Kansas Geodata Compatibility Guidelines

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Kansas GIS Standards Task Force
Geodata Compatibility Guidelines Working Group
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KANSAS GEODATA COMPATIBILITY GUIDELINES

INTRODUCTION

There is a great need in Kansas for easily and economically shareable information concerning the land, water, air, and man-made facilities. This kind of information is commonly called geographic information, which means that the information can be linked to specific geographic locations. It is widely acknowledged that 85% to 90% of all information collected and used by government agencies and utilities is geographically related. The use of guidelines and standards will make the collection, sharing and use of geographic information more efficient and less expensive.

The geographic data environment in Kansas should be a consistent, standardized set of digital geospatial data and supporting services that will:

- provide a geospatial foundation to which an organization can add detail and attach attribute information
- provide a base on which an organization can accurately register and compile other themes of data, such as land use, addresses, accident data, hazardous waste site data, etc.
- orient and link the results of an application to the landscape.

The Kansas geographic data environment should help data producers locate their information in its correct position and provide a means of integrating this information with other geospatial data.

The first and most important task in developing such a geographic data environment for Kansas is to develop data standards for the various data themes that are most commonly needed and shared by users. When data standards are clearly defined, useful data can and will be developed and shared by multiple data producers and users all across the state.

The guidelines presented here are intended to guide the creation of standards for geographic data, or geodata as they will be referred to throughout the remainder of this document, and establish a vision for geodata development statewide that closely parallels geodata development throughout the rest of the country.

ROAD MAP

Vision Statement

In the summer of 1995, a diverse group of individuals and organizations from the Kansas Geographic Information System (GIS) Community participated in organizing a forum on GIS issues in Lindsborg, Kansas. As a result of this forum, the Kansas GIS Community developed the following **vision statement** to guide future activities:

To shape the growth of GIS through open communication, education, and cooperation in order to:

- Optimize data accuracy, reliability, and accessibility
- Meet the needs of the technical and non-technical user community
- Support the decision-making process

The **objectives** to be achieved as a result of that vision were identified as follows:

- Create an attitude of cooperation
- Generate something that will build support at home
- Identify common interests
- Identify processes for developing and maintaining standards
- Identify areas of need for standardization
- Identify obstacles and barriers to data sharing
- Avoid duplication in creating data
- Establish standardized metadata
- Ensure data security
- Create flexible standards
- Establish guidelines by which standards may be developed
- Catalogue existing data
- Build a larger community of technical and non-technical users
- Develop a geographic data framework for Kansas that is compatible with the concept of the National Geospatial Data Framework

As a result of that forum, the GIS Technical Advisory Committee of the Governor's GIS Policy Board assisted in establishing the Kansas GIS Standards Task Force. The Task Force is composed of representatives from all levels of government, utilities, academia, and the private sector. The Task Force organized another forum, this time in Wichita, Kansas, to bring the GIS community together for a discussion of standards. At that forum, held in the Spring of 1996, a proposed standard for metadata was presented, as was a proposed standards development and adoption process. Concensus was reached among the GIS community represented at the forum regarding acceptance of the proposed metadata standard. It was also agreed that the metadata standard should proceed through the rest of the standards adoption process, as presented at the forum.

Standards Development and Adoption Process

With an unspecified group of standards necessary to make data sharing possible and more efficient, the following standards development and adoption process was agreed to at the second Standards Forum in Wichita:

