



ArcGIS® Survey Analyst Cadastral Editor: Cadastral XML—A Technical Description

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ArcGIS Survey Analyst Cadastral Editor: Cadastral XML—A Technical Description

An ESRI Technical Paper

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ArcGIS Survey Analyst Cadastral Editor: Cadastral XML—A Technical Description

Introduction The ArcGIS® Survey Analyst Cadastral Editor technology has been developed to build and maintain a cadastral land records system called a cadastral fabric. Portions of the cadastral fabric, called cadastral fabric jobs, can be extracted into a file format called Cadastral XML.

This paper describes the data model of the cadastral fabric and presents the structure of the XML tags that make up the data model when represented in the Cadastral XML file format. The data model for the cadastral fabric has been formalized and developed into a geodatabase structure.

The Cadastral Fabric Data Model

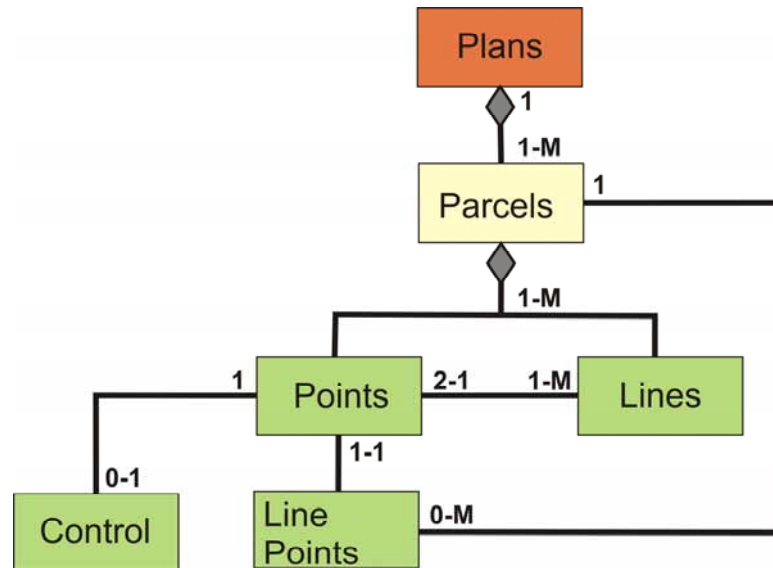
A cadastral fabric is a representation of the information held in legal records such as survey subdivision plans and legal deed descriptions. A cadastral fabric is a continuous surface of connected parcels. Parcel boundary line dimensions in the cadastral fabric match the dimensions on the survey record. Dimensions in the cadastral fabric are edited to match the survey record. A parcel split adds two new parcels to the fabric and maintains the original parcel as historic.

Overview The cadastral fabric data model defines a parcel-based topology that describes how parcels, boundary lines, and corner points share coincident geometry.

Parcel polygons are defined by a series of boundary lines, which store recorded dimensions as attributes in the lines table. Parcel polygons can also be linked to each other by connection lines—for example, connection lines that cross roads or a sequence of connection lines that tie into a control point at a street intersection.

Because each parcel is either linked or connected, a seamless network of connected parcel boundaries—the continuous cadastral fabric—is formed. Parcel lines have endpoints, which are the parcel corners. Parcel corner points are common between adjacent parcel boundaries, establishing connectivity and maintaining topological integrity in the fabric. Since parcels each have their own set of lines, there can be multiple record lines defined between the same pair of points.

Figure 1
Cadastral Fabric Data Model



***Cadastral Fabric
 Classes***

A cadastral fabric dataset in the geodatabase is defined by the following tables:

1. Plans store information about the record of survey. The plan may contain just a single parcel or represent a simultaneous conveyance of multiple parcels. Conceptually, the meaning of a *plan* can range from "a collection of parcels" to "a legal instrument conveying one or more parcels."
2. Parcel polygons are defined by parcel lines.
3. Parcel lines store and preserve recorded boundary dimensions.
4. Parcel points store x,y,z coordinates.
5. Line points are parcel corner points that lie on the boundaries of adjacent parcels.
6. Control points have accurate, published coordinates for a physical location.

In addition, tabular information used in the cadastral editing workflow is also maintained as part of the dataset. This includes the following:

1. Cadastral fabric jobs track edits to the cadastral fabric.
2. Accuracies define weights that are used in least-squares adjustments.
3. Adjustment vectors are used to store displacement vectors derived from least-squares adjustments, and these are used to spatially update other related feature layers associated with the cadastral fabric (buildings and so forth).

