

# File Geodatabase Standards

## for Data Creation, Publication, and Distribution

---

Last Updated 2023.01.10



Created by GeoBC and Regional Geospatial Services,  
BC Ministry of Land, Water and Resource Stewardship  
Comments and Questions: [GeoBCinfo@gov.bc.ca](mailto:GeoBCinfo@gov.bc.ca)

<b>1. Introduction .....</b>	<b>5</b>
1.1. Document History .....	5
<b>2. File Geodatabase Standards in Brief .....</b>	<b>7</b>
<b>3. Detailed File Geodatabase Standards .....</b>	<b>9</b>
3.1. File Geodatabase Structure/When to use Feature Datasets .....	9
3.1.1. Project Level Work.....	9
3.1.2. Data Publication (Data warehouses, BC Geographic Warehouse staging area, etc.) .....	10
3.1.3. Data Distribution (FTP, Web Site, Sharepoint) .....	11
3.1.4. Receiving Data from Contractors .....	12
3.2. Naming Conventions .....	13
3.2.1. Generic Naming Standards .....	13
3.2.2. GDB Naming Standards .....	13
3.2.3. Feature Dataset Naming Standards .....	13
3.2.4. Feature Class Naming Standards .....	14
3.2.5. Attribute Fields Naming Standards.....	15
3.3. Spatial Reference, Projection and Datum.....	15
3.4. XY(and Z) Tolerance .....	16
3.5. XY (and Z) Resolution .....	17
3.6. Configuration Keyword .....	17
3.7. File Geodatabase Fields .....	17
3.7.1. Feature Codes .....	17
3.7.2. Unique Identifiers.....	18
3.7.3. ORCS and ARCS .....	18
3.8. Field Indexing .....	18
3.9. Spatial Indexing .....	19
3.10. Data Integrity .....	19
3.10.1. Repairing Geometry.....	19
3.10.2. Topology (Spatial Data Integrity).....	19
3.10.2.1. Topology Validation .....	21
3.10.2.2. Error Reporting .....	21
3.10.2.3. Topology Standards:.....	21
3.10.3. Attribute Domains (Attribute Data Integrity).....	22
3.11. Metadata.....	23
3.12. Compacting File Geodatabases.....	25
3.13. Compressing Data.....	25
<b>4. Tools for Implementing the File Geodatabase Standards .....</b>	<b>26</b>
4.1. Tools Overview .....	26
4.1.1. Checking/Reporting Tool.....	26

4.1.2.	Create New File Geodatabase with Feature Dataset Tool .....	26
4.1.3.	Apply Default Topology Tool.....	26
4.1.4.	FGDB Project Close-out Tool.....	26
4.1.5.	FGDB Publication/Distribution Tool .....	26
4.2.	Accessing and Using FGDB Standards Tools .....	27
4.2.1.	Internal government employees working on the GIS Terminal Server (GTS).....	27
4.2.2.	Outside of Government .....	27
4.2.3.	Adding the FGDB Standards Toolbox to ArcToolbox.....	27
4.2.4.	Executing FGDB Standards Tools .....	28
4.2.5.	Accessing Help Documentation .....	28
<b>5.</b>	<b>Applying File Geodatabase Standards – Step by Step Directions .....</b>	<b>31</b>
5.1.	Creating a New Feature Class or Feature Dataset .....	31
5.1.1.	Defining Projection to the NAD 1983 BC Environment Albers ("BC Albers") Projection .....	33
5.1.2.	XY Tolerance and Resolution .....	33
5.1.3.	Configuration Keyword .....	34
5.2.	Indexing Fields .....	34
5.3.	Optimizing the Spatial Index .....	37
5.4.	Repairing Geometry.....	38
5.5.	Creating and Applying Topology .....	38
5.5.1.	Creating a Topology Element .....	38
5.5.2.	Validating Topology .....	44
5.5.3.	Finding and Fixing Topology Errors .....	45
5.5.4.	Reporting out from Topology.....	48
5.6.	Creating and Applying Attribute Domains .....	49
5.6.1.	Creating a Domain .....	49
5.6.2.	Applying a Domain.....	52
5.6.3.	Editing with a Domain .....	53
5.6.4.	Checking for Attribute Errors .....	53
5.7.	Creating Metadata .....	55
5.8.	Compacting a Geodatabase.....	57
5.9.	Compressing a Geodatabase .....	57

# 1. Introduction

The File Geodatabase Standards detail the standards for storing, publishing, and distributing corporate GIS data using ESRI's file geodatabase (FGDB) data format.

File geodatabases, first introduced with ArcGIS 9.2, are ideal for working with GIS data at a project level and for data storage and sharing. They are the native data format to use with BC government's ArcGIS software packages from ESRI and offer critical benefits over shapefiles such as:

- The ability to apply data integrity checks for both spatial and attribute data,
- Storage in a single file/folder (folder with .gdb extension),
- Efficient storage for larger datasets.

Due to the broad range of FGDB capabilities and use scenarios, these standards should be used as guidelines and not as absolute prescriptive law.

These standards are endorsed by the Natural Resource Information and Digital Services' Data Management Working Group (DMWG). They will be updated as software and data use changes necessitate. Please send questions and comments to [GeoBCinfo@gov.bc.ca](mailto:GeoBCinfo@gov.bc.ca)

## 1.1. Document History

Publication Date (YYYY.MM.DD)	Summary of Changes	Author/Editor
2008.09.22	Document first published.	Chris Ens
2009.03.26	Various spelling corrections. Added note on Datum transformations in section 3.4. Updated section 4 with new tools for FGDB standards implementation.	Chris Ens
2009.04.02	Corrected error with point and line topology rules.	Chris Ens
2010.04.12	4.2.1 Updated path to FGDB standards tool in the script warehouse.	Chris Ens
2010.04.23	3.3.2; 3.3.4 Updated GDB and feature class naming standards to include examples consistent with standards.	Chris Ens
2013.03.22	Full document refresh to reflect changes to software (ArcGIS 10) and government organizational changes since original document created.	Chris Ens
2021.03.01	Edited to reflect changes to software and government organizational changes. Modified to reflect the perspectives and needs of various parts of the Data Management Working Group: GeoBC, Regional Geospatial, DataBC, IIT	Ian Laing

2021.08.13	Edited to reflect changes to software and government organizational changes. Modified to reflect the perspectives and needs of various parts of the Data Management Working Group: GeoBC, Regional Geospatial, DataBC, IIT	Corinne Bexson Brad Sparks
2022.03.03	Reviewed and edited to include considerations and perspective of Architecture and Business Strategy Branch	Cody Crocker
2022.09.22	Edited to reflect changes suggested by other reviewers. Tidied up to prepare for upload to intranet page.	Ian Laing
2023.01.10	Minor edits based on Corrine Bexson's recommendations from November, 2022.	Ian Laing

## 2. File Geodatabase Standards in Brief

<b>File Geodatabase Structure / Use of Feature Datasets</b>	<a href="#">Full details</a>
Project Level Work	<ul style="list-style-type: none"> <li>• Use Feature Datasets</li> <li>• Many Feature Classes per Geodatabase</li> </ul> <a href="#">more information</a>
Data Publication	<ul style="list-style-type: none"> <li>• Single Feature Class per Geodatabase</li> <li>• No Feature Datasets</li> </ul> <a href="#">more information</a>
Data Distribution	<ul style="list-style-type: none"> <li>• Single Feature Class per Geodatabase except when distributing sets of data</li> <li>• Use Feature Dataset only when distributing sets of data</li> </ul> <a href="#">more information</a>
Receiving Data (from Contractors, etc.)	<ul style="list-style-type: none"> <li>• Use Feature Datasets</li> <li>• Many Feature Classes per Geodatabase</li> </ul> <a href="#">more information</a>
<b>Format for Distribution/Receiving</b>	<ul style="list-style-type: none"> <li>• Zipped compressed geodatabase (&lt;FGDB name&gt;.gdb.zip)</li> </ul> <a href="#">more information</a>
<b>Naming Standards</b>	<ul style="list-style-type: none"> <li>• Names should strive to be descriptive and concise. See the <a href="#">Naming Conventions</a> section for full details.</li> </ul>
<b>Projection and Datum</b>	<ul style="list-style-type: none"> <li>• BC Environment Albers (NAD83)</li> </ul> <a href="#">more information</a>
<b>XY Tolerance</b>	<ul style="list-style-type: none"> <li>• 1/10<sup>th</sup> positional accuracy (0.1 m for 1:20k data)</li> </ul> <a href="#">more information</a>
<b>XY Resolution</b>	<ul style="list-style-type: none"> <li>• Default (0.0001 meters)</li> </ul> <a href="#">more information</a>
<b>Configuration Keyword</b>	<ul style="list-style-type: none"> <li>• Default</li> </ul> <a href="#">more information</a>
<b>Standard Fields</b>	<ul style="list-style-type: none"> <li>• FEATURE_CODE</li> </ul> <a href="#">more information</a> <ul style="list-style-type: none"> <li>• _TAG (for linking to other databases/tables)</li> </ul> <a href="#">more information</a> <ul style="list-style-type: none"> <li>• ORCS_ or ARCS_ (for fields with associated managed government records with ORCS or ARCS numbers)</li> </ul> <a href="#">more information</a>
<b>Field Indexing</b>	<ul style="list-style-type: none"> <li>• Apply to attribute fields that are queried often when there are many records in the table and after editing is complete</li> </ul> <a href="#">more information</a>

<b>Spatial Indexing</b>	<ul style="list-style-type: none"> <li>Re-calculate spatial indexes when feature classes are complete</li> </ul> <a href="#">more information</a>
<b>Data Integrity</b>	
Repair Geometry	<ul style="list-style-type: none"> <li>Apply the <i>'Repair Geometry'</i> tool to each feature class</li> </ul> <a href="#">more information</a>
Topology (Spatial Data Integrity)	<a href="#">Full details</a> <ul style="list-style-type: none"> <li>Cluster Tolerance = XY Tolerance</li> <li>Only feature classes with rules applied to them should participate in a topology element</li> <li>More trusted feature classes should be higher ranks (lower number; i.e., 1 is the highest rank)</li> <li>Rules will depend on what spatial relationships require enforcing. See <a href="#">common rules</a> section for more details.</li> </ul>
Attribute Domains (Attribute Data Integrity)	<ul style="list-style-type: none"> <li>Apply domains to fields that have specified values or value ranges</li> </ul> <a href="#">more information</a>
<b>Metadata</b>	<ul style="list-style-type: none"> <li>ArcCatalog's metadata should be filled in with the key fields required for the <a href="#">BC Data Catalogue</a>. See <a href="#">Metadata</a> section for more details.</li> </ul>
<b>Compacting File Geodatabases</b>	<ul style="list-style-type: none"> <li>File geodatabases should be compacted once they are ready for distribution or publication.</li> </ul> <a href="#">more information</a>
<b>Compressing File Geodatabases</b>	<ul style="list-style-type: none"> <li>File geodatabases should be compressed for distribution and publication.</li> </ul> <a href="#">more information</a>



## 3. Detailed File Geodatabase Standards

### 3.1. File Geodatabase Structure/When to use Feature Datasets

Geodatabases are databases for storing feature classes, raster data, tabular data, tools for processing data, and other related elements for defining data's behaviour.

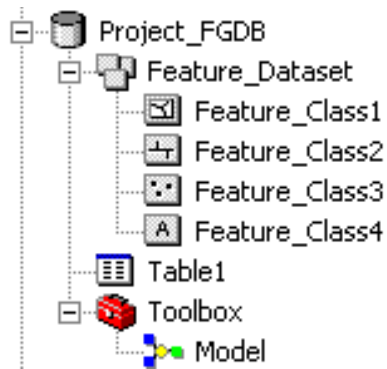
A [feature dataset](#) can be seen as a sub-directory within a geodatabase to store feature classes and elements governing spatial behaviour. Feature datasets can be used to organise related feature classes, however, their primary function is to apply consistent spatial properties to its contents. All feature classes in a feature dataset will have the same spatial reference (i.e., projection), XY tolerance, and XY resolution. It is advantageous to store feature classes within a feature dataset to ensure that all feature classes share the same projection. Topology rules require feature classes to be stored inside feature datasets. All participating feature classes in a topology element must be stored in the same feature dataset. Tabular data, raster data, and toolboxes are stored at the base geodatabase level and cannot be stored inside a feature dataset.

**Toolboxes** are storage bins for storing geoprocessing tools. Toolboxes can be stored directly within a geodatabase or as a .TBX file. Within a toolbox, [toolsets](#) can be used to organise tools into groupings. Tools inside a toolbox (or toolset) can take the form of ArcGIS system tools from ArcToolbox, ModelBuilder models, or custom script tools (tools that reference and run scripts).

#### 3.1.1. Project Level Work

The following standards apply to using FGDBs for project level data creation, storage, and analysis:

- Feature datasets must conform to the [spatial reference, projection and datum; XY tolerance; XY resolution](#); and [naming conventions](#) defined in the following sections of this document.
- All feature classes must conform to the [spatial reference, projection and datum; XY tolerance; configuration; naming conventions](#); and [metadata](#) standards defined in the following sections of this document.
- Where appropriate, feature classes should have [attribute domains](#) and [topology elements](#) applied to them.
- FGDBs must be [compacted](#) and [compressed](#) when work is completed.
- Multiple feature classes can be stored within a single feature dataset.
- Model Builder models and script tools used in the creation of data may be stored in toolboxes within the FGDB, but only when their only task is to create data within the FGDB. Scripts (i.e. Python .py files) may also be stored in an accompanying folder to the FGDB.



Rational for the above standards:

- Having each feature class inside a feature dataset ensures that all data has the same projection, XY tolerance and XY resolution, and allows topology rules to be applied.
- When processing is complete compacting and compressing geodatabases makes them take up less storage space.
- When appropriate, storing toolboxes within the geodatabase makes them portable with the rest of the project data.

### 3.1.2. Data Publication (Data warehouses, BC Geographic Warehouse staging area, etc.)

The following standards apply to publishing data to publication directories such as the BC Geographic Warehouse (BCGW) staging area:

- For specific requirements when publishing to the BCGW staging area, please refer to [DataBC's Staging Area standards](#)
- Each geodatabase must have a single feature class that conforms to the [projection](#), [XY tolerance](#), [XY resolution](#), [configuration keyword](#), [naming conventions](#), and [metadata](#) standards defined in the following sections of this document.
- FGDBs may be [compacted](#) and [compressed](#).
- Each feature class must be [topologically correct](#).



Rational for the above standards:

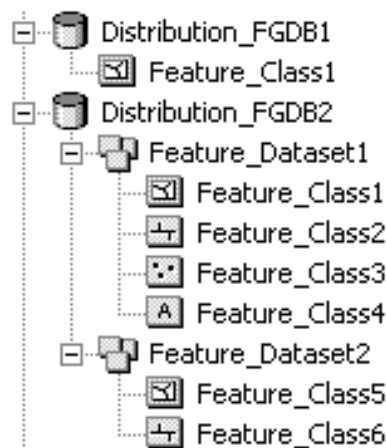
- Compacting and compressing geodatabases makes them take up less storage space and makes the data read-only. Compressing causes a feature class to become read-only and cannot be edited (until uncompressed)
- Single feature class per geodatabase limits chances of schema locking.
- Single feature class per geodatabase limits the risk of data loss due to file corruption or loss of files.