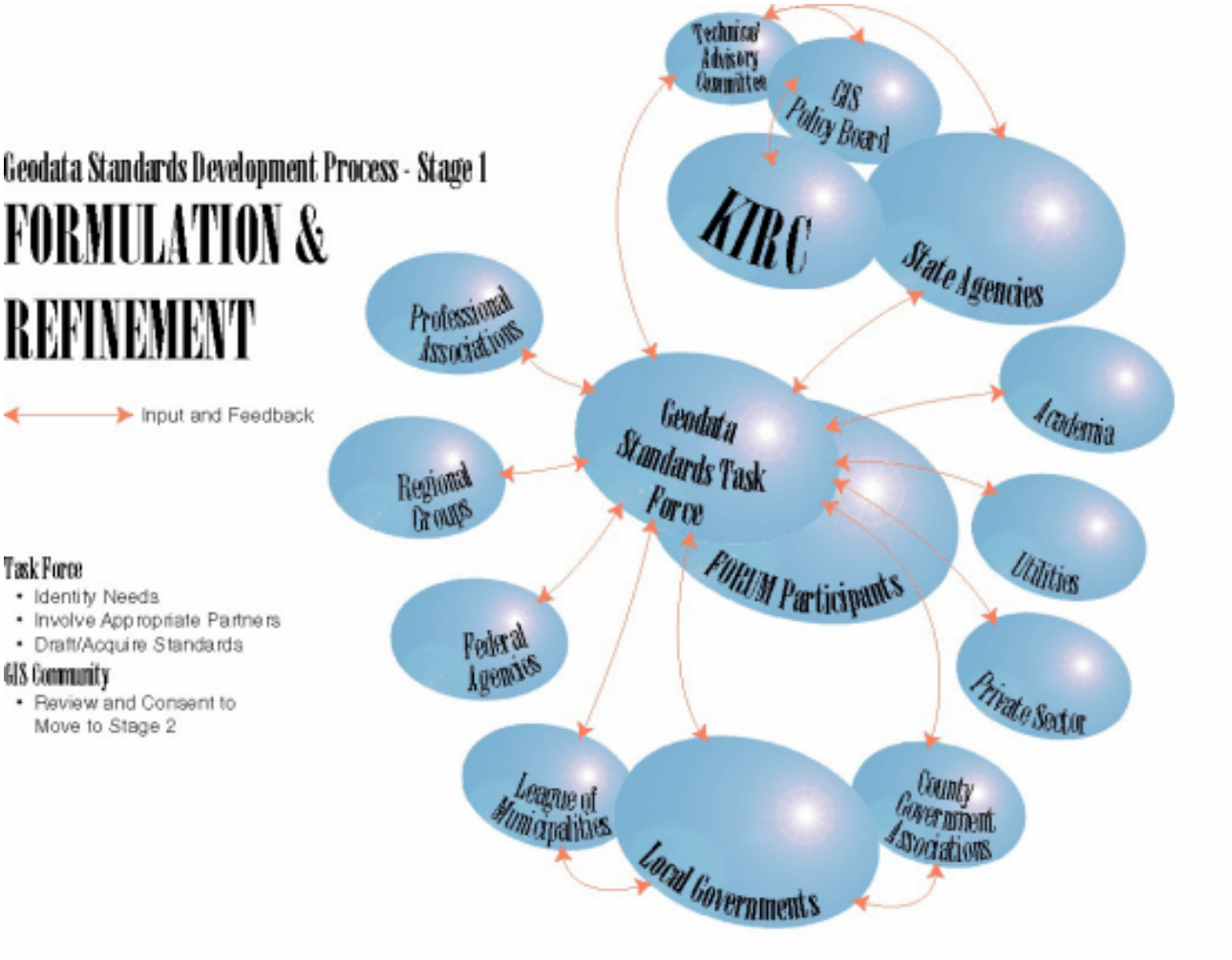
Formulation and Refinement

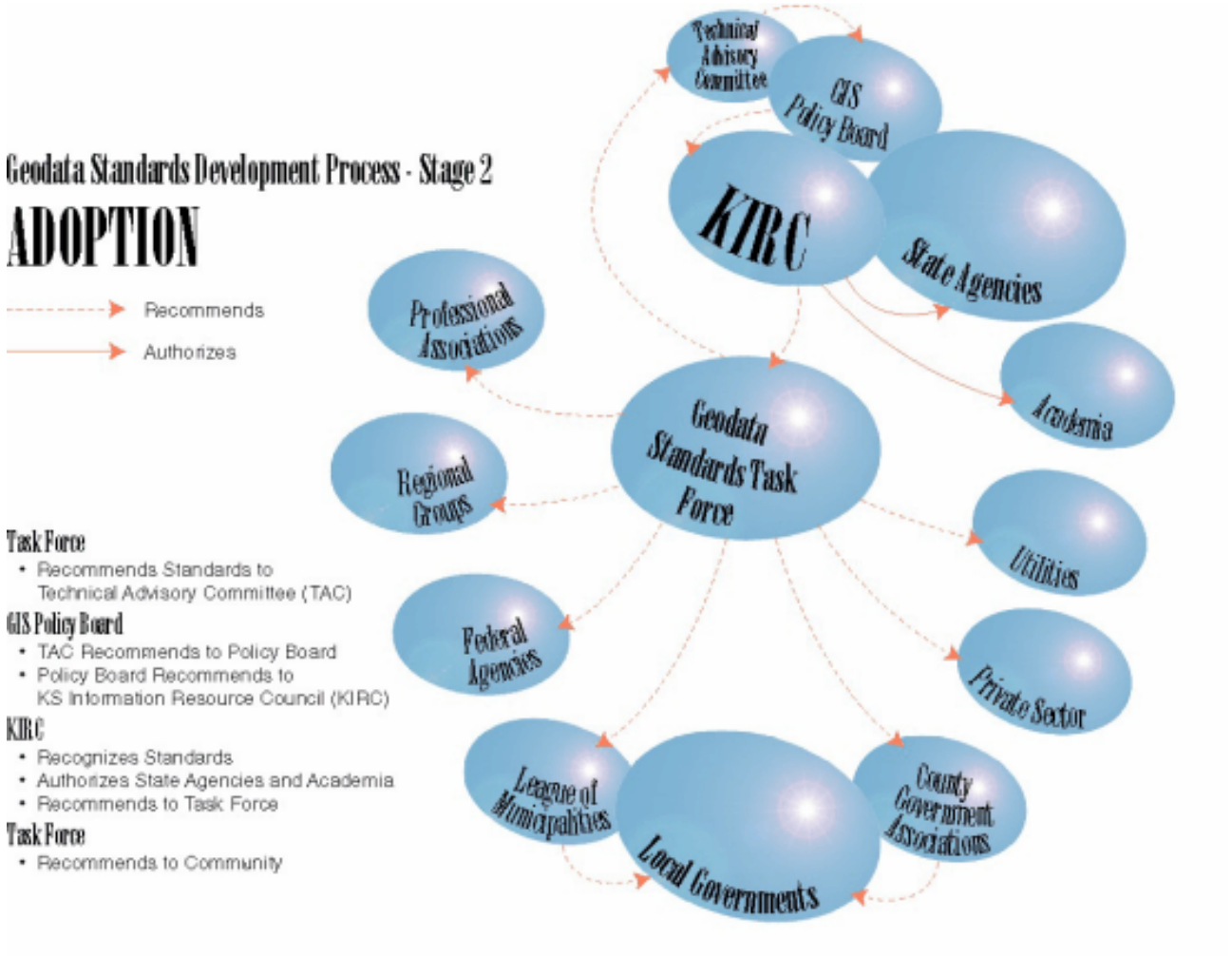
1. GIS Standards Task Force will work with the GIS Community to identify standards requirements.
2. GIS Standards Task Force will involve appropriate partners on working groups to draft and/or identify required standards. The Standards Working Groups will test proposed standards against the guidelines presented here. The Task Force will submit proposed standards to GIS Community for review.
3. GIS Community will review proposed standards, suggest revisions, and/or consent to move the proposed standards to the next phase of the process.
4. Standards Working Groups and Task Force will revise standards as appropriate and move to the next phase of the process.

