



By Joseph H. Bell, LS

Joe Bell is licensed in California and New Mexico. He has been reviewing software for surveyors since 1982.

Topocad 9 from Chaos Systems

Topocad from Chaos System comes to us from Sweden. In this day and age more and more municipalities are requesting some form of surveying and engineering work that can be incorporated into their local GIS, so having a program that fits seamlessly into ArcGIS is pretty handy. Topocad is an independent survey and design program that needs no other programs, yet it works seamlessly with other programs.

The design of roads, survey calculations, surface designs on which other designs such as profiles can be made are integrated and need no plug-ins. Topocad seems to have all of the functions for survey and design that other high-end programs have that I have reviewed. Topocad connects to databases (from Microsoft Excel to SQL databases). With the ISM (Independent Spatial Management) module you can use an Oracle Spatial Database.

2D and 1D adjustments become part of the drawing. The net adjustment will actually look at your data and find the nets which are adjustable. This is something I have not seen before, and can imagine this would be a great time saver for the busy practitioner. To the practicing geodesist, this is a minor problem because after checking the loop closures there are usually but a few nets to check. It is a fully functional least squares adjustment. It can be forced into an existing net or it can be a completely “free” adjustment. The results are easy to understand and to give you confidence to stand behind your field work, or the work you have imported from another source such as ArcGIS. Among other things, this means you can check the work of others before

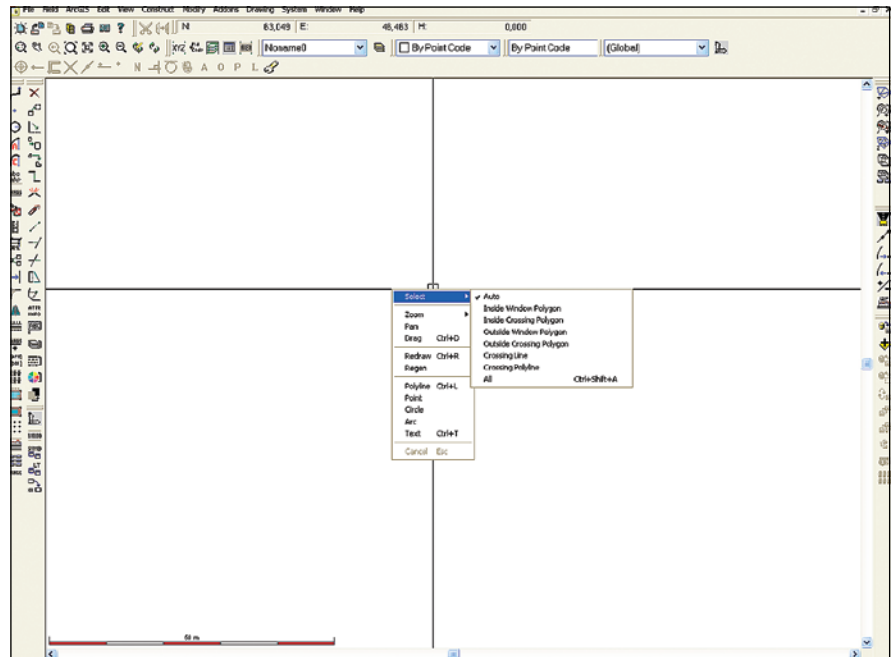


Figure 1 Drawing screen

you add it into your project. You can do a “free” adjustment to check the reliability and then force it into your own work.

Because Topocad uses functions that are very similar to other high end programs, it is easy to learn. There is a 397-page manual, step-by-step directions on the Internet, active demonstrations available on the Internet, and e-mail support. I know I have never been on a job where some little thing didn't need to be changed. With some programs the change was difficult. With Topocad the changes are easy, and it does not matter if the screw up is in the design or in the field work. It easily handles actual changes on the ground since the original field work was finished, or a change in the design due to some other change in the design.

Figure 1 is the drawing screen. Note that control of every function is visible. Also note the pull down menu which can be brought up at any time with the right click of the mouse. The scale and the drawing cursor are always visible. I believe a Topocad drawing contains more information than any other drawing format. The user has complete control over all of the details of all figures at all times. Drawings can be coordinated with the special features (symbols, colors, size, etc.) from a GIS.

Integration with databases

Integration is the one word that best describes Topocad. Not only because of the integration with popular GIS formats but also for others databases such as

