UNIT 25: USING COGO FOR DATA INPUT

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Context

Coordinate Geometry (COGO) is a method of inputting surveying or engineering data into GIS, CAD or mapping softwares. These data may be collected in the field using conventional surveying techniques and instrumentation, or may be derived from existing maps, plats, engineering plans, drawings or records.

Data collected in the field consist typically of coordinates of points, distances and bearings between points, and point identifiers (with possibly additional descriptions for these points). The data are observed and recorded through standard field surveying procedures, such as a traverse or a series of layout measurements. The data may be non-digital (recorded in notebooks), or digital (recorded on some sort of total station or data logging device) In the latter case the data will be transferred to office computers through specialized software.

Existing maps and plans include subdivision plans, showing legal lot boundaries, and engineering drawings. In both cases features are depicted with some coordinate values, and distances and bearings or offset distances are shown between the features.

Example Application

The City of Abbotsford has developed a reasonably accurate cadastral base for their GIS implementation, but a more accurate data set is required to support future engineering applications. To achieve this, the cadastral base map is being improved in an incremental fashion, using COGO to enter new field survey data as it becomes available. City survey crews collect some survey data when they tie in property corners at major intersections during routine surveys, and legal survey plans from the Land Title Office are frequently acquired when new subdivisions are developed.

The GIS technician is responsible for entering the field and plan data into the GIS software using the COGO module. She also must check the data carefully, and adjust the data sets, in consultation with the City Surveyor and the GIS manager, to ensure a good fit with the base map as a whole.

Learning Outcomes

The following list describes the expected skills which students should master for each level of training, i.e. Awareness/Competency/Mastery.

Awareness:

The expected learning goals of this section are to achieve a general understanding of COGO, its potential uses, and a working knowledge of basic COGO vocabulary.

Competency:

The learning goals of this section are to develop the ability to perform common COGO operations.

Mastery:

The learning goals of this section are to be able to perform more advanced technical operations associated with field survey data and COGO.

Preparatory Units

Recommended:

Unit 4 - Land Records
Unit 8 - Error Checking
Unit 9 - Spatial Data Conversion

Complementary:

Unit 11 - Registration And Conflation
Unit 12 - Planning A Digitizing Project
Unit 13 - Digitizing maps
Unit 14 - Digitizing on-screen
Unit 16 - Planning A Scanning Project
Unit 17 - Scanning Maps
Unit 23 - Creating Maps With CAD
Unit 24 - Collecting GPS Data

Other Recommended

General: Knowledge of applications and survey measurement practices which utilize field surveying/cogo regularly - for example municipalities, forestry, utility, civil engineering ,

energy/gas/oil/pipeline companies

For Competency and Mastery levels, thorough knowledge of coordinate systems, field surveying methods and plane survey computations

For Mastery level, knowledge of survey data adjustment procedures

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Awareness

Learning Objectives:

At the completion of these exercises, the student will be able to

1. Explain basic terms associated with COGO.
2. Describe some applications and uses of COGO.
3. List the basic functionality associated with COGO software.
4. Explain some of the advantages and disadvantages of COGO, with respect to other methods of data input.

Vocabulary

- field surveying
- legal surveys
- traverse
- layout
- sideshot
- total station
- closure
- accuracy
- precision

Topics

What is COGO ?

What is the relationship of COGO to CAD, GIS, engineering software?

What is the relationship to other methods of data input ?

Who uses COGO ?

How is COGO accomplished ?

Advantages and Disadvantages;

Advantages - accuracy, adjustment of measurements, automated feature generation, attribute tables, links to surveying and engineering activities, automated transfer of data

Disadvantages - time, cost of conversion

Competency

Learning Objectives:

1. Student will be able to
    - invoke COGO module in software and setup basic operational parameters for a session
    - utilize COGO software to enter survey data
    - edit COGO entered data, and regenerate associated graphic representations
    - conflate COGO data with other GIS database

Vocabulary

(see 'Other Recommended' above, for prerequisite knowledge for this section)

Topics

Setup a COGO session in GIS/CAD software

- invoke the COGO software
- setup COGO project (where applicable)
- set coordinate origin
- coordinate system (metric,imperial,units)
- angular units (DMS, DD)
- angular system (bearings, azimuths)
- setup point numbering/naming

enter data into COGO

- key-in data from field survey notes or existing legal or engineering plans into COGO
- generate graphics and 'attribute' table for a survey
- verify data entry by closing on known coordinate points

editing of COGO data

- edit the COGO attribute data to correct blunders
- assess the accuracy of the final COGO data set
- Conflate COGO data with existing GIS data sets

Mastery

Learning Objectives:

1. Student will be able to:

    - import field data from external data files or data logging devices into GIS or Cad software
    - edit imported data through tasks such as 'reduction' to plane (slope to horizontal)
    - adjust COGO entered data through operations as least squares, compass rule, level balancing

Vocabulary

(see 'Other Recommended' above, for prerequisite knowledge for this section)

Topics (requires good background in civil, forestry, survey field methods and measurements)

Import field data

- Edit data into a format suitable for transfer into COGO
- load ASCII files into COGO
- connect data logging devices; setup transfer protocol and transfer data to CAD/GIS software
- verify correct transfer of data from external sources into software

Editing Data

- Reduce 'raw' field data to plane (e.g. angular reduction, slope reduction) using COGO functions

Adjustment of Measurements

- Enter complex survey data into COGO and use industry standard methods for adjusting data for closure
- Verify accuracy of data

Follow-up Units

Resources

A list of GIS Resources.

