Creation of the 1880 Cadastral Layer

Data

The cadastral plans are provided by the Bibliothèque nationale du Québec.
The originals have been transferred to disc labeled Sicotte (MAP Project).

Three series were available for the region of Montreal in the 1870s and 1880s:

1. Cadastral Plans of the City of Montreal (1880?). G 1144 M65G46 C33 1880 CAR. Trbd0001-0049 (jpg)
2. Sicotte, L.W. (Louis-Wilfrid), 1838-1911. Plans officiels des comtés d'Hochelaga et Jacques Cartier [1876]. G 1142 M65G46 S53 1876 CAR. Trbc0001-0017 (jpg)
3. Sicotte, L.W. (Louis-Wilfrid), 1838-1911. Plans officiels de la Paroisse de Montréal [1878]. G 1144 M65G46 S53 1878 CAR. Trbb0001-0016 (jpg)

The 2000 cadastral layers is provided by the city of Montreal for most of the coverage area. Files in the folder cad_dgn.83 were used.

Steps

1. Integrate subdivided plots onto the original plots. (Corel Photo Paint)
2. Rectify the cadastral survey maps to the 2000 cadastral vector layer. (Image Analysis extension of Arc View)
3. Prepare and touch-up the image for autovectorization of cadastral lines (Corel Paint)
4. Conversion of image and preparation (Corel Paint)
5. Autovectorization (ArcEdit)
6. Cleanup of the arcs (ArcEdit/ArcMap)
7. Building of Polygons (ArcTools)
8. Addition of cadastral numbers (ArcEdit)

Step 1: Incorporating insets into the 1870 cadastral plots

Background

The cadastral plans from the 1870s (Sicotte) contain the streets and the cadastral lots for the City of Montreal, the Parish of Montreal, and the other parishes found on the island of Montreal in that period of time. Each plate contains a map of the cadastral lots (and subdivisions), their corresponding numbers, and the street names. In some cases, the information about individual lots is too detailed to be included on the map (usually due to subdividing of the original lots). Details about these lots are in the form of insets. These insets are usually found next to the original map or on pages appended to the original document.

File Structure

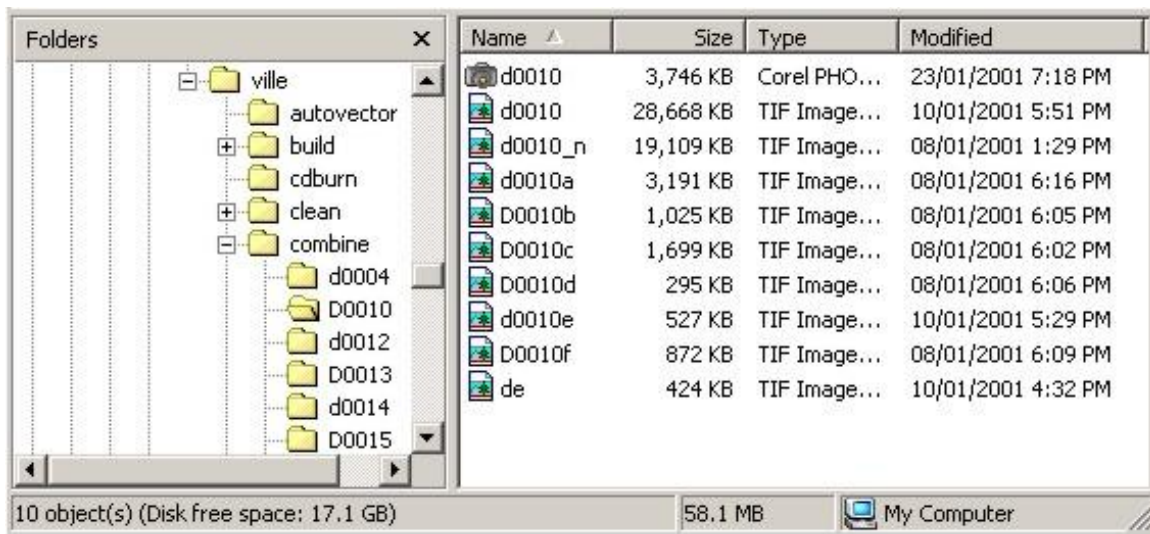Lists of subdivided lots cut for integration into the cadastral plan

C:\rosa\sicotte\ville\subdivisions_trbd0046.doc
C:\rosa\sicotte\ville\subdivisions_trbd0047.doc
C:\rosa\sicotte\ville\subdivisions_trbd0048.doc
C:\rosa\sicotte\ville\subdivisions_trbd0049.doc

