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# FIPS PUB 173-1

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FEDERAL INFORMATION PROCESSING STANDARDS PUBLICATION  
(Supersedes FIPS PUB 173 – 1992 August 28)

# SPATIAL DATA TRANSFER STANDARD (SDTS)

CATEGORY: SOFTWARE STANDARD

SUBCATEGORY: INFORMATION INTERCHANGE

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1994 June 10

FIPS PUB 173-1

408

.A8A3

NO. 173-1

1994



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Computer Systems Laboratory  
National Institute of Standards and Technology  
Gaithersburg, MD 20899

Issued June 10, 1994



**U.S. Department of Commerce**  
Ronald H. Brown, Secretary  
Technology Administration  
Mary L. Good, Under Secretary for Technology  
National Institute of Standards  
and Technology  
Arati Prabhakar, Director



Developed Under A Memorandum of  
Understanding with Geological Survey,  
U.S. Department of the Interior.

## Foreword

The Federal Information Processing Standards Publication Series of the National Institute of Standards and Technology (NIST) is the official publication relating to standards and guidelines adopted and promulgated under the provisions of Section 111(d) of the Federal Property and Administrative Services Act of 1949 as amended by the Computer Security Act of 1987, Public Law 100-235. These mandates have given the Secretary of Commerce and NIST important responsibilities for improving the utilization and management of computer and related telecommunications systems in the Federal Government. The NIST, through its Computer Systems Laboratory, provides leadership, technical guidance, and coordination of Government efforts in the development of standards and guidelines in these areas.

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James H. Burrows, Director  
Computer Systems Laboratory

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## Abstract

This standard provides specifications (developed through the Department of the Interior) for the organization and structure of digital spatial data transfer, definition of spatial features and attributes, and data transfer encoding. The purpose of the standard is to promote and facilitate the transfer of digital spatial data between dissimilar computer systems.

**Key words:** cartographic data structures; data exchange format; data quality; data sharing; Federal Information Processing Standard; GIS data interchange; GIS standards; spatial data transfer; spatial features and attributes; spatially referenced data; topological vector profile; vector and raster data.

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National Institute of Standards  
and Technology  
FIPS PUB 173-1  
7 pages (June 10, 1994)  
CODEN: FIPPAT

U.S. Government Printing Office  
Washington: 1994

For sale by the National  
Technical Information  
Service  
U.S. Department of Commerce  
Springfield, VA 22161

**Federal Information  
Processing Standards Publication 173-1**

1994 June 10

**Announcing the Standard for**

**SPATIAL DATA TRANSFER STANDARD (SDTS)**

Federal Information Processing Standards Publications (FIPS PUBS) are issued by the National Institute of Standards and Technology (NIST) after approval by the Secretary of Commerce pursuant to Section 111(d) of the Federal Property and Administrative Services Act of 1949 as amended by the Computer Security Act of 1987, Public Law 100-235.

- 1. Name of Standard.** Spatial Data Transfer Standard (SDTS) (FIPS PUB 173-1).
- 2. Category of Standard.** Software Standard, Information Interchange.
- 3. Explanation.** This standard provides specifications for the organization and structure of digital spatial data transfer, definition of spatial features and attributes, data transfer encoding, and topological vector profile. The purpose of the standard is to promote and facilitate the transfer of digital spatial data between dissimilar computer systems.

Work on a national spatial data transfer standard was initiated by the National Committee for Digital Cartographic Data Standards, American Congress on Surveying and Mapping in 1982 to develop a comprehensive set of data exchange standards for the profession. In 1985, the Standards Working Group of the Federal Interagency Coordinating Committee on Digital Cartography also began work on spatial data exchange standards. During 1987, the results of these parallel efforts were merged by the Digital Cartographic Data Standards Task Force into the proposed Digital Cartographic Data Standard, published as a special issue of *The American Cartographer* in January 1988.