ARC/INFO COGO manual, ESRI, esp. Cranes Roost exercise. ARC/INFO COGO is an optional module for workstation and NT ARC/INFO. The ARC/INFO documentation provides an excellent overview of the COGO module. The Crane's Roost Exercise is a lengthy one, but can be used at the introductory and intermediate levels.

Lab Exercise This exercise is written for Arc/Info COGO, but the data set can be easily used with other software. The exercise takes about 2-3 hours to complete. It involves coordinating a subdivision plan, and makes use primarily of traversing, sideshots, and curve layout operations. However the data is such that more advanced exercises can be introduced. For example, depending on how the student computations are done, it may be necessary to balance the traverse, break some lines, apply multiple distances along a bearing. In addition the exercise can involve placement of annotation directly from the attribute tables, and the use of other ARCEDIT functions for copying some lines (including snapping). The exercise can be used at all levels. There are also Powerpoint lecture notes for this exercise, covering basic terms and features of COGO, in particular ARC/INFO COGO

Microstation and CivilDraft

Instructors who have the Microstation Geoengineering Academic Suite will also have Geopaks CivilDraft software. This provides extensive COGO capabilities within Microstation. Alternatively, Autocad software can be used in conjunction with Softdesk civil engineering software to introduce COGO.

Created: May 14, 1997. Last updated: October 5, 1998.

Lab Exercise

Arcedit: Data Entry Using Coordinate Geometry

Objectives:

After completion of this module you should be able to:

1.List the advantages and disadvantages of coordinate geometry as a method of data entry for GIS

2.Create COGO coverages using ARC/INFO

3.Use the ARC/INFO COGO menu commands

4.Enter data using COGO and create a small subdivision plan

Learning Activity 1Introduction to Coordinate Geometry

Action: create a new workspace named **mod10,** and change workspace to mod10. Create a new coverage called **control** in the mod10 workspace. Add the CONTROL.TIC values below:

IDTIC XTIC YTIC

1 1000.00 1000.00

2 1100.00 1000.00

3 1000.00 1150.00

4 1100.00 1150.00

5 1000.00 1300.00

6 1100.00 1300.00

It is often very important to establish an accurate spatial database. Many applications in a municipal environment are based on parcels of lands which are based on legal survey plans. These plans contain legal descriptions of the property, and the numeric information (coordinates, bearings, distances) which define the parcel accurately on the ground. One method of data entry for survey or engineering data of this type is known generically as coordinate geometry or COGO. COGO software typically provides a number of functions to generate accurately positioned points, lines, and areas for these features.

Learning Activity 2 Coordinate Geometry in Arcedit

ESRI markets an optional COGO extension of ARCEDIT with a full set of COGO functions. This module shows the use of ARCEDIT COGO to enter data from a subdivision plan. A number of ARC/INFO macros (AMLs) and menus can be used with COGO.

In general the steps to use the COGO extensions follow those of ARCEDIT.

1.Initialize device environment and graphic display.

2. Set your precision

3.Create an arc coverage with the COGO attribute extensions and a point coverage to hold all the cogopoints.

4.Start ARCEDIT

5.Specify the edit coverage, edit features and draw environments

6.Specify the snap environment

7.Specify the search environment

8.Set the Grain tolerance

9.Set constants and format

10.Input the plan features and edit them

11.Annotate arcs with there COGO attributes

12.Save your changes.

For this exercise, steps 5-8 will be performed automatically by using COGO AMLs.

Now you will create a cogo coverage called LOTS using the CREATECOGO AML. This AML requires the user to specify the coverage name (**lots**) and the associated tic file (**control**).

Type: **precision double double**

Type: **createcogo arc lots control**

Now create a point coverage (**lotpnts**) where all the entered COGO points will be stored.

Type: **createcogo cogopoint lotpnts control**

List your new coverages, and examine the attribute file items that have been automatically created (e.g.: ITEMS LOTS)

Now start ARCEDIT (and specify your station file) as usual

Now execute the COGO AML named COGOENV which loads the specified coverage and fulfils the requirements of steps 5-8.

Type: **cogoenv lots lotpnts**

The 'FORMAT' command sets the format for data storage and display. For this exercise, azimuths will be entered in degrees, minutes and seconds ('dms'), and distances will be displayed with 3 decimal places.

Type: **format azimuth dms 3**

Invoke the cogo menu;

Type: **menu**

System response: ;the first cogo menu will appear at the top of the graphics area.

Take some time to familiarize yourself with the options in the cogo menu. To keep the menu selection open click the right mouse button with the cursor arrow on the menu and then move the arrow onto the menu box to highlight the desired option, and click the left mouse button.

