader lines and referenced alphabetic/numeric characters (symbols in some cases). A gap of 0.5mm (0.02in) shall be maintained between symbolized linework, leader lines, and data information holder lines and any data placed above, below, or alongside these lines. Figure 56 illustrates the use of leader lines.

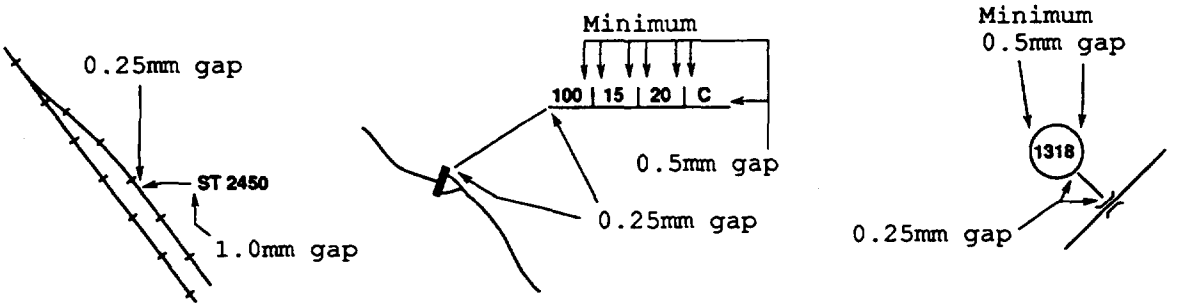


FIGURE 56. Use of leader lines and gaps between symbols and alpha/numerics.

3.22.1.3.4 Leader line lengths. Leader lines shall have a minimum length of 2.0mm (0.08 inches) and a nominal maximum length of 40.0mm (1.6 inches). Leader lines should be as short and direct as possible while still maintaining minimum lengths, legibility, and preferred positioning of symbols and type.

3.22.1.3.5 Breaking leader lines. Leader lines, if possible, should not be broken. However, if necessary, because of the density of detail and lack of room for placement, leader lines may be broken, with a gap of 0.5mm (0.02 inches) on each side of the break, no more than twice (once is preferred).

3.22.1.3.6 Number of leader lines from one code or symbol. Each code, symbol, or data information holder should have only one leader line extending from it. However, to improve legibility and clarity in very dense areas, codes, symbols and data information holders may be grouped together with multiple leader lines pointing to the individual feature or symbol locations. In addition, the leader line leaving the code, symbol or data information holder may be shared, if necessary for clarity and legibility. However, shared leader lines must diverge from each other before reaching their individual feature, symbol location or arrowhead.

3.22.1.3.7 Leader lines turning corners. Leader lines will make turns (change direction) with straight line (point to point) angles rather than curves, to avoid confusion with curved features.

3.22.1.3.8 Leader lines without arrowheads. Leader lines without arrowheads indicate point features or minimum size symbols (symbolized features with a longitudinal ground axis of less than that required for portrayal as linear features). For the PTADB this is either 2mm (500m ground distance) or 10mm (2500m ground distance) depending on the particular feature.

3.22.1.3.9 Leader lines with arrowheads.

a. Leader lines with arrowheads are used to indicate areal and lineal features (symbolized features with a longitudinal ground axis of greater than or equal to 2mm [500m ground distance]), "to scale" symbols, and data displaced from its normal position, such as offset road widths. They are also used when word symbols indicating the extent or condition of a specified feature must be offset.

b. The leader line is centered on the arrowhead so the shaft comes out of the back of the arrowhead in line with the arrow point. Arrowhead lengths are not included in the overall minimum length requirements for the leader line.

c. Arrowheads will terminate 0.25mm (0.01 in) from their target line, symbol, or area, pointing towards the mid-point of the longitudinal axis of a depicted linear feature or center of an areal feature.

3.22.2 Type.

3.22.2.1 Type style and size.

a. Type Style - Unless designated otherwise herein under the appropriate symbol number in Appendix B or on the Style Sheets, Appendix A, the type used for identifying or coding features on the final overlays is Univers Medium (113A) style for type sizes 24 point or smaller and Univers Light (114A) style for type larger than 24 point. If these Univers type styles are not available, a closely matching style may be substituted. All type numbers in parentheses are DMA type number references only.

b. Type Size - Where the type specifications permit a range of type sizes based on the areal limits of a feature, a Type Template (as shown in Appendix G) is used as a guide to assure uniformity of selections. When space prohibits the use of a prescribed size, or the size indicated by the template will obviously distort the relative importance of the feature a more appropriate size is to be selected.

c. Type sizes and styles for attribute values in data information holders and symbols are provided in Appendix B.

d. If lettering is inked, which is allowed only for rapid response products and **as directed by supplemental project instructions**, it should approximate the Univers type in size and style. A sampling of various Univers type sizes and styles is provided in Appendix F.

3.22.2.2 Descriptive type.

a. Descriptive type is used to provide information about the identification of features or conditions that cannot be fully portrayed by map symbols. It can be simply a label used to identify a symbol, or it can be used to label or describe an area or a particular feature. It can also be used for notes of caution or may, as circumstances dictate, detail an important or peculiar aspect or activity of an area.

b. The type style for terrain analysis descriptive type is Univers Medium (113A), bold, condensed, upper and lower case. For example: **Minefield** or **Impact area** (area features), **Ford** (point feature), and **Pipeline** (linear feature). Point and linear feature descriptive type size is limited to 7, 8, and 10pt. Use of the Type Template for TA Area Features (Appendix G) will help type size consistency in polygon areas.

c. Conditions can exist where descriptive type would be applicable throughout a sheet. Consideration should be given to adding a note to the margin as opposed to placing type throughout the sheet. For example: "CAUTION: Roads subject to coverage by drifting sand".

3.22.2.3 Positioning type.

a. Letters and/or number codes are centrally positioned within an areal feature, where possible. When the feature is too small to accommodate a code, the code should be positioned adjacent to the feature with an arrowheaded leader line pointing to the area. Codes or arrows should not touch any other code, line or symbol. All letters and/or numbers should read from left to right and be oriented parallel to the tangent of the south neatline of the base map, except for coding on certain linear features where codes are oriented along or parallel to the feature. The size of the code used may vary according to the size of the area. A large open area, for example, will be coded with a larger letter and/or number placed within it than a smaller open area. (See Figure 57 and 3.22.2.1.b.).

b. If a proper horizontal position for a 7 pt. size code can not be found within the feature or the nominal maximum 40mm (1.6 inches) distance for the leader line (if offset), then the code may be tilted to fit within the feature or between features, provided minimum clearances and all of the required distance specifications are met. Tilting should be done so that the code reads left to

right at an angle of no more than plus or minus 30 degrees from the horizontal. Off-set symbols and data information holders are not tilted.

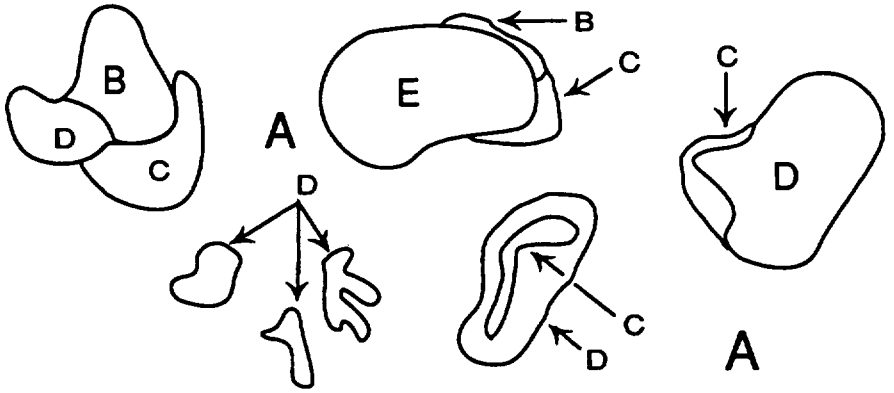


FIGURE 57. Placement of codes on areal features.

c. If a proper position for a code is still not found after attempting to tilt it, then the closest horizontal position beyond the 40mm (1.6 inches) maximum shall be utilized.

d. Normally, codes, arrows, leader lines and symbols shall not be depicted within the open water areas except for the "W" code. Exceptions may be necessary when the surrounding area is extremely dense and the only available space for the placement of codes and/or symbols is within the open water area. If coding is placed within the open water area, the entire code and/or symbol must be placed within the open water area, not partially in the open water and partially on land.

3.23 Reproduction and storage. The inked or engraved overlays in final format will be reproduced and stored by DMA as film negative reproduction material. The film negative material can then be used to produce transparent overlay copies.

3.24 Magnetic variation.

This section is not applicable to this specification.

3.25 Feature/Attribute. Refer to the applicable paragraphs in section 3, as well as Appendix B, Symbology; Appendix D, Legends; Appendix I, Miscellaneous Features, for the features, feature attribute values, inclusion conditions, and specific rules corresponding to PTADB production of the various thematic overlays.

3.26 Surface materials. This section provides the basic guidance for the production of the Surface Materials Overlay for the PTADB.

3.26.1 General surface materials information.

a. The Surface Materials (Soils) Overlay portrays thematic mapping units (features) that delineate boundaries of homogeneous classes of surface materials and surface roughness characteristics.

b. The treatment of surface materials is limited to those parameters of soils and other surface materials identified as significant to existing and anticipated data requirements for military operations.

c. Surface materials are classified and coded with two letters designating surface material type followed by one or two numbers designating surface roughness type. Whereas the two letters designating surface material type remain the same for all projects; the latter numerical sets are reordered and tailored for each project area. Areas that are not evaluated (generally built-up areas) and common open water areas are identified with the single letters "X" and "W", respectively. Soil depth is indicated by underlining the code with a solid line, and moisture content is shown by underlining the code with a sequence of dashes or dots.

d. A sample legend showing soil type and surface roughness codes (map units), and all other information to be shown on the Surface Materials Overlay is provided in Appendix D.

3.26.2 Surface material classification and coding.

3.26.2.1 Surface materials definitions.

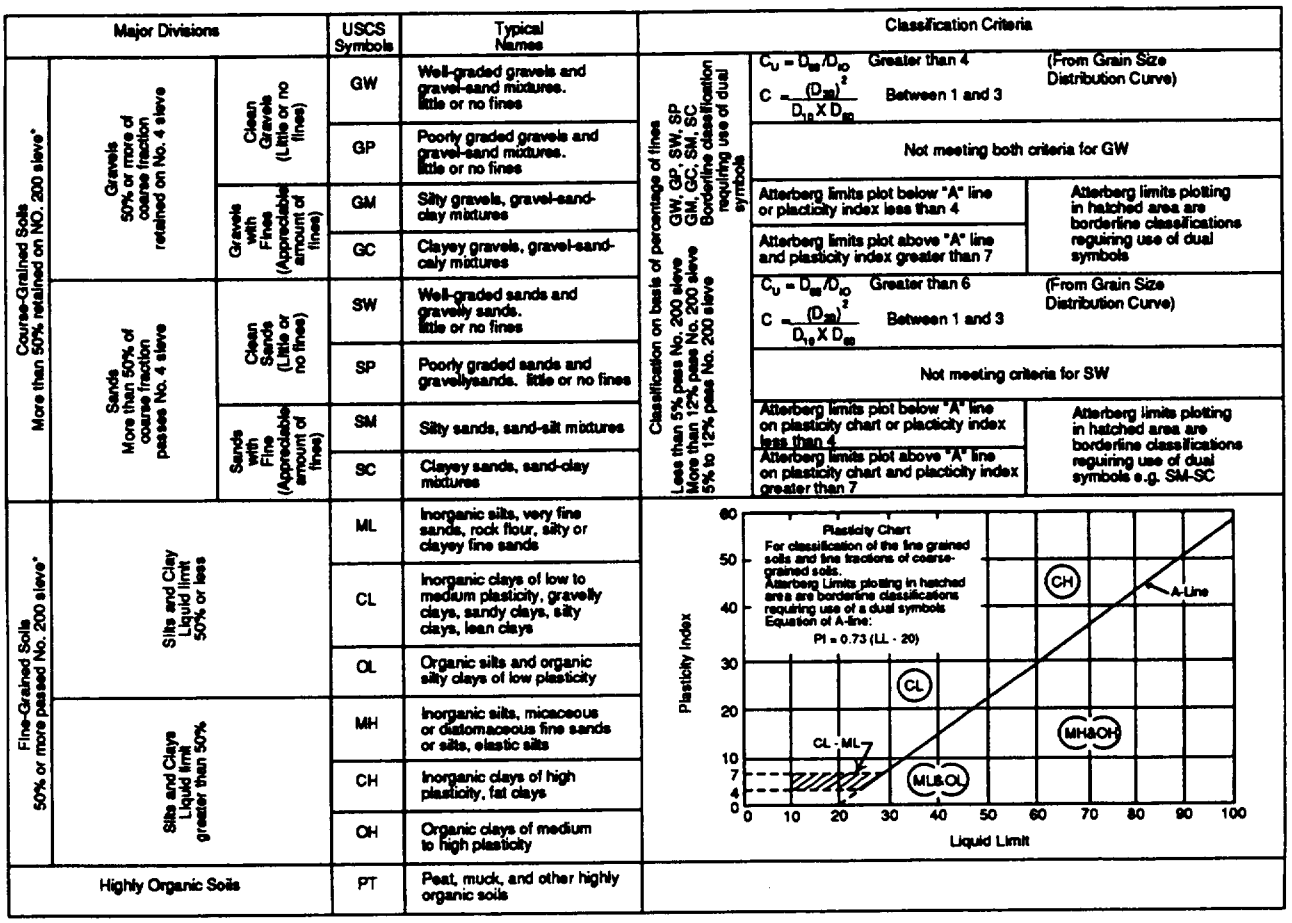
a. Surface materials, as defined for this thematic overlay, consist of soils and a number of other materials including rock outcrops, permanent snowfields, and evaporites. Surface materials are analyzed and mapped from the ground surface to a depth of 50cm, with particular emphasis on the depth between 15 to 38cm (6 to 15 inches) below the surface. This is generally the critical layer for cross-country movement where the rating cone index (an indicator of the soil load bearing capacity) is considered the most significant measure of trafficability.

b. For the purposes of terrain intelligence, soil is defined as the unconsolidated material that overlies bedrock. All soils are classified according to the Unified Soil Classification System (USCS), see Figure 58. This system classifies soils into categories based primarily on grain size, plasticity, and organic content. The information given in the following section was derived mainly from "The Unified Soil Classification System," Corps of Engineers, U.S. Army, Technical Memorandum No. 3-357, Vols. 1 and 3, March 1953 (Revised April 1960).

3.26.2.2 The Unified Soil Classification System.

3.26.2.2.1 General.

a. The Unified Soil Classification System (USCS) was designed to classify soils in accordance with the properties they possess which influence their behavior as a construction material for roads, airfields, embankments, foundations and other engineering structures. The U.S. Army has adopted the USCS for use not only for the aforementioned purposes but also to indicate soil trafficability characteristics for cross-country movement evaluations and to designate areas suitable for foxhole and/or mortar pit excavations and sensor emplacement.



Where: C = Coefficient of Curvature

C_U = Uniformity Coefficient

D_{10} = Grain diameter in mm at which 10% of material by weight passes sieves

D_{30} = Grain diameter in mm at which 30% of material by weight passes sieves

D_{60} = Grain diameter in mm at which 60% of material by weight passes sieves

FIGURE 58. Unified Soil Classification System

b. The USCS categorizes all soil particles up to 7.62cm (3in) in diameter into three major divisions: coarse-grained soils, fine-grained soils, and highly organic soils. A summary of the USCS can be found in Figure 58. This classification system does not consider coarse factions greater than 7.62cm (3in) in diameter.

(1) Coarse-grained Soils.

(a) Coarse-grained soils are identified and classified by sieve analysis. They contain greater than or equal to 50 percent, by weight, soil material that is retained on a No. 200 sieve. This sieve has an opening size of 0.074mm (approximately equal to the smallest size particle visible to the naked eye).

(b) Coarse-grained soils are subdivided into gravels and sands. The gravels are characterized as having greater than half of the coarse

fraction (soil material retained on the No. 200 sieve) larger than the No. 4 sieve size (4.76 mm); whereas sands are characterized as having greater than half of the coarse fraction smaller than the No. 4 sieve (4.76mm). Coarse-grained gravels and sands are further subdivided based on grain size distribution characteristics.

(c) The GW, GP, SW, and SP soil type groups (defined in 3.26.2.2.4) are made up of granular soil materials containing less than five percent fines (by weight) passing the No. 200 sieve (0.074mm).

(d) The GM, SM, GC, and SC soil type groups are composed of granular soil materials containing more than 12 percent fines (by weight) passing the No. 200 sieve (0.074mm).

(e) Gravels and sands containing between five and twelve percent fines (by weight) passing the No. 200 sieve are classified as borderline soils, which have characteristics of more than one soil type group. Currently no borderline soil type groups are used on the Surface Materials Overlay. Borderline soils will be classified into the more restrictive soil type of the two comprising a particular borderline soil.

(2) Fine-grained Soils.

(a) Fine-grained soils contain greater than or equal to 50 percent, by weight, soil material that passes through a No. 200 sieve (0.074mm).

(b) Unlike coarse-grained soils, which are subdivided on the basis of grain size distribution, fine-grained soils are subdivided on the basis of compressibility and plasticity characteristics. Silts are defined as fine-grained soils which have plasticity indexes and liquid limits that plot below the "A" line (see plasticity chart) in Figure 58, whereas clays are fine-grained soils which have plasticity indexes and liquid limits that plot above the "A" line. Organic clays are an exception to this rule; they plot below the "A" line. Fine-grained soils are further subdivided based on liquid limits: low plasticity groups have liquid limits less than or equal to 50; and high plasticity groups exhibit liquid limits greater than 50.

(3) Highly Organic Soils - The highly organic soils, such as peat or muck, are readily identified by their distinctive color or odor, spongy feel, and their frequently fibrous characteristics; thus, no laboratory tests have been developed for their identification. They are classified into a single category and are not subdivided. When clay is present, organic soils generally have an organic carbon content ranging from greater than 12 to 18 percent (the latter when soil content is 60 percent clay).

3.26.2.2.2 Soil size fractions.

a. According to the USCS, soil particles are divided into four soil size fractions: cobbles, gravels, sands, and fines. Following is a listing of the size ranges for these soil material components:

Soil Fraction	Size Range
Cobbles	Larger than 7.62cm (3in)
Gravel	7.62cm (3in) to No. 4 sieve (4.76mm)
coarse gravel	7.62cm (3in) to 3/4in (1.91cm)
fine gravel	1.91cm (3/4in) to No. 4 sieve (4.76mm)
Sand	No. 4 sieve (4.76mm) to No. 200 sieve (0.074mm)
coarse sand	No. 4 sieve (4.76mm) to No. 10 sieve (2.0mm)
medium sand	No. 10 sieve (2.0mm) to No. 40 sieve (0.42mm)
fine sand	No. 40 sieve (0.42mm) to No. 200 sieve (0.074mm)
Fines (silt, clay,)	Less than No. 200 sieve (0.074mm)

b. Fines (clay, silt, or both) are not subdivided in terms of particle size; rather, they are defined in terms of their plasticity and compressibility characteristics. "Silt" is used to connote fine-textured material exhibiting low plasticity; whereas "clay" is used to connote fine-textured material showing high plasticity characteristics.

(1) A plasticity chart is used in the classification of fine-grained material; this chart is shown in Figure 58. Laboratory test values are determined for the liquid and plastic limits of the portion of the soil material smaller than the No. 40 sieve (0.042mm) and the plasticity index is calculated. The plasticity index is then plotted against the liquid limit and entered into Figure 58, and the appropriate soil group classification is then assigned to the soil material. The "A" line in Figure 58 separates the plastic, clayey soil materials which are plotted above the line from the generally silty, non-plastic soil materials that are plotted below the "A" line.

(2) In the above discussion, the terms used to describe soil consistency have the following meanings:

(a) Liquid Limit (LL) - The percent moisture content (by weight) corresponding to an arbitrarily defined boundary between the semi-liquid and plastic states. The liquid limit line of 50 divides these soils into groups of high (H) or low (L) liquid limit and related plasticity.

(b) Plastic Limit (PL) - The percent water content (by weight) corresponding to an arbitrarily defined boundary between the plastic and semi-solid states.

(c) Plasticity Index (PI) - The moisture content (by weight) between a soil material's liquid limit and plastic limit (PI=LL-PL). The larger the PI, the more plastic the soil.

(d) Procedures for determining the LL, PL, and PI of a soil material are outlined in Technical Manual TM 5-530, Materials Testing, Departments of the Army, the Navy, and the Air Force, February, 1971.

3.26.2.2.3 Soil groups.

a. The soil groups in the USCS are composed of two letter (or four letters in the case of a borderline soil) connotative symbols composed of a prefix and a suffix. The prefix indicates the main soil type and the suffix indicates subdivisions of these main groups. A tabular listing of these symbol components follow:

Main Soil Type	Symbol
Gravel	G
Sand	S
Silt	M
Clay	C
Organic silts and clays	O
Peat	Pt
Gradation	
Well-graded	W
Poorly-graded	P
Liquid Limit	
Low LL (<= 50)	L
High LL (> 50)	H

b. The terms used under the heading of "Gradation" above have the following definitions:

(1) Well-graded - soil materials characterized by a complete range of all representative grain sizes, and without an excess or deficiency of any of these grain sizes.

(2) Poorly-graded - soil materials characterized by predominantly one grain size (these materials are commonly described as uniformly graded) or a range of sizes with some intermediate sizes missing (these materials are sometimes described as gap-graded, skip-graded, or step-graded).

3.26.2.2.4 **Soil categories**. (Symbol 104, labelled "GW" to "PT" as listed below). The following is a description of each individual USCS soil type group to be shown and the standard USCS soil designator used to represent them on the Surface Materials Overlay. These soil type codes are standardized and remain the same for all projects:

a. **Well-graded gravels** (code GW) - Well-graded gravels are coarse-grained soils where more than 95 percent of the soil material by weight is larger than the No. 200 sieve (0.074mm). These soils are clean, well-graded gravels and gravel-sand mixtures where more than 50 percent of the coarse fraction by weight is larger than the No. 4 sieve (4.76mm), and which contain little or no non-plastic fines. Any fine textured soil material present must not interfere with internal drainage or appreciably affect soil strength characteristics.

b. **Poorly-graded gravels** (code GP) - Poorly-graded gravels are coarse-grained soils where more than 95 percent of the soil material by weight is larger than 0.074mm (No. 200 sieve). These soils are clean, poorly-graded gravels or gravel-sand mixtures where more than 50 percent of the coarse fraction by weight is larger than 4.76mm (No. 4 sieve), and which contain little or no fines. These soil materials are sometimes referred to as uniform gravels, which consist of predominantly one particle size; or gap-graded gravels and sands consisting of non-uniform mixtures of coarse material and fine sands, with some intermediate sizes missing and with little or no fines.

c. **Silty gravels** (code GM) - Silty gravels are coarse-grained soils where more than 50 percent of the soil material by weight is larger than 0.074mm (No. 200 sieve), and more than 50 percent of the coarse fraction, by weight, is larger than 4.76mm (No. 4 sieve) in size. These predominantly gravel mixtures of soil material consist of more than 12% fines that are non-plastic or of low plasticity. The gradation of the soil separates in this soil group is not considered significant; thus, both well-graded mixtures of gravel-sand-silt and poorly-graded mixtures of silty gravel are included in this group.

d. **Clayey gravels** (code GC) - Clayey gravels are coarse-grained soils where more than 50 percent of the soil material by weight is larger than 0.074mm (No. 200 sieve), and more than 50 percent of the coarse fraction, by weight, is larger than 4.76mm (No. 4 sieve). These predominantly gravel mixtures contain more than 12% clayey fines smaller than 0.074mm (No. 200 sieve) and exhibit low to high plasticity characteristics. This soil group includes well-graded mixtures of gravel-sand-clay and poorly-graded mixtures of clayey gravels.

e. **Well-graded sands** (code SW) - Well-graded sands are coarse-grained soils where more than 95 percent of the soil material by weight is larger than 0.074mm (No. 200 sieve), and less than 50 percent of the coarse fraction , by weight, is larger than 4.76mm (No. 4 sieve). These soils are clean, well-graded sands and well-graded gravel-sand mixtures that contain little or no fines. Any fine-textured soil material present must not appreciably affect soil strength characteristics or interfere with internal drainage.

f. **Poorly-graded sands** (code SP) - Poorly-graded sands are coarse-grained soils where more than 95 percent of the soil material is larger than 0.074mm (No. 200 sieve), and less than 50 percent of the coarse fraction , by weight, is larger than 4.76mm (No. 4 sieve). These soils are clean, poorly-graded sands and poorly-graded gravel-sand mixtures with little or no fines. They are sometimes referred to as uniform sands, which consist of predominantly one sand size; or gap-graded materials consisting of non-uniform mixtures of coarse material and fine sands with some intermediate sizes missing. Any fine textured soil material present must not appreciably affect soil strength characteristics or interfere with internal drainage.

g. **Silty sands** (code SM) - Silty sands are coarse-grained soils where more than 50 percent of the soil material is larger than 0.074mm (No. 200 sieve), and less than 50 percent of the coarse fraction, by weight, is larger than 4.76mm (No. 4 sieve) in size. These predominantly sand mixtures of soil material consist of more than 12% fines that are non-plastic or of low plasticity. The gradation of the soil separates in this soil group is not considered significant; thus, both well-graded and poorly-graded mixtures of silty sands and sand-silt mixtures are included in this group.

h. **Clayey sands** (code SC) - Clayey sands are coarse-grained soils where more than 50 percent of the soil material is larger than 0.074mm (No. 200 sieve), and less than 50 percent of the coarse fraction , by weight, is larger than 4.76mm (No. 4 sieve). These predominantly sand mixtures contain more than 12% clayey fines smaller than 0.074mm (No. 200 sieve) and exhibit low to high plasticity characteristics. This soil group includes both well-graded and poorly-graded clayey sands and sand-clay mixtures.

i. **Inorganic silts and very fine sands** (code ML) - Inorganic silts and very fine sands are fine-grained soils where more than 50 percent the material is smaller than 0.074mm (No. 200 sieve). These soils have a liquid limit of less than or equal to 50; exhibit relatively low plasticity characteristics and lie below the "A" line on the plasticity chart (Figure 58); and include inorganic silts and very fine sands, rock flour, silty or clayey fine sands, and clayey silts with slight plasticity. Loess-type soils and kaolin clays exhibiting low plasticity characteristics usually fall into this class also.

j. **Inorganic silts** (code MH) - Inorganic silts are fine-grained soils where more than 50 percent of the soil material is smaller than 0.074mm (No. 200 sieve). These soils have a liquid limit of greater than 50 and lie below the "A" line on the plasticity chart (Figure 58), exhibiting low to medium plasticity characteristics. These soils include inorganic silts, micaceous or diatomaceous, fine sandy or silty soils, and elastic silts.

k. **Inorganic clays of low to medium plasticity** (code CL) - Inorganic clays of low to medium plasticity are fine-grained soils where more than 50 percent of the material is smaller than 0.074mm (No. 200 sieve). These soils have a liquid limit of less than or equal to 50; lie above the "A" line on the plasticity chart (Figure 58); exhibit low to medium plasticity characteristics; and include inorganic clays, gravelly clays, sandy clays, silty clays, and lean clays.

l. **Inorganic clays of high plasticity** (code CH) - Inorganic clays of high plasticity are fine-grained soils where more than 50 percent of the material is smaller than 0.074mm (No. 200 sieve). These soils have a liquid limit of greater than 50; lie above the "A" line on the plasticity chart (Figure 58); exhibit high plasticity characteristics; and include soil materials such as fat clays, gumbo clays, bentonite, and certain volcanic clays.

m. **Organic silts and organic silty clays of low plasticity** (code OL) - Organic silts and organic silty clays of low plasticity are fine-grained soils where more than 50 percent of the material is smaller than 0.074mm (No. 200 sieve). These soils have a liquid limit of less than or equal to 50; lie below the "A" line on the plasticity chart (Figure 58); exhibit low plasticity characteristics; and include organic silts and organic silty clays.

n. **Organic clays and silts of medium to high plasticity** (code OH) - Organic silts and organic silty clays of medium to high plasticity are fine-grained soils where more than 50 percent of the soil material is smaller than 0.074mm (No. 200 sieve). These soils have a liquid limit above 50 and lie below the "A" line on the plasticity chart (Figure 58).

o. **Peat and other highly organic soils** (code PT) - Peat and other highly organic soils are soils of a spongy, fibrous texture. Typical of soils in this group are peat, humus, muck, and some swamp and marsh soils. They are commonly composed of substantial amounts of leaves, grass, branches, or other fibrous vegetal matter in varying states of decomposition.

3.26.2.2.5 Supplemental surface materials. The USCS soils defined above are currently supplemented with the following additional surface materials, which are also normally shown in the legend:

a. **Rock Outcrop** (code RK) - Areas of bedrock with 10 percent or less soil cover present. The type of bedrock is not identified. Surface materials classified as RK (Rock Outcrop) shall not require underlining (paragraph 3.26.4) to indicate soil materials less than 0.5 meters deep; shallow soil is assumed.

b. **Permanent Snowfields** (code PS) - Areas covered by snow or ice throughout the year.

c. **Evaporites** (code EV) - Sediments deposited from aqueous solutions as a result of evaporation, such as salt pans, salt encrustations, areas of salt evaporators, etc.

3.26.2.2.6 Miscellaneous surface materials. Additional unique and significant miscellaneous surface materials are almost certain to exist and when encountered will be given an appropriate (as defined by this specification to the maximum extent possible) two letter map unit code and added to the legend. Appendix I gives the definitions and codes for the only two previously requested surface material features, rock fields and inorganic clay/silt combinations.

3.26.2.3 Altered surface materials and common open water.

3.26.2.3.1 **Not-evaluated** (code X).

a. The not-evaluated code is mostly used in areas where construction or development precludes evaluation of the natural surficial materials.

b. In common urban (built-up) areas, the surface materials are not determined due to their modification and alteration by man-made residential, commercial, and industrial developments where the roads, paving and buildings cover approximately 30 percent or more of the available land area, as defined in 3.15.2.1.2n. Examples are towns, cities, railroad yards, airports, etc. These features are obtained from the Vegetation Overlay.

c. The not-evaluated code may also be used in other areas of surface materials identified as being disturbed by man. Such areas will include extensive slag piles, mine tailings, land fills, garbage dumps, and other disturbed areas where the USCS coding would be inappropriate. In these instances, bracketed descriptive type will be used adjacent to or underneath the "X" to label the man-disturbed areas, e.g., X [Mine tailings].

3.26.2.3.2 **Common open water areas** (code W). These are bodies of water, both natural and man-made, such as rivers, lakes, reservoirs, oceans, etc., as defined in 3.13.2. All common open water areas will be obtained from the Surface

Drainage Overlay. The open water map unit code "W" is standard for all thematic overlays.

3.26.3 Surface roughness classification and coding.

3.26.3.1 Surface roughness thematic subject. While surface roughness is a thematic subject in and of itself, it is included on the Surface Materials overlay in order to save the need for another separate overlay and because it is most closely associated with the surface materials and their weathering or erosional characteristics. Surface roughness is synonymous with microrelief and covers the expression of the land surface or surface geomorphic features which are less than the contour interval of the base map in height. For this thematic overlay, surface roughness is that aspect of the microrelief on the land surface (boulder fields, hummocky ground, gullies, rugged bedrock, etc.) which reduces the rate of cross-country movement for vehicles or foot troops during military operations.

3.26.3.2 Surface roughness qualifier numbers. Surface roughness is classified and coded on the surface materials overlay by a project tailored set of sequential numbers designating the surface roughness type. Each separate surface roughness type found in the project area is assigned a map unit number, referred to as the Surface Roughness Qualifier (SRQ), which follows the two letter surface materials code. The only surface material types not assigned SRQ type numbers are the not-evaluated (code X) and common open water (code W) areas. The surface roughness types are determined from stereoscopic photointerpretation, and the analysis of ground photos, written descriptions, field checks, and any other source providing the information.

3.26.3.3 Surface roughness descriptions.

a. In the surface roughness table, which is included as part of the surface materials legend, each SRQ type identified and coded on the project overlay(s) is given a corresponding Surface Roughness Descriptor (SRD).

b. By design, the SRDs are a generalized descriptive statement of the small-scale differences in relief that are not normally shown or interpretable on a regular topographic map. Examples might include rock outcropping, boulders, patterned ground, solifluction lobes, coppice mounds or low sand dunes, and badland erosional features. These surface roughness descriptions can also include cultural features, for example, numerous closely spaced stone walls or closely spaced ditches, that can not be shown as discrete features yet in aggregate cause substantial degradation of the cross country movement rates for vehicles and foot troops. These descriptors shall detail the surface roughness within a specific mapping unit rather than combining several different and separately occurring surface roughness descriptions together.

c. Some examples of commonly used surface roughness descriptors can be found in Appendix D.

3.26.3.4 Surface roughness qualifier type numbers. SRQ type numbers 1 and 2 have standardized SRDs which are used as follows:

1 - No surface roughness effect
2 - Area of high landslide potential

3.26.3.4.1 No surface roughness effect. SRQ type number 1, with a SRD reading, "No surface roughness effect", refers to a uniformly smooth, relatively flat non-paved surface that would not slow or otherwise hinder, either by the ride dynamics or the physical characteristics of the vehicle movement, the driving of a military vehicle at its maximum cross-country movement (off road) speed. On the thematic overlay, these areas are coded with a two letter surface material type (USCS soil map unit) followed by the number 1, which is reserved for areas of no surface roughness effect.

3.26.3.4.2 Potential Landslide Areas (Usually not shown on PTADBs).

a. These are usually in upland positions where even light pressure or movement has a high probability of causing the area to collapse with a rapid down slope movement of a mass of rock and/or earth.

b. Areas with high potential for landslides are shown wherever they occur, even when not adjacent to roads or railroads. These areas are coded with a two letter surface material type (USCS soil map unit) followed by the number 2, which is reserved for areas of high landslide potential. These areas are relatively rare, and will not be depicted on PTADBs without supplemental project instructions. Even then they usually make up only a small percentage of a project area.

