

# Full Contents

---

## Section 1: Overview Essentials

---

<b>1.1</b>	<b>Introduction</b> .....	<b>3</b>
	<b>Learning InRoads</b> .....	<b>3</b>
	Basic Rules .....	3
	<b>How to Use This Guide</b> .....	<b>4</b>
	Section Breakdown .....	5
	<i>Section 1: Overview Essentials</i> .....	5
	<i>Section 2: Production Essentials</i> .....	5
	<i>Glossary</i> .....	5
	<i>Index</i> .....	5
	What's in a Chapter? .....	5
	Font Conventions .....	6
	<i>Italic</i> .....	6
	<i>Bold</i> .....	6
	<i>Bold and Italic</i> .....	7
	<i>Small Caps</i> .....	7
	<i>Underlined Small Caps</i> .....	7
	<b>How to Use the CD</b> .....	<b>7</b>
	Files on CD-ROM .....	7
	<i>Training Folders</i> .....	7
	<i>Training Files</i> .....	8
	<i>Chapter Files</i> .....	10
	Other CD Content .....	10
	<b>Software Information</b> .....	<b>10</b>
	AutoCAD versus MicroStation .....	10
	Version Compatibility .....	11
	Software File Paths .....	11
<b>1.2</b>	<b>Orientation to InRoads</b> .....	<b>13</b>
	<b>Chapter Prerequisites</b> .....	<b>14</b>
	<b>The Bigger Picture</b> .....	<b>14</b>
	InRoads versus CAD .....	15
	<i>The CAD Platform</i> .....	15
	<i>File Types</i> .....	15
	<i>InRoads and CAD</i> .....	16
	<b>The InRoads Interface</b> .....	<b>17</b>
	The Menu Bar .....	17
	The Workspace Bar .....	18
	The Feedback Pane .....	18
	Status Bar .....	19
	Toolbars .....	19
	<b>The Surface Model</b> .....	<b>21</b>
	Surface Origins .....	21
	Intelligent Models .....	22
	Surface Display .....	24

<b>Geometry</b>	<b>25</b>
COGO Points	25
Horizontal Alignments	25
Vertical Alignments	27
Event Points	27
<b>Profiles</b>	<b>28</b>
Annotation	29
<b>Typical Sections</b>	<b>30</b>
Backbone	30
Cut and Fill Conditions	30
Layers and Components	31
Surface Intelligence	32
<b>Roadway Models</b>	<b>32</b>
Express Modeler	33
Roadway Designer	33
Defining the Roadway	34
Running the Modeler	34
Superelevation	36
<b>Cross Sections</b>	<b>38</b>
Custom Cross Sections	39
Cross Section Viewer	40
Annotation	40
Cross Section Editing	40
<b>Volumes</b>	<b>41</b>
Triangle Volume	41
Grid Volume	41
End-Area Volume	42
<b>Reporting</b>	<b>42</b>
XML Reporting	43
<b>Preferences</b>	<b>45</b>
Tools> Options	46
<b>The Managers</b>	<b>46</b>
Symbology Manager	47
Features - Style Manager	48
Geometry - Style Manager	50
Preference Manager	51
<b>The Locks</b>	<b>52</b>
Pen and Pencil	52
Locate Lock	53
Snap Lock	53
Station Lock	54
Report Lock	55
Feature Filter	55
<b>InRoads Support</b>	<b>56</b>
InRoads Help File	57
Training	57
Bentley	58
Consultants	58
<b>Chapter Challenge</b>	<b>58</b>
Quiz Questions	58
<b>1.3 Sample Project Defined</b>	<b>61</b>
<b>Preliminary Design Statement</b>	<b>61</b>
Project Design Criteria	61