WARNING : If you click the left mouse button on the main COGO menu it will execute the

default option of that pulldown menu - SO ALWAYS USE THE RIGHT MOUSE BUTTON TO MOVE AROUND THE COGO MENU !

To enter the data as shown on the plan, a number of menu selections will be used. These are;

- traverse - new closed loop
- traverse -edit
- traverse - adjustment
- traverse - new closed
- layout
- breakline
- curve
- copy curve parallel
- join
- annotate

To begin drawing the lots, first set the mapextents to the default option. This establishes the minimum and maximum of the drawing.

Action: select the mapextent default option under the 'Screen' menu

Note: You can issue a normal ARCEDIT command at any time by selecting the SYS - ARCEDIT COMMAND menu option. You may want to do this to change the DRAWENVIRONMENT and issue the command to turn on the TIC IDS.

To start traversing the lots boundaries;

Action: select the 'New - close loop' option under the 'Trav' menu

This selection requires you to enter a start ('takeoff') point, which will also be used as an end point for the traverse closure.

System response: Enter the takeoff point

1 = Select 2 = Next 3 = Accept 4 = Free

9 = Quit

Action: select tic 1 with the left mouse button and accept it with a right mouse button (TIC 1 is the bottom left tic).

System response: course(1):

The 'course' prompt indicates that ARCEDIT is waiting for azimuth and distance information for 'courses', i.e. vectors. Angular measurements can be entered in several ways, which are independent of the 'format' previously specified. This allows for plan information in different

formats, (for example, bearings, north or south azimuths) to be entered in different ways. For example, assume you had a course with an azimuth of 127 minutes, 30 minutes, 15 seconds. ARC/INFO will accept any of the following entry methods.

N127-30-15

127-30-15-5 (the last '5' indicates full circle north azimuth)

S52-29-45E

Since all of the plan data for this module is in azimuth notation, either of the first two methods is acceptable. To begin traversing, start at the south-west corner of lot 19, and proceed in a counter-clockwise direction.

Type: **n86-53-42,33.101**

System response: course: ;the first course will be drawn on the screen

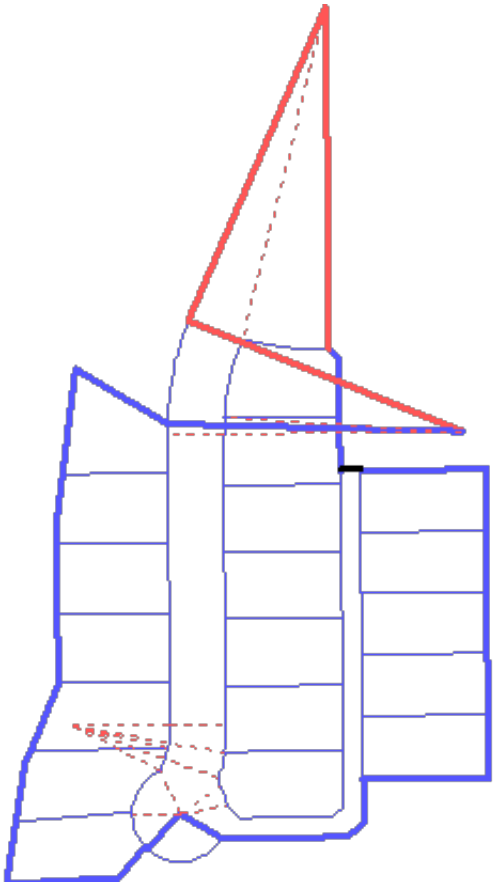
Type: **n44,11.665**

System response: course:

The # symbol is used as a wildcard to indicate that the previous azimuth or distance is to be used. Consequently, if you now key in

Type: **#,14.000**

You will establish a point at the center of the cul-de-sac. Continue to traverse, utilising the following table of data to establish the outline of the plan. Remember that you have already traversed to the centre of the cul-de-sac, so begin with the data for course 4. Figure 1 shows a sketch of the 'new - closed loop' - YOU ARE GOING TO CREATE THE THICK LINE NOW.



If you make a mistake entering a course you can use the oops command to delete it, and then continue on. Just type oops at the course; prompt and the last course will be deleted.

Traverse Data Start point (1000,1000)

COURSE BEARING DISTANCE

1 N86-53-42 33.101

2 N44-00-00 11.665

3 N44-00-00 14.000

4 N120-16-57 14.000

5 N89-25-19 37.116

6 N44-25-19 6.364

7 N359-25-19 12.646

8 N89-25-19 36.670

9 N359-25-19 18.000

10 # #

11 # #

12 # #

13 # #

14 N269-25-19 36.670

15 # 6.000

16 N359-25-19 32.339

17 N314-25-20 4.243

18 N359-25-19 100.000

19 N203-27-40 100.000

20 N111-58-23 86.500

21 N271-40-09 86.500

22 N300-50-00 31.119

23 N187-17-17 30.877

24 N187-17-17 13.279

25 N179-25-2 57.500

26 # 20.310

27 # #

28 N202-15-28 21.158

29 # 4.338

30 N189-09-35 16.886

31 # 18.420

When finished enter q at the 'course: ' prompt

System response: course:

Type: **q**

Even though you entered the data exactly as indicated, there may still be a small error of misclosure. If a significant error has been made, it will be necessary to correct one of the courses.

