ArcGIS® 9

Using ArcPad®

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Getting started

Section 1

Welcome to ArcPad

1

IN THIS CHAPTER

- **What can you do with ArcPad?**
- **Customizing ArcPad**
- **Tips on learning ArcPad**

ESRI® ArcPad® software is a mobile mapping and geographic information system (GIS) technology. Mobile computing is bringing fundamental changes to the way geography is utilized with the ability to bring your work with you and to interact directly with the world around you. Mobile GIS comprises the integration of four technologies: GIS, lightweight hardware, the global positioning system (GPS), and wireless communication.

ArcPad provides database access, mapping, GIS, and GPS integration to users out in the field via handheld and mobile devices. Data collection with ArcPad is efficient and significantly improved with immediate data validation and availability.

What can you do with ArcPad?

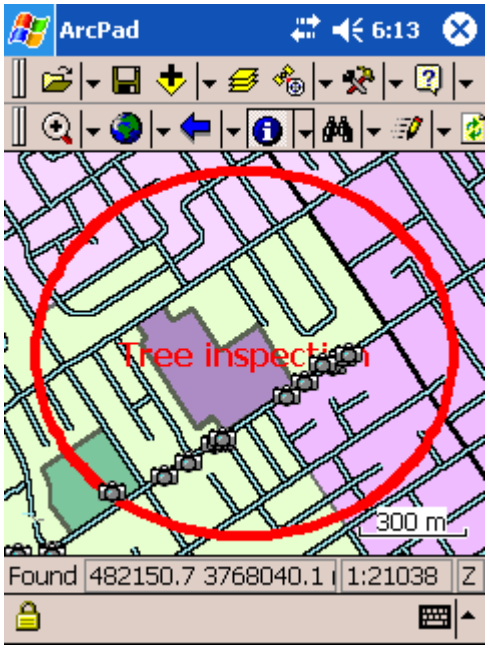
Using your existing data

ArcPad leverages existing mapping and GIS software systems and databases. ArcPad supports vector map and raster image display including numerous industry-standard formats. In addition, ArcPad supports most of the symbology used in ArcGIS Desktop, enabling you to display layers in your mobile GIS applications using the standards of your organization.

Capturing data in the field

ArcPad provides a comprehensive set of tools users need for collecting and capturing data in the field including redlining using a graphics layer, and extensive support for capture devices such as GPS receivers, rangefinders, and cameras.

ArcPad supports vector and raster data in a multilayered environment.



ArcPad enables you to identify target areas for inspections using a graphics layer. The camera icon represents the location of a feature with a georeferenced photo.

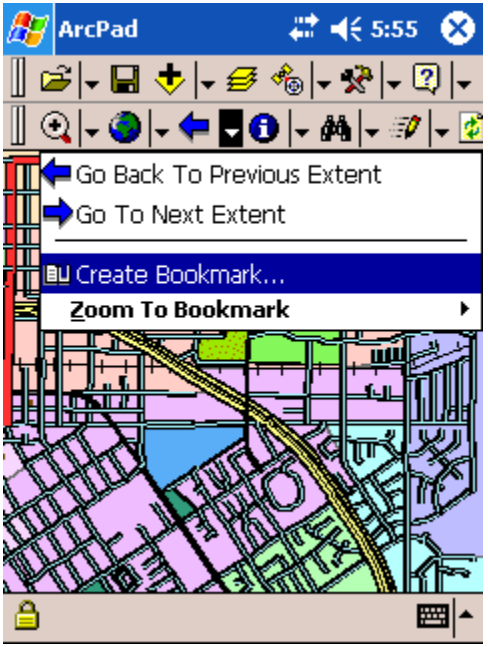
ArcPad enables you to capture photos in the field using a connected digital camera. The photos are then immediately associated with features in a layer.

Moving around your map

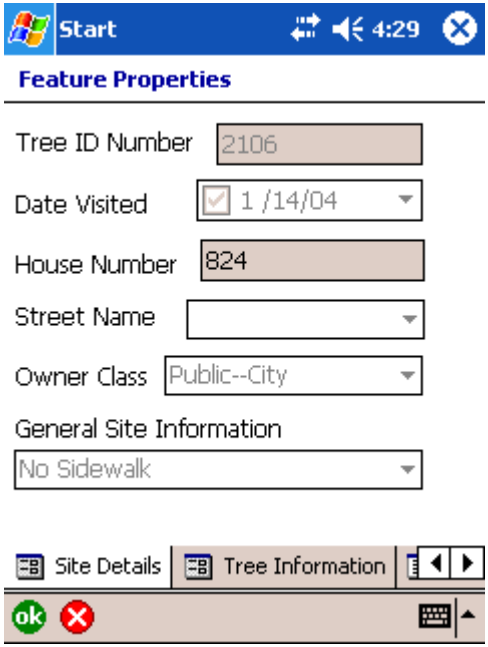
ArcPad has a number of map navigation tools, including variable zoom and pan, fixed zoom, zoom to a specified layer or spatial bookmark, and center on the current GPS position.