Scope of Work Details .....	62
<i>Typical Sections</i> .....	63
<i>Concept Sketches</i> .....	64
<i>Design Criteria</i> .....	66
<i>Project Vicinity Map</i> .....	68
<b>1.4 Getting Going Now! .....</b>	<b>69</b>
<b>Chapter Prerequisites .....</b>	<b>70</b>
Files Needed .....	70
<b>Hands On—Get Going Now! .....</b>	<b>71</b>
Hands-On—An Introduction .....	71
Orientation .....	71
Loading the Training Files .....	75
<i>Preparing and Opening InRoads</i> .....	75
<i>Project Defaults</i> .....	76
<i>Creating a New Project Default Configuration</i> .....	79
<i>Opening the Data</i> .....	80
Lock Settings .....	81
CAD File Preparation .....	81
Surface Review and Display .....	82
<i>Perimeter</i> .....	82
<i>Contours</i> .....	83
<i>Triangles</i> .....	84
<i>Update 3-D/Plan Surface Display</i> .....	85
<i>Surface Properties</i> .....	87
<i>Feature Properties</i> .....	88
<i>View Features</i> .....	89
Horizontal Geometry File Creation .....	92
<i>The Geometry Project</i> .....	92
<i>Horizontal Alignment</i> .....	94
<i>Vertical Alignment</i> .....	95
Horizontal Geometry Workspace Bar Review .....	96
<i>Workspace Bar Shortcuts - Review</i> .....	97
<i>Workspace Bar Shortcuts - View</i> .....	98
<i>View Stationing</i> .....	100
<i>Alignment Stationing</i> .....	101
<i>Horizontal Annotation</i> .....	103
Profiling .....	106
<i>Create Profile</i> .....	107
Vertical Geometry Viewing .....	112
<i>View Vertical</i> .....	112
<i>View Vertical Annotation</i> .....	113
Typical Sections .....	114
<i>Templates</i> .....	115
Roadway Modeling .....	118
<i>Express Modeler</i> .....	118
<i>Running the Express Modeler</i> .....	121
Creating Cross Sections .....	124
<i>Create Cross Sections</i> .....	124
<i>Cross Section Viewer</i> .....	127
Express Modeler and Cross Section Repetition .....	129
<i>Express Modeler Revisited</i> .....	129
<i>Cross Sections Revisited</i> .....	130
End-Area Volumes .....	131

<i>End-Area Volumes</i> .....	131
<b>Chapter Challenge</b> .....	<b>135</b>
Additional Exercises .....	135
Quiz Questions .....	135

## Section 2: Production Essentials

---

<b>2.1 Starting Up</b> .....	<b>139</b>
<b>Chapter Prerequisites</b> .....	<b>139</b>
Knowledge Prerequisites .....	139
Data Prerequisites .....	139
Files Needed .....	139
<b>Hands On—Starting Up</b> .....	<b>140</b>
Selecting a CAD Platform .....	140
Starting InRoads .....	141
<i>InRoads Versus CAD</i> .....	141
The InRoads Interface .....	143
<i>The Menu Bar</i> .....	143
<i>The Workspace Bar</i> .....	144
<i>Workspace Bar Shortcuts</i> .....	146
<i>Active Data</i> .....	147
<i>Repositioning</i> .....	148
<i>The Feedback Pane</i> .....	149
Toolbars .....	150
<i>Standard Issue Toolbars</i> .....	150
<i>Modifying a Toolbar</i> .....	151
<i>Restoring Toolbar Defaults</i> .....	152
<i>Building a Custom Toolbar</i> .....	153
<i>Exporting and Importing Toolbars</i> .....	154
Project Defaults .....	155
<i>Creating a New Configuration</i> .....	155
Application Add-ins .....	157
Saving InRoads Data .....	158
Bentley Embedded Help .....	158
Exiting InRoads .....	159
<b>Chapter Challenge</b> .....	<b>160</b>
Additional Exercises .....	160
Quiz Questions .....	161
<b>2.2 Settings, Styles and Symbology</b> .....	<b>163</b>
<b>Chapter Prerequisites</b> .....	<b>163</b>
Knowledge Prerequisites .....	163
Data Prerequisites .....	163
Files Needed .....	164
<b>Hands on — The Managers</b> .....	<b>164</b>
<i>Managers Overview</i> .....	165
Using the Symbology Manager .....	166
<i>Using Named Symbology - Part 1</i> .....	168
<i>Using Named Symbology - Part 2</i> .....	170
<i>Using Named Symbology - Part 3</i> .....	171
Introduction to Intelligent DTMs .....	172
Style Manager - DTM Features .....	172
<i>Style - Surface Display</i> .....	175
Style Manager - Geometry .....	175