Example of list from subdivisions_trbd0048.doc

Saint Antoine Ward

Lot	File (Plate)	Cross Streets	
No 86	Trbd0010_n.jpg	St-Antoine / Bishop	D010b
No 87	Trbd0010_n.jpg	St-Antoine / Bishop	D010c
No 623	Trbd0011_n.jpg	St-Antoine, LaGauch / Cemetry	D010d
No 1458	Trbd0012_n.jpg	Ste-Catherine / Peel, Metcalfe	D012a
No 1606	Trbd0010_n.jpg	St-Antoine / Guy	D010g
No 469	Trbd0010_n.jpg	St-Joseph/Guy	D010f
No 461 466	Trbd0010_n.jpg	St-Antoine, G_trunk / Guy, Mountain	D0010a
No 467 591	Trbd0010_n.jpg	St-Antoine, G_trunk / Guy, Mountain	D0010a
No 1546	Trbd0013_n.jpg	St-Antoine, Scotland / Aqueduct	D0013a
No 171	Trbd0010_n.jpg	Canning / St-Joseph	D0010e

Folder structure for Image file trbd010.jpg

Folders	×		Name △	Size	Type	Modified
⊟ ville			d0010	3,746 KB	Corel PHO...	23/01/2001 7:18 PM
autovector			d0010	28,668 KB	TIF Image...	10/01/2001 5:51 PM
⊞ build			d0010_n	19,109 KB	TIF Image...	08/01/2001 1:29 PM
cdburn			d0010a	3,191 KB	TIF Image...	08/01/2001 6:16 PM
⊞ clean			D0010b	1,025 KB	TIF Image...	08/01/2001 6:05 PM
⊟ combine			D0010c	1,699 KB	TIF Image...	08/01/2001 6:02 PM
d0004			D0010d	295 KB	TIF Image...	08/01/2001 6:06 PM
D0010			d0010e	527 KB	TIF Image...	10/01/2001 5:29 PM
d0012			D0010f	872 KB	TIF Image...	08/01/2001 6:09 PM
D0013			de	424 KB	TIF Image...	10/01/2001 4:32 PM
d0014						
D0015						

10 object(s) (Disk free space: 17.1 GB) · 58.1 MB · My Computer

### *Incorporating Insets Using The Corel PhotoPaint program*

   A. Open the subdivision file (d0010a).
   B. Open the cadastral survey file (d0010_n.tif)

   C. For the subdivision file, using the mask tool ⬡, select the subdivision that will be transferred to the cadastral survey (onto d0010_n.tif).
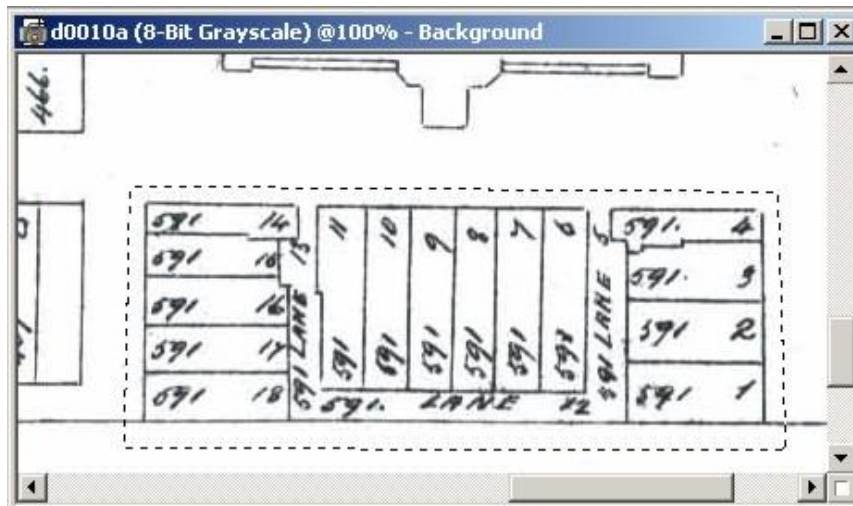
D. Copy the object (CTRL C) and paste it (CTRL V) into the d0010_n file.
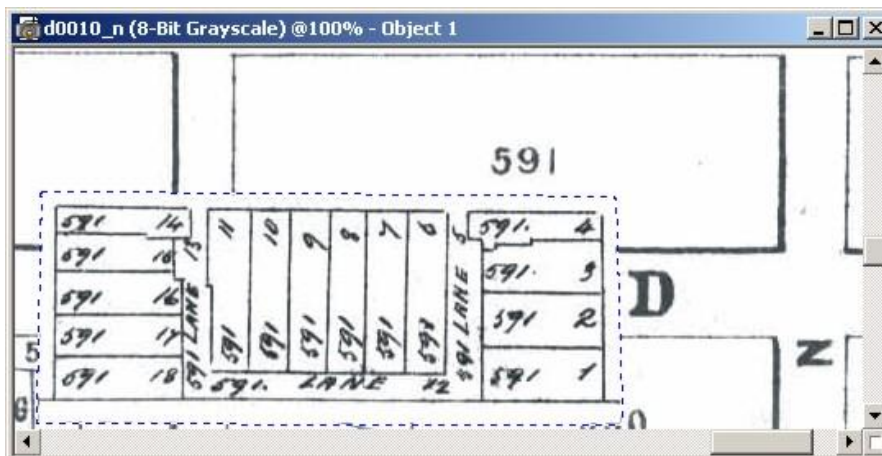
E. Using the object select tool and the transparency tool move the object so that it overlaps on top of the cadastral lot.
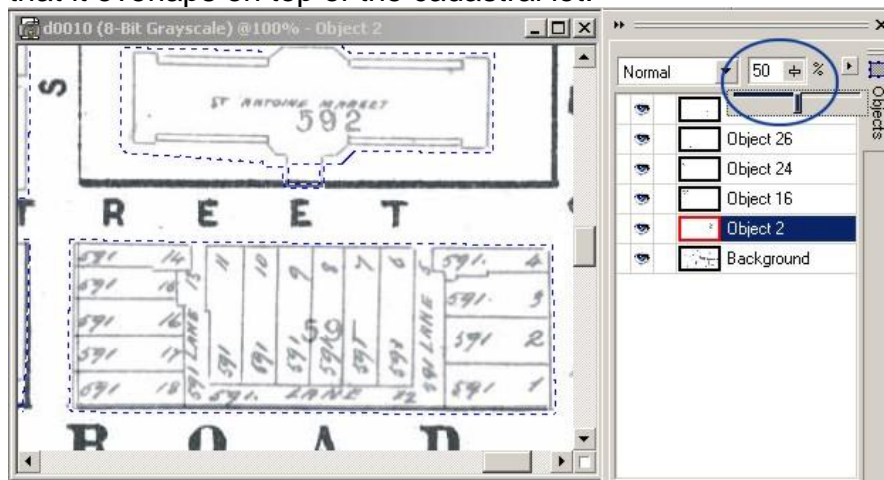
F. A touch up job may be necessary such as removing lines or rotating the object so it aligns with the lot etc. Using these tools for alignment:

G. Once object is aligned to your liking then bring the transparency back to 100% and bring in other subdivisions to the image.
H. Save the image as a Corel Paint file in this case (d0010n)
I. The final image should be saved as a tiff file. This file is placed in the directory c:\rosa\sicotte\ville\ready. This image will be rectified, as outlined in Step 2.

Step 2: Rectifying the Cadastral Survey
(Using the Image analysis extension of ArcView)

Selection of Control Points

Initially, four control points are established (one near each corner of the image). It isn't always possible to do this due to changes in the cadastral system since 1880. These changes are due to expropriation of land for street widening, fusion of cadastral lots for large development projects, and the subdivision of original plots.

Procedure

1. Electronic copies of the documents to read for this procedure are from the book "Environmental Systems Research Institute. <u>ArcView Image Analysis: Enhanced Image Integration, Display, and Analysis.</u> 1998. Environmental Systems Research Institute." follow their example of rectifying an area of Seattle Washington.

   Chapter 1: Introduction to the Arc view image analysis extension
   C:\rosa\rectifytrials\imageanalyst\image analysis intro.doc

   Chapter 2: quick start tutorial :
   C:\rosa\rectifytrials\imageanalyst\image analysis tutorial.doc

   Chapter 6 .

2. Maintain the lowest error possible. Sometimes only 4 or 5 control points are needed.
3. When saving the final output image, save it as a tiff file and deposit into: C:\rosa\sicotte\ville\rectify\   (d0010n.tif)

## Step 3: Prepare and Touch-up the Image for Autovectorizations (Corel Photopaint)

Objective

Autovectorization refers to the process of extracting intersecting vector lines from a raster image. Some images are not appropriate for this procedure due to the complexity of the image (such as too many colours or too many layers of information), On occasion a simple image can be used to do the autovectorization process. The Sicotte images are excellent examples of maps ideal for autovectorization.
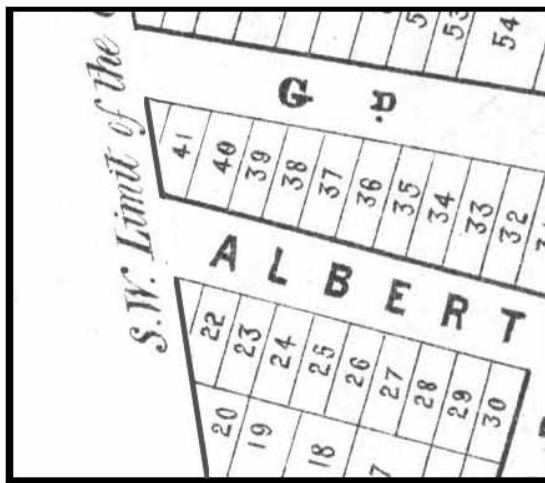
Method