3.26.3.5 Remaining surface roughness qualifier type numbers. The analyst tailored SRQ type numbers begin with type 3 and are usually ordered according to their perceived affect on the Large and Medium Tanks vehicle class category, beginning with the surface roughness type with the least degradation on speed and proceeding to that with the greatest degradation on speed. This serves as an aid to the production of cross-country movement (CCM) products, which are normally based on the Main Battle Tank (usually the M-1 Abrams).

3.26.4 Depth of surface material.

a. Depth of surface materials will be determined from the interpretation of the evidence furnished from the collected sources. This evidence may be as specific as an on-site measurement or as general as that derived from analysis of aerial photography.

b. Surface materials less than 0.5 meters deep from the ground surface to underlying bedrock, caliche, indurated pans, fragipans, or other cemented pans are indicated by a solid underlining of the map unit code (symbol 106, ———————). Lack of a solid line under the map unit code indicates that the surface material is generally greater than or equal to 0.5 meters in depth.

3.26.5 Soil moisture.

a. Soil moisture, or state of the ground, is an important consideration when planning military operations. The soil moisture content from the surface of the soil to the depth of the critical layer for military vehicles, usually the layer 15 to 38 centimeters (6 to 15 inches) below the surface, has a highly significant influence on soil trafficability during cross-country movement. Soil moisture conditions are dependent not only upon climatic conditions, such as temperature, precipitation, evapotranspiration, etc., but also upon USCS soil type properties, internal and external drainage characteristics, water table level, and topographic position.

b. Since soil moisture conditions are related in part to climatic factors, they are temporal and can thus change rapidly over a relatively brief period of time. As the Surface Materials Overlay can only depict soil properties of a constant nature, potential soil moisture conditions, and not actual soil moisture conditions, are shown in the data base. This is accomplished through the delineation of topographic position and site characteristics, which affect the natural soil drainage categories (where soil drainage refers to the frequency and duration of periods when the soil is free of saturation).

c. Potential soil moisture categories (as defined by topographic position and site characteristics) shall be determined for all areas on this thematic overlay, exclusive of common open water (code W) and not-evaluated (code X) areas. PTADB users can then integrate these natural soil drainage categories with recent climatic data to determine the present state of the ground for a particular area.

d. An exception to this rule occurs in areas where the natural soil moisture condition of the ground has been changed by human activities. For example, the level of the groundwater table in agricultural fields can be lowered through the use of drainage tiles or ditches, and conversely, the level of groundwater tables can rise due to dam construction and subsequent inundation of the reservoir area. In these areas, the current human induced condition and not the natural potential soil moisture condition shall be portrayed.

e. While any state of the ground moisture condition (dry, moist, or wet), can exist in any area at a particular time, depending upon recent climatic conditions, the following three topographic positions and site characteristic categories are used to indicate the predominant soil moisture condition or the potential for the soil to become moist or wet:

(1) High (Potentially Dry) Topography Sites

(a) High topography sites are higher areas of the terrain where better soil drainage conditions exist and the depth to the groundwater table is deep enough so that capillary fringe does not extend up to within 0.5 meters of the ground surface for most of the year. These sites usually occupy convex upland positions in the landscape, such as on ridges and upper slopes; however, high topography sites can also exist in many other landscape positions, for example, terrace slopes, upland toe slopes, upland flats, terrace flats, and flood plains that have well drained soil moisture conditions. These areas have a lower susceptibility to becoming moist or wet than low topography sites, and, when they do become moist or wet, have a lower probability of remaining moist or wet for long periods of time.

(b) Soils in high topography sites are well drained and exhibit good to moderate internal and external drainage characteristics without any influence from impervious pans, cemented layers, or other soil horizons restricting free water movement within the soil. These soils do not have physical indications of saturation by water, such as strongly mottled and gleyed soil horizons, within 0.5 meters of the ground surface, nor do they have groundwater tables within 0.8 meters of the surface for most of the year in the case of either fine-grained soils or coarse-grained soils with fines, or within 0.5 meters for most of the year in the case of coarse-grained soils without fines. Note: Capillary fringe usually extends above the groundwater table an average of .05 to .15 meters in coarse-grained soils without fines (GW, GP, SW, and SP) and .30 to .45 meters

in fine-grained soils and coarse-grained soils with fines. Thus, the soils in these sites should only become moist (or possibly saturated) in the upper 0.5 meters immediately after a precipitation event and not remain moist for an extended period of time due to influences from the groundwater table.

(2) Low (Potentially Moist) Topography Sites

(a) Low topography sites are lower areas of the terrain where poorer soil drainage conditions exist and the groundwater table is high enough so that capillary fringe commonly reaches the soil horizons within 0.5 meters of the ground surface. Low topography sites commonly have low chroma mottles (chroma <= 2) and grayish or bluish horizons, which are indicative of poor drainage, within 0.5 meters from the surface. The more mottled and gray the subsoil, the poorer the soil drainage. The more intense the mottles and the closer they are to the soil surface, the longer the period of saturation or the higher the water table. Note: Coarse-grained soils without fines, especially the GW and GP soil types, very rarely if ever exist in a moist state - they are either dry or wet, depending on their proximity to the groundwater table. Capillary fringe effects are minimal in these soils.

(b) Low topography sites, which have a greater potential to exhibit moist soil conditions than high topography sites, generally occupy low-lying and concave or depressed positions in the landscape. These sites can occur at the base of slopes, in upland depressions, and on some floodplains, low terraces, or other low-lying land along watercourses. In these landscape positions, the groundwater table is found at a depth of within 0.8 meters of the surface for most of the year in both fine-grained soils and coarse-grained soils with fines, and within 0.5 meters (and usually much shallower) for most of the year in coarse-grained soils without fines. Capillary fringe effectively moistens all or part of the upper 0.5 meters of the soil, particularly when the groundwater table is highest in the rainy season, or in fall, winter, or spring when cooler weather lowers evapotranspiration rates. In addition, these low topography sites not only have a higher susceptibility to becoming moist or wet after a precipitation event, but they also subsequently retain this moisture for a longer period of time than higher topographic positions in the landscape that have received equal amounts of precipitation.

(c) Low topography sites with a higher potential to exhibit moist soil conditions can also exist in upland flats and other level areas that have soils with poor internal or external drainage. Sites in this category can also occur in soils with impervious pans or cemented layers that restrict percolation and cause perched water tables. In addition, soils influenced by seepage from downslope or lateral movement of water, or soils influenced by underground springs can also exhibit a greater potential for moist soil conditions.

(3) Perennially Wet Sites

(a) Areas exhibiting perennially wet soil conditions are very poorly drained and commonly waterlogged or flooded at least part of the year. These areas often have surface accumulations of organic materials, and also have soil horizons immediately below the surface horizon that are mottled, gleyed, or both. Groundwater tables in perennially wet sites are at or near the surface throughout most of the year. Soils in a wet condition frequently support hydrophytic vegetation and are commonly found in swamps, marshes, tidal flats, bogs, and other

low-lying, perennially wet areas, e.g., a closed, landlocked depression fed by a perennial stream.

(b) Perennially wet soils can also exist seasonally in level to nearly level upland flats with poor internal drainage or shallow, restrictive pans or impervious layers. Other perennially wet soils can exist in sloping areas with soils that have very poor internal drainage, are affected by seepage, or both. In some cases, the soil in these sites may be moist or even dry for relatively brief periods of time, particularly in the summertime when increased evapotranspiration rates can temporarily lower the water table. However, the soil at these sites will normally be saturated.

f. In the above discussion, the soil moisture terms used to describe the state of the ground have the following characteristics:

(1) Dry - Dry state of the ground conditions exist when the soil moisture content is less than that at field capacity, i.e., the amount of water held in the soil after excess gravitational water or free water has drained away (usually two or three days after a soaking rain).

(2) Moist - Moist state of the ground conditions exist when the soil moisture content is greater than or equal to field capacity but less than the soil moisture content at the liquid limit, which is usually about 150 percent of field capacity.

(3) Wet - Wet state of the ground conditions exist when the soil moisture content ranges from the soil's liquid limit to its maximum water holding capacity, which approaches complete saturation and is equal to approximately 200 percent of field capacity. A soil in a wet condition commonly has free standing water at or near the soil surface.

g. The three soil moisture categories described above are represented on the Surface Materials Overlay by underlining (or not underlining) the map unit codes with the following symbols:

(1) No underline indicates high topography sites which are normally characterized by soils in a dry state of the ground condition.

(2) A dashed underline (----------, symbol 107) indicates low topography sites which have higher potential to exhibit soils in a moist (or even wet) state of the ground condition than high topography sites.

(3) A dotted underline (....., symbol 108) indicates topographic sites which are normally characterized by perennially wet soils.

h. Special cases can occur where the map unit code has double underlining. This would occur where the soil is less than 0.5 meters deep, and its landscape position or site characteristics normally yields a moist or wet soil moisture condition.

i. Notes detailing the state of the ground (normal seasonal moisture content variation of the ground) and the seasonal moisture condition of special or unique features will be added to the legend. Examples are located in the sample Surface Materials Overlay Legend in Appendix D.

3.26.6 Areal extent. Whereas surface materials are represented by an areal overlay, all areas within the neatline must be assigned a map unit code. No slivers (gaps or overlaps) shall exist between map unit boundaries. Except for common open water streams, canals, etc., which have an areal extent of 40mm² (2,500,000 m² ground area) with a nominal perennial water gap width of 2mm (500m ground distance), the minimum size polygon shown must have an areal extent of at least 80 square millimeters (5,000,000 square meters ground area) with a minimum width greater than or equal to 2mm (500m ground distance) in the polygon's shortest dimension.

3.27 Obstacles. This section provides the basic guidance for the production of the Obstacles Overlay for the PTADB.

3.27.1 General obstacles information.

a. The treatment of obstacles is limited to any natural and/or man-made features that divert ground based military cross-country movement.

b. A sample Obstacles Legend and coding scheme are shown in Appendix D. Symbology is shown in Appendix B.

3.27.2 Classification and definition of obstacles.

3.27.2.1 Obstacle types. All Obstacles are classified into the following types:

3.27.2.1.1 Man-made linear obstacles.

a. **Road/Railroad Cut** (Symbol 700) - An excavation, with a side slope gradient > 60%, through earth and/or rock at a constant or smoothly changing grade or level which provides a passageway for a transportation feature such as a road, railroad, etc. Any non-transportation cuts, not otherwise covered on this thematic overlay, found in other types of excavations shall be shown also. Examples include the cut faces of quarries and mines and construction excavations.

b. **Road/Railroad Fill** (Symbol 701) - An embankment, with a side slope gradient > 60%, of earth and/or rock at a constant or smoothly changing grade or level constructed to provide a passageway for a transportation feature such as a road, railroad, etc. Any non-transportation fills, not otherwise covered on this thematic overlay, such as the edge caused by fill used to level recreation ares, school fields, large commerical parking lots, etc., shall be shown also.

c. **Embankment/Dike/Levee/Causeway** (Symbol 706) - A raised, solid linear, artificial structure, having some breadth, with a slope/gradient > 60%, usually of earth or gravel, constructed above the surrounding natural ground level, used to hold back higher level water on one side (dike or levee) or to provide dry passage of a transportation feature across wet ground or water (causeway). Embankments are usually man-made features; however, naturally occurring embankments or levees sometimes form along the banks of mature streams with heavy sediment loads, especially, if they flood on a regular basis.

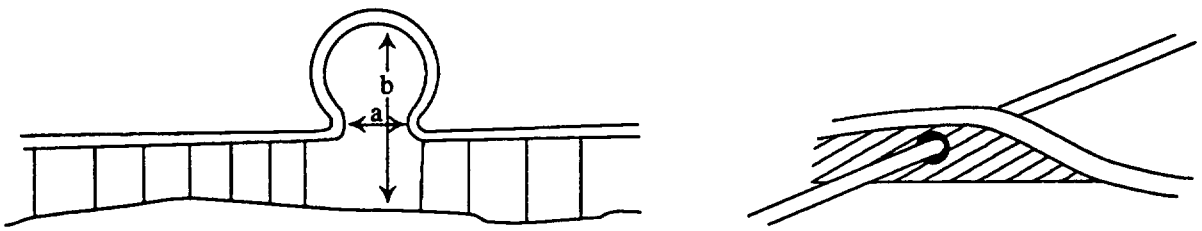
d. **Above Ground Pipeline** (Symbol 708) - Man-made conduits for water, oil, gas, or other fluids which rest on or are elevated above the ground. They are

considered a hindrance to cross-country movement and thus shown on this thematic overlay, if they have either a height greater than or equal to 1.5 meters or less than 3.0 meters clearance beneath them.

e. **Pipeline Gap/Earth Filled Crossing Point** (Symbol 709):

(1) A pipeline gap is a looped arch in an on or above ground pipeline used to reduce the velocity and break up the force of the fluid in the pipeline. They will be shown if wide enough (>3.65m) and tall enough (>3.0m) to permit the passage of the main battle tank (M-1 Abrams).

(2) An earth filled crossing point is a mound of earth or gravel around and above a pipeline (or other linear obstacle) which permits the passage of military vehicles over the pipeline. These features are normally associated with a secondary or loose surface road and may themselves be paved or unpaved. See examples in Figure 59.



a. >3.65m Horizontal Clearance.
b. >3.0m Overhead Clearance.

FIGURE 59. Pipeline gap and earth filled crossing point.

3.27.2.1.2 Natural linear obstacles.

a. **Escarpment/Cliff** (Symbol 711).

(1) A natural relief feature characterized by a nearly vertical (slope/gradient > 80 to 90 degrees) to overhanging face of rock or earth of significant height and length (>1.5m high and >2500m long in this case), separating two comparatively level or more gently sloping surfaces. Escarpments can be distinguished from embankments in that they are usually natural relief features, whereas embankments are usually man-made structures.

(2) As per 3.14.4b., very steep (>60%), long (>10mm map or 2500m ground distance), thin (<2mm map or 500m ground distance) slopes are shown as escarpments on the Obstacles Overlay. See Figure 54.

b. **Volcanic Dike** (Symbol 712) - A natural, rock wall like structure, generally formed by the erosion of softer less resistant materials on both sides of a narrow, vertical or nearly vertical, intrusion of very hard igneous or metamorphic materials.

3.27.2.1.3 Military obstacle. **Dragon's (Tiger) Teeth** (Symbol 716) - A row or series of rows of large concrete blocks or metal barriers designed to block vehicular movement, especially armored vehicles. They are often shaped like

truncated pyramids or welded I-beams with their height and spacing designed to impede or "hang-up" vehicles attempting to cross them.

3.27.2.1.4 Natural and man-made areal obstacles.

a. For the Obstacles thematic these features consist of rises and **depressions** (Symbol 717), such as mesas, craters, quarries, caves, mines, sink holes, land fills, etc., with very steep (>60%) to nearly vertical walls. In order to be shown, these features must measure at least 5mm (1250m ground distance) in their longest dimension or axis.

b. Since it is the obstacle effect of their side walls, cuts, fills, terracing, etc. which affects cross-country movement, all of these features will be treated as closed linear features (they may be broken at the point of access road ramps). Even though theses features will often appear to be delineated to scale as areal features on this thematic, in actuality they are linear features which close back on themselves. Therefore, rises shall be shown with a closed linear fill or escarpment symbol and depressions shall be shown with their normal depression symbol or closed linear escarpment symbol.

3.27.2.2 Obstacle directivity. The teeth or ticks on any obstacle symbol with directivity, such as escarpments, embankments, cuts, fills, etc., shall always point downhill toward the base of the feature. The back of the symbol indicates the exact alignment of the feature along its uphill side.

3.27.2.3 Hydrologic obstacles. Hydrologic obstacles such as open water, drainage ditches, channelized streams, and river banks are shown on the Surface Drainage Overlay. As per 3.13.4.1, vertical or nearly vertical (between 80 and 90 degrees from the horizontal) stream banks greater than 5 meters high are portrayed on the Obstacles Overlay as escarpments. See Figure 60.

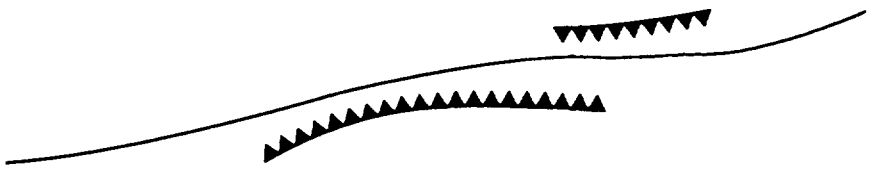


FIGURE 60. Cliffs Along Stream with Vertical Banks.

3.27.3 Depiction of obstacles.

a. Obstacle symbology is shown in Appendix B.

b. Obstacle Size - The minimum sizes for linear obstacle features to be shown are: > 1.5 meters high, > 2500 meters long on the feature's main axis (10mm at map scale), and > 60% slope.

c. One or more adjoining short obstacles with a combined length greater than 2500 meters shall be shown. See Figure 61.

d. Delineated obstacles should be in rural and non-urban areas where they are of primary importance for the diversion of cross-country movement of either vehicles or foot troops. Obstacles located in common urban areas normally will

not be shown, unless they are the dominant feature in the area, such as high embankments, escarpments, or cliffs running through a city. Small numerous obstacles normally associated with urban areas, such as wooden or wire fences, small embankments, retaining walls, etc., generally will not be shown; however, city walls and major fortifications shall be shown.

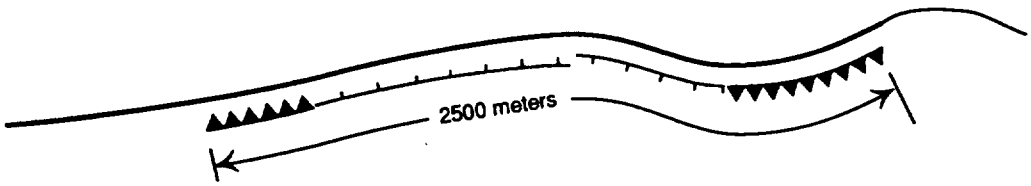


FIGURE 61. Combined obstacles meeting length requirement.

e. If obstacle locations can be accurately determined in areas of dense forest (75 - 100% canopy closure), on very steep slopes (>60%), or within the gap width of streams, they shall be shown. For example: cuts, fills, and escarpments are portrayed in dense forests and on steep slopes.

3.27.4 Displacement and/or breaking of obstacle features.

a. In order to prevent the overprinting of obstacles on transportation and surface drainage features when synthesized products are generated from the PTADB, the following normal displacement rules shall guide the positioning of obstacle symbols, unless supplementary guidance specifies otherwise:

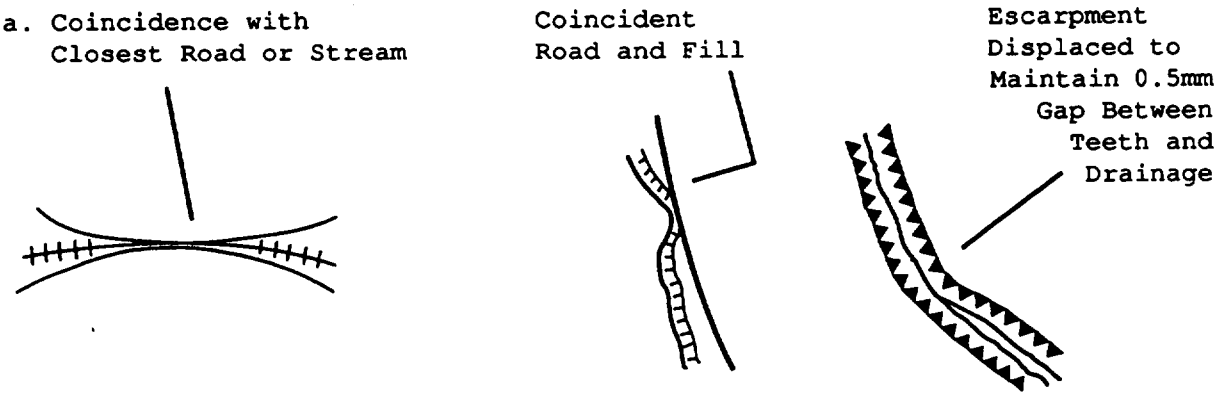
(1) Obstacle symbols can be displaced in order of holding priority by surface drainage features (never moved), railroads (displaced only by drainage features), or roads (displaced by drainage features and railroads).

(2) Obstacle symbols are displaced such that a 0.5mm map scale gap is maintained between themselves or their directivity teeth/ticks and any surface drainage feature symbol representing a ground gap width between 18 and 1000 meters. As both print magenta on the CCM map, the gap is necessary to distinguish between them. See Figure 62c.

(3) In places with dense or squeezed cartographic detail, an obstacle symbol can be displaced to the point where it is coincident with the closest transportation (preferred) or surface drainage feature. The length of the teeth or tick marks on directivity symbols will be shortened or eliminated in order to maintain a 0.5mm gap between them and the other symbol. If a smaller gap is shown on the base map, it may be used. See Figure 62a. and b. If it is not cartographically possible to show any of the teeth or ticks, the obstacle line will be labelled as to its identity, such as: escarpment, embankment, cut, fill, etc.

(4) The teeth or ticks of various obstacle features may print into common open water areas (which are blue on printed CCM maps). See Figure 63a.

(5) As surface drainage features less than or equal to 18 meters wide on the ground are not shown on the CCM product, coincident or overlapping obstacle symbols are not displaced for these features. See Figure 63b.



a. Embankment between two roads or streams.

b. Fill along road above stream.

c. 18 - 1000m gap width streams in gorge with side walls >5m high.

FIGURE 62. Examples of "squeezed" obstacle symbols.

a. Obstacles or teeth/ticks coincident with open water.

b. Obstacles or teeth/ticks coincident with stream <= 18 meters ground gap width.

FIGURE 63. Example situations with no displacement of obstacle symbols for surface drainage features.

(6) Where transportation features are built on top of embankments or narrow fills (less than 0.25 mm or 12.5 meters on the ground exists between the edge of the transportation feature and the edge of the slope [or point of 'fall off']), the obstacle and transportation symbols can be coincident with each other.

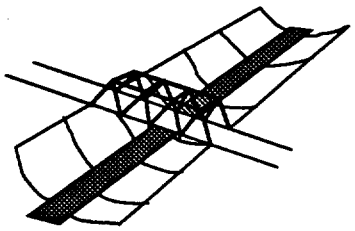
b. Generally, obstacle symbols will be broken with a gap of 0.5mm on each side of any transportation or surface drainage feature passing through them. However, the following special conditions shall override this rule:

(1) In places where a transportation feature passes over an obstacle and its removal (such as a bridge over a narrow steep sided gully or road cut) would leave the obstacle intact, no break is made in the obstacle feature symbol. See Figure 64a.

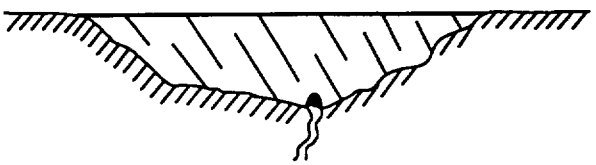
(2) If a stream or road passes through a fill via a culvert or tunnel not large enough for an M-1 Abrams Tank (≤3.65 m wide or ≤3.0 m high) to traverse, the obstacle will not be broken. See Figure 64b.

(3) Obstacles such as escarpments, dragon's teeth, fences, etc, will not be broken if they actually exist across a transportation or surface drainage feature (forming vehicle traps, waterfalls, rapids, dry season stream bed obstructions, navigation barriers, etc.). See Figure 64c.

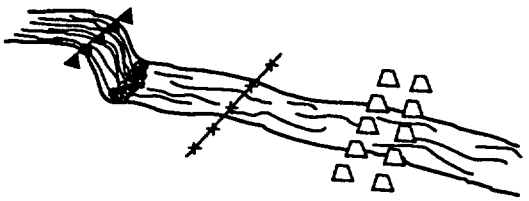
c. If an obstacle symbol is broken solely so it does not conflict with a transportation or surface drainage symbol actually passing through it when overlaid or overprinted with each other, both sides of the obstacle shall be shown, even if one or both sides are less than 10mm (2500 meter ground distance) long. As an example, consider a fill across a valley with a traversable culvert or tunnel through it (imagine Figure 64b. with a traversable culvert or tunnel). A gap of 0.5mm will be shown between the edges of the traversing symbol and the broken sections of the obstacle symbol. Total length of the obstacle before breaking must be greater than 10mm (2500m ground distance).



a. Bridge over road cut



b. Fill across valley with non-traversable culvert or tunnel



c. Obstacles crossing streams

FIGURE 64. Example situations with no break in obstacles.

d. Storm water management structures shall be shown as embankments. These normally earthen structures act as control devices for slowing flood waters, and the major portion of their basins are dry during most of the year. The dam portion of the structure is shown on the Surface Drainage Overlay. See Figure 65.

e. Obstacles will not be displaced such that the true relative position of features to each other is misrepresented - such as a cut, fill, embankment, etc. being shown on the wrong side of a road or stream.

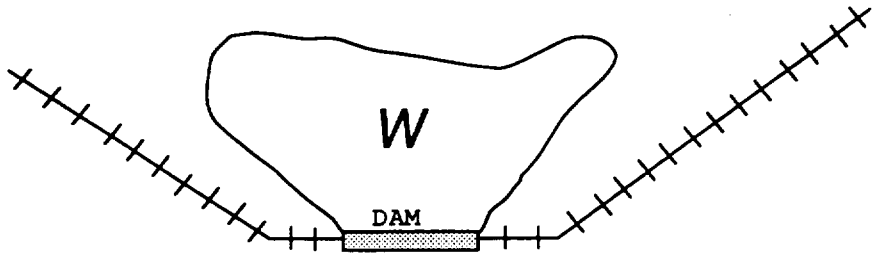


FIGURE 65. Storm water structure and dam.

3.27.5 Miscellaneous obstacle features.

a. Additional obstacle features (such as fences, walls, hedgerows, shelter/windbreaks, on-ground aqueducts, elevated structures, wooded gullies, and military obstacles - anti-tank ditches, impact areas, and minefields) may be encountered which are a major hindrance or obstruction to military ground movement. In some geographic settings, these additional obstacle features may be of significance. As some production systems can handle only a limited number of miscellaneous items on each of the thematics, care must be taken to show only those that would have a major impact on military operations.

b. Unless specified otherwise in Appendix I, depiction of these and/or other similar features may require modification of the legend and/or symbology in order to provide unique symbology of the feature. Where possible, standard (as defined by this specification) linear obstacle symbology will be used. If the feature requires unique symbology, standard symbols from the Military Specifications for the Joint Operations Graphics Series 1501A (Air) and 1501 (Ground) (JOG A/G), MIL-J-89100, and the Military Standard for MC&G Symbology, MIL-STD-2402, will be used to the maximum extent possible.

3.27.6 Linear extent. The minimum length shown for an obstacle or combined obstacles shall be 10mm at map scale or 2500 meters on the ground. The only exception being when an obstacle symbol long enough to be portrayed is broken solely so it does not conflict with a transportation or surface drainage feature passing through it when overlaid or overprinted with each other. In that case either one or both sides may be depicted as less than 10mm long. See 3.27.4c.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The

absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.2 Classification of inspection. The inspection requirements specified herein are classified as follows:

a. Visual examination (see 4.4)
b. Review of construction records (4.5)

4.3 First article inspection. When a first article inspection is required (see 3.1 and 6.2), it shall be examined for defects as specified in 4.4, and the construction record reviewed for compliance with 4.5.

4.4 Visual examination. The map/chart/overlay shall be examined for defects and errors as specified by the contracting officer or by internal DMA standard procedures. Required corrections shall be made to manuscripts, drafting positives, and reproducible material before the item is sent to the next production stage. Defects detected during the inspection of the reproduced "catch copy" shall be evaluated by DMA for criticality, and suitable corrective action.

4.5 Review of construction records. Records about the construction of the map/chart/overlay shall be maintained. The records shall document sources, decisions regarding reconciliation of conflicting data, etc. Overlay records/ construction histories shall be reviewed concurrently with visual examinations (see 4.4). to ensure that proper cartographic procedures have been followed.

4.6 Final product quality. Final product quality will reflect the quality expressed by each applicable military standard and specification.

5. PACKAGING

5.1 General. A set of PTADB overlays shall be issued as flat stock, unfolded, reproducible, film based, positives for all of the thematics generated for the area covered by the set, unless specifically requested otherwise by the customer.

5.2 Packaging. Packaging shall be level C (see 6.2), unless otherwise specified. This packaging provides minimum protection, and it is needed to protect material under favorable conditions. The following criteria determine the requirements for this degree of protection:

a. Use or consumption of the item at the first destination.

b. Shock, vibration, and static loading during the limited transportation cycle.

c. Favorable warehouse environment for a maximum of 18 months.

d. Effects of environmental exposure during shipment and in transit delays.

e. Stacking and supporting superimposed loads during shipment and temporary storage.

5.3 Marking. In addition to any special markings required by the contract or order, markings shall be in accordance with requirements of MIL-STD-129 for military levels of protection.

5.4 Complete PTADB package. In addition to the six or more thematic terrain factor overlays covering a base map area, a complete PTADB package will also include a base map composite film positive made from the reproduction negatives used to produce the base map to which the overlays are keyed.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory).

6.1 Intended use. PTADB is a product developed to satisfy the armed services requirements for a cartographic presentation of Terrain Analysis data at the planning scale.

6.2 Acquisition requirement. Acquisition documents must specify the following:

a. Title, number, and date of this specification.

b. Issue of the DODISS to be cited in the solicitation, and if required, the specific issue of the individual documents referenced (see 2.1.1 and 2.2).

c. When a first article is required (see 3.1, 4.3, and 6.3).

d. Levels of packaging (see 5.2).

6.3 First article. When a first article is required, it shall be inspected and approved under appropriate provisions of FAR 52.209. The contracting officer shall specify the appropriate type of first article and the number of units to be furnished. The contracting officer shall also include specific instructions in the acquisition documents regarding arrangement for selection, inspection, and approval of the first article.

6.4 Supersession. These specifications supersede the Military Specification Planning Terrain Analysis Data Base (PTADB), MIL-P-89305, 30 October 1990, which for various reasons was never put into use, and which in turn superseded the Defense Mapping Agency Product Specifications for the Hard Copy Planning Terrain Analysis Data Base (PTADB), Scale 1:250,000, First Edition, December 1982, (PS/3JB/020). These specifications support current and future manual PTADB overlay and Interim Terrain Data (ITD)/Planning Interim Terrain Data (PITD) file production, at least until Digital Production System (DPS) production commences.

6.5 Definitions.

6.5.1 PTADB. The Planning Terrain Analysis Data Base (PTADB) is a 1:250,000 scale geographic information system type data base consisting of a set of selected single subject thematic terrain information overlays used to satisfy planning military requirements. Data on the physical, biological and cultural features of the Earth's surface is presented in a hard copy cartographic format. These specifications cover only the cartographic thematic overlay presentation.

6.6 Standardization agreements. Certain provisions of this specification may be subject to international standardization agreements. When amendment, revision, or cancellation of this specification is proposed that will modify the international agreement concerned, the preparing activity will take appropriate action through international standardization channels, including departmental standardization offices, to change the agreement, or make other appropriate accommodations.

6.6.1 NATO standardization agreements (STANAGs).

2251 MGD IGEO	-	Scope and Presentation of Military Geographic Information and Documentation.
2253 MGD IGEO	-	Military Geographic Documentation - Roads
	-	and Road Structures.
2254 MGD IGEO	-	Navigable Inland Waterways.
2256 MGD IGEO	-	Inland Hydrography.
2257 MGD IGEO	-	Railways.
2259 MGD IGEO	-	Terrain
3992 IGEO	-	Terrain Analysis (AGeoP-1).

6.6.2 Quadripartite standardization agreements (QSTAGs).

QSTAG 10348, Ed.1 - Terrain Analysis

6.6.3 Air standardization coordinating committee agreements (ASCCs).

This section is not applicable to this specification

6.6.4 International MC&G agreements.

This section is not applicable to this specification

6.6.5 Executive orders.

This section is not applicable to this specification

6.6.6 Inter-Agency agreements.

This section is not applicable to this specification

6.6.7 Other documentation.

This section is not applicable to this specification

6.7 Subject term (key word) listing. This paragraph contains an alphabetical listing of subject terms (key words) that allow for identification of the document during retrieval searches. Note subject terms do not repeat words from title of this document, "Military Specifications, Planning Terrain Analysis Data Base (PTADB), Scale 1:250,000":

Airfields
Bridge Information Table (BIT)
Bridges
Canals
Culture
Hydrography
Hypsography/Physiography
Landing Areas
Obstacles
Open Water
Railroads
Roads
Runways
Slope
Soil Moisture
Soils
Surface Configuration
Surface Drainage
Surface Materials
Surface Roughness Qualifiers
Transportation
PTA
Tunnels
Urban Areas
Vegetation

6.8 Changes from previous issue. Some of the most significant changes in this edition of the PTADB Military Specification (Mil-Spec), MIL-P-89305A, from the first edition, DMA Product Specifications for the Hard Copy Planning Terrain Analysis Data Base (PTADB), Scale 1:250,000, PS/3JB/020, December 1982, (as stated earlier, the edition still in use because MIL-P-89305 was never authorized for production) are: (1) additional features and attributes, (2) the elimination of the requirement for the Vegetation and Surface Roughness Factor (VRF and SRF, respectively) numerical values for vehicle speed degradation, (3) the inclusion of up-graded style sheets and numerous concept illustrations, (4)expansion of symbology, legend, and other appendixes, (5) some minor corrections to existing features and attributes, (6) attempt to standardize and bring order to the array of minimum sizes previously authorized,and (7) the addition of the copyright note. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

6.9 Utilization.

a. The thematic overlays are designed to provide basic terrain information to the user and to support the generation of a variety of synthesized products including, but not limited to:

(1) Cross-Country Movement (CCM)-Main Battle Tank
(2) Concealment/Aerial Detection-Summer
(3) Concealment/Aerial Detection-Winter
(4) Drop Zones
(5 Landing Zones
(6) Nap of the Earth
(7) Line of Sight
(8) Horizontal Visibility
(9) Sensor Emplacement
(10) Ground Detection
(11) Potential Activities Areas
(12) Avenues of Approach
(13) War Game Simulation
(14) Operations Planning
(15) Intervisibility Studies
(16) Fields of Fire
(17) Airburst Effectiveness
(18) CCM - Any Vehicle (Friendly or Hostile)
(19) CCM - Foot Troops
(20) Transportation Capabilities Analysis

b. PTADBs are produced for the normal conditions a military unit would expect to find on a dry day during the season with the most optimal climatic conditions for military operations. For most areas of the world, the best days of the year for military operations occur during the summer months, or dry season of the year when climatic and vegetative factors combine to produce conditions of relatively high evapotranspiration and low soil moisture, at least for temperate climates. The evaluation assumes no recent precipitation (within two or three days), flooding, or prolonged drought, which would distort the normal condition of the natural surface roads and canals, the growth of crops and natural vegetation, soil moisture conditions, etc. For areas where another season is optimal for military operations, such as winter time in an Arctic tundra area (where the optimal operational period might be a frozen winter day with little or no snow cover), a statement as to this time of the year shall be added to the thematic overlays (especially the State of the Ground section of the Surface Materials legend).

