Note to Self-Paced Users of this Day 1 Seminar Handbook

AGTEK users working through this *Day 1 Seminar Handbook* on their own (especially new users without any prior training/experience on AGTEK's earthwork software) should do so in the following suggested sequence:

1. Verify that you are using the ***latest version of your AGTEK earthwork software*** and download/ install any available update as needed (see page 234 in ***Appendix A***)—this is important because this handbook documents techniques and functions that may differ from those available in older versions of the AGTEK software.

2. ***Download the training files*** corresponding to this *Day 1 Seminar Handbook* (see ***Appendix C***, pages 259-262).

3. Familiarize yourself with the ***Program Overview*** section of this handbook (pages 19-49), which provides lots of useful tips and background information); ***if you're new to earthwork construction, see page 19***; and all new AGTEK users should ***see the functional organization overview of AGTEK's earthwork software*** on pages 40-49.

4. ***Work through the "Earthwork Modeling Step-by-Step" exercise*** beginning on page 50 (the site plan and details provided on pages 50-51 are referenced throughout the exercise).

5. After working through the ***Earthwork Modeling Step-by-Step*** exercise, ***new AGTEK users should then apply the same steps to model/takeoff the dirt on one of their own projects*** for which accurate takeoff quantities are available to check against (a smaller, not-to-complicated project would be best for this learning step)—this suggested step will provide the new user with confidence that they are using AGTEK correctly *before* they "jump in" and model/takeoff earthwork for projects that are being actively bid.

6. When you begin using AGTEK on your own projects, ***locate detailed instructions on the various steps of site modeling and takeoff*** with this handbook's ***Quick Reference*** (page 2), ***Table of Contents*** (pages 3-15) and ***Typical Data Entry Sequence*** (page 49). Tip: The "Data Entry Guide" (pages 47-48) is a useful memory jogger for new users.

7. *Appendix H* (pages 301-319) and ***Appendix J*** (pages 323-351) offer optional stand-alone exercise examples documenting additional site modeling/takeoff methods and techniques that may be of interest to some AGTEK users.

8. Once you have some hands-on experience with the ***Earthwork Modeling Step-by-Step*** applications in this handbook, consider attending AGTEK's instructor-guided training classes (if you haven't done so already). Attending ongoing training classes is a great way to fill in any blanks, get answers to any questions, and update your AGTEK skills by keeping up with new software functions and applications. Information on AGTEK training classes is available in ***Appendix A*** (page 233) and at ***www.agtek.com/training.html***).

9. See the ***help options*** in ***Appendix A*** (pages 231-232) and the ***Catalog of Day 1 Handbook Web Resources*** in *Appendix D* (pages 263-272) for additional learning resources.

Copyright © 2023 Earthwork Software Services, LLC. All rights reserved. www.EarthworkSoftwareServices.com

Day 1 Quick Reference

Image Selection Utility (Gradework 4D)	34, 117
Shader Support (AGTEK 4D) and Other Start-Up Options Menu Settings	36, 92
Status Bar Display Options in Entry Mode (Ctrl-Q / Q)	44, 77, 88, 246, 336
Length/Area Utility	58, 229
Move Point, Extend/Shorten Line Function (F7)	69, 107, 129, 241
Documentation Layer (AGTEK 4D)	72, 131
Display Pointer Snap Radius (Draw Snap Circle)	75, 119
Contour Streaming Entry	76
Adjustable Point Compression Utility	76, 86, 328, 340
Continue Last Entry Option (Right-Click Menu)	77, 128
Delete Segments from Data Line (Remove Selected Function)	85
Drag-Select Range of Scroll Points for Edits and Offsets	85, 136, 145, 331, 341, 343, 347
Contour Surface Utility	94, 160, 351
Assign Elevations by Daylight	104-105, 151, 157, 340
Move Start (Diamond) Point of Closed Object (Ctrl-M)	136
Swap Ends Utility (Ctrl-S)	142, 146, 198, 316
Assign Elevations by Slope	151, 343
Staged Design Option	164, 171, 192, 203, 208
Wildcard Label Selection	191, 338
Station Generator Utility	201, 333
Display Cut-Fill Map Colors as Background Image (Alt-K in Gradework 4D)	204
Display Region Hatching on Cut-Fill Maps	206
Export TXT or XLSX Volume Report for Excel	225, 228
Trim Lines Utility (Ctrl-T)	240, 329
Fillet Line Utility (Ctrl-F)	240, 346
Circle Utility	327, 339
Cut/Paste Surface Layer Data (AGTEK 4D)	334
Auto Pad Utility	337-338
Assign Elevations by Conform Utility	344

