# Creating an Accurate Seamless Map from Accurate "Tiled" CAD Maps

In the beginning all map information was "tiled" by necessity (breaking up a large area map into smaller pieces or tiles). This is because there is a limit to how much information can fit onto a single sheet of Linen / Paper / Mylar and maintain readability. Over time, much of this information has been converted to CAD, but retained its tiled, sheet orientation.

The advent of digital mapping technology has eliminated the need to tile and has made the "Seamless" map possible, even for very large areas with dense information. A complete map coverage of any area of interest has many potential benefits, not the least being the possibility of viewing or printing a complete picture.
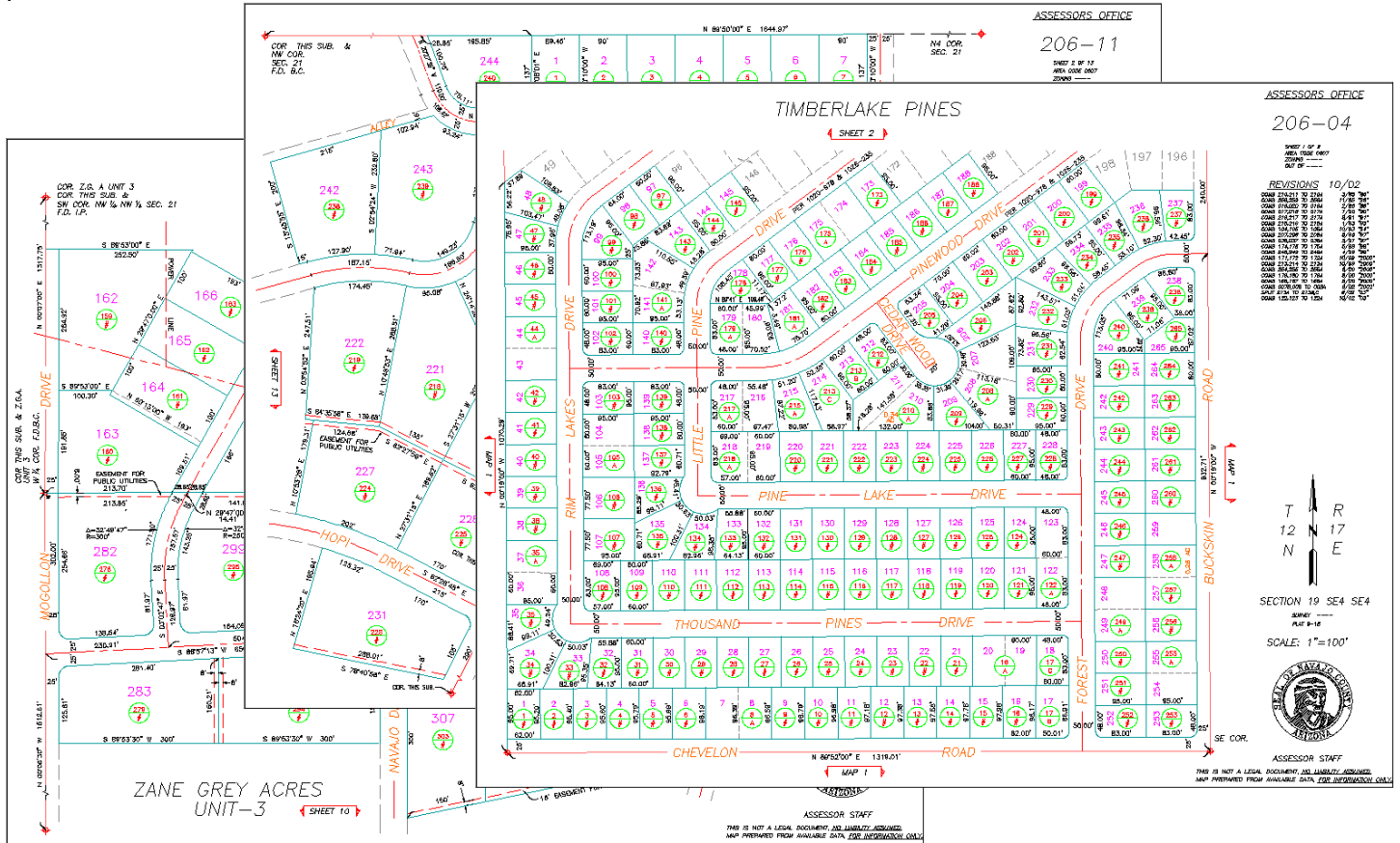
Preserving the Accuracy of Tiled CAD Data

Making the Whole as Accurate as the Sum of the Parts

Navajo County Arizona has maintained an accurate landbase record for over 20 years. The County Assessors office has used AutoCAD to maintain over 2000 tiled drawings, detailing over 74,000 parcels covering over 9200 square miles.