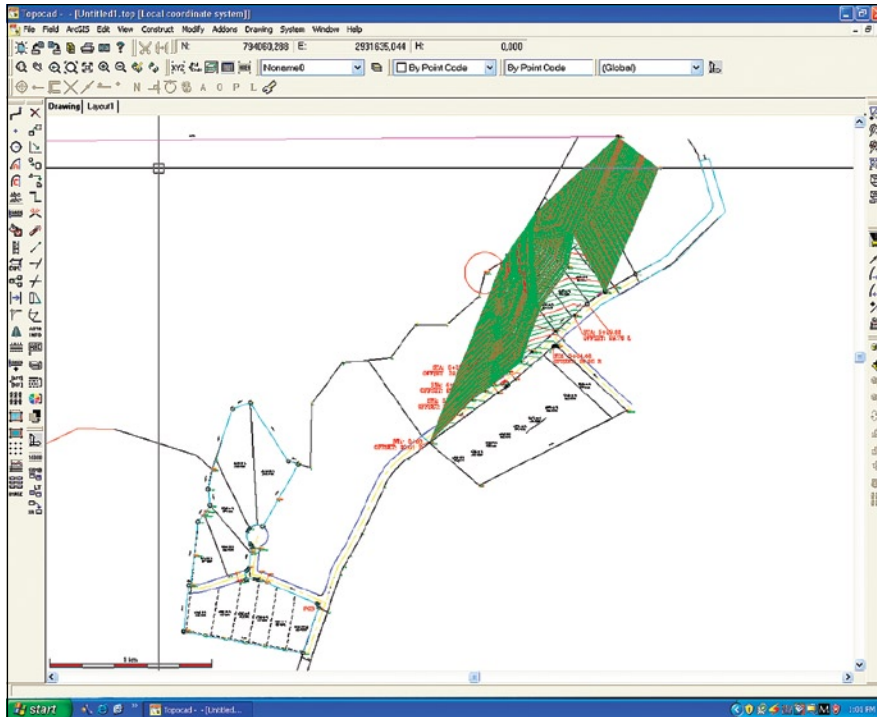


Figure 2 Road design along the visible contours

Oracle. You can read and write raw data to the following file formats; Topocad, AutoCAD drawing format, AutoCAD exchange format, MicroStation design file-2D, Leica file format, Trimble file format, GeoDOS coordinate format, GeoDOS roadline format, GEO/Point coordinate file, Marit coordinate file, Point/GEO roadline, Point/GEO road profile, DRD roadline format, DRD road profile, Topocad roadline, Drd coordinate file, DRD sections, Topocad polygon point, Sokkia SDR format, Geosecma coordinate files and Generic import/export. Whatever you are now using, chances are that you will be able to use it with Topocad.

Figure 2 shows a road design along the visible contours. This road follows the top of a cliff overlooking Elephant Butte Lake (one of the many dams on the Rio Grande). After creating an existing ground surface, you layout the centerline of the road. When you are satisfied with the alignment of the road, you check the profile of the ground under the road alignment. Then design the vertical alignment. You have control of the fall off, camber, etc. You can cut sections wherever you need them and then use the sections to calculate cuts and fills. Topocad keeps volumes of different layers such as rock and dirt of different kinds. The volumes thus calculated prepare the construction crews with exactly what

they need. You can change one or more cross section templates at any time and recalculate the differential volumes.

Topocad also creates the lines made up of what we call daylight points. Construction boundaries can be easily defined. As you can see, most of this kind of design can be done by a

number of different design programs. Topocad has several unique features. The first one of interest to the average working surveyor is the ease with which changes are made when the ground changes or a misinterpretation of the field work occurs or for some reason the design changes. The second feature is really special.

If you buy a license for Topocad for your office computer (the one that keeps you connected to the data base or ArcGIS) and you want to take a portable computer out in the field, you do not need to buy a second license for the portable. You can actually borrow the license from one computer to the other. When you have finished the field work, you transfer the license back to the main computer. For smaller companies, Topocad gives you an easy interface as subcontractor to larger companies.

For larger companies who do tunnels, there is a set of tools and a system to add tunnels to your design without creating confusions over the tunnel elevations and surface elevations. This set of design functions allows you to run cross sections, volumes, alignments, etc. You always know what the clearance is between the surface and other structures. And you have the advantage of an easy interface to both subcontractors and larger companies. One company may be constructing a tunnel under the river, another may be