6.10 Source material.

a. A critical component in the production of terrain analysis data bases is the proper utilization of available source materials. Imagery, especially aerial photography, is the primary tool used in the production of the PTADB.

b. Collateral sources are often as important as imagery. The following are some of the types of collateral materials which can be used in conjunction with imagery to produce the various terrain analysis data bases:

(1) DIA Automated Installation Intelligence File (AIIF)
(2) Books and Documents by Subject
(3) Topographic Maps
(4) Tourist Guides and Maps
(5) Terrain and Environmental Studies
(6) Land Use Maps and Studies
(7) Thematic Maps of Soils, Forestry, etc.
(8) Military Maps of Mobility, CCM, etc.
(9) Periodicals and Journals in the Various Disciplines
(10) Ground Photos
(11) Surveys of Soils, Forestry, etc.
(12) Foreign and U.S. produced Military Geographic Information and Documentation (MGID) Products
(13) Intelligence Surveys
(14) Stratigraphic Columns and Well Logs
(15) Multispectral Imagery Studies
(16) Thermal and Radar Sensor Data Reports
(17) Engineer Reconnaissance Reports etc.
(18) Military Terrain Team Studies, Special Products, etc.

c. Precedence is given to imagery over collateral sources, except when collateral sources provide more detailed, documented and/or updated information than can be derived from the imagery.

d. In non-denied areas, the best up-to-date and most reliable source material is the information (on those features and attributes that can not be extracted through imagery) derived through the analysis of data collected in the field (on the ground) by Terrain Analysts, while on a field trip to the area of interest.

6.11 Not-evaluated areas. The not-evaluated (NE) code is used in areas that cannot be classified because of a total absence of imagery or collateral sources. This code shall be used for these gap areas when it is impossible to extrapolate accurately from the surrounding areas. The areal extent of the not-evaluated code, if used at all, should normally cover only a small fraction of the overlay.

6.12 Classification and special handling of thematic overlays.

a. The classification of the final PTADB overlays will be determined by the appropriate security section responsible for the final classification. The lowest possible classification of the final product is desired.

b. Even though the final overlays might be unclassified, a handling caveat could be required. Some NATO and other countries have mapping and other agreements which dictate the handling of materials produced over their country. Security elements should check for caveat requirements at the beginning of each project.

APPENDIX A

PTADB STYLE SHEETS

10. SCOPE

10.1 Scope. This appendix provides graphic guidance for the format and portrayal of the marginal information on the PTADB thematic overlays. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. PTADB STYLE SHEETS

30.1 Use of style sheet appendix.

a. The information presented below is general style sheet guidance to the format and presentation for the marginal information found on the various PTADB overlays. While the required information is authoritative, the presentation of this information on these style sheets may be adjusted in spacings, type sizes, number of columns, position (in whole or in part), and/or reduced in size in order to fit into the available margin space. All such adjustments shall: (1) maintain or repeat headings, as necessary, to insure clarity to users as to the part of the marginal data covered, (2) retain all required information, (3) place contiguous parts of the marginal information and/or legends next to or below each other, and (4) remain clear and legible.

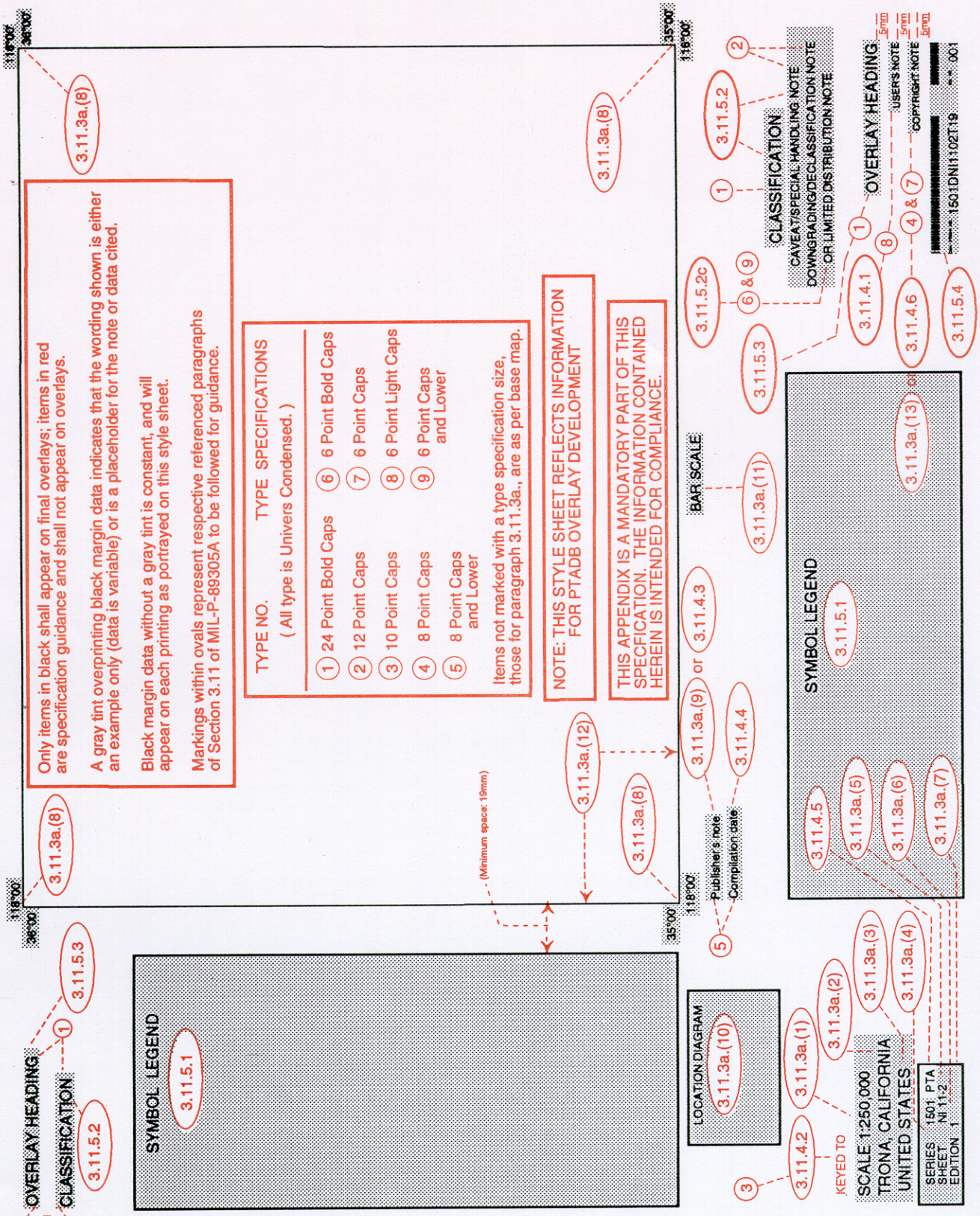
b. The PTADB Style Sheet with the marginal information in the left hand symbol legend space will be the one primarily used for PTADB overlays developed by DMA producers and contractors for most of the world. Depending on size and available marginal space, the legends can be placed below the neatlines, or, as necessary, it can be split between the left and bottom symbol legend spaces.

c. The three pages of the Bridge Information Table (BIT) Style Sheet give precise information for its set up and should be changed only if absolutely necessary. The work limits for the BIT have been established in common with those of the Tactical Terrain Analysis Data Base (TTADB). This yields a standardized format, size, columns, and rows applicable to the BITs of both Terrain Analysis products.

30.2 Style sheets. See next four pages.

APPENDIX A

PLANNING TERRAIN ANALYSIS DATA BASE STYLE SHEET



APPENDIX A

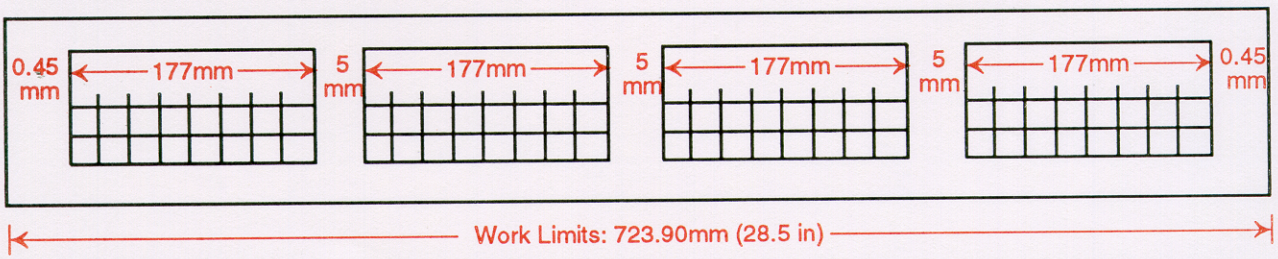
PLANNING TERRAIN ANALYSIS DATA BASE
BRIDGE INFORMATION TABLE STYLE SHEET

A. OVERALL BRIDGE INFORMATION TABLE (BIT) LAYOUT

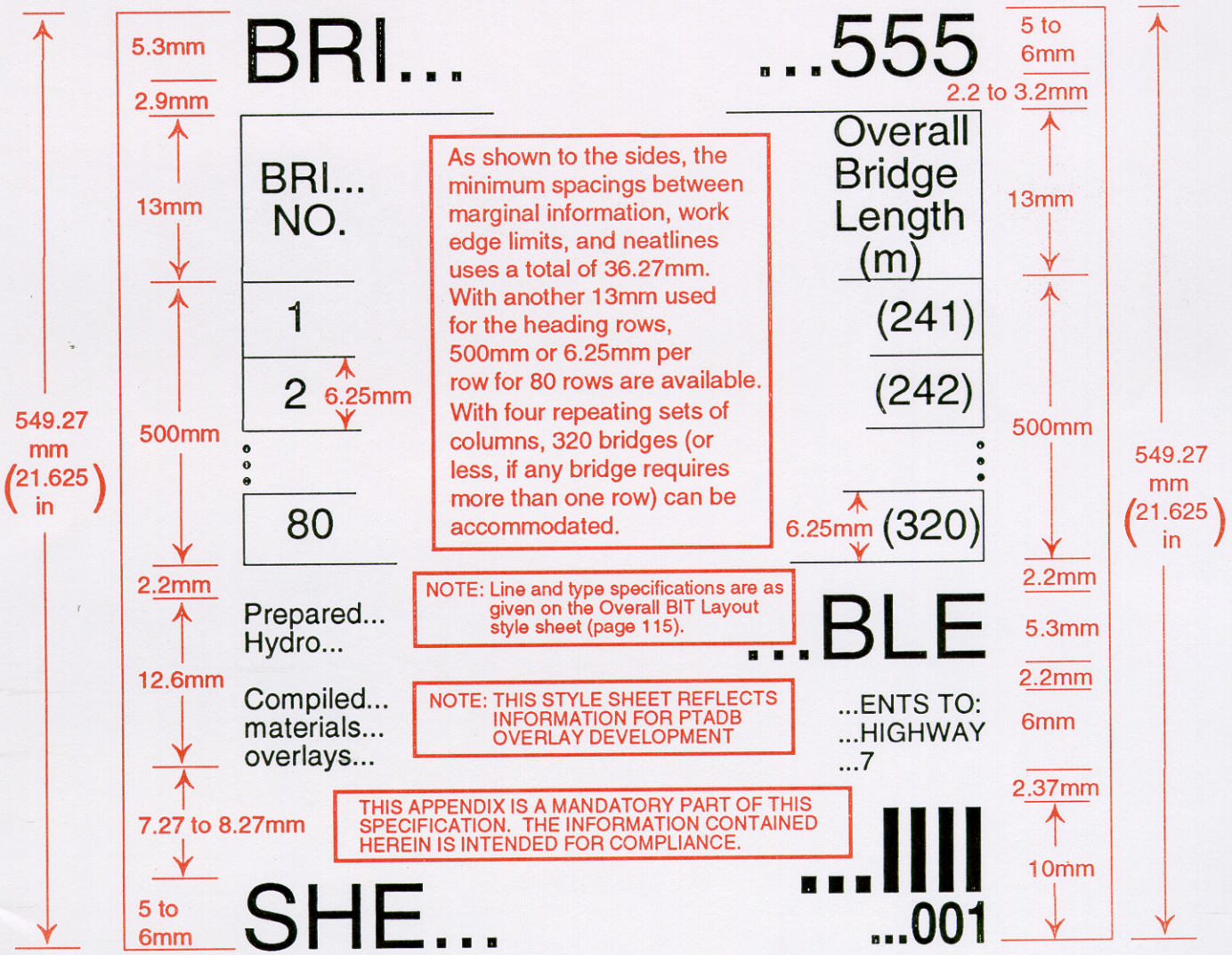
APPENDIX A

PLANNING TERRAIN ANALYSIS DATA BASE
BRIDGE INFORMATION TABLE STYLE SHEET (Continued)

B. BIT AND COLUMNAR WIDTHS. Combining the work limits found in Appendix C of both the TTADB and PTADB Specifications yields 723.90mm (28.5 in) x 549.27mm (21.625 in) as the maximum size work limits for a standardized BIT sheet, which will not change depending on the area of the world. As shown below, using this maximum size yields four columnar sets, each 177mm wide, with 5mm between sets of columns and 0.45mm on the ends to the edge of the maximum work limits.



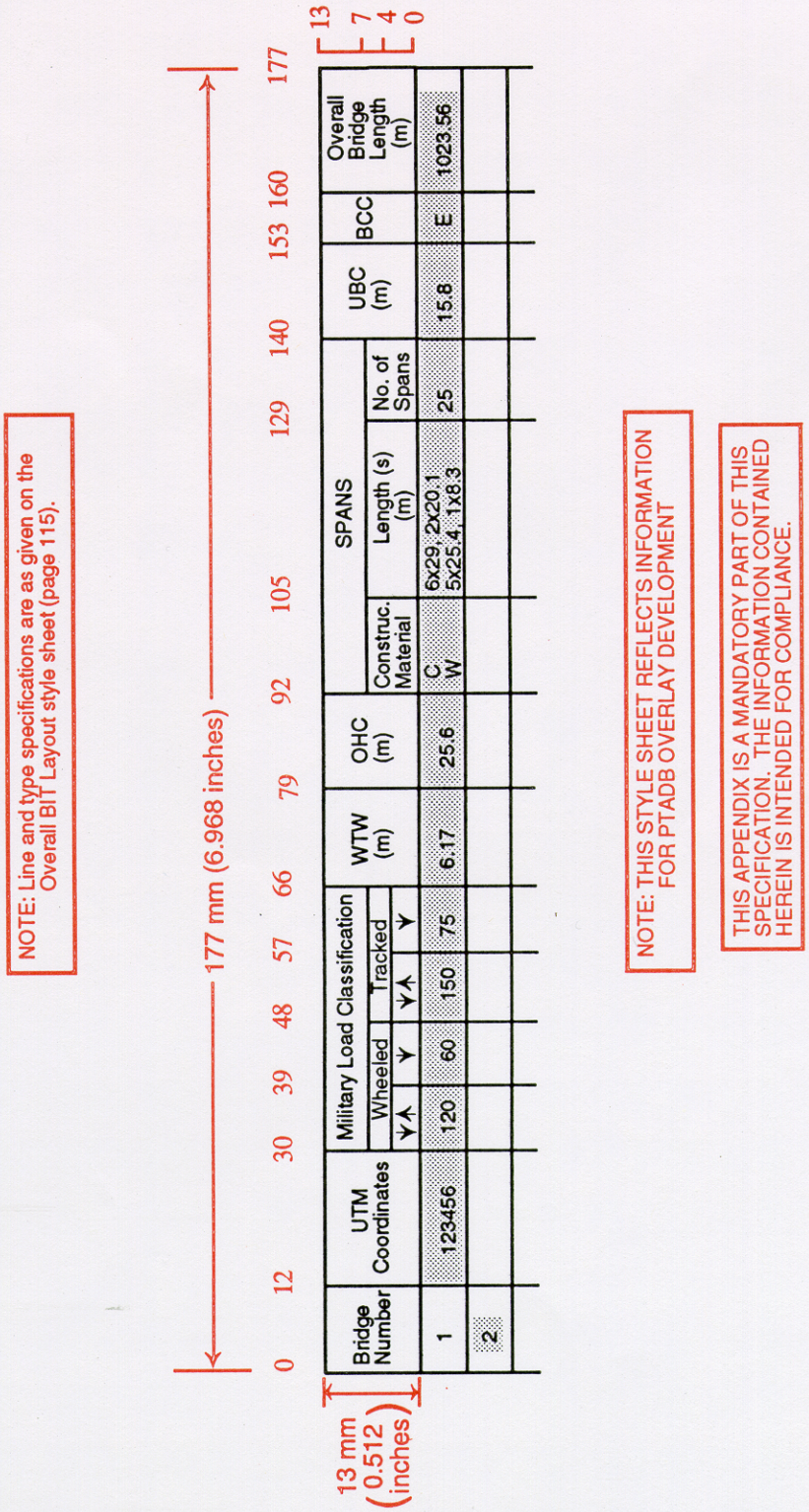
C. BIT AND COLUMNAR HEIGHTS. Using the combined maximum size work limits defined above will also yield the following Bridge Information Table and columnar heights, as shown in the expanded view below:



APPENDIX A

PLANNING TERRAIN ANALYSIS DATA BASE
BRIDGE INFORMATION TABLE STYLE SHEET (Continued)

D. COLUMNAR HEADERS. Individual column widths, header heights, and header labels within each columnar set are as shown below:



APPENDIX B

PTADB SYMBOLOGY

10. SCOPE

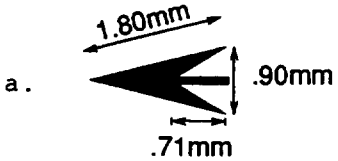
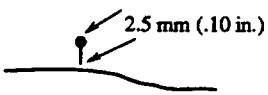
10.1 Scope. This appendix provides the specifications for the PTADB symbols. This appendix is an optional part of the specification; therefore, any conflict between it and the official MC&G symbology document, as cited below, shall be resolved as per the latter. The information contained herein is intended as additional guidance for the production of the PTADB overlays.

20. APPLICABLE DOCUMENTS

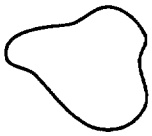
20.1 Military Standards: MIL-STD-2402 - MC&G Symbology

30. SYMBOLS

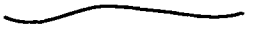
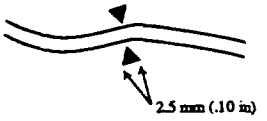
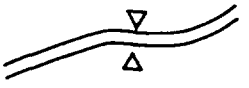
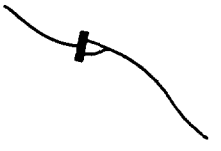
30.1 General symbols. Sidewings, arms, and/or tick spacings on any of the data information holders shall be extended beyond their normal 6.0mm length, as needed for longer or more detail numbers and/or letters.

FEATURE	SYMBOL	SPECIFICATIONS	NO.
Leaderlines	a. b. 	Lineweight: 0.20mm(.008in) a. Straight b. Cornered (Point to Point Angles)	100
Arrowheads	a.  b.	Length: Longer sides:1.80mm (.071in) Short side: 0.90mm (.035in) Leaderline in line with point of arrowhead. a. Enlarged b. Actual size	101
Point of Change Marker		Ball on top of line. Lineweight: 0.30mm (.012in) Line length: 1.5mm (.06in) Ball diameter: 1.0mm (.04in) Or use posicut No. 1414	102
Feature Under Construction		Circle with letters "UC" in 7 pt. Univers Bold Condensed (Cond.) Caps inside. Lineweight: 0.30mm (.012in) Circle diameter (dia.): 6.0mm (.24in) Or use posicut No. 1414	103

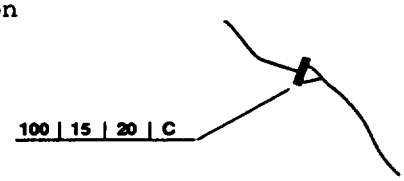
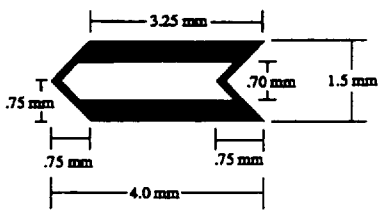
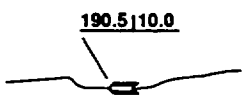
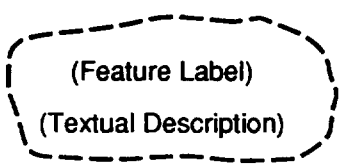
30.1 General symbols (Continued)

FEATURE	SYMBOL	SPECIFICATIONS	NO.
Polygons for: Surface Configuration (Slope), Vegetation, Surface Materials (Soils), Common Open Water, and Obstacles		Lineweight: 0.30mm (.012in) Area: Varies (see individual titles under section 3), but in general is: >= 80 square millimeters (mm^2) (5,000,000 square meters (m^2) ground area (ga)) for non-water features and >= 40 mm^2 (2,500,000 m^2 ga) for most water featues. Width:>=2mm (0.08in) (500 meter (m) ground distance(gd)) Codes in Univers Caps, sized as per Appendix G	104
Islands on: Surface Configuration (Slope), Vegetation, Surface Materials (Soils), and Surface Drainage		Land area completely surrounded by either common or noncommon open water; therefore, it does not have a boundary of its own. Islands of polygon size (Symbol 104) will be shown on all these overlays. Smaller islands will be shown only on the Surface Drainage Overlay if they have: Area: >40 mm^2 (2,500,000 m^2 ga) Width: >=2mm (0.08in) (500m gd) Codes in Univers Caps, sized as per Appendix G.	105
Lines for Underlining:			
Solid	————————	Lineweight: 0.30mm (.012in)	106
Dashes	- - - - - - - - - -	Lineweight: 0.30mm (.012in) Dash length: 1.0mm (.04in) Space: 0.5mm (.02in)	107
Dots	.....	Dot diameter: 0.30mm (.012in) Center spacing: 0.80mm (.032in)	108

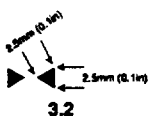
30.2 Surface drainage symbols.

FEATURE	SYMBOL	SPECIFICATIONS	NO.
Non-common Open Water		Polygon with letter "W" in Univers Caps inside. Lineweight: 0.30mm (.012in) Area: >40 mm² (2,500,000 m² ga) Width: >=2mm (0.08in) (500m gd)	500
Stream, canal, etc. (Gap Width >18m and <=142m)		Lineweight: 0.30mm (.012in)	504
Stream, canal, etc. (Gap Width >142m)		Plot to scale Lineweight: 0.30mm (.012in)	505
Covered Drainage		Words "Covered drainage" in 7 pt Univers Bold Cond. LC around dashed line. Lineweight: 0.30mm (.012in) Dash length: 2.0mm (.08in) Space: 1.0mm (.04in)	506
Off Route Ford		Two solid equilateral triangles perpendicular to stream bank. Length on each side: 2.5mm (.10in) Or use posicut No. 1414	511
Float Bridge/ Raft Site		Two open equilateral triangles perpendicular to stream bank. Lineweight: 0.30mm (.012in) Length on each side: 2.5mm (.10in)	512
Dam (Height >=5m)		Block across stream. Plot to scale or minimum size: 1.0mm wide x 4.0mm long (.04in x .16in)	513

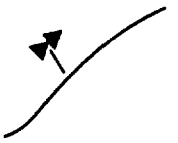
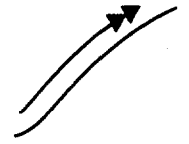
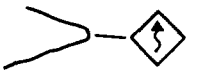
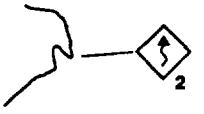
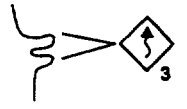
30.2 Surface drainage symbols (Continued)

FEATURE	SYMBOL	SPECIFICATIONS	NO.
Dam Information Holder		Baseline with ticks and letters and numbers in 7 pt. Univers Bold Cond. C/L. Lineweight: 0.30mm (.012in) Length: baseline: 24.0mm (.96in) ticks: 2.0mm (.08in) Tick spacing: 6.0mm (.24in) Leader lineweight: 0.20mm (.008in)	514
Lock	 (Enlarged)  (Actual size)	Arrow shaped parallelogram which points upstream. Plot to scale Minimum overall size: 1.5mm wide x 4.0mm long (.06in x .16in) Long sides: Length: 3.25mm (.13in) Lineweight: 0.40mm (.016in) Short sides, length horizontally /vertically to tip of points: 0.75mm (.03in) Lineweight: 0.25mm (.01in) Angles across stream at 45°	516
Lock Information Holder		Baseline with ticks and letters and numbers in 7 pt. Univers Bold Condensed C/L. Lineweight: 0.30mm (.012in) Length: baseline: 18.0mm (.71in) ticks: 2.0mm (.08in) Tick spacing: 6.0mm (.24in) Leader lineweight: 0.20mm (.008in)	517
Drainage code	123456789	Nine digit number in 7 pt. Univers Bold Condensed LC.	521
Miscellaneous Surface Drainage Feature		Letters and numbers (if any) in Univers C/L within dashed line. Lineweight: 0.50mm (.02in) Dash length: 3.0mm (.12in) Space: 1.0mm (.04in)	524

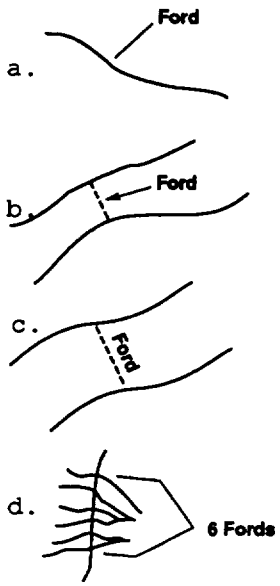
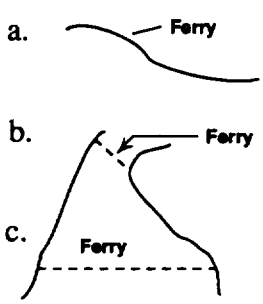
30.3 Transportation symbols.

FEATURE		SPECIFICATIONS	NO.
All weather, dual/divided highway		Lineweight: 0.63mm (.025in) Minimum space: 0.25mm (.01in) Plot to scale if wider	600
All weather, hard surface road		Lineweight: 0.63mm (.025in)	601
All weather, loose surface road		Lineweight: 0.30mm (.012in)	602
Fair weather, loose surface road		Lineweight: 0.30mm (.012in) Dash: 5.0mm (.20in) Space: 1.0mm (.04in)	603
Track		Lineweight: 0.30mm (.012in) Dash: 2.0mm (.08in) Space: 0.5mm (.02in)	604
Road Width Change (Road width in meters)	a.  b. 	Carrot with numbers in 7 pt. Univers Bold Cond. LC. Lineweight: 0.30mm (.012in) Length each side: 3.0mm (.12in) Sides slanted 45° to road and join at right angle a. All road classes except dual lane. b. Dual/divided lane highways.	606
Constriction (Width in meters)		Two solid equilateral triangles perpendicular to road centerline with numbers in 7 pt. Univers Bold Cond. LC. Length on each side: 2.5mm (0.10in) Or use posicut No. 1414	607

30.3 Transportation symbols (Continued).

FEATURE	SYMBOL	SPECIFICATIONS	NO.
Steep Grade (> 7%)	a.  b.  c. 	Two solid adjoining equilateral triangles (tail, as needed). Length on each side: 2.5mm (.10in) Length of tail plotted to scale if grade is longer than 4.3mm (1075m gd). Tail lineweight: 0.30mm (.012in) Leader lineweight: 0.20mm (.008in) a. If < 2mm long (<500m gd) b. If 2 to 4.3mm long (500 - 1075m gd) c. If > 4.3mm long (>1075m gd), measured from tip of first triangle to end of tail)	609
Sharp Curve (radius <30 meters)	a.  b.  c. 	Square (diamond) with solid triangle and curved tail inside with numbers in 7 pt. Univers Bold Cond. LC. Lineweight: 0.30mm (.012in) Square/side: 5.0mm (.20in) Triangle on each side: 1.5mm (.06in) Tail lineweight: 0.20mm (.008in) a. Single curve b. Multiple curves within 2mm (500m gd) c. Multiple curves <= 5mm (1250m gd) apart	610

30.3 Transportation symbols (Continued).

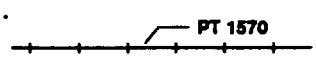
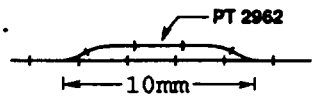
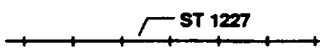
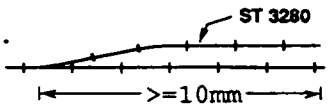
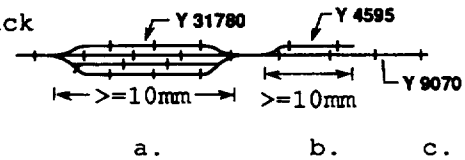
FEATURE	SYMBOL	SPECIFICATIONS	NO.
On Route Ford		Word "Ford" or "Fords" and number (as needed) in 7 pt. Univers Bold Cond. C/L. If >= 2mm (>= 500m gd) include dashed line showing route: Lineweight: 0.30mm (.012in) Dash length: 1.0mm (.04in) Space: 0.50mm (.02in) a. < 2mm (500m gd) b. >= 2-6mm (500 - 1500m gd) c. > 6mm (1500m gd) d. Multiple fords <= 5mm (1250m gd) apart	611
Ferry		Word "Ferry" in 7 pt. Univers Bold Cond. C/L. Lineweight: 0.30mm (.012in) Dash length: 1.0mm (.04in) Space: 1.0mm (.04in) a. < 2mm (500m gd) b. >= 2-6mm (500-1500m gd) c. > 6mm (1500m gd)	612
Single Track, Normal Gauge		Lineweight: 0.30mm (.012in) Tick spacing: 6.4mm (.252in) Tick length: 1.3mm (.052in)	614
Multiple Track, Normal Gauge		Lineweight: 0.30mm (.012in) Tick spacing: 6.4mm (.252in) Tick length: 1.3mm (.052in) Spacing between ticks of a pair: 0.50mm (.02in)	615

APPENDIX B

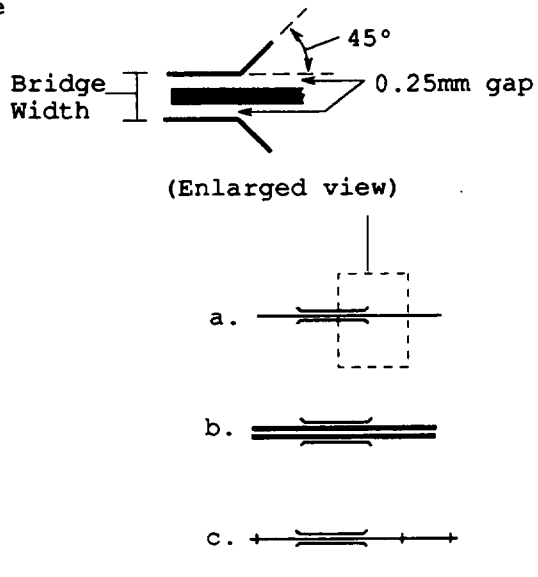
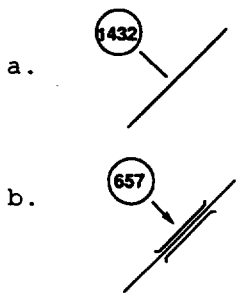
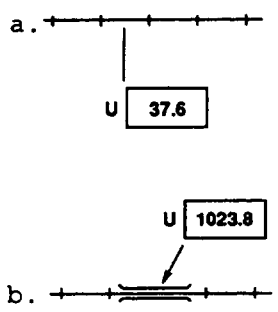
30.3 Transportation symbols (Continued).

FEATURE	SYMBOL	SPECIFICATIONS	NO.
Narrow Gauge	a.	Lineweight: 0.30mm (.012in) Tick spacing: 6.4mm (.252in) Tick length: 0.65mm (.026in) Spacing between ticks of a multiple pair: 0.50mm (.02in) a. Single track b. Multiple track	616
	b.		
Broad Gauge	a. 	Word "Broad" in 7 pt. Univers Bold Cond. C/L above any railroad symbol. Lineweight: 0.30mm (.012in) Tick spacing: 6.4mm (.252in) Tick length: 1.3mm (.052in) Spacing between ticks of a multiple pair: 0.50mm (.02in) a. Single track b. Multiple track	617
	b. 		
Electrified Line	a.	Two small dots above every other cross tick or pair of cross ticks. Dot diameter: 0.50mm (.02in) Spacing between dots, single track RR: 1.0mm (.04in) Spacing between dots, multiple track RR: 1.3mm (.052in) Dot pair spacing: 12.8mm (.504in) Dot bottom height above tick: 0.10mm (.004in) a. Normal gauge, single track b. Normal gauge, multiple track c. Narrow gauge, single track d. Narrow gauge, multiple track e. Broad gauge, single track f. Broad gauge, multiple track	618
	b.		
	c.		
	d.		
	e. 		
	f. 		