Copyright © 2023 Earthwork Software Services, LLC. All rights reserved. www.EarthworkSoftwareServices.com

Day 1 Table of Contents

Note to Self-Paced Users of the Day 1 Seminar Handbook i

Notices 1

Quick Reference 2

Seminar Outline 16

Program Overview 19

- Note to Earthwork Beginners 19
- Software Installation and Setup Notes 20
- A Toolbox for Creating Earthwork Models 23
- AGTEK Site Modeling Products Compared 24
- Should AGTEK 3D Users Upgrade to AGTEK 4D? 26
- Data-Entry Options for Site Modeling and Takeoff 28
- Requirements for Paper Plan Digitizing 30
- Requirements for Working with PDF Plan Sheets 31
- Raster PDF vs. Vector PDF 32
- Tips for Working with Multiple PDF Plan Sheets 33
  - Revised PDF Plan Sheets 34
  - Image Selection Utility (Gradework 4D) 34
  - Alignment Strategies 35
- Start-Up Options Menu 36
- AGTEK Data File Maintenance 39
- Screen Layout in AGTEK 3D and AGTEK 4D 40
- Modes, Surfaces and Layers Overview 41

Copyright © 2023 Earthwork Software Services, LLC. All rights reserved. www.EarthworkSoftwareServices.com

Day 1 Table of Contents (Cont.)

Program Overview (Cont.)

- Entry Mode Screen Reference 44
- Edit Mode Screen Reference 45
- Utility Toolbar Reference 46
- Data Entry Guides 47
- Typical Data Entry Sequence 49

Earthwork Modeling Step-by-Step 50

- Sample Site Grading Plan 50
- Street Details, Site Location Map and Plan Abbreviations/Notes 51
- New Job File Setup 52
- Import First PDF Plan Sheet 53
  - Multi-Page Preview Dialog 54
  - Adjust Display and Note PDF Data Type 55
  - Set Scale for First PDF Plan Sheet 56
  - Verify and Correct PDF Plan Scale - AGTEK 4D 57
  - Verify PDF Plan Scale - AGTEK 3D 58
  - Correct PDF Plan Scale - AGTEK 3D 59
  - Translate Job File to Designer's Coordinates 60
  - Determine Best Use of Raster PDF Plan Sheet 61
    - Raster-to-Vector Conversion Option 62
    - Unrecognized Vector PDF Plan Sheet Problem 63-A
- Geo-Reference Job File with Google Earth 64

Copyright © 2023 Earthwork Software Services, LLC. All rights reserved. www.EarthworkSoftwareServices.com

Day 1 Table of Contents (Cont.)

Earthwork Modeling Step-by-Step (Cont.)

Enter Notes on Documentation Layer 72

Enter Existing Perimeter 73

Two Problems with Existing Perimeter Inside Grading Limits 74

Multiple Existing Perimeters and Perimeter Holes 74

Enter Existing Data Lines 75

Existing Data Lines Overview 75

Existing Contours 75

Streaming Entry Option 76

Existing Spot Elevations 78

Critical Spot Elevations 78

Entry Options 78

Spot Elevation Topo (No Contours) 80

Open Job File (with Data Line Errors), Re-Load PDF Plan Sheet 81

Error-Check and Correct Existing Data Lines 82

Error Check with Plan View 83

Crossing Data Lines 83

Display Elevation Labels 84

Horizontal Spike 85

Point Reduction of Streamed Contours 86

Error Check with 3D View 87

Obvious Vertical Errors 87

Copyright © 2023 Earthwork Software Services, LLC. All rights reserved. www.EarthworkSoftwareServices.com

Day 1 Table of Contents (Cont.)

Earthwork Modeling Step-by-Step (Cont.)