Adoption

1. GIS Standards Task Force reviews and recommends proposed standards to the Technical Advisory Committee of the Governor's GIS Policy Board.
2. Technical Advisory Committee reviews and recommends proposed standards to the GIS Policy Board.
3. GIS Policy Board reviews and approves proposed standards and provides to the Kansas Information Resources Council a policy recommendation for specific standards adoption.
4. Kansas Information Resources Council recognizes the proposed standards and authorizes them for State agencies and academic institutions, while sending a recommendation for adoption to the GIS Standards Task Force for distribution to the GIS Community at large.

The following diagrams indicate this process graphically.





Standards Classification

The following table indicates the standards currently identified and scheduled for development by the Kansas GIS Standards Task Force:

Table of Standards Classification

Data Useability and Transfer Standards	
Content Standard for GeospatialMetadata	Documents data sets, describing content, history, accuracy, quality, and other characteristics of data
Spatial Data Transfer Standard	Facilitates movement of data from one system to another by standardizing description and formatting of spatial data
Data Content Standards	
Geodetic Control	Basic reference framework for all geodata
Cadastral (property ownership)	Land rights data fundamental to a modern land records system
Administrative/Governmental Boundaries	Widely used district, service, and government boundaries
Transportation	Primary and secondary road network and related features
Digital Orthoimagery	Georeferenced image from photography or remote sensing
Elevation	Digital elevation model of georeferenced vertical positions
Hydrography	Surface water network and related features
Infrastructure (public & regulated utilities)	Local service facilities and cross-country transmission features

GUIDELINES

The objectives of this section of the Geodata Compatibility Guidelines are two-fold:

- to guide the creation and adoption of geodata standards
- to establish a vision for geodata development throughout the state

There is a need among geodata users in Kansas for a few common themes of geographic data that can be easily and economically shared by all. To enable the ease and economy of data sharing, these common data themes must be developed in a standardized fashion.

The remainder of this document offers specific guidance on the formulation of proposed geodata standards, the technical and operational context of a distributed geographic data environment in Kansas within which geodata standards should be developed, and a brief description of the common data themes that need to be standardized, including minimum graphic and attribute content.

Expectations

As statewide standards in support of the Kansas geographic data environment, there are several expectations for geodata standards.

Within Task Force Scope - Geodata standards will be within the scope of the vision statement and objectives of the Kansas GIS Standards Task Force and the goals and objectives of the Kansas GIS Policy Board. Geodata standards must relate to geospatial data, cover appropriate topical areas, and standardize either data or processes to advance data sharing and minimize duplication of effort.

Future Focused - Future focused means that geodata standards are intended to remove impedances to sharing information rather than changing existing successful data sharing arrangements. Geodata standards should be developed to promote new and enhanced interaction with existing coordinating mechanisms, such as the GIS Policy Board, that have interest in the generation, collection, use, and transfer of spatial data. Geodata standards need to focus on solving future problems. Geodata standards are not intended to re-formalize existing solutions.

Structured - Geodata standards need to be developed and presented in a structured manner that will lead to understandability and useability by consumers. This guideline provides minimal guidance for development and documentation of standards. There are many structured methodologies that can be employed by standards developers that will lead to complete and understandable standards. This guideline does not specify a development methodology.

Technology Independent - Geodata standards will not constrain technology development. They will not be developed or implemented in a way that limits the use of new and emerging technologies. They also will not be written or implemented in a way that limits any vendor or technology to maximize the use of the standard.