Adjustment vectors are not stored in the Cadastral XML. These vectors are maintained in the database only.

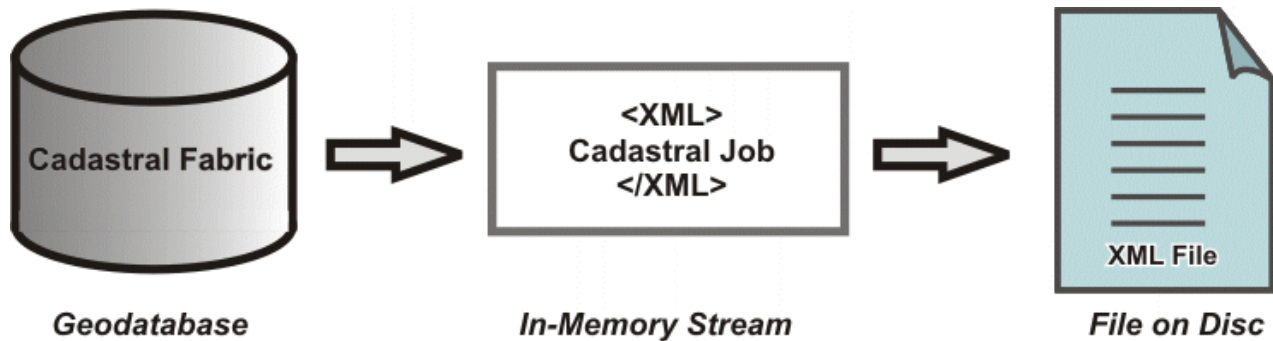
The Cadastral Fabric Job

A cadastral fabric job is a collection of parcels and control points that has been extracted from a cadastral fabric dataset, usually for the purpose of adding new cadastral record information or for updating/correcting cadastral record information.

When data is extracted from a cadastral fabric, a copy of the information is held in memory in the Cadastral XML format that represents the cadastral job. A user of Cadastral Editor can save the cadastral job that is held in memory as the Cadastral XML file.

The cadastral fabric job, once edited, can be finished and placed back into the cadastral fabric dataset. Until a cadastral job is finished, the cadastral fabric dataset held in the database will not have had any edits applied.

Figure 2
A Cadastral Fabric Job



It is important to point out that the cadastral job and the plan are orthogonal concepts. A job can represent parcels from multiple plans, be a subset of parcels from a single plan, or be a combination of the above.

How Is the Cadastral XML File Used?

A Cadastral XML file can be used in the following situations:

1. Sharing of cadastral information between software applications and/or organizations that use the cadastral fabric data model
2. Data backup for a cadastral fabric job

For the purposes of this document, the Cadastral XML file, the cadastral job, and the XML stream can all be considered equivalent and will be used interchangeably. The term cadastral fabric refers to the cadastral data represented and stored in the geodatabase in the cadastral fabric dataset.