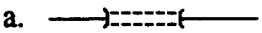
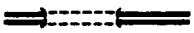
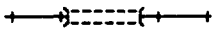
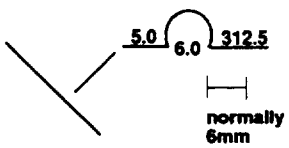
30.3 Transportation symbols (Continued).

FEATURE	SYMBOL	SPECIFICATIONS	NO.
Dismantled Railroad		Lineweight: 0.30mm (.012in) Tick Spacing: 6.4mm (.252in) Tick Length: 0.65mm (.026in) Dash length: 5.4mm (.213in) Space: 1.0mm (.04in)	620
Passing Track >= 280m (total track length in meters)	a.  b. 	Letters "PT" followed by ground length in meters in 7 pt. Univers Bold Cond. Caps. Lineweight: 0.30mm (.012in) Tick Spacing: 6.4mm (.252in) Tick Length: 1.3mm (.052in) Leader lineweight: 0.20mm (.008in) a. If <10mm (2500m gd) long b. If ≥10mm (2500m gd) long	621
Siding >= 280m (total track length in meters)	a.  b. 	Letters "ST" followed by ground length in meters in 7 pt. Univers Bold Cond. Caps. Lineweight: 0.30mm (.012in) Tick Spacing: 6.4mm (.252in) Tick Length: 1.3mm (.052in) Leader lineweight: 0.20mm (.008in) a. If <10mm (2500m gd) long b. If ≥10mm (2500m gd) long	622
Yard >= 280m (total track length in meters)		Letter "Y" followed by ground length in meters in 7 pt. Univers Bold Cond. Caps. Lineweight: 0.30mm (.012in) Tick Spacing: 6.4mm (.252in) Tick Length: 1.3mm (.052in) a. If ≥10mm (2500m gd) long and ≥2mm (500m gd) wide b. If ≥10mm (2500m gd) long and <2mm (500m gd) wide c. If <10mm (2500m gd) long	623

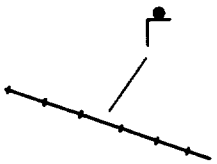
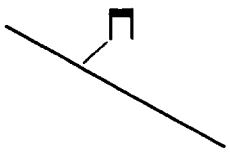
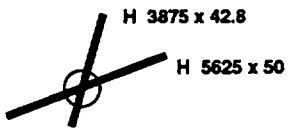
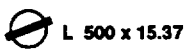
30.3 Transportation symbols (Continued).

FEATURE	SYMBOL	SPECIFICATIONS	NO.
Bridge		Parallel lines with wingticks. Plot to scale or minimum length between wingticks: 2.0mm (.08in) Wingtick length: 0.6mm (.024in) Wingtick Angle:45° Lineweight: 0.30mm (.012in) Space between sides: Same as width of overall crossing road or railroad symbol plus 0.25mm (.01in) space on each side. Cross ticks of railroad symbol(s) are not shown on bridge a. Non-dual lane road bridge b. Dual lane divided highway bridge c. Railroad bridge	626
Road Bridge Information Holder		Circle surrounding bridge number in 7 pt. Univers Bold Cond. C/L. Lineweight: 0.30mm (.012in) Circle dia.: 6.0mm (.28in) Leader lineweight: 0.20mm (.008in) DMA Posicut No. 1414 a. Bridge length between >0.072mm (18m gd) and <2mm (500m gd) b. Bridge length >=2mm (500m gd)	627
Railroad Bridge Information Holder		Rectangle with letters and numbers in 7 pt. Univers Bold Cond. C/L. Lineweight: 0.30mm (0.012in) Rectangle size:5.0mm x 10.0mm (0.20in x 0.40in) Leader lineweight: 0.20mm (.08in) (Continued)	628

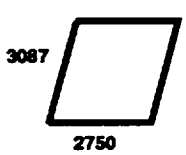
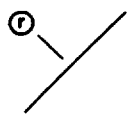
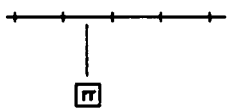
30.3 Transportation symbols (Continued).

FEATURE	SYMBOL	SPECIFICATIONS	NO.
Railroad Bridge Information Holder (Continued)		a. Bridge length between >0.072mm (18m gd) and <2mm (500m gd) b. Bridge length >=2mm (500m gd)	
Tunnel	a.  b.  c. 	Entranceway lines across feature with wingticks and parallel dashed lines between them. Plot to scale or minimum size: Minimum length between entranceways:2.0mm (.08in) Minimum entranceway line length: 1.5mm (.06in) Minimum spacing between dashed lines: 1.2mm (.048in) Lineweight: 0.30mm (.012in) Wingtick length: 0.6mm (.024in) Wingtick angle:45° Dash length: 1.0mm (.04in) Space: 0.5mm (.02in) Associated transportation symbol is suppressed inside tunnel. a. Highway/Road tunnel b. Dual/divided highway tunnel. Plot width the same as overall highway width. c. Railroad tunnel	631
Tunnel Information Holder		2/3 Circle with sidewings and numbers in 7 pt. Univers Bold Cond. LC. Lineweight: 0.30mm (.012in) Circle dia.: 6.0mm (.24in) Sidewings: 6.0mm (.24in) Leader lineweight: 0.20mm (.008in) Or use Posicut No. 1414. Sidewings may be extended as needed for long numbers.	632

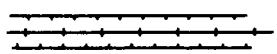
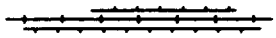
30.3 Transportation symbols (Continued).

FEATURE	SYMBOL	SPECIFICATIONS	NO.
Side Drop		Solid ball centered and touching horizontal line with vertical support leg. Lineweight: 0.30mm (.012in) Ball diameter: 1.5mm (.06in) Line length: Top: 3.0mm (.12in) Leg: 3.5mm (.14in) Leader lineweight: 0.20mm (.008in) Or use Posicut No. 1414.	635
Overhead Drop		Solid block supported on two vertical legs. Lineweight: 0.30mm (.012in) Top line: Width: 1.0mm (.04in) Length: 3.0mm (.12in) Leg line length to top of horizontal line: 4.0mm (.16in) Leader lineweight: 0.20mm (.008in) Or use Posicut No. 1414.	636
Airfield Runways	a.  b. 	Heavy line with centered circle (or point of main intersection on multiple crossing runways) and letters and numbers in 7 pt. Univers Bold Cond. C/L. Orient and plot to scale or minimum size. Minimum runway width: 1.0mm (.04in) Minimum runway length: 6.20mm (.248in) Circle lineweight: 0.30mm (.012in) Circle dia. 4.80mm (.192in) a. Multiple hard surface runways, at scale. b. Single loose runway, minimum size.	638

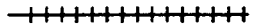
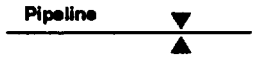
30.3 Transportation symbols (Continued).

FEATURE	SYMBOL	SPECIFICATIONS	NO.
Landing Area	a.  b. 	Heavy outline around area with numbers in 7 pt. Univers Bold Cond. LC. Orient and plot to scale. Lineweight: 1.0mm (.04in) Minimum outside diameter: 4.0mm (.16in) a. Parallelogram, at scale b. Circular, minimum size.	640
Small Road Bridge Marker (Length <=18 metres)		Letter "r" in 7 pt. Univers Bold Cond. LC in small open circle. Lineweight: 0.30mm (.012in) Circle Dia: 3.00mm (.12in)	641
Small Railroad Bridge Marker (Length <=18 metres)		Letters "rr" in 7 pt. Univers Bold Cond. LC in small open rectangle. Lineweight: 0.30mm (.012in) Length, each side of rectangle: 3.00mm (.12in)	642

30.4 Obstacle symbols.

FEATURE	SYMBOL	SPECIFICATIONS	NO.
Road or Railroad Cut		Line with ticks pointing downhill, usually at a transportation feature. Lineweight: 0.30mm (.012in) Tick length: 0.50mm (.02in) Tick space: 3.0mm (.12in)	700
Road or Railroad Fill		Line with ticks pointing downhill, usually away from a transportation feature. Lineweight: 0.30mm (.012in) Tick length: 0.50mm (.02in) Tick space: 3.0mm (.12in)	701

30.4 Obstacle symbols (Continued).

FEATURE	SYMBOL	SPECIFICATIONS	NO.
Embankment/Dike		Perpendicular cross ticks on line. Lineweight: 0.30mm (.012in) Tick length: 2.0mm (.08in) Tick space: 2.0mm (.08in)	706
Pipeline (Above Ground)		Word "Pipeline" in 7 pt. Univers Bold Cond. C/L above line. Lineweight: 0.30mm (.012in)	708
Pipeline Gap/Earth Filled Crossing Point		Two solid equilateral triangles. Length each side: 2.5mm (.10in)	709
Escarpment		Baseline with solid triangles. Lineweight: 0.30mm (.012in) Triangles, length of each side: 1.5mm (.06in) Where escarpments curve in on themselves, every other triangle may be omitted.	711
Volcanic Dike (wall like)		Words "Volcanic dike" in 7 pt. Univers Bold Cond. C/L on top of heavy line. Lineweight: 0.45mm (.018in)	712
Dragon's Teeth		Small squares on line. Lineweight: 0.30mm (.012in) Squares, length each side: 1.0mm (.04in) Line length: 4.0mm (.16in)	716
Depression		Inward facing ticks on line. Lineweight: 0.30mm (.012in) Tick length: 0.50mm (.02in) Tick space: 3.0mm (.12in)	717

APPENDIX C

SIZE LIMITS FOR 1:250,000 MAP SHEET

10. SCOPE

10.1 Scope. This appendix provides the size specifications for the base maps to which the PTADB's are keyed. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENTS

This section is not applicable to this Appendix.

30. SIZE LIMITS

30.1 Sheet lines. Sheet lines are the means by which a geographic area is divided to establish the limits of individual sheets. Sheet lines are generally formed by parallels of latitude and meridians of longitude. The sheet lines of individual maps on sides without bleeding edges are also referred to as neatlines. The sheet lines of the base map (normally a JOG) are duplicated on all the PTADB overlays keyed to it as neatlines. Bleeding edges are not shown or used on the PTADB overlays.

30.2 Size limits.

a. Work limits define the area available for printing. Standard maximum work limit is 7.60 mmm (0.30 in) from the bottom trim limit, with the west work limit defined by centering the sheet's longitude and latitude on the January 1984 MISOMEX Punch Registration System overlay. For JOGs the north and east edges "bleed" off to the trim limits.

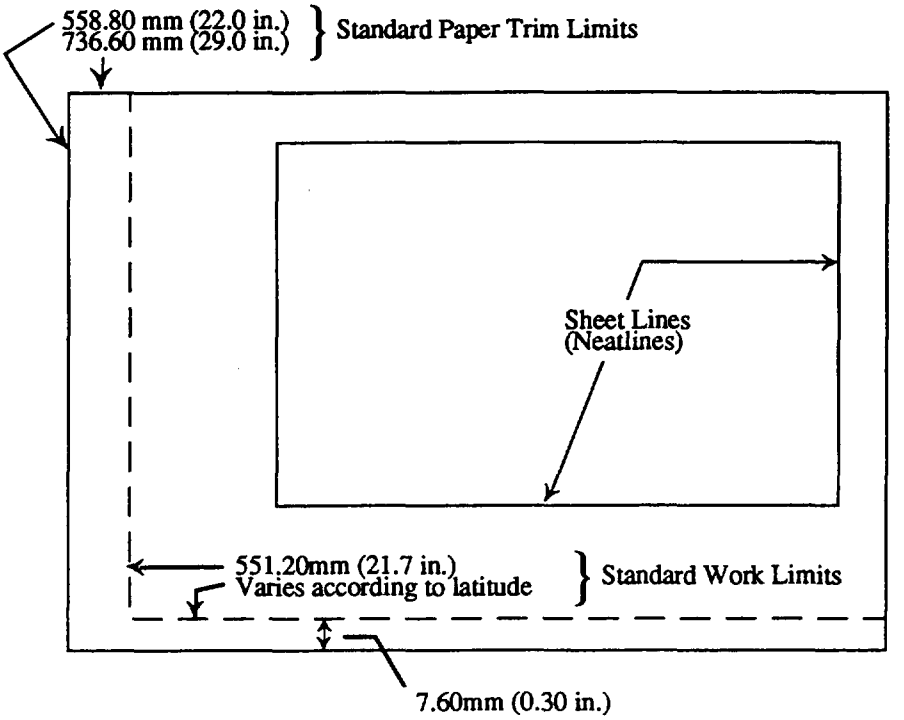
b. Trim size pertains to the overall dimensions to which a map is cut after printing. Standard trim size is 558.80 mm x 736.60 mm (22.0 x 29.0 in). Oversized JOG trim limit is 558.80 mm x 886.46 mm (22.0 x 34.5 in).

c. If possible, the PTADB thematic overlays shall be at least as large as the work limits of the sheet to which they are keyed. Preferably they shall be as large as the trim limits of their associated map sheet. All the PTADB overlays of a single set (same edition over the same map sheet) shall be the same size.

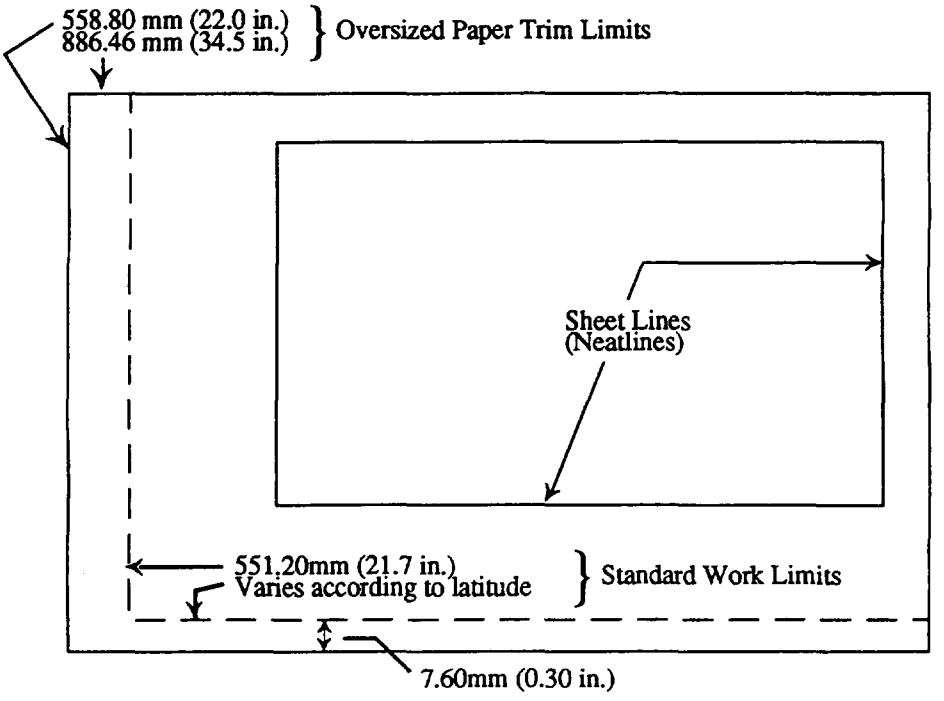
d. See diagrams on next page.

30.2 Size limits. (Continued)

a. Standard JOG Map Sheet Sizes (Not to scale)



b. Oversized JOG Map Sheet Sizes (Not to scale)



APPENDIX D

PTADB LEGENDS

10. SCOPE

10.1 Scope. This appendix provides the legends for the PTADB thematic overlays. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. LEGENDS

30.1 Use of legend appendix.

a. Note that some of the information contained in the various legends of this appendix are noted as example data or statements only. When so noted, this data is either omitted from the thematic overlays because it does not appear in the project area or must be specifically tailored to meet the conditions that are relevant to the project area.

b. The information presented below is general guidance to the format and presentation of the various legends of the PTADB overlays. While the required information is authoritative, the presentation of these legends may be adjusted in spacings, type sizes, number of columns, position (in whole or in part), and/or reduced in size in order to fit into the available margin space. All such adjustments shall: (1) maintain or repeat column headings, as necessary, to insure clarity to users as to the part of the legend covered, (2) retain all required information, (3) place contiguous parts of the legend next to or below each other, and (4) remain clear and legible.

30.2 Surface configuration legend.

SURFACE CONFIGURATION (SLOPE) LEGEND — 14pt. Caps

MAP UNIT CODE	SLOPE (%)
A	0 - 3
B	3 - 10
C	10 - 20
D	20 - 30
E	30 - 45
F	>45
Y	Naturally and/or culturally dissected land (0 - >45)
W	Open Water

12pt. Caps

10pt. C/l

NOTE: All type is Univers 113A, sizes indicated.

30.3 Vegetation legend.

VEGETATION LEGEND

14pt. Caps

MAP UNIT CODE	TYPE
A1	Agriculture (dry crops)
A2	Agriculture (wet crops)
A3	Agriculture (terraced crops, both wet & dry)
A4	Agriculture (shifting cultivation)
A5	Agriculture (with scattered woodlots
B1	Brushland (<5m high, open to medium spacing)
B2	Brushland (<5m high, medium to dense spacing)
C**	Evergreen/Coniferous Forest
D**	Deciduous Forest
E**	Mixed Forest (Evergreen/Deciduous)
FC**	Evergreen/Coniferous Orchard/Plantation/Nursery
FD**	Deciduous Orchard/Plantation/Nursery
FE**	Mixed Orchard/Plantation/Nursery
FP**	Palm Orchard/Plantation/Nursery
G1	Grassland, Pasture, Meadow
G2	Grassland with Scattered Trees, some Scrub Growth
H	Forest Clearing (cutover areas, burns, etc.)
IC*	Swamp (Coniferous/Evergreen)
ID*	Swamp (Deciduous)
IE*	Swamp (Mixed)
IM*	Swamp (Mangrove)
J	Marsh/Bog (treeless bogs, muskegs, etc.)
K	Wetlands (land subject to inundation)
L	Vineyards/Hops/Ginseng
M	Bamboo/Wild Cane
N	Bare Ground
W	Common Open Water
X	Common Built-up Area

10pt. C/l

* These vegetation types are given a three digit map unit code. In addition to the letter(s) for the type code, a number is added as the canopy closure code.

10pt. C/l

** These vegetation types are given a three or four digit map unit code. In addition to the letter(s) for the type code and a first number for canopy closure, a second number is added as the height code. See the Canopy Closure Table, Height Table, and example below.

NOTE: All type is Univers 113A, sizes indicated.

30.3 Vegetation legend (Continued).

CANOPY CLOSURE TABLE — 12pt. Caps

MAP UNIT CODE	CANOPY CLOSURE (%)
1	0 - 25
2	25 - 50
3	50 - 75
4	75 - 100

HEIGHT TABLE — 12pt. Caps

MAP UNIT CODE	HEIGHT (meters)
1	0 - 5
2	>5 - 20
3	>20

12pt. C/l

10 pt. C/l

UNDERGROWTH — 12pt. Caps

———————— Dense undergrowth — 10pt. C/l

(No underline indicates sparse undergrowth or the presence and/or density of undergrowth is unknown)

Example: D23 indicates Deciduous Forest with canopy closure of 25 - 50%, height >20m, and dense undergrowth. — 10pt. C/l

NOTE: All type is Univers 113A, sizes indicated.

TREE SPACING (m) -- STEM DIAMETER (cm) -- TABLE * 12 pt. Caps

FOREST TYPE AND CANOPY CLOSURE 10 pt. Caps

HEIGHT CODE	C1	C2	C3	C4	D1	D2	D3	D4	E1	E2	E3	E4	F_1*	F_2*	F_3*	F_4*	I_1*	I_2*	I_3*	I_4*
1																				
2																				
3						4.86 15.2	Entries in table are 8 pt. LC.														

Except for Orchards/Plantations/Nurseries and Swamps, forested areas <5 meters high shall be included in the Brushland category.

10 pt. C/l

Example : D23 indicates the following: 4.86 m - Average Tree Spacing
15.2 cm - Average Stem Diameter

* Examples only, tailor as necessary for each project area.
NOTE: All type is Univers 113A, sizes indicated.

30.4 Surface materials legend.

SURFACE MATERIALS LEGEND — 14pt. Caps

SOIL TYPE — 12pt. Caps

MAP UNIT CODE (1ST TWO DIGITS)	DESCRIPTION — 12pt. Caps
GW	Well-graded gravels, gravel-sand mixture, little or no fines.
GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
GM	Silty gravels, gravel-sand-silt mixtures.
GC	Clayey gravels, gravel-sand-clay mixtures.
SW	Well-graded sand, gravelly sands, little or no fines.
SP	Poorly graded sands or gravelly sands, little or no fines.
SM	Silty sands, sand-silt mixtures.
SC	Clayey sands, sand-clay mixtures. — 10pt. C/l
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
OL	Organic silts and organic silty clays of low plasticity.
MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
CH	Inorganic clays of high plasticity, fat clays.
OH	Organic clays of medium to high plasticity, organic silts.
PT	Peat and other highly organic soils.
EV	Evaporites.
PS	Permanent snowfields.
RK	Rock outcrops.
X	Not evaluated (common urban areas and other man altered surfaces where USCS determination can not be made)
W	Common Open Water

NOTE: All type is Univers 113A, sizes indicated

30.4 Surface materials legend (Continued).

SOIL DEPTH — 12pt. Caps

_____ < 0.5 meters — 10pt. L/C

(No underline indicates soil depth is > 0.5 meters)

SOIL MOISTURE — 12pt. Caps

---------- Low topographic (potentially moist) sites
..... Perennially wet sites — 10pt. L/C

(None of the above indicates high topographic (normally dry) sites

Example: Map unit code SC3 = Clayey sands, sand-clay mixtures, stony with scattered surface rock, normally moist, depth < 0.5 meters.*

STATE OF THE GROUND* — 12pt. Caps

(1) Normal seasonal moisture content variation of the ground is:

Dry - March, June through October
Moist - April and November
Wet - May
Frozen - December through February — 10 pt. C/l

Note: Optimal operational period is a normal dry winter day with little or no snow cover.

(2) Map unit codes CL4 and OL4 represent rice paddy soils with the following seasonal moisture characteristics:

Dry - None
Moist - March, April and November
Wet - May through October
Frozen - December through February

*Examples only, all notes must be tailored for each project.

NOTE: All type is Univers 113A, sizes indicated.

30.4 Surface materials legend (Continued)

(The following is an example only. All surface roughness legends must be individually tailored for each project area. Headings are 12pt. Caps and entries are 10pt. C/l.)

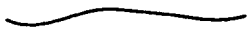
SURFACE ROUGHNESS TABLE

MAP UNIT CODE (3RD/4TH DIGIT)	SURFACE ROUGHNESS DESCRIPTION
0	No Data
1	No surface roughness effect
2	Area of high landslide potential (Not Shown on PTADB)
3	Stony soil with scattered surface rock
4	Area of numerous diked fields
5	Quarries
6	Area of numerous terraced fields
7	Extensive surface rock & boulders with scattered thin soil
8	Moderately dissected
9	Highly dissected
10	Area of numerous sinkholes
11	Area of hummocky terrain
12	Rugged terrain with numerous outcrops
13	Salt evaporators with numerous dikes
14	Area of numerous walls
15	Area of shallow meander scars
16	Area of numerous canals/ditches
17	Area of numerous hedgerows
18	Area of many small pits and quarries
19	Rock outcrops
20	Wadis with transverse sand ridges
21	Lava plain, rough rocky surface
22	Agricultural allotment area, wooden fences, numerous small enclosed areas

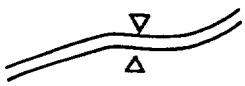
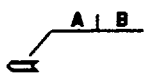
NOTE: All type is Univers 113A, sizes indicated.

30.5 Surface drainage legend.

SURFACE DRAINAGE LEGEND — 14pt. Caps

SYMBOL	DRAINAGE CHANNELS — 12pt. Caps
	[1]Stream/Canal/Channelized Stream/Aqueduct/Irrigation Canal/Drainage Ditch , Gap Width >18 and <=142 meters
	Stream/Canal/Etc., Gap Width >142 meters
	Drainage Channel Point of Change Marker — 10pt. C/l
	Covered Drainage
224132221	Sample Format Code (See Coding Table below)

SYMBOL	NORMALLY OPEN WATER AREAS — 12pt. Caps
	[2]Open Water (Coastal Waters, Lakes, Ponds and Reservoirs) — 10pt. C/l

SYMBOL	ARTIFICIAL DRAINAGE FEATURES — 12pt. Caps
	Off Route Fords
	Float Bridge/Raft Site
	Dam >= 5 meters high — 10pt. C/l A. - Length B. - Width at Crest C. - Height D. - Construction Material C - Concrete E - Earthwork S - Stone U - Unknown
	Lock A. - Length B. - Width

[1] Unless otherwise designated, all streams, canals, channelized streams, aqueducts, irrigation canals, drainage ditches, etc., with gap widths of less than or equal to 18 meters are considered minor drainage features and are not shown on this overlay. — 10pt. C/l

[2] For location of Swamps, Marshes, and Wetlands (Land Subject toInundation) refer to Vegetation Overlay.

NOTE: All type is Univers 113A, sizes indicated.

30.5 Surface drainage legend (Continued).

(The following notes are examples only; all notes must be individually tailored for each project area)

NOTE: All overlays in this Planning Terrain Analysis Data Base (PTADB) are produced for conditions expected to exist on a normal dry day during the summer season.

Discharge and velocity of both the Nisqually River and Muck Creek vary seasonally. High water period: Dec. - Feb., low water period: July - Oct. Portions of Muck Creek may dry up during summer months.

SURFACE DRAINAGE CODING TABLE

12pt. Caps

DIGIT	CATEGORY DESCRIPTION	CODE
1st	Type :	
	No Data	0
	Stream Channel (Intermittent or Ephemeral)	1
	Stream (Perennial)	2
	Stream (Subject to Tidal Fluctuations)	3
	Canal/Channelized Stream/Aqueduct/ Irrigation Canal/Drainage Ditch	4
	Stream (Braided)	5
	Stream (Gorge)	6
2nd	Military Gap Width	
	Bank to Bank (m):	
	No Data	0
	> 18 - 142	1
	> 142 - 1000	2
	>1000	3
3rd	Bottom Material:	
	No Data	0
	Clay and Silt	1
	Sand and Gravel	2
	Rocks and Boulders	3
	Bedrock	4
	Paved	5
4th	*Height, Right Bank (m):	
	No Data	0
	<= 1.0	1
	> 1.0 - 5.0	2
	> 5.0	3

10pt. C/l

NOTE: All type is Univers 113A, sizes indicated

30.5 Surface drainage legend (Continued).

CODING TABLE (Continued)

5th	*Height, Left Bank (m):	
	No Data	0
	<= 1.0	1
	> 1.0 - 5.0	2
	> 5.0	3
6th	Slope, Right Bank (%):	
	No Data	0
	<= 60	1
	> 60	2
7th	Slope, Left Bank (%):	
	No Data	0
	<= 60	1
	> 60	2
8th	Water Velocity, Average (m/second):	
	No Data	0
	<= 1.5	1
	> 1.5	2
9th	Water Depth, Average (m):	
	No Data	0
	<= 1.2	1
	> 1.2 - 2.4	2
	> 2.4	3

10pt. C/l

* Underlined bank height codes indicate dense vegetation (thick brush or closely spaced trees able to prohibit vehicle movement) along bank for greater than 50% of stream segment.

NOTES: Category descriptions in Coding Table are ranked, from 1 through 9, depending on relative accuracy and availability of data.

10pt. C/l

Bank heights and slopes are read facing downstream.

NOTE: All type is Univers 113A, sizes indicated

30.6 Transportation legend.

TRANSPORTATION LEGEND

14pt. Caps

SYMBOL	GENERAL TRANSPORTATION FEATURES (May be used with roads, railroads, airfields, or other general transportation features)	12pt. Caps 10pt. C/l
UC	Feature Under Construction	
Ferry	Ferry	
	Overhead Drop	10pt. C/l
	Side Drop	
	Transportation Point of Change Marker	

SYMBOL	ROADS	12pt. Caps
	All weather, dual highway	
	All weather, hard surface	
	All weather, loose surface	
	Fair weather, loose surface	
	Track	10pt. C/l
6.0 7.5	Road Width (meters) Road Width Change Marker	
A	Constriction A. - Width (meters)	
	Steep Grade, > 7%	
	Sharp Curve (radius < 30 meters)	
Ford	On Route Ford	10 pt. C/L

NOTE: All type is Univers 113A, sizes indicated.

30.6 Transportation legend (Continued).

SYMBOL	RAILROADS	12pt. Caps
	Single track, normal gauge	
	Multiple track, normal gauge	
	Narrow gauge	
Broad	Broad gauge	
	Electrified line	
	Dismantled Railroad	
PT 1570	Passing track (>= 280 meters)	
ST 3280	Siding (>= 280 meters)	10pt. C/l
Y 23780	Yard (total track length in meters)	

*NOTE: Normal gauge for this map sheet is 1.435m (4ft. 8 1/2 in.)
Narrow gauge is 0.762m (2ft. 6in.)

*Example only, tailor for each project.

SYMBOL	BRIDGE DATA	12pt. Caps
	Bridge (Length >= 500 meters)	
(A)	Road Bridge Information Holder A. - Bridge Number (See Bridge Information Table)	
(r)	Small Road Bridge Marker (Length <=18 meters)	
A B	Railroad Bridge Information Holder A. - Overhead Clearance (meters) U = Unlimited R = Restricted B. - Overall Bridge Length (meters)	10pt. C/l
[rr]	Small Railroad Bridge Marker (Length <=18 meters)	

NOTE : All type is Univers 113A, sizes indicated.

30.6 Transportation legend (Continued).

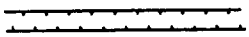
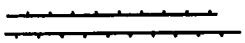
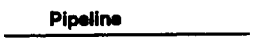
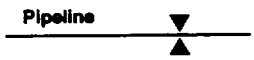
SYMBOL	TUNNEL DATA	12pt. Caps
)::::::(	Tunnel (Length >=500 meters)	
A B C	Tunnel Information Holder A. - Height clearance (meters) B. - Width clearance (meters) C. - Length (meters)	10pt. C/l

SYMBOL	AIRFIELD/AIRPORT RUNWAY DATA	12pt. Caps
C A x B	Line denotes orientation A. - Length (meters) B. - Width (meters) C. - H = Hard L = Loose Operational unless labeled	10pt. C/l
A C B	Landing Area A. - Length (meters) B. - Width (meters) C. - H = Hard L = Loose	

NOTE: All type is Univers 113A, sizes indicated.

30.7 Obstacles legend.

OBSTACLES LEGEND — 14pt. Caps

SYMBOL	DESCRIPTION (12pt. Caps)
	Road/Railroad Cut
	Road/Railroad Fill
	Escarpment
	Depression (10pt. C/l)
	Embankment
	Pipeline (Above ground)
	Pipeline Gap/Earth Filled Crossing Point
	Volcanic Dike (Wall like)
	Dragon's Teeth

NOTE: Linear obstacles shown are > 1.5 meters high, > 2500 meters in length, and > 60 percent slope. Refer to the Surface Drainage Overlay for potential hydrologic obstacles.

NOTE: All type is Univers 113A, sizes indicated.

APPENDIX E

GENERAL GUIDE TO FORMER VEGETATION AND SURFACE ROUGHNESS FACTOR VALUES

10. SCOPE

10.1 Scope. This appendix provides a general guide to the vegetation and surface roughness factor (VRF and SRF, respectively) values normally associated with all Vegetation and Surface Materials (Soils) Overlays produced prior to January 1993. This appendix is an optional part of the specification. The information contained herein is intended to convey an idea of how these factor values were generated and how they were used in synthesized TA products. Since the decision has been made to use the Condensed Army Mobility Model System (CAMMS), instead of the DMA Cross-Country Movement (CCM) Mobility Model, for the generation of CCM products, these **VRF and SRF values are no longer required in the data base.**

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. GENERAL GUIDE TO ROUGHNESS FACTOR VALUES

a. The VRF and SRF values were estimated numerical factor values reflecting the degree of degradation of vehicular and foot troop speed solely due to travel through or over a particular type of vegetation (VRF) or surface roughness type (SRF), as though it was on horizontal ground. These VRF and SRF values allowed input to the synthesized models, such as the DMA CCM Mobility Model, for psychological and physical vegetation and surface roughness terrain characteristics which are not directly captured in the data base, but which will affect and influence the rate of movement or otherwise cause a human or mechanical slowing of vehicles and/or foot troops. These include factors which interfere with visibility (line of sight) or actual (mechanical) movement, such as:

(1) For vegetation - tall grasses or crops, fallen trees, tree stumps, low hanging and/or dense branches, thick vines, plowed fields, root emergence, and other vegetation land use related activities. Note that stem diameter and tree spacing are treated as inputs to all known CCM models and thus were not considered in estimating the VRF.

(2) For surface roughness - dissected land, incised streams, boulders, areas of closely spaced channels, rice patty dikes, hummocky surfaces, and other surface roughness characteristics.

b. The factor values designated were subjective and determined by separate groups of experienced vegetation and surface materials analysts (best if made by analysts knowledgeable about, experienced on, and/or trained in the ride dynamics and performance characteristics of military vehicle movement) for the entire project area. In estimating the magnitude of the VRF and SRF values for specific vehicles or vehicle types, the analysts considered not only all of the physical characteristics of the vegetation and surface roughness types but also the physical characteristics of the vehicles, such as vertical obstacle height climbability, ground clearances, sight height of vehicle driver, self bridging capabilities, wheel sizes, and other vehicle parameters, as well as the usual lengths, widths, heights, etc.

c. These values could be any numeric value from 0.00 to 1.00 in 0.05 increments. They were used as multipliers in the vegetation and surface roughness modules of the DMA CCM Mobility Model. The values decreased with increasing difficulty of movement. For example, a VRF or SRF value of 0.80 would degrade the computed vehicle speed by twenty percent. Thus, a value of 1.00 for a vehicle class would indicate no degradation of speed in the appropriate season.