Integrated - Geodata standards will be integrated with one another and with related standards. This means there will not be overlapping definitions, authorities, or procedures. Standards development will be coordinated to eliminate duplicate efforts and to maximize the efforts of the volunteers contributing to and implementing standards. Geodata standards will lead to an integrated geographic data environment for Kansas.

Evolving - Geodata standards will evolve as technology and institutional mandates change. The standards will be written to allow for evolution and will accommodate backward compatibility for information gathered under previously known standards. There will be known update and maintenance procedures that are timely and responsive to changes. The procedures will be documented as a part of the standards development process.

Supportable - Geodata standards must be supportable by the geospatial vendor community. They will be developed in a manner that is supportable by known or emerging technology.

Publicly Available - Geodata standards will have a broadly based public notice of their availability. Geodata standards will not be developed from copyrighted or proprietary standards that would limit the ability of the final standard to be publicly available. They will not contain any copyrights or other limitations on their use or reproduction. Geodata standards will be available electronically whenever possible.

Complete and Consistent - Geodata standards will be complete in terms of the standards components and methodology described in this guideline. Geodata standards will have a consistent form and format.

Geodata Standards Format

Geodata standards are intended to increase interoperability among automated geospatial information systems. A major objective of geodata standards is the eventual development of a statewide digital spatial information resource with the involvement of all geodata users, including but not limited to, utilities, academia, private sector, Federal, State, and local governments. This statewide information resource, linked by guidelines and standards, will enable sharing and efficient transfer of spatial data between producers and users. Enhanced coordination will build information partnerships among government institutions and the public and private sectors, avoiding wasteful duplication of effort and ensuring effective and economical management of information resources in meeting essential user requirements.

The goal of the GIS Standards Task Force is to provide guidelines for the development and documentation of geodata standards with a minimal structure for standards developers. This structure is intended to support geodata working groups, as subsets of the GIS Standards Task Force, in their efforts to develop and recommend the use of geodata standards. The following guidelines with regard to format will apply to all geodata standards developed and promulgated through the activities of the Kansas GIS Standards Task Force and the Kansas GIS Policy Board:

- Geodata Standards will have a title page that will include the title of the standard, the responsible Geodata Subcommittee or Working Group, and contact information including postal and e-mail addresses.
- Geodata Standards will have a table of contents. All pages will be numbered and dated.
- Geodata Standards will contain an introduction that will describe the following:
    - Mission and Goals of Standard
    - Relationship to Existing Standards
    - Description of Standard
    - Applicability and Intended Uses of Standard
    - Standard Development Procedures
        - Participants
        - Comments and Reviews
    - Maintenance of the Standard
- The body of the standard will follow the introduction.
- References will be listed in a separate section.
- The Standards Task Force will receive digital copies of the standard from the working group in both Microsoft Word and WordPerfect formats. Digital versions will be made available at the GIS Policy Board's Data Access and Support Center (DASC) home page in multiple formats at http://gisdasc.kgs.ukans.edu.

Standards will also address the following topics:

- Content

  Identify what is being standardized and the scope of the standards project.

- Need

  Identify why this standard is being proposed, describing as possible the benefits of developing the standard and the consequences of not developing the standard.

- Participation

  Identify participating agencies or organizations and methods that were used to assure a consensual development process.

- Integration

  Describe the relationship of this standards proposal to ongoing geodata standards efforts and existing geodata standards. If there are relationships with other existing standards, identify both the standard and the relationship.

Technical and Operational Context

The following discussion establishes the context within which geodata standards for Kansas will be developed. Each of the issues below plays an important role in the direction of standards development and will be addressed within the content of individual standards.

Data Environment

Access to a published version of geodata sets (current and past versions) by information networks and digital media should be supported. Users should be able to find available geodata through a central data clearinghouse where all metadata would be stored and accessible. Official versions of geodata sets, however, should be stored and maintained in a distributed environment at the site where they are produced.

Reference Systems

Use of a common means of referencing coordinate positions on the Earth is essential to allow geodata from various sources and different geographic locations to be joined and integrated. In addition, to be used as the locational framework for other thematic data, the coordinate system must be well established, clearly specified, and consistent with national and world use. Multiple datums are currently in use for various data themes. The Kansas geodata environment should support the use of a single consistent datum for referencing horizontal coordinate information and a single consistent datum for referencing vertical coordinate information. In addition, support should be given to efforts toward converting existing data to the latest recognized horizontal and vertical datums where such conversion is feasible and of value. The latest recognized datum for horizontal coordinate information for geodata is the North American Datum of 1983. The latest recognized datum for vertical coordinate information is the North American Vertical Datum of 1988.

Global Positioning Systems

Also important to the geodata environment in Kansas are Global Positioning System (GPS) technologies and related services provided by GPS base stations and differential GPS techniques that are tied to the national coordinate reference systems. These technologies can significantly lower the costs of acquiring accurately positioned data. They also provide a means for users to locate themselves in reference to published geodata during field operations.