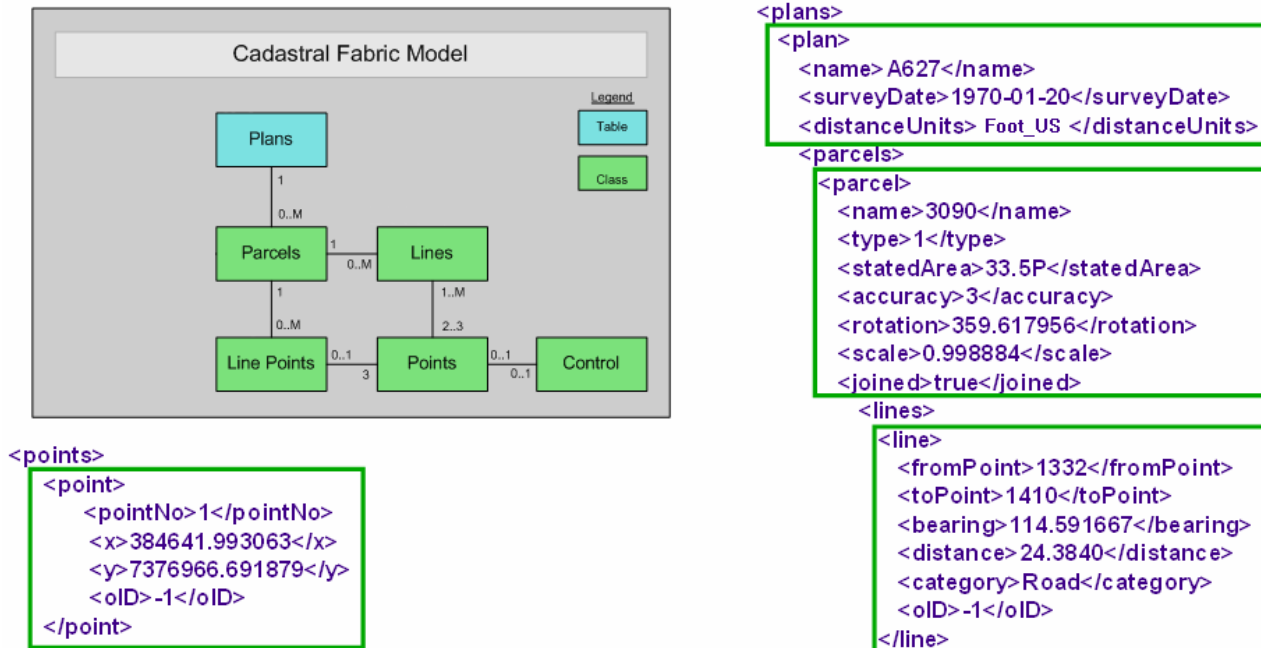
The Cadastral XML File Tags

The structure or schema of the Cadastral XML file mirrors the data model as stored in the geodatabase.

There is a nested hierarchy from plans to parcels to lines that implies successive levels of

containment, where each plan contains parcels and the parcels, in turn, are composed of lines that hold and define cadastral record dimensions.

Figure 3
The Basic Cadastral XML Schema



Plans contain parcels, the latter being composed of a sequence of lines. This can be seen in the snippets of XML text shown in figure 3. The points are represented independent and outside of the plan "container," since many points are shared between the parcels in the plans.

There is also an <oid> tag that refers to the identifier for the object in the database (object ID). When this value is -1, it indicates that the feature is new within the job and does not yet have a database ID. Once the Finish Job command is used, the Cadastral Editor assigns proper database object IDs to the new cadastral fabric features.

The plan information holds the metadata for the direction, length units, curve entry, scale factors, and so on, as they are recorded on the original record. This is metadata as it applies to each individual plan and is used for on-the-fly conversion to represent the information in the user interface (UI) of Cadastral Editor. These settings do not reflect the units for the values in the XML stream.

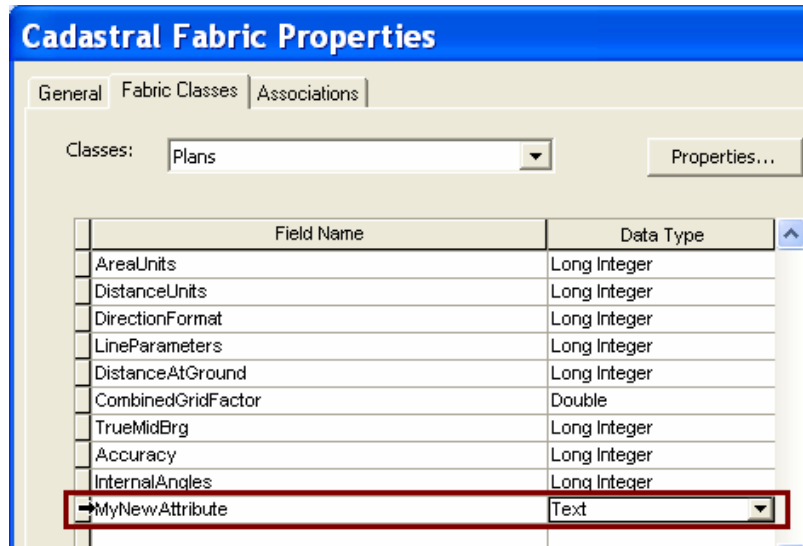
***Limits Imposed by
the Database
Platform***

The Cadastral XML file can be any size, and the number of data entities and the length of character strings for entity names and descriptions are unlimited in the file. However, if the data is to be inserted into a cadastral fabric in the geodatabase, then the field and table restrictions defined by the geodatabase DBMS platform will need to be enforced in the XML file.