Querying your data

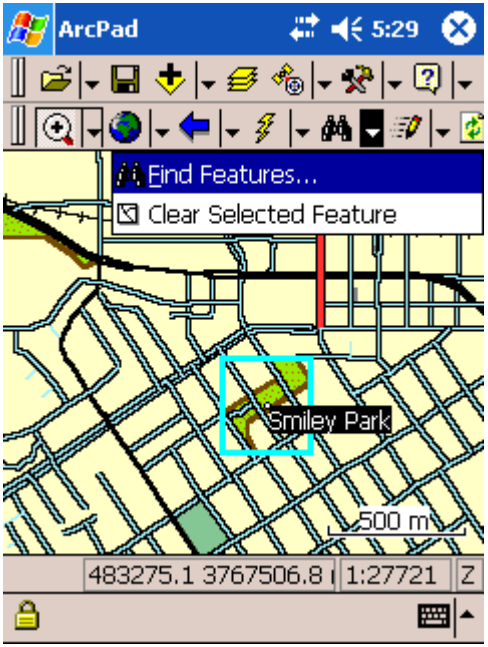
ArcPad enables you to identify features by tapping on them; display additional information about features through a hyperlink; navigate to a specific geographic coordinate; and locate a feature within the extent of your map, label it, and zoom to it.



Create a spatial bookmark to easily identify your study area.



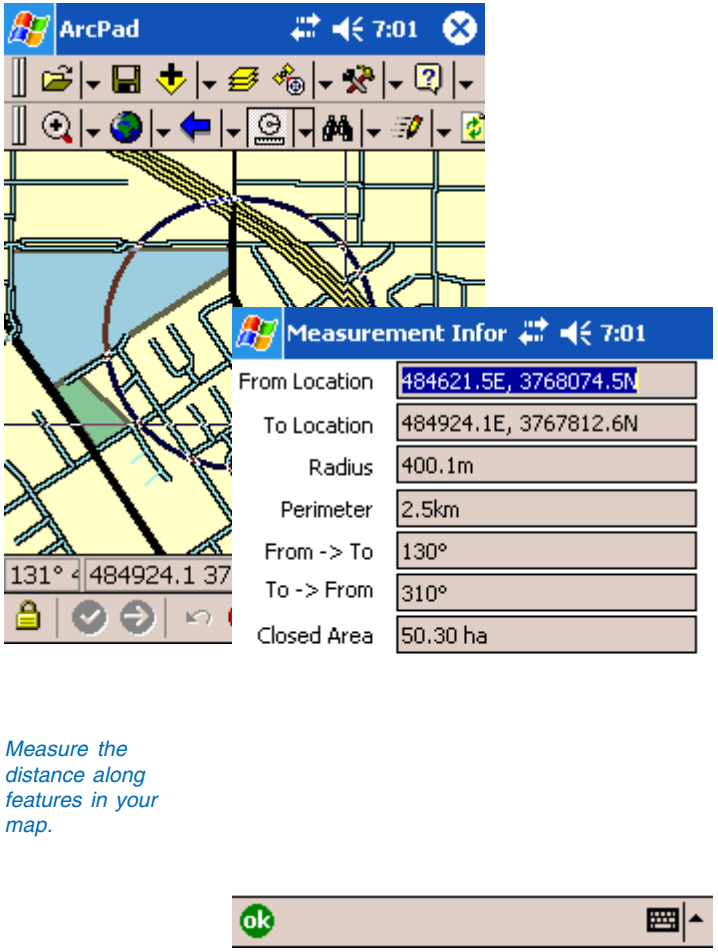
Use the Identify tool to display information about a feature.



Locate a feature, label it, and zoom to it.

Measuring distances on your map

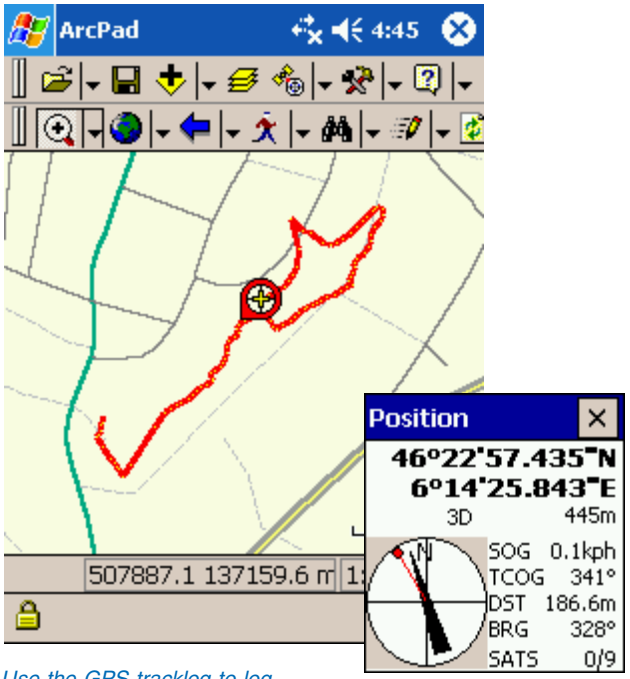
ArcPad lets you measure distance, area, and bearings on your map with three measuring tools: Measure, Freehand Measure, and Radial Measure.



Measure the distance along features in your map.

Navigating with your GPS

Connect a GPS to your mobile device and let ArcPad guide you. ArcPad provides navigational information from the current GPS position to the destination and a GPS tracklog that illustrates the path you have traveled.