- Not using feature datasets simplifies the data model since only single feature classes are stored within each FGDB.
- Feature Datasets (and Topology elements) are not required as data should already be topologically correct before publishing. The project dataset will include topology, but the Data Publication version will not.

### 3.1.3. Data Distribution (FTP, Web Site, Sharepoint)

The following standards apply to publishing data for distribution on an FTP site or other distribution service:

- When geodatabases are storing single feature classes, feature datasets must not be used.
- Feature datasets may be used to separate data into logical groupings when many feature classes are being distributed as a package inside a single FGDB.
- Feature classes and feature datasets must conform to the standards around [spatial reference](#), [projection and datum](#), [XY tolerance](#), [XY resolution](#), [configuration keyword](#), [naming conventions](#), and [metadata](#) defined in the following sections of this document.
- All feature classes must be [topologically correct](#).
- FGDBs should be [compacted](#) and [compressed](#).



Rationale for the above standards:

- To simplify the data model, do not use feature datasets (when distributing single feature classes).

Data Format for distribution:

- File geodatabases must be [compressed](#) and then zipped. The zip file should consist of the name of the FGDB followed by the '.zip' extension.

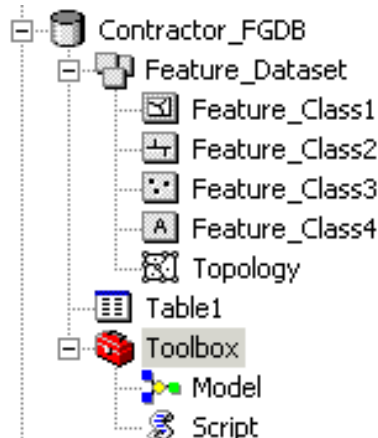
Example: <FGDB name>.zip

Ensure privacy and security principles are applied, and custodial permission is granted. When distributing data for public consumption, a BC Data Catalogue metadata record should be created. This metadata record will include a resource link to your data file(s) or can be a place to store SMALL datasets.

#### 3.1.4. Receiving Data from Contractors

The following standards apply to the geodatabase structure for receiving data from contractors:

- All feature classes should be within feature datasets.
- Feature datasets must conform to the [spatial reference, projection and datum; XY tolerance; XY resolution; configuration keyword; naming conventions](#); and [metadata](#) defined in the following sections of this document.
- All feature classes must conform to the [spatial reference, projection and datum; XY tolerance; configuration; naming conventions](#); and [metadata](#) standards defined in the following sections of this document.
- [Data integrity](#) must be ensured and checkable:
  - i.e., if there is a requirement for topologically clean data, each feature class must have a [topology element](#) applied.
  - Where appropriate, [attribute domains](#) must be applied to attribute fields.
- FGDBs must be [compacted](#) and [compressed](#).
- Multiple feature classes can be contained within a single feature dataset.
- Any ModelBuilder models or scripts used in the creation of a dataset should be included as contract deliverables, preferably in toolboxes stored within the geodatabase. Scripts (i.e. Python .py files) should be delivered as separate files along with FGDBs. If applicable, script tools should have their scripts imported to reside within the toolbox.



## 3.2. Naming Conventions

Geodatabases use name strings at a variety of levels. Examples include the geodatabase itself, feature datasets, feature classes, tables, domains, and relationship classes.

A generic standard that is applicable for all entities will be first described, followed by additional standards applicable to specific entity types. These standards should be applied for data publication and distribution.

### 3.2.1. Generic Naming Standards

- Please refer to NRM Data Development Guidelines section [on Naming Conventions](#) for core recommendations.
- Name strings should include only:
  - Alphanumeric characters (letters and numbers)
  - An underscore character to separate words
- Name strings must not include:
  - Spaces, periods, dashes, or any other special characters.
- If abbreviations must be used, use standard abbreviations to indicate extent, such as Natural Resource District codes for example. If letters are to be removed to form an ad-hoc abbreviation, removal of vowels first is the preferred method.

### 3.2.2. GDB Naming Standards

- Generic standards apply (as described above)
- The name should be formed using a concatenation of:
  - General Descriptor (mandatory)
  - Spatial extent (optional) Eg. sir, dpc, 082g, bc

Examples:

watershed\_bc.gdb  
silviculture\_dpg.gdb  
wildlife\_sir.gdb  
trim\_082g.gdb

### 3.2.3. Feature Dataset Naming Standards

- Using feature datasets is optional depending on the purpose of the geodatabase (refer to [Geodatabase Structure](#) section).
- Generic standards apply.
- The name should be formed using a concatenation of:

- General Descriptor (mandatory)
- Projection (mandatory for non Albers) Eg. utm12, geo, alb

Examples:

water\_geo (geographic, which is unprojected)

fdp\_utm11 (UTM zone 11)

### 3.2.4. Feature Class Naming Standards

- Generic standards apply. See Data Publication and Services' guidelines on [Naming and Describing](#)
- No limit on length, however, keep in mind that for data that will eventually be published to the BCGW, a 30 character limit exists in that storage environment, and shorter names are generally easier to work with.
- Also, for data that will act as a staging area source for the BC Geographic Warehouse (BCGW), the feature class should be named in a consistent manner with the BCGW layer. See Data Publications and Services' guidelines on [Staging Area datasets](#)
- The name should be formed using a concatenation of:

Component	Description	Applicability	Domain Type	Examples
Subject Descriptor	The principle theme of the dataset	Mandatory	User specified	ungulate
Type Descriptor	A more specific type description.	Mandatory	User specified	winter_range
Status Descriptor	Dataset status.	Optional	Coded value	Proposed, draft, legal
Year	Year, or year range of data capture	Optional	Coded value or range	2003 2001_2007
Spatial Extent	Spatial extent code.	Optional	Coded value or user specified	sir, dmh, 082g
Feature Type	Feature geometry type.	Optional	Coded Value	Poly, line, point, anno, ras
Scale Descriptor	Data capture scale, divided by 1000 (=k), or 1,000,000 (=m).	Optional	Coded Value	20k, 50k, 250k, 2m,

Version	Dataset version, if multiple versions are present	Optional	Coded Value	V1, V2, V3, etc
---------	---	----------	-------------	-----------------

Examples:

Subject	Type	Status	Year	Extent	Feature Type	Scale	Version
ungulate	winter_range	draft	2006	kor		20k	
cadastre	ici		2007	dco			
watershed	boundary			nir		50k	

ungulate\_winter\_range\_draft\_2006\_kor\_20k

cadastre\_ici\_2007\_dco

watershed\_boundaries\_nir\_50k

#### Related Links:

[DataBC Data Publication Naming and Describing Standards](https://bcgov.github.io/data-publication/pages/dsg_naming_describing.html)

[https://bcgov.github.io/data-publication/pages/dsg\\_naming\\_describing.html](https://bcgov.github.io/data-publication/pages/dsg_naming_describing.html)

#### 3.2.5. Attribute Fields Naming Standards

- Field Names should be descriptive of the field content.
- Because Field Names are case sensitive they should maintain consistent case within a featureclass or between featureclasses in one gdb; e.g., [FOREST\_FILE\_ID], [NATURAL\_RESOURCE\_DISTRICT] or [Client\_Name], [Licensee]

### 3.3. Spatial Reference, Projection and Datum

As a standard, file geodatabase content should be created in BC's standard Albers projection, NAD83 datum ([EPSG: 3005](https://epsg.org/3005/)). The coordinate units should be meters and stored without offsets (i.e., in direct Albers projection coordinates). Because this projection goes by different names, for consistency, whenever possible, the projection file used should be named "NAD83 BC Environment Albers

For further information see:

- <http://spatialreference.org/ref/epsg/3005/>

Datum transformation between NAD 27 and NAD 83 must use the Canadian National Transformation version 2 (NTv2). To use the NTv2 grid shift matrix with ArcGIS the files need to be downloaded and installed (already done for BC Government terminal servers). These files can be downloaded from [ESRI Canada](https://esri.ca/). For more information on the NTv2 refer this webpage:

### 3.4. XY(and Z) Tolerance

XY Tolerance (and Z Tolerance), also referred to as Cluster Tolerance in some contexts, is the distance within which two vertices are considered to be coincident. XY tolerance is a property of feature classes and feature datasets. The XY tolerance of a feature dataset will be applied to all the feature classes stored within it. XY tolerance is applied during topology validation, buffering, overlay operations, and some editing operations to eliminate small errors in feature classes that could otherwise cause undershoots, overshoots, gaps and sliver polygons. When XY tolerance is applied, vertices within the XY tolerance of each other will be moved to the same location.

XY tolerance is not meant to generalize data but to eliminate errors. Too large an XY tolerance will generalize data, compromising its accuracy; while too small an XY tolerance can leave small undershoot and overshoot errors untouched and mean topological operations on coincident geometry will not work as planned. It is recommended to use an XY tolerance an order of magnitude smaller than the data's accuracy. If the data's collection accuracy is not known, the standard of 1/10<sup>th</sup> positional accuracy should be used. Positional accuracy is defined as the width of the smallest line visible on a map translated into map units. The smallest line visible on a map is about 0.05 mm. At a scale of 1:20,000 this translates to 1 meter (0.05 mm = 0.00005m; 0.00005m \* 20,000 = 1m). So, an acceptable XY tolerance for 1:20,000 scale data is 0.1 meters or 1/10<sup>th</sup> positional accuracy (1m / 10 = 0.1 m). When setting XY Tolerance for a feature dataset, use an appropriate tolerance for the most accurate data to be stored within it.

Table of appropriate XY Tolerance values by scale of data to be used as a guideline:

Map Scale	XY Tolerance
1:10,000	0.05 meters
1:20,000	0.1 meters
1:50,000	0.25 meters
1:100,000	0.5 meters
1:250,000	1.25 meters
1:500,000	2.5 meters
1:1,000,000	5 meters
1:2,000,000	10 meters



1:5,000,000	25 meters
1:10,000,000	50 meters

For submitting data as a source for a spatial database, best to refer to standards required for that particular infrastructure (e.g., BCGW)

[Step by Step Directions](#)

Esri Help: [X,Y Tolerance](#)

### 3.5. XY (and Z) Resolution

XY resolution (and Z resolution where there are Z coordinates) defines the numeric precision that coordinates are stored with (or the number of decimal places used to store coordinates). XY resolution is defined for feature classes and for feature datasets; however, a feature dataset will enforce its XY resolution on the feature classes stored within it. The default XY resolution is 0.0001 meters, translated into the units of the dataset.

For submitting data as a source for a spatial database, best to refer to standards required for that particular infrastructure (e.g., BCGW)

[Step by Step Directions](#)

Esri Help: [X, Y Resolution](#)

### 3.6. Configuration Keyword

The configuration keyword defines how data is stored in a geodatabase and can slightly improve performance for specific types of data. The default configuration keyword uses the UTF8 format for data storage. So that data storage is compatible with the BCGW and other Oracle databases, the default configuration keyword, 'DEFAULT', should be used. Other keywords optimize storage for text using non-Latin alphabet (TEXT\_UTF16), slightly improves storage for datasets less than 4 GBs (MAX\_FILE\_SIZE\_4GB), or allows for large raster files greater than 1 TB in size (MAX\_FILE\_SIZE\_256TB).

[Step by Step Directions](#)

### 3.7. File Geodatabase Fields

#### 3.7.1. Feature Codes

Some older BCGW-published datasets have a 10-character feature code. Where this is relevant to a feature class being published, include a character field called 'FEATURE\_CODE'. Values for the codes must be from the list referred to in [BC Geographic Feature Catalogue](#).

### 3.7.2. Unique Identifiers

- Consider adding a business key standard attribute; i.e., a unique identifier that is meaningful to the business. Also consider recommending GUIDS where a business key is not possible. The reason being that ESRI object IDs are recreated during overlay activities, thereby cutting the tie to original primary keys.
- Consider adding standard audit columns (or record-level metadata) to track when record-level changes were made, and by whom. For example, when toggled on in the Feature Class Properties dialog box, Esri's Editor Tracking enables the automatic tracking in user-specified fields: e.g., create\_date, create\_user, update\_date, update\_user

### 3.7.3. ORCS and ARCS

For features that have managed government records with ARCS or ORCS numbers associated with them, a field beginning with 'ARCS\_' or 'ORCS\_' populated with the ARCS or ORCS record number should be included.

- ARCS (Administrative Records Classification System) numbers are used for government wide record management.
- ORCS (Operational Records Classification System) numbers are used for ministry specific record management.

## 3.8. Field Indexing

Field indexes can increase the speed of attribute queries on feature classes and tables in a file geodatabase. Multiple indexes can be applied to different attribute fields of any table or feature class (unlike with shapefiles), however, at this point multicolumn indexes are not available for the file geodatabase.

Indexes can slightly slow down the speed of editing as for each edit the index is also updated. For this reason, indexes should only be set up once a feature class or table is ready to be used. Each index for a particular feature class or table must have a unique name.

Field indexes may be appropriate to implement when the following is true:

- The field is queried often.
- There are many records in the table.
- Most of the editing is complete.

[Step by Step Directions](#)

## 3.9. Spatial Indexing

Spatial indexes help ArcGIS to locate spatial features quickly when displaying, editing, and querying. ArcGIS spatial indexes for file geodatabases consist of a set of up to three grids that spatial features are indexed to. ArcGIS creates these grids automatically whenever a new feature class is created.

Spatial indexes may need to be recalculated for optimization if features are added to a feature class that are different in size from the features already in a feature class. They can be recalculated or set manually through a feature class's properties or through tools in the geoprocessing framework. Only in rare cases will significant performance enhancements be achieved by manually setting the spatial indexes. Generally, to ensure an optimal spatial index has been created, it is enough to get ArcGIS to recalculate the spatial index for a feature class. Spatial indexes should be recalculated when a feature class is complete and ready for publication.

[Step by Step Directions](#)

## 3.10. Data Integrity

### 3.10.1. Repairing Geometry

The '*Check Geometry*' and '*Repair Geometry*' tool must be run on all completed feature classes. This Check Geometry tool checks for geometric errors and reports them in a table stored in the geodatabase; and the Repair Geometry tool fixes geometric errors. Errors fixed by this tool include deleting null geometry, deleting short segments (too short for the spatial reference's units), reorienting incorrectly oriented internal and external rings of polygons, and intersecting where lines self-intersect. **Caution:** Repair Geometry modifies the input data (i.e., no output is created).

Data users or analysts that are confronted with issues or errors while running geoprocessing operations (e.g., overlays) should run 'Check Geometry' tool to rule out geometry errors. If errors are found by the tool, users can either a) run and validate topology rules, or b) run the 'Repair Geometry' tool, to attempt to correct the errors. **Caution:** Repair Geometry modifies the input data (i.e., no output is created).

[Step by Step Directions](#)

### 3.10.2. Topology (Spatial Data Integrity)

Topology is one tool to help maintain spatial data integrity. In a file geodatabase it is a collection of rules and relationships that, coupled with a set of editing tools and techniques, enables the geodatabase data to more accurately model geometric

relationships found in the world.

Topology in the file geodatabase is a separate element that resides inside a feature dataset and sets up rules to govern behaviour between features within feature classes, and between different feature classes that participate in the topology. A cluster tolerance is employed to shift geometry small distances to ensure that coincident geometry is indeed coincident so that spatial relationships between points, lines, and polygons can be tested and any errors found.