To exploit the capabilities of GPS, the following items are needed: (1) a network of a few, very accurately positioned and easily accessed monumented points, (2) a set of continuously operating reference stations, (3) a high resolution geoid (needed to relate heights determined by conventional surveying to those determined by GPS techniques), and (4) precise post-fit GPS satellite orbits.

The federal government has proposed enhancing the National Spatial Reference System (NSRS) to provide this capability. Included in the upgraded NSRS will be 25 to 50 continuously operating reference stations at the most accurately determined geodetic control stations in the Federal Base Network. Observables from GPS satellites will be recorded and made available through electronic networks. Differential GPS base stations operated by the public and private sectors in Kansas should be positioned relative to these reference stations so as to provide information that is tied to a single, consistent, and very accurate coordinate reference system.

Integration of Themes

As a long-term goal, geodata sets should be integrated across themes. In the near term, this goal would be difficult to achieve for places where data for various themes are collected at different resolutions and by different data producers. However, as integrated geodata sets are developed, these data sets should be held to the same standards as geodata containing a single theme.

Encoding

Geodata should be encoded using vector or raster spatial data models as appropriate to theme and feature content. Raster data models are appropriate for image data; vector data models for geodetic control, planimetrics, hypsography, transportation, hydrography, administrative boundaries, infrastructure, cadastral data, land cover, soils, and geology. Vector-based spatial objects must conform to topological rules.

Resolution

To meet the different needs of users, the geographic data environment in Kansas should support geodata at varying resolutions. Multiple resolutions of the same data theme (for example, land use data at different levels of generalization and having positional accuracies of 50, 10, and 1 meter) may exist for any given location. Where practical and where suitable higher resolution data exist, the lower resolution data may be generalized from the higher resolution data. The data should be generalized according to a standardized set of rules for each theme. Alternate rule sets may be needed for a broad range of generalization.

Accuracy

Accuracy considerations are critical for data interoperability. The accuracy of any particular dataset should be appropriate for the applications for which it is used. The accuracy, at whatever level, must be documented in the metadata according to the minimum criteria indicated in the Kansas Core Metadata Standard.

Edge Matching

As a general principle, geometric seamlessness is desireable. However, the accruacy of geometric postions of geodata to be integrated from various sources should not be compromised to achieve geometric seamlessness. For example, if a road crosses the boundary of two (otherwise equivalent) geodata sets from two different sources, the positions of the road at the common edge should be geometrically joined only if it can be achieved within the postional accuracy of the dataset.

If it is not possible to achieve geometric seamlessness within the positional accuracy of the datasets, the disjoint lines that represent the location of the road should instead be associated through a common feature, resulting in "logical seamlessness." The coding schemas necessary for such logical seamlessness should follow the schemas currently under development at the national level. The reasoning for this is based on the assumption that organizations that integrate data would not have information better than those that contributed the data, and so there is little basis for "repairing" the data. Of course, data producers should be encouraged to work with those in adjoining jurisdictions to align their data and remove these ambiguities.

Feature Identification Code

To allow maintenance of users' existing data investments, to minimize the effort required to integrate geodata from various sources, and to link data represented at different resolutions, a consistent method of identifying units of geodata is needed.

To provide for these capabilities, the geodata environment in Kansas should employ a model of geographic reality that utilizes the concept of a 'feature', which is a description of geographic phenomena (for example, a road) at or near the Earth's surface. Each occurrence of a phenomenon (e.g., a road) should be assigned a unique, permanent feature identification code. A feature should be linked to spatial objects (such as points, lines, and polygons) to identify the location of the feature; different sets of spatial objects should exist for different resolutions.

The feature identification code:

- provides users a "key" through which they can associate geographic data from various sources to their own attribute data,
- serves as a tracking mechanism for performing transactional updates,

- and provides a link among representations of a feature at different resolutions and across different areal extents.

Once assigned, the "permanent" code should change only when absolutely necessary and following a standardized process.

Attributes

When a feature is captured in digital form, it may be further described by a set of attributes and relationships. Attributes define the feature's characteristics; examples include name and function. Relationships may be defined to express interactions that occur between features, such as flow in a river system or connectivity in a transportation network.

Transactional Updating

The geodata environment in Kansas should support transactional updating so that data producers make change files available and users only need to process changes. This approach reduces the impact of changes on existing investments. The metadata for geodata sets should support the concept of date stamping for individual features or, at a minimum, for individual tiles or other geographic organizational schemas.

Records Management

Past versions of geodata should be retained so that information is available for historical or process studies. Access to past versions is necessary to support historical thematic data and time-based studies essential in many applications.

Metadata

Metadata detailing the characteristics and quality of the geodata must be provided. Metadata must follow, at a minimum, the Kansas Core Metadata Standards and should make every effort to meet the more rigorous standards set forth in the Federal Metadata Content Standard, where feasible. Metadata is of crucial importance to the geodata environment in Kansas. A user should be able to access metadata regarding any geodata set completed for any location easily and effectively. The metadata should provide sufficient information to allow the user to determine if that geodata set will meet the intended purpose, as well as telling the user how to access the data.

