Test Profiles for Digital Terrain Models

1.1   Overview

Jointly developed by the Photogrammetics and GEOPAK Units within the Minnesota Department of Transportation, this procedure details the standard procedure and deliverables of test profile DTM data from district Surveys to Photogrammetics.

Standard data collection procedures are used, however, specific feature codes should be utilized in order to share data with Photogrammetics.

Past procedures required the delivery of chains, profiles, and ASCII print-outs to Photo. This is no longer necessary.

Note: The only required deliverable for these test profiles from Surveys to Photo is the GEOPAK coordinate geometry database (GPK) file.

1.2 Survey Procedure

In the case of traditional DTMs, the feature code TPRO should be used for test shots. In the case of LIDAR projects, the codes in the table on the next page should be utilized.

The purpose of this study is to do a comparison of LIDAR data to field survey data. The results of comparing the data over several projects will allow the establishment of anticipated accuracies achievable with different types of land covers.

1.2.1 Field Testing Procedure

Field crews are to create a GEOPAK database (GPK) file recording 25 shots in each of the different land type areas listed below.

Area	Land Cover Type	Description	Special Instructions	Feature Code (1)
1	Open, hard surface	Paved surfaces	Take shots ONLY on paved surfaces	L1OHS
2	Open, soft surface	Short grass	None	L2OSS
3	Low ground cover	Tall grass, bushes	Take shots in brushy, swampy areas	L3LGC
4	High ground cover	Deciduous trees	Take shots within tree cover	L4HGC
5	Dense ground cover	Dense evergreen trees	Take shots within tree cover	L5DGC

(1) GEOPAK Survey Manager database (smd) and cg_description table have been updated to reflect the new codes as of August 6, 2001. They are available in the MnDOT Standards on all district and Central Office servers.

1.3 Photogrammetic Procedure

Step 1.   Open any MicroStation file, in order to access GEOPAK. This file should be in the same directory as the coordinate geometry database (GPK file) from Surveys.

Step 2.   Select **Applications > GEOPAK Road (or Site or Survey) > Geometry > Coordinate Geometry.** The Start-Up dialog opens, as depicted below.
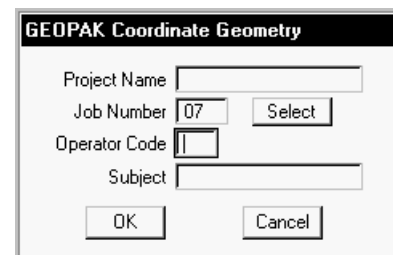
**Step 3.**   I entify the Coordinate Geometry database (GPK file) by pressing the **Select** button, then highlighting the desired file. When complete, the Job Number field should be populated. Press the **OK** button to continue, which closes the Start Up dialog and opens the main COGO dialog, as depicted below. Note: due to the customization options of COGO, your window may look slightly different than the graphic below.
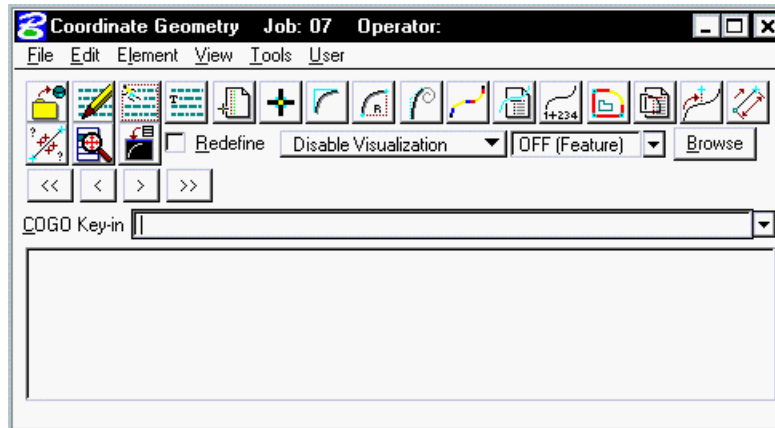
Step 4. **If the test DTM shots are the only points in the current database or are easily found by scanning, steps 4, 5 and 6 may be skipped.** Open the COGO navigator by selecting **Tools > Navigator** or selecting the icon. The pop-up dialog depicted to the right opens. Set the **Element** to Point.