A topology element has the following properties:

- **A name:**  
Because a topology is its own element within a geodatabase, it needs to have a unique name.
- **Cluster Tolerance:**  
Similar to the XY tolerance, the cluster tolerance is applied when topology is validated. Feature parts within the cluster tolerance distance of each other will be assumed to be coincident and will be clustered together to reflect this (i.e., assigned a common coordinate value; in other words, they are co-located).
- **Participating Feature Classes:**  
A list of feature classes participating in the topology element.
- **Ranks of Feature Classes:**  
Each participating feature class has a rank referring to how trusted or accurate the data are. Lower ranked features will be snapped to higher ranked features and equally ranked features will be clustered together during the validation process.
- **Topology Rules:**  
Topology Rules define geometric relationships between features of a single feature class or between features of different feature classes. Rules can be exported to a .RUL file and imported to a new topology element. To simplify workflow, a standard set of rules can be saved to a .RUL file and imported into new topology elements.

Some general rules governing how topology elements are set up:

- Topology elements must reside within a feature dataset.
- All participating feature classes must reside within the same feature dataset as the topology element.
- A feature dataset may have many topology elements.
- Each topology element may have many participating feature classes with many rules applied to each feature class.
- Each feature class may participate in only one topology element.
- Subtypes of feature classes behave as feature classes within a topology element meaning each subtype may have different rules applied to it.

### **3.10.2.1. Topology Validation**

Topology validation first applies the cluster tolerance to the participating feature classes, shifting the geometry so that features are coincident, and then applies the topology rules to find errors. When the cluster tolerance is applied, equally ranked feature parts will be clustered together and lower ranked feature parts will be snapped to higher ranked feature parts.

**Caution:** Topology should only be validated in an ArcMap edit session so that it can be undone if it is discovered that the geometry shifts too much due to too large a cluster tolerance being employed. Topology validated in ArcCatalog can not be undone.

Once topology has been validated errors can be viewed and fixed or marked as exceptions within an ArcMap edit session using tools on the *Topology* toolbar.

### **3.10.2.2. Error Reporting**

Once a topology element has been validated a report of the errors and exceptions can be viewed through the topology element's properties on the '*Errors*' tab by pressing the '*Generate Summary*' button. This summary can be exported to a .txt file using the '*Export to File...*' button.

### **3.10.2.3. Topology Standards:**

The following standards for topology should be followed for all feature classes being published, shared, or received from contractors. In addition, when receiving data from contractors, a topology report CSV file should accompany the geodatabase named with the same name as the topology element. This report will allow quick review of what rules have been applied to what feature classes and where there are any exceptions to these rules (There should not be any errors in a completed dataset.).

#### **Cluster Tolerance:**

- Should be set to an appropriate scale for the data so that data is not shifted too much. The smallest cluster tolerance allowed is the XY tolerance of the feature dataset. In most cases this will be the appropriate cluster tolerance to use.

#### **Participating Feature Classes:**

- Only feature classes that have rules related to them should participate in the topology so that cluster tolerance is not applied and geometry shifted needlessly.

**Ranks:**

- When more than one feature class is participating in the topology element, more accurate or trusted datasets should be higher ranks (lower numbers) than less accurate and less trusted data.

**Rules:**

What rules to apply will depend on what the data is modelling and how its features spatially relate to each other and to features in other feature classes. Listed below are common rules that will apply to most datasets. There will be times when additional rules will need to be applied when these rules are not appropriate.

**Polygons:**

- *Must not overlap*
- *Must not have gaps* (The exterior boundary line work will always be an exception when this rule is applied. The idea is to not have 'holes' in the data but, by design, the rule will flag as errors wherever features are not coincident with other features.)
- *Must be covered by feature class of* – to be applied with a project boundary feature class to make sure features fall within the project area.

**Lines:**

- *Must not have pseudonodes* – to remove needless nodes and merge together lines
- *Must not self intersect* – to guard against small digitizing errors
- *Must not self overlap* – to guard against small digitizing errors
- *Must be inside* – to be applied with a project boundary feature class to make sure features fall within the project area.

**Points:**

- *Must be properly inside polygons* - to be applied with a project boundary feature class to make sure features fall within the project area

[Step by Step Directions](#)

### **3.10.3.Attribute Domains (Attribute Data Integrity)**

Attribute domains define rules for attribute value behaviour and are used to enforce attribute data integrity. They help to ensure data is entered correctly the first time and enable attribute value validation.

There are two types of domains: Coded and Range.

- Coded value domains define a list of valid values (along with descriptions of these values). During editing, fields with coded value domains applied to

them will have a drop-down list of values to pick from preventing the user from mis-typing entries.

- Range domains define valid ranges for numeric and date fields.

Both range and coded value domains can be validated (checked for errors) in ArcMap using either the '*Data Reviewer*' extension or in an edit session using the '*Validate Features*' command found on the '*Editor*' pull-down menu on the '*Editor*' toolbar. Even with domains applied to fields it is possible to enter incorrect values when using the '*Calculate Field*' tool, and so all fields with domains should be validated using the '*Validate Features*' command.

### Attribute Domain Standards

- Whenever fields have specific values or should be confined to a range of values, domains must be implemented to improve consistency of data entry and to enable the values to be validated.
- When data is being edited by a third party, domains must to be applied to specified fields to ensure data is consistently entered and can be checked. Tables of defined domain values can be provided so they can be imported to domains using the '*Table to Domain*' geoprocessing tool.

[Step by Step Directions](#)

## 3.11. Metadata

Every FGDB created in ArcCatalog will contain basic information on the '*Description*' viewing tab. It is important to add pertinent information about your data using the editor provided and should contain other mandatory fields and recommended standard fields. See table below for mandatory and recommended fields.

The default metadata style for ArcGIS ("Item Description") does not have the required fields to capture key information. To be consistent with national standards, metadata should be entered using the "North American Profile of ISO19115 2003" metadata standard, which the BC Data Catalogue metadata is also based on.

Mandatory Criteria (for Corporate Metadata)	Description	ArcCatalog Metadata XML Editor Location
Title	Title of Dataset	Overview section -> Item Description page -> Title text box
Description	One or two sentences describing the dataset.	Overview section -> Item Description page -> Description box

Data Custodian Organisation	The data owner organization.	Overview section -> <i>Citation Contacts</i> page -> <i>New Contact / Contact</i> ; Complete the <i>Organization</i> text box <u>and</u> mark <i>Role</i> as 'Custodian'
Dates (Creation, Publication, Revision)	Dates data created, published, revised.	Overview section -> <i>Citation</i> page -> <i>Dates</i>
Resource Status	Complete, In Progress, etc.	Resource section -> <i>Details</i> page -> <i>New Status / Status</i>
Update Cycle	How often is this dataset updated? Or when will it be updated next?	Resource section -> <i>Maintenance</i> page -> <i>Update Frequency; Next Update</i>
Purpose	Intended Use of the Data.	Overview section -> <i>Item Description</i> page -> <i>Summary</i> text box
Contact Information / Role	Point of contact. Custodians delegates with business knowledge.	Resource section -> <i>Points of Contact</i> page
Use Limitations	Limitations affecting the fitness of the use of the data. (ex. "Not for Navigation")	Overview section -> <i>Item Description</i> page -> <i>New Use Limitations / Use Limitations</i> text box
Security Classification	Is this data restricted to certain people?	Resource section -> <i>Constraints</i> page -> <i>New Security Constraints / Security Constraints</i> Classification pull-down menu: <i>Unclassified</i> = general access <i>Restricted</i> = government only Use <i>New Use Limitations / Use Limitations</i> text box for additional constraints on access and use.
<b>Recommended Criteria</b>		
Data Distribution Instructions	Instructions on how to obtain the data.	Resource section -> <i>Distribution</i> page -> <i>New Distributor / Distributor</i> -> <i>New Ordering Process / Ordering Process</i>
Data's Scale	The scale the data is meant to be viewed at.	Resource section -> <i>Details</i> page -> <i>Scale Resolution</i>
Data Completeness	How complete is the data	Overview section -> <i>Item Description</i> page -> <i>New Use Limitation / Use Limitation</i>
Data Accuracy	Spatial accuracy of the dataset including Scale.	Overview section -> <i>Item Description</i> page -> <i>New Use Limitation / Use Limitation</i>
Spatial Reference	The Projection and Datum	Resource section -> <i>Spatial Reference</i> page (automatically filled in)
Geographic Extent	Extent of the dataset.	Resource section -> <i>Extent</i> page -> <i>Extent -&gt; Bounding Box</i> (automatically filled in)
History of Data	How the data came to be. For each process step to create the data, what was done and who did it.	Resource section -> <i>Lineage</i> page -> <i>New Process Step / Process Step</i>
Attribute Domain Explanations	An explanation of each attribute and its corresponding values.	Resource section -> <i>Fields</i> page -> expand attribute list & attribute properties -> use <i>Enumerated Domain</i> or <i>Range Domain</i> options.



Reference to Data Dictionary	Any reference to data dictionaries for this dataset.	<i>Resource section -&gt; Details page -&gt; Supplemental Information text box</i>
Other Relevant Information	Any other relevant information.	<i>Resource section -&gt; Details page -&gt; Supplemental Information text box</i>

[Step by Step Directions](#)

## 3.12. Compacting File Geodatabases

Geodatabases should be compacted once editing operations are complete.

As features are added and deleted from feature classes, geodatabases become fragmented on disk, causing a decrease in performance due to the larger file size and the increase in record-seeking operations when using the data. Compacting a geodatabase re-orders records and eliminates free space, reducing the size of the geodatabase and increasing performance of processing.

[Step by Step Directions](#)

## 3.13. Compressing Data

Feature classes should be compressed once they are in a complete or publishable state.

Unlike compacting a geodatabase, where data is re-ordered to be more efficiently stored on the server, compressing a geodatabase applies an algorithm to vector and table data to reduce redundancy for more efficient storage. Compression varies from dataset to dataset but on average, a compressed dataset is about ½ its uncompressed size.

A compressed geodatabase is in a read-only state. Apart from editing the name, attribute indexes, and metadata, no editing is permitted. Compressed data, however, can continue to be viewed and used. Compression/uncompression can be applied to the contents of an entire FGDB, to the contents of a feature dataset, or to individual feature classes or tables. Feature datasets and their contents are compressed or uncompressed as a single entity - feature classes within a feature dataset cannot be compressed or uncompressed individually. Furthermore, compressed feature classes cannot be added to topology elements.

Compressed feature classes and tables dataset will display '(compressed)' in the 'Type' field of ArcCatalog when viewing geodatabase contents. The compression state of a feature class or table is also listed on the 'General' tab of its properties window in ArcCatalog.

[Step by Step Directions](#)

## 4. Tools for Implementing the File Geodatabase Standards

Tools have been developed to automate the application of the file geodatabase standards so that, wherever possible, tasks that can be automated, have been. Section 4.1 gives an overview of the current geodatabase standards tools. Section 4.2 explains how to access these tools and their help documentation.

### 4.1. Tools Overview

#### 4.1.1. Checking/Reporting Tool

This tool inventories the contents of a file geodatabase and reports out into a text file a summary of the entities and their properties. The output report consists of two sections. The first section contains a concise summary of the entities found within the geodatabase. The second section contains detailed information about each entity.

#### 4.1.2. Create New File Geodatabase with Feature Dataset Tool

The Create New File Geodatabase tool is a shortcut to create a new FGDB with a feature dataset in the BC Albers projection and the specified XY tolerance. If the geodatabase already exists, the script will continue and create the new feature dataset within it.

#### 4.1.3. Apply Default Topology Tool

The Apply Default Topology tool creates a new topology element in the indicated feature dataset, applies the standard generic topology rules to the selected feature classes, and optionally validates the topology to find errors.

Users may wish to edit the topology element afterwards to apply additional more specific topology rules.

#### 4.1.4. FGDB Project Close-out Tool

The FGDB Project Close-out tool is used to close-out a FGDB once a project is complete. It compacts the geodatabase, compresses the geodatabase, re-calculates the spatial indexes of feature classes, runs the Check Geometry command, and (optionally) runs the Repair Geometry command.

#### 4.1.5. FGDB Publication/Distribution Tool

The Publication and Distribution tool prepares individual feature classes for publication and/or distribution by copying them to their own geodatabases that conform to the publication standards. The tool puts selected feature classes each in their own FGDB named the same as the feature class name, compresses the new FGDB, and (optionally) zips the FGDB giving it a name <FGDB name>.zip.

## 4.2. Accessing and Using FGDB Standards Tools

Internal government users can access the FGDB Standards tools through the Script Warehouse (See section [4.2.1](#)). Users outside of the BC government can access these tools through the data distribution service (See section [4.2.2](#)).

There are two versions of the tools and toolboxes. One was created for ArcGIS 9.2 and the other updated for ArcGIS 10.0. The 10.0 updated tools were re-written to use the arcpy site package and includes an additional default topology rule in the *Apply Default Topology* tool that was new in ArcGIS 10.0. The 9.2 tools will work in ArcGIS 9.2 and newer releases. The ArcGIS 10.0 tools will work in ArcGIS 10.0 and newer releases.

### 4.2.1. Internal government employees working on the GIS Terminal Server (GTS)

The File Geodatabase Standards Tools are located in the Script Warehouse:

[P:\corp\script\\_whse\python\Utility\\_Misc\Published\FGDBStandardsTools\](P:\corp\script_whse\python\Utility_Misc\Published\FGDBStandardsTools\)

If the P: drive is not already mapped it should be mapped as:

[\\giswhse.env.gov.bc.ca\whse\\_np](\\giswhse.env.gov.bc.ca\whse_np)

The tools are also available for download from Github:

<https://github.com/bcgov/FGDB-Standards-Tools>

Each tool and their required scripts are located in individual folders. The master toolbox, FGDBStandardsTools.tbx, contains script tools to run all the File Geodatabase Standards Tools. See section [4.2.3](#) and [4.2.5](#) below for instructions on how to add these tools to ArcToolbox and how to access their help documentation.