System response: ;the closure error and relative error will be displayed in the cogo window.

System response:

Close bearing traverse with 32 courses

Takeoff point1000.000 1000.000

Tie point1000.0001000.000

Calculated end 999.965 999.999

Closure 0.035 0.001 N88-10-57E0.035

Total length 892.011Relative error 1: 25206

If a large error has been made (relative error greater than 1: 5000), you will have to examine the courses entered, and edit those where the error has occurred. To view the courses entered;

Action: select 'edit courses' from the 'trav' menu

System response: Insert, Delete, Change, List, Status, Quit:

Type: **list**

Action: select 'edit courses' from the 'trav' menu

System response: ; a listing of courses will be printed

Course| Attribute Values |input values

1 | N86-53-42E 33.10| (n86-53-42e) 33.10

2 | N44-00-00E 11.66| (N44-00-00e) 11.66

Continue ?

Type: **<Return>**

System response:

3 | N44-00-00E 14.00| (n44-00-00e) 14.00

4 | S59-43-03E 14.00| (n120-16-57e) 14.00

.

This command will list the courses as they were entered. Examine these and compare them to the table of values above. Locate the source of the error. If incorrect values were entered, select the 'change' option and change the course in question. If the error was omitting a course, select insert and enter the course number of the course immediately preceding the one omitted. If an extra course was entered, select 'delete' and delete that course. When you have corrected these exit the edit menu;

.

Type: **quit**

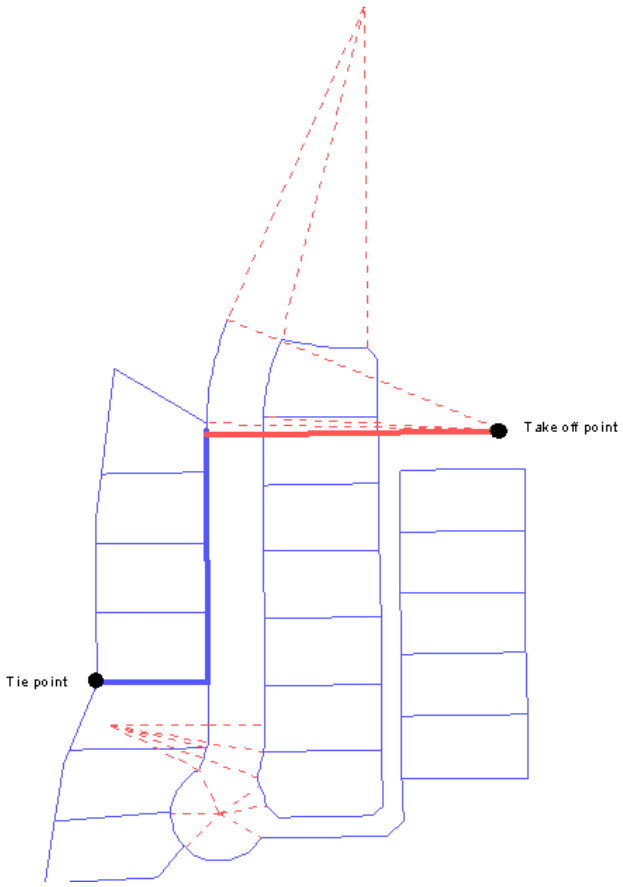
When the large errors have been eliminated, or if the original error is small, the traverse will need to be adjusted. Perform the following step.

Action: select the 'adjust-compass' option from the 'trav' menu

System response: ;the system will automatically adjust the traverse so that it will close

USE THE 'SYS' MENU AND SAVE YOUR SESSION FREQUENTLY TO PREVENT LOSS OF DATA SHOULD YOU ACCIDENTALLY ABORT THE EDIT SESSION !!!

The 'trav new closed' option is similar to 'trav new closed loop', but the known start point and end ('tie') point are different. Figure 2 shows the 'new - closed' loop which you will be entering as the bold line.



Action: select 'new - closed' from the 'trav' menu

System response: Enter the takeoff point

1 = Select 2 = Next 3 = Accept 4 = Free

9 = Quit

Action: select the centre of the circular arc subtending the north-east corner of lot 13 (this point lies above lot 1 on the plan, COGO point 20) with the 1 mouse button and accept it with a 3 mouse button

Note: Your COGO point ID numbers may be different depending on how you have added and edited the points - you should look at figure 2 to make sure you select the correct points.