40. GUIDE TO VEGETATION ROUGHNESS FACTOR (VRF) VALUES

a. In general the VRF values were generic and applied equally to all vehicles. However, if needed, they could be tailored for individual vehicles or vehicle types (such as tracked, wheeled, or foot troops). Bare ground is an example of an area with a VRF value of 1.00. Most grasslands, meadows, pastures, and agricultural areas with little effect will have VRF values of 0.90 to 0.80 depending on the predominate vegetation for the season. However, a virtually impassable mangrove swamp with a tangle of aerial roots would have VRF values of 0.10 to 0.00. The final set of VRF values reflected a logical degree of difference in the relative difficulty of movement through the vegetation in one area as compared to movement through the vegetation another area, disregarding stem diameter and tree spacing.

b. Each vegetation type was given a VRF value. These reflect the difference in vegetation influence on movement on a normal dry day, usually during the summer. Note that a low VFR value could be caused by mechanical factors (fallen timber, stumps, etc.) as well as human factors (visibility affected by low hanging branches, leafy undergrowth, bushes, etc.). Once determined by the analyst the VRF values had to remain the same throughout the project area. **The vegetation roughness factors applied only to the vegetation effect on human and mechanical factors and not related factors such as slope or soils.**

c. The VRF values for vegetation areas without tree heights were listed separately in the legend; while those for the vegetation areas with tree heights were categorized in a separate Tree Spacing/Stem Diameter/Vegetation Roughness Table. The legend and table were tailored for each project area.

d. A table of the typical range of estimated VRF values for tracked vehicles with possible causes of variation is shown below. If ground truth collateral data existed indicating a different value would be more appropriate, this value was used instead of these estimated VRF table values.

VEGETATION TYPE	ESTIMATED VRF	POSSIBLE CAUSES FOR VARIATION
A1	.70 - .90	f(type of crop, cultivation practices, type and depth of plowing, crop rotation, etc.)
A2	.30 - .60	f(type of crop, height and density of dikes)
A3	.00 - .60	f(type of crop, density and height of terraces)
A4	.40 - .70	f(% of cleared/forested area)
A5	.50 - .70	f(canopy closure of woodlots, type of crop)
A6	.70 - .90	f(canopy closure of trees, type of crop)
A7	.30 - .80	f(type of crop, depth, spacing, and density of ditches)
B1	.70 - .90	f(density, height, spacing)
B2	.50 - .90	f(density, height, spacing)
C,D,E,F	.40 - .80	f(species, branching fern, % underbrush, age, fallen trees, stumps, etc.)

G1	.80 - .90	f(species, height)
G2	.60 - .70	f(density, height)
H	.30 - .80	f(method and % of removal)
IC	.10 - .70	f(species, branching fern, aerial rooting, density, % understory, etc.)
ID	.10 - .70	f(same as above)
IE	.10 - .70	f(same as above)
IM	.00 - .50	f(same as above)
IN	.10 - .70	f(same as above)
J	.30 - .80	f(species, height, density, canopy closure of trees)
K	.60 - .90	f(species, height, density)
L	.40 - .60	f(species, management practices)
M	.30 - .60	f(density,height)
N	1.00	No vegetation, no effect
TA	.80 - 1.00	f(species)
TB	.00 - .80	f(species, seasonality, height, and density)
TH	.70 - 1.00	f(species, seasonality, height, and density)
TW	.60 - .95	f(species, seasonality, height, and density)
W	0.00	f(open water)
X	NE	Built-up Area (Not Evaluated)

NOTE: f( ) is defined as "function of (.....) "

50. GUIDE TO SURFACE ROUGHNESS FACTOR (SRF) VALUES.

a. For each SRQ and its corresponding SDR in the legend, there was an associated set of five SRF values, sometimes also referred to as general roughness categories (GRCs). Each SRF value corresponded to one of the five categories of vehicle types or classes for which surface roughness was considered for the TTADB: Large and Medium Tanks GR1), Small Tracked Vehicles (GR4), Large Wheeled Vehicles (GR2), Small Wheeled Vehicles (GR3), and Foot Troops (GR5). For the TTADB all five SRFs were used, but for the PTADB, only the SRF for Large and Medium Tanks (GR1) was used. A typical table of SRQs, SDRs, and their associated SRF values for all five vehicles types for which they were generated is shown on the next page.

b. Maximum vehicle or foot troop speed with a surface roughness factor (SRF) value of 1.00 (no surface roughness effect) would occur on a smooth, hard, flat to very gently undulating surface with no gullies, rills, stone outcrops or other geomorphic microrelief features. Salt flats would be an example of areas with SRF value of 1.00; most smooth (non-rocky/stony) grasslands, meadows, pastures, and agricultural areas in temperate climates would have SRF value of 0.9 to 0.7. A highly dissected flood plain (even with a flat hard surface that was smooth between the gullies) would be given a medium to low SRF value based on the analyst's estimate of the effect of the gullies on the movement of the various vehicle types. Thus, the SRF values often varied from one vehicle class to another.

c. An example of a SRD might be, "stony soil and ground surface". Some of the important characteristics considered in estimating the degree of vehicle speed degradation would include size, shape, density, distribution, etc. of the stones. Obviously, if there were only a few scattered small, rounded, mostly buried stones, the GRC factor value would approach 1.00 indicating little degradation of speed, whereas increases in density, size, angularity, etc., would produce a smaller factor of 0.65, for example, with greater degradation of speed.

(The following is an example only. All surface roughness legends must be individually tailored for each project area. Headings are 12pt. Caps and entries are 10pt. C/l.)

SURFACE ROUGHNESS TABLE

MAP UNIT CODE (3RD/4TH DIGIT)	SURFACE ROUGNESS DESCRIPTION	ESTIMATED SURFACE ROUGHNESS FACTORS* MEDIUM & LARGE TANKS	LARGE WHEELED VEHICLES	SMALL WHEELED VEHICLES	SMALL TRACKED VEHICLES	FOOT TROOPS
0	No Data	-	-	-	-	-
1	No surface roughness effect	1.00	1.00	1.00	1.00	1.00
2	Area of high landslide potential	0.00	0.00	0.00	0.00	0.00
3	Stony soil with scattered surface rock	0.90	0.90	0.95	0.95	0.95
4	Area of numerous diked fields	0.15	0.00	0.00	0.10	0.10
5	Quarries	0.35	0.10	0.10	0.25	0.25
6	Area of numerous terraced fields	0.25	0.00	0.00	0.10	0.10
7	Extensive surface rock & boulders with scattered thin soil	0.45	0.20	0.20	0.40	0.40
8	Moderately dissected	0.75	0.75	0.65	0.65	0.65
9	Highly dissected	0.25	0.30	0.10	0.20	0.20
10	Area of numerous sinkholes	0.45	0.55	0.50	0.55	0.55
11	Area of hummocky terrain	0.75	0.65	0.65	0.75	0.75
12	Rugged terrain with numerous outcrops	0.10	0.10	0.05	0.05	0.05
13	Salt evaporators with numerous dikes	0.05	0.05	0.00	0.00	0.00
14	Area of numerous walls	0.25	0.05	0.05	0.15	0.15
15	Area of shallow meander scars	0.90	0.80	0.75	0.85	0.85
16	Area of numerous canals/or ditches	0.60	0.40	0.45	0.50	0.50
17	Area of numerous hedgerows	0.40	0.10	0.05	0.15	0.15
18	Area of many small pits and quarries	0.30	0.35	0.40	0.40	0.40
19	Rock outcrops	0.35	0.10	0.10	0.25	0.25
20	Wadis with transverse sand ridges	0.45	0.35	0.40	0.40	0.40
21	Lava plain, rough rocky surface	0.10	0.05	0.00	0.05	0.05
22	Agricultural allotment area, wooden fences, numerous small enclosed areas	0.50	0.30	0.15	0.40	0.40

*Surface roughness factors are indicated with 0.00 having maximum and 1.00 having the least impact on CCM.

NOTE: All type is 113A, sizes indicated.

d. The SRF values for areas of No Surface Roughness Effect was always 1.00, for all five GRCs; while on the other hand, the SRF values for areas of high landslide potential were always 0.00 for all five GRCs.

APPENDIX F

TYPE SPECIMENS

10. SCOPE

10.1 Scope. This appendix provides samples of the PTADB type styles. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance. Type numbers in parentheses are DMA type number references only.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. TYPE SPECIMENS

30.1 Type specimens for Univers Medium (113A) and Univers Light (114A).

UNIVERS MEDIUM

(113A) (UM)

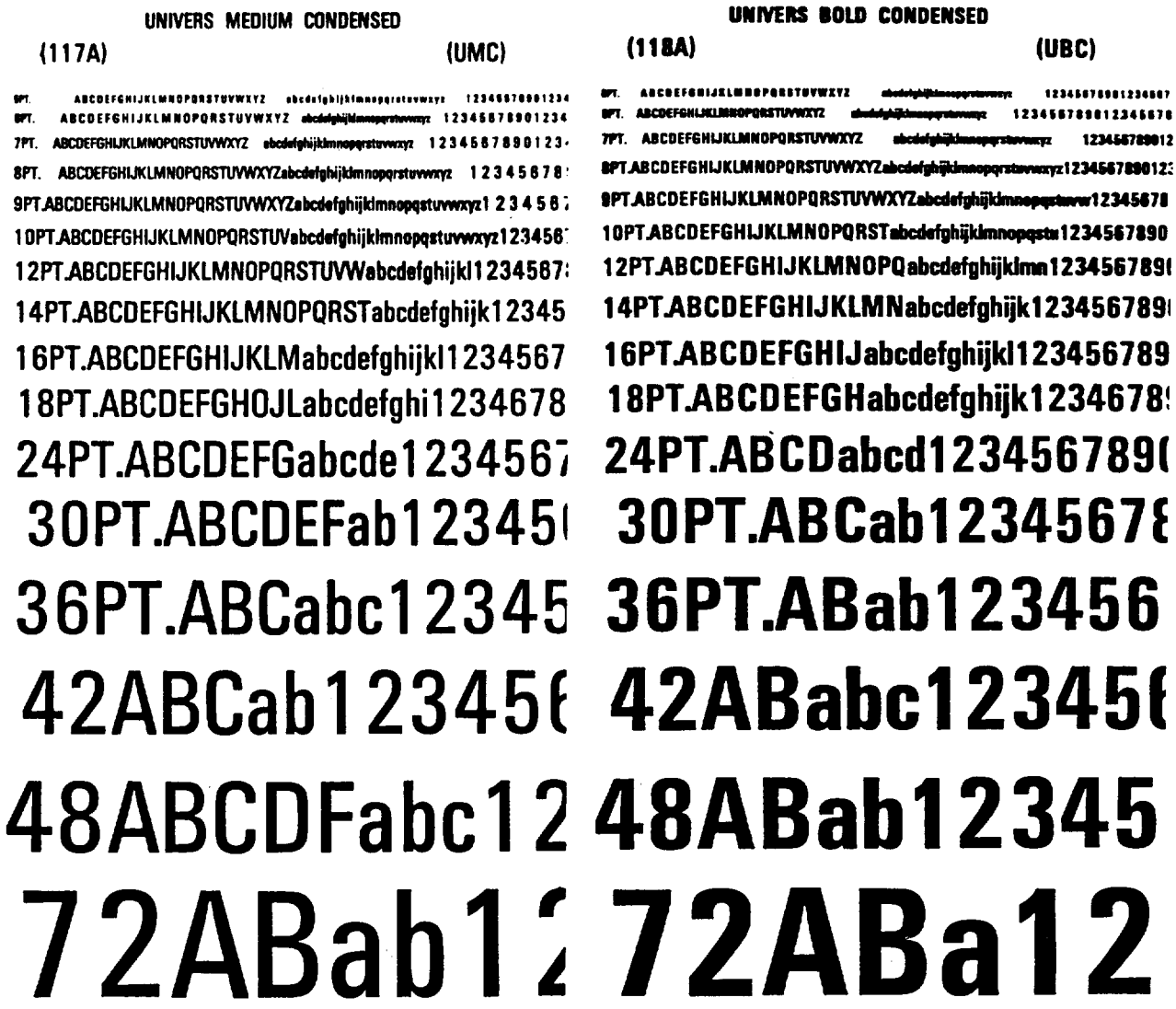
6PT. ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz 12345678
6PT. ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz123456789
7PT. ABCDEFGHIJKLMNOPQRSTUVWabcdefghijklmnopqrstuvwxyz123456
8PT.ABCDEFGHIJKLMNOPQRSTUabcdefghijklmnopqrstuvw123456
9PT.ABCDEFGHIJKLMNOPQRSTabcdefghijklmnopqs12345
10PT.ABCDEFGHIJKLMNOPabcdefghijklmnopq12345
12PT.ABCDEFGHIJKLMNabcdefghijk123456
14PT.ABCDEFGHIJKabcdefghijk12345
16PT.ABCDEFGabcdefghijkl1234
18PT.ABCDEFabcdefghij1234
24PT.ABCabcd12345
30PT.ABCab1234
36PT.ABab123
42ABabc123
48ABab123
72Aa12

UNIVERS LIGHT

(114A) (UL)

5PT. ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz 12345678
6PT. ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz 12345678
7PT. ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz1234567
8PT.ABCDEFGHIJKLMNOPQRSTUVWabcdefghijklmnopqrstuvw1234567
9PT.ABCDEFGHIJKLMNOPQRSTUVabcdefghijklmnopqst123456
10PT.ABCDEFGHIJKLMNOPQRabcdefghijklmnopqs12345
12PT.ABCDEFGHIJKLMNOabcdefghijkl1234567
14PT.ABCDEFGHIJKLabcdefghijk123456
16PT.ABCDEFGHabcdefghijkl12345
18PT.ABCDEFabcdefghijk12346
24PT.ABCDabcd123456
30PT.ABCab12345
36PT.ABab1234
42ABabc123
48ABab123
72Aa12

30.2 Type specimens for Univers Medium Condensed (117A) and Univers Bold Condensed (118A).



APPENDIX G

TYPE TEMPLATE FOR TERRAIN ANALYSIS
AREA FEATURES

10. SCOPE

10.1 Scope. This appendix provides a general guide to the type sizes to be used for coding or otherwise identifying the areal feature polygons on the various PTADB thematic overlays. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. GUIDE TO TYPE SIZES

30.1 Use of the type template. Where the type specifications permit a range of type sizes based on the areal limits of a feature's polygon, the type template shown on the next page will be used as a guide to assure uniformity of selections. When space or odd shape prohibits use of a prescribed size, or the size indicated by the template will obviously distort the relative importance of a feature, a more appropriate size is to be selected.

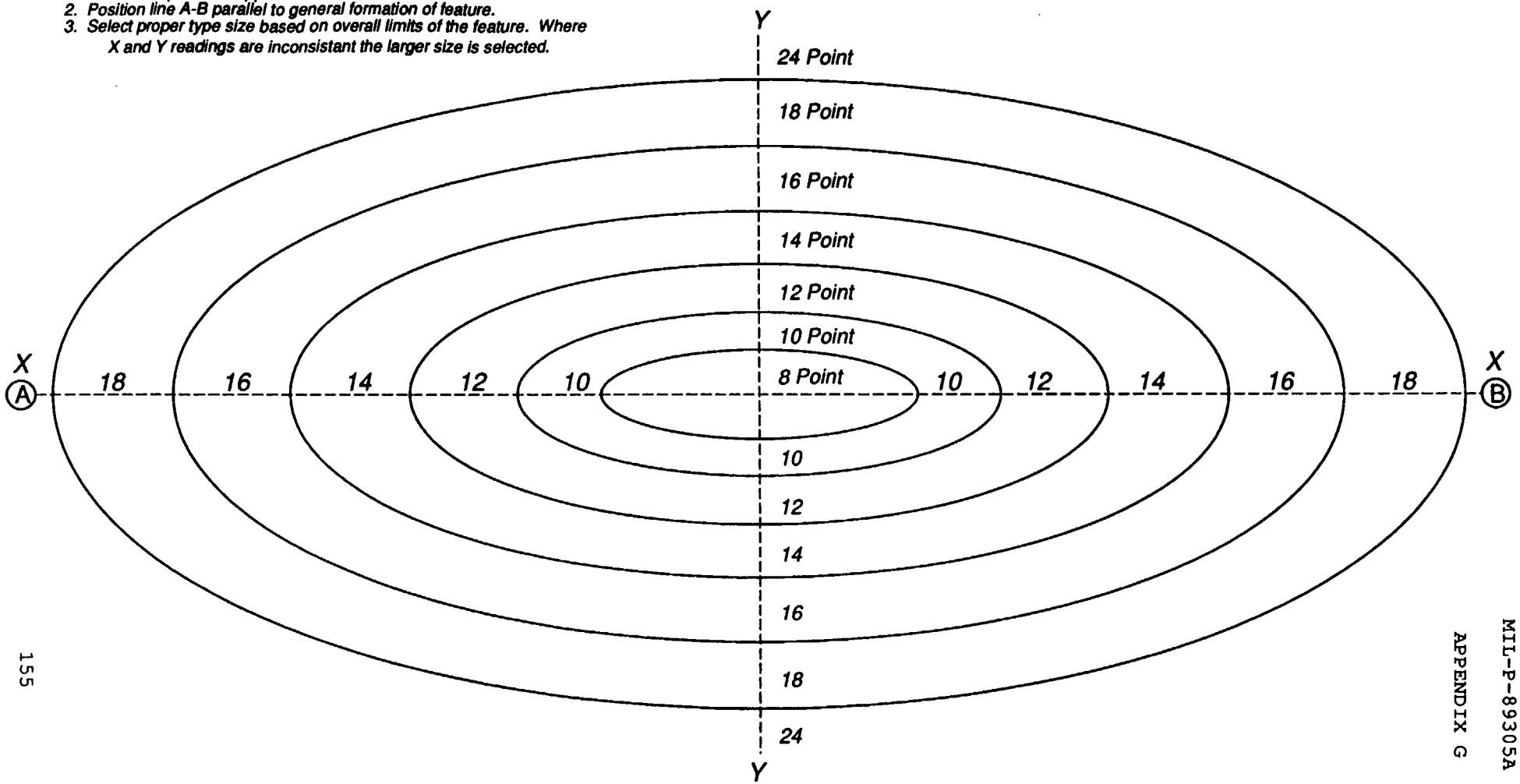
30.2 Type template. See next page.

TYPE TEMPLATE FOR TERRAIN ANALYSIS

AREA FEATURES

Instructions:

1. *Center templet over approximate center of feature.*
2. *Position line A-B parallel to general formation of feature.*
3. *Select proper type size based on overall limits of the feature. Where X and Y readings are inconsistant the larger size is selected.*



APPENDIX H

PTADB CONCEALMENT-AERIAL DETECTION (C-AD) TABLE

10. SCOPE

10.1 Scope. This appendix provides a general guide to the general concealment-aerial detection possibilities from overhead observation normally associated with the canopy closure of each PTADB vegetation type. This appendix is an optional part of the specification. The information contained herein is intended as additional guidance for the production of the PTADB Vegetation Overlay.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. GENERAL GUIDE TO CONCEALMENT-AERIAL DETECTION

30.1 Use of PTADB concealment-aerial detection table. If ground truth collateral data exists indicating a different value would be more appropiate, this value will be used instead of the indicated table value.

30.2 PTADB concealment-aerial detection table.

Vegetation Overlay Unit	Vegetation Type	Canopy Closure (%)	C-AD (Summer) (%)	C-AD Map Unit (Summer)	C-AD (Winter) (%)	C-AD Map Unit (Winter)
A1-A3	Agriculture (dry, wet, terraced)	-	75-100	4	75-100	4
A4	Shifting Cultivation	(1)50-75	25-50	2	25-50	2
A5	Agric. w/Scattered Woodlots	(2)25-50	50-75	3	75-100	4
A6	Agric. w/Scattered Trees/Rows	(2)05-25	75-90	4	75-100	4
A7	Agriculture (ditch irrigation)	-	75-100	4	75-100	4
B1 & B2	Brushland/Scrub	-	75-100	4	75-100	4
C11-C13	Coniferous Forest	0-25	75-100	4	75-100	4
C21-C23	" "	25-50	50-75	3	50-75	3
C31-C33	" "	50-75	25-50	2	25-50	2
C41-C43	" "	75-100	0-25	1	0-25	1
D11-D13	Deciduous Forest	0-25	75-100	4	75-100	4
D21-D23	" "	25-50	50-75	3	75-100	4
D31-D33	" "	50-75	25-50	2	75-100	4
D41-D43	" "	75-100	0-25	1	75-100	4
E11-E13	Mixed Forest	0-25	75-100	4	75-100	4
E21-E23	" "	25-50	50-75	3	75-100	4
E31-E33	" "	50-75	25-50	2	50-75	3
E41-E43	" "	75-100	0-25	1	50-75	3
FC_ _	Orchard/Plantation	(1) See Coniferous Forest (C11-C43) Categories				
FD_ _	Orchard/Plantation	See Deciduous Forest (D11-D43) Categories				
FE_ _	Orchard/Plantation	See Mixed Forest (E11-E43) Categories				
FP_ _	Orchard/Plantation	(1) See Coniferous Forest (C11-C43) Categories				

30.2 Concealment-aerial detection table. (CONT'D)

Vegetation Overlay Unit	Vegetation Type	Canopy Closure (%)	C-AD (Summer) (%)	C-AD Map Unit (Summer)	C-AD (Winter) (%)	C-AD Map Unit (Winter)
G1	Grassland, Meadows, Pasture	-	75-100	4	75-100	4
G2	Grassland w/Scattered Trees	0-25	75-100	4	75-100	4
H	Forest Clearings (burns,cuts,etc)	-	75-100	4	75-100	4
IC_ _	Evergreen/Coniferous Swamp	(See Coniferous Forest (C11-C43) Categories)				
ID_ _	Deciduous Swamp	(See Deciduous Forest (D11-D43) Categories)				
IE_ _	Mixed Swamp	(See Mixed Forest (E11-E43) Categories)				
IM_ _	Mangrove Swamp	(1)	(See Coniferous Forest (C11-C43) Categories)			
IN_ _	Nipa Swamp	(1)	(See Coniferous Forest (C11-C43) Categories)			
J	Marsh/Bog (peat)	-	75-100	4	75-100	4
K	Wetlands(LSI)	0-25	75-100	4	75-100	4
L	Vineyard/Hops	-	75-100	4	75-100	4
M	Bamboo/Wild Cane	(2) 75-100	0-25	2	75-100	4
N	Bare Ground	-	75-100	4	75-100	4
TA,TB, TH,& TW	Tundra Areas	-	75-100	4	75-100	4
W	Common Open Water	-	75-100	4	75-100	4
X	Common Built-up Area	(3) 25-50	50-75	3	50-75	3

(1) Assumed to be coniferous/evergreen trees or plants that retain most of their leaves year-round; if there is a loss of leaves on a seasonal basis, that category of vegetation will fall into map unit code 4 for the winter product.

(2) Assumed to be deciduous trees or plants that lose most of their leaves for at least one season.

(3) If percent of roof cover is not given, default value is assumed to be 25-50%.

NOTE: This table can be modified to reflect variations in vegetation conditions as they exist in a particular area of the world and to include categories not listed above.

APPENDIX I

PREVIOUSLY USED AND REQUESTED MISCELLANEOUS FEATURES

10. SCOPE

10.1 Scope. This appendix defines and specifies the symbology to be used for most of the miscellaneous and/or unique features which have been occasionally added to the various thematic overlays since the first edition PTADB specifications (PS/3JB/020) were published in December 1982. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance, on an as needed basis, **and only as directed by supplemental project instructions**.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix

30. PTADB MISCELLANEOUS FEATURES

30.1 Miscellaneous features that are now part of the PTADB specification. Current features in this specification which started as miscellaneous and/or unique features on previous terrain analysis projects include: (1) Both types of dropgates, (2) Float bridge/raft sites, (3) Dragon's teeth, (4) Above ground pipelines and pipeline crossing points, (5) Volcanic dikes, (6) Kanats, (7) Naturally and culturally dissected areas, etc.

30.2 Miscellaneous feature definitions.

30.2.1 **Slope categories** (Symbol 103, labeled "A" to "I" as listed below). In order to meet the requirement for helicopter landing areas to have a slope no greater than 15% and to take advantage of the ability of newer vehicles coming into the military inventory to approach a practical field limit climbability of 60% or more, some previous projects have changed the slope categories listed in 3.14.2.1.1 to those shown below. For older vehicles the practical field limits remain 30% for wheeled vehicles and 45% for tracked vehicles.

Map Unit Code	Slope (%) Category
A	0 - 3
B	> 3 - 10
C	>10 - 15
D	>15 - 20
E	>20 - 30
F	>30 - 45
G	>45 - 60
H	>60 - 85
I	>85

30.2.2 Vegetation features (Symbol 103, labeled "TH" to "IN" as listed below).

a. Tundra regions, which comprise almost 20 percent of the Earth's land surface, mostly in the northern Arctic areas, with their ecologically fragile environments are another unique situation. These are normally flat to undulating treeless plains found in arctic and subarctic regions, and characterized by frozen

to moist topsoils over permafrost. These areas may have low grass tufts with ice cores (pingos), which vary in continuity and uniformity. Since ground saturation inhibits movement during the summer thaws, these areas are often only suitable for movement during the winter months when the top soil layers are completely frozen. Tundra environments are generally described as being one of four types:

(1) **Alpine Tundra** (code TA) - In dry, or alpine tundra, vegetation is generally sparse, growing closely matted to the ground. In higher elevations, alpine tundra vegetation may be scattered among barren rocks and rock outcrops. Vegetation found in dry tundra commonly includes mountain-avens, lichens, and mosses and may include other herbs, grasses and sedges growing on bare rocks, sand, or gravel. If less than 10 percent ground cover, this category will be coded bare ground (Code N).

(2) **Brush (shrub) Tundra** (code TB) - Tundra area in which the vegetation is dominated by scattered to dense woody shrubs and thickets, usually in association with mosses, sedges, and grasses.

(3) **Herbaceous Tundra** (code TH) - Tundra regions characterized by non-woody vegetation associations of mosses, lichens, sedges, and grasses often forming an almost continuous ground cover. There can be minor occurrences of low growing (less than .5m) woody shrubs and thickets.

(4) **Wet tundra** (code TW) - Tundra area characterized by low topographic relief with standing water usually present during the summer season. Vegetation is predominantly sedges, rooted aquatic plants, and a few shrubby plants on the drier sites.

b. An additional type of treed agricultural area can be locally important in some regions:

Agriculture with Scattered Trees/Rows of Trees (code A6) - Cropland is the predominant vegetation with fields and/or roads bordered by rows of trees or scattered individual and/or small clumps of trees covering 5 to 25 percent of the area. Rows of trees and/or individual trees are dispersed (intermixed with cropland) throughout the area. Large areas of open cropland next to A6 areas will be portrayed as A1, A2, A3, or A7 agricultural areas.

c. **Ditch Irrigation** (code A7) - Cropland in areas irrigated by water channeled in small ditches or furrows which are usually 10 to 20cm deep and 100 to 400m long with centers spaced 75 to 150cm apart. This type of cropland can occur in all climatic regions and at times can appear to be very similar to wet crops.

d. **Nipa Swamp** (code IN) - A separate swamp class which consists of a dense growth of stemless palms found in tropical and semi-tropical tidal and brackish waters. It usually occurs farther inland than mangrove and forms strips in channels through which the tidal waters flow.

e. Modification of undergrowth categories - The presence and/or density of undergrowth is given in five, instead of two, categories.

(1) A solid line under a wooded vegetation map unit indicates medium to dense undergrowth (greater than 50% ground cover).

(2) A dashed underline indicates a sparse to medium (15 to 50 percent) ground coverage) undergrowth.

(3) A dashed/dotted underline indicates sparse (5 - 15 percent) ground coverage.

(4) A dotted underline indicates there is open to no undergrowth (less than 5 percent ground cover) - either there is not enough light reaching the forest floor or some man or animal activity , such as gleaning or grazing, has removed the undergrowth.

(5) No underline indicates that the presence and/or density of undergrowth is unknown.

(6) The undergrowth underline symbols shall be straight line versions of symbol 106 (________________), symbol 107(----------------------), symbol 108 (.......................................), and symbol 109 (-.-.-.-.-.-.-.-.-.-.-.-.-.-.).

30.2.3 Surface materials features (Symbol 103, labeled "CM or RF" as listed below).

a. **Inorganic clay and silt combinations** (code CM) - Inorganic clay and silt combinations are borderline soils which exhibit the properties of both the CL and ML soil groups. These soils plot in a zone on the plasticity chart (Figure 400-1) where no clear break between silty and clayey soils exists. These soils have plasticity index values between 4 and 7, and a liquid limit below 29.

b. **Rock Field** (code RF) - Areas with surface covering of rocks ranging in size upward from cobbles (larger than 7.62cm or 3 inches in diameter) to 50 percent or less bedrock outcrop (code RK). These areas are sometimes also referred to as boulder fields. Neither the type of rocks or bedrock is identified.

c. Perennially frozen sites (attribute of soils):

(1) Permafrost is the condition of perennially frozen ground which underlies about 20 percent of the Earth's land surface, mostly in the northern Arctic tundra regions. As these soils have temperatures below freezing, the soil moisture in the pore spaces is frozen and the soil components are bound together into a solid mass. Permafrost is usually found in level to nearly level lowland areas, but can also be found in upland depressions and regions of sloping surfaces with soils that have very poor internal drainage.

(2) Note that the top layers (first few inches) of permafrost soils, such as expanses of Arctic tundra, are subject to thaw and on sloping ground to solifluction (soil creep downhill due to constant freezing and thawing) during the summer. Therefore, if possible, they should be avoided during that season.

(3) A dash/dot underline (-.-.-.-.-.-.-.-.-.-.-.-.-.-., symbol 109) indicates topographic sites with soils in a frozen or in a permafrost condition, even during the summer months.

30.2.4 Surface drainage features.

a. **Intermittent lakes** (Symbol 501).

(1) An inland body of standing water that exists only on a seasonal basis. The depression or area it occupies fluctuates between being covered with standing water and being dry on some periodic, usually yearly, cycle. These are sometimes referred to as ephemeral or temporary lakes. Salt evaporators are man-made intermittent lakes. These features are delineated at their normal flood stage extent.

(2) As illustrated in Figure 66, intermittent lakes can be features unto themselves but they are also found on the outer edges of permanent lakes.

FIGURE 66. Intermittent lakes.

(3) When dry, most intermittent lakes will support full or at least partial military operations across them.

(4) Intermittent lakes no matter what their size, are only shown on the Surface Drainage Overlay. However, they must meet a minimum size limitation of >= 40 square millimeters (2,500,000 square meters ground area) with a minimum width equal to or greater than 2mm (500 m ground distance).

(5) Intermittent lakes are coded with the capital letters "IW" and are depicted with a dashed line (Symbol 501).

b. **Anastomosing Stream** (First digit is 7).

(1) Areas where perennial streams contain numerous interlacing channels with stabilized islands. As illustrated in Figure 67, these are depicted by showing the minimum size islands (40 square millimeters) within the full stream channel.

(2) If necessary, and room is available, a special note giving other descriptive information is added to the legend. For example, "Average gap widths between islands in anastomosing streams range from 4.5m to 19m".

(3) The gap width is taken as the bank to bank width across the entire normal limits of the stream's flood channel, not just across the flood channels between the islands. The entire gap width is coded with the nine digit code.

c. **Wash/Wadi/Arroyo** (First digit is 8 - Symbol 507).

(1) A steep sided, usually dry, watercourse, channel, or gulch with a nearly flat floored flood plain or gully of an ephemeral or intermittent stream,

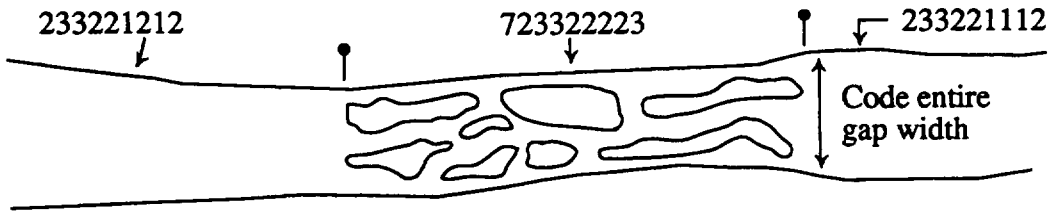


FIGURE 67. Example of anastomosing stream channel.

generally found only in arid areas. This type of feature is subject to flash flooding after brief but heavy rainfall over even a small area having steep slopes, usually mountainous uplands. In the uplands, these are usually steep-sided, broad and rather shallow features cut through unconsolidated material with bouldery, gravelly, stony or sandy beds. Washes/Wadis/Arroyos are often situated at the bottom of a steep valley, canyon, or ravine but most commonly occur as flood formed features incised into a flat or nearly flat plained desert area.

(2) Most washes/wadis are fed by a series of intermittent streams, which are not shown inside a wash/wadi. This type of feature usually ends on either an outwash plain, an area of enmeshing channels, or a perennial stream will develop at the end of the wash/wadi, as illustrated in Figure 68.

(3) The banks of the wash/wadi at the normal limit of flood stage (normal flood channel) is used as the line of measurement for determining wash/wadi width, delineating the location of permanent streams within the feature, and stream coding. Perennial streams within the wash areas are shown and coded, as appropriate.

(4) The wash/wadi banks greater than or equal to 5 meters high will also be picked up on the Obstacles Overlay as escarpments. The linework between the Drainage Overlay showing the washes/wadis and the Obstacles Overlay indicating the escarpments should be exact (line for line).

(5) The channels within these areas are often numerous and braided. An oversized dashed outline will be used to show the areal extent of the wash/wadi with the addition of the capital letters "WS" inside the dashed outline, as depicted in Figure 67.