Subsequent testing, modification, and refining of the specifications were done by the Spatial Data Transfer Standard Technical Review Board. These efforts resulted in the approval and issuance of the Spatial Data Transfer Standard (SDTS) as Federal Information Processing Standard (FIPS) Publication 173 consisting of three parts: Part 1 – Logical Specifications, Part 2 – Spatial Features, Part 3 – ISO 8211 Encoding. The revision of this standard adds Part 4, the Topological Vector Profile (TVP). The TVP is a limited subset of SDTS specifications for the transfer of vector data, it also specifies several changes and clarifications to Parts 1 and 3 of SDTS. They are as follows:

- a. many-to-many and many-to-one relationships between spatial objects and attributes are permitted (Section 5.3);
- b. composite objects which do not contain component objects are permitted (Section 5.4);
- c. the Entity Authority and Attribute Authority subfields in the Data Dictionary/Schema module may contain a maximum of 8 characters; if Part 2 of the SDTS is the source of a definition the subfield shall contain "SDTS-USA"; a provision for standard feature registers of other countries has been added (Section 5.12);
- d. the Attribute Authority subfield in the Data Dictionary/Domain and Data Dictionary/Definition modules may have a maximum length of 8 characters (Sections 5.13 and 5.14);
- e. the External Spatial Reference subfield in the Conformance field in the Identification module shall have a null value meaning "undefined, not relevant" when used in a transfer containing only a master data dictionary; it is acceptable to specify this by omitting this subfield (Section A.2.2);

- f. in the Point-Node module, the Attribute ID field is not mandatory for objects "NE" and "NL" (Section 5.5.4);
- g. in the Line module, Annex D allows the simultaneous use of both the Chain Component ID and Spatial Address subfields (Section D.6.2); and
- h. the ISO 8211 tag for the Primary Field of the Arc module shall be ARCC (Section D.7.2).

SDTS supports the transfer of vector data with geometry and topology, raster data, graphic representation modules, and geometry-only vector data. The SDTS Topological Vector Profile supports only geographic vector data with geometry and topology.

An SDTS application profile, not requiring the full functionality of SDTS, defines requirements for a specific type of data and/or application. A SDTS profile simplifies the implementation of SDTS while maximizing the probability of successful data interchanges between dissimilar computer systems.

**4. Approving Authority.** Secretary of Commerce.

**5. Maintenance Agency.** U.S. Department of Interior, United States Geological Survey (USGS), National Mapping Division.

**6. Related Documents.**

a. Federal Information Resources Management Regulations (FIRMR) subpart 201.20.303, Standards, and subpart 201.39.1002, Federal Standards.

b. A list of references is contained in section 1.3 and Annex F of Part 1 of the specifications.

**7. Objectives.** The objectives of the SDTS are to:

- provide a common mechanism for transferring digital spatial information between dissimilar computer systems, while preserving information meaning, and minimizing the need for information external to this standard;
- provide, for the purpose of transfer, a set of clearly specified spatial objects and relationships to represent real world spatial entities, and to specify the ancillary information necessary to accomplish the transfer;
- provide a transfer model that will facilitate the conversion of user-defined to standardized set of objects, relationships, and information.

**8. Applicability.**

a. This standard is intended for use in the acquisition and development of government applications and programs involving the transfer of digital spatial data between dissimilar computer systems.

b. The use of the FIPS SDTS applies when the transfer of digital spatial data occurs or is likely to occur within and/or outside of the Federal government.

c. The use of the FIPS SDTS does not apply to the transfer of digital geocoded data files which are not intended to represent spatial entities as digital geographic or cartographic features.

d. FIPS SDTS is not intended to facilitate product distribution of spatial data in a form designed for direct access by application software specific to a particular data structure, class of computer platform, or distribution media.

e. Nonstandard features should be used only when the needed operation or function cannot be reasonably implemented with standard features alone. Although nonstandard features can be very useful, it should be recognized that the use of these or any other nonstandard elements may make the interchange of digital spatial data and future conversions more difficult and costly.

f. Use of this standard or a FIPS approved SDTS application profile, such as the SDTS TVP, is required for Federal Government implementations of this standard. FIPS SDTS implementations not requiring full functionality are designated as application profiles. Application profiles, requiring all three parts of the FIPS SDTS, are limited subsets designed for use with a specific type of data and/or application. The SDTS Topological Vector Profile (TVP) is an application profile.