System response: Enter the tie point

1 = Select 2 = Next 3 = Accept 4 = Free

9 = Quit

Action: select the south-west corner of lot 16 (COGO point 27) with the 1 mouse button and accept it with a 3 mouse button

System response: course:

Now enter the following data

1 N269-25-19 70.000

2 # 16.500

3 N179-25-19 10.928

4 # 20.701

5 # 20.310

6 # #

7 N269-25-19 32.500

When finished, check your results as you did for the closed loop traverse and correct as necessary (the acceptable error is around 1: 68000)

Now, lay out the radial lines from the center of the cul-de-sac

Action: select the 'layout' option from the 'Other' menu

System response: Course:

Type: **n81-59-10,14.00**

System response: Enter the start point for the line

1 = Select 2 = Next 3 = Accept 4 = Free

9 = Quit

Action: pick the centre with the 1 button (COGO point 3)

System response: ;a triangle will highlight the point picked

Action: accept the point with the 3 button

Repeat the layout option for the remaining points on the cul-de-sac, using the following values;

N54-30-55 14.00

N334-26-42 14.00

N270-32-30 14.00

The breakline function provides for the breaking of a line at a given distance from a given point and for breaking a line into equal length sections. For example, the south-east corner of lot 12 can be established by breaking the traverse line which you previously established.

Action: select the 'distance from end' option in the 'break' menu box

System response: Distance:

Type: **16.930**

System response: 1 = Select 2 = Next 3 = Who 4 = Break 9 = Quit

Action: select the north end of the line with a 1 button (COGO point 16)

System response: Arc 47 User-ID: 47 with 2 points selected

Action: break the line with a 4 button (SHIFT-1 on the mouse)

To place the curves in the plan, you must first enter the radius of the curve and then indicate the start and end points. Then indicate what type of curve you want to place. Curves can be 'left' or 'right' (indicating the direction the curve will be drawn, relative to the centre of the curve) and may be 'short' or 'long', indicating a major or minor arc. For the east boundary of lot 34;

Action: select 'curve' menu and the 'short left' option

System response: you will be prompted for the radius and then start and end points

System response: Radius:

Type: **86.5**

System response: Enter the start point for the curve

1 = Select 2 = Next 3 = Accept 4 = Free 9 = Quit

Action: select and accept the northern point of the curve (COGO point 19)

System response: Node (1053.348,1164.265)

Enter the end point for the curve

1 = Select 2 = Next 3 = Accept 4 = Free 9 = Quit

Action: select and accept the southern point of the curve (COGO point 21)

System response: Node (1047.108,1134.419)

System response: ; the curve will be drawn.

An additional useful curve command is 'curve parallel'. This option is selected from the 'curve' menu box. The required data is the selection of an existing curve and a positive or negative offset distance at which to make a parallel copy of the selected curve.

Action: select 'parallel' from the 'curve' menu

System response: Delta radius:

Type: -**16.5**

System response: 1 = Select 2 = Next 3 = Who 4 = Curve Parallel 9 = Quit

Action: select the eastern boundary of lot 34 with the 1 button

System response: Arc 52 User-ID: 83 with 62 points selected

1 = Select 2 = Next 3 = Who 4 = Curve Parallel 9 = Quit

Action: accept this with the 4 button, and the curve will be copied to become the western boundary of lot 12.

A useful option when traversing is to enter the number of legs to be computed along a given distance and bearing. For example, if a 'new - closed' traverse has been selected for the western boundaries of lots 1-5, and the south-west corner of lot 5 has been selected as the start point, then entering the following values will generate the south west corners of the five lots;

359-25-19,18.00,5

For example;

Action: select 'new closed' from the 'trav' menu

System response: Enter the takeoff point

1 = Select 2 = Next 3 = Accept 4 = Free

9 = Quit

Action: select the southwest corner of lot 5 (COGO point 7) with 1 mouse button and accept it with a 3 mouse button

System response: Enter the tie point

1 = Select 2 = Next 3 = Accept 4 = Free

9 = Quit

Action: select the north-west corner of lot 1 (COGO point 14) with the 1 mouse button and accept it with a 3 mouse button

System response: course:

Now enter the following data

Type: **n359-25-19,18.00,5**

System response: all of the lot boundaries for lots 1-5 will be drawn.

Using the above commands and examples, continue and draw as many of the outer boundaries of the lots as you can, including curved boundaries. You should be able to add the rest of the cul-de-sac curves (radius 14).

The interior boundaries can be added with the 'JOIN' AML. This actually uses the 'layout' command, but allows one to use previous distances and/or bearings in a 'friendlier' fashion. The dialog will appear like this;

Action: Select 'Join' from the 'Other' menu

System response: Enter the start point for the line

1 = Set distance 2 = Set angle 3 = Set both 4 = Same 9 = Quit

You are then expected to click on the start point of the 'join' line with the appropriate button. If

you need to enter both azimuth and distance, you would use the 3 button; if you wanted to use the previous azimuth, use the 1 button and enter a distance; if you needed to enter only a new azimuth, use the 2 button; and if you wanted to use the precious azimuth and distance use the 4 button.