<i>Geometry Style - Details</i> .....	178
Creating a New Geometry Style .....	181
<i>General Information</i> .....	182
<i>Assigning Symbolology</i> .....	182
<i>Assigning New Symbolology</i> .....	185
<i>Defining the Settings</i> .....	188
Geometry Styles - Assigning .....	189
Preferences .....	191
<i>Preference Manager</i> .....	193
<i>Changing the Default Preference</i> .....	194
<i>Preferences Expanded</i> .....	195
<b>Chapter Challenge</b> .....	<b>199</b>
Additional Exercises .....	199
Quiz Questions .....	200
<b>2.3 Surface Essentials</b> .....	<b>203</b>
<b>Chapter Prerequisites</b> .....	<b>203</b>
Knowledge Prerequisites .....	203
Data Prerequisites .....	203
Files Needed .....	203
<b>Hands On—Surface Essentials</b> .....	<b>204</b>
Getting Started with Surfaces .....	204
<i>Starting Checks</i> .....	204
What is a DTM anyway? .....	205
DTM Basics .....	206
<i>Surface—New</i> .....	206
<i>The Basic DTM Point Types</i> .....	207
<i>Surface Properties</i> .....	208
The Existing Surface .....	209
<i>Feature Properties</i> .....	209
<i>The Three Feature Characteristics</i> .....	210
Introduction to the Locks .....	211
<i>The Pencil Setting</i> .....	211
<i>The Pen Setting</i> .....	211
Surface Viewing .....	212
<i>Perimeter</i> .....	212
<i>Contours</i> .....	212
<i>Triangles</i> .....	212
<i>Update 3-D/Plan Surface Display</i> .....	213
<i>View Features</i> .....	214
Text Import Wizard - ASCII DTM Data .....	215
<i>Confirming Data Import</i> .....	225
<i>Processing Imported Surface Data</i> .....	225
<i>Viewing Imported Surface Data</i> .....	226
<i>Surface Import from Graphics, Utilities</i> .....	227
<i>Drape Surface, Utilities</i> .....	230
<i>Surface Import From Graphics, Contours</i> .....	233
DTM Data Viewing .....	236
Triangulation .....	237
<i>Triangulate Surface</i> .....	238
Saving Surfaces .....	240
<b>Chapter Challenge</b> .....	<b>242</b>
Additional Exercises .....	242
Quiz Questions .....	243

<b>2.4</b>	<b>Horizontal Geometry</b>	<b>245</b>
	<b>Chapter Prerequisites</b>	<b>245</b>
	Knowledge Prerequisites	245
	Data Prerequisites	246
	Files Needed	246
	<b>Hands On—Geometry</b>	<b>246</b>
	Project Scope Orientation	246
	The Geometry Project File	247
	<i>Opening Existing Geometry</i>	247
	Existing Geometry—Examination	248
	<i>Workspace Bar Assessment</i>	248
	<i>Feedback Pane Assessment</i>	249
	<i>Viewing Assessment—Preparation</i>	249
	<i>View Horizontal Alignment</i>	251
	<i>Point Symbolology</i>	251
	<i>Review Horizontal Alignment</i>	255
	<i>View Stationing</i>	257
	<i>Viewing Assessment - Continued</i>	258
	<i>Review Geometry Points</i>	259
	<i>Horizontal Annotation—Cogo Points</i>	260
	Horizontal Layout Discussion	263
	<i>Layout Methods</i>	263
	<i>Project Orientation</i>	264
	Main Road Layout	264
	Layout Option 1	264
	<i>Creating Geometry</i>	265
	<i>Saving Geometry</i>	266
	<i>Horizontal Curve Set—Add PI</i>	267
	<i>PI—Precision Key-in</i>	268
	<i>Review/Save Horizontal</i>	269
	<i>Horizontal Curve Set—Define Curve</i>	270
	<i>Defining the Beginning Station</i>	272
	<i>View Stationing</i>	273
	Alignment Completion	274
	<i>Import Geometry from Graphics</i>	275
	<i>Completion Steps</i>	277
	<b>Chapter Challenge</b>	<b>278</b>
	Additional Exercises	278
	Layout Option 2	278
	<i>Create/Edit Alignment by Cogo Points</i>	278
	<i>Horizontal Alignment Annotation</i>	280
	<i>Copy Geometry</i>	282
	<i>Viewing Geometry</i>	283
	<i>Delete Horizontal PI</i>	284
	<i>Delete Horizontal Element</i>	285
	<i>Alignment Discontinuity Check</i>	289
	<i>Add Horizontal Free Curve</i>	290
	<i>Defining the Beginning Station</i>	292
	<i>View Stationing</i>	292
	Layout Option 3	293
	<i>Add Fixed Line</i>	294
	<i>Add Horizontal Free Curve</i>	296
	<i>Defining the Beginning Station</i>	297
	<i>View Stationing</i>	297