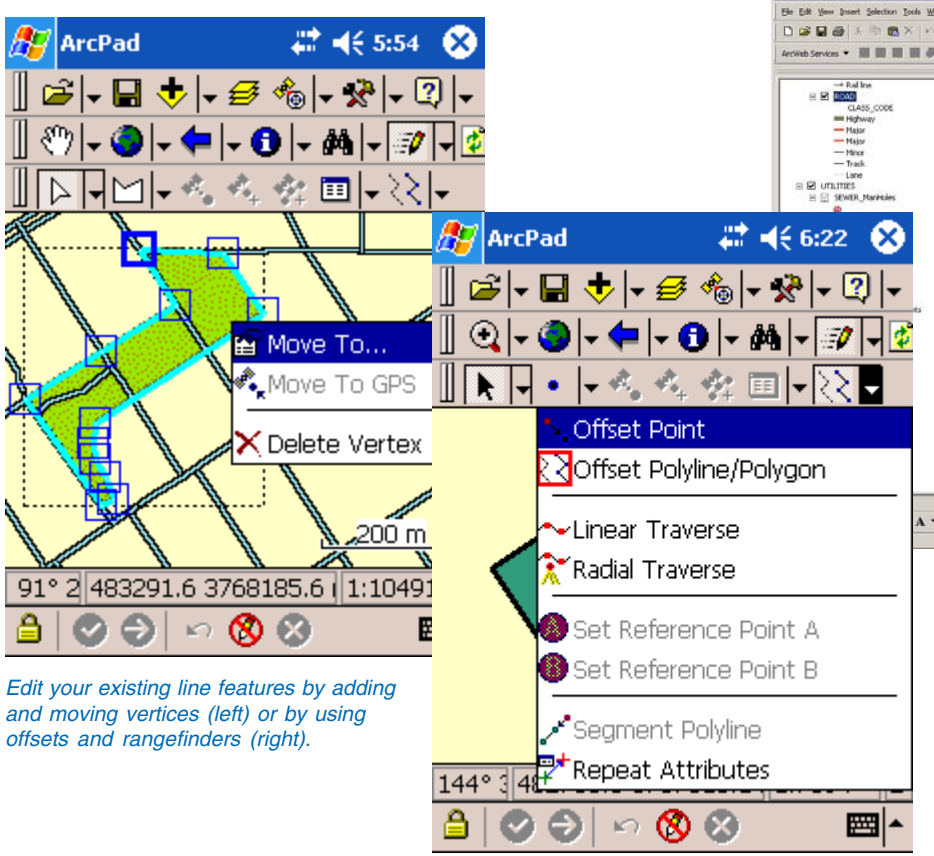


Use the GPS tracklog to log the path you have traveled.

Use the compass to view the direction from the current GPS position to the selected destination in red.

Editing your data

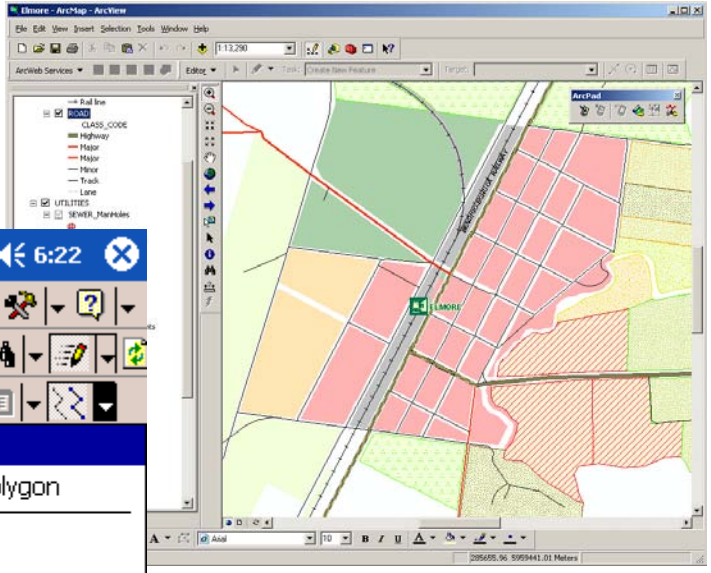
In addition to displaying and querying spatial data, ArcPad allows you to create and edit spatial data using input from either the mouse pointer, pen, GPS, or rangefinder. ArcPad also supports offsets, traverses, repeated attributes, and segmented lines to ensure more accurate and efficient data capture.



Edit your existing line features by adding and moving vertices (left) or by using offsets and rangefinders (right).

Including ArcPad in your GIS solution

ArcPad is the field component to your ArcGIS solution. Use the ArcPad Tools custom toolbar for ArcGIS. These tools allow you to extract, convert, and project your data using the ArcGIS Desktop products (ArcView, ArcEditor, or ArcInfo).



Use data maintained in ArcGIS Desktop in the field with ArcPad.