Non-Graphical Elevation Error Detection Tools 88

Site Min/Max Elevations 88

Find Elevation Function 88

Line Editor vs. Point Editor 90

Error Check with Trimesh Utility 91

The TIN Surface 91

Disable Shader Support for Trimesh Evaluation (AGTEK 4D) 92

Effect of Break Line on TIN 92

Error Check with Water Flow Utility 93

Error Check with Contour Surface Utility 94

Trimesh, Water Flow, and Contour Methods Compared 95

Enter Corrective Existing Break Lines 96

Ridge and Saddle 97

Swale Flow Line 99

Connecting Widely-Separated Contours at Site Perimeter 101

Spread Debris Pile 102

Existing Street 106

Views of Completed Existing Surface 108

Match Point Selection for Aligning Next PDF Plan Sheet 110

Direct Coordinates or Selected (Common) Points? 110

Import and Align Next PDF Plan Sheet (Direct Coordinates) 111

Copyright © 2023 Earthwork Software Services, LLC. All rights reserved. www.EarthworkSoftwareServices.com

Day 1 Table of Contents (Cont.)

Earthwork Modeling Step-by-Step (Cont.)

Selected (Common) Points Alignment Outtake 114

Re-Loading PDF Plan Sheets (AGTEK 3D) 115

Re-Loading PDF Plan Sheets (Earthwork 4D) 116

Re-Loading PDF Plan Sheets (Gradework 4D) 117

Manual PDF Realignment (Align Matching Edges) 118

Enter Design Data Lines 119

Design Data Lines Overview 119

Building Data Lines (and Adjacent Landscape Grades) 120

Fixed Elevation Building (Fixed Landscape) 120

Stepped Elevation Building (Sloped Landscape) 121

Building with Retaining Wall (Fixed and Sloped Landscape) 123

Pond Data Lines 125

Street Data Lines 126

Line Labels on Data Lines 127

Offset Design Data Lines 129

Pre-Offset Error Checking 129

Horizontal Error 129

“Guesstimate” Correction to Bad Plan Street Grade 130

Note Bad Plan Grade on Documentation Layer 131

Offset Line Utility Options and Settings 132

Fixed Landscape Grade at Building 134

Copyright © 2023 Earthwork Software Services, LLC. All rights reserved. www.EarthworkSoftwareServices.com

Day 1 Table of Contents (Cont.)

Earthwork Modeling Step-by-Step (Cont.)

Offset Specified Range of Points 136

Pond Data Lines 138

Street Data Lines 140

Four Approaches to Offsetting Street Data Lines 141

Swap Ends Utility 142

Offset Lines for Walks, C & G, Crown 143

Apply Template Option for Street Data Lines (AGTEK 4D) 146

Enter Supplemental Design Data Lines 151

Enter Elevations by Slope and Daylight 151

Design Landscape Contours 152

Design and Drafting Entry Options 153

Plan-Profile Entry Options 153

Contours or Break Lines to Model Fixed-Slope Areas 154

Views of Design Surface (without Design Perimeter) 155

Enter Design Perimeter 156

Hole in Design Perimeter at Undisturbed Area 157

Editing Design Perimeter Alignment 157

Design Perimeter Alignment by Slope Intercept 157

Error-Check and Correct Design Data Lines 158

Check with Plan and 3D Views (Edit Mode) 159

Check with Trimesh Utility 160

Copyright © 2023 Earthwork Software Services, LLC. All rights reserved. www.EarthworkSoftwareServices.com

Day 1 Table of Contents (Cont.)

Earthwork Modeling Step-by-Step (Cont.)

Check with Water Flow Utility 160

Check with Contour Surface Utility 160

Check with Plan and 3D Views (3D View Mode) 161

Enter Corrective Design Break Lines 162

Bad Street Surface Example 162

Flat TIN Triangles at Site Perimeter Corners 163

Views of Completed Design Surface 164

Existing and Design Surface Adjustments 165

Enter Stripping Areas 166

Topsoil Stripping 166

Holes in Stripping Areas 167

Debris Removal (Over Topsoil) 167

Existing Sidewalk Removal 168

Stripping Beyond Design Perimeter 169

Stripping Fill or Cut Areas Only 169

Stripping Variable Depth Topsoil 169

Verify and Edit Stripping Areas 170

Report Regions and Sectional Areas Defined 172

Enter Report Regions and Sectional Areas 173

Building Areas 174

Pond Top, Slope and Bottom Areas 176

Copyright © 2023 Earthwork Software Services, LLC. All rights reserved. www.EarthworkSoftwareServices.com

Day 1 Table of Contents (Cont.)