	<i>Copy Geometry</i> .....	297
	Side Road Centerline Layout .....	299
	Horizontal Regression .....	299
	<i>Regression Deviation Check</i> .....	300
	<i>Side Road Regression Check</i> .....	303
	Quiz Questions .....	304
<b>2.5</b>	<b>Profiling</b> .....	<b>305</b>
	<b>Chapter Prerequisites</b> .....	<b>306</b>
	Knowledge Prerequisites .....	306
	Data Prerequisites .....	306
	Files Needed .....	306
	<b>Hands On—Profiling</b> .....	<b>307</b>
	Creating Profiles .....	307
	Updating the Profile Overview .....	309
	Updating the Profile .....	312
	Profiles—Other Commands .....	313
	<b>Chapter Challenge</b> .....	<b>314</b>
	Additional Exercises .....	314
	Create Profile Settings .....	315
	Create Profile - General Leaf .....	315
	<i>Set Name</i> .....	315
	<i>Direction</i> .....	315
	<i>Exaggeration</i> .....	315
	<i>Surface Symbology</i> .....	316
	Create Profile - Source Leaf .....	318
	Create Profile - Controls Leaf .....	318
	<i>Limits</i> .....	319
	<i>Window Clearance</i> .....	319
	Create Profile - Offsets Leaf .....	320
	Create Profile - Include Leaf .....	321
	<i>Crossing/Projected Features</i> .....	321
	<i>Styles and Display</i> .....	321
	<i>Bandwidth</i> .....	323
	Create Profile - Symbology .....	324
	Quiz Questions .....	325
<b>2.6</b>	<b>Vertical Geometry</b> .....	<b>327</b>
	<b>Chapter Prerequisites</b> .....	<b>328</b>
	Knowledge Prerequisites .....	328
	Data Prerequisites .....	328
	Files Needed .....	328
	<b>Hands On—Vertical Geometry</b> .....	<b>329</b>
	Vertical Layout Discussion .....	330
	<i>Layout Methods</i> .....	330
	<i>Vertical Alignment Layout Prerequisites</i> .....	330
	<i>The Project Orientation</i> .....	331
	Main Road Layout .....	332
	Layout Option 1—Import from DTM .....	332
	<i>Import Vertical from Surface</i> .....	333
	<i>View and Review</i> .....	334
	<i>View Vertical Annotation</i> .....	335
	<i>Matching or Paralleling Existing Grade</i> .....	337
	<i>Saving Vertical Alignments</i> .....	337
	Creating New Vertical Geometry .....	337