Data Characteristics

The information content of the Kansas geodata environment should include the following commonly shared foundational data themes:

- geodetic control
- cadastral data
- administrative/governmental boundaries
- transportation
- digital orthoimagery
- elevation
- hydrography
- infrastructure

The foundational aspect of each of these data themes is such that none requires a more basic or elemental graphic data set upon which to be compiled. These themes serve as the shared foundation and reference upon which most, if not all, other thematic data sets are compiled. The Federal Geographic Data Committee's Development of a National Digital Geospatial Data Framework specifies a similar list of commonly shared data themes. In

addition, many other states have adopted similar lists of data themes as a necessary foundation upon which to develop a shared and shareable statewide geodata environment. The list of data themes above reflects the most commonly needed and shared geodata in Kansas. Each of the data themes indicated above should be standardized in order to ensure the ease and economy of data sharing state wide. The standards to be developed and adopted for each individual data theme should address, at a minimum, the graphic and attribute content indicated below. In addition, it is anticipated that the standards for each data theme will address a host of issues and data content appropriate to that theme, as determined by the data producers and users of that data theme.

Geodetic Control

Geodetic control provides the means for determining locations of features referenced to common, nationally-used horizontal and vertical coordinate systems. Geodetic data provide the basic reference framework for all geodata and provide a method for relating different layers and sets of geodata to one another. Geodetic data are essential in developing a common coordinate reference for all other geographic features. Horizontal or vertical location is used as a basis for obtaining locations of other points. The Kansas geodata environment should include, at a minimum, the following geodetic control feature and attribute data:

- geodetic control points, referenced to the National Spatial Reference System maintained by the National Geodetic Survey
- station name
- bench mark
- GPS base station
- monument/survey marker
- feature identification code
- latitude and longitude (with accuracy code) for each control point, or state plane coord., or UTM coord.
- selected projection

The latitude, longitude, and ellipsoid height should be determined relative to the Geodetic Reference System of 1980 reference ellipsoid, a mathematical model of the Earth. The orthometric height should be determined relative to the most current geoid model for the United States, GEOID93, developed by the National Geodetic Survey.

Cadastral (property ownership)

Cadastral, or land rights, information is arguably the most important geographic data set for local government users. Cadastral information is the graphic and attribute data describing parcels of land and the rights people hold to those parcels. Cadastral data serves as the foundation upon which the majority of local thematic geodata is compiled. In Kansas, the Public Land Survey System (PLSS) serves as the cadastral reference grid to which land rights features and attributes are linked. The cadastral geodata environment should include at least the following features and attributes:

- 1/4 section, section, township, and range lines (PLSS)
- PLSS section, township, and range numbers, situs address
- subdivision boundary, blocks, lots
- subdivision name
- parcel boundary
- feature identification code
- accuracy level
- boundary corner
- document reference

Administrative/Governmental Boundaries

Administrative and governmental boundaries are the district, service, governmental, election, and census polygons that serve to organize administrative and governmental functions. Administrative and governmental boundaries define geographic areas within which resources can be targeted and services can be reasonably managed. The geographic features for administrative and governmental boundaries that should be considered for inclusion, as per Kansas Statutes Annotated, in the Kansas geodata environment are:

- fire or emergency district
- public school district
- utility boundary
- taxing units
- watersheds
- 100 year floodplain
- political boundary
- county boundary
- incorporated places and consolidated cities functioning as legal minor civil divisions
- American Indian Reservations and Trustlands
- zip code boundary
- census tract

Each should have the name and the applicable Federal Information Processing Standard (FIPS) code, to serve as its unique identifier. In addition, the boundaries of the features should include information about other features (such as roads, railroads, or streams) with which the boundaries are associated.

Transportation

The primary and secondary road network and associated features, facilities, and attributes constitute the transportation theme. This theme includes a linear referencing system important for locating incidents within the network. In addition, a feature identification code should be developed and applied to every segment of the network and to all associated features and facilities. The geodata environment in Kansas for transportation data should include, at a minimum, the following feature and attribute data elements:

- airports
- bridges
- navigable waterways
- tunnels
- road centerlines
- address ranges
- railroads
- trails
- ports
- linear referencing system
- name
- feature identification code
- functional classification

Digital Orthoimagery

An orthoimage is a georeferenced image prepared from a perspective photograph or other remotely-sensed data in which displacements of images due to sensor orientation and terrain relief have been removed. Many geographic features can be interpreted and compiled from the orthoimage. Orthoimages can serve as a backdrop,

in addition to linking the results of an application to the landscape. The Kansas geodata environment should include, at a minimum:

- digital orthoimages, cast on the latest available datum
- feature identification code for each image
- measurable accuracy and resolution
- image georeferencing

The geodata environment will likely include imagery that varies in resolution from sub-meter to tens of meters. High-resolution data (one meter or smaller pixels) are thought to be the most useful to support local data needs. For some regional, state, and federal uses, lower resolution imagery may be sufficient.