In early 2003, Bill Cox the Director of Public Works decided to fund an internal project to assemble a seamless parcel basemap to form the foundation of a new countywide GIS. The project was to be headed up by Jeff Cook, the County GIS Coordinator.

Jeff's chosen GIS platform was Arc/Info so he began looking at the tools and methods available to import the AutoCAD drawings and assemble them into Arc/Info. He did not find an acceptable solution. Next he looked for a method to assemble an accurate, seamless basemap using AutoCAD. He knew that he could easily create the desired Arc/Info coverage from a seamless AutoCAD basemap. He found the solution he needed at the TCI Software website and soon thereafter purchased the tools and training he needed. This is the story of Navajo Counties success.

Tiled Assessors Maps

Many Assessor organizations maintain their landbase information using "tiled" AutoCAD drawings. A common drawing structure is to use a standard title block positioned at the origin (coordinates 0,0). These drawings are typically named according to a legacy convention (like Book and Page number) and some part of the landbase is drawn inside of the title block boundary. Because of the tiled nature, the drawings will also include a label to indicate which pages are adjacent.

The Navajo County Assessors office has used this format since 1997 and now has almost 2000 "pages" of landbase records – one page per drawing.
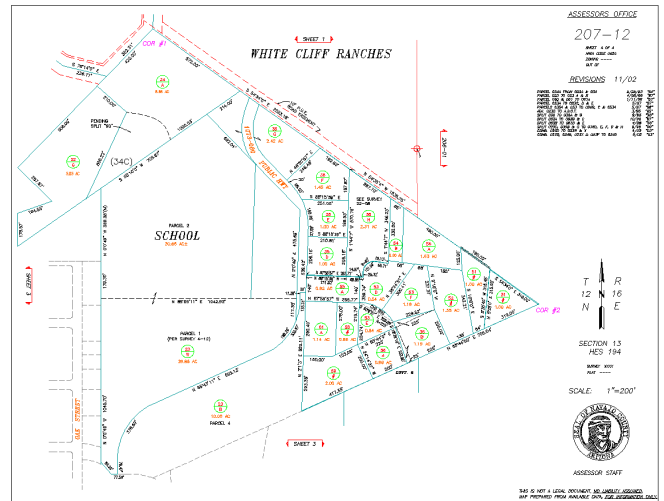
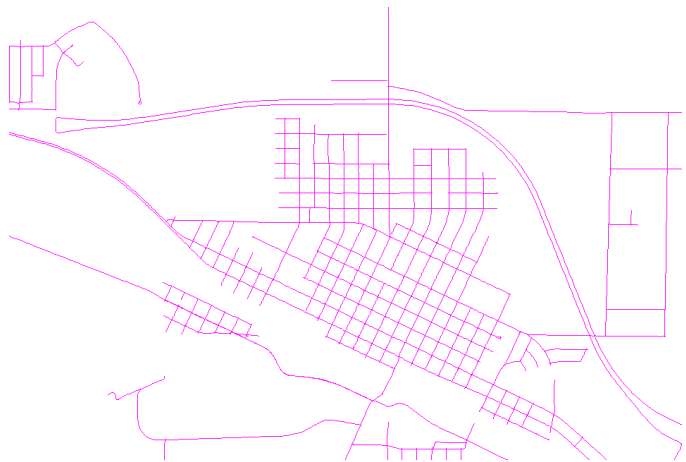## *Acquiring an Accurate GeoReference*

The first step in any project that aims to create an accurate seamless map is to acquire an accurate georeferenced representation of the project area. This could take the form of: existing georeferenced maps, survey points, GPS linework, aerial photography or some combination of these.