Layout Option 2—Vertical Curve Set .....	338
<i>VPI—Precision Key-in</i> .....	339
<i>Vertical Curve Set Tools</i> .....	339
<i>Preparation</i> .....	339
<i>VPI Dynamics</i> .....	340
<i>Vertical Curve Set – Add PI</i> .....	340
<i>Review Alignment</i> .....	342
<i>Adding More VPIs</i> .....	342
<i>Vertical Curve Set—Move PI</i> .....	343
<i>Vertical Curve Set – Insert PI</i> .....	345
<i>Vertical Curve Set—Define Curve</i> .....	346
<i>Move Curve PI</i> .....	347
<i>Completion Notes</i> .....	348
<i>Vertical Alignment Annotation</i> .....	348
<b>Chapter Challenge</b> .....	<b>349</b>
Additional Exercises .....	349
<i>Side Road Vertical Layout</i> .....	349
<i>Vertical Alignment Layout Option 1</i> .....	349
<i>Previous Chapter Challenge Work</i> .....	349
Layout Option 3—Vertical Element .....	349
<i>Update Profile</i> .....	351
<i>Element Command Overview</i> .....	351
<i>Vertical Starting Point</i> .....	352
<i>Add Fixed Vertical Line</i> .....	354
<i>Add Fixed Vertical Line</i> .....	356
<i>Add Free Vertical Curve</i> .....	358
<i>Add Fixed Vertical Curve</i> .....	359
<i>Vertical Alignment Discontinuity Check</i> .....	360
<i>Add Floating Vertical Line</i> .....	361
<i>Add Free Vertical Curve</i> .....	362
<i>Vertical Discontinuity Check</i> .....	363
<i>Add Floating Vertical Line</i> .....	363
<i>Upcoming Vertical Assessment</i> .....	365
<i>Copy Elements</i> .....	366
<i>Add Free Vertical Curve</i> .....	367
<i>Add Fixed Vertical Line</i> .....	368
<i>Add Free Vertical Curve</i> .....	369
<i>Vertical Completion Checks</i> .....	369
<i>Vertical Alignment Annotation</i> .....	370
Quiz Questions .....	370
<b>2.7 Typical Sections</b> .....	<b>373</b>
<b>Chapter Prerequisites</b> .....	<b>374</b>
Knowledge Prerequisites .....	374
Data Prerequisites .....	374
Files Needed .....	374
<b>Hands On—Typical Sections</b> .....	<b>375</b>
Creating a Template Library .....	375
Opening a Template Library .....	378
Reviewing a Template Library .....	378
Viewing Templates .....	381
<i>View Controls</i> .....	383
Styles and the Intelligent DTM .....	384
Components .....	386



Components Expanded .....	388
Template Review .....	389
<i>Template CAD Display</i> .....	391
<i>Template Layers</i> .....	394
Component Constraints .....	397
<i>More on Constraints</i> .....	399
New Template #1 .....	400
<i>New Template Placeholder</i> .....	400
<i>Template Section Details</i> .....	401
<i>Drag and Drop Insertion Point</i> .....	402
<i>Template Options</i> .....	403
<i>Last Minute Settings</i> .....	404
<i>Dragging and Dropping Components</i> .....	405
<i>Last Edit Undo / Redo</i> .....	407
<i>Component Mirroring</i> .....	407
<i>Template #1 Completion</i> .....	410
<i>Adding Cut / Fill Slopes</i> .....	412
<i>Component Merging</i> .....	415
<i>Constraint Release</i> .....	418
<i>End Condition Testing</i> .....	422
Create Template Command Summary .....	423
New Template #2 .....	424
<i>Saving Templates</i> .....	424
Additional Template Topics .....	425
<i>Preparation</i> .....	425
<i>Add Details Step by Step</i> .....	425
<i>Multiple Passes</i> .....	426
<i>Independent Control Notes</i> .....	426
<i>Copy Typical Sections</i> .....	427
<b>Chapter Challenge</b> .....	<b>428</b>
Additional Exercises .....	428
<i>Template Basics Checklist</i> .....	429
Component Creation .....	430
Simple Components .....	430
<i>Preparation</i> .....	430
<i>Construction and Placement</i> .....	433
<i>Component Properties</i> .....	436
<i>Point Properties</i> .....	437
<i>Using a Simple Component</i> .....	440
<i>Simple Component - Template Review</i> .....	443
Workspace Bar Shortcut .....	446
Simple Components Continued .....	447
<i>Template Construction</i> .....	450
Template Points - Names .....	452
Constrained Component #1 .....	455
<i>Component Curb Details</i> .....	456
<i>Component Construction</i> .....	457
<i>Component Review</i> .....	461
Unconstrained Components .....	463
<i>Unconstrained Component #2</i> .....	466
Component Construction .....	467
<i>Bike Path / Walkway</i> .....	467
End Conditions .....	468
<i>Fill Slope Creation</i> .....	468