Extended Attributes

The database schema for the cadastral fabric data model can be extended with the addition of new attributes to the cadastral fabric classes. If a new attribute field is added to the plan fabric class, for example:

Figure 4
Adding a Fabric Class Attribute in the Geodatabase



then when the cadastral job is created, this attribute will be present in the plan tag as follows:

```
<plan>
  <name>142\051</name>
  <surveyDate>2007-7-6</surveyDate>
  <surveyor>CF Cogo Importer</surveyor>
  <company>Unknown</company>
  <angleUnits>DMS</angleUnits>
  <areaUnits>SquareUSFoot</areaUnits>
  <distanceUnits>Foot_US</distanceUnits>
  <directionFormat>Quadrant</directionFormat>
  <lineParameters>ChordBearingAndChordLengthAndRadius</lineParameters>
  <accuracy>4</accuracy>
  <extendedAttributes>
    <extendedAttribute>
      <name>MyNewAttribute</name>
      <type>VT_BSTR</type>
      <value />
    </extendedAttribute>
  </extendedAttributes>
</plan>
```

The extended attributes of a cadastral job are ignored by Cadastral Editor if they are not part of the cadastral fabric schema represented in the geodatabase.

Settings, Units, and Projection

In addition to the nested hierarchy described above for plans, parcels, and lines, the cadastral job has information attached to it that defines requirements for successful operation.

This information is contained at the head of the file and, for the purposes of this document, will be referred to as the header information. The header information contains three main sections:

1. Units
2. Job parameters
3. Accuracies

Cadastral Editor is built on an underlying software library called the GeoSurvey Engine (GSE). GSE works internally in units of international meters for coordinates and distances. The header information refers to the actual values found in the file. In the case of the Cadastral Editor implementation, this information is used by GSE to convert the data into the internal format that it requires (meters).

The spatial reference header information holds the metadata for the coordinate value units, length and distance units, and the coordinate system projection information. It applies to all the values in the entire Cadastral XML file, irrespective of the units defined for individual plans within the file.

Cadastral Editor also writes the <distanceUnit> tag into the XML stream, and this is retrieved from the projection string. Hence, the distance units and projection string units will always be the same when using Cadastral Editor.

```
<units>  
  <distanceUnits>Foot_US</distanceUnits>  
  <angleUnits>Degree</angleUnits>  
  <areaUnits>Square Meter</areaUnits>  
  <directionFormat>North Azimuth</directionFormat>  
</units>
```

The units tag defines the units across the entire XML job, so even though the plan's unit tags may differ, the values under the plan are in the units specified in the units tag at the head of the file. The plan units, on the other hand, are metadata about the plan itself and only have meaning when retrieved back into the User Interface and the data entry grid, where they are used to convert the values in the User Interface to the plan's settings.

The other unit settings and formats in this header describe how the values in the file are represented. In the case of Cadastral Editor, the values for directions are always in degree (decimal degrees) and north azimuth.

Within the Job parameters section, there is a tag representing the projection. This string defines the projection of the coordinates found in the file including the units of the coordinate values:

```
<jobParameters>
  <packetId>14</packetId>
  <owner>tim2379</owner>
  <esriSpatialReference>
    PROJCS["NAD_1983_StatePlane_California_VI_FIPS_0406_Feet",GEOGCS.....
    .],UNIT["Foot_US",0.3048006096012192]]
  </esriSpatialReference>
</jobParameters>
```

When used within the Cadastral Editor environment, this string is passed to and used by the GeoSurvey Engine. This projection information is taken from the current coordinate system of the data frame. Cadastral Editor will only allow the creation of a cadastral job while the data frame is in a projected coordinate system.

Note that this does not preclude the use and management of the cadastral fabric in a geographic coordinate system. The cadastral fabric in the geodatabase can be defined using a geographic coordinate system. The Cadastral Editor leverages the powerful ArcGIS projection-on-the-fly technology and will automatically place the edited data back into the geodatabase in its native projection.

The Accuracies section describes categories of accuracies that can be assigned to plans, parcels, or lines. The standard deviations for bearings and distance and the parts per million value (PPM) are represented and stored within a particular accuracy category.