For practice join the northwest corner of lot 18 to the north east corner;

Action: click on the northwest corner (COGO point 28) with the 3 button

System response: course:

Type: **n89-25-19,39.901**

System response: angle N89-25-20E distance 39.90

Attrib: angle N89-25-19E distance 39.90

To do the same for lot 5;

Action: click on the northwest corner with the 3 button

System response: course:

Type: **n89-25-18,36.67**

System response: angle N89-25-18E distance 36.67

Attrib: angle N89-25-19E distance 36.67

1 = Set distance 2 = Set angle 3 = Set both 4 = Same 9 = Quit

Join the remaining interior lot lines for lots 1-5 using this command (Hint: button 4 will make things much easier, since the lot boundaries are all the same). When you are finished, use the 9 button on the mouse (CTRL-3) to exit 'Join'.

Your COGO coverage should contain all the lines shown in figure 3.

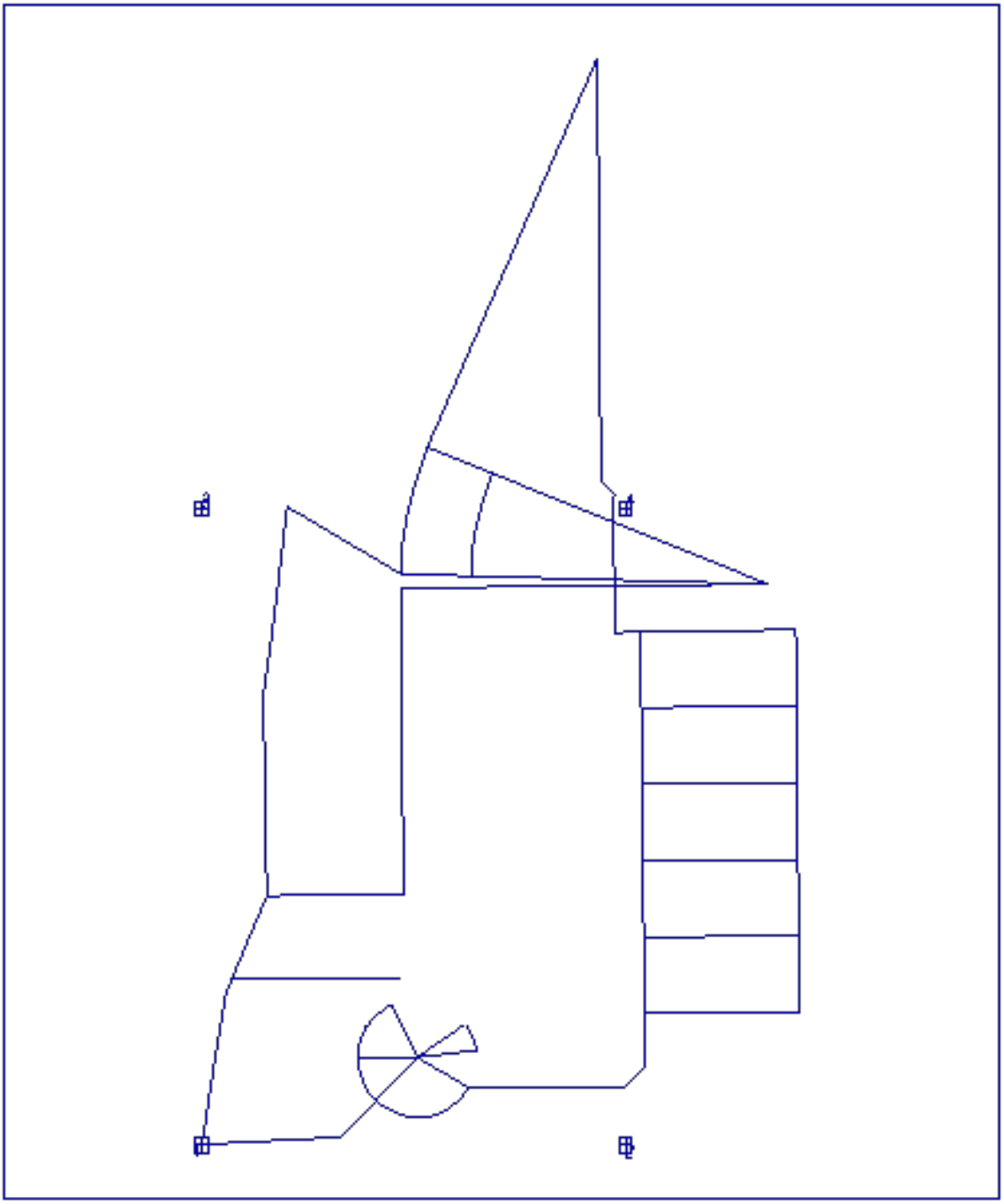


Fig. 3 - Arcs that should be visible in your COGO lots coverage

The individual arcs generated in COGO can be annotated with azimuth and distance using 'annotate'.