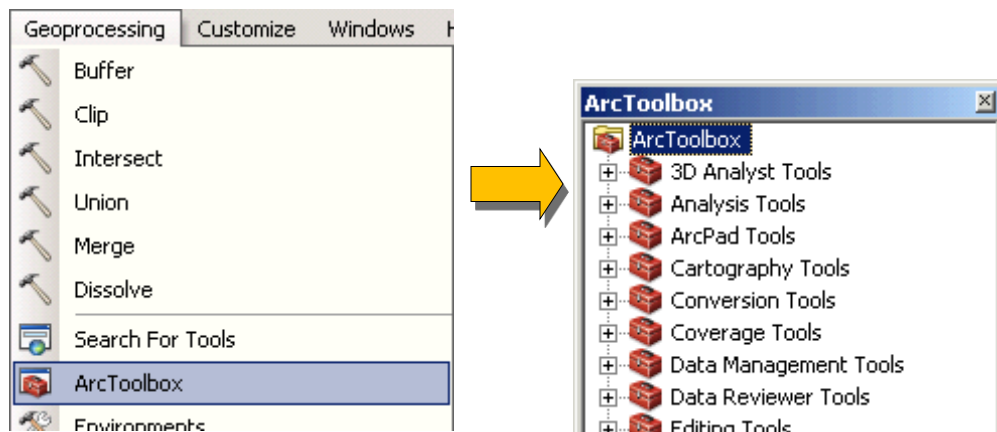
### 4.2.2. Outside of Government

For those outside of the BC government networks, the File Geodatabase Standards Tools can be downloaded from Github:

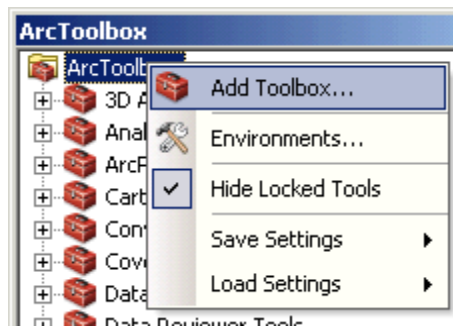
<https://github.com/bcgov/FGDB-Standards-Tools>

### 4.2.3. Adding the FGDB Standards Toolbox to ArcToolbox

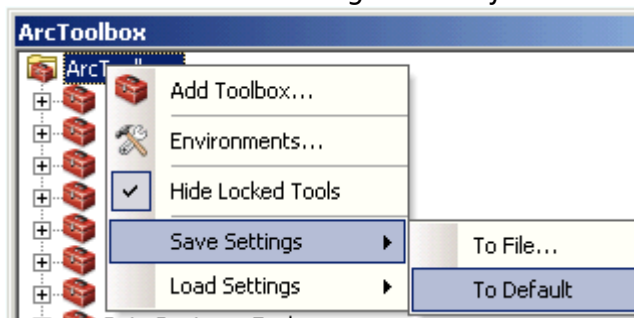
- 1) Open ArcToolbox
  - In ArcCatalog or ArcMap open ArcToolbox:
    - *Geoprocessing* menu -> *ArcToolbox*



- 2) Add the FGDBStandardsTools toolbox into ArcToolbox
  - Drag and drop the 'FGDBStandardsTools' toolbox into ArcToolbox
  - OR Right-click in ArcToolbox -> Add Toolbox...



- 3) Save Settings to 'Default'
- So that the new toolbox will be in ArcToolbox in other ArcGIS applications when they are opened, we must save our Environment Settings to 'Default':
- Right-click in ArcToolbox -> Save Settings -> To Default



#### 4.2.4. Executing FGDB Standards Tools

Execute the FGDB standards tools as you would any other system ArcGIS tool:

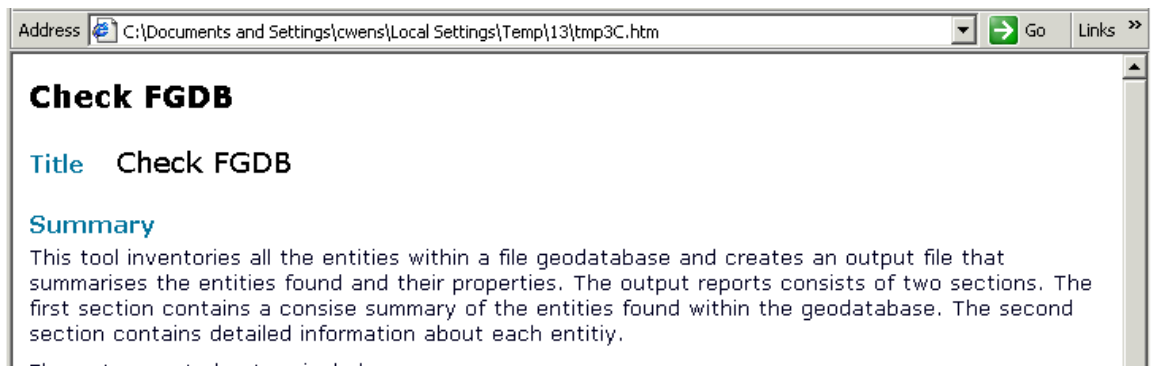
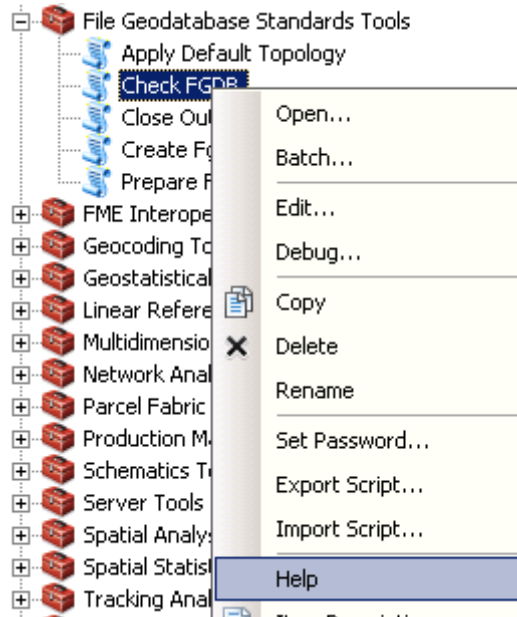
- Double-click on the tool in ArcToolbox and complete the dialog box.

#### 4.2.5. Accessing Help Documentation

### From ArcToolbox:

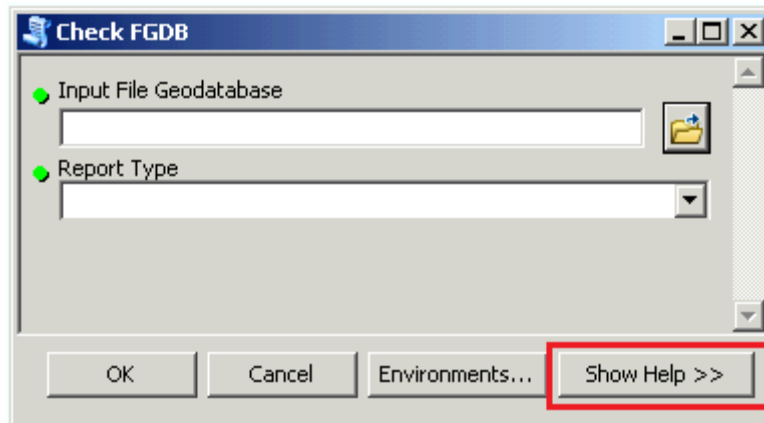
An HTML page of full tool documentation for each tool is available through ArcToolbox.

- *ArcToolbox -> right-click on tool -> Help*

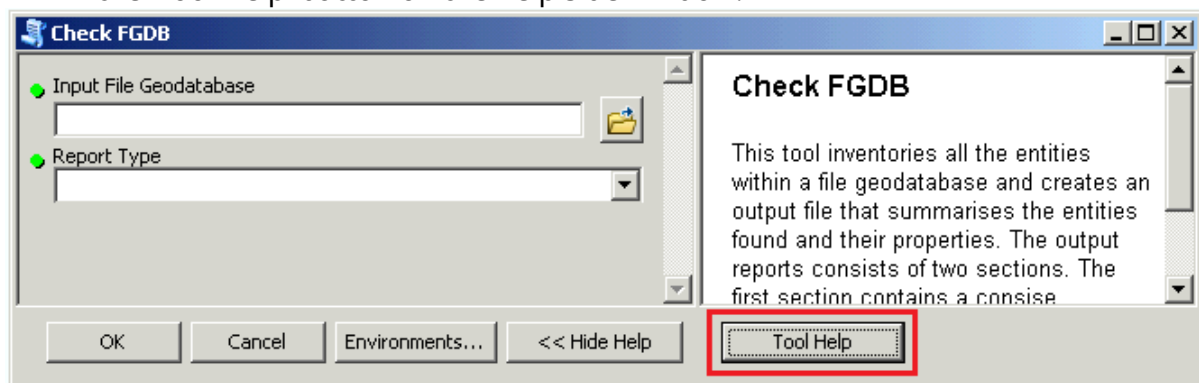


### From the Tool Dialog box:

- Tool documentation from the tool dialog box is available for individual parameters in a side window through the 'Show Help >>' button.



- The complete Help documentation HTML page can be brought up through the 'Tool Help' button on the help side window.



## 5. Applying File Geodatabase Standards – Step by Step Directions

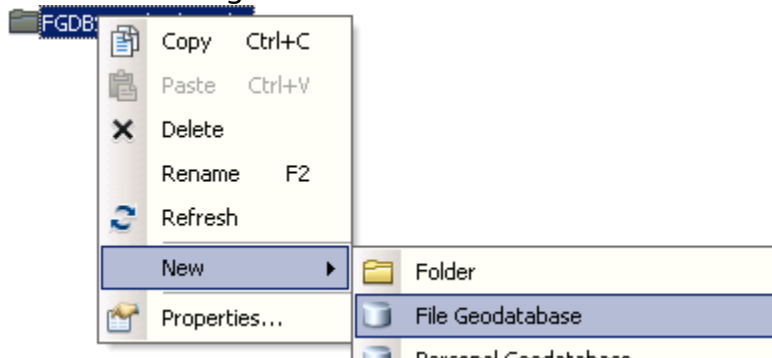
5.1.	Creating a New Feature Class or Feature Dataset .....	31
5.1.1.	Defining Projection to the PCS_Albers Projection .....	33
5.1.2.	XY Tolerance and Resolution.....	33
5.1.3.	Configuration Keyword.....	34
5.2.	Indexing Fields .....	34
5.3.	Optimizing the Spatial Index.....	37
5.4.	Repairing Geometry.....	38
5.5.	Creating and Applying Topology .....	38
5.5.1.	Creating a Topology Element.....	38
5.5.2.	Validating Topology .....	44
5.5.3.	Finding and Fixing Topology Errors .....	45
5.5.4.	Reporting out from Topology .....	48
5.6.	Creating and Applying Attribute Domains.....	49
5.6.1.	Creating a Domain .....	49
5.6.2.	Applying a Domain.....	52
5.6.3.	Editing with a Domain.....	53
5.6.4.	Checking for Attribute Errors.....	53
5.7.	Creating Metadata .....	55
5.8.	Compacting a Geodatabase .....	57
5.9.	Compressing a Geodatabase .....	57

### 5.1. Creating a New Feature Class or Feature Dataset

Geodatabases are created either through right-clicking in ArcCatalog or through geoprocessing tools.

Before a feature class or feature dataset can be made, there must first be a geodatabase for it to exist in. **To create a new FGDB:**

- *Right-click in ArcCatalog -> New -> File Geodatabase*



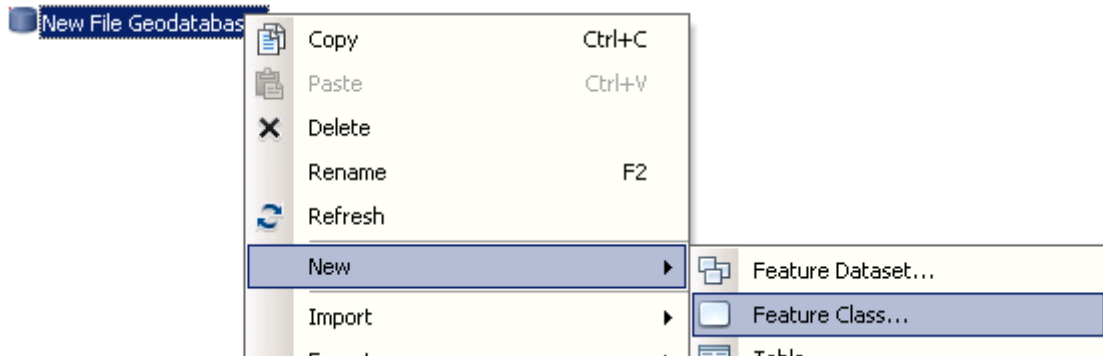
- Give the new File Geodatabase a name.



A file geodatabase can also be created using the 'Create File GDB' geoprocessing tool located in the 'Data Management Tools' toolbox and 'Workspace' toolset.

**To create a new feature dataset or feature class:**

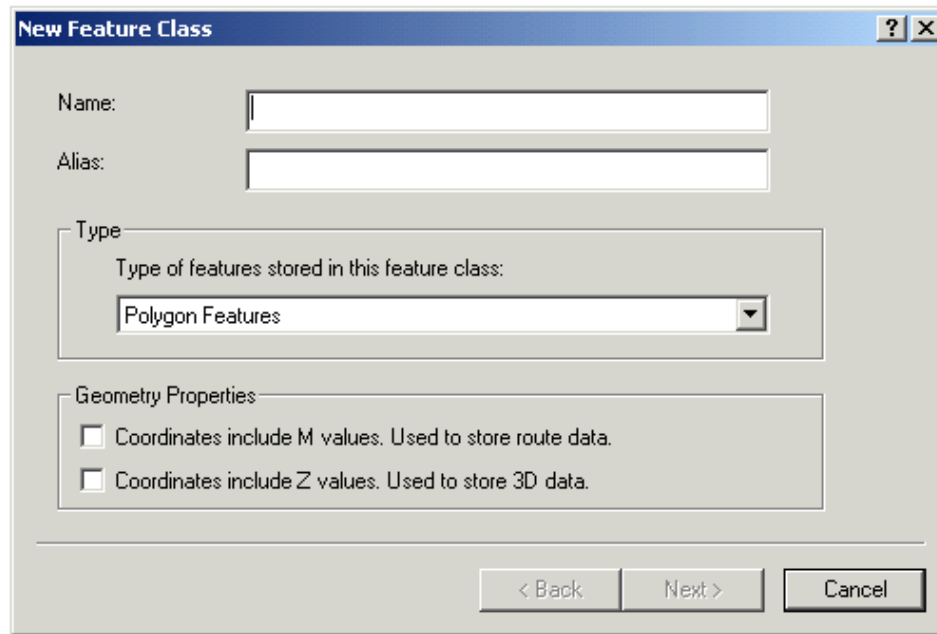
- *Right-click* on the new file geodatabase -> *New -> Feature Dataset... or Feature Class...*



For **Feature Datasets** the 'New Feature Dataset' wizard will appear. This wizard will prompt you for a name for the feature dataset, the [coordinate system](#), and the [XY Tolerance](#). Follow sections 5.1.1 and 5.1.2 below for directions on filling out each of these criteria.

For **Feature Classes** the 'New Feature Class' wizard will appear. The first screen of this wizard prompts for a name for the feature class, its geometry type (point, line, polygon, etc.), and whether it has M values and Z values. The next tabs help define the [coordinate system](#), the [XY Tolerance and Resolution](#), and the [Configuration Keyword](#). See sections 5.1.1 to 5.1.3 below for directions through these tabs.





A feature dataset or feature class can also be created using the 'Create Feature Dataset' geoprocessing tool located in the 'Data Management Tools' toolbox and the 'Workspace' toolset and the 'Create Feature Class' geoprocessing tool located in the 'Data Management Tools' toolbox and the 'Feature Class' toolset.

#### 5.1.1. Defining Projection to the NAD 1983 BC Environment Albers ("BC Albers") Projection

If working on the internal government terminal server use ESRI's "NAD 1983 BC Environment Albers" projection file which is the exact same except for name. This project file can also be downloaded from <http://spatialreference.org/ref/epsg/3005/>.