1. Copy the tiff file and it's other extensions (mainly the twf file) from the c:\rosa\sicotte\ville\rectify folder to c:\rosa\sicotte\ville\lineart

2. Eliminate or clarify any lines that would interfere with the drawing of vectors.
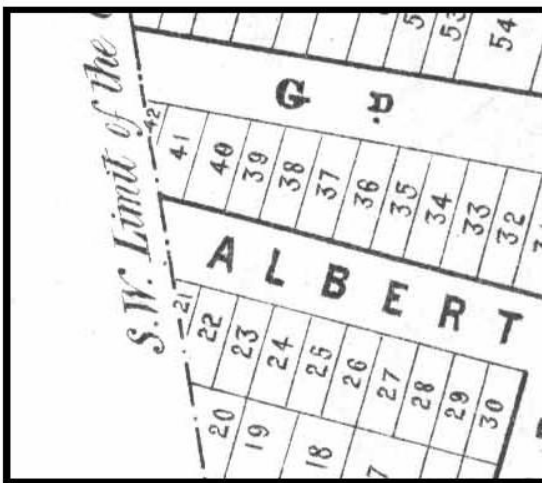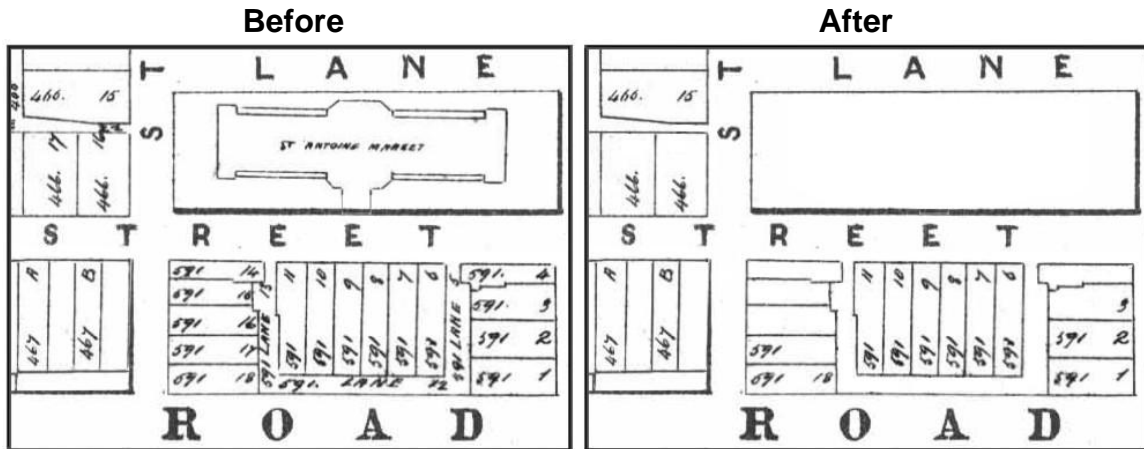
Before	After

3. Eliminate any "text" or objects touching the lines & strengthen any lines that have gaps or are too thin

Before	After

The best tools to use are: the line tool and the polygon tool with a white background and a grey toned outline that can be captured using the

eyedrop tool

4. Save an changes to the document as a corel paint document. This document will be used in Step 4.

Step 4: Conversion of image and preparation

Image Preparation

1. Open Image into CorelPhotoPaint found in c:\rosa\sicotte\ville\line folder.
2. Image – Mode – Black and White (1-bit). Parameters: Conversion = Line Art Threshold =160
3. Save Image as a BMP or a TIFF in the c:\rosa\sicotte\ville\line

Setting up your workspace

1. Open Arc
2. Arc: arctools

3. The arctools box will come up and select command tools, and OK
4. Command Tools – ArcTools – Workspace
5. Using the arrow button and the subdirectory dialog browse to the folder in which you want your workspace to be & Press OK
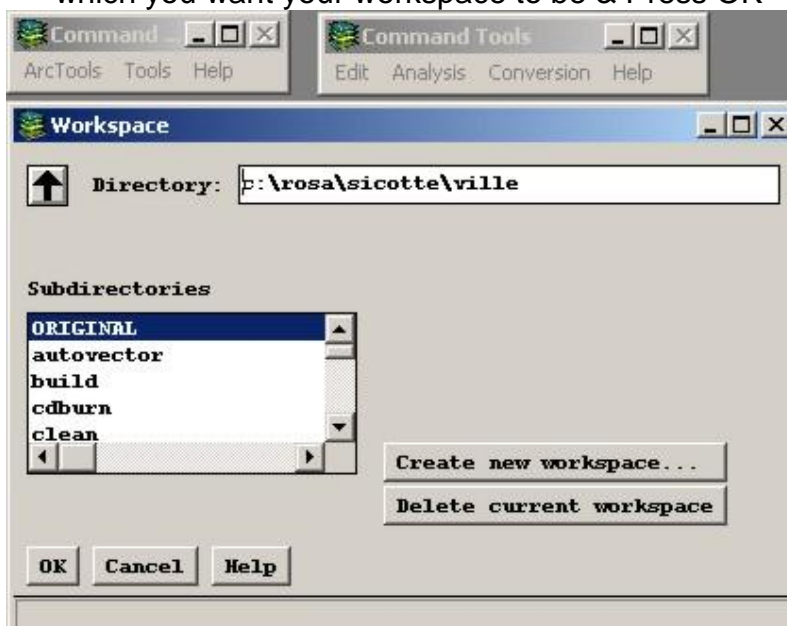
Image to Grid Conversion