An accuracy category can be assigned to a plan, parcel, or line.

```
<accuracies>
  <accuracy>
    <category>5</category>
    <compiled>>true</compiled>
    <brgSD>300.000000</brgSD>
    <distSD>0.656167</distSD>
    <pPM>125.000000</pPM>
    <description>5 - Before 1881</description>
  </accuracy>
  <accuracy>
    <category>6</category>
    <brgSD>3600.000000</brgSD>
    <distSD>3.280833</distSD>
    <pPM>1000.000000</pPM>
    <description>6 - 1800</description>
  </accuracy>
  <accuracy>
    <category>7</category>
    <brgSD>6000.000000</brgSD>
    <distSD>32.808333</distSD>
    <pPM>5000.000000</pPM>
    <description>7 - Lowest</description>
  </accuracy>
  ....
</accuracies>
```

Default Values

Certain data elements do not need to be in the XML file if they have the default value. When reading an XML file, if a particular tag does not appear in the file (it is missing), even though it is a part of the data model in the cadastral fabric, then the default value for that element is assumed. The default values are defined by the application. In the case of Cadastral Editor, the following rules are applied:

1. The data element (DE) stored with the cadastral fabric defines accuracy category defaults for any new plan created.
2. The accuracy category of the parcels defaults to the accuracy category of the plan they are in.
3. The accuracy category of the lines defaults to that of the parcel they form.

Mandatory Values

Certain tags must be present in the XML file. These tags are marked as Mandatory in the tables of appendix A.

Appendix A: XML Tags

Extended Description for XML Tags

Items marked as Read Only (RO) should not be changed by any application that edits the XML file. They are defined by the creator of the XML file to provide additional information about the data for the editing application. The following XML tags are contained in the Cadastral XML file.

Job Parameters

The following data is stored as part of the cadastral job parameters

Data	Description	Mandatory	Default Value	Type	Editor
Owner	The name of the operator, the person who created this dataset	No		char(20)	RW
packetId	Job OID. This can be used to identify the job in the database.	Yes		char(20)	RO
esriSpatialReference	ESRI Spatial Reference (prj) string	Yes		char(400)	RO*

* These values can be written by the Cadastral Editor when a new file is being created.

```
<jobParameters>
  <owner>John Citizen</owner>
  <esriSpatialReference>PROJCS.....</esriSpatialReference>
</jobParameters>
```

Plans The <Plan> entity represents one or more parcels of land. A plan has legal status that needs to be modeled as part of a land information system.

The following data is stored for a parcel.

Data	Description	Mandatory	Default Value	Type	Editor
name	Plan name	Yes		char	RW
description	The description of the plan	No	none	char	RW
surveyor	The name of the person who entered/created the plan	No	none	char	RW
company	The company who lodged the plan	No	none	char	RW
surveyDate	The date of survey on the plan in ISO 8601 format (yyyy-mm-dd)	No	none	char	RW
legalDate	The date of registration of the plan in ISO 8601 format (yyyy-mm-dd)	No	none	char	RW
angleUnits	Display units for angles. See the Direction Units table for possible values (radian, degree, etc.).	No	degree	char	RW
areaUnits	Units for the display of areas. See the Area Units table for possible values.	No	square meter	char	RW
distanceUnits	Units for the display of linear distances. See the Distance Units table for possible values.	No	meter	char	RW
directionFormat	Angle origin for directions (bearings). See the Direction Format table for possible values (north azimuth, polar, etc.).	No	north azimuth	char	RW
lineParameters	Display method for a curved line. See the Cadastral Line Parameters for possible values.	No	bearing distance	char	RW
distanceAtGround	Flag to indicate the distance is a ground distance	No	true	Boolean	RW
combinedGridFactor	Grid scale factor for grid distances on this plan	No	1.000	double	RW
trueMidBearing	Flag for true mid bearings	No	false	Boolean	RW
accuracy	Accuracy class number, usually a number 0–7	No	0	int	RW
oID	Database object ID number	No	0	int	RO
extendedAttribute	Extended parcel attributes use the Extended Attributes Type .	No	none	char	RW
internalAngles	Flag for angle mode on line in parcels	No	false	Boolean	RW

J-9678

```

<plans>
  <plan>
    <name>LTO83/82</name>
    <surveyDate>1983-08-03</surveyDate>
    <distanceUnits>meter</distanceUnits>
    <directionFormat>north azimuth</directionFormat>
    <oID>0</oID>
    <parcels>
      .....
    </parcels>
  </plan>