Action: select 'annosize' from the 'Anno' menu - this sets the text size

System response: Enter Annosize:

Type: **1**

Action: select 'annooffset' from the 'Anno' menu - this sets the offset distance the text will be placed from the arc

System response: Enter annooffset:

Type: **1**

Action: select the annotate lines option under the Anno box

System response: ; a menu of options for the buttons will appear; select the desired option

1 = Direction above2 = Distance above3 = Oops

4 = Direction below5 = Distance below6 = Window

7 = Edit8 = Sum of distances9 = Quit

Action: point to the line you wish to annotate, and select the type and position of annotation you desire by clicking with the corresponding button

You can also annotate lines using ARCEDIT commands:

Action: select 'ARCEDIT commands' from the 'Misc' menu

To annotate a line with its length -

System response: Arcedit:

Type: **annoitem line length auto**

System response: Arcedit:

Type: **add**

System response: Point to the feature for the annotation

TEXT=(**No feature selected**)

1 = Select 2 = Next 3 = Keep 9 = Quit

Action: point to where you want the text to be located near the line, select it with the 1 button, if the line is the right one depress the 3 button

To annotate a line with it's bearing

System response: Arcedit:

Type: **annoitem line angle auto**

System response: Arcedit:

Type: **add**

System response: Point to the feature for the annotation

TEXT=(**No feature selected**)

1 = Select 2 = Next 3 = Keep 9 = Quit

Action: point to where you want the text to be located near the line; select it with the 1 button, and accept with the 3 button

Add some annotation to your drawing. Remember to save your work periodically.

There is no assignment with this module - just enjoy experimenting with COGO.

Lecture notes

COGO

03/02/98

Click here to start

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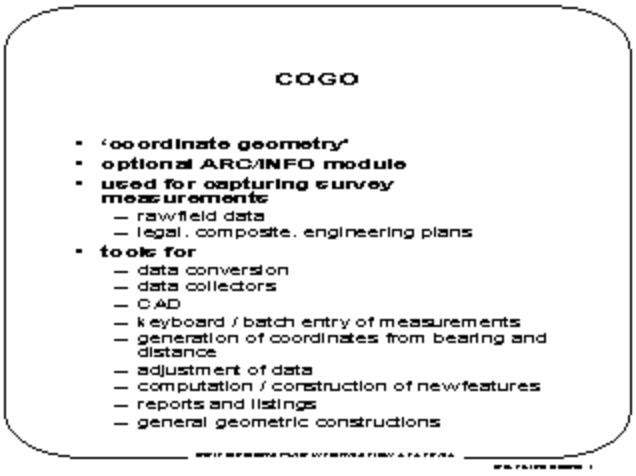
COGO
'coordinate geometry'
optional ARC/INFO module
used for capturing survey measurements
— rawfield data
— legal, composite, engineering plans
tools for
— data conversion
— data collectors
— CAD
— keyboard / batch entry of measurements
— generation of coordinates from bearing and distance
— adjustment of data
— computation / construction of newfeatures
— reports and listings
— general geometric constructions

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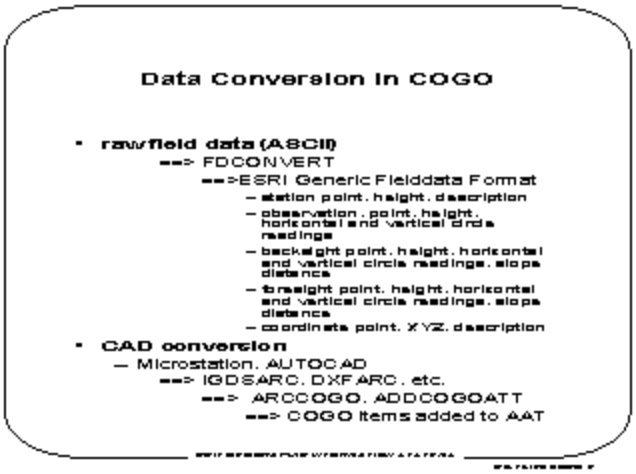
Data Conversion In COGO
raw field data (ASCII)
==> FDCONVERT
==>ESRI Generic Fielddata Format
– station point, height, description
– observation, point, height, horizontal and vertical circle readings
– backsight point, height, horizontal and vertical circle readings, slope distance
– foresight point, height, horizontal and vertical circle readings, slope distance
– coordinate point, XYZ, description
CAD conversion
– Microstation, AUTOCAD
==> IGDSARC, DXFARC, etc.
==> ARCCOGO, ADDCOGOATT
==> COGO items added to AAT

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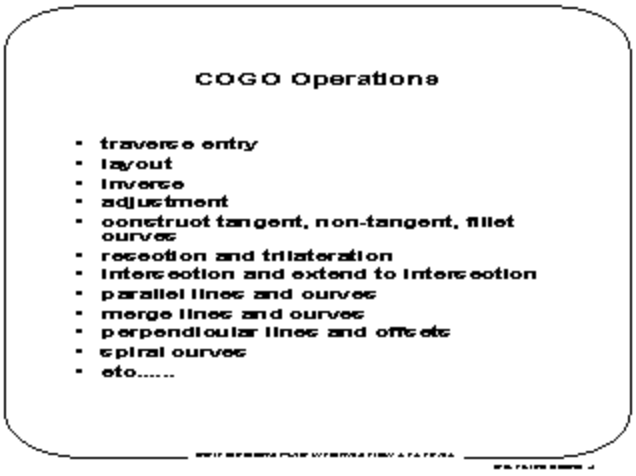
COGO Operations
traverse entry
layout
inverse
adjustment
construct tangent, non-tangent, fillet curves
reception and trilateration
intersection and extend to intersection
parallel lines and curves
merge lines and curves
perpendicular lines and offsets
spiral curves
etc.....