<i>Set Dynamic Origin</i> .....	473
<i>Reset Dynamic Origin</i> .....	475
<i>Dynamic Origin Alert</i> .....	475
<i>Cut Slope Creation</i> .....	476
Building Template #1 .....	477
<i>Template Drag and Drop</i> .....	478
<i>End Condition Testing</i> .....	480
<i>End Condition #3</i> .....	483
<i>Add Additional End Condition</i> .....	485
<i>End Condition Re-Test</i> .....	485
Building Template #2 .....	486
Merging Components .....	486
Component Summary .....	487
<i>Component Types</i> .....	487
<i>Terminology</i> .....	487
<i>Component Concept #1</i> .....	488
More on Point Controls .....	488
Create Your Own .....	489
Quiz Questions .....	489
<b>2.8 Corridor Modeling</b> .....	<b>491</b>
<b>Chapter Prerequisites</b> .....	<b>492</b>
Knowledge Prerequisites .....	492
Data Prerequisites .....	492
Files Needed .....	492
<b>Hands On—Corridor Modeling</b> .....	<b>492</b>
Opening Earlier Data .....	493
New Roadway Design File .....	493
Saving the Roadway Design File .....	494
The Project File .....	495
Modeling Basics .....	498
<i>Prerequisites</i> .....	498
The Roadway Designer .....	498
<i>Menu Commands</i> .....	498
<i>Corridor Management</i> .....	500
Project Scope .....	501
Adding Template Drops .....	503
<i>Continuing Template Drops</i> .....	505
End Condition Exceptions .....	506
Saving the Roadway Design File .....	508
Corridor Review .....	509
<i>Transition Bands</i> .....	510
<i>Connecting Transition #1 Points</i> .....	513
<i>Connecting Transition #2 Points</i> .....	516
Pre-Processing the Corridor .....	518
Create Surface .....	520
<i>Name and Preference</i> .....	521
<i>New Surfaces for Each Corridor</i> .....	521
<i>Empty Design Surface</i> .....	521
<i>Add Exterior Boundary</i> .....	522
<i>Densify Curves</i> .....	522
<i>Triangulate</i> .....	522
<i>Create Surface(s) from</i> .....	523
<i>Add Transverse Features</i> .....	523

	<i>Display Features in Plan View</i> .....	524
	<i>Final Set-up</i> .....	524
	Creating the Design Surface .....	525
	Surface Properties .....	527
	Saving the Design Surface .....	529
	Viewing Roadway Features .....	530
	Updating the Project File .....	531
	<b>Chapter Challenge</b> .....	<b>533</b>
	Additional Exercises .....	533
	Quiz Questions .....	533
<b>2.9</b>	<b>Cross Sections</b> .....	<b>535</b>
	<b>Chapter Prerequisites</b> .....	<b>535</b>
	Knowledge Prerequisites .....	535
	Data Prerequisites .....	536
	Files Needed .....	536
	<b>Hands On—Cross Sections</b> .....	<b>536</b>
	Creating Cross Sections .....	538
	Cross Section Viewer .....	540
	Adding and Displaying New Features .....	540
	<i>Symbology Manager</i> .....	541
	<i>Style Manager</i> .....	543
	<i>Adding Geometry to the DTM</i> .....	544
	<i>Feature Properties</i> .....	547
	<i>Drape Surface</i> .....	547
	Updating the Cross Sections Overview .....	549
	<i>Styles and Cross Sections</i> .....	551
	Updating the Cross Sections .....	552
	<i>Display On</i> .....	552
	<i>Refreshing</i> .....	552
	<i>Component Updating</i> .....	553
	Cross Sections—Other Commands .....	554
	<b>Chapter Challenge</b> .....	<b>555</b>
	Additional Exercises .....	555
	Create Cross Section—Settings .....	555
	<i>Cross Section Interval</i> .....	556
	<i>Surface Symbology</i> .....	559
	<i>Use Features Only</i> .....	560
	Create Cross Sections - Source Leaf .....	561
	Create Cross Sections—Controls .....	561
	Create Cross Sections—Include Leaf .....	562
	<i>Crossing &amp; Projected Features</i> .....	562
	<i>Components</i> .....	563
	<i>Styles and Display</i> .....	563
	<i>Show Features Outside</i> .....	563
	Create Cross Sections—Symbology .....	564
	Cross Section Layout .....	564
	Custom Cross Sections .....	566
	Quiz Questions .....	567
	<b>Glossary</b> .....	<b>569</b>
	<b>Index</b> .....	<b>581</b>