```

Parcels The following data is stored for a parcel:

Data	Description	Mandatory	Default Value	Type	Editor
name	Lot number as shown on the plan	Yes	none	varchar	RW
type	A number indicating the lot type	No	0	int	RW
statedArea	Stated area on the plan	No	none	varchar	RW
compiled	Parcel is compiled. The parcel dimensions were not measured in the field, they were derived from measurements on other plans.	No	false	Boolean	RW
historical	Flag to indicate parcel has been superseded by other parcels and hence is of historical interest only	No	false	Boolean	RW
legalStartDate	Date when this parcel became the legal definition for the land parcel	No	none	varchar	RW
legalEndDate	Date when this parcel ceased to be the legal definition for the land parcel	No	none	varchar	RW
groupID	Group number	No	0	int	RW
accuracy	Accuracy class, a number from 0 to 7	No	0	int	RW
rotation	Parcel rotation angle in decimal degrees	No	0.0	double	RW
scale	Parcel scale factor	No	1.0	double	RW
backsightBearing	Backsight bearing of the first line when in angles mode	No		double	RW
unclosed	Parcel is closed or not	No	false	Boolean	RW
miscloseRatio	Misclose error ratio	No		double	RW
miscloseBearing	Bearing of the misclose in decimal degrees	No		double	RW
miscloseDistance	The length of the parcel misclose error of the main close of the parcel	No	0.0	double	RW
joined	Parcel is joined or not joined	No	false	Boolean	RW
trueMidBearing	Flag for true mid bearings	Yes	false	Boolean	RW
shapeStdErrorE	Parcel distortion in the easting	No		double	RW
shapeStdErrorN	Parcel distortion in the northing	No		double	RW
oID	Database ID number	No	0	int	RO
locked	Parcel is locked in the database and can be changed.	No	true	Boolean	RO
construction	Parcel is under construction.	No	false	Boolean	RW
extendedAttribute	Extended parcel attributes use the Extended Attributes Type .	No		varchar	RW

```
<plans>
  <plan>
    <name>LTO83/82</name>
    <surveyDate>1983-08-03</surveyDate>
    <parcels>
      <parcel>
        <name>6810</name>
        <type>1</type>
        <statedArea>4630</statedArea>
        <accuracy>4</accuracy>
        <rotation>0.362222</rotation>
        <scale>1.000135</scale>
        <joined>true</joined>
        <oid>0</oid>
        <lines>
          .....
        </lines>
      </parcel>
    </parcels>
  ..
</plan>
</plans>
```


Lines The following data is stored for a line.

Data	Description	Mandatory	Default Value	Type	Editor
fromPoint	Point number of the start point of the line	Yes		int	RW
toPoint	Point number of the end point of the line	Yes		int	RW
bearing	Bearing of the line in decimal degrees	Yes		bearing	RW
distance	Length of the line in units defined in header section of the file	Yes		double	RW
type	A number indicating the type of line, as defined by the model implemented in the cadastral fabric	No	0	int	RW
calculated	Line is calculated.	No	false	Boolean	RW
category	Indicates the usage of the line in the parcel network. See the Cadastral Line Category table for possible values.	Yes	boundary	varchar	RW
radius	If curved, the radius of the circle/curve in units defined in header section of the file	No		double	RW
arcLength	Length of the arc for curved line units defined in header section of the file	No		double	RW
delta	Angle at the center for a curved line in decimal degrees	No		double	RW
centerPoint	If curved, the point number of the center point	No		int	RW
radialBearing	Bearing of the line from the center point to the start point of the curve in decimal degrees	No		double	RW
tangentBearing	Tangent bearing at the start point of the curve. This is the radial bearing rotated clockwise by 90 degrees in decimal degrees.	No		double	RW
internalAngle	The internal angle of the line in decimal degrees	No		angle	RW
referenceObject	Point number of the reference point for this line when in angles mode	No		int	RW
lineParameter	Display method for a curved line. See the Cadastral Line Parameters for possible values.	No	bearing distance	varchar	RW
computedMinus Observed	The difference between the computed line distance from the coordinates and the observed line distance. This length difference is in units defined in header section of the file.	No		double	RW
accuracy	Accuracy class, a number from 0 to 6	No	0	int	RW
oID	Database ID number	Yes	0	int	RO
extendedAttribute	Extended line attributes use the Extended Attributes Type .	No		varchar	RW

```

<lines>
  <line>
    <fromPoint>1028</fromPoint>
    <toPoint>1032</toPoint>
    <bearing>59.111111</bearing>
    <distance>57.3300</distance>
    <oID>0</oID>
  </line>
  <line>
    <fromPoint>1032</fromPoint>
    <toPoint>1033</toPoint>
    <bearing>148.650000</bearing>
    <distance>82.0000</distance>
    <oID>0</oID>
  </line>
  ....
</lines>