Elevation Data (hypsography)

Elevation refers to a spatially referenced vertical position above or below a datum surface. Digital, georeferenced elevation data can exist in several forms, including digital elevation models (DEMs), triangulated irregular networks, vector contour files, and spot elevations. The other forms of elevation data can be derived from DEMs, so the DEM should serve as the minimum element for elevation data within the Kansas geodata environment. The geodata environment for elevations of land surfaces should at least include:

- digital elevation models
- feature identification code
- density of elevation values
- selected base datum

Most existing land surface elevations are referenced to the National Geodetic Vertical Datum of 1929, but implementation of the National Geodetic Vertical Datum of 1988 should be addressed in any standard that deals with elevation data.

Hydrography

Hydrography defines a surface water feature that may or may not be connected to other surface water features. These surface water features are commonly referred to as reaches. The hydrography geodata environment in Kansas should at least include the following feature and attribute components:

- stream reaches
- open water shorelines
- miscellaneous features (wells, springs, etc.)
- name
- feature identification code
- connectivity (flow paths)
- direction of flow
- measurable accuracy level or range
- classification by reach type

Infrastructure

It may be that standards for infrastructure are developed in two or more phases, one or more for service facilities that are provided or managed at the local government level, and one or more for cross-country transmission

lines, distribution lines, and facilities generally managed by public utilities or the private sector. The general data content for the infrastructure geodata environment in Kansas should, at a minimum, include the following:

- Transmission/Distribution lines (electric, gas, telecommunications)
- Water/Wastewater/Stormwater pipelines
- Node facilities (manholes, valves, poles, transformers, outfalls, etc.)
- Feature identification code

[Note: Some of the text used in the body of the Guidelines document and in Apps. A and B was borrowed from the FGDC's Standards Reference Model, 1996 and the Development of a National Digital Geospatial Data Framework, 1995.]

Appendix A - Standards Task Force Working Groups Evaluation Criteria

The Standards Task Force Working Groups review documents at step 2 of the standards development and adoption process. The following describes the review criteria to be used at this stage:

Within Task Force Scope

Is the standard topic included in the Kansas Geodata Compatibility Guidelines?

Is the type of standard proposed a data standard or a process standard?

Does the standard proposal relate to geospatial data or processes?

Does the standard proposal advance data sharing or minimize duplication?

Does the standard proposal have a statewide scope?

Future Focused

Does the standard proposal remove an impedance to data sharing?

Does the standard proposal promote new or enhanced coordination?

The standard does not re-formalize an existing standard or procedure.

Structured

Is the standard presented in an understandable and useable manner?

Does the standard follow the format of the Geodata Compatibility Guidelines?

Does the standard contain all necessary documentation?

Technology Independent

Does the standard proposal stand independent of a specific technology solution?

The standard proposal does not limit any appropriate vendor from access.

Integrated

Are there other similar standards available or is there other similar standards development ongoing?

The standard proposal does not overlap with an existing standard.

Is the standard development coordinated with related standards?

Evolving

Does the standard allow for updates?

Does the standard include documented maintenance and update procedures?

Are the ways to submit updates documented in the standard?

Supportable

Can the standard be implemented with known technology?

Are there identified consumers for the standard?

Publicly Available

The standard will not be developed from proprietary information.

The standard does not carry any copyright or licensing limitation on use.

What are the proposed mechanisms for making the standard available electronically?

Complete and Consistent

Does the proposal have all the necessary components?

Does the proposal follow a reasonable methodology for development?

Is the proposal in a consistent and readable format and presentation?

Appendix B - Standards Taxonomy

[NOTE: There are many different types of standards. To assist the GIS Community in better understanding standards issues and to provide some context within which the work of the Kansas GIS Standards Task Force can be placed, the following information was modified from the Federal Geographic Data Committee's Standards Reference Model document.]

The taxonomy of standards is derived from the principles of information engineering as modified by the FGDC Standards Working Group's Technical Advisory Group. Information engineering is a design and standards development technique developed by IBM in the late 1970's and early 1980's. It is often applied to systems development and has been used for standards development and maintenance. An information engineering approach was selected because it provides minimal guidance on structure, yet allows for standards to achieve coordination and interoperability status. This approach does not dictate step-by-step processes.

One way that information engineering provides a structured approach to standards development is by providing a method to describe different standards types. It also provides a means to describe the relationships among various standards of the same type. For example, two data standards can be related to one another, eliminating duplicate definitions and domains of values. In this manner it is well adapted to the diversity of the National Spatial Data Infrastructure and the FGDC.

The four basic categories of information engineering standards are:

- data
- processes
- organizations
- technology

One geodata standard may contain several categories of standards.

Data Standards

Data are the most widely recognized and documented component of standards and information technology. Data modeling describes how the bits of information are defined and structured so they can be applied in a meaningful way. Most geodata standards will be of this type.

Data standards describe objects, features or items that are collected, automated, or affected by activities or functions of agencies. Data are organized and managed by institutions. Data standards are semantic definitions that are structured in a model.