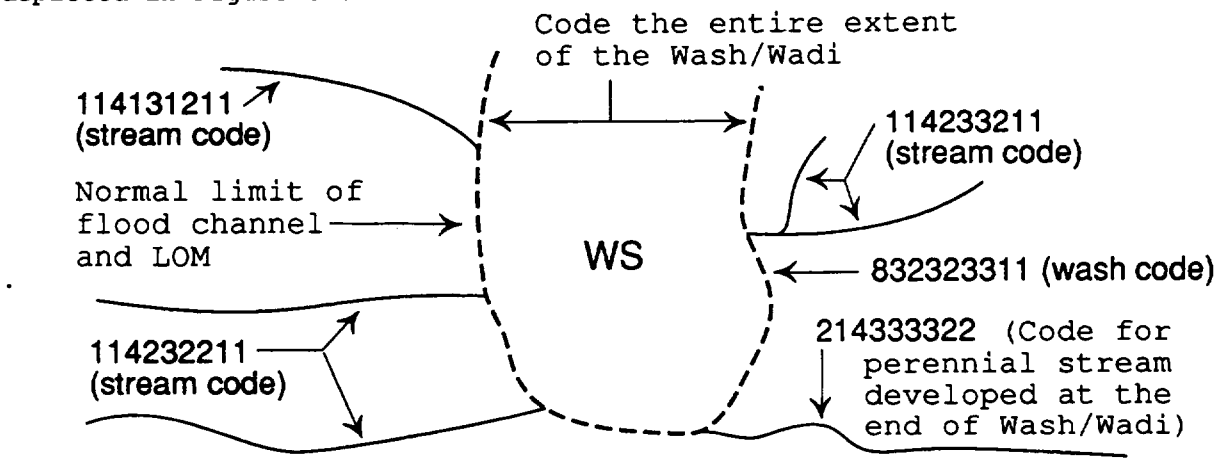


FIGURE 68. Portrayal of wash/wadi/arroyos.

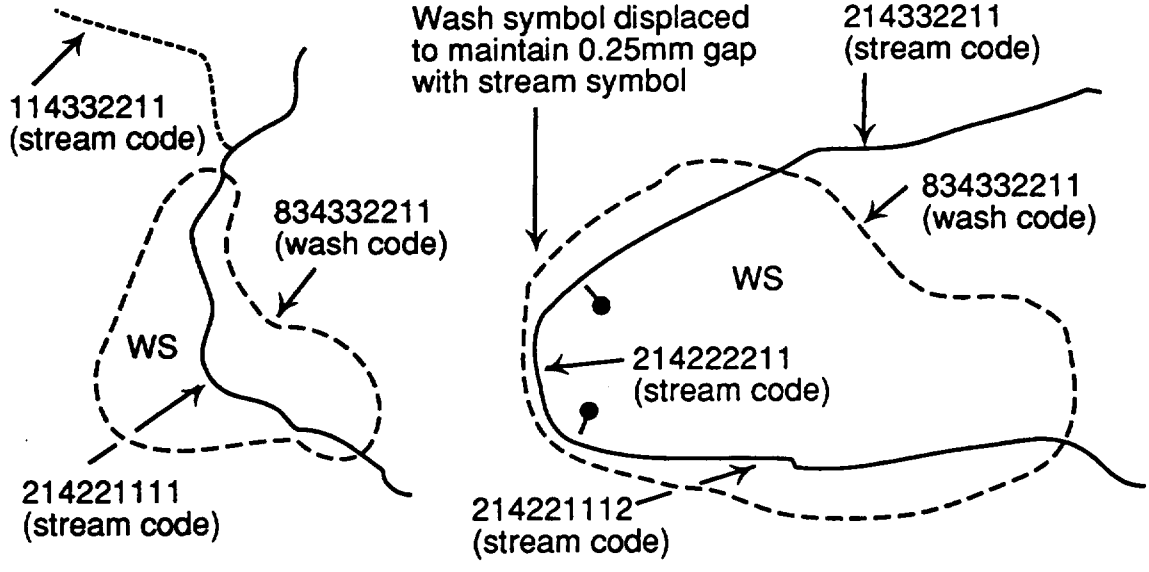
(6) Perennial streams within washes/wadis.

(a) Only permanent perennial streams within washes/wadis are shown and coded.

(b) The line representing the stream should pass through the gaps in the wash/wadi symbol (Symbol 507). Leader lines may pass through or be broken.

(c) If wash/wadi boundary and perennial stream segment are coincident, the wash/wadi symbol is displaced to the outside to leave a gap of 0.25mm between the symbols.

(d) Examples of perennial streams in wash/wadi areas are shown in Figure 69.



a. Stream does not touch side of wash/wadi.

b. Stream touches side of wash/wadi.

FIGURE 69. Perennial streams in wash/wadi/arroyos.

(7) Rock outcrops within washes/wadis

(a) In some arid areas, permanent rock outcrops (similar to islands) occur within washes/wadis. Figure 70 is an example of the portrayal of these features.

(b) Washes/wadis with rock outcrops (islands) should be treated similarly as anastomosing streams. They are to be coded across their entire outside extent, as though the outcrops (islands) were not there. The rock outcrops (islands) inside the areal extent of the washes/wadis will be outlined and the capital letters "WS" placed in the wash/wadi.

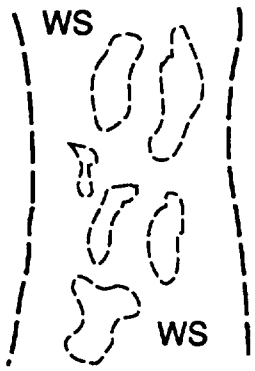


FIGURE 70. Rock outcrops within wash/wadi/arroyos.

d. **Enmeshing Channels** (Symbol 508).

(1) The large area of enmeshing channels is used when individual drainage features can not be coded separately. An area of enmeshing channels is generally an area of considerable size, wider than 20mm (5000m ground distance) where the interlacing channels of one or more washes/wadis/arroyos fan out over a large area in a pattern of tangled intertwining channels. The whole area is subject to flash flooding either during the local rainy season or after regional precipitation in the upland portions of the watershed. See Figure 71.

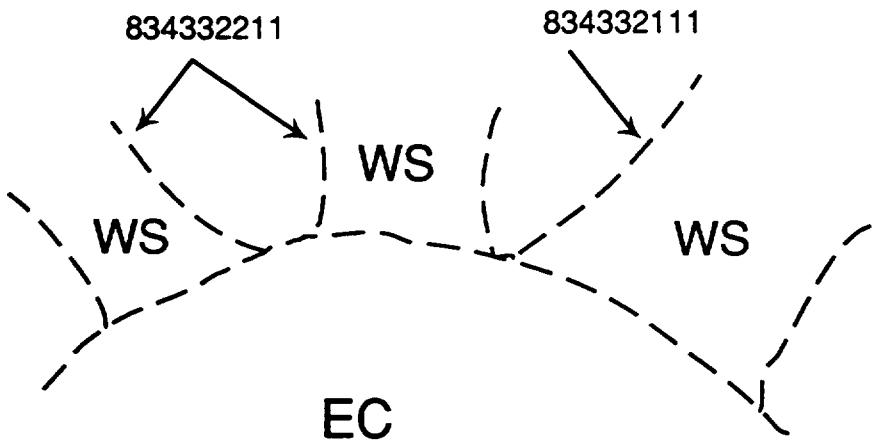


FIGURE 71. Wash/wadi converging into a large enmeshing channel.

(2) The area of enmeshing channels will not be coded except with the capitol letters "EC" inside the area delineated with an oversized dashed line (Symbol 508).

(3) Permanent perennial streams and rock outcrops within areas of enmeshing channels will be treated in the same way as they are in washes/wadis/arroyos. See Appendix I, 30.2.3c.(7).

(4) If the boundaries of an enmeshing channel area are formed by steep sided cliffs (over 5m in height) they will also be depicted on the Obstacles Overlay as escarpments.

e. **Elevated aqueducts** (Symbols 518 and 519). Artificial bridge-like structure used for carrying an elevated stream, canal, ditch, or water supply conduit (aqueduct) over another stream, canal, transportation feature, depression, or valley.

(1) On the Surface Drainage Overlay, bridge-like aqueducts will be shown only if they occur along open drainage features already described in that section. Most of these will be located along large navigable streams and canals.

(2) If less than or equal to 2mm (500m ground distance) long, the aqueduct will be treated as a point feature.

(3) If greater than 2mm (500m ground distance) long, the aqueduct will be shown to scale. Point of change symbols will be used to indicate where the elevated section of the waterway begins and ends.

(4) Elevated aqueducts are not coded with the standard nine-digit surface drainage code. They will be depicted using the capital letters "EA" (Elevated Aqueduct) (Symbol 518), with an aqueduct information holder symbol (Symbol 519) indicating in order the overall length, waterway width, and waterway depth. (See Figure 72).

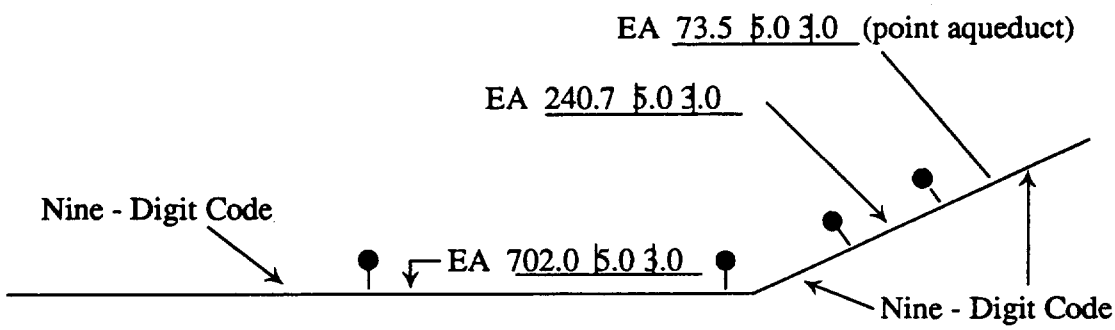


FIGURE 72. Coding elevated aqueducts.

f. **Tidal Flats** (Symbol 509).

(1) A tidal flat is a flat or nearly flat, barren or slightly marshy area. It is generally of considerable size, being formed through deposition caused by the alternate rise and fall of the tide and consists mostly of unconsolidated silts, clays and/or sands. Tidal flats of silts and clays are usually wet and do not make a good surface for military vehicle movement, however, at low tide, the sandy tidal flats, depending on their soil moisture content, might make an excellent surface for military vehicle movement, before the next high tide.

(2) Tidal flats will be coded with the capital letters "TF" and an oversized dashed line (Symbol 509) delineating the area.

g. **Weirs** (Symbol 515).

(1) Weir - A small artificial barrier across a stream used to raise the water level or to divert its flow into a desired channel. Normally the water

will either overflow the barrier or flow through a notch designed to regulate and/ or measure the stream discharge or water flow. All weirs are depicted with a weir symbol (Symbol 515).

(2) Where a road or railroad bridge crosses over a Sluice Gate (Figure 73), the sluice gate will be shown as a weir on the Surface Drainage Overlay (Symbol 515), while the road bridge will be picked up on the Transportation Overlay.

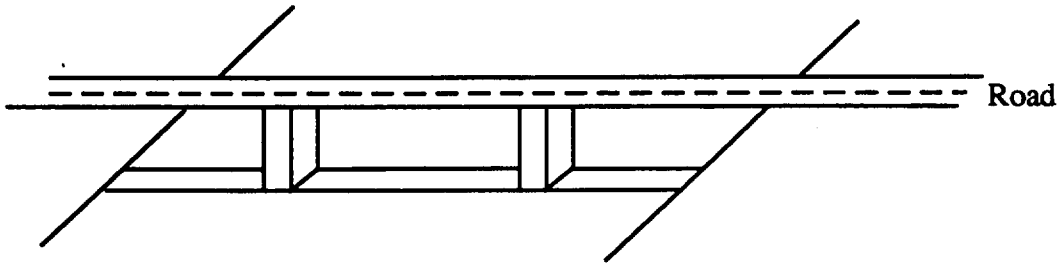


FIGURE 73. Road crossing over a weir (sluice gate).

h. **Flood barrages** (Symbols 525 & 526).

(1) Flood barrage - An opening dam across a channel which, when required, is closed to control flood waters, typically to protect upstream areas from flooding due to storm surges. Normally the flood barrage is open to allow shipping to pass through or over it. Theoretically, they can be raised during periods of low water (such as during extremely low tides or droughts) in order to maintain higher water levels in upstream drainage ways or canals of low or flat land areas (peneplain like areas) than would exist downstream. Thus, flood barrages are usually found in tidal or low land areas subject to high tide variations and severe storms, such as the coastal areas in and around the North Sea.

b. Flood barrages are mapped with (1) a flood barrage symbol (Symbol 525) which uses dashed lines to indicate their normal open position, and (2) a flood barrage information holder (Symbol 526) which names the feature and annotates its length, width, and depth, if known (See Figure 74).

(1) Length - The overall length of the feature is the distance between the extreme end points of the structure at the end walls/dams on the abutments. For multiple gate flood barrages this will include all associated barrage gates and intermediate supports along with the width of the abutments.

(2) Width - The smallest distance between the sides or gates of the structure (width of ships which may pass through - if a series of gates, only the largest designated as part of the shipping channel is given)

(3) Depth - Hydrographic depth to bottom of channel or top of drop gate is given, if known.

c. Flood barrages less than 2mm (500 m ground distnce) long are considered point features and mapped with a minimum size symbol; those equal to or greater than 2mm (500m ground distance) long are considered linear features. Each flood barrage symbol shall have at least one full open space in its dashed line.

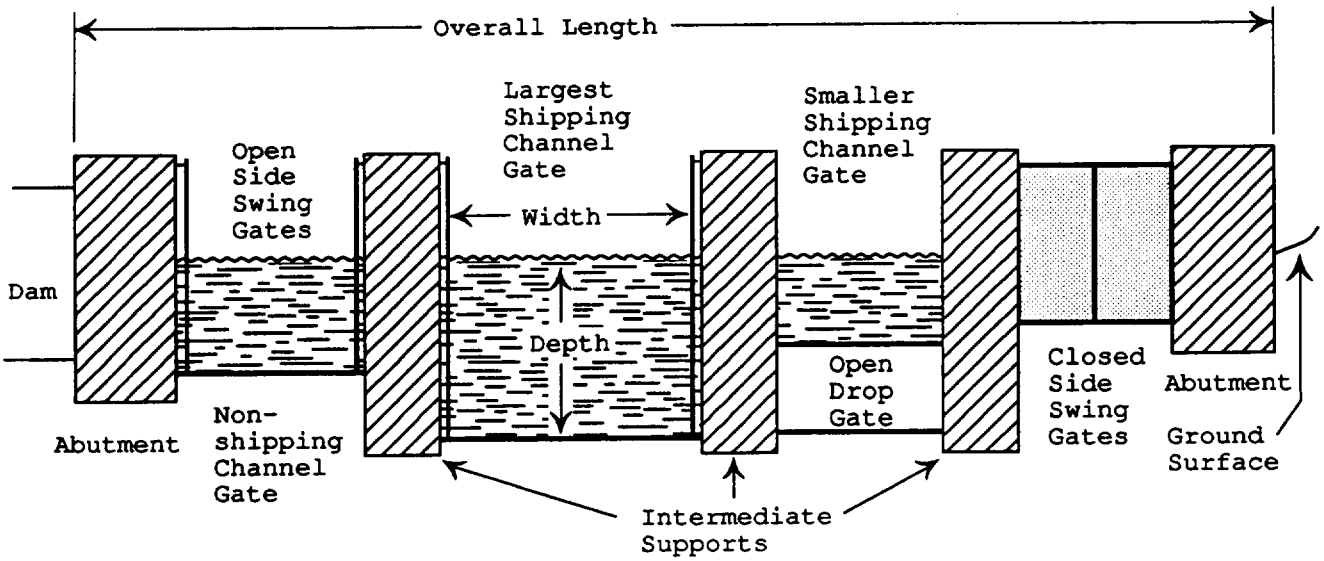


FIGURE 74. Flood barrage, channel cross-section view.

i. **Salt evaporators** (Symbol 522).

(1) Shallow pools in coastal areas or adjacent to saline inland bodies of water used for the collection of salt by the periodic flooding and natural evaporation of the briny water.

(2) Salt evaporators shall be coded with the capital letters "SE" and an oversized dashed line (Symbol 522) delineating the area.

j. **Sabkhas** (also sebkha or sabkhah) (Symbol 523).

(1) Flat (< 0.05%) plains, with wet to moist subsoils and smooth to puffy salt-encrusted surfaces, which occur in sandy or clayey soil filled natural depressions in inland deserts and adjacent to coastal waters in arid and semiarid areas. Their unique characteristics derive from a high water table which lies only 1 to 2 meters below the surface. This soil moisture is periodically recharged by local or upstream precipitation, sheet flooding, or tidal action. After a heavy inundation, area may resemble a shallow lake with water temporarily covering the salt crust. Through continuous evaporation and capillary action, the near surface materials remain wet (with marshy to quicksand like characteristics) to moist and the water concentrates into a saline brine which causes the salt-encrustation at the surface. Wet sabkhas often have salt tolerant, marshy type, halophytic plants growing up through the crust. In areas of wind blown dunes, salt surface may be covered with a thin layer of sand. Except for an occasional preexisting well compacted roadbed, sabkhas are best avoided during cross-country movement. Should the salt crust break during movement over such an area, vehicles and or foot troops are liable to become mired in the muck beneath the salt encrusted surface.

(2) Sabkhas shall be coded with the capital letters "SK" and a normal sized line (Symbol 523) delineating the area.

k. **Features Under Construction** (Symbol 103)

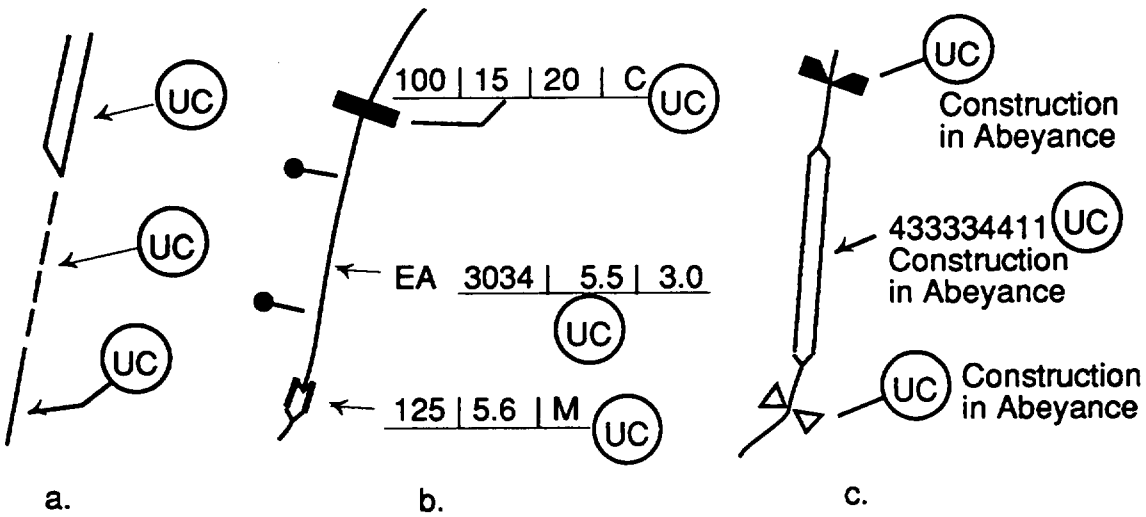
(1) Features designated as under construction are those where construction is actually underway. The under construction symbol is used to indicate which point, linear, or areal feature or segment is being built or rebuilt. Point of change symbols (Symbol 102) are used to show the extent or length of linear or areal features under construction.

(2) The under construction symbol can be used in a number of ways:

(a) All unknown features which are under construction along a stream, canal, ditch, or other drainage way are symbolized with a circled "UC" and leader line pointing to the center of the point, linear segment, or areal feature. See Figure 75.a. Unknown (neither identified or classified) linear segments will be shown with the stream, canal, etc., gap less than or equal to 18 meters symbol (Symbol 503). Unknown areal segments and features will be shown with the stream, canal, etc., gap width greater than 142 meters symbol (Symbol 505).

(b) All under construction features which can be identified and classified will utilize their proper symbol with a circled "UC" being applied to the right of the feature symbol or data information holder. See Figure 75.b.

(c) If construction was started, but now has been indefinitely suspended, the words "Construction in Abeyance" will be added to the right of the circled "UC" symbol. See Figure 75.c.



a. Use of "UC" symbol for unclassified features under construction.
b. Use of "UC" symbol for classified features under construction.
c. Use of "UC" symbol for suspended construction of features.

FIGURE 75. Use of under construction symbol.

1. **Representative Pattern Area** (Symbol 520).

(1) This is a fourth method of portraying drainage in cartographically crowded areas where the sheer density and extent of the features prevents the coding of small segments.

(2) A representative pattern area may be used in these situations where the Surface Drainage features are cross spaced less than 10mm (5000m ground distance) apart or parallel spaced less than 5mm (1250m ground distance) apart over an areal extent of at least 40 square millimeters (2,500,000 square meters ground area) with a minimum width greater than or equal to 2mm (500m ground distance). These areas should also be covered by surface roughness numbers, descriptors, and factors on the Surface Materials Overlay.

(3) When Surface Drainage features are spaced greater than 5mm (1250 meters ground distance) apart, without numerous, closely spaced, or moderately spaced traverse drainage features, all drainage features will be delineated and coded.

(4) If much wider than the other drains to be included in the representative pattern area, the primary drains running through the area shall be individually delineated and coded.

(5) When a representative pattern area is used to portray or code the situation, a dashed line around the area with a short descriptive note will be shown on the thematic overlay (Symbol 520). The descriptive note will cite the type of drainage being represented, the range of code values being represented, and other pertinent information (such as the spacing between canals or ditches), as illustrated in Figure 76.

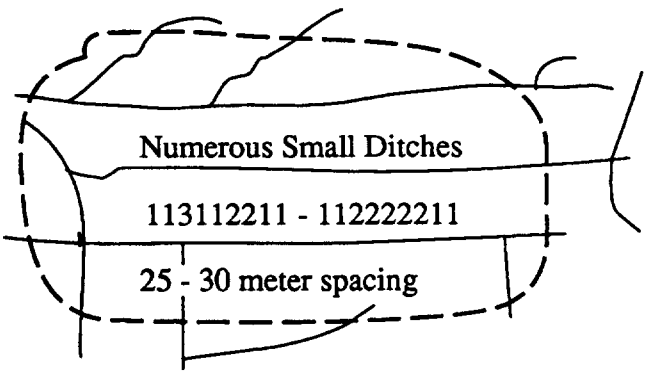


FIGURE 76. Use of representative pattern area with descriptive note in an area of dense drainage ditches.

(6) Some of the possible representative pattern area descriptors and their conditions for stream, canal, ditch, or (whatever the feature) spacings are:

(a) Moderately spaced: greater than 5 - 10mm (1250 - 2500 m ground distance (gd)) apart.
(b) Closely spaced: 2 - 5mm (500 - 1250m gd) apart.
(c) Numerous: less than 2mm (500m gd) apart.

(7) Some of the possible representative pattern area descriptors and their conditions for stream, canal, ditch, or (whatever the feature) width sizess are:

(a) Small: less than 18 meters (ground distance) wide.
(b) Medium: 18 - 142 meters gd wide.
(c) Large: greater than 142 meters gd wide.

m. Use full range of standard bottom materials categories (3rd digit, stream format code):

Bottom Material		Third Digit Code
a.	Clay and Silt	1
b.	Silty Sand	2
c.	Sand and Gravel	3
d.	Gravel and Cobble	4
e.	Rocks and Boulders	5
f.	Bedrock	6
g.	Paved	7
h.	Peat and/or highly organic material	8

k. Use full range of standard dam construction material categories:

Dam Information Holder Code	Construction Material
C	Concrete
E	Earthen
R	Stone (Rock) and Earth
W	Wood
O	Other

l. Lock construction material - The lock information holder is extended to include a letter "C" compartment, which is used to show the construction materials of locks in the following categories:

Lock Information Holder Code	Construction Material
C	Concrete
M	Masonry (Stone/Brick)
R	Stone (Rock) and Earth
S	Steel
W	Wood
O	Other

30.2.5 Transportation features.

a. **Trails** (Symbol 605) - A natural traveled way not wide enough to accommodate wheeled or track vehicles (less than or equal to 1.8 meters wide). Trails are generally created by the historical passage of animals or humans over a natural travel way. By their nature, trails are liable to shift alignment on a seasonal and/or yearly basis.

(1) Trails intersecting with higher road classifications do not affect road segments, individual road segments are not formed.

(2) Road widths are not given for trails; however, a note next to the trail symbol in the legend will give the average trail width for the project area.

b. **Restricted (Narrower) Passage** (Symbol 608)

(1) Any point along a road segment where the road width narrows by 2.5 meters ground distance (approximately one lane) or more from the rest of the road, but is still greater than or equal to 4 meters wide, is considered to be a restricted (narrower) passage. This may occur at any point along a road segment.

(a) If the restricted passage is less than 2mm (500m ground distance) in length, it is depicted with the triangles of the associated restricted passage symbol (Symbol 608) opposing each other.

(b) If the restricted passage is between 2mm (500m ground distance) and less than 10mm (2500m ground distance), it is depicted with the triangles of the restricted passage symbol (Symbol 608) offset to the beginning and end of the section from each other.

(2) Width measurement is indicated (preferred) adjacent to the lower right side of lowest triangle and parallel to the tangent of the southern neatline

(3) Restricted passages are not shown on tracks or trails.

c. **Abandoned railroad** (Symbol 619) - An abandoned railroad is a track system which is no longer in use but whose tracks and bridges are still in place. The word "Abandoned" is placed above and parallel to the original track symbol.

d. **Canals/Inland Waterways** (Symbol 624)

(1) On the Transportation Overlay(s) the depiction of canals is limited to navigable inland waterways less than or equal to 0.64mm (160m ground distance) wide, which are defined as any stretch of a natural watercourse or maintained canal or channelized stream available to and used by commercial water craft. Canals or inland waterways greater than 0.64mm (160m ground distance) are treated as common open water areas and are not shown on this thematic overlay(s).

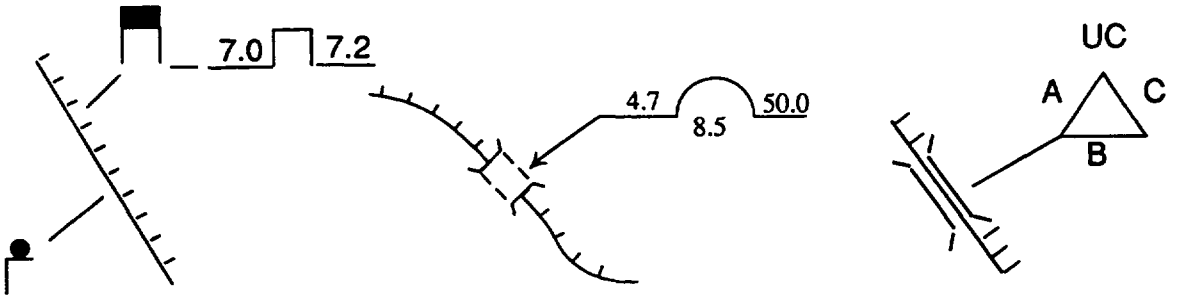
(2) All facilities must be wide enough and deep enough to allow the passage of boats and/or ships over its entire length. Thus, these can be country specific depending on the size and draft of the boats and barges using them. These canals form a linkage of man-made waterways, streams, and open water areas over

which personnel and goods can be moved by boat or ship between built-up areas, transportation transfer points, military facilities, and between seas and oceans.

(3) A navigable canal should have a minimum length of at least 20mm (5000m ground distance) before it is shown on the Transportation Overlay. The mainline of the canal symbol (Symbol 624) will be shown following the centerline of its associated drainage feature, unless sources give a more precise channel location.

(4) As the channel characteristics (nine-digit code) and some of the support facilities (i.e., locks and dams) are fully covered on the Surface Drainage Overlay, they do not need to be duplicated on the Transportation Overlay. However, in order to maintain the integrity of the bridging relationship, where these canals or navigable waterways are carried over other canals, roads, railroads, or other obstacles by bridge-like aqueducts, the latter will be shown on the Transportation Overlay using the regular bridge symbol (Symbol 626) and canal bridge information holder (Symbol 629).

(5) Associated transportation features, such as dropgates and tunnels, use the same depiction rules for canals as for roads and railroads. Figure 77 illustrates the use of some these features along canals.



a. Dropgates b. Tunnel c. Bridge Under Construction In Congested Area

FIGURE 77. Associated features along canals.

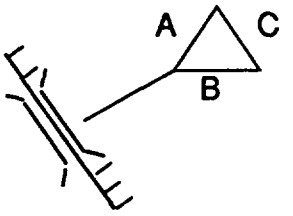
e. **Canal Bridges** (Symbol 626) - All bridges use same symbol.

(1) **Canal (Aqueduct) Bridge Information Holder** (Symbol 629). The symbol indicating the attribute placement for Overhead Clearance, Overall Bridge Length, and Waterway Width is illustrated in Figure 78.

(a) For canal bridges, the normal height of the water surface is defined as the transport surface for measuring overhead clearance. The value corresponds to "A" in the Canal Bridge Information Holder - add to Transportation Legend (See Appendix I, 30.4.5a.(5)(b)).

(b) For canal bridges the overall bridge length is the length of the bridge's water surface supporting material with end plates between the points of intersection with the abutments. The value corresponds to "B" in the Canal Bridge Information Holder section of the Transportation Legend (30.4.5a(5)(b)).

(c) Waterway Width - The traveled way width of a canal bridge is measured horizontally at the normal height of water surface and perpendicular to the bridge length centerline from the inside of one wall to the inside of the other wall. The value corresponds to "C" in the Transportation Legend (Canal Bridge Information Holder), see Appendix I, 30.4.5a(5)(b).



A. Overhead Clearance
B. Overall Bridge Length
C. Waterway Width

FIGURE 78. Attribute placement in canal bridge information holder.

f. Viaducts and/or **Elevated Roads, Railroads, and Canals** (Symbol 625).

(1) Viaducts and/or elevated roads, railroads, and canals are bridge-like structures consisting of a long series of usually short, evenly spaced, bridge spans which lift the route over water, congested portions of urban areas or carry it over areas otherwise unsuitable for placement on the ground, such as tidal marshes, steeply sloping deep valleys, areas subject to flooding, areas which would otherwise require extensive engineering effort and subbase preparation, or other obstructions. Support abutments or piers may range in height above the ground and carry the route in a generally horizontal position. The main construction materials are concrete, masonry blocks, or steel.

(2) Only the arch (open and closed spandrel), beam, girder, and slab bridge types, over 20mm (5000m ground distance), crossing mainly land features or acting as causeways will be considered for treatment as elevated transportation routes. All others are considered regular bridges.

(3) Extended elevated transportation routes will often change bridge types or span lengths where they cross over a stream (river) or transportation feature. At these points, the changed span or spans will be shown as a regular bridge abutting the elevated structure at both ends. If a bridge is not shown where another transportation route passes under an elevated structure, an overhead obstruction symbol (Symbol 637, Appendix I, 30.2.5h.) and a gap of 0.5mm (0.02in) on each side of the elevated structure symbol will be used on the underpassing transportation feature. See Figure 79.

(4) Elevated roads, railroads, and canals shall be depicted as linear features.

(5) The elevated road (ER), elevated railroad (ERR) or elevated canal (EC) identification letters (Symbol 625) should be centered between the point of change symbols (Symbol 102) which indicate the beginning and end of the elevated structure at non-intersection points and placed parallel with the transportation route. If space does not allow for adjacent labeling of the elevated structure, leader lines will be used to point from the label to the location of the particular feature and will be placed horizontal to the southern neatline.

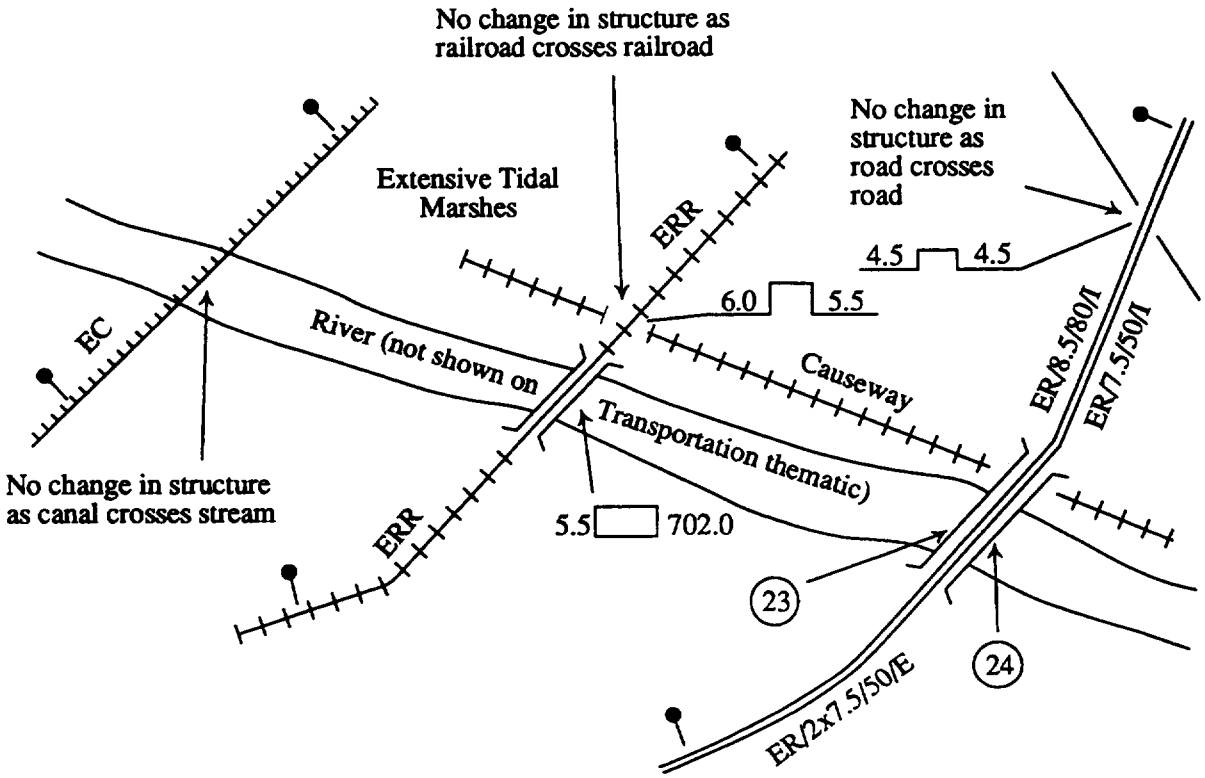


FIGURE 79. Elevated transportation routes.