Step 5. Select the **Select > Selection Set** option from the Navigator menu bar. The dialog depicted below opens.
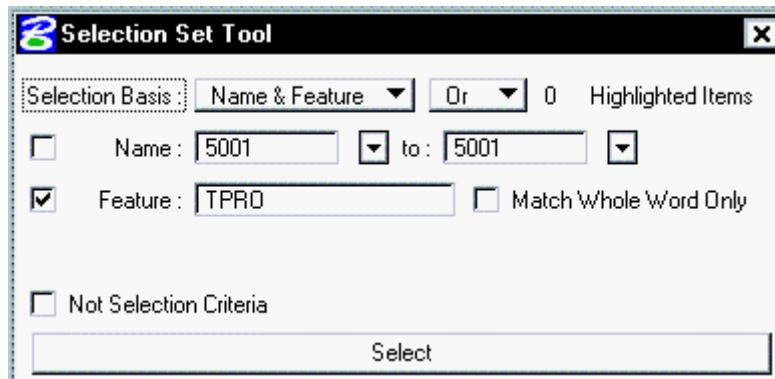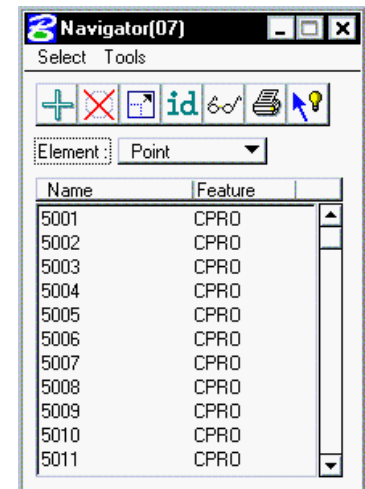
Step 6. Activate the **Feature** toggle and set the Feature to TPRO. This is the feature which Surveys utilized when collecting test shots. Press the **Select** button, which highlights all points in the current database with the Feature of TPRO. The revised Navigator is illustrated below.
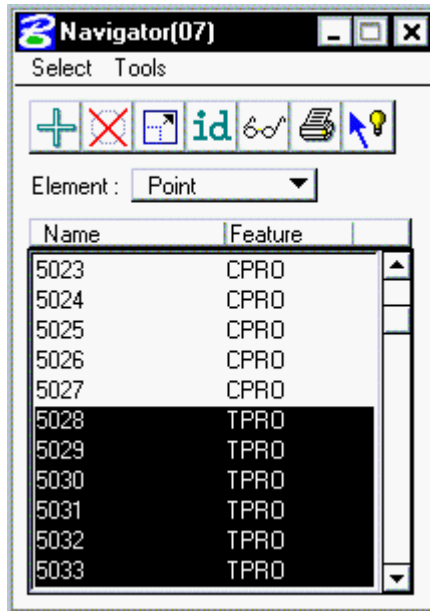
Step 7.   Move the Navigator aside (do not close) and utilize the main COGO dialog. **Select Element > Point > Compare Points to TIN**. The dialog depicted below opens.
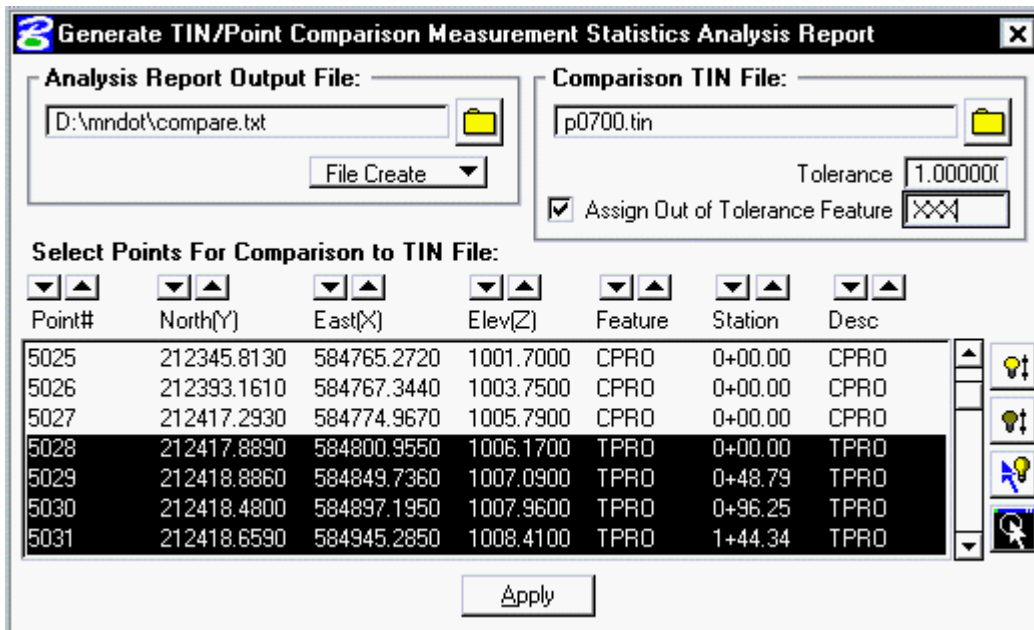

Step 8.   If the Navigator was not utilized, simply scroll through the list box and highlight points with the desired feature. Note standard Windows conventions may be utilized (shift and control keys).   If all points are desired, press the yellow light bulb icon to the right of the list box, which highlights all points. If the Navigator was utilized, press the **Get Points from Navigator** icon, which is the third button down to the right of the list box. The points are now highlighted in the list box.