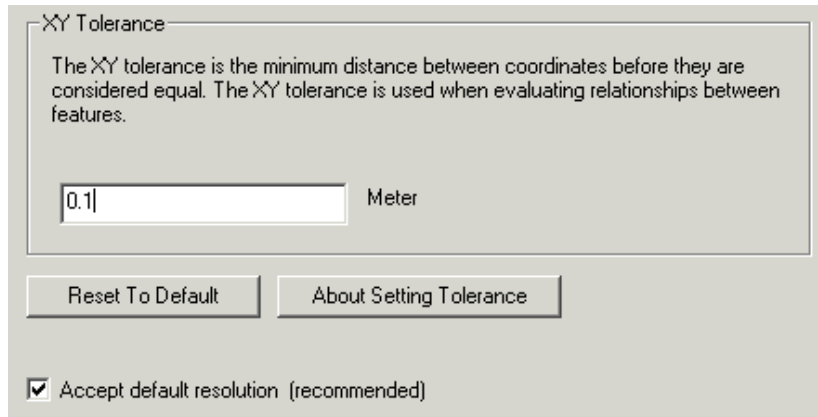
Historically, "PCS\_Albers" was used prior to 2014 in some cases, and has the same definition as BC Albers. However, best practice is to upgrade the projection definition to BC Albers.

[Back to Standards Section](#)

#### 5.1.2. XY Tolerance and Resolution

The *XY Tolerance* and *Resolution* tab on the 'New Feature Dataset' or 'New Feature Class' wizard prompts the user to define the XY tolerance and resolution. Both of these settings can only be set when first creating the geodatabase element - they cannot be edited once created.

The XY tolerance should be appropriate for the scale of the data. See the [standards](#) section for details. The default resolution should be accepted.



**XY Tolerance**

The XY tolerance is the minimum distance between coordinates before they are considered equal. The XY tolerance is used when evaluating relationships between features.

0.1 Meter

Reset To Default    About Setting Tolerance

☒ Accept default resolution (recommended)

More help available from Esri's help section:

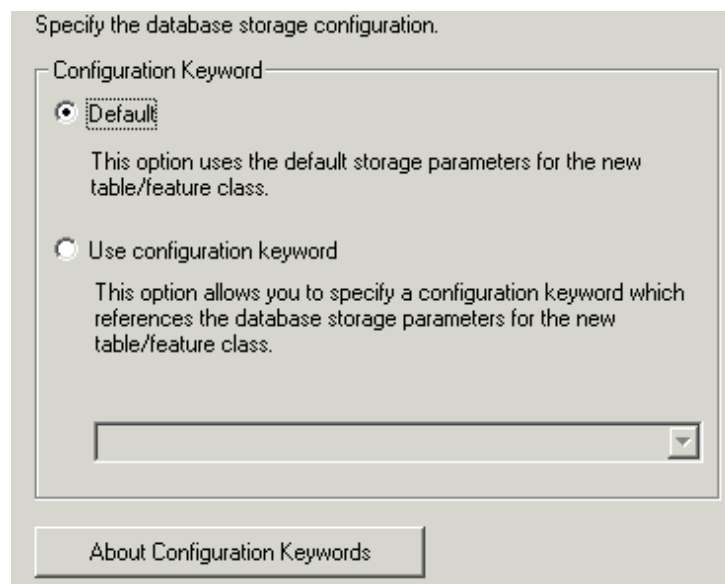
<https://desktop.arcgis.com/en/arcmap/latest/tools/environments/xy-tolerance.htm>

[Back to Standards Section](#)

### 5.1.3. Configuration Keyword

The *Configuration Keyword* tab on the 'New Feature Class' wizard prompts the user to define the configuration keyword which defines how character data is stored in the database. This setting cannot be changed once it is set.

The default configuration keyword is recommended. See the [standards](#) section for details.



Specify the database storage configuration.

**Configuration Keyword**

☒ Default

This option uses the default storage parameters for the new table/feature class.

☐ Use configuration keyword

This option allows you to specify a configuration keyword which references the database storage parameters for the new table/feature class.

[Empty text box with dropdown arrow]

About Configuration Keywords

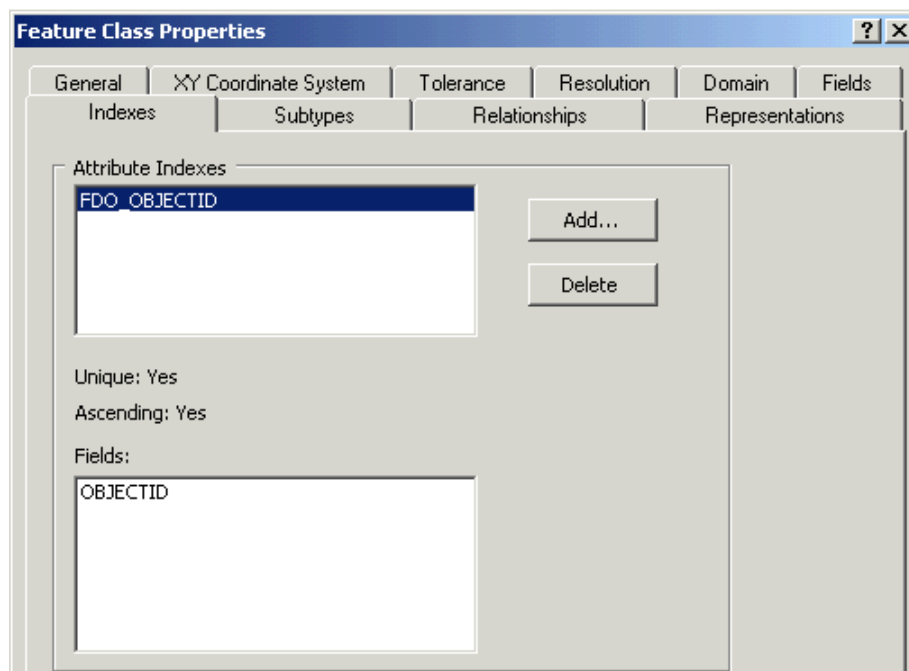
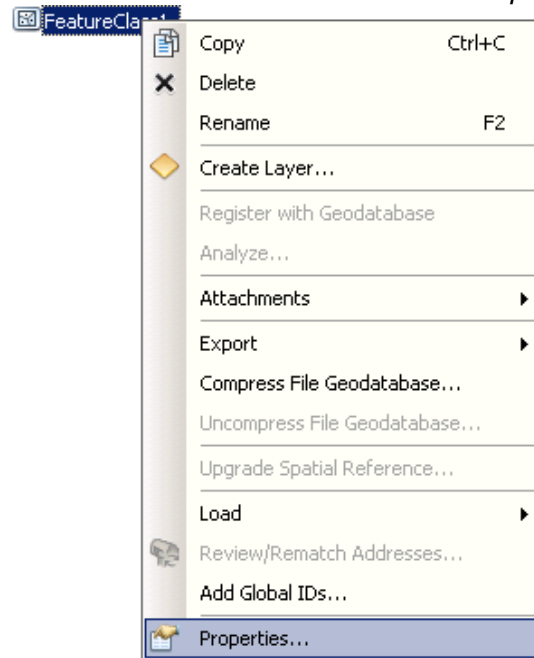
[Back to Standards Section](#)

## 5.2. Indexing Fields

Field indexes are created and deleted through a feature class's or table's properties or by using geoprocessing tools.

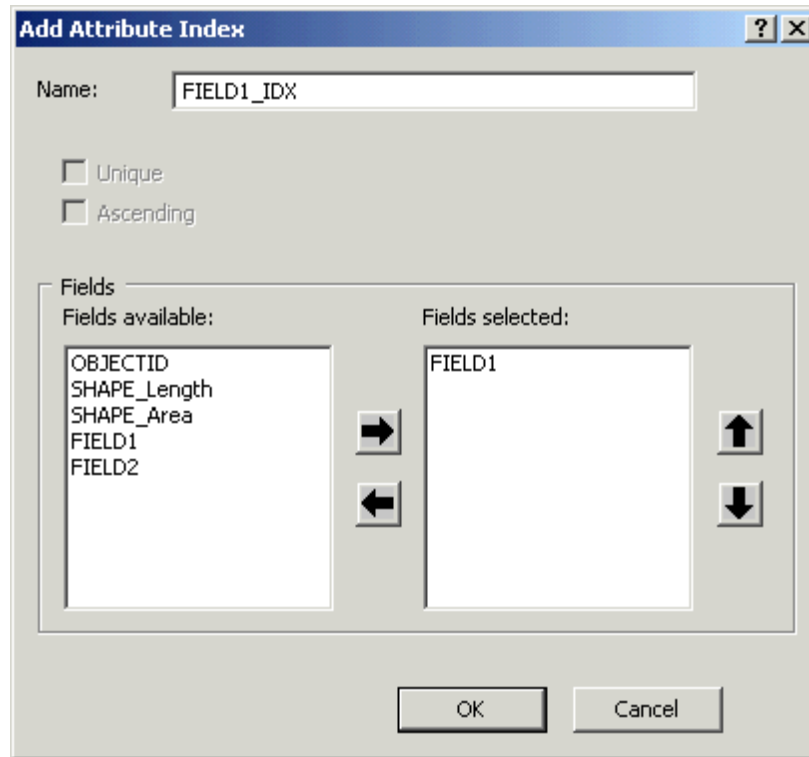
Using **ArcCatalog**:

1. Go into the properties for a feature class or table to the *Indexes* tab.
  - Right-click on the feature class or table -> *Properties...* -> *Indexes* tab



Existing indexes are listed in the *Attribute Indexes* box and their properties below.

2. Press the 'Add...' button to add an attribute index.
3. In the 'Add Attribute Index' window:
  - Give the index a name
  - Select the field to index and use the arrow to move it to the 'Fields Selected' box.



**Note:** With file geodatabases there are no unique or ascending indexes or multi-field indexes. Only a single field should be in the 'Fields Selected' box.

4. Press the 'OK' to accept the index properties.
5. Press 'OK' to create the index and close the properties window or 'Apply' to create the index but leave properties open.

An index can be deleted from the 'Indexes' tab of the properties window by highlighting the index in the 'Attribute Indexes' window and pressing the 'Delete' button.

#### Using **geoprocessing tools**:

Use the 'Add Attribute Index' and 'Remove Attribute Index' geoprocessing tools to manage attribute indexes. These tools are found in the 'Indexes' toolset within the 'Data Management Tools' toolbox.

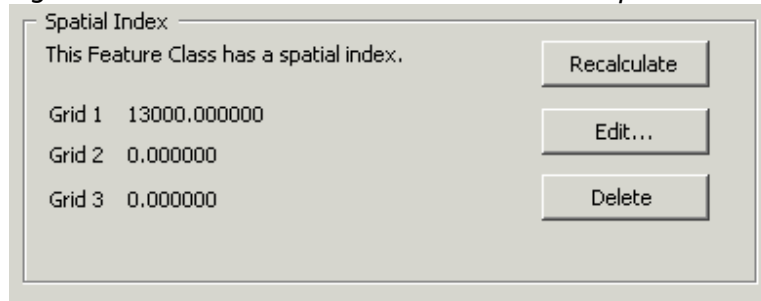
[Back to Standards Section](#)

### 5.3. Optimizing the Spatial Index

Spatial indexes can be recalculated/optimized either through a feature class's properties in ArcCatalog or using geoprocessing tools.

Through **ArcCatalog**:

1. Go into the properties for a feature class to the 'Indexes' tab.
  - *Right-click* on the feature class or table -> *Properties...* -> *Indexes* tab



The 'Spatial Index' box is at the bottom of the 'Indexes' tab.

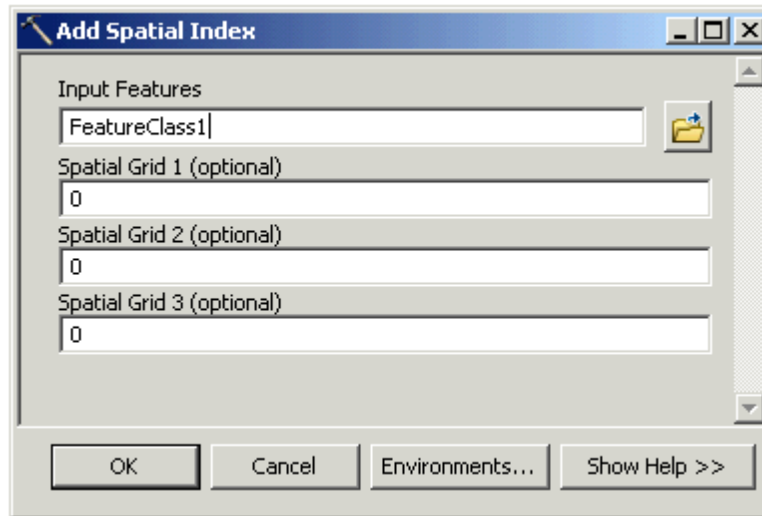
2. The 'Spatial Index' box has three buttons:
  - Use the 'Recalculate' button to recalculate the spatial index.
  - Use the 'Edit...' button to manually edit the spatial index.
  - Use the 'Delete' button to remove the spatial index.

Recalculating the spatial index is sufficient for optimizing a feature classes spatial reference.

3. Press 'OK' to save changes and close the properties window.

To optimize (recalculate) the spatial index through the **geoprocessing framework**:

- Run the 'Add Spatial Index' tool (in the 'Indexes' toolset within the 'Data Management Tools' toolbox) on the feature class with '0' (Zero) selected for the three 'Spatial Grid' parameters.



[Back to Standards Section](#)

## 5.4. Repairing Geometry

The two tools available to help identify and repair geometry errors are located in the 'Features' toolset within the 'Data Management Tools' toolbox. The **Check Geometry** tool checks the geometry of one or more feature classes and produces an output table summarizing errors found. The **Repair Geometry** tool finds and repairs geometry of a single feature class.

To repair geometry of a feature class:

1. Run the 'Check Geometry' tool if you desire to have a record of what errors there are (if any).
2. Run the 'Repair Geometry' tool to find and repair geometry errors.

[Back to Standards Section](#)

## 5.5. Creating and Applying Topology

Topology elements are used to help model spatial relationships within a feature class or between feature classes. Once a topology element is defined, data can be validated for specific spatial relationships and errors can be found and fixed.