Customizing ArcPad

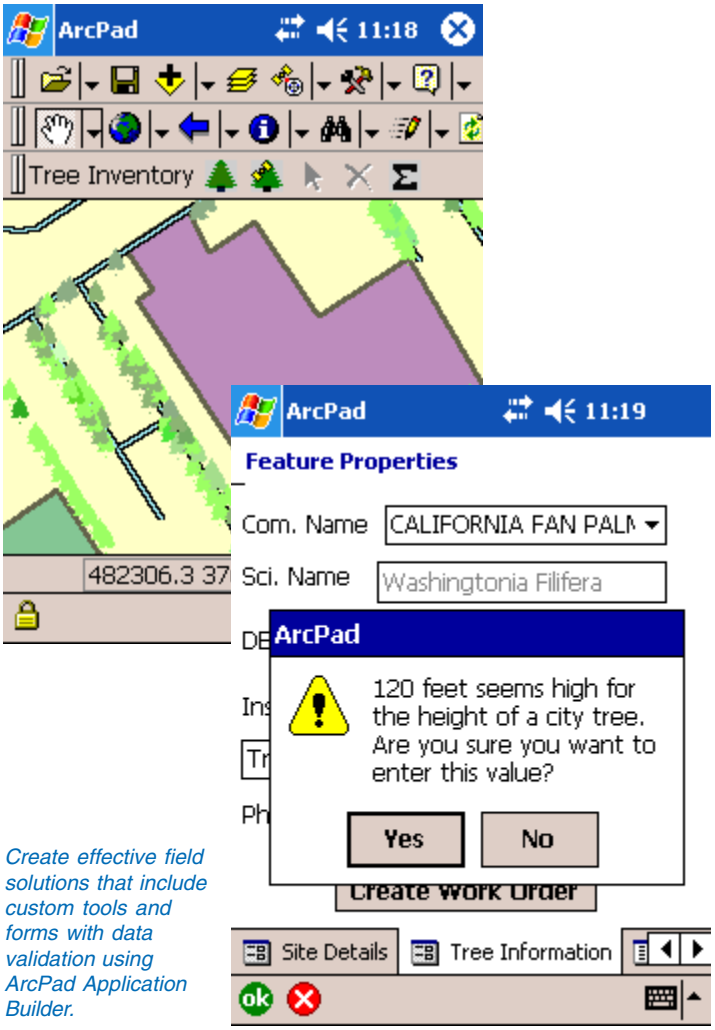
ArcPad Application Builder is the development framework for building custom ArcPad applications for Mobile GIS projects. Creating a customized field solution for data collection and data maintenance is essential to ensure the integrity and value of your GIS data. The ability to accurately capture attribute and spatial data directly in the field improves efficiency and reduces time spent correcting or reentering the data into the main database back in the office.

With ArcPad Application Builder, you can:

- Design custom forms to streamline data collection
- Ensure data integrity by validating data directly in the field
- Tailor applications to user skill levels and specific fields tasks
- Write scripts that interact with ArcPad's internal objects
- Develop scripts to support data collection devices

All customization for ArcPad is performed on the desktop and deployed on the mobile device. ArcPad Application Builder includes a copy of ArcPad, ArcPad Studio, detailed online documentation, sample code, and first-year maintenance.

For more information about customizing ArcPad and ArcPad Application Builder, refer to the Appendix at the end of this book. You can also visit the ESRI Web site at *www.esri.com/applicationbuilder*.



Create effective field solutions that include custom tools and forms with data validation using ArcPad Application Builder.

Tips on learning ArcPad

If you're new to field GIS and mapping, you don't have to learn everything about ArcPad to get immediate results. Begin learning ArcPad by reading Chapter 3, 'Quick-start tutorial'. This chapter shows you how easy it is to work with ArcPad to accomplish your field mapping goals. ArcPad comes with the data used in the tutorial, so you can follow along step by step on your mobile device or desktop computer. You can also read the tutorial without using your computer.

Finding answers to questions

Like most people, your goal is to complete your tasks while investing a minimum amount of time and effort on learning how to use software. You want intuitive, easy-to-use software that gives you immediate results, without having to read pages of documentation. However, when you do have a question, you want the answer quickly so that you can complete your task. That's what this book is all about—getting you the answers you need when you need them.

This book describes how to add your geographic data into your ArcPad map, explore the data, and organize and manage the data. Although you can read this book from start to finish, you'll likely use it more as a reference. When you want to know how to do a particular task such as collecting GPS position coordinates, just look it up in the table of contents or index. What you'll find is a concise, step-by-step description of how to complete the task. Some chapters also include detailed information that you can read if you want to learn more about the concepts behind the tasks. You may also refer to the glossary in this book if you come across any unfamiliar terms or need to refresh your memory.

In addition to this book, the 'ArcPad Reference Guide' provides a description of all the ArcPad tools and all the fields in the ArcPad Options, GPS Preferences, Rangefinder Preferences, Table of Contents, and Feature Properties dialog boxes.

Getting help in the field

ArcPad includes a 'Quick Reference' guide for the tools and buttons on the ArcPad interface which can be easily used in the field.

Getting started with ArcPad Templates

A collection of ArcPad Templates is available as a starting point for creating your own ArcPad projects. The templates highlight specific applications of ArcPad technology to solve industry specific problems. These templates vary from tools to applets to forms, all of which illustrate the practical benefits of Arcpad . Visit the ESRI Web site at *www.esri.com/publicarcpad* to learn more and download an ArcPad Template.

Learning about ArcPad Application Builder

For more information about customizing ArcPad and ArcPad Application Builder, refer to the Appendix at the end of this book. You can also visit the ESRI Web site at *www.esri.com/applicationbuilder*.

Using the ArcPad sample data

ArcPad includes three sets of sample data to get you started: Redlands, Elmore, and World. These data sets are used in the tasks throughout the book so that you can easily follow along. To load the sample data onto your Windows Mobile device, from the Start menu, click on Programs>ArcGIS>ArcPad 7>Install ArcPad 7.0 <name> Sample Data on Windows Mobile.

Redlands, California, USA

The Redlands sample data includes the following layers: an aerial photograph from DigitalGlobe (jp2), shapefiles for parks,

railroads, school boundary areas, streets, and trees, a graphics layer (FieldNotes), a photo layer, and georeferenced photos. The trees data was provided by West Coast Arborists, Inc. The streets data was provided by TeleAtlas. The QuickBird image of Redlands was provided by DigitalGlobe, Inc.

Elmore, Victoria, Australia

The Elmore sample data includes the following layers: an aerial photograph (.jp2), shapefiles for customers, rail, road, sewer manholes, pump stations, out flow, pipes, rising mains, connection points, morphology, parcels, land use, and zoning. For detailed information about the Elmore data, see Chapter 3, 'Quick start tutorial'. The Coliban Region Water Authority, Bendigo, Victoria, Austalia provided some of the Elmore sample data.