In the upper right corner of the dialog, enter the name of the **TIN File**. Note the name of the file may be typed into the field. If the file is in the working directory, no path is needed. In lieu of typing, pressing the **Files** icon opens the File Manager dialog, wherein the desired file may be selected.

Enter the desired **Tolerance** (in terms of master units). If desired, activate the toggle for **Out of Tolerance** feature and enter the Feature. This makes sorting for questionable shots easier.

Press the **Apply** button to commence processing. When processing is complete, the Alert message illustrated below is displayed.
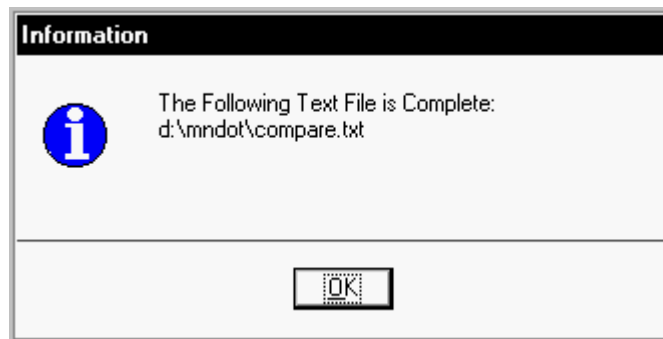
The results of the processing above are placed in the text file. One sample is depicted below. Note point 5034 is out of tolerance, therefore the feature has been changed to XXX.

```
Compare COGO Points to TIN Surface

JOB File: D:\mndot\job07.gpk
TIN File: p0700.tin


Point      Feature     COGO Elevation   TIN Elevation   Elev Diff   Location
===========================================================================
5028       TPRO        1006.1700        1006.3161       -0.1461     BELOW
5029       TPRO        1007.0900        1007.1979       -0.1079     BELOW
5030       TPRO        1007.9600        1007.9885       -0.0285     BELOW
5031       TPRO        1008.4100        1008.4104       -0.0004     BELOW
5032       TPRO        1008.7500        1008.7500        0.0000     EQUAL
5033       TPRO        1008.7400        1009.7164       -0.9764     BELOW
5034       XXX         1008.5100        1009.9176       -1.4076     BELOW***
5035       TPRO        1011.2700        1011.4377       -0.1677     BELOW
5036       TPRO        1010.7800        1010.8576       -0.0776     BELOW
5037       TPRO        1010.6800        1010.6800        0.0000     EQUAL
5038       TPRO        1010.4400        1010.2741        0.1659     ABOVE
5039       TPRO        1010.1600        1010.2339       -0.0739     BELOW
5040       TPRO        1009.6900        1009.6900        0.0000     EQUAL
5041       TPRO        1008.8800        1009.0496       -0.1696     BELOW
5042       TPRO        1008.3800        1008.4580       -0.0780     BELOW
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5043	TPRO	1007.6700	1007.7315	-0.0615	BELOW
5044	TPRO	1006.9100	1007.0527	-0.1427	BELOW
5045	TPRO	1006.1600	1006.3083	-0.1483	BELOW
5046	TPRO	1005.5000	1005.5000	0.0000	EQUAL
5047	TPRO	1004.8800	1004.9604	-0.0804	BELOW
5048	TPRO	1004.6400	1004.6868	-0.0468	BELOW
5049	TPRO	1004.5600	1004.6447	-0.0847	BELOW
5050	TPRO	1004.5100	1004.5567	-0.0467	BELOW
5051	TPRO	1004.4600	1004.5964	-0.1364	BELOW
5052	TPRO	1004.5300	1004.7509	-0.2209	BELOW
5053	TPRO	1004.5800	1004.8001	-0.2201	BELOW
5083	TPRO	1008.9000	1009.0328	-0.1328	BELOW
5084	TPRO	1007.6600	1007.7934	-0.1334	BELOW
5085	TPRO	1007.4500	1007.3244	0.1256	ABOVE
5086	TPRO	1007.5800	1007.5888	-0.0088	BELOW
5087	TPRO	1007.7200	1007.7707	-0.0507	BELOW
5088	TPRO	1008.1400	1008.0477	0.0923	ABOVE
5089	TPRO	1008.4800	1008.6072	-0.1272	BELOW
5090	TPRO	1009.0900	1009.1551	-0.0651	BELOW
5091	TPRO	1009.6100	1009.6246	-0.0146	BELOW
5092	TPRO	1010.1100	1010.0760	0.0340	ABOVE
5093	TPRO	1010.2500	1010.0365	0.2135	ABOVE
5094	TPRO	1010.5100	1010.1524	0.3576	ABOVE
5095	TPRO	1010.6400	1010.6761	-0.0361	BELOW
5096	TPRO	1010.5100	1010.4230	0.0870	ABOVE