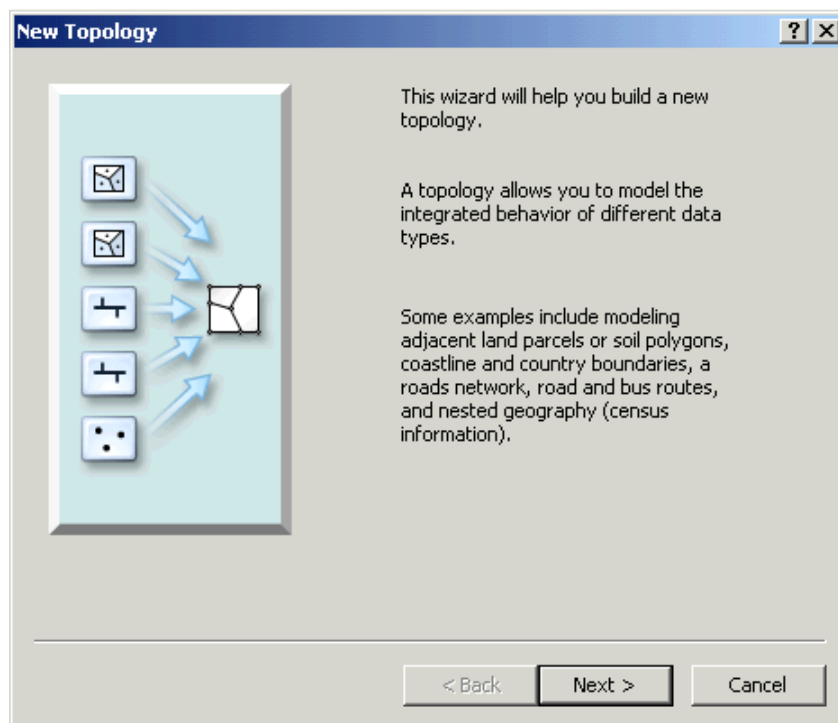
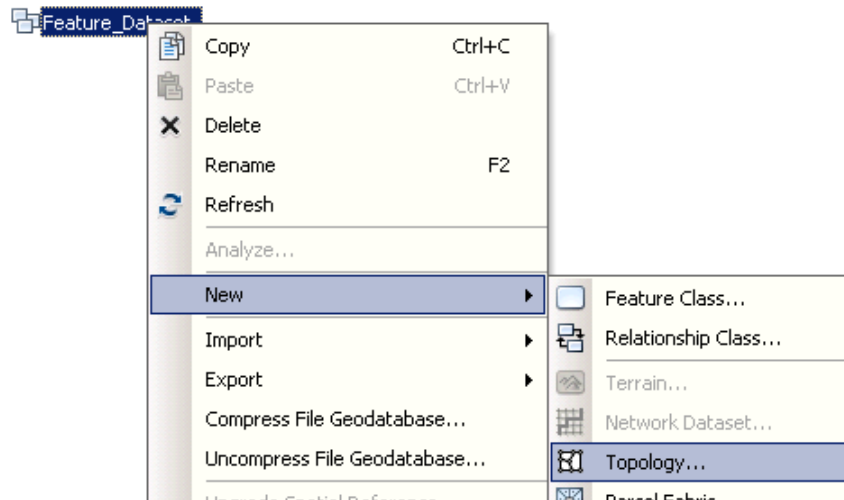
**Note:** Creating and applying topology elements requires "Standard" or "Advanced" licensing level of ArcGIS. Topology cannot be created using the "Basic" licensing level of ArcGIS.

### 5.5.1. Creating a Topology Element

Topology elements are created within a feature dataset and used to apply rules to feature classes within the same feature dataset. Topology elements can be created using [ArcCatalog](#) or using [geoprocessing tools](#).

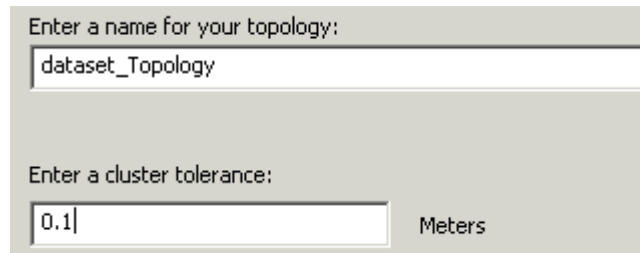
To create a topology element using **ArcCatalog**:

1. Open up the 'New Topology' Wizard by *right-clicking* on a feature dataset -> *New -> Topology...*



2. Give the topology element a name and a cluster tolerance:
  - Press 'Next' to go to the wizard screen for entering the name and cluster tolerance.
  - Give the topology element a name that will be unique within the file geodatabase.

- Give the topology element an appropriate cluster tolerance for the feature classes that rules will be defined for (usually based on the most accurate participating feature class).



Enter a name for your topology:  
dataset\_Topology

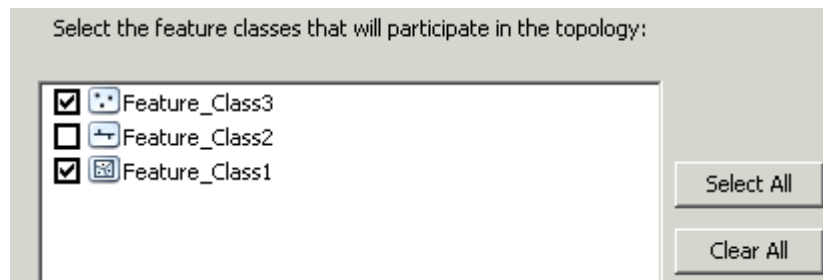
Enter a cluster tolerance:  
0.1 Meters

**Note:** The cluster tolerance cannot be smaller than the XY tolerance of the feature dataset it is within. See the [XY tolerance](#) standards section for guidelines on defining the cluster tolerance.

- Press 'Next' to go on to the next wizard window.

### 3. Identify participating feature classes:

- Choose feature classes to participate in the topology element from the list of available feature classes in the feature dataset.



Select the feature classes that will participate in the topology:

<input checked="" type="checkbox"/>		Feature_Class3
<input type="checkbox"/>		Feature_Class2
<input checked="" type="checkbox"/>		Feature_Class1

Select All  
Clear All

**Note:** Only feature classes not already participating in a topology element will be listed. Feature classes can only participate in a single topology element.

- Press 'Next' to go on to the next wizard window.

### 4. Define the ranks of the participating feature classes:

- Enter the number or ranks (up to 50).
- In the table enter the rank of each participating feature class.



Enter the number of ranks (1-50):

Specify the rank for a feature class by clicking in the Rank column:

Feature Class	Rank
<input checked="" type="checkbox"/> Feature_Class3	2
<input checked="" type="checkbox"/> Feature_Class1	1

**Note:** Lower ranked features (Higher number) will be shifted to higher ranked features (Lower number). Feature classes may be assigned the same rank. Equally ranked features will be moved to an average location.

- Press 'Next' to go on to the next wizard window.

##### 5. Specify the rules of the topology:

**New Topology**

Specify the rules for the topology:

Feature Class	Rule	Feature Class
---------------	------	---------------

- Press the 'Add Rule...' button to bring up the 'Add Rule' window for adding a new rule.


**Add Rule**

Features of feature class:


Rule:

Feature class:

**Rule Description**



An area must not overlap another area from the same layer.



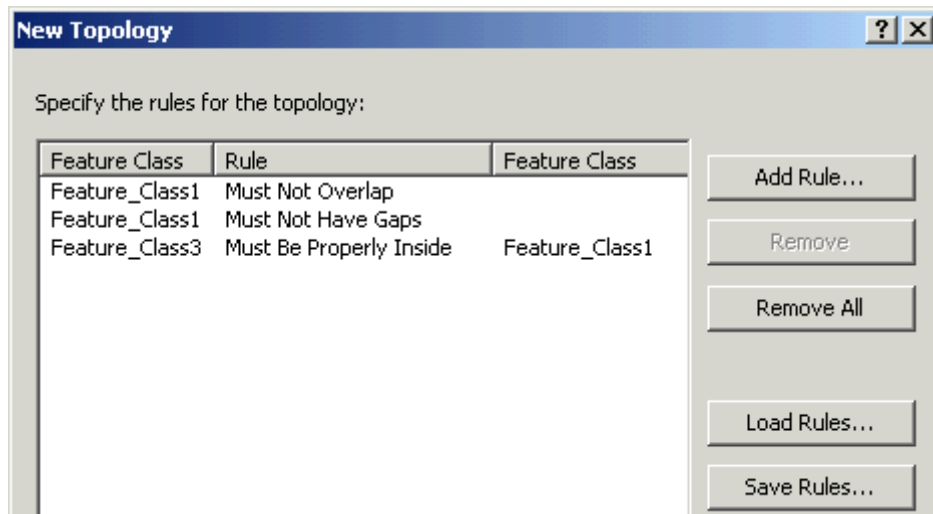
Any area where features overlap is an error.

☒ Show Errors

- In the 'Add Rule' window select the rules and feature classes to apply them to. The 'Rule Description' box explains the rules both textually and visually.

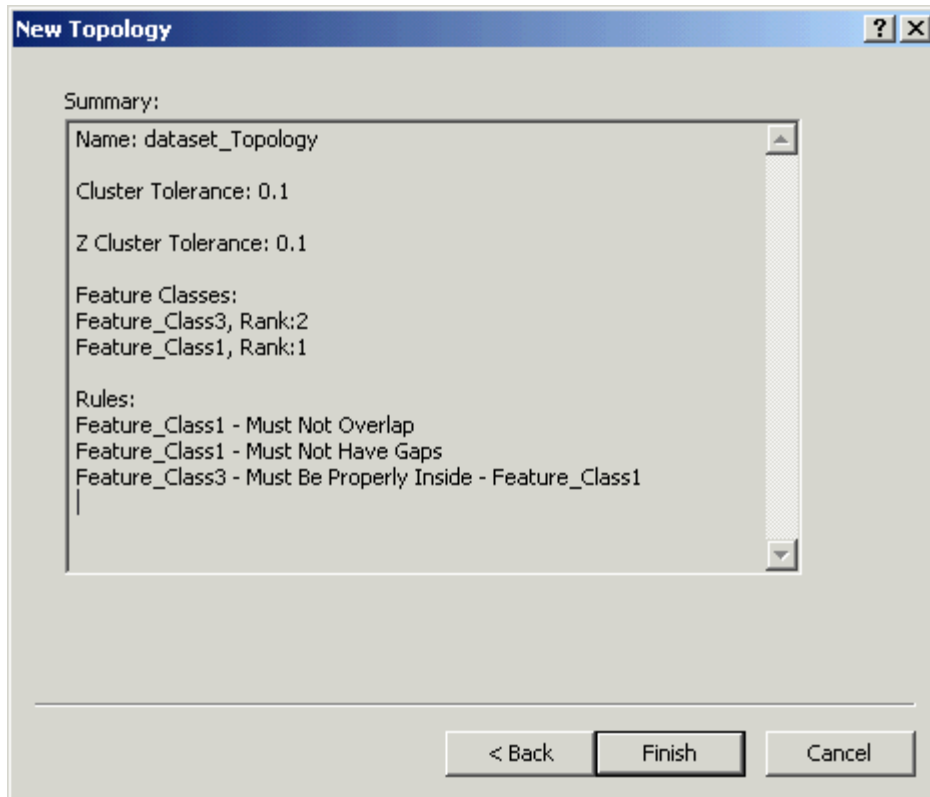
**Note:** Refer to the [ArcGIS Geodatabase Topology Rules](http://resources.arcgis.com/en/help/main/10.1/01mm/pdf/topology_rules_poster.pdf) poster for further details on what rules exist and how they are applied:  
[http://resources.arcgis.com/en/help/main/10.1/01mm/pdf/topology\\_rules\\_poster.pdf](http://resources.arcgis.com/en/help/main/10.1/01mm/pdf/topology_rules_poster.pdf)

- Press 'OK' to add the rule.
- Use the 'Add Rule...' button to continue adding more rules or the 'Remove' and 'Remove All' buttons to remove rules.
- The 'Load Rules...' and 'Save Rules...' buttons are used to export a set of rules to a .RUL file or to import in rules from a .RUL file.



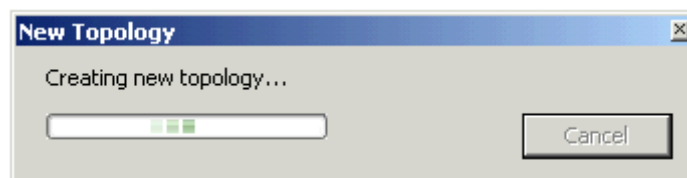
- Press 'Next' to go on to the next 'Summary' wizard window.

6. Finish completing the topology element:

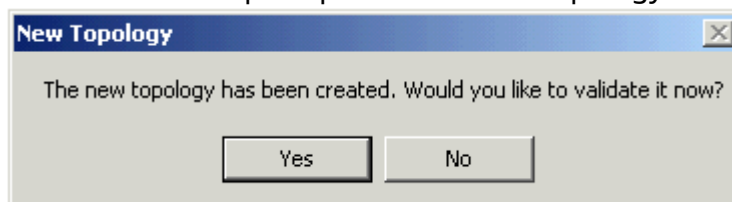


The last window of the 'New Topology' wizard summarizes the properties defined for the new topology element.

- Press 'Finish' to complete the topology element.



- Choose 'No' when prompted to validate topology.



**Note:** Topology validated in ArcCatalog cannot be undone. It is safer to validate topology in an ArcMap edit session where the validation can be undone.

To create a topology model using **geoprocessing tools**:

The 'Topology' toolset within the 'Data Management Tools' toolbox contains tools for creating and editing topology elements. Some of these tools are explained below:

- Create Topology – The Create Topology tool creates a new topology element prompting the user for the feature dataset location, the name of the topology element, and the cluster tolerance.
- Add Feature Class to Topology – Add Feature Class to Topology tool adds a feature class to a topology element including the rank of the new feature class.
- Add Rule to Topology – The Add Rule to Topology tool adds a new rule to a topology and applies it to one of the participating feature classes.

[Back to Standards Section](#)

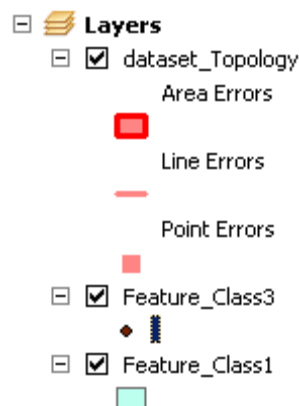
### 5.5.2. Validating Topology

When validating topology, the cluster tolerance is applied to participating features, shifting geometry to make features coincident. Lower ranked features are moved to higher ranked features and equally ranked features are clustered to an average location. Next, topology rules are evaluated to identify topology errors.

It is safest to validate topology in an ArcMap edit session so that the validation (and any geometry shifts) can be undone if it is found that too large a cluster tolerance was used.

To validate topology in an **ArcMap**:

1. Load the topology element and its participating feature classes into the ArcMap session:



2. Make the 'Editor' and 'Topology' toolbar visible.
3. Start an Edit session:
  - *Editor* pulldown menu -> *Start Editing*



4. Use one of the 'Validate Topology' buttons to validate the topology:

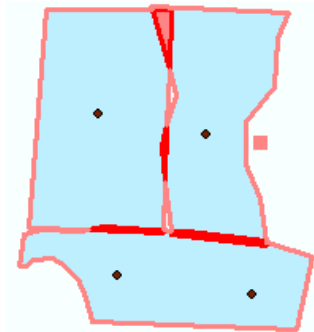


Validate Selected Areas – only validate area selected by cursor.



Validate Current Extent – only validate the current map view area.

Once validation is complete, errors will show up as features in the ArcMap map window:



To validate topology through the **geoprocessing framework** use the 'Validate Topology' tool found in the 'Topology' toolset within the 'Data Management Tools' toolbox. Validating topology through the geoprocessing framework cannot be undone and will permanently alter participating feature classes.