**9. Specifications.** The FIPS SDTS, in four parts, provides specifications for the organization and structure of digital spatial data transfer, definition of spatial features and attributes, data transfer encoding, and Topological Vector Profile.

Specifications of this FIPS have the following characteristics:

- a. ability to transfer vector, raster, grid and attribute data and other ancillary information;
- b. common set of terminology and definitions for spatial features;
- c. internal description of the data types, formats, and data structures such that the information items can be readily identified and processed in the recipient system; and
- d. media independence and extensibility to encompass new spatial information as needed.

**10. Implementation.** The implementation of this standard involves three areas of consideration: acquisition of FIPS SDTS implementations, validation, and interpretations of the standard.

**10.1 Acquisition of FIPS SDTS Implementations.** This revised standard becomes effective December 30, 1994.

**10.2 Validation.** Conformance to FIPS SDTS is applicable whether implementations are developed internally, acquired as part of an automated data processing (ADP) procurement, acquired by separate procurement, used under an ADP leasing arrangement, or specified for use in contracts for programming services.

Conformance criteria, based on application profiles, will be developed for use in validating the conformance of FIPS SDTS implementations. Validation of implementations for conformance to FIPS SDTS conformance criteria, policy, and procedures are under the authority of the FIPS program.

**10.3 Interpretation of FIPS SDTS.** Resolution of questions regarding this standard will be provided by NIST. Questions concerning the content and specifications should be addressed to:

Director  
 Computer Systems Laboratory  
 ATTN: FIPS SDTS Interpretation  
 National Institute of Standards and Technology  
 Gaithersburg, MD 20899  
 Telephone: (301) 975-3271

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- a. Compliance with a standard would adversely affect the accomplishment of the mission of an operator of a Federal computer system, or

b. Cause a major adverse financial impact on the operator which is not offset by Governmentwide savings.

Agency heads may act upon a written waiver request containing the information detailed above. Agency heads may also act without a written waiver request when they determine that conditions for meeting the standard cannot be met. Agency heads may approve waivers only by a written decision which explains the basis on which the agency head made the required finding(s). A copy of each such decision, with procurement sensitive or classified portions clearly identified, shall be sent to: National Institute of Standards and Technology; ATTN: FIPS Waiver Decisions, Technology Building, Room B-154, Gaithersburg, MD 20899.

In addition, notice of each waiver granted and each delegation of authority to approve waivers shall be sent promptly to the Committee on Government Operations of the House of Representatives and the Committee on Governmental Affairs of the Senate and shall be published promptly in the *Federal Register*.

When the determination on a waiver applies to the procurement of equipment and/or services, a notice of the waiver determination must be published in the *Commerce Business Daily* as a part of the notice of solicitation for offers of an acquisition or, if the waiver determination is made after that notice is published, by amendment of such notice.

A copy of the waiver, any supporting documents, the document approving the waiver and any supporting and accompanying documents, with such deletions as the agency is authorized and decides to make under 5 U.S.C. Sec. 552(b), shall be part of the procurement documentation and retained by the agency.

**12. Where to Obtain Copies.** Copies of this publication are for sale by the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161. (Sale of the included specifications document is by arrangement with the United States Geological Survey (USGS).) When ordering, refer to Federal Information Processing Standards Publication 173-1 (FIPSPUB173-1), and title. Payment may be made by check, money order, or deposit account.