5097	TPRO	1010.4700	1010.4740	-0.0040	BELOW
5098	TPRO	1010.1200	1010.0571	0.0629	ABOVE
5099	TPRO	1009.4400	1009.4883	-0.0483	BELOW
5100	TPRO	1008.4900	1008.4561	0.0339	ABOVE
5101	TPRO	1007.9100	1007.9686	-0.0586	BELOW
5102	TPRO	1008.3400	1008.6272	-0.2872	BELOW
5103	TPRO	1009.6000	1009.5472	0.0528	ABOVE
5104	TPRO	1010.0200	1009.9601	0.0599	ABOVE
5105	TPRO	1009.8200	1009.9108	-0.0908	BELOW
5106	TPRO	1009.7500	1009.7892	-0.0392	BELOW
5107	TPRO	1008.9800	1008.8852	0.0948	ABOVE
5108	TPRO	1008.1900	1008.1608	0.0292	ABOVE
5162	TPRO	1014.4900	1014.5581	-0.0681	BELOW
5163	TPRO	1014.5800	1014.6466	-0.0666	BELOW
5164	TPRO	1014.8500	1014.8808	-0.0308	BELOW
5165	TPRO	1015.0700	1015.2056	-0.1356	BELOW
5166	TPRO	1015.3300	1015.4621	-0.1321	BELOW
5167	TPRO	1015.6300	1015.7084	-0.0784	BELOW
5168	TPRO	1015.8600	1015.9260	-0.0660	BELOW
5169	TPRO	1016.0400	1016.1665	-0.1265	BELOW
5170	TPRO	1016.1700	1016.2551	-0.0851	BELOW
5171	TPRO	1016.1900	1016.3571	-0.1671	BELOW
5172	TPRO	1016.4300	1016.5041	-0.0741	BELOW

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5173        TPRO            1016.4700        1016.5116        -0.0416          BELOW
5174        TPRO            1016.3500        1016.3875        -0.0375          BELOW
5175        TPRO            1016.0200        1016.1497        -0.1297          BELOW
5176        TPRO            1016.2300        1016.2855        -0.0555          BELOW
5177        TPRO            1016.0300        1016.0003         0.0297          ABOVE
5178        TPRO            1015.7900        1015.8913        -0.1013          BELOW
5179        TPRO            1015.5000        1015.5409        -0.0409          BELOW
5180        TPRO            1015.1800        1015.2149        -0.0349          BELOW
5181        TPRO            1014.9400        1014.9756        -0.0356          BELOW
5182        TPRO            1014.6600        1014.7452        -0.0852          BELOW
5183        TPRO            1014.5000        1014.5690        -0.0690          BELOW
5184        TPRO            1014.3800        1014.3974        -0.0174          BELOW
5185        TPRO            1014.2600        1014.2842        -0.0242          BELOW
5186        TPRO            1014.2500        1014.2126         0.0374          ABOVE
5187        TPRO            1014.0700        1014.0680         0.0020          ABOVE
5188        TPRO            1013.9400        1013.9916        -0.0516          BELOW
                                                            ============
                      The Sum of (Elev Diff)Squared = 3.8046
                      The Ave of (Elev Diff)Squared = 0.0482
                      The Root Mean Square Error is = 0.2195
National Standard for Spatial Data Accuracy(NSSDA) is = 0.4301


Points PASS the 95% confidence test based on 1.96 Chi Square Value.




User defined Tolerance = 1.0000
==============================================================
  1.3%  of the points are between Tolerance and Half Tolerance

  1.3%  of the points are greater than Tolerance ***

  -1.4076   is the maximum difference BELOW

  0.3576   is the maximum difference ABOVE

   79  Total number of points

   59  Points are below the TIN Surface

   16  Points are above the TIN Surface

    4  Points are equal to the TIN Surface
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