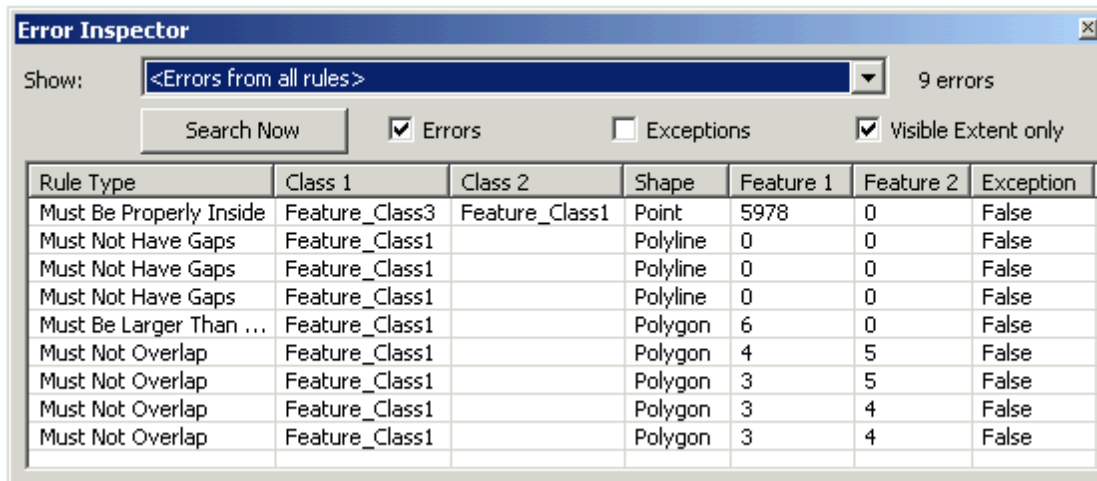
[Back to Standards Section](#)


### 5.5.3. Finding and Fixing Topology Errors

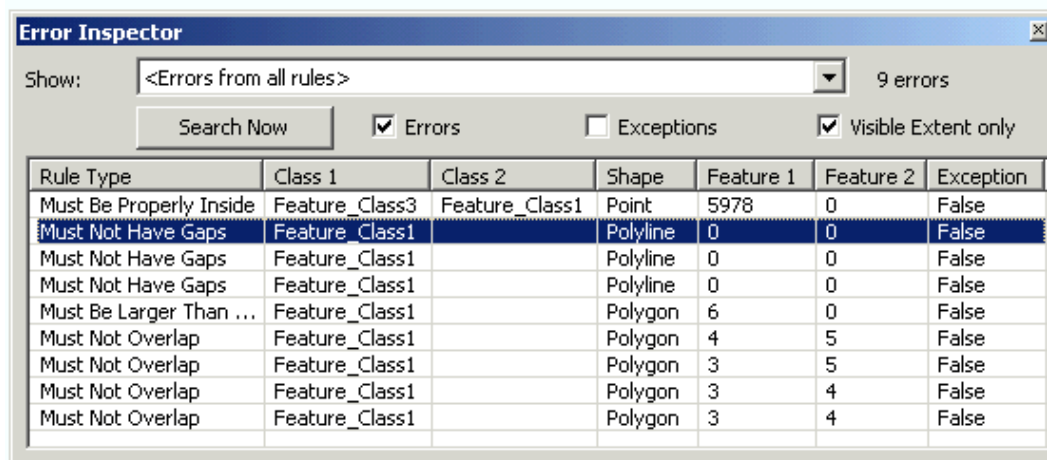
Once a topology has been validated, topology errors can be found and fixed in an ArcMap edit session.

There are two tools on the 'Topology' toolbar used to locate and fix topology errors:

1. The **Error Inspector** window:

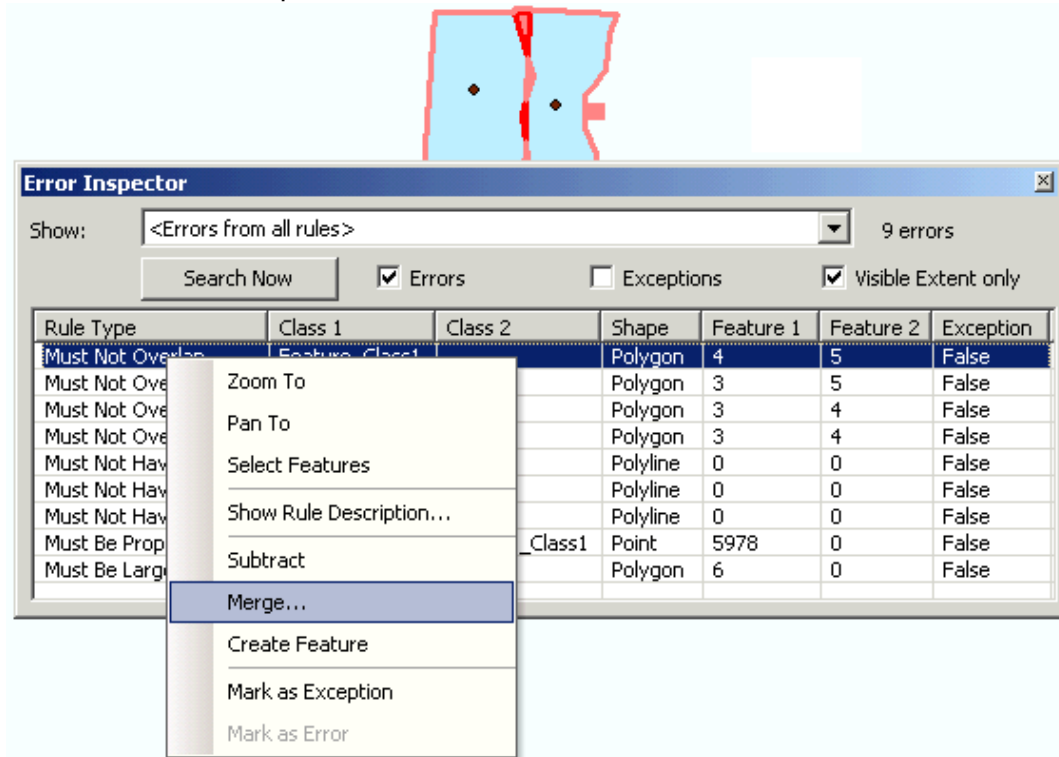


- Opened from the  button on the 'Topology' toolbar.
- Lists errors in a table.
- Use the 'Search Now' button to search the checked options (Errors, Exceptions, Visible Extent) for the rule chosen in the 'Show:' box.
- Errors selected in the 'Error Inspector' window will also be selected in the ArcMap map view (highlighted in black).



- Errors can be sorted alphabetically by clicking on the 'Error Inspector' table headers.
- Many errors can be selected at once.

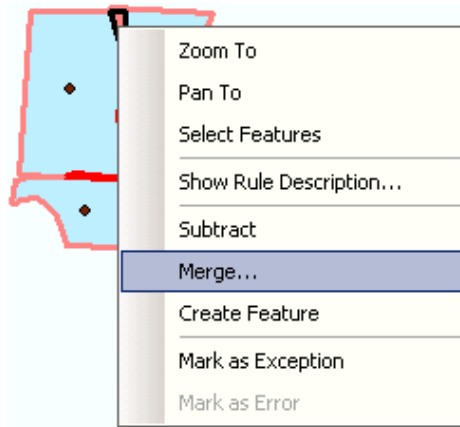
- Additional options are available by right-clicking on errors in the 'Error Inspector' window.



- The middle section of this window lists automatic fixes available for the particular error.
- The bottom section gives options for marking an Error as an Exception or an Exception as an Error. Once an error has been marked as an exception it will no longer be visible – it is as if it has been fixed.

## 2. The 'Fix Topology Error' tool :

- Selects errors in the map view.
- Errors selected with this tool will also be selected in the 'Error Inspector' window.
- Selection options can be defined in the properties of the topology element under the 'Selection' tab. The properties window is accessed by right-clicking on the topology element in the ArcMap table of contents.
- Right-clicking with this tool in the ArcMap map window will bring up the same options as right-clicking in the 'Error Inspector' does.



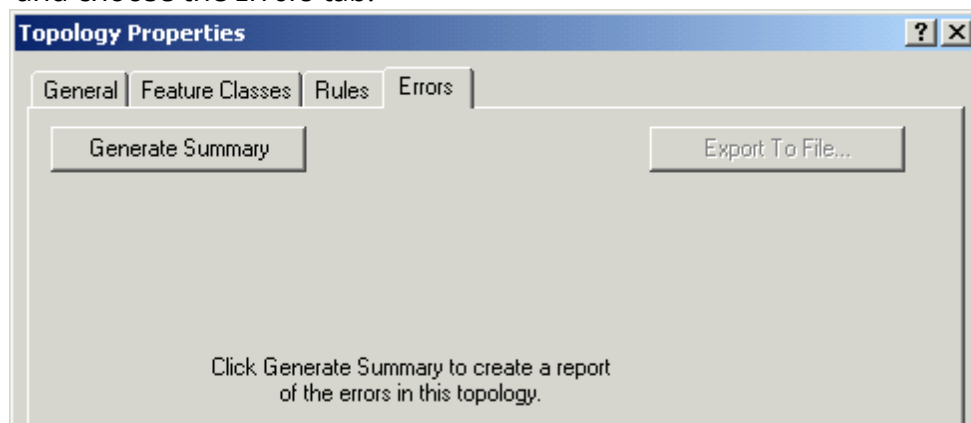
Topology error fixing is an iterative process. Once errors have been fixed the topology should be validated again to see if there are any new errors. When re-validating, only features that have had geometry changes will be validated. Any new errors will need to be either fixed or marked as exceptions and re-validated again. Continue with this process until no errors remain after validating.

[Back to Standards Section](#)

#### 5.5.4. Reporting out from Topology

Once a topology element has been validated a report of the errors and exceptions can be viewed through the topology element's properties on the 'Errors' tab by pressing the 'Generate Report' button.

- In ArcCatalog (or ArcMap) *right-click* on the topology element -> *Properties* and choose the *Errors* tab.



- Press the 'Generate Summary' button to generate the summary report of all the errors and exceptions by feature class for the topology.



General   Feature Classes   Rules   Errors		
Generate Summary		Export To File...
Rule	Errors	Exceptions
Must Be Larger Than Cluster Tolerance	0	0
Must Not Have Gaps		
Feature_Class1	0	1
Must Not Overlap		
Feature_Class1	0	0
Must Be Properly Inside		
Feature_Class3, Feature_Class1	0	1
Total	0	2

- To export this report out to a CSV (comma separated values) text file for viewing in MS Excel press the 'Export to File...' button.

[Back to Standards Section](#)

## 5.6. Creating and Applying Attribute Domains

Attribute domains are defined as properties of a file geodatabase and then applied to fields of tables and feature classes within the geodatabase. Attribute domains can be created and applied through ArcCatalog or by using geoprocessing tools.

### 5.6.1. Creating a Domain

Creating an attribute domain through **ArcCatalog**:

1. Open the 'Domains' tab of the 'Database Properties' window:
  - *Right-click* on the File Geodatabase -> *Properties*
  - Choose the 'Domains' tab in the 'Database Properties' window.

Domain Name	Description

Domain Properties:

Field Type	Long Integer
Domain Type	Range
Minimum value	0
Maximum value	0
Split policy	Default Value
Merge policy	Default Value

Coded Values:

Code	Description

OK Cancel Apply

2. Enter the domain name and description:
  - Enter the domain name and give it a description in the 'Domain Name' and 'Description' columns of the top part of the 'Domains' tab. The domain name will be used to assign the domain to a field and its description is used simply to describe a domains purpose or use.

Domain Name	Description
status_domain	Approval status of planning cells.

3. Enter the Domain properties:

**Field Type:**

Domains are assigned to a particular field type. For example, text field domain types can only be assigned to text fields. Field properties must also be able to accommodate the values assigned to the domain (field width, etc.).

**Domain Type:**

**Range** domains apply to numeric or date fields. When a domain type of 'Range' is chosen, 'Minimum value' and 'Maximum value' properties need to be completed to specify the minimum and maximum values in the permitted range.

Domain Properties:	
Field Type	Short Integer
Domain Type	Range
Minimum value	1
Maximum value	6
Split policy	Default Value
Merge policy	Default Value

**Coded Value** domains specify discrete values for a particular field. They can be applied to numeric, date, or text fields. When the coded values 'Domain Type' is selected codes and their descriptions are entered in the 'Coded Values' table at the bottom of the 'Domains' tab. Codes are the actual code to be populated as the field value, however, users will see the codes descriptions when viewing or populating the data.

Domain Properties:	
Field Type	Text
Domain Type	Coded Values
Split policy	Default Value
Merge policy	Default Value

Coded Values:	
Code	Description
a	Approved
p	Proposed
r	Under Revision

### Split Policy:

The split policy defines how feature attributes will be populated if a feature is split into multiple new features. For coded value domains there are the options to duplicate the current value or to assign the default value to new features. Range domains offer an additional option to calculate a value based on a geometric ratio.

### Merge Policy:

The merge policy defines how feature attributes will be populated if multiple features are merged into a single new one. For coded value domains the only option is to assign the new attribute the default value. Range domains add options to sum the values or do a weighted average.

### Creating an attribute domain using **geoprocessing tools**:

Geoprocessing commands used to create and update domains are located in the 'Domains' toolset within the 'Data Management Tools' toolbox.

- Create Domain tool – The Create Domain tool is used to create a new domain for a geodatabase and complete its properties (except for the range or coded values).
- Add Coded Value to Domain tool – The Add Coded Value to Domain tool adds a coded value and description to a coded value domain.
- Set Value For Range Domain tool – The Set Value For Range Domain tool sets the minimum and maximum values in a range domain.
- Table To Domain tool – The Table to Domain tool creates a new coded value domain from a table of codes and descriptions.
- Domain To Table tool – The Domain to Table tool exports a coded value domain to a table so that the 'Table To Domain' tool can be used to create the same domain in a different geodatabase.

[Back to Standards Section](#)

### 5.6.2. Applying a Domain

Once a domain has been created as a geodatabase property it can then be applied to fields of tables or feature classes within the geodatabase.

Applying an attribute domain through **ArcCatalog**:

1. Open up the properties of a feature class or table to the 'Fields' tab:
  - *Right-click* on the feature class or table -> *Properties*
  - Choose the 'Fields' tab in the properties window.
2. Select the field to add a domain to:
  - In the upper table of the 'Fields' tab select the field to add a domain to.

Field Name	Data Type
OBJECTID	Object ID
SHAPE	Geometry
status	Text
SHAPE_Length	Double

3. Apply the domain to the selected field:
  - In the 'Field Properties' box select the domain to apply from the 'Domain' drop box.

The screenshot shows the 'Field Properties' dialog box for the 'status' field. The 'Domain' dropdown is open, displaying 'status\_domain' as the selected option. Other visible fields include 'Alias' (status), 'Allow NULL values' (Yes), 'Default Value' (empty), and 'Length' (empty). An 'Import...' button is located at the bottom right.

**Note:** Only domains from the current geodatabase that match the field type will be listed in the 'Domains' drop box.

4. Press 'OK' to apply the settings.

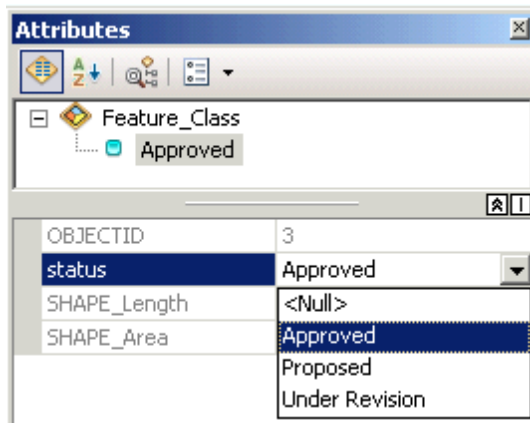
Applying an attribute domain using **geoprocessing tools**:

Use the 'Assign Domain To Field' tool (located in the 'Domains' toolset within the 'Data Management Tools' toolbox) to assign a domain to a field.

[Back to Standards Section](#)

### 5.6.3. Editing with a Domain

When editing in ArcMap, a field with a coded value domain applied to it will have a drop box that will only allow domain values to be selected.