Data Classification - Data classification standards provide groups or categories of data that serve an application. Data classification standards are the attributes common to elements of a group. Examples are wetland and soil classifications. See process standards for standards on how to apply a data classification standard.

Data Content - Data content standards provide semantic definitions of a set of objects. Data content standards may be organized and presented in a data model such as an entity-relationship model or an IDEF1X model.

Data Symbology or Presentation - Data symbology or presentation standards define graphic symbols. They standardize the language for describing those symbols. See processes standards for methods for applying symbols and the rules for displaying them.

Data Transfer - Data transfer standards are independent of technology and applications and facilitate moving data among systems, without prior specification of the intended end use of the data. The Spatial Data Transfer Standard (SDTS) is an example of a data transfer standard, which is endorsed by FGDC. SDTS is FIPSPUB 173. Profiles or domains of values for SDTS will be defined by FGDC Subcommittees and working groups. Transfer standards that are specific to a technology, such as the FTP (File Transfer Protocol) on the Internet, are outside the scope of the FGDC.

Data Useability- Data Useability standards describe how to express the applicability or essence of a data set or data element and include data quality, assessment, accuracy, and reporting or documentation standards. The FGDC Content Standard for Geospatial Metadata is an example of a Data Useability standard.

Process Standards

Processes or functions describe tasks and how information and technology are used to accomplish organizational goals. Process standards may also be called service standards. They describe how to do something, procedures to follow, methodologies to apply, procedures to present information, or business process rules to follow to implement other standards. A smaller portion of geodata standards will be process standards.

The intent of Geodata Process standards are:

- to establish a threshold for minimally acceptable data,
- to determine the best data for an application, or
- to promote interoperability and broad based use of data.

General Data Transfer Procedures - General data transfer procedure standards are the activities required to convert data to a general data format, such as SDTS, for general access.

Specific Data Transfer Procedures - Specific data transfer procedure standards are the activities or requirements to fulfill a specific data request for a known activity in a known data structure.

Existing Data Access Procedures - Existing data access procedure standards are the procedures required to gain access to an existing data set in a known data format, such as the methods and procedures required to access an existing data posting on the World Wide Web or a bulletin board.

Classification Methodology - Classification methodology standards are the procedures to follow to implement a data classification standard. They describe how data are analyzed to produce a classification. The processes that are followed to achieve data precision are examples of classification methodologies.

Data Collection - Data collection procedure standards are the methods and processes for the collection of new or conversion of existing data.

Storage Procedures - Storage procedure standards address the mechanisms and schedules for archiving or backing up data. If appropriate, the storage procedures also address the storage media.

Presentation Standards - Presentation standards are the methods for displaying or formatting information from a data set or data standard.

Data Analyzing Procedures - Analytical procedures include the methods for computing, comparing, contrasting, assembling, or evaluating a data set for an application or specified product.

Data Integration - Data integration procedures are the methods for combining various data sets into a unified, geographically harmonious data set. Data generalization standards are a data integration process standard.

Quality Control and Quality Assurance - Quality control and quality assurance processes are respectively the methods followed to achieve a specified quality and the methods to check the quality of an existing data set. Precision for measurements or other activities are included in these standards.

Organizational Standards

The organizational component of information engineering consists of the rules for assigning responsibilities and authorities for the people who perform tasks and use technology. These include things like who does which tasks, what data do they need, and what are the attendant skill requirements.

Organizational or institutional standards are the specifications for communication among communities. These are the human and institutional interactions necessary to carry out data, activity, and technology standards. Ways to organize, communicate, identify responsible parties, and coordinate roles are examples of organizational standards.

Technology Standards

Technology includes things like software, hardware, and system protocols. In system design, the technology may be specifically described in terms of known application solutions such as computer aided mass appraisal, topologic processing, or coordinate geometry computations.

Technology standards relate to the tools, environment, and interfaces among systems, and are often called information technology specifications. They are the tools to produce, manipulate, manage, organize, disseminate, or otherwise implement activity or data standards.

Appendix C - Standards Outline

The following outline will be followed by all working groups of the Kansas GIS Standards Task Force in development of individual standards documents.

Title Page
Introduction
- Mission and Goals of Standard
- Relationship to Existing Standards
- Description of Standard
- Applicability and Intended Use of Standard
- Standard Development Procedures
  - Participants
  - Comment Opportunities and Reviews
- Maintenance of the Standard

Body of the Standard
- Scope and Content of the Standard
- Need for the Standard
- Participation in Standards Development
- Integration with Other Standards
- Technical and Operational Context
  - Data Environment
  - Reference Systems
  - Global Positioning Systems
  - Integration of Themes
  - Encoding
  - Resolution
  - Accuracy
  - Edge Matching
  - Feature Identification Code
  - Attributes
  - Transactional Updating
  - Records Management
  - Metadata
  - Other Topics (optional)
- Data Characteristics
  - Minimum Graphic Data Elements
  - Minimum Attribute or Non-graphic Data Elements
  - Optional Graphic Data Elements
  - Optional Attribute or Non-graphic Data Elements

References
Appendices