1. Command Tools – Conversion – To Grid – Image to grid
2. a) In the input image box, click with the right button and browse to the directory containing your image file
   b) Type in your output grid. Place the grid in the c:\rosa\sicotte\ville\grid folder.
   c) Deselect the colormap option
   d) Select the 1 band
   e) Keep the sampling and blocking methods as the defaults
   f) Press OK

Step 5: Autovectorization

Setting up work environment

1. Set up your work space (see instructions above)
2. Close the Command Tools menu
3. From the ArcTools menu, select the Edit Tools, and press OK
4. File – Grid – Open
5. Appears is the "select an edit grid" menu. From the "Grid" menu select the grid that is to be used for vectorisation
6. File – Coverage – New
7. Type in the name of the coverage file
8. Select "arc" and verify if it appears in the "feature to create" dialog
9. Click on the "enter tics button, in the dialog that appears select the cursor options.
10. To register the first tick, click the button with the "cross-hair". Drag and click the corner of the image file. Once done, give the tic-id an id (ex. 1). Click on the "add tic to list" button.
11. Repeat step 9 for the remaining 3 ticks.
12. Press OK.
13. Return to the New Coverage dialog and press OK.

Autovectorization

1. To set up the trace environment, select the trace environment icon
2. Once in the the trace environment, select the line properties button and change the value from 1 to 0. Other values can be "fiddled with" to achieve a more accurate tracing of the property lines. Once finished with press dismiss on both dialogs.
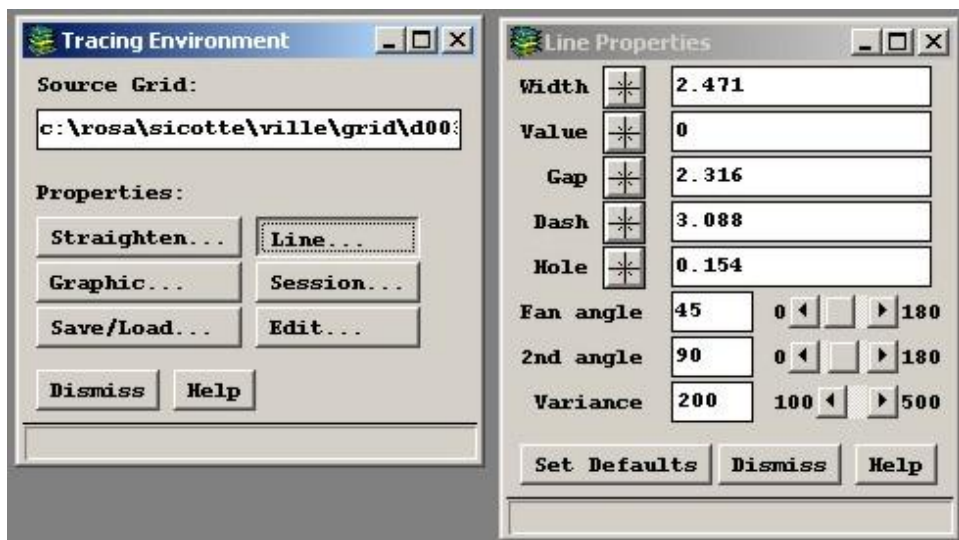
3. Select the trace button ![TRACE], and set up the work environment as shown below.
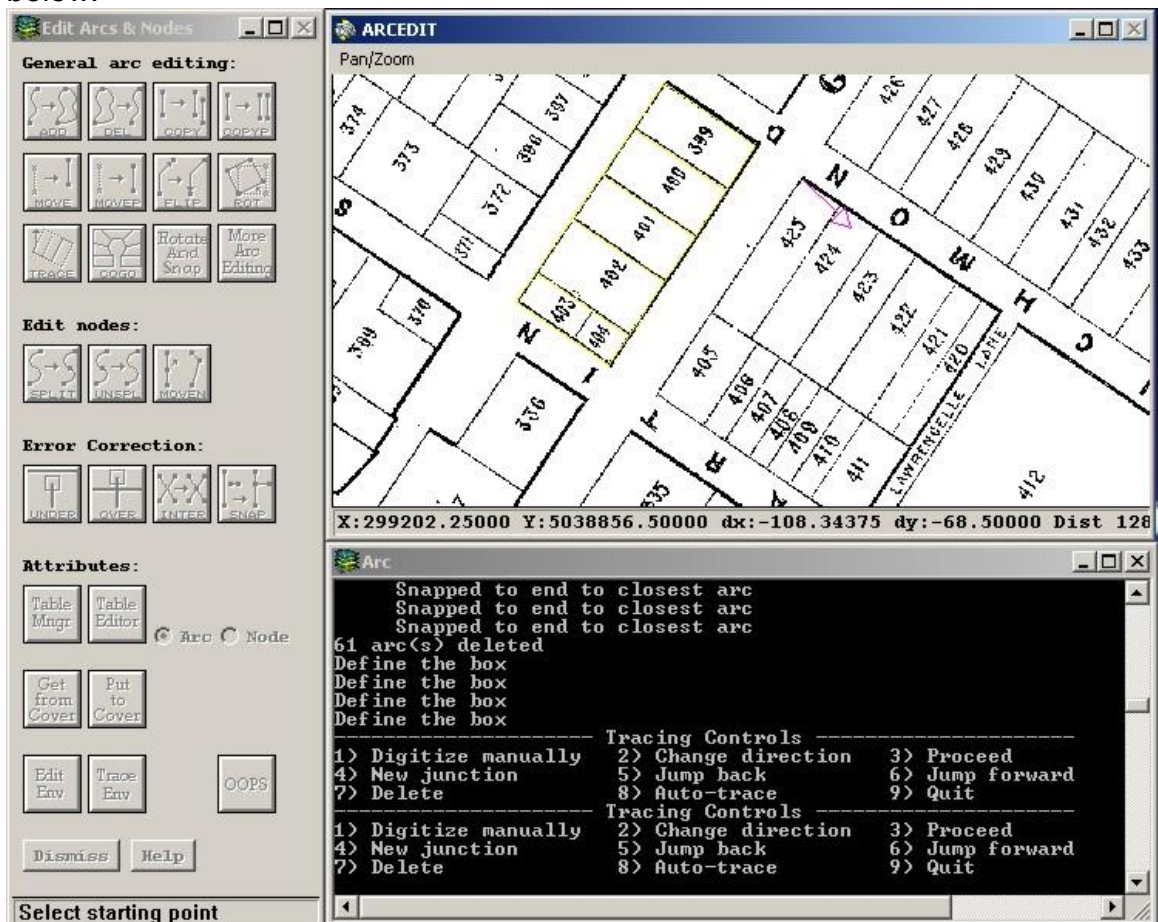
4. Click on a corner of a set of cadastral plots (as seen in the diagram above). To trace use the options in the arc box. To trace the area without manual control select "8" for autotrace. That will created create arcs for the coverage file. To stop tracing press "9" to quit. For more control of the

tracing, you can use the change direction and the arrow keys to help facilitate the process. The 5 and 6 key to jump forward and backward from the different node points. When the block is finished, press 9 to quit. Sometimes it is necessary to use the "digitize manually option" because of large gaps in the lines. Every time a new area is to be traced the trace button has to be used to start the process.

5. Save the process on a regular basis (and at the end of the process).
6. To quit select the close option from the "File" drop down menu.

Step 6 : Cleanup of the arcs (ArcMap)

It is necessary to clean up the arc files because the autotracing technique is not perfect. In some cases, complicated intersections are not traced properly therefore it is necessary to edit the files. The arc files are compared to the original rectified image or the grid image.

Startup

1. Open ArcCatalog. In arc catalog copy the desired coverage file from the c:/Rosa/sicotte/ville/coverage to c:/Rosa/sicotte/ville/clean1.
2. Open ArcMap. In ArcMap, click the Add Data button ⬇.
3. Navigate to the folder c:/Rosa/sicotte/ville/clean.
4. Select the coverage later. From the editor dropdown list, select the "start editing" option. The window that pops up allows you to select the workspace and layer you want to edit. Press OK. The layer to be edited will appear on the tool bar as the "target" layer.
5. To set the snapping area, Click on editor and then click snapping. Check the boxes for vertex, and close the window. This specifies that any lines you draw in your coverage file will snap to vertices either located at intersections or along curves in the line.
6. Open Arc map, click Add Data, Navigate to the folder c:/Rosa/sicotte/ville/grid and click on the raster file of interest (such as d0024n). Press OK. Click on the coverage file name and slide that layer so that it will on top of the raster image. If the image doesn't appear go to step 7.
7. Double click on the coverage name. The layer properties window will appear, and select the symbology tab. Select the unique value property.
8. Double click on the colour box next to the value 1. Select the colour as white. In the no data box select the colour as black. Press Apply. The block outline of the cadastral blocks should appear on the image.
9. To change the colour and thickness of the coverage file. Double click on the name of the coverage. Select symbology. A thickness of 1.5 and a purple or pink colour for the line is recommended.

Editing a pre-existing line

1. Click on the Current Task dropdown arrow and click Modify Feature.
2. Select the sketch tool. Edit tool and click the line or polygon to which you want to make changes.
3. To add a vertex. Position the pointer over the vertex you want to add until the pointer changes. Right click and click Insert Vertex. To delete a vertex. Position the pointer over the vertex you want delete until the pointer changes. Right click and click delete vertex.
4. To move a vertex. Position the pointer over the vertex you want to move until the pointer changes. Click and drag the vertex to the desired location.
5. To finish the modifications: Right click over any part of the sketch (selected line) and click Finish Sketch. The feature is now reshaped.

Digitizing a Line

1. Click on the Current Task dropdown arrow and click Create New Feature.
2. Select the sketch tool on the editor tool bar
3. On the map, position the pointer over the vertex you want to start from. If a circle appears, click on that point to start the new line. Draw the line using the left mouse button to the end point or intersection of lines. Double click the left mouse to end the line.

Close a Session

1. To stop editing, go to the editor dropdown menu and select the stop editing.
2. Close the session by going to File – Close.

Step 7: Verification of Maps and of Cadastral Numbers

Step 7B) Addition of Cadastral Numbers

Preparing Cadastral Coverages for Cadastral Numbers

Example: Cadastral 1870.

Note: A similar procedure will be done for the 1880 layer when it is ready.

Directory Structure:

C:\rosa\cadastral1870\city\ contains folders needed to produce the 1870 cadastral layer for the city of Montreal.

C:\rosa\cadastral1870\suburbs contains folders needed to produce the 1870 cadastral layer for the suburbs of the city of Montreal

The City directory is divided up into wards, whereas the suburb directory is divided into municipalities. For the instructions, the city ward East, will be used as an example.

The c:\rosa\cadastral1870\city\east directory contains several folders.
The folder Coverarcs has the cadastral lines that have been edited (or may still need some editing) for that ward.
The folder Fuse contains a file where all of the files in the coverarcs folder have been joined to form an arc file for that ward.
The Clean1 folder contains the file that has been transformed from arcs into a polygon format. The file east1.cov will be edited to allow for the entering of attributes (in this case cadastral numbers). The folder clean 1 contains the final product.

The raster images used for comparison and to add attributes are located in one of two locations:
c:\rosa\sicotte\city\rectify (for plates that have no subdivision) or
c:\rosa\sicotte\city\ready (for plates with subdivisions)
Refer to the index sheet to find out what cadastral plates correspond with which ward.

Procedure

1. In ArcMap verify if all the vectors correspond with each property on the image.
   Use the *Step 6: cleanup of the arcs*.
   For comparison of cadastral numbers use the c:Rosa\sicotte\ville\rectify files

2. **Note:** If the ward contains only 1 coverage file then go straight to **step 3**
   For wards that contain **more than 1 coverage** (vector) file , create a fused file by doing the following

   open **ArcToolbox** – **Data Management Tools**- **Aggregate** – **Append Wizard.**
   Coverages to appended : select coverages from
   c:\rosa\cadastral1870\city\east\coverarcs\
   Append all features but not feature attributes : check this option -- Next.
   Output coverage: deposited into c:\rosa\cadastral1870\city\east\fuse\ as "eastf"
   Create unique Ids: tics and features.-- Next -- Finish.

3) **Building of Polygons** The clean tool prepares the file for the building of polygons. It ensures that all arc and nodes are connected.
Open **Arctoolbox** – **Data Management Tools - Topology – Clean**
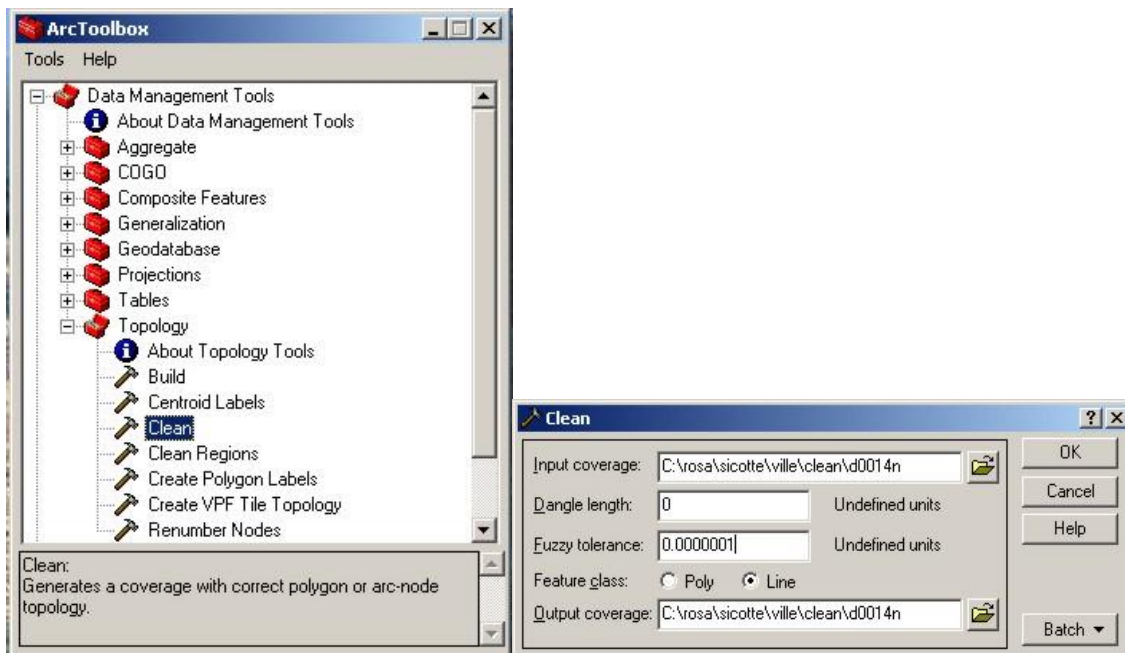
   Input coverage : c:\rosa\cadastral1870\city\east\fuse\eastf
   Dangle length : 0
   Fuzzy tolerance : 0.0000001
   Feature class : poly

Output coverage : c:\rosa\cadastral1870\city\east\clean1\east1

1. In ArcTool box, select the build tool. Specify the input coverage and select poly as the topology. Press OK

3. Open ArcCatalog, scroll down to c:\rosa\cadastral1870\city\east\clean1\east1, click on east1 so that the components of the arc file appear (arc, label, polygon, tic). Select the **label** and click the right button and select properties.
4. Add button. Brings up add item dialog.
   To add the cadastral number column:
   Item name: **cad_no**
   Type: char
   Input width: 5
   Display width: 5 or greater
   OK
   To add the subdivision column:
   Add button:
   Item name: **SubDiv**
   Type: char

Input width: 5
Display width: 5
OK
To add the ward column:
Add button:
Item name: **wardID**
Type: Float
Width: 4
OK
Note: Due to gliches in program, must add a fake item and delete it, then press APPLY, then press Ok.

5.b   Open **Arctoolbox – Data management tools – Topology- Create polygon labels**

   select your input coverage file. (the file you just cleaned)
   Id Base Value=1

5. Adding cadastral numbers and ward number
    a. Open ArcMap.
    b. Click on the Add Layer Button.
    c. Open both the polygon and label by Selecting
        c:\rosa\cadastral1870\city\east\clean1\east1. OK.
    d. Add Layer. Select c:\rosa\sicotte\ville\rectify\ folder and select d0007.tif
        and d0008.tif images (rectified image of cadastral east ward). If you are
        unsure what cadastral image to select refer to the index map located in the
        sicotte "paper index" folder.
    You can also look in the coverarcs folder for that ward ie cov0019 to see
    which rectified image files you need to use, then obtain the image file from
    the c:\rosa\sicotte\ville\rectify\ folder
    e. Change the polygon symbol so that it will have a thicker outline and a see
        through polygon (no colour option). The numbers on the raster image for
        each cadastral plot should be visible.
    f. In the editor drop down menu, select "start editing". Ensure that your
        Target (ie file you are about to edit) is the label file.
    g. Select the edit point, and press the "attributes". An attributes dialog will
        appear.
    h. Select the cadastral plot on the view (#1). That polygon is highlighted,
        and the attribute details appear. Type 1 as the value for cad_no attribute.
        If a subdivision of a cadastral plot occurs type in the subdivision number
        in the subdiv field. Repeat this step until each polygon is labeled with its
        cadastral number and subdivision.
        .
    i. To verify if the procedure worked. Select the east1 polygon from the
        layers list, and click with the right button Open Attribute Table. Scroll
        down the cad_no column to verify if the values are there.
    j. To add the wardID. Highlight the wardid column, clicking on right button
        on the wardID title, select the calculator button. In the dialog that appears,
        type 3 under the wardID= label. Press OK. 3 should appear for each
        entry. Note:each ward number is different!

k. When completely finished, select "save edit", the "Stop editing" from the editor drop down menu.