```

Line Points A line point is a parcel network rule that constrains a point to lie along a line. This enforces the intention of the parcel network design. The following data is stored for a line point.

Data	Description	Mandatory	Default Value	Type	Editor
fromPoint	Point number of the start point of the line	Yes		int	RW
toPoint	Point number of the end point of the line	Yes		int	RW
linePoint	Point number of the line point	Yes		int	RW
oID	Database ID number	Yes	0	int	RO

```

<linePoints>
  <linePoint>
    <fromPoint>1032</fromPoint>
    <toPoint>1050</toPoint>
    <linePoint>994</linePoint>
    <oID>0</oID>
  </linePoint>
</linePoints>

```

Points The following data is stored for a point. The coordinate units and projection are defined in the header section of the file.

Data	Description	Mandatory	Default Value	Type	Editor
pointNo	The point number	Yes		varchar	RW
x	Easting of the point	Yes		double	RW
y	Northing of the point	Yes		double	RW
z	Height of the point (usually natural surface rl)	No		double	RW
type	Point type. See the Point Type table for possible values.	No	normal	int	RW
category	Point usage. See the Cadastral Point Category table for possible values.	No	0	int	RW
historical	Indicates if the point is not used by any "current" parcel	No	false	Boolean	RW
name	The point name; this can be the control mark name if it is a control point.	No		varchar	RW
legalStartDate	Date when this point became the legal definition for the land parcel	No	none	varchar	RW
legalEndDate	Date when this point ceased to be the legal definition for the land parcel	No	none	varchar	RW
centerPoint	Point is a center point.	No	false	Boolean	RW
oID	Database point number or entity ID	No	0	int	RO
extendedAttribute	Extended parcel attributes	No		varchar	RW

```

<points>
  <point>
    <pointNo>1733</pointNo>
    <x>708504.334928</x>
    <y>8628699.057876</y>
    <oID>0</oID>
  </point>
  <point>
    <pointNo>1734</pointNo>
    <x>708491.128076</x>
    <y>8628717.887176</y>
    <oID>0</oID>
  </point>
  <point>
    .....
  </point>
</points>

```

Control Points The following data is stored for a control point:

Data	Description	Mandatory	Default Value	Type	Editor
pointID	PointID of the fabric point that the control point is connected to	Yes		int	RW
name	Control point name, usually an alphanumeric string assigned by the government authority	Yes		varchar	RW
x	Control easting of the point	Yes		double	RW
y	Control northing of the point	Yes		double	RW
z	Height of the point	No		double	RW
active	This is a flag to indicate if the control point is to be included in the least-squares adjustment.	No	false	Boolean	RW
accuracyXY	Accuracy class of the point in xy	No	-	varchar	RW
accuracyZ	Accuracy class of the point in z	No	-	varchar	RW
surveyDate	Date when this control point was surveyed in ISO 8601 format	No	none	varchar	RW
type	Point type. See the <i>Point Type</i> table for possible values	No	normal	char	RW
oID	Database ID number	Yes		int	RW
extendedAttribute	Extended point attributes use the <i>Extended Attributes Type</i> .	No		varchar	RW

```

<controlPoints>
  <controlPoint>
    <pointID>86</pointID>
    <name>k1_1</name>
    <x>708035.306000</x>
    <y>8629259.757000</y>
    <z>0.000000</z>
    <active>true</active>
  </controlPoint>
  <controlPoint>
    <pointID>12</pointID>
    <name>k1_2</name>
    <x>707942.048000</x>
    <y>8629147.629000</y>
    <z>0.000000</z>
    <active>true</active>
  </controlPoint>
  ....
</controlPoints>

```

Extended Attributes The XML format for the cadastral fabric data needs to allow the schema to be extended by the user to store additional data values for each plan, parcel, line, or point. The <extendedAttributes> tag is used for this purpose.