World

The World sample data includes the following layers: world cities, rivers, lakes, world time zones, counties, and ocean. The World data set is very large so you would most likely only use portions of this data on your Windows Mobile device. Learn how to export data for ArcPad using ArcGIS Desktop in Chapter 18, 'ArcPad Tools for ArcGIS'.

Nyon, Vaud, Switzerland (Not included as sample)

Although not included with ArcPad, street data for Nyon from Tele Atlas (Copyright © 2005 Tele Atlas NV) was used to illustrate many of the tasks for Section 4, 'Using Data Capture Devices'.

Contacting ESRI

If you need to contact ESRI for technical support, see the product registration and support card you received with ArcPad or visit *http://support.esri.com/arcpad*. You can also visit ESRI on the Web at *www.esri.com/arcgis* for more information on ArcPad and ArcGIS Desktop.

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Introduction to Windows Mobile

2

IN THIS CHAPTER

- **Overview of Windows CE and Windows Mobile**
- **Supported mobile devices**
- **Selecting a mobile device**
- **Transferring data to a Windows Mobile device**
- **Windows Mobile and Windows CE resources**

The Windows® Mobile and Windows CE operating systems have similar user interfaces and file systems to the desktop versions of Windows, but there are also many differences. This chapter discusses some of these differences, especially those that are encountered when using ArcPad. The chapter ends with a section on resources that are useful whether you are new to Windows Mobile and Windows CE, or an experienced user.

Windows CE

Windows CE (also referred to as Windows CE .NET) is a 32-bit, multitasking, and multithreaded operating system that is designed to run on embedded and mobile devices. There are a wide range of embedded and mobile devices using Windows CE, such as handheld computers, Personal Digital Assistants (PDAs), gas pumps, point-of-sale terminals, game computers, and even automated cow-feeding machines.

Windows CE is not an operating system that can simply be installed on a device or computer. It requires a development toolset, which a manufacturer uses to configure the operating system for a specific hardware platform, including the user interface, processor chip, drivers, and application programming interface (API). The resultant operating system is burned into the device's read-only memory (ROM). The operating system can only be changed or upgraded by physically changing the ROM chip, or by a ROM software upgrade if the device uses a flash or rewritable ROM chip.

Windows CE implements a subset of the Win32 API, which was completely rewritten for embedded devices. Consequently, Windows CE has a lot of similarities to desktop versions of Windows. From a user's perspective, the main similarities are the user interface and the file system.

The Windows CE user interface, or shell, is a separate component of the operating system which the developer of a Windows CE device can optionally choose to use. Windows Mobile is an implementation of the Windows CE development platform which Microsoft has developed for mobile devices. The Windows Mobile user interface is quite different to the Windows CE user interface, even though the underlying operating system is basically the same.

Windows CE, Pocket PC, and Windows Mobile

In the past few years Microsoft has used a number of terms for the version of Windows used for mobile devices.

In 2000, Microsoft introduced the *Pocket PC*, which used Windows CE 3.0 as the underlying operating system together with a new graphical user interface, and additional applications such as Pocket Word. Although technically these new devices were running Windows CE, they were branded and referred to as Pocket PCs. Consequently, many users were unaware that Pocket PC devices used Windows CE as the underlying operating system.

In 2003, Microsoft released a new version of Pocket PC, with Windows CE 4.2 as the underlying operating system. However, in order to create a stronger branding, Microsoft started referring to these new Pocket PC devices as *Windows Mobile* devices. (More specifically, these new devices were *Windows Mobile 2003 for Pocket PC* devices.)
In 2004, Microsoft released another update, Windows Mobile 2003 Second Edition, and has subsequently dropped the use of the term "Pocket PC".
In 2005, Microsoft released Windows Mobile 5.0, which is built using the Windows CE 5.0 development platform.

With ArcPad 5 and ArcPad 6, for ease of communication ESRI used the term "Windows CE" as a generic term to include both Windows CE and Pocket PC devices. For the first few years this approach worked as there were very few Pocket PC devices on the market – and most rugged mobile devices used Windows CE. Today the situation has reversed with most devices running Windows Mobile and very few devices running pure Windows CE. Consequently, with ArcPad 7, ESRI will be using the term "Windows Mobile" as a generic term to include both Windows Mobile and Windows CE devices.

Windows Mobile

If you are familiar with desktop Windows, you should immediately recognize and be able to use the Windows Mobile user interface.

The similar file system for desktop Windows (Windows XP and Windows 2000) and Windows Mobile means that no conversion takes place when copying or moving files between desktop PCs and Windows Mobile devices. The only exception is when the communication software, Microsoft ActiveSync®, is specifically configured to convert files to formats used by Windows Mobile applications such as Pocket Word.

ArcPad takes advantage of the similar file systems when sharing GIS data with desktop GIS software. GIS files which are supported by ArcPad, such as shapefiles and supported images, can be used with desktop GIS software, such as ArcView, and then copied to the Windows Mobile device for use with ArcPad—no file conversion is required at any point. Although the file systems are similar, the medium for storing files is quite different and constitutes one of the main differences, from a user's perspective, between Windows Mobile and desktop Windows.

File storage and program memory

Windows Mobile devices do not use hard drives for storage like desktop PCs—except when a CompactFlash or PC Card hard drive is used as an accessory for additional storage. Instead, ROM, random access memory (RAM), and flash memory are used for storage. Just as on desktop PCs, RAM is volatile—meaning that the contents of RAM are lost when a Windows Mobile device is rebooted or shutdown. Unlike desktop PCs, switching off a Windows Mobile device does not clear the contents of RAM since in the latter case only the screen is turned off and not the actual device.