Earthwork Modeling Step-by-Step (Cont.)

Street Blacktop, C & G and Walk Areas 180

Landscape Areas 187

Verify and Edit Report Regions/Sectional Areas 188

Holes in Report Regions and Sectional Areas 188

Selection Methods and Cross-Hatching 189

Individual Region/Area Edits 190

Multiple Region/Area Edits 191

Editing Region/Area Boundary 191

Subgrade Modeling Notes 193

Entering, Viewing and Interpreting Profiles 196

Surface Selection and Layers Display 196

Two-Point (Straight-Line) Profile Example 196

Multi-Point (Curving) Profile Example 197

Evaluating Profiles 198

Profile Interpretation 198

Profile Point Scroll 199

Set Profile Station Start Value (Edit Station Offsets Utility) 200

Cross Sections on Profile (Station Generator Utility) 201

Viewing and Interpreting Plan View Maps 202

Cut-Fill Maps, Display Options, and Settings 202

Stripping Area and Sectional Area Depth Maps 206

Copyright © 2023 Earthwork Software Services, LLC. All rights reserved. www.EarthworkSoftwareServices.com

Day 1 Table of Contents (Cont.)

Earthwork Modeling Step-by-Step (Cont.)

3D Drive-Through Simulation 207

Calculating, Reporting and Interpreting Cut/Fill Volumes 208

Setting Up the Calculations 208

Ref and Diff Surface Considerations (AGTEK 4D vs. AGTEK 3D) 209

Volume Calculation Error and Warning Messages 210

Calculation Screen, Control Keys and Results Dialog 211

Overview of the Three-Part Volume Report 212

Cut/Fill Quantities (Part 1) 212

Stripping Quantities (Part 2) 212

Sectional Quantities (Part 3) 212

Detailed Breakdown of Cut/Fill Quantities (Part 1) 213

Answering Questions with the Volume Report 214

Shrink/Swell Adjustments 215

Three Volume/Density States of Soil 215

Estimated Shrink/Swell 215

Soils Report Densities 215

Densities Not Provided 216

Mixed Onsite Fill Materials 218

Measured (Actual) Shrink/Swell 219

Shrinkage on Remove/Scarify/Re-Compact Volumes 219

Subsidence Loss Adjustment 219

Copyright © 2023 Earthwork Software Services, LLC. All rights reserved. www.EarthworkSoftwareServices.com

Day 1 Table of Contents (Cont.)

Earthwork Modeling Step-by-Step (Cont.)

Bump the Fill Factor 220

Rule of Thumb Adjustments 220

Compaction Depth Formula 221

Topo Method 221

Haul Swell Adjustment 222

References and Comments 223

Export Volume Report to Text File for Excel 225

Export Volume Report to XLSX File for Excel (AGTEK 4D) 228

Other Applications 229

Length/Area Utility 229

Appendix A - How to Get Help, Training, Program Updates 231

Getting Help 231

Getting Trained 233

Getting Program Updates 234

Appendix B - Keyboard Shortcuts 237

Import (CAD Transfer) Mode 237

Edit Mode 239

Entry Mode 244

Profile View Mode 248

Plan View (Cut-Fill Map) Mode 250

3D View Mode 253

Copyright © 2023 Earthwork Software Services, LLC. All rights reserved. www.EarthworkSoftwareServices.com

Day 1 Table of Contents (Cont.)

Appendix B - Keyboard Shortcuts (Cont.)

Volume Report Mode 256

Haul Report Mode 257

Print Preview Mode 258

Appendix C - Download and Use Day 1 Seminar Data Files 259

Appendix D - Catalog of Day 1 Handbook Web Resources 263

Appendix E - Format and Print Documentation 273

Print Device Setup 273

Volume Report 274

3D Views 276

Cut-Fill Map 277

Cut-Fill Map (Over Plan Sheet Image) 278

Profile Views 279

Spanning Multiple Printed Pages 280

Combine Images from Different Job Files on Same Print Page 281

Export Image Object from Print Page to EMF File 281

Save Print Page Layout to AIP File 281

Recover Print Page Layout from AIP File 282

Save Print Page Layout to PDF File 283

Save 3D Surface to VRML (WRL) File 283

Legacy Image Presenter Compatibility 283

Publish to Google Earth (AGTEK 3D Options) 283

Copyright © 2023 Earthwork Software Services, LLC. All rights reserved. www.EarthworkSoftwareServices.com

Day 1 Table of Contents (Cont.)