The extended attributes are allowed for parcels, plans, lines, and points. Any number of extended attributes can be defined.

Data	Description	Mandatory	Default Value	Type	Editor
name	Name of the attribute	Yes		varchar	RO
value	Data value of the attribute	Yes		varchar	RW
type	Data type of the attribute. This is a value in the Extended Attributes Type .	Yes		int	RO

Note that the units used in any data values in the extended attributes for an entity are known only to the originator of the extended attribute. Values for extended attributes should ideally use the same units as the rest of the data file, as specified in the header information of the file.

Accuracies The following data is stored for the accuracy categories:

Data	Description	Mandatory	Default Value	Type	Editor
category	Category number	Yes		int	RO
description	Text description of the category	No		vchar	RO
brgSD	Bearings standard deviation	Yes		double	RO
distSD	Distances standard deviation	Yes		double	RO
pPM	Distances parts per million	Yes		double	RO
default	Indicates this is the default category for measurements with no accuracy category	No	true	Boolean	RO
compiled	This category is to be used for measurements on compiled plans.	No	-	Boolean	RO

```

<accuracies>
  <accuracy>
    <category>5</category>
    <compiled>true</compiled>
    <brgSD>300.000000</brgSD>
    <distSD>0.656167</distSD>
    <pPM>125.000000</pPM>
    <description>5 - Before 1881</description>
  </accuracy>
  <accuracy>
    <category>6</category>
    <brgSD>3600.000000</brgSD>
    <distSD>3.280833</distSD>
    <pPM>1000.000000</pPM>
    <description>6 - 1800</description>
  </accuracy>
  <accuracy>
    <category>7</category>
    <brgSD>6000.000000</brgSD>
    <distSD>32.808333</distSD>
    <pPM>5000.000000</pPM>
    <description>7 - Lowest</description>
  </accuracy>
  ....
</accuracies>

```

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Units The distanceUnits value specifies the units of the distance values or lengths (length of a lot side) in the file.

Data	subData	Description	Mandatory
units	distanceUnits	Units for distances and coordinates in this file. See the Distance Units table for possible values (meter, foot, foot_us, link, etc.).	Yes
	areaUnits	Units for area values in this file. See the Area Units table for possible values (square meter, square foot, square link, etc.).	Yes
	angleUnits	Units for angle values in this file. See the Direction Units table for possible values (degree).	Yes
	directionUnits	Units for bearing and direction values in this file. See the Direction Units table for possible values (degree).	Yes
	directionFormat	Origin for directions (bearings). See the Direction Format table for possible values (north azimuth, polar, quadrant bearing).	Yes

Distance Units

XML Value
Meter, Metre
Foot
Chain
Link
Foot_US
Chain_US
Link_US

Direction Units

XML Value
Radian
Degree
Dms
Gradian
Gon

Direction Format

XML Value
north azimuth
south azimuth
Polar
Quadrant

***Cadastral Line
 Parameters***

XML Value
bearingAndDistance
angleAndDistance
chordBearingAndDeltaAndRadius
deltaAndRadius
chordBearingAndChordLengthAndRadius
chordLengthAndRadius
chordBearingAndArcLengthAndRadius
arcLengthAndRadius
chordBearingAndDeltaAndArcLength
deltaAndArcLength
radialBearingAndDeltaAndRadius
radialBearingAndChordLengthAndRadius
radialBearingAndArcLengthAndRadius
radialBearingAndDeltaAndArcLength
tangentBearingAndDeltaAndRadius
tangentBearingAndChordLengthAndRadius
tangentBearingAndArcLengthAndRadius
tangentBearingAndDeltaAndArcLength

***Cadastral Line
 Category***

XML Value
Boundary
Dependent
Precise
Connection
Radial
Road
OriginConnection

***Cadastral Point
 Category***

XML Value
Boundary
Tie-in
Construction

***Extended Attributes
 Type***

XML Value	Meaning
VT_I2	Integer data type, (two bytes)
VT_I4	Long integer (4 bytes)
VT_R4	Single-precision floating point
VT_R8	Double-precision floating point
VT_DATE	Date data type
VT_BSTR	String data type