(6) For elevated roads, an elevated road information holder (Symbol 639) is also used. Thus the complete label not only includes the structure identification letters, but also the roadway width, Military Load Classification, and bypass condition as illustrated in Figure 80.

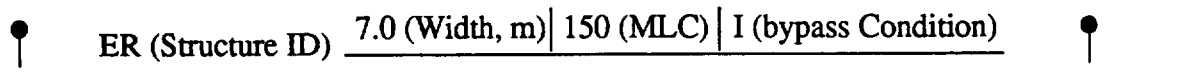


FIGURE 80. Elevated road structure identification.

(7) In most cases, the military load classification (MLC) for elevated roads will be identical for the entire structure. If the MLC varies along the elevated road structure, the minimum MLC of any section is used for classifying the entire structure.

g. **Culverts** (Symbol 630).

(1) A culvert is defined as a transverse drainage structure which serves as a water conduit permitting a stream, canal or ditch to pass under a road, railroad, or canal. This conduit may be constructed of metal and/or concrete and may be circular, semicircular or rectangular in cross-section. The culvert inlet barrel may project from the roadway fill or it may be mitered to the embankment slope. Culvert inlets sometimes have wingwalls, apron slabs, or headwalls. Two types of culverts, as shown in Figure 81 and Figure 82, have been portrayed on the Transportation Overlay(s).

(2) Earth Back-filled Culverts

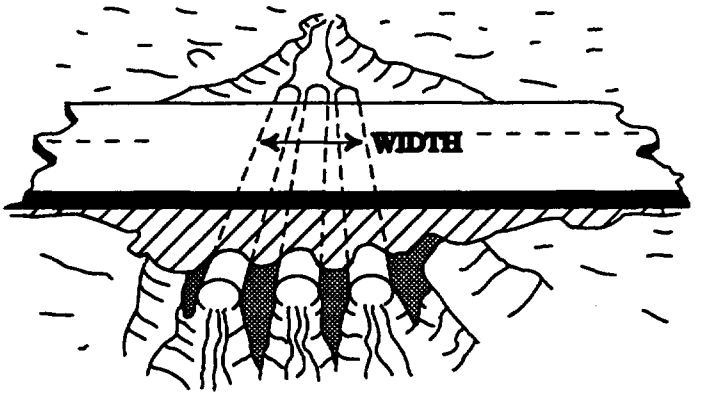
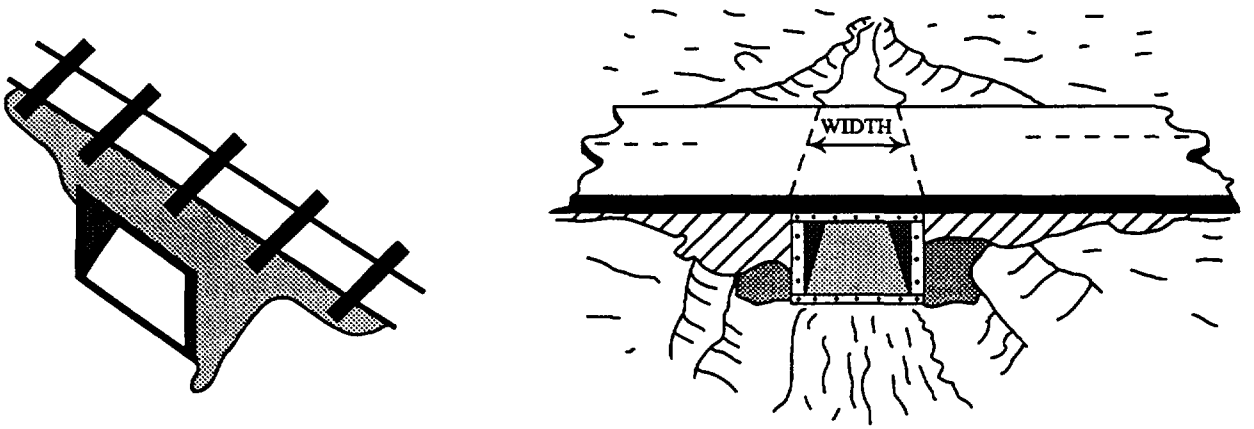


FIGURE 81. Earth back-filled culvert.

(a) Earth back-filled culverts are composed of one or more conduits (concrete pipe, oval concrete pipe, corrugated metal pipe, etc.) that are covered with compacted soil. These culverts are usually associated with soil overburden existing between the culvert structure and the road or railroad traveled way. With this structure the soil is the load-bearing material. The width of this structure can be of any dimension, no structure width limitations are imposed.

(b) Earth back-filled culverts (concrete pipe, oval concrete pipe, corrugated metal pipe, arch pipe, etc.) less than 2.5 meters wide are not classified or mapped. Culverts 2.5 meters or greater are classified and identified with the letter "c" (Symbol 630).

(3) Box Culvert:



a. Earth Back-Filled b. Load Bearing

FIGURE 82. Box culverts.

(a) Box culverts are composed of one or more conduits with a square or rectangular cross section. Normally box culverts are constructed of concrete or concrete with reinforced metal. This structure may or may not be

associated with soil back-filling. If not back-filled, the top member of this structure normally serves as the transport support surface or base and is the primary load-bearing member.

(b) Box culverts less than 2.5 meters in width are not classified or mapped. Box culverts with width's 2.5 meters to 5 meters are classified and tagged as culverts using the letter "c" (Symbol 630). Box culverts with no overburden and greater than 5 meters in width are classified and treated on the Transportation Overlay(s) as bridges. Box culverts having overburden and width's greater than 5 meters: **will not** be classified as bridges but will be identified and tagged as culverts using the letter "c" (Symbol 630).

h. **Snowsheds/Rocksheds/Galleries** (Symbols 633 and 634).

(1) Snowsheds, rocksheds, and galleries are structures built along transportation routes, (roads, railroads, and canals) for the purpose of preventing blockage by snowslides and/or rockslides respectively. Often the roof adjoins the side of a cliff or cut and steeply slopes over the transportation route to divert snow or rock slides to lower elevations on the other side. These structures are usually found in mountainous areas and are generally built of wood. Often they will have the downhill side open for light and ventilation of exhaust gasses.

(2) All snowsheds, rocksheds, and galleries along the portrayed transportation network that can be identified on the imagery or derived from current collateral sources shall be included on the thematic overlay(s). Those less than 2mm (500m ground distance) in length will be treated as point features and depicted with a minimum size snowshed/rockshed/gallery symbol (Symbol 633); whereas those greater than or equal to 2mm (500m ground distance) in length will be treated as linear features and plotted "to scale" in length (and width, if needed).

(3) No distinction is made for the type of transportation route passing through a snowshed, rockshed, or gallery. The data displayed in the snowshed/rockshed/gallery information holder (Symbol 634) is the same for three of these features. All associated attributes measured from the imagery will be shown to the nearest half meter (0.5m). If available, more precise measurements from field check (on-the-ground) data or collateral sources will be shown instead.

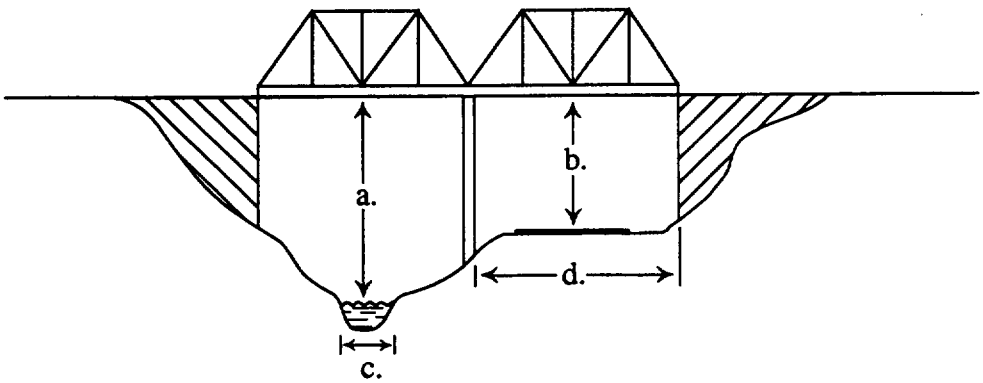
(4) The characteristics covered in the snowshed/rockshed/gallery information holders are symbolized as shown in Appendix I, 30.3.4, and if shown should be added to the Transportation Legend, Appendix D, 30.6, after the tunnel data section, as Snowshed/Rockshed/Gallery Data. They are assigned attribute measurement values or codes for the same items as tunnels (See 3.12.10.2): (1) Height or overhead clearance, (2) Width or horizontal clearance, and (3) Length.

(5) The snowshed/rockshed/gallery symbol suppresses the transportation route symbols where they are coincident, the transportation feature going through the snowshed/rockshed/gallery is not shown, even though the data base holds them for feature continuity.

i. **Overhead Obstructions** (Symbol 637).

(1) An overhead obstruction is any height and/or horizontal obstacle through or under which a depicted road, railroad, or canal passes which is not already shown or attributed on the Transportation Overlay(s). Examples of places

where overhead obstructions occur are where transportation features pass through town walls, towers, gate houses or archways in older urban areas; under walkways, water supply aqueducts or low overhead pipelines; under bridges where the underbridge clearance (given in the BIT) is to the lower stream level rather than the higher level transport surface (see Figure 83); under elevated transportation features and other such man-made or even natural obstructions and obstacles part of which overhangs the feature of interest and is of sufficient strength to constitute a height barrier if hit by underpassing vehicles. They are sometimes referred to as underpasses or mini-tunnels. Note that where the representative pattern bridges itself and there is more than a one meter difference between the underbridge clearance and the overhead clearance, two symbols will be needed, one for the bridge and one for the overhead obstruction.



a. Under Bridge Clearance.
b. Overhead Clearance for road.
c. Horizontal Clearance for stream.
d. Horizontal Clearance for road.

FIGURE 83. Measuring clearances under overhead obstructions.

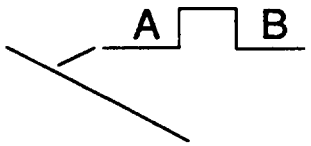
(2) All overhead obstructions are considered to be point features, less than 2mm (500m ground distance) in overhead length above the affected transportation feature. If the overhead obstruction is greater than or equal to 2mm (500m ground distance) in length above the transportation feature of interest, it will be considered and treated as a tunnel. An example of the latter would be a railroad passing under a large building for a distance greater than 2mm (100m ground distance).

(3) All overhead obstructions along the portrayed transportation network that can be identified on the imagery or derived from current collateral or field check data shall be included on the thematic overlay(s). The associated attributes measured from imagery will be shown in the overhead obstruction information holders to the nearest half meter (0.5m). If available, more precise measurements from field check (on-the ground) measurements or collateral sources will be shown instead.

(4) There is no independent symbol for overhead obstructions, instead a leader line from the overhead obstruction information holder (Symbol 637) points to the location of the obstruction along the affected transportation feature. The attributes covered in the overhead obstruction information holders are depicted and symbolized in accordance with the Transportation Legend, General Transportation Features, and the Transportation Symbols, Appendix I.

(5) Overhead obstructions are assigned attribute measurement values or codes for (1) Horizontal clearance or width of opening and (2) Overhead clearance or height of opening.

(a) Horizontal clearance or width of opening - Horizontal clearance or width of opening is the minimum usable width of the opening through the obstruction measured above the transport surface horizontally from the inner side of one wall, guardrail, raised walkway, or abutment to the other. The measurement is made perpendicular to the transportation feature's length centerline as it passes under the obstruction. The letter "R" following a horizontal clearance measurement (side to side width is known) or by itself (side to side width is not known) indicates the obstruction has a width constriction such as a guardrail or raised walkway an unknown distance from the sidewalls. For transportation features passing under bridges this is usually the horizontal distance from the inside of one abutment to the other. The horizontal clearance value corresponds to "A" in the Transportation Legend (General Transportation Features, see Figure 84).



A. Horizontal Clearance

B. Overhead Clearance

FIGURE 84. Attribute placement in overhead obstruction information holder.

(b) Overhead clearance or height of opening - Overhead clearance or height of opening is the minimum usable height of the opening through the obstruction between the top of the transport surface and the highest part of the obstruction ceiling. The letter "R" following a height measurement (ceiling height is known) or by itself (ceiling height is not known) indicates the obstruction is known to have a height constriction such as lights or railroad electrification lines of an unknown distance below the ceiling. The overhead clearance value corresponds to "B" in the Transportation Legend (General Transportation Features, see Figure 84).

(c) Overhead dropgates are in effect a special form of overhead obstructions. Therefore, if both dropgates and overhead obstructions are being used, the overhead dropgate symbol shall be shown with an overhead obstruction information holder (Symbol 637). See Figure 85 for example uses along various types of transportation routes.

k. Additional Bridge Attributes:

(1) Railroad and canal bridge numbers - the assignment of railroad and canal bridge numbers provides an absolute unique identification for each bridge, regardless of type, along the portrayed transportation network. Whereas, especially in cartographically crowded areas, coordinate identification and/or location within the nearest 1000 meter UTM grid square might yield several bridges of the same or varying types. Also, in areas where a complete analysis of the transportation capabilities of the railroads and/or canals is required and, **as directed by supplementary project instructions**, these bridges can then be ident-

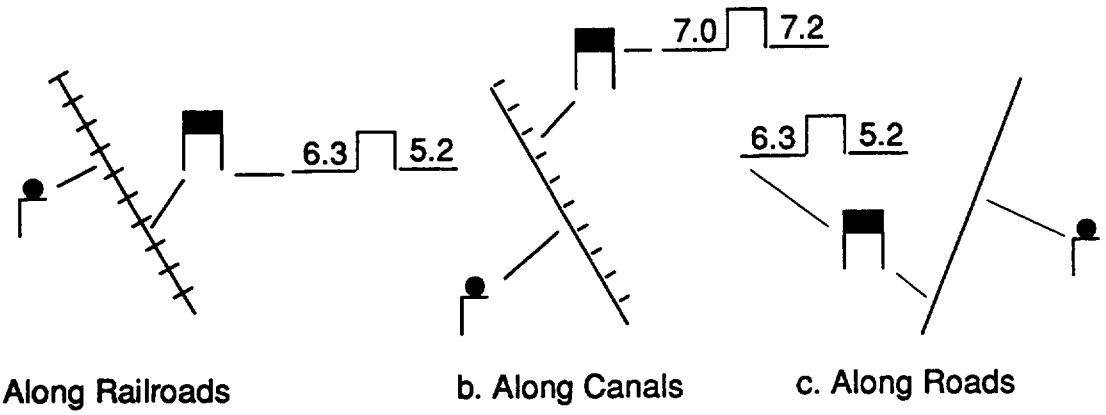


FIGURE 85. Depiction of dropgates.

ified with just their bridge numbers (like road bridges) inside their respective information holder symbols and their partial or complete attribute data entered into the Bridge Information Table.

(a) Railroad bridge numbers are assigned in the same way as road bridge numbers and begin their numbering, (1) at least 20 numbers higher than the last road bridge number, or (2) at 20, if there are no road bridges.

(b) Canal bridge numbers are also assigned in the same way and begin their numbering, (1) at least 20 numbers higher than the last railroad bridge number, or (2) 20 higher than last road bridge number, if there are no railroad bridges, or (3) at 20, if there are no railroad or road bridges.

(c) These bridge numbers will be placed inside their respective symbols. In the regular setup these numbers will constitute the letter "C" under Railroad Bridge Information Holders and the letter "D" under Canal Bridge Information Holders as shown in Figure 86.

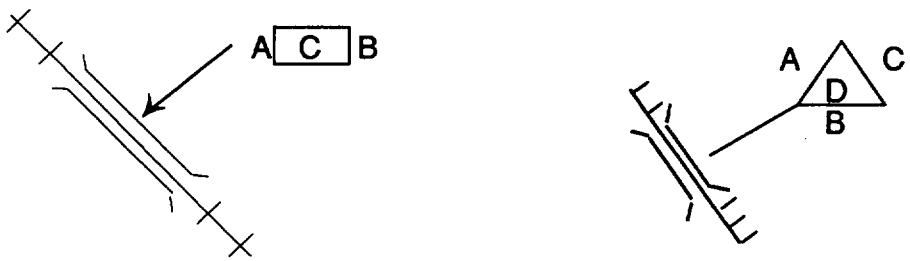


FIGURE 86. Railroad and canal bridge numbers.

(d) In the modified setup, the bridge numbers will constitute the letter "A" inside their respective symbols for all three types of bridge information holders. In this case, the BIT can contain either the reduced set of attributes normally shown in the railroad and canal bridge information holders or additional data as required for a more complete analysis of the capabilities of the whole transportation network.

(2) If there is an obstruction of unknown height on a bridge, the letter (R) for restricted clearance shall be used in the overhead obstruction position of the appropriate bridge type information holder.

(3) If the MLC is not known, but a civilian load classification is available, the latter will be shown in the BIT within parentheses.

(4) Horizontal clearance (HZC)

(a) The horizontal clearance is the overall usable width of a bridge measured 30cm (approximately 12 inches) above the traveled way surface. It is a measure of the width of a load which may be moved across or through a bridge.

(b) For road bridges, this measurement may be identical to the roadway width measurement if no other usable space is available on the bridge surface. However, this measurement would be different if the usable portion of the bridge included not only roadway width but also bridge pullovers, parking areas, curbs, and/or bridge shoulders.

(c) If there is no truss, girder, guardrail, or other obstruction to prevent the load from extending past the edges of the bridge the letter (U) for unlimited clearance is used. If there is an obstruction of unknown width, the letter (R) for restricted clearance is used.

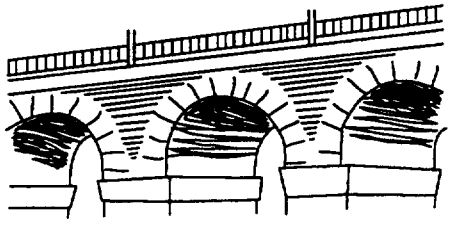
(5) Bridge design category (BDC) (formerly bridge architectural type (BAT)) - The bridge design or architectural type is an indication of the size, shape, and construction of the structure, as well as an indication to possible restrictions on the size of the loads which may be moved over the bridge. The basic eleven types of bridges recognized and their code letters are listed below: (See Figure 87.)

(a) Arch, Closed Spandrel (A)
(b) Arch, Open Spandrel (O)
(c) Beam (B)
(d) Cable Stayed (C)
(e) Cantilever (V)
(f) Floating (F)
(g) Girder (G)
(h) Slab (S)
(i) Suspension (P)
(j) Truss (T)
(k) Other (X)

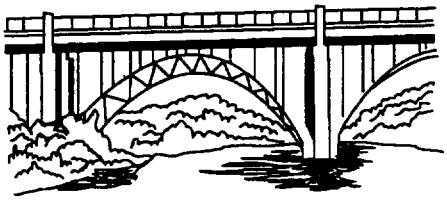
(6) Bridge opening type (BOT) (formerly bridge movement (BMT)) - The bridge opening or movement type indicates the mobility characteristics of the bridge structure. (See Figure 88.) The types of movement and their code letters are listed below:

(a) Bascule (drawbridge) (B)
(b) Fixed (F)
(c) Lift (vertical) (T)
(d) Retractile (semipermanent, engineer moveable) (R)
(e) Swing (S)
(f) Other (X)

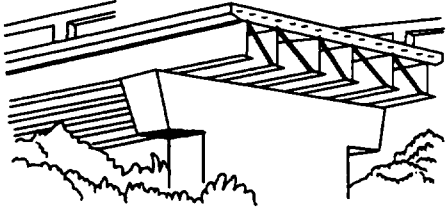
(a) ARCH (Closed Spandrel)



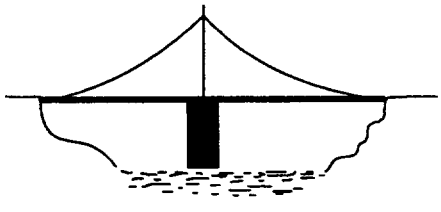
(b) ARCH (Open Spandrel)



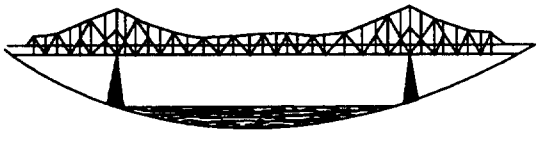
(c) BEAM



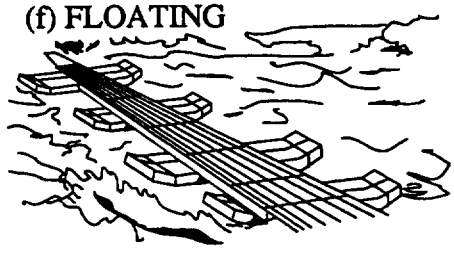
(d) CABLE STAYED



(e) CANTILEVER

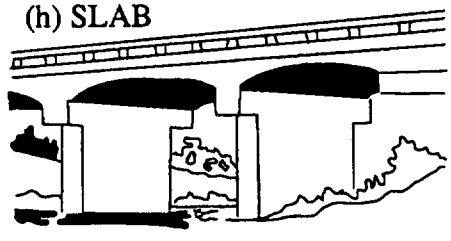


(f) FLOATING

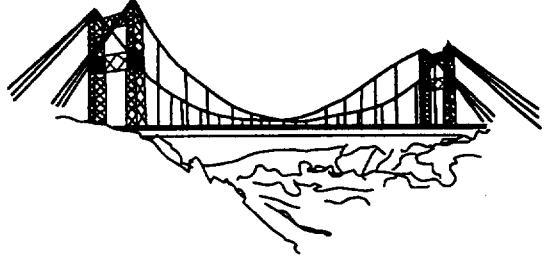


(g) GIRDER

(h) SLAB



(i) SUSPENSION



(j) TRUSS

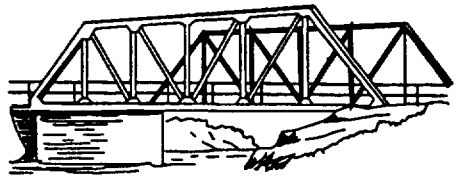


FIGURE 87. Examples of bridge structures.

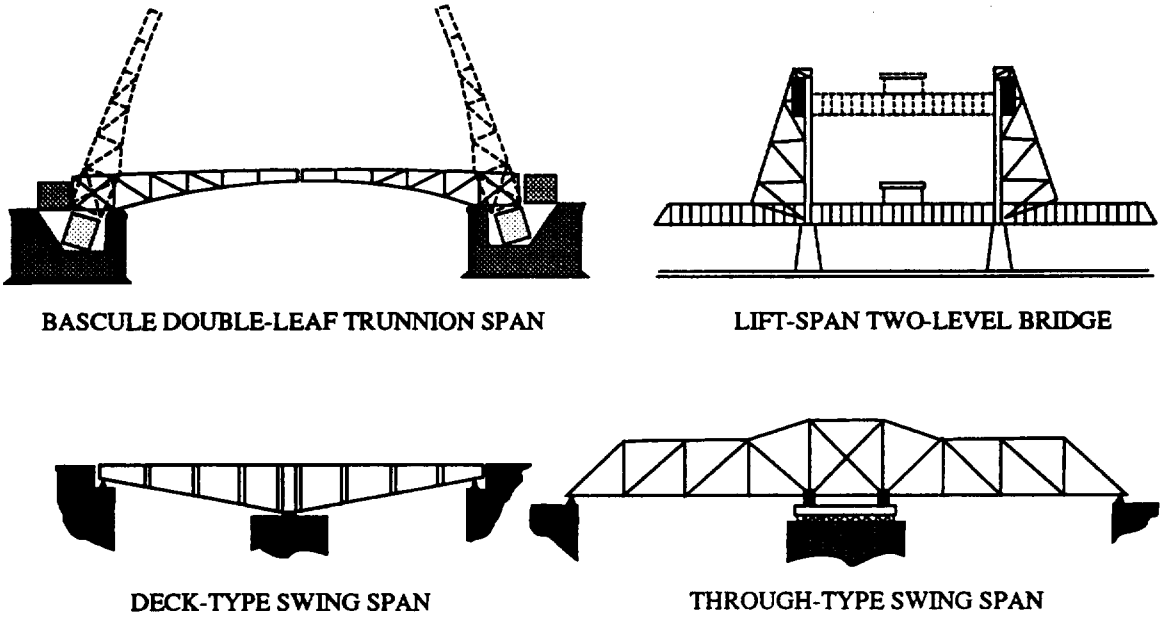


FIGURE 88. Examples of movable bridges.

k. Additional Runway Non-operational Status Labels:

(1) "Damaged" - facilities and runway(s) partially ruined by military or natural forces, lengthy repairs necessary before field can be made operational.

(2) "Dismantled" - facilities and runway(s) taken apart.

(3) "Destroyed" - facilities and runway(s) totally ruined by military or natural forces.

l. Additional Feature Underconstruction label - If construction was started, but now has been indefinitely suspended, the words, "Construction in abeyance" will be added to the right of the circled "UC" symbol. (See Figure 89).

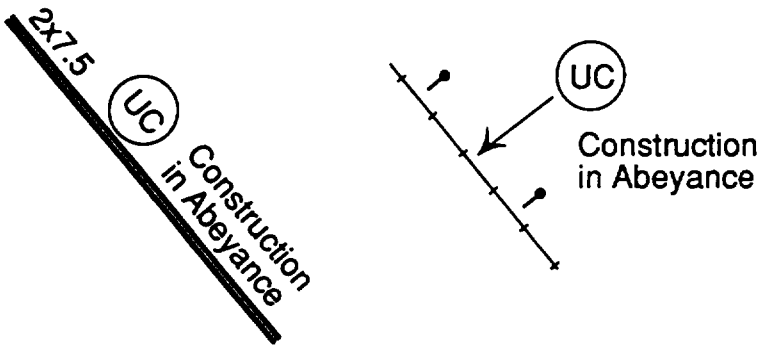


FIGURE 89. Use of construction in abeyance with the under construction symbol for transportation features.

30.2.6 Obstacle features.

a. Fence/Wall - A long horizontal ground barrier which hinders or prevents ground movement by foot troops and/or vehicles. Some of the most common include:

(1) **Fence (Wire or Wood)** (Symbol 702) - A long line of relatively light structural material, such as chain linked, permanent concertina, or loosely strung barbed wire or wooden slats, high enough to hinder or block passage by vehicles or foot troops.

(2) **Retaining Wall** (Symbol 703) - A barrier of wood, steel, stones, boulders, concrete, or masonry which restrains the lateral pressure of the material behind it, usually soil or earth fill, from sliding. This category includes seawalls.

(3) **Masonry Wall** (Symbol 703) - A long line of relatively heavy material, such as stones, boulders or masonry, either loosely piled or cemented together and high enough (1.5m) to block passage by vehicles. This category includes breakwaters.

b. **Hedgerow** (Symbol 704) - A long row of closely spaced shrubs or a combination of shrubs and some trees enclosing or separating fields. They are used to mark field boundaries and to provide wind erosion protection. Depicted hedgerows are high enough (1.5m) and thick enough to block passage by vehicles or foot troops. Shrubs and trees may be growing on or around an earthen or stone foundation which adds to the obstacle effect.

c. **Shelterbelt/Windbreak** (Symbol 705) - A long row or multiple rows of tall bushes or trees used as a natural snow fence to protect transportation features and/or agricultural areas from drifting snow and/or wind erosion - not a common treed fence line. The vegetation is so closely spaced that it prevents vehicles from leaving the roads or passing between them.

d. **Moat** (Symbol 707) - A long, wide, man-made ditch with steep masonry or earthen sides used to protect a built-up area or military strong point. The moat may be dry or contain water.

e. **On-Ground Aqueducts** (Symbol 718) - Open or covered, man-made conduits for carrying large quantities of flowing water for either domestic or industrial water supply purposes which rest directly on the ground. They may be constructed of brick, stone, concrete, or have natural earth sides. For military ground movement they act as walls with an open or closed trench-like opening lengthwise down the middle. See Figure 90.

f. **Above Ground or Elevated Structures** (Symbol 719)

(1) Structures, such as elevated aqueducts, railroad trestles, low bridges, etc., which are characterized by height and/or width clearances between supports that prohibit military vehicles from passing beneath or through them. In some structures the normal definition of the height and width clearances would permit passage under the structure, but the supporting members arrangement will still block passage. If this is the case, the structure shall be shown as an above ground obstacle, see Figure 91. Collateral source and/or field checking are essential for obtaining reliable under-structure information.

a. Open (Trench-like). b. Closed (Solid Wall-like).

FIGURE 90. On-ground aqueducts.

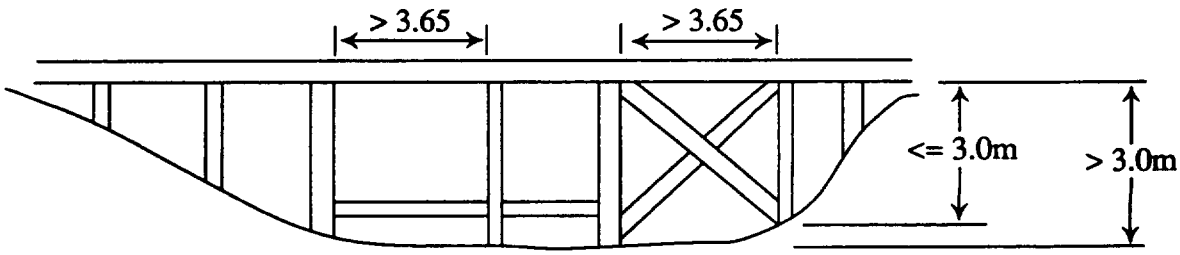


FIGURE 91. Above ground obstacle where supporting structure blocks movement.

(2) For above ground obstacles (e.g., aqueducts, aerial pipelines, railroad trestles, etc.) to be shown, the height and width clearances must be such that the Main Battle Tank (M-1 Abrams) could not pass under or between the supports. Height clearance must be equal to or less than 3.0 meters and the width clearance must be equal to or less than 3.65 meters.

g. **Wooded Gully** Symbol 721) - A narrow (<2mm map or 500m ground distance width), steep sided (>60 percent slopes), heavily vegetated (>75% canopy closure), dry gully or ditch. Its effect on cross-country movement is like that of a combination moat and shelterbelt; hence, its symbol is a mixture of their two symbols.

h. **Anti-Tank Ditch** (Symbol 713) - A man-made "V" shaped trench dug for the purpose of imposing an obstacle to armored vehicle cross-country movement in otherwise favorable areas. Their obstacle value is that they are too wide (>2.77m for the M-1 Abrams Tank) for armored vehicles to self bridge and that the angle of the "V" is less than the vehicle approach angle needed to climb out, if they did enter. They are generally found in open, broad, unbroken, expanses of plain, prairie, or steppe areas where they substitute for a sparse pattern of natural drains, but can be found anywhere, even across narrow mountain valleys.

i. **Impact Areas** (Symbol 714) - Mostly artillery target practice areas where there is a high probability of unexploded ordnance. If possible, movement through these areas is normally avoided.

j. **Minefield** (Symbol 715) - An area planted with explosive devices or charges in order to prevent movement through it. Only those areas known to be permanently mined will be shown.

30.2.7 Urban areas.

a. The term "urban area" covers everything from open spaced jungle or desert villages with mud or grass huts to the most built-up areas with high rise dwelling and office buildings.

b. Urban areas are shown on the combined Obstacles-Urban Areas thematic with the use of the general areal feature symbol (Symbol 103) and an Urban Areas information holder symbol (Symbol 722), which contains the alphanumeric codes for predominant land use, settlement pattern, and predominant urban area height. As with open water, two categories of urban areas are recognized, but not differentiated from each other on the Obstacles-Urban Areas Overlay.

a. **Common urban areas** (Symbol 103, labeled as per 30.2.7c. below).

(1) Common urban areas are defined as built-up places where the roads, area paving, and buildings cover approximately 30% or more of the available land area. Urban areas with less than 30% built-up ground cover (such as suburban residential areas) will still allow cross-country movement and will be considered non-common urban areas.

(2) Built-up areas are normally symbolized by using straight lines. However, it is acceptable to outline built-up areas with curved lines, if the boundary follows the edge of some rounded feature, such as open water, a river, a railroad, a canal, or town wall.

(3) The common urban areas on this overlay are common to and will also be depicted on the Surface Materials (Soils) and Vegetation Overlays. This allows the common urban areas to be depicted with identical outlines (line for line) on all three overlays.

b. **Other (non-common) urban areas** (Symbol 103, labeled as per 30.2.7c. below).

(1) Non-common urban areas are defined as built-up places where the roads, area paving, and buildings cover approximately 5% to 30% of the available land area. The buildings are in close enough proximity to be considered a common unit, for example: an open village settlement, industrial park, rural prison, open college campus, or a scattered processing facility of several buildings within a common boundary.

(2) In rural areas with scattered residential dwellings and farm buildings, at least several buildings with some evidence of commonality (walkways, trails, common well, etc.) between several families must be clumped closely together in order to be considered an urban area. Individual or two family farms or homesteads are not to be considered in this category.

c. Classification and Coding of Urban Areas

(1) Within all urban areas on the thematic overlay, the following categories and attributes will be classified and coded. To be considered predominant, the man-made structures, paved areas, and transportation network must support 60% or more of the category being classified and coded.

(2) Predominant Land Use - Human use of urban or built-up land areas is divided into nine categories:

(a) **Residential** (Code R) - The majority of the area and its supporting features are devoted to the living accommodations (dwelling units) of human beings. These range from small single family huts to large high-rise apartment or condominium buildings. The area may be interspersed with small shopping centers, churches, schools and small fire, police, telecommunication and power stations, etc.

(b) **Recreational** (Code S) - Large sports complexes and other areas which are devoted to athletic events or recreational activities. An example is a fairground or a stadium area and their surrounding parking lots. Note that parks and other open space areas, even within built-up areas, which meet the minimum size specifications, will be shown and coded on the other overlays and will not be depicted on this thematic.