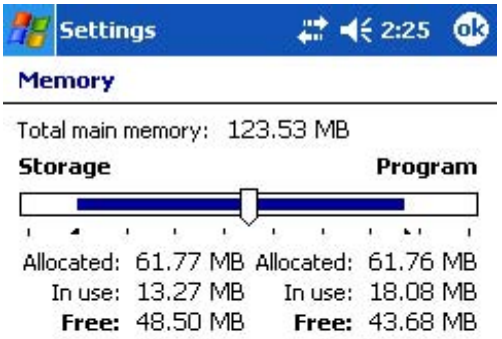
The operating system is stored in ROM; it is not stored on the hard drive as in desktop PCs. Consequently, Windows Mobile devices boot up much more quickly than desktop PCs. Reading the operating system from ROM is much faster than reading the operating system from a hard disk.

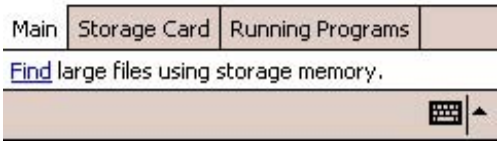
RAM is used for storing both application programs and data, as well as for running the operating system and programs. (Although, with Windows Mobile 5.0 devices, RAM will only be available for running the operating system and programs. Windows Mobile 5.0 devices will include non-volatile flash memory, or built-in storage, for installing application programs and data.) RAM on a Windows Mobile device can be viewed as the equivalent of the combination of a desktop PC's RAM, hard drive, and virtual memory or paging file space. On desktop PCs the combined RAM and virtual memory is typically at least 512 MB, while on Windows Mobile devices the total RAM is typically 64 MB.

Storage cards—either flash memory or hard drives—can increase the amount of storage space for a Windows Mobile device, but they cannot increase the amount of memory available for running programs. Programs can only run in the memory installed on the device. It is therefore important to limit the amount of data and programs stored in RAM and in so doing maximize the amount of free memory available for running programs. Fortunately, an increasing number of Windows Mobile devices include built-in, non-volatile, flash memory—in addition to ROM and RAM. For these devices it is recommended that applications, and optionally data, be installed in the built-in storage—keeping most of the RAM free for running the operating system and programs. Different Windows Mobile devices use different names for the built-in storage: Dell uses the name *Built-in Storage*, HP uses the name *iPAQ File Store*, Thales uses the name *MyDevice*, and Trimble uses the name *Disk*.

Windows Mobile automatically manages the allocation of memory for storage and running programs. You can use the Memory dialog box on Windows Mobile, or the Memory page of the System Properties dialog box on Windows CE, to view how much memory is allocated, used, and free for storage and programs, as well as for adjusting the memory allocation.

To configure memory on Windows Mobile, tap Start>Settings, the System tab, and the Memory icon to open the Memory dialog box.





To configure memory on a Windows CE device, tap Start>Settings>Control Panel, then double-tap the System icon to open the System Properties dialog box. Tap the Memory tab to open the Memory settings page.

The left part of the slider bar represents storage memory—in RAM—while the right part of the slider bar represents memory for running programs. The amount of storage and program memory allocated and in use is reported below the slider bar. Windows Mobile also shows the amount of free storage and program memory. You can adjust the amount of memory allocated for storage and programs by moving the slider to the left or to the right.

Supported mobile devices

ArcPad 7 supports the following Windows operating systems: Windows 2000 and XP, Windows CE and Windows Mobile. ArcPad does not support specific Windows Mobile or Windows CE devices, but instead supports specific Windows CE versions and processor chips. ArcPad should run on any Windows Mobile and Windows CE device that uses a supported processor chip, runs a supported version of Windows CE, and meets the minimum requirements for memory and scripting.

ArcPad is designed to run on any Windows Mobile or Windows CE device that meets the following minimum system requirements:

Windows CE version

ArcPad supports Windows CE 4.2 or higher. This includes Windows Mobile 2003 and Windows Mobile 2003 Second Edition devices. For Windows Mobile devices, ArcPad supports the Pocket PC and Pocket PC Phone Edition form factors – it does not support the Smartphone form factor.

Processor chip

Windows CE devices are built using a variety of processors, or CPU chips. Unlike desktop PCs where processor chips are compatible—for example, Intel® and AMD chips—processor chips used for Windows CE devices are not compatible and require that software be compiled specifically for the particular processor chip.

ArcPad 7 only supports ARM-based CPU chips for Windows Mobile and Windows CE devices. ARM-based CPU chips include, but are not limited to, chips made by Intel (StrongARM and XScale), Samsung, Texas Instruments, and Atmel.

Memory

ArcPad requires a Windows Mobile device with at least 32 MB of RAM; however, there may be insufficient free RAM available to work with anything but the smallest and simplest datasets. Therefore, ESRI recommends a minimum of 64 MB of RAM, and preferably more RAM if available.

The amount of free RAM required to install and run ArcPad depends on what sort of data will be used. Installing ArcPad requires approximately 6 MB of free RAM (8 MB if the NADCON tables are installed). Running ArcPad could require 20 MB or more of free RAM, especially if you are using compressed images in formats such as MrSID® and JPEG2000.

Scripting (customization only)

ArcPad can be customized using ArcPad Application Builder and scripting languages, such as VBScript and JScript. The corresponding scripting runtime library file must be installed on the device before running scripts. Customization of ArcPad is disabled when running ArcPad on a device that does not have the required scripting runtime library installed.