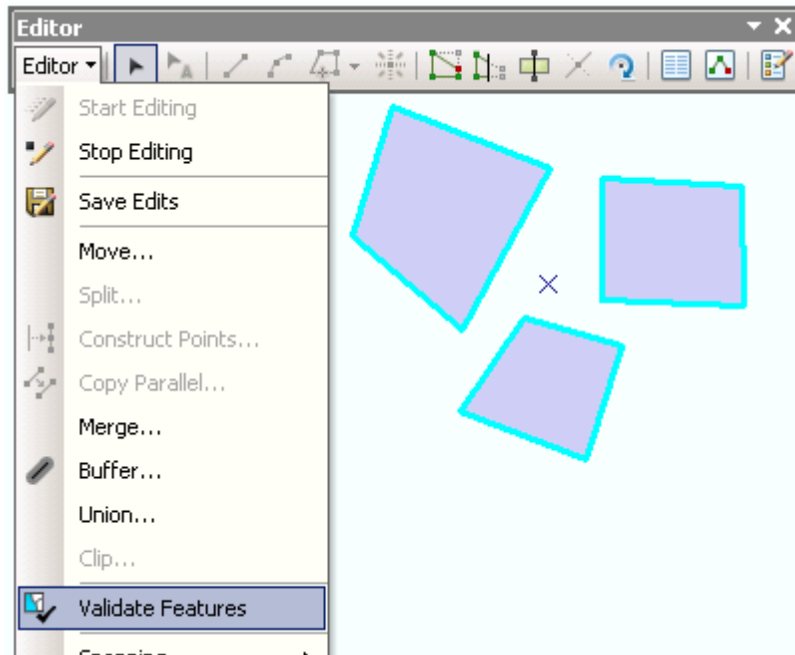
**Note:** It is still possible to have wrong values in a coded value domain from where values have been calculated before the domain has been applied or calculated through the geoprocessing framework. It is also possible to enter in values outside the range of a range domain. For this reason, it is important to validate features to check for attribute errors.

[Back to Standards Section](#)

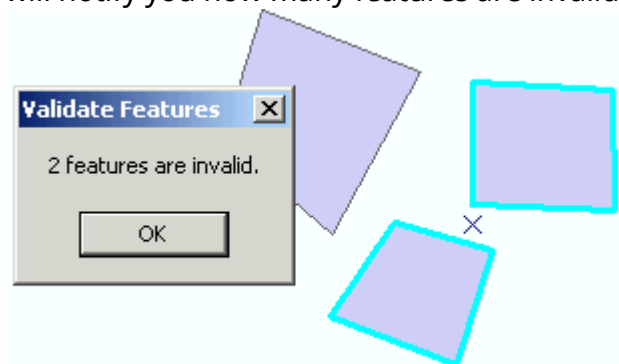
### 5.6.4. Checking for Attribute Errors

Fields with domains applied can be checked for attribute errors in an ArcMap edit session using the 'Validate Features' tool found on the 'Editor' pull-down menu on the 'Editor' toolbar.

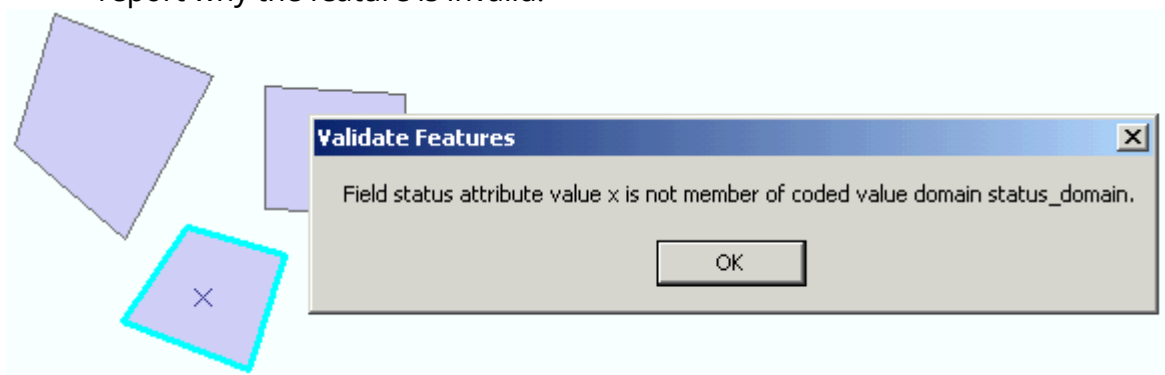
1. Begin an edit session.
2. Select the features to test for valid attributes.
3. Use the 'Validate Features' tool to test for errors.



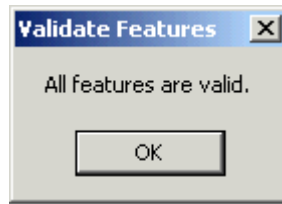
4. If any errors are found, only features with errors will remain selected and a pop-up box will notify you how many features are invalid.




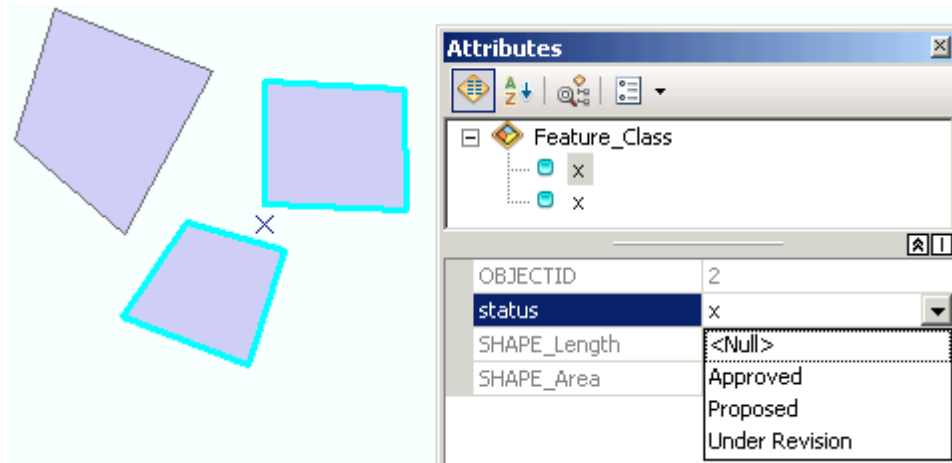
**Note:** if only a single feature is selected the 'Validate Features' tool will report why the feature is invalid.



If all features are valid a pop-up box will let you know there are no errors:



5. Open up the attributes for the selected features and fix any error values:
  - Use the 'Attributes'  button on the 'Editor' toolbar to open up the attribute values for selected features.



- Edit invalid attribute values

[Back to Standards Section](#)

## 5.7. Creating Metadata

All geodatabase elements have XML metadata automatically created for them and automatically populated with basic information from the properties of the dataset. Metadata should be edited to fill in additional information so that other users will know details such as: what the data is; how it is to be used; who created it; use limitations; etc.

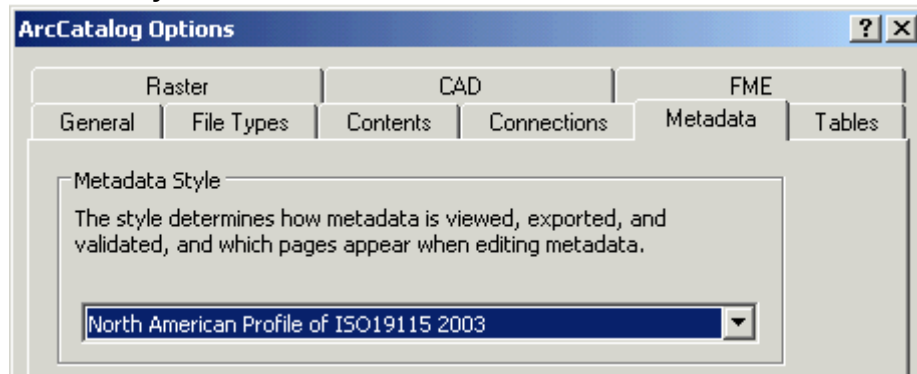
### Viewing Metadata

Metadata is viewed using the 'Description' tab in the ArcCatalog viewing window.

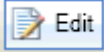


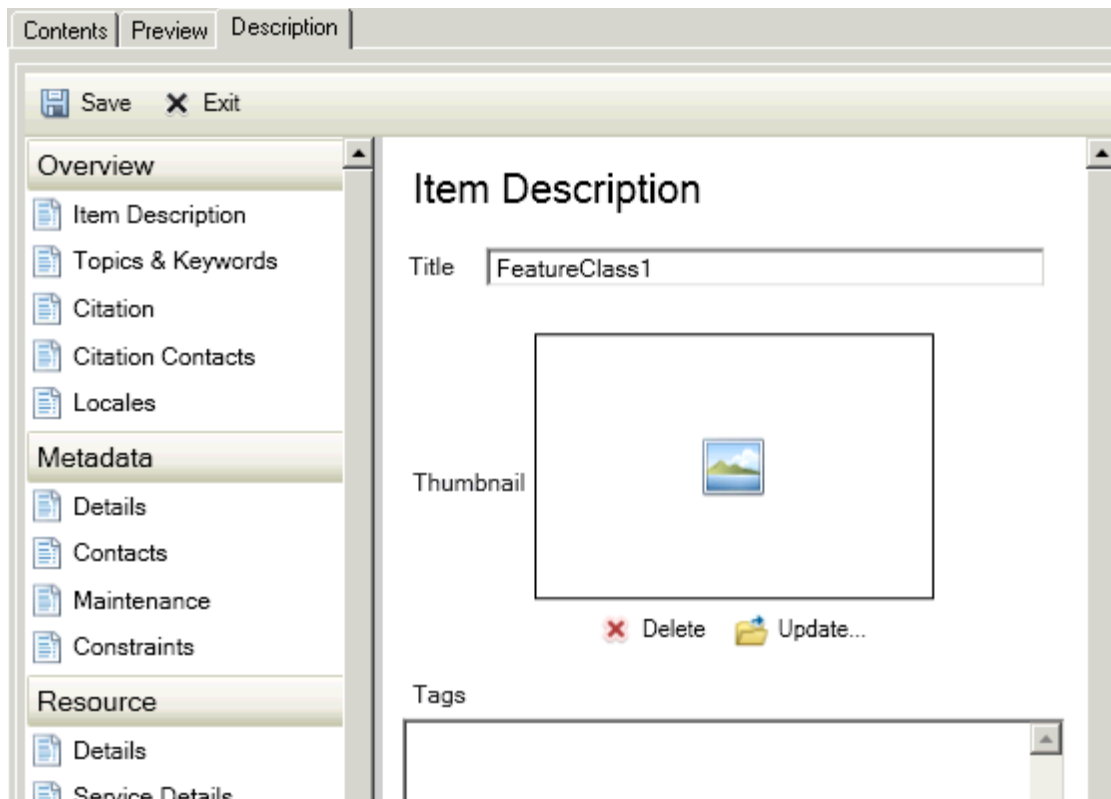
The default metadata view limits the information we see about a particular dataset. It is important to change the Metadata Style so that we see (and can add) all relevant information:

- *Customize* menu -> *ArcCatalog Options...*
- On the *Metadata* tab choose the 'North America Profile of ISO19155 2003' metadata style.




## Editing Metadata

Use the  button to access the metadata editing environment.





Refer to the [metadata standards](#) section of this document for details on what sections of the metadata to complete.

Press the  button to save and exit out of the metadata editing environment.

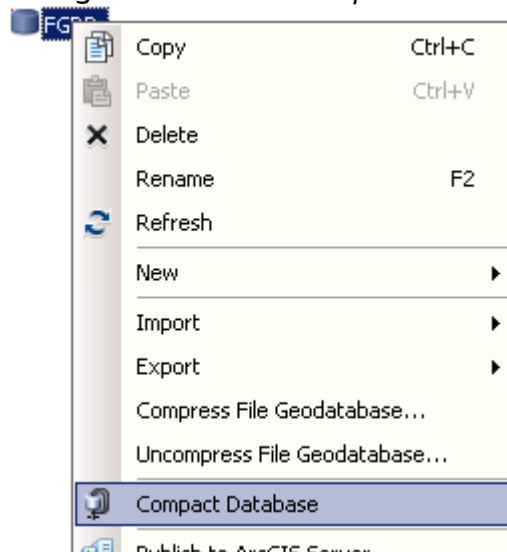
[Back to Standards Section](#)

## 5.8. Compacting a Geodatabase

A file geodatabase can be compacted through ArcCatalog or using a geoprocessing tool.

To compact a file geodatabase in **ArcCatalog**:

- *Right-click* on the file geodatabase -> *Compact Database*



**Note:** The cursor will switch to the hourglass icon while the file geodatabase is being compacted. This step can take a few minutes for large geodatabases.

To compact a file geodatabase using **geoprocessing tools**:

- Use the 'Compact' tool located in the 'Database' toolset within the 'Data Management Tools' toolbox.

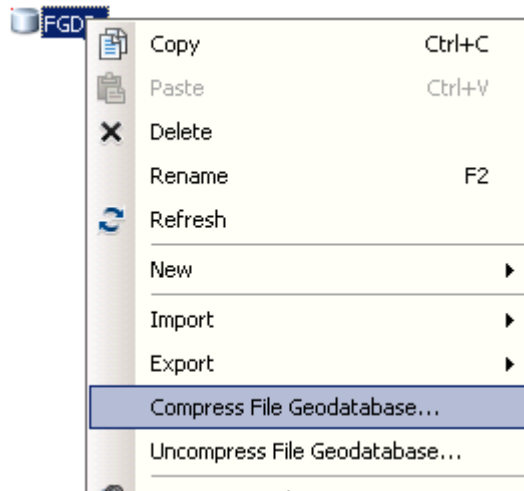
[Back to Standards Section](#)

## 5.9. Compressing a Geodatabase

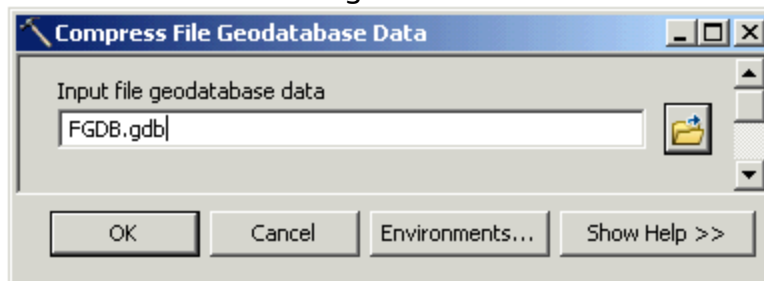
File geodatabases, feature datasets, feature classes, and table can be compressed or uncompressed in ArcCatalog or by using geoprocessing tools.

To compress/uncompress data in **ArcCatalog**:

- *Right-click* on the file geodatabase -> *Compress File Geodatabase...* or *Uncompress File Geodatabase...*



The 'Compress File Geodatabase Data' dialog box will open and will already be populated with the selected geodatabase.



- Press 'OK' to compress the data.

**Note:** The 'Uncompress File Geodatabase Data' dialog box adds an additional parameter for '[Configuration Keyword](#)'. This parameter should either be left blank or the 'DEFAULTS' option should be chosen.

To compress/uncompress data using **geoprocessing tools**:

- Use the 'Compress File Geodatabase Data' or 'Uncompress File Geodatabase Data' tool located in the 'File Geodatabase' toolset within the 'Data Management Tools' toolbox.

[Back to Standards Section](#)