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Gaithersburg, MD 20899

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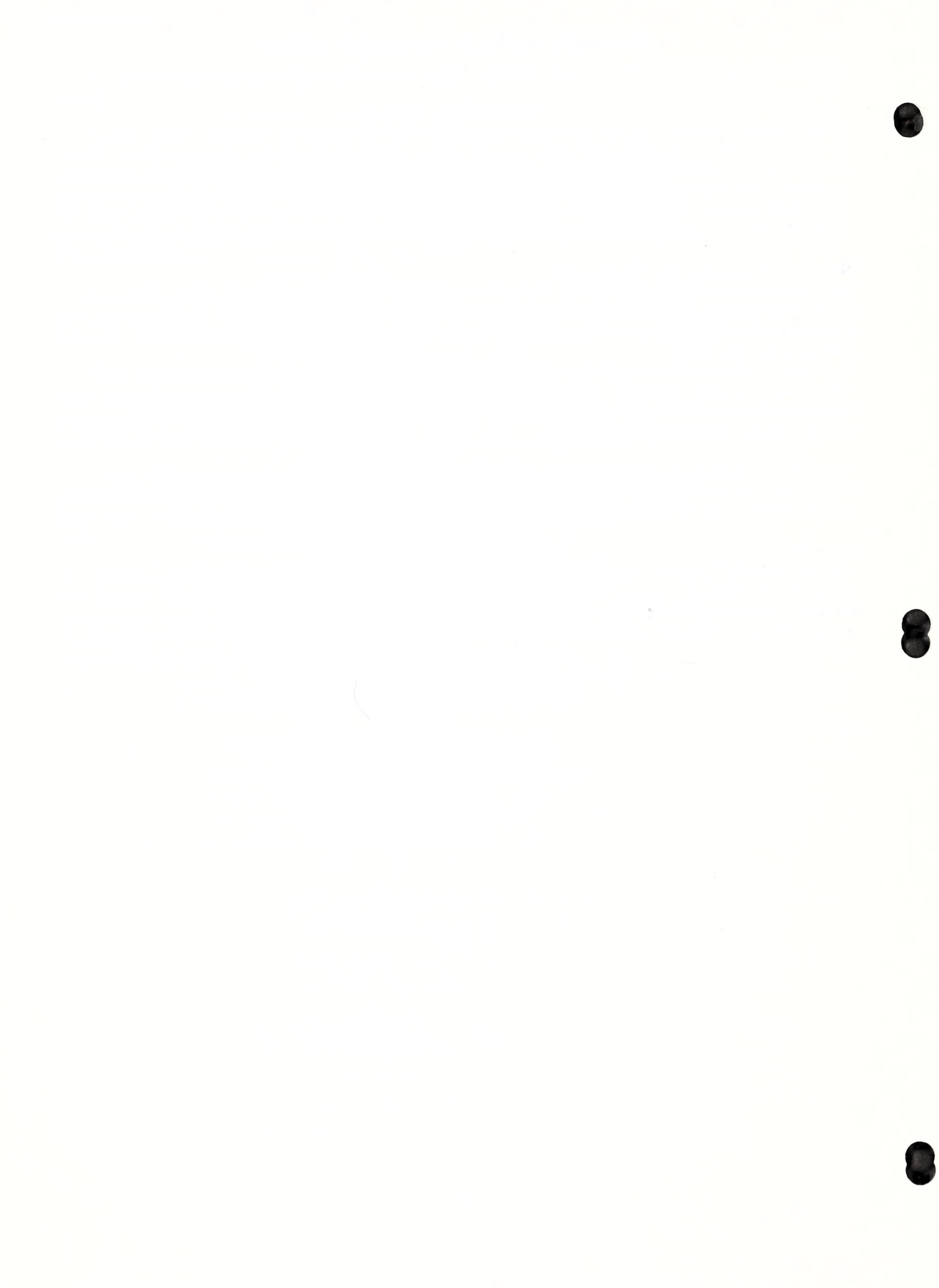
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