Selecting a mobile device

Mobile GIS involves a variety of tasks that are performed under varying environments and conditions. No two Mobile GIS applications are the same, and different people have different preferences. For example, one person may be comfortable with entering text using a pen (or stylus) and character recognition software, while another person using the same application may prefer to use a physical keyboard. Similarly, one person may be comfortable with working with map data on a quarter-VGA (Video Graphics Adapter) screen (240 x 320 pixels), while another person may prefer a larger screen.

Selecting a suitable device for Mobile GIS involves a process to determine which criteria are essential, "nice to have", or not required. There is no perfect device for Mobile GIS since many criteria are mutually exclusive. For example, it is not possible to have a device with a large screen and is compact enough to fit in your pocket—unless, of course, you have large pockets!

The following factors should be considered when selecting a device that best meets the needs and requirements of your Mobile GIS application.

Operating system

ArcPad runs on Windows 2000, XP, and Windows Mobile devices. The first factor to consider is whether the Mobile GIS device needs to run Windows Mobile or a PC version of Windows.

The advantages of Windows Mobile devices are:

- More robust. Windows Mobile devices usually use solid-state technology with no moving parts (for example, flash memory for storage instead of a hard drive) and therefore tend to be more robust than PCs.
- Less power consumption due to solid-state technology and low-power processors.
- Instant on and off. Windows Mobile devices can be switched on without needing to boot up and, similarly, can be switched off without needing to be shut down. This is a significant advantage for Mobile GIS tasks, which often involve switching the device off while moving to a new location.
- Portability. Windows Mobile devices are available in a variety of form factors, some of which are small enough to fit in a pocket. Windows Mobile devices also tend to weigh less than comparable tablet PCs.
- Sunlight readable displays. Most Windows Mobile devices have screens which are easily readable in outdoor conditions, including direct sunlight.
- Lower cost than PCs. However, this cost advantage can be reduced by the type of accessories needed for a Mobile GIS application.

The disadvantages of Windows Mobile devices are:

- Limited operating system compared to desktop Windows. Although Windows Mobile is a powerful operating system for mobile devices, it does not have all of the capabilities, built-in tools, and applications that desktop Windows does. This can also be an advantage for situations where a simpler operating system is preferable.
- Limited number of available applications. Only a limited, but growing number of applications support Windows Mobile. In many cases applications that have been ported to Windows Mobile have less functionality on Windows Mobile than on desktop Windows. This is only a disadvantage if your Mobile GIS tasks require additional applications that are not available on Windows Mobile.
- Use of RAM as the primary storage medium. Windows Mobile devices do not have a hard drive but instead use RAM for storing application programs and data and for program

processing. Most Windows Mobile devices do not have the option of adding additional RAM. There is a limit, therefore, of how many applications and datasets you can store in RAM and still have sufficient RAM free for program processing. Another limitation is that RAM requires power to maintain its contents. The contents of RAM are lost if the battery is drained on the Windows Mobile device. The battery can be drained by leaving the Windows Mobile device disconnected from a power supply for long periods of time. The RAM uses small amounts of power even when the Windows Mobile device is not being used. It is therefore a good idea to always connect a Windows Mobile device to a power supply when it is not in use.

The disadvantage of using RAM as the primary storage medium can be reduced by using a storage card for storing application programs and data—or by using built-in, non-volatile storage when available.

For many Mobile GIS tasks a tablet PC running Windows XP Tablet PC Edition may be a better choice than a Windows Mobile device. This is especially true if you require a larger screen and/or need to run additional software that does not support Windows Mobile. There are a number of hardware vendors that manufacture Windows XP Tablet PC Edition devices suitable for Mobile GIS.

Cost

Your budget for each Windows Mobile device will help dictate which factors are essential. For example, ruggedized Windows Mobile devices are at least double the cost of standard Windows Mobile devices. When considering cost it is essential to consider the total cost of the Mobile GIS task, including labor and replacement costs. Labor accounts for the major portion of Mobile GIS costs, and therefore it is more cost effective in the long run to purchase robust, ruggedized devices, which last longer, resulting in less downtime from damaged and broken devices.

Size of device

How large or small does the mobile device need to be? Ruggedized devices are usually bulkier and heavier than nonruggedized devices. The size of the device will dictate the screen size and whether the device has a physical keyboard.

Ruggedization

Do you need a ruggedized mobile device? Ruggedized devices cost more to purchase but are more cost effective in the long run as discussed above.

Screen size and display

How large or small does the screen need to be? Some people are comfortable using a small screen, while others prefer a larger screen. Most Windows Mobile devices have quarter-VGA screens (240 x 320 pixels), while Windows XP Tablet PCs have full-VGA (640 x 480 pixels) or larger screens.

Do you need a color screen display? Some applications do not require color displays, but most GIS data requires color to distinguish the various features and details on a map. This is especially true when using image data. Some of the ruggedized mobile devices are only available with grayscale displays.

If a color screen is a requirement, then it is essential that the display be readable in sunlight since Mobile GIS tasks are usually performed outdoors. It is strongly recommended that you test any potential mobile device outdoors, in both direct sunlight and shade, before purchasing the device. Most Windows Mobile devices available today use reflective thin film transistor (TFT) screen technology, which is readable in direct sunlight.

Memory and storage capacity

How much data and what type of data do you need to store and use on your Windows Mobile device? It is recommended that you store your data on a storage card, or built-in storage, and not in RAM to keep as much RAM free for processing as possible. This also ensures that data is not lost if the battery is drained on the Windows Mobile device. It is also recommended that the Windows Mobile device have at least 64 MB of RAM and preferably more, if available.