One important consideration when choosing the georeference source is the amount of "commonality" that exists between the georeference source and the tiled maps to be assembled. For instance, 1000's of GPS points representing the locations of power poles are not useful for a parcel basemap project where the tiled maps show only streets and parcels.

GPS Road Linework and Aerial Photography: a good choice for parcel basemap assembly.

When the task at hand is the assembly of landbase records from tiled CAD drawings, road centerlines are an excellent source of reference points. Road centerline intersection points can be easily identified in most CAD drawings and the corresponding georeference points can be derived from aerial photography or GPS road centerline linework.

This strategy can yield a dense, well distributed array of calibration data for use during the assembly process. This was the strategy chosen by Navajo County.

GPS Centerline Linework

Jeff was able to quickly assemble recent, accurate, georeferenced aerial photography covering the entire 9,200 square mile county on a modest budget (thanks to the USGS DOQQ program). He then used the counties existing GPS equipment to create reasonably accurate (submeter), georeferenced road centerline linework for a significant portion of the county in a matter of days.

These combined elements formed the georeference foundation to be used by Jeff and his staff (of 1) during the assembly process. They started in Winslow Arizona (pictured here).

Aerial Photo with GPS Linework Overlaid

Precision Rubbersheeting = Accurate Seamless BaseMap

Automated Assembly with MapTools– Accurate, Flexible and Cost Effective

After an extensive search, Navajo County selected our **MapTools Pro** suite and retained us to provide onsite training and support. Jeff needed concrete, usable results quickly and he had a limited budget.

"We chose MapTools because it offered precision rubbersheeting and many other automated tools to facilitate the assembly process. It was obvious to me that TCI had a lot of experience doing exactly what we needed to do." - Jeff Cook, Navajo County GIS Coordinator

Precision Rubbersheeting – the key to preserving or even improving accuracy

When a seamless map is assembled from a group of tiled CAD drawings, the quality of the finished product is dependant on many factors:

- the quality of the source material – how accurate are the individual tiles
- the accuracy of the georeference
- the accuracy of the assembly and edgematching process – how is the original accuracy impacted by the assembly process

But the measure of success is simple and clear – does the new seamless map accurately reflect "real world" conditions. So it makes perfect sense to perform the assembly operation in an environment where this judgment can be made each step of the way.

Here we see Navajo County's assembly environment with the first tile inserted and 8 calibration vectors selected.
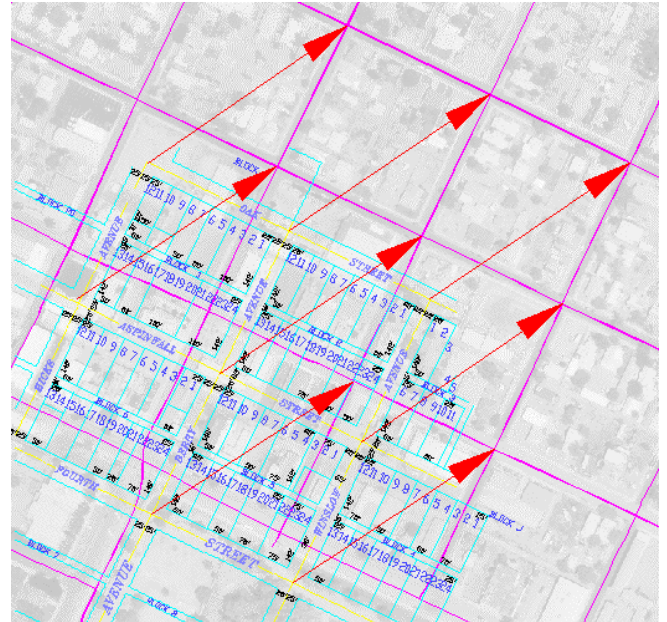
Flexible Assembly