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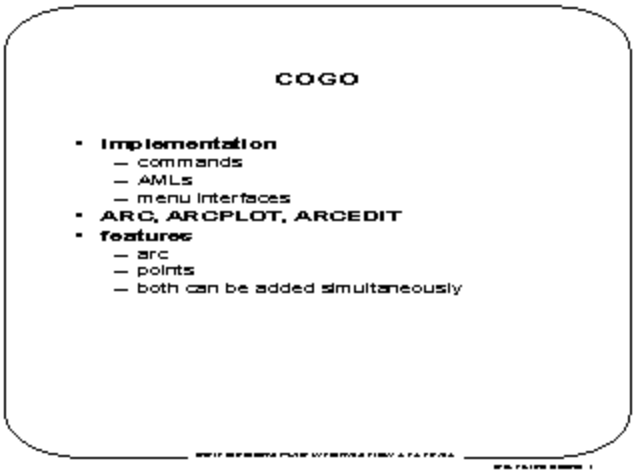
COGO
Implementation
– commands
– AMLs
– menu interfaces
ARC, ARCPLOT, ARCEDIT
features
– arc
– points
– both can be added simultaneously

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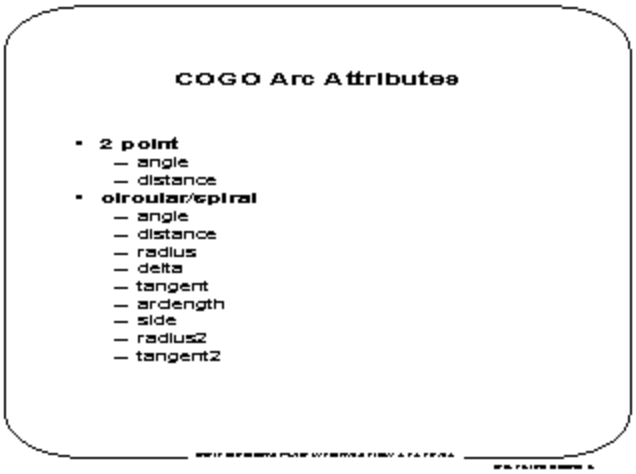
COGO Arc Attributes
2 point
angle
distance
circular/spiral
angle
distance
radius
delta
tangent
arclength
side
radius2
tangent2

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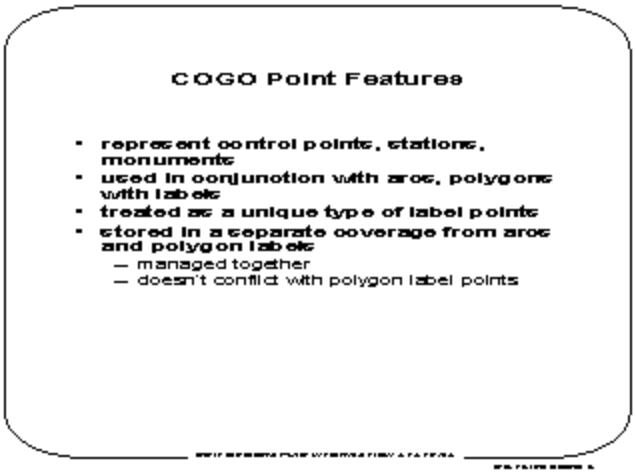
COGO Point Features
represent control points, stations, monuments
used in conjunction with arcs, polygons with labels
treated as a unique type of label points
stored in a separate coverage from arcs and polygon labels
— managed together
— doesn't conflict with polygon label points

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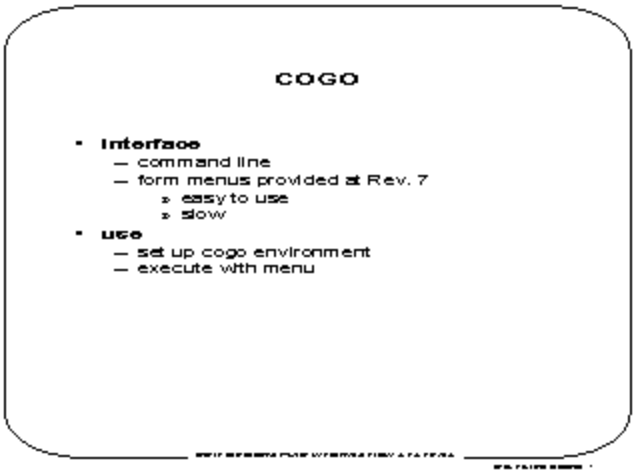
COGO
Interface
— command line
— form menus provided at Rev. 7
» easy to use
» slow
use
— set up cogo environment
— execute with menu

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