As of this writing, the maximum capacity of commonly available and affordable storage cards is as follows:

Storage media	Maximum capacity
CompactFlash (CF)	8 GB for flash memory
	5 GB for microdrive hard drive
Secure Digital (SD)	2 GB for flash memory

Flash memory is a slightly more expensive storage media than hard drives but is more robust due to the solid-state technology used in flash memory.

Integrated GPS

Do you need a GPS for your Mobile GIS task? If yes, do you need a GPS that is integrated with the mobile device? Integrated GPS receivers are easier to use, especially for the novice user. And integrated GPS receivers do not require any cumbersome cables for connecting the GPS to the mobile device—although an increasing number of GPS receivers are Bluetooth enabled, which eliminates the need for cables.

Integrated Camera

Does your Mobile GIS task require a digital camera for taking photographs in the field? If yes, do you need a camera that is integrated with the mobile device? The biggest advantage of an integrated camera is that the image files are automatically stored on the same device as the Mobile GIS data, resulting in easier and better integration of data. Unfortunately, integrated digital cameras are currently of inferior quality compared to standalone digital cameras, especially in terms of image resolution, optical zoom, and minimum light needed for taking a photograph. However, it is quite possible that an integrated camera may meet the requirements for your Mobile GIS task.

Wireless connectivity

Does your Mobile GIS task require wireless connectivity? If yes, then it is recommended that you select a mobile device that has the required wireless connectivity integrated with the device.

There are a variety of wireless options available, each for a different purpose.

Bluetooth is designed for eliminating cables by wirelessly connecting mobile devices and accessories, using serial communications. Bluetooth is ideal for connecting a mobile device to a GPS receiver, laser range finder, or bar code scanner. Bluetooth is also useful for setting up an ActiveSync partnership between a Windows Mobile device and a desktop PC. It is important to note that Bluetooth implementation is not consistant across all manufacturers. If you need to connect multiple Bluetooth devices simultaneously you should ensure that you choose a mobile device that supports multiple Bluetooth connections.

WiFi (using either the 802.11b or 802.11g protocols) is useful for wirelessly connecting your mobile device to a local area network, or LAN. Connecting to a LAN is useful for accessing an ArcIMS web service, downloading or uploading data, as well as for setting up an ActiveSync partnership between a Windows Mobile device and a desktop PC.

Wide area networks are used for similar purposes as LANs, however the wireless technology for connecting to WANs have a longer range than the technology for connecting to LANs. The wireless protocols for connecting to WANs include GPRS, CDMA, EV-DO, UMTS/WCDMA, and EDGE.

Expansion capability and accessories

What accessories do you need to use for your Mobile GIS tasks? Your Windows Mobile device should have at least one serial port, or be Bluetooth enabled, for connecting GPS receivers and other serial input devices. Your Windows Mobile device should also have at least one expansion slot for a storage card, for example, CompactFlash or Secure Digital. Multiple expansion slots are useful when you need to use a storage card and accessory (such as a CompactFlash GPS receiver) simultaneously.

There are a variety of accessories available for CompactFlash and Secure Digital expansion slots. These accessories include flash memory, hard drives, GPS receivers, landline and wireless modems, digital phone cards, wired (Ethernet) and wireless local area network (LAN) cards (802.11b, 802.11g) Bluetooth cards, digital cameras, VGA cards, bar code scanners, and serial I/O cards.

Field testing

It is highly recommended that you test potential Windows Mobile devices under similar conditions to those expected to be encountered when performing your Mobile GIS tasks to ensure that the device meets your requirements. A color display may look bright and crisp under artificial office lighting but may be almost black when viewed in direct sunlight.

For more information on selecting a Windows Mobile device you can download the ESRI Whitepaper, *ArcPad 7 Devices and Accessories*, from the Literature link on *www.esri.com/arcpad*, or from *support.esri.com/arcpad.*

Transferring data to a Windows Mobile device

You can easily transfer data between your Windows Mobile device and your desktop PC by establishing a connection between the two devices and then simply dragging and dropping files from one device to another.

The primary software used for connecting Windows Mobile devices to the desktop PC is Microsoft ActiveSync. ActiveSync is preinstalled in ROM on Windows Mobile devices, and a CD containing ActiveSync for desktop PCs is shipped with every Windows Mobile device. You can also download ActiveSync, for free, from Microsoft at:

http://www.microsoft.com/windowsmobile/downloads/activesync38.mspx

As of this writing the current version of ActiveSync is version 3.8. The ActiveSync CD or download also contains help on using ActiveSync and establishing a connection with your Windows Mobile device.

ActiveSync serves four major purposes: data synchronization, file management, file backup, and software installation. An ActiveSync connection between your Windows Mobile device and desktop PC is required to install ArcPad on your Windows Mobile device. Once you have established an ActiveSync connection, you can use Windows Explorer on your desktop PC to transfer files to and from your Windows Mobile device. You can also use the Explore button on the ActiveSync dialog box to start Windows Explorer.

Your Windows Mobile device is automatically listed as a file system in the Windows Explorer dialog box and is called *Mobile Device*. You can copy, move, and drag and drop files to and from the Mobile Device file system as you would with any other local or remote file system using Windows Explorer. It is a good practice to always store your data under the My Documents folder, whether on your Windows Mobile device or on a storage card. Some Windows Mobile applications require that data be located under the My Documents folder otherwise they cannot be viewed by the application.

By default, ActiveSync uses the USB port of your desktop PC to connect to your Windows Mobile device. You can also connect

to your Windows Mobile device by using Bluetooth, an Ethernet wired connection to your LAN, or a wireless LAN card.

Most Windows Mobile devices today come standard with USB connections; however an increasing