(c) **Institutional** (Code G) - Areas and complexes used for governmental, educational, religious, penal, research, care of the aged, and other administrative purposes. Note that medical facilities and hospitals are treated as a separate category.

(d) **Military** (Code A) - The cantonment or built-up areas of an armed forces base containing structures and facilities for the quartering and training of troops, base defense, depots, vehicle parks, and repair facilities that are exclusively military. This does not include the open space, maneuver areas and other non-built-up areas on a military base.

(e) **Transportation and Utilities** (Code T) - Large blocks of land used for transportation, utility and storage of bulk goods. For example: large public utility areas (water and sewage treatment plants, major power generation stations, etc.), large terminals, trans-shipment points, storage and repair facilities associated with the movement of goods and personnel by road, railroad, canal, airway, or pipeline. The linear segments of transportation features both within and without urban areas, even if parallel to each other, are not included on this thematic overlay.

(f) **Commercial** (Code C) - A concentrated area of retail and wholesale establishments, financial institutions, office buildings, hotels, garages, public buildings and other structures and facilities used primarily for the sale and exchange of goods and services.

(g) **Industrial** (Code I) - An area of individual plants and buildings with associated grounds, limited storage areas, and transportation facilities that are engaged in manufacturing activities. For example: these include heavy industries such as metal processing plants, rolling mills,

fabrication yards, pulp and lumber mills, oil refineries, shipyards, etc. and light industries engaged in such activities as the design, assembly, finishing, processing, and packaging of products.

(h) **Mixed Urban** (Code U) - Urban area where no single use category predominates. These will generally be a mixture of residential and commercial uses, although any combination is possible.

(i) **Medical Facilities/Medical Complexes** (Code M) - An area of a large hospital complex or medical research institution with its associated structures and facilities used for the care and treatment of patients or biological research.

(j) **Unknown** (Code X) - Urban area for which neither a predominant use nor a mixture of uses can be determined from the source material.

(3) Settlement Pattern (Based on street pattern) - The urban area settlement pattern is defined as the modal or most frequently occurring geometric configuration (pattern) of streets found in a specified urban space or classified polygonal unit. Patterns of urban streets are to be classified and coded into twelve categories:

(a) **Regular, Rectangular** (Code RR) - Streets form an intersecting grid pattern of approximately regularly spaced lines at right angles to each other.

(b) **Irregular, Rectangular** (Code IR) - Same as above, except all the streets are not continuous. This causes blocky irregularities in the pattern. This is often done to form small urban parks, or to discourage through traffic in a residential neighborhood.

(c) **Regular, Radial** (Code RD) - The streets tend to radiate out from a central point in a somewhat evenly spaced pattern in all directions like the spokes on a wheel. Side streets connecting to the radials tend to be unevenly spaced and to connect only a couple of the radials instead of going completely around.

(d) **Irregular, Radial** (Code ID) - Same as above, except radial spokes are unevenly spaced.

(e) **Regular, Concentric** (Code RC) - The main street pattern is a series of some what evenly spaced, increasingly large circles around a central point. Side streets connecting to the circles tend to be unevenly spaced and to connect only a couple of the circles instead of radiating out continuously from the center.

(f) **Regular Canals** (Code RL) - The main thoroughfare areas are a series of regularly spaced canals, similar to the regular rectangular street pattern.

(g) **Irregular Canals** (Code IL) - Same as above, except canals are unevenly spaced and arranged in relation to each other.

(h) **Contour Conforming or Regular Contouring** (Code CC) - The majority of the somewhat evenly spaced streets follow the contour of the land staying near the same elevation most of the way. Usually found in urban areas on steep slopes where a few steep and sharply twisting side streets connect the paralleling contour streets.

(i) **Irregular, Contouring** (Code IC) - Same as above except the contour following streets are unevenly or widely spaced from each other.

(j) **Irregular, Medieval or Preindustrial** (Code IM) - These areas are usually found in the center of older urban areas where streets expanded in irregular patterns from the center (usually a church or fortress) as the town grew.

(k) **Curvilinear (cluster) or Irregular Modern** (Code CM) - An area where the streets follow a planned pattern of curves and irregularities designed to discourage through traffic and insure increased privacy. Usually only found in residential neighborhoods.

(l) **Linear (strip)** (code LS)- Urban area has one main street and perhaps a short paralleling side street or it stretches out in both directions along two main intersecting roads (in outline looks like a cross). This type of pattern is also sometimes referred to as strip development and is common on the edge of expanding urban areas or in rural areas where the main thoroughfare or intersecting roads are the only ones paved or otherwise improved.

(m) **Mixed** (Code MX) - The street pattern is a combination of two or more of the above patterns; none of which alone adequately describes the pattern.

(4) Predominant Urban Area Heights

(a) The predominant height of an urban area is defined as the modal or most frequently occurring height of the tallest buildings covering 10% or more of the land area in a specified urban area; i.e., the majority height of the tallest buildings covering at least 10% of the designated zone.

(b) Eleven predominant height classes (in meters) are coded:

Height Range	Map Unit Code
<= 10	01
> 10 - 20	02
> 20 - 30	03
> 30 - 40	04
> 40 - 50	05
> 50 - 60	06
> 60 - 70	07
> 70 - 80	08
> 80 - 90	09
> 90 - 100	10
> 100	11

d. The minimum size polygon shown for an Urban Area areal feature shall have an extent of at least 80 square millimeters (5,000,000 square meters ground area) with a minimum width greater than or equal to 2mm (500 meters ground distance).

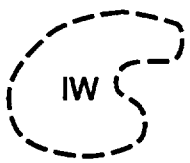
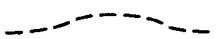
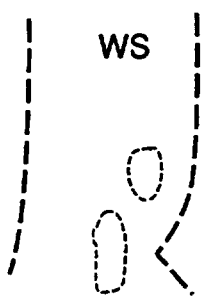
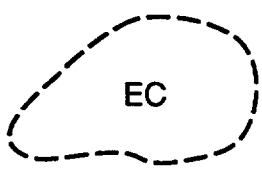
30.3 Miscellaneous feature specifications.

30.3.1 General features.

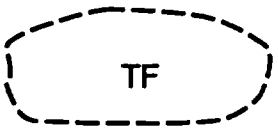
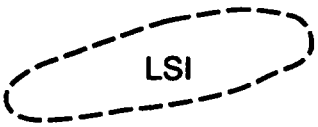
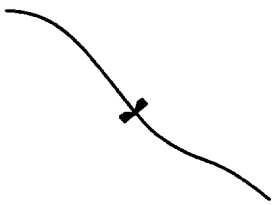
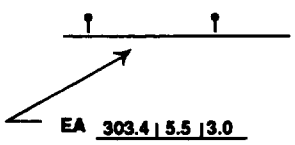
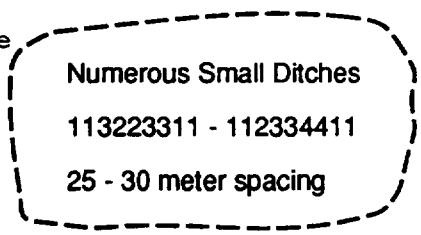
FEATURE	SYMBOL	SPECIFICATIONS	NO.
Lines for Underlining:			
Dash/Dot	.....	Lineweight: 0.30mm (.012in) Dot diameter: 0.30mm (.012in) Dash length: 1.0mm (.04in) Space: 0.5mm (.02in)	109

30.3.2 Miscellaneous vegetation and surface materials features. Miscellaneous features on these two areal thematic overlays use the same symbol (Symbol 103) as their regular polygons with only the alphanumeric codes changed.

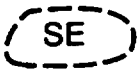
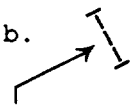
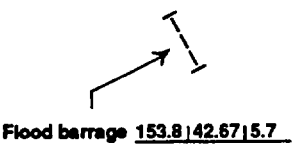
30.3.3 Surface drainage features.

FEATURE	SYMBOL	SPECIFICATIONS	NO.
Intermittent Lake		Letters "IW" in Univers Caps within dashed line. Lineweight: 0.50mm (.02in) Dash length: 3.0mm (.12in) Space: 1.0mm (.04in)	501
Stream, canal, etc. (Gap width <=18m)		Lineweight: 0.30mm (.012in) Dash: 2.0mm (.08in) Space: 1.0mm (.04in)	503
Wash/Wadi		Letters "WS" in Univers Caps within dashed line. Lineweight: 0.50mm (.02in) Dash length: 3.0mm (.12in) Space: 1.0mm (.04in) Islands: Lineweight: 0.30mm (.012in) Dash length: 1.0mm (.04in) Space: 0.50mm (.02in)	507
Area of Enmeshing Channels		Letters "EC" in Univers Caps within dashed line. Lineweight: 0.5mm (.02in) Dash length: 3.0mm (.12in) Space: 1.0mm (.04in)	508

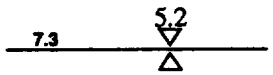
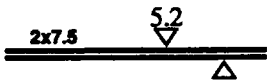
30.3.3 Surface drainage features (Continued).

FEATURE	SYMBOL	SPECIFICATIONS	NO.
Tidal Flats		Letters "TF" in Univers Caps within dashed line. Lineweight: 0.50mm (.02in) Dash length: 3.0mm (.12in) Space: 1.0mm (.04in)	509
Land Subject to Inundation		Letters "LSI" in Univers Caps within dashed line. Lineweight: 0.50mm (.02in) Dash length: 3.0mm (.12in) Space: 1.0mm (.04in)	510
Weir		Notched block across stream. Plot to scale or minimum size: 1.0mm width X 4.0mm long (.04in X .16in) Notch opening: 45° on each side from center of bottom or one side, faces upstream	515
Elevated Aqueduct (bridge-like)		Letters "EA" in 7 pt. Univers Bold Condensed Caps over solid line (bounded by Point of Change Markers, as necessary). Lineweight: 0.30mm (.012in)	518
Elevated Aqueduct Information Holder		Baseline with ticks and numbers in 7 pt. Univers Bold Cond. C/L. Lineweight: 0.30mm (.012in) Length: baseline: 18.0mm (.71in) ticks: 2.0mm (.08in) Tick spacing: 6.0mm (.24in) Leader lineweight: 0.20mm (.008in)	519
Representative Pattern Area		Letters and numbers in Univers C/L within dashed line. Lineweight: 0.50mm (.012in) Dash length: 3.0mm (.12in) Space: 1.0mm (.04in)	520

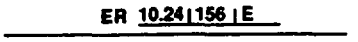
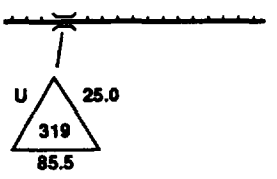
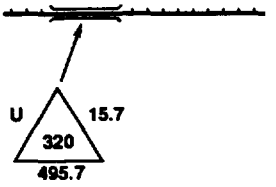
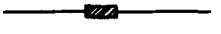
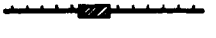
30.3.3 Surface drainage features (Continued).

FEATURE	SYMBOL	SPECIFICATIONS	NO.
Salt Evaporator		Letters "SE" in Univers 7 pt. Caps within dashed line. Lineweight: 0.50mm (.02in) Dash length: 3.0mm (.12in) Space: 1.0mm (.04in)	522
Sabkha		Polygon with letters "SK" in Univers 7 pt. Caps inside. Lineweight: 0.30mm (.012in) Area: >40 square millimeters (2,500,000 m^2 ground area) Width:>=2mm (.04in) (500m gd)	523
Flood Barrage	a.  b. 	Words "Flood barrage" and dashed line with end walls to scale or minimum size. Lineweight: 0.30mm (.012in) Dash length: For minimum size point features: 1.0mm (.04in) For linear features: 2.0mm (.08in) Space: 0.50mm (.02in) End wall length: 2.0mm (.08in) Leader lineweight: 0.20mm (.008in) Each flood barrage symbol must have at least one full space. a. Point feature <2mm (500m gd). b. Linear feature >=2mm (500m gd).	525
Flood Barrage Information Holder		Baseline with ticks and numbers in 7 pt. Univers Bold Cond C/L. Lineweight: 0.30mm (.012in) Length: baseline: 18.0mm (.71in) ticks: 2.0mm (.08in) Leader lineweight: 0.20mm (.008in)	526

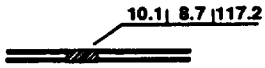
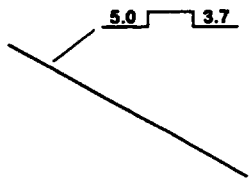
30.3.4 Transportation features.

FEATURE	SYMBOL	SPECIFICATIONS	NO.
Trail	.....	Dot diameter: 0.75mm (.030in) Dot space: 2.0mm (.08in)	605
Restricted Passage (Width in meters)	a.  b. 	Two open equilateral triangles perpendicular to road with numbers in 7 pt. Univers Bold Cond. LC. Lineweight: 0.30mm (.012in) Length of each side: 2.5mm (.10in) Spacing = lineweight of road plus 0.25mm on each side. a. Restriction <2mm (500m ground distance) in length. b. Restriction 2-10mm (500m-2,500m g.d.) in length.	608
Abandoned Railroad		Word "Abandoned" in 7 pt Univers Bold Cond. C/L. above any railroad symbol.	619
Canal/Inland Waterway		Heavy line with small ticks on one side. Mainline lineweight: 0.50mm (.02in) Tick lineweght: 0.30mm (.012in) Tick Space 2.0mm (.08in) Tick length 0.5mm (.02in)	624
Elevated Road/ Railroad/Canal	a.  b.  c. 	Letters "ER", "ERR", or "EC" in 7 pt. Univers Bold Cond. Caps, respectively above any road, railroad, or canal symbol. a. = Elevated Road b. = Elevated Railroad c. = Elevated Canal	625

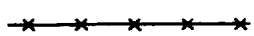
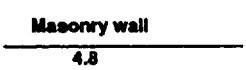
30.3.4 Transportation features (Continued).

FEATURE	SYMBOL	SPECIFICATIONS	NO.
Elevated Road Information Holder		Baseline with ticks and letters and numbers in 7 pt. Univers Bold Cond. C/L. Lineweight: 0.30mm (.012in) Length: baseline: 18.0mm (.71in) ticks: 2.0mm (.08in) Tick spacing: 6.0mm (.24in)	639
Canal Bridge Information Holder	a.  b. 	Open triangle with letters and numbers in 7 pt. Univers Bold Cond. C/L. Lineweight: 0.30mm (.012in) Length each side: 7.0mm (.28in) Leader lineweight: 0.20mm (.008in) a. Bridge length < 2mm (<500m ground distance) b. Bridge length >= 2mm (>= 500m ground distance)	629
Snowshed/Gallery	a.  b.  c.  d. 	Rectangle with parallel hash lines. Plot to scale or minimum size Lineweight: 0.30mm (.012in) Minimum width: 1.5mm (.06in) minimum length: 1.0mm (.08in) Diagonal lines: angle: 45° spacing: 0.5mm (.02in) Associated transportation symbol is suppressed inside snowshed/gallery. a. Dual lane divided highway b. Single lane highway c. Railroad d. Canal	633

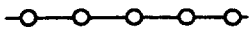
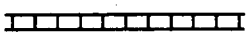
30.3.4 Transportation features (Continued).

FEATURE	SYMBOL	SPECIFICATIONS	NO.
Snowshed/Gallery Information Holder		Baseline with ticks and numbers in 7 pt. Univers Bold Cond. LC. Lineweight: 0.30mm (.012in) Length: baseline: 24.0mm (.96in) ticks: 2.0mm (.08in) Tick spacing: 6.0mm (.24in) Leader lineweight: 0.20mm (.008in)	634
Overhead Obstruction Information Holder		Jointed baseline with numbers in 7 pt. Univers Bold Cond. LC. Lineweight: 0.30mm (.012in) Horizontal lines length (each of 3):6.0mm (.24in) Vertical lines length (each of 2):2.5mm (.10in) Leader linewt: 0.20mm (.008in)	637

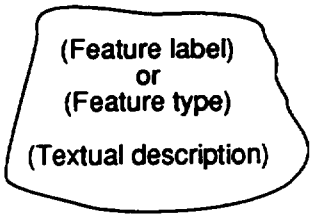
30.3.5 Obstacle features.

FEATURE	SYMBOL	SPECIFICATION	NO.
Wire/Wood Fence		Cross ticks on line. Lineweight: 0.30mm (.012in) Tick length: 2.0mm (.08in) Cross tick space: 7.0mm (.28in) Ticks meet at center of line, perpendicular to each other and at 45° angle to line. Must have at least one set of cross ticks per line.	702
Wall	a.  b. 	Words "(Type) wall" in 7 pt. Univers Bold Cond. C/L above line. Label type of wall if known. Lineweight: 0.30mm (.012in)	703

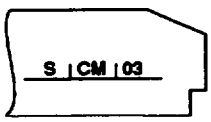
30.3.5 Obstacle features (Continued).

FEATURE	SYMBOL	SPECIFICATION	NO.
Hedgerow		Circles on line. Lineweight: 0.30mm (.012in) Circle dia.: 2.0mm (.08in) Line length between circles: 4.0mm (.16in)	704
Shelterbelt/ Windbreak		Touching circles. Circle dia.: 2.0mm (.08in) Lineweight: 0.30mm (.012in)	705
Moat		Sectioned parallel lines. Lineweight: 0.30mm (.012in) Long line spacing: 2.0mm (.08in) Short line spacing: 3.0mm (.12in)	707
Anti-Tank Ditch		Words "Tank trap" in 7 pt. Univers Bold Cond. C/L above line. Lineweight: 0.30mm (.012in)	713
Impact Area		Words " Impact area" in 7 pt Univers Bold Cond. C/L within solid outline (Symbol 104). Lineweight: 0.30mm (.012in)	714
Minefields		Word "Minefield" in 7 pt. Univers Bold Cond.C/L within solid outline (Symbol 104). Lineweight: 0.30mm (.012in)	715
On-ground Aqueduct		Word "Aqueduct" in 7 pt. Univers Bold Cond. C/L above line. Lineweight: 0.30mm (.012in)	718
Elevated Structure		Letters "ES" in 7 pt. Univers Bold Cond. Caps above line. Lineweight: 0.30mm (.012in)	719

30.3.5 Obstacle features (Continued).

FEATURE	SYMBOL	SPECIFICATION	NO.
Wooded Gully		Line of rectangles with centered circles. Lineweight: 0.30mm (.012in) Long line spacing: 2.0mm (.08in) Short line spacing: 3.0mm (.12in) Circle dia.: 2.0mm (.08in)	721
Miscellaneous Area Obstacle		Polygon (Symbol 104) with letters and numbers (if any) in Univers C/L inside. Lineweight: 0.30mm (.012in)	723
Miscellaneous Linear General Obstacle		Line with descriptive label in 7 pt. Univers Bold Cond. C/L. Lineweight: 0.30mm (.012in)	724
Miscellaneous Linear Military Obstacle		Small diamonds (squares) on line with descriptive label in 7 pt. Univers Bold Cond. C/L. Lineweight: 0.30mm (.012in) Line Length: 1.50mm (.06in) Line placement: Between corners of adjacent squares and running along feature alignment. Length of each side of squares: 1.0mm(.04in)	725

30.3.6 Urban area features. Urban areas are shown on a combined Obstacles-Urban Areas Overlay with the use of the general areal feature symbol (Symbol 103) and an Urban Areas information holder symbol (Symbol 722), which contains the alphanumeric codes for predominant land use, settlement pattern, and predominant urban area height.

FEATURE	SYMBOL	SPECIFICATION	NO.
Urban Area Information Holder		Baseline with ticks and letters and numbers in 7 pt. Univers Bold Cond. C/L within urban area outline (Symbol 103). Lineweight: 0.30mm (.012in) Length: baseline: 18.0mm (.71in) ticks: 2.0mm (.08in) Tick spacing: 6.0mm (.24in)	722

30.4 Miscellaneous feature and attribute changes to legends. If any of the miscellaneous features or attributes listed in this appendix are used on a PTADB, the various thematic legends shall be modified to accommodate the feature(s) and/or attribute(s).

30.4.1 Surface configuration legend modified:

MAP UNIT CODE	SLOPE (%)
A	0 - 3
B	3 - 10
C	10 - 15
D	15 - 20
E	20 - 30
F	30 - 45
G	45 - 60
H	60 - 85
I	>85
Y	Naturally and/or culturally dissected land (0 - >60)
W	Open Water

30.4.2 Vegetation legend modifications.

a. Vegetation legend additions:

A6	Agriculture (with scattered trees/rows of trees)
A7	Agriculture (ditch irrigation)
IN*	Swamp (Nipa)
TA	Tundra (Alpine)
TB	Tundra (Brush/Shrub)
TH	Tundra (Herbaceous)
TW	Tundra (Wet)

b. Change undergrowth attribute section to the following:

UNDERGROWTH

———————— Dense undergrowth
---------- Medium undergrowth
-.-.-.-.-.-.-.-.-.-.-.- Sparse undergrowth
..... No undergrowth

(No underline indicates presence and/or density of undergrowth is unknown)

30.4.3 Surface materials legend modifications:

a. Surface materials legend additions:

CM	Inorganic clay and silt combinations (CL-ML).
RF	Rock Field

b. Soil moisture attribute addition:

Normally frozen (permafrost) sites

30.4.4 Surface drainage legend modifications:

a. Surface drainage legend additions:

(1) Add to Drainage Channels section:

Stream, Canal/Channelized Stream/Aqueduct/
Irrigation Canal/Drainage Ditch,
Gap Width <= 18 meters

EA A | B | C

Elevated Adequate (bridge-like)
A. - Length
B. - Waterway width
C. - Waterway Depth

(2) Add to Normally Wet or Moist Areas section:

Sabkha

(3) Add the following new section to the legend:

SYMBOL	DRY/WET FLUCTUATING AREAS
IW	Intermittent Lake
LSI	Land Subject to Inundation(LSI)/Low Lying Wet Areas
EC	Area of Enmeshing Channels (Subject to Sheet Flooding)
SE	Salt Evaporator
TF	Tidal Flat
WS	Wash/Wadi
(Descriptive notes)	Representative Pattern Area

(4) Add to Artificial Drainage Features section:

Weir

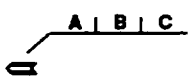
Feature Under Construction

Flood Barrage A. - Length
B. - Width
C. - Depth

b. Use the following standard dam construction material categories:

Dam Information Holder Code	Construction Material
C	Concrete
E	Earthen
R	Stone (Rock) and Earth
W	Wood
O	Other

c. Change lock section of legend to:



Lock

A. - Length
B. - Width
C. - Construction Material
C - Concrete
M - Masonry (Stone/Brick)
R - Stone (Rock) and/or Earth
S - Steel
W - Wood
O - Other

d. Additions to 1st digit (Drainage type) of the Surface Drainage Coding Table:

Stream (Anastomosing)	7
Wash/Wadi/Arroyo	8

e. Change codes of 2nd digit (Military gap width) of the Surface Drainage Coding Table to the following, in order to reflect more precise range of gap widths:

No Data	0
<= 18	1
> 18 - 50	2
> 50 - 100	3
>100 - 142	4
>142 - 300	5
>300 - 500	6

(Continued on next page)

> 500 - 750	7
> 750 - 1000	8
> 1000	9

f. Use full range of codes for 3rd digit (Bottom materials) of the Surface Drainage Coding Table:

No Data	0
Clay and Silt	1
Silty Sands	2
Sand and Gravel	3
Gravel and Cobble	4
Rocks and Boulders	5
Bedrock	6
Paved	7
Peat and/or highly organic material	8

30.4.5 Transportation legend modifications:

a. Transportation legend additions:

(1) General Transportation Features section:

Overhead Obstruction Information Holder
A. = Horizontal Clearance (meters)
B. = Overhead Clearance (meters)

(2) Roads section:

Trail (average width is 2.5-3.0 meters*)

Restricted Passage (narrower than rest of road)
A. = Width (meters)

Elevated Road
A. = Width (meters)
B. = Military Load Classification
C. = Bridge Bypass Conditions
(See road bridges)

Culvert

*Example only tailor for each project area

(3) Railroads section:

Abandoned

Elevated Railroad

(4) New canals section:

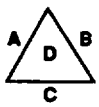
SYMBOL	CANALS (NAVIGABLE)	12pt. Caps
	Canal (Inland Waterway)	10pt. C/l
EC	Elevated canal (waterway)	

(5) Bridge data section:

(a) Addition to Railroad Bridge Information Holder:

C. - Bridge Number
(If applicable, see Bridge Information Table)

(b) New canal bridge information holder segment:



Canal Bridge Information Holder
A. - Overhead Clearance (meters)
U = Unlimited
R = Restricted
B. - Overall Bridge Length (meters)
C. - Waterway Width (meters)
D. - Bridge Number
(If applicable, see Bridge Information Table)

(6) New snowshed section:

SYMBOL	SNOWSHED, ROCKSHED, AND GALLERY DATA	12pt.Caps
	Snowshed, Rockshed, or Gallery	
		10pt. C/l
A | B | C | D	Snowshed/Rockshed/Gallery Information Holder	

A. - Shed type:
G = Gallery
R = Rockshed
S = Snowshed
B. - Overhead clearance (meters)
C. - Width (meters)
D. - Length (meters)

b. Transportation attribute changes

(1) Add bridge numbers for railroad and/or canal bridges to the BIT.

(2) Add horizontal clearance (HCA), bridge design category (BDC), and bridge opening type (BOT) columns to the BIT.

(3) Add HCA, BDC, BOT, and RBC acronyms to BIT marginal data (see 3.11.6.8, notes).

BDC = Bridge Design Category
BOT = Bridge Opening Type
HCA = Horizontal Clearance

(4) Add BDC and BOT codes to BIT marginal data (see 3.11.6.8, Codes).

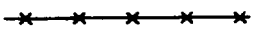
BDC Codes: A = Arch, Closed Spandrel, O = Arch, Open Spandrel, B = beam, C = cable staged, V = cantilever, F = floating, G = girder, S = slab, P = suspension, T = truss, X = other.

BOT Codes: B = bascule (drawbridge), F = fixed, C = lift (vertical), R = retractile, S = swing, X = other.

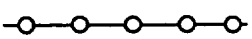
c. Add columns for the HCA, Overall Structure Length, BDC, BOT, and RBC attributes to the BIT as shown in the modified columnar headers style sheet (for comparison see Appendix A, BIT style sheet, section D) on the next page.

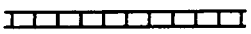
30.4.6 Obstacle legend modifications:

a. Obstacle legend additions:


Fence

Wall, types:
(a) Retaining
(b) Masonry
(c) Steel
(d) Wood
(e) Other - label as to type
(f) Unknown


Hedgerow


Moat

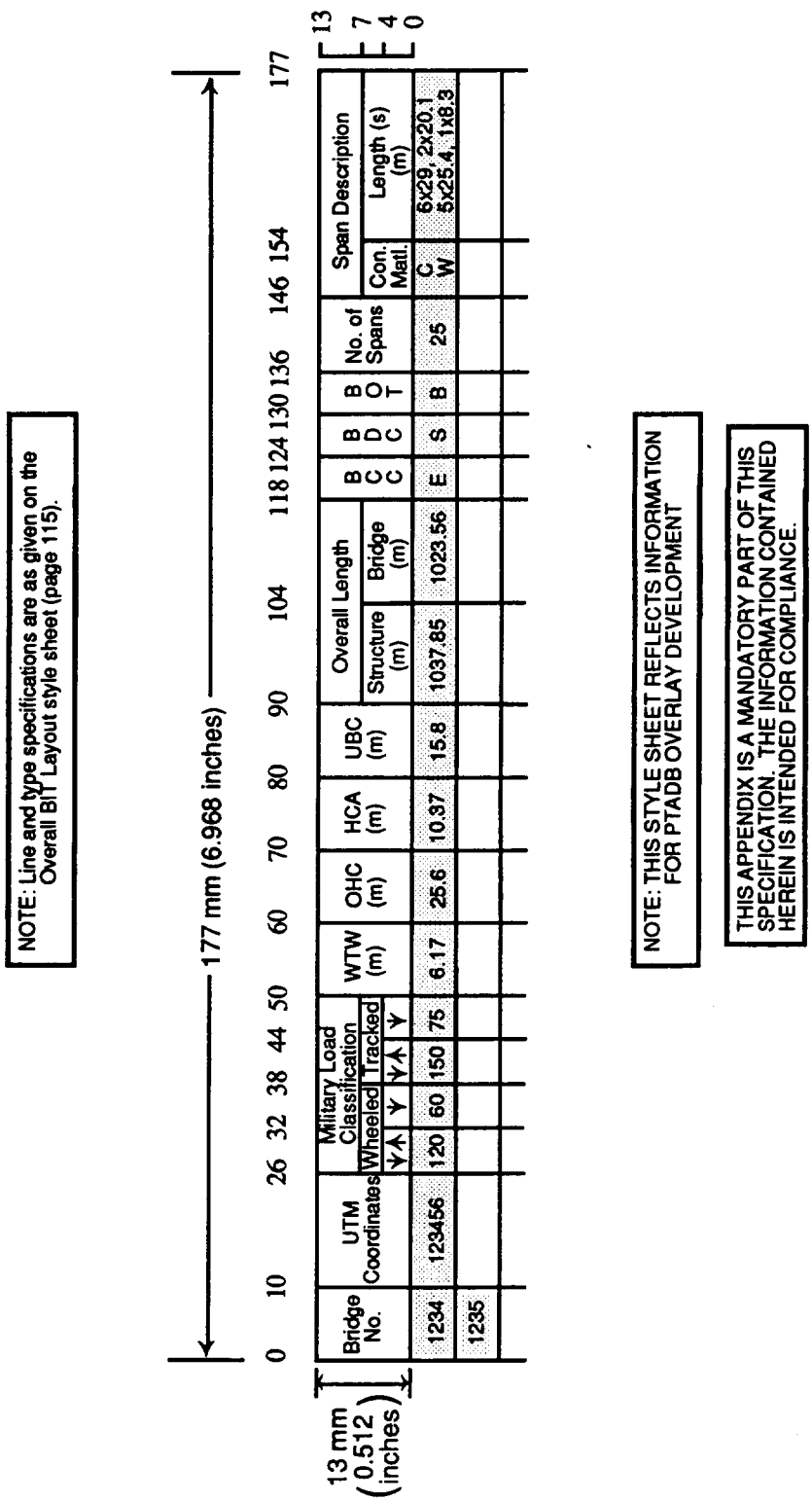

Shelterbelt/Windbreak

On-Ground Aqueduct (wall like)

Elevated Structure (Low enough to prevent the MBT from passing under)

MODIFIED PLANNING TERRAIN ANALYSIS DATA BASE
BRIDGE INFORMATION TABLE STYLE SHEET

D. COLUMNAR HEADERS. Individual column widths, header heights, and header labels within each columnar set are as shown below:

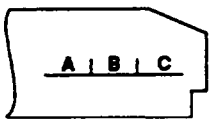


Wooded Gully

Anti-Tank Ditch

Impact Area

Minefield



Urban Areas
A. - Predominant Land Use
B. - Settlement Pattern
C. - Predominant Urban Area Height

b. Urban areas attribute addition(s) to the Obstacles Overlay:

PREDOMINANT LAND USE TABLE — 12pt. Caps

MAP UNIT CODE	LAND USE CATEGORY	12pt. Caps
R	Residential	
S	Recreational	
G	Institutional	
A	Military	
T	Transportation and Utilities	10pt. C/l
C	Commercial	
I	Industrial	
U	Mixed Urban	
M	Medical Complex	
X	Unknown	

SETTLEMENT PATTERN TABLE — 12pt. Caps

MAP UNIT CODE	URBAN STREET PATTERN	12pt. Caps
RR	Regular, Rectangular	
IR	Irregular, Rectangular	
RD	Regular, Radial	
ID	Irregular, Radial	
RC	Regular, Concentric	
RL	Regular, Canals	
IL	Irregular, Canals	10pt. C/l
CC	Contour Conforming (Regular Contouring)	
IC	Irregular, Contouring	
IM	Irregular, Medieval or Preindustrial	
CM	Curvilinear (Cluster) or Irregular Modern	
MX	Mixed	

URBAN HEIGHT TABLE		12pt. Caps
MAP UNIT CODE	HEIGHT RANGE (meters)	12pt. Caps
01	<=10	
02	>10 - 20	
03	>20 - 30	
04	>30 - 40	
05	>40 - 50	
06	>50 - 60	10pt.C/l
07	>60 - 70	
08	>70 - 80	
09	>80 - 90	
10	>90 - 100	
11	>100	

c. If the urban areas section of this appendix is in effect, the overlay heading (name) of this thematic overlay, as given in 3.11.5.3, shall be changed to Obstacles-Urban Areas. In addition, the DMA stock number identification code for this specific terrain factor overlay, as given in 3.11.5.4.4d, shall be the next available free "T" number within the obstacles identification codes group, such as T11.

30.4.7 Need for legend modifications. Legends shall be modified to show only those miscellaneous features and attributes actually appearing on any of the various PTADB overlay sets of a project area, **as prescribed by supplemental project instructions**.

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

CONCLUDING MATERIAL

Custodians:
DMA - MP

Review activities:
Army - PO
Air Force - 09
Navy - NO

Preparing activity:
DMA - MP

(project MCGT-0110)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-P-89305A	2. DOCUMENT DATE *(YYMMDD)* 940701

3. DOCUMENT TITLE Military Specification for Planning Terrain Analysis Data Base (PTADB) Scale 1:250,000

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME *(Last, First, Middle Initial)*	b. ORGANIZATION	
c. ADDRESS *(Include Zip Code)*	d. TELEPHONE *(Include Area Code)* (1) Commercial (2) AUTOVON *(if applicable)*	7. DATE SUBMITTED *(YYMMDD)*

8. PREPARING ACTIVITY

a. NAME Defense Mapping Agency ATTN: PR, ST A-13	b. TELEPHONE *(Include Area Code)* (1) Commercial (703) 285-9333	(2) AUTOVON 356-9333
c. ADDRESS *(Include Zip Code)* 8613 Lee Highway Fairfax, VA 22031-2137	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA. 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	