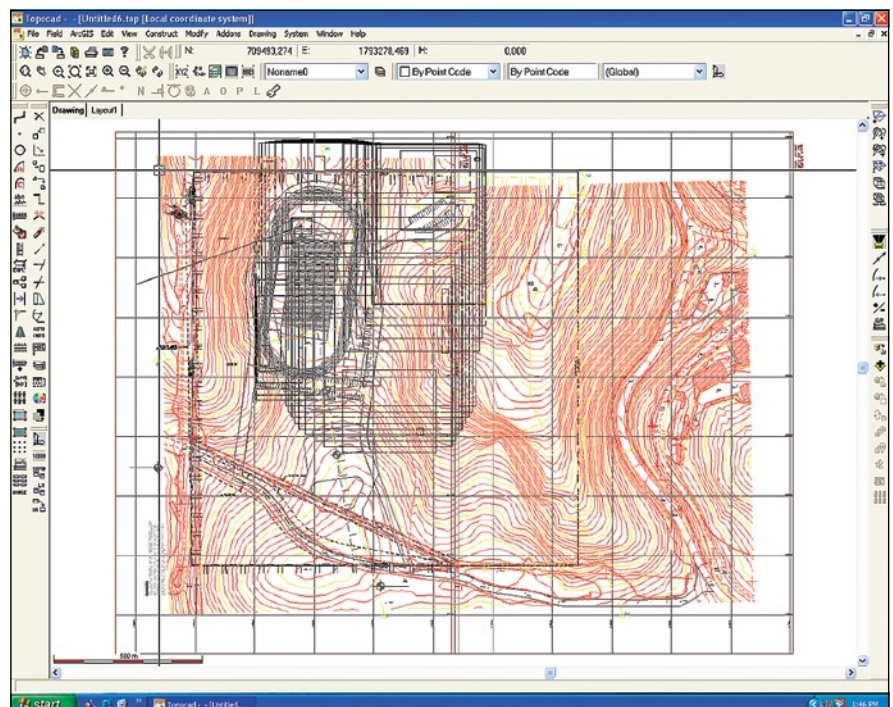


Figure 3 Topocad program working within AutoCAD

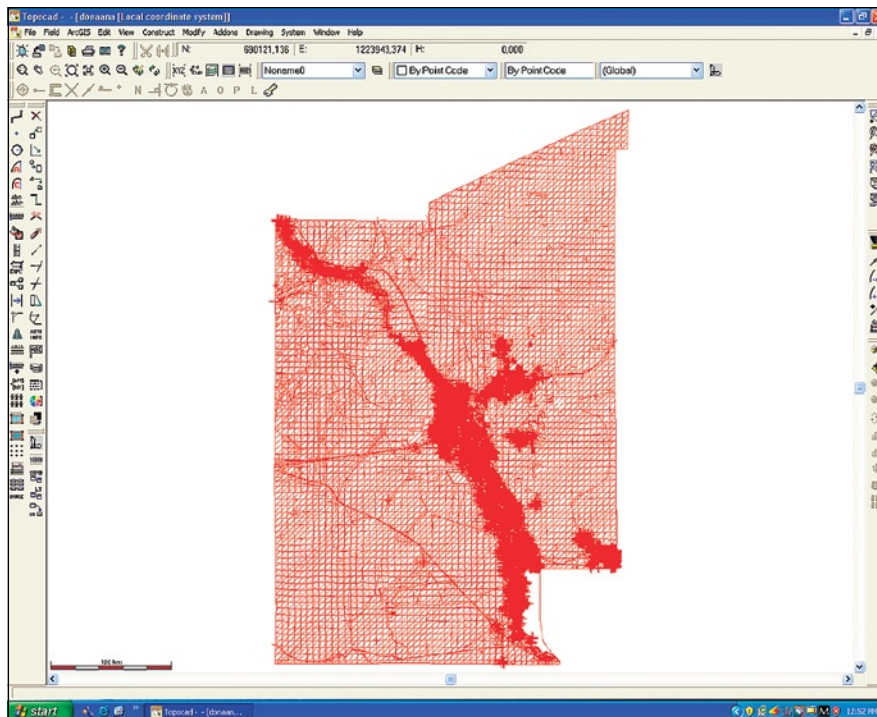


Figure 4 Shapefiles imported from ArcGIS

doing the road work, and other may be constructing an associated building.

For international companies, Topocad is used in 60 countries and has been translated into 15 languages. This eases the problems of working together over different countries and even in different languages.

This also solves a problem that has bothered me about other inter-company programs. These programs work from a single database, but the database is not under the direct control of the main contractor. The database may not even be in the same country. I think it is workable, but I am (and I think most people are) more comfortable with a distributed database with each person having control over his own data. Corrections and updates can be dated and transferred with ease.

Figure 3 shows Topocad working with an AutoCAD drawing. The colored contours are made from a set of points taken with a Leica total station of the existing ground. It is in a clearing in a forest near Cloudcroft. The coordinate system is NM83 Central in feet. The superimposed black lines are the design of a high school track and football field. Regenerations were slow but there were no errors in the transport. From this contour map, imported from AutoCAD, Topocad was able to extract almost 3,000 3D points. Topocad created

its own TIN/DTM. Now there is a Topocad surface model on which all functions can be performed including buildings, new roads, etc.

Figure 4 was a set of shapefiles imported from ArcGIS. This is Dona Ana County New Mexico. Considering the size of the data, the importation was very rapid. The shapefiles are in NAD83 New Mexico Central coordinates in U.S. survey feet, but there were no elevations so I could not test the commands that work on a surface. These are shapefiles I had on disk, but there is no ESRI license on this computer and the ArcGIS commands in Topocad do not work unless an ESRI license is present. The other drawing and design commands work fine.

Here's a list of the Topocad modules:

- Topocad Base
- Topocad GIS
- Topocad Design
- Topocad Field
- Topocad database connector for ArcGIS

All in all, Topocad is easy to learn and easy to use, a good program for the real job in the field. It is a very interesting program. The tools give you extraordinary control over the design and changes are very easy. View an online demonstration at www.chaos.se/eng/topocad.htm. *AS*

THE American Surveyor

A FOOT IN THE PAST... AN EYE TO THE FUTURE



Your comments and suggestions are valuable to us—feel free to let us know what you think.

You can reach our staff and contributing writers through the online message center at: www.amerisurv.com

or

The American Surveyor
905 West Seventh Street, #331
Frederick, MD 21701