Appendix E - Format and Print Documentation (Cont.)

Publish to Google Earth (AGTEK 4D) 284

Appendix F - Digitizing from Paper Site Grading Plans - AGTEK 3D 287

New Job Setup for Paper Plan Digitizing 287

Paper Plan Scaling Method 1 (Arbitrary Coordinates) 288

Paper Plan Scaling Method 2 (Designer's Coordinates) 290

Rescaling Paper Plan Sheet 292

Adjusting Data Digitized at Wrong Paper Plan Scale (Stretch) 293

Calculating an Unknown Paper Plan Scale 294

Appendix G - Digitizing from Multiple Paper Plan Sheets - AGTEK 3D 295

Appendix H - Digitizing from Paper Profile Sheets - AGTEK 3D 301

Appendix I - Merging AGTEK ESW Job Files 321

Appendix J - Design and Drafting Tools 323

Example Base Map and Existing Topo Contours 324

Circle Utility 327

Point Compression Utility 328

Trim Lines Utility 329

Station Generator Utility 333

Copy vs. Cut for Pasting Surface Layer Data (AGTEK 4D) 334

Auto Pad Utility 337

Wildcard Label Selection 338

Assign Elevations by Daylight Function 340

Copyright © 2023 Earthwork Software Services, LLC. All rights reserved. www.EarthworkSoftwareServices.com

Day 1 Table of Contents (Cont.)

Appendix J - Design and Drafting Tools (Cont.)

Assign Elevations by +/- Edit Function 342

Assign Elevations by Slope Edit Function 343

Assign Elevations by Conform Utility 344

Fillet Line Utility 346

Establish Limit of Grading by Slope Intercept 349

Contour Surface Utility 351

About the Author and Seminar Instructor 353

Seminar Attendee Survey 355

Tear-Out Grading Plan Sheet for Earthwork Modeling Exercise 357

Copyright © 2023 Earthwork Software Services, LLC. All rights reserved. www.EarthworkSoftwareServices.com

Program Overview
Typical Data Entry Sequence

After the initial steps of setting up a new job file and scaling the plan sheet, data entry can be performed in any preferred sequence, but the following sequence works well for modeling and quantifying site earthwork (we use this sequence in the *Day 1 Earthwork Modeling Step-by-Step* exercise starting on page 50) . . .

- Start the AGTEK earthwork program by double-clicking the corresponding desktop shortcut:

- If digitizing from a raster PDF plan sheet, create job file, import PDF plan sheet then set/check/correct plan scale (pages 52-59). *[See page 287 if digitizing from a paper plan sheet.]*
- Translate arbitrary job file coordinates to match designer's coordinates (page 60).
- [*AGTEK 4D* only] Geo-reference PDF plan sheet with Google Earth (pages 64-71).
- Enter Existing Perimeter (pages 73-74).
- Enter Existing Data Lines (pages 75-81).
- Error-check/edit Existing Data Lines and Existing Surface (pages 82-108).
- Design Data Line entries (pages 119-128), initial error-check/edits (pages 129-131) and Design Data Line Offsets (pages 132-145).
- Enter Design Perimeter (pages 156-157).
- Final error-check/edits of Design Data Lines and Design Surface (pages 158-164).
- Enter, error-check/edit Stripping Areas (pages 166-171).
- Enter, error-check/edit Report Regions and Sectional Areas (pages 172-192).
- Enter Strata Bore Hole data (see *Day 3 Seminar Handbook*).
- Graphical surface comparisons with profile views (pages 196-201) and cut-fill maps (pages 202-206).
- Calculate cut/fill volumes (pages 208-211) and evaluate the volume report (pages 212-214).
- Format and print volume report and supporting graphical documentation (*Appendix E*, pages 273-280).
- [*AGTEK 4D* only] Export job file data to KMZ for Google Earth (*Appendix E*, pages 284-286).

Copyright © 2023 Earthwork Software Services, LLC. All rights reserved. www.EarthworkSoftwareServices.com