If the CAD tile being processed has been drawn very accurately and the calibration points selected very accurately, the **Best Fit** tool (part of MapTools) can automatically orient it perfectly **without scaling or rotating** the data. When less accurate tiles are processed or less accurate calibration points are used, both scaling and rotation can be allowed during the "best fit" operation to produce a "better fit", or **"rubbersheeting"** can be performed to stretch the tile in all directions to distribute the errors over the whole tile and deliver a result with a zero error at every calibration point.
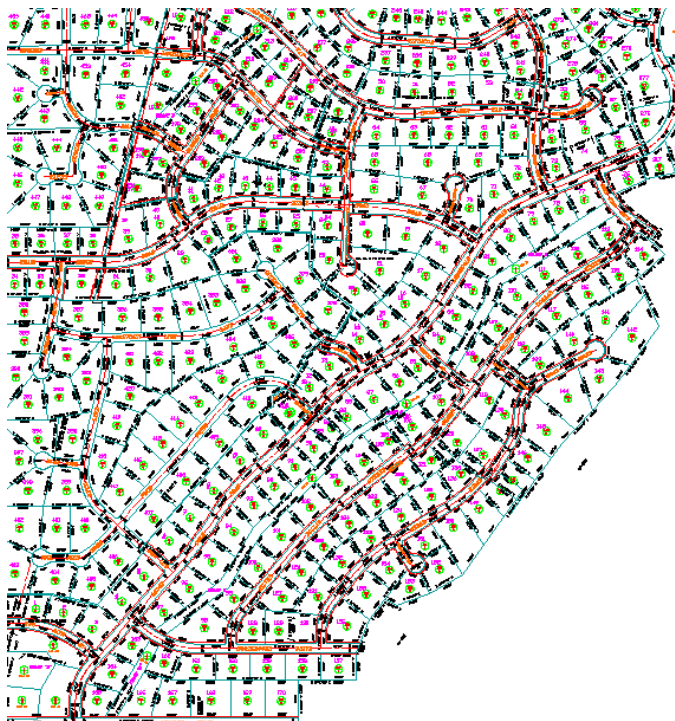
The assembly process then becomes:
- Insert an adjacent tile
- Pick calibration points, including points along the tiles edges
- Best Fit and/or Rubbersheet the tile
- Edgematch and Cleanup

MapTools includes several unique tools that were specifically developed to aid this final process, such as linework manipulation, automated text label orientation and block standardization.

Navajo County is very satisfied with result they are getting from this assembly process.

"The Bottom Line for us is – its working! We were able to assemble over 400 tiles in our first 3 weeks using just one operator."
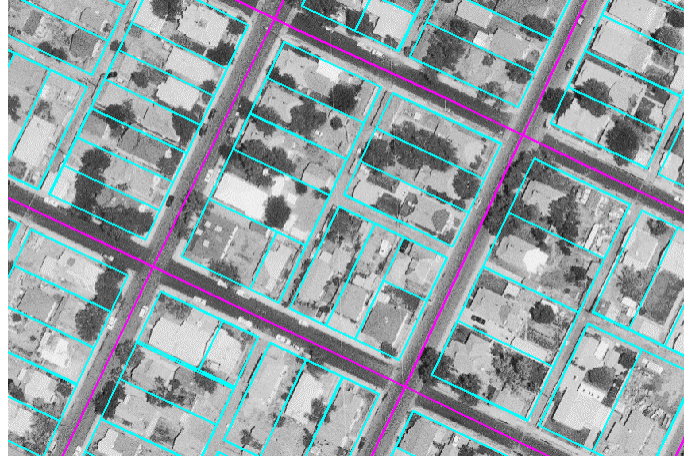
- Jeff Cook, Navajo County GIS Coordinator

Navajo County finds success by choosing its tools and resources wisely

In todays financially constrained climate it can be difficult to add significant new capabilities. In the case of Navajo County, they had a desire to enable a host of new services, all requiring a Countywide GIS – which requires a seamless basemap. To accomplish the goal, they found tools and services at TCI to enable them to quickly assemble a portion of the county parcel basemap (shown here overlaid with aerial photography).

Once a significant portion of the basemap was assembled in AutoCAD (400+ tiles), Jeff imported it into Arc/Info and created links to some of the Counties SQL databases to prove the concept and display the functionality.

Less than 30 days after MapTools was delivered and training complete, the county had created a working GIS covering 16,000+ parcels.

The New Navajo County GIS

To find out how TCI can help you Assemble a Seamless map from CAD Tiles:

Call toll free: **1-800-291-7533**

Or send an email to: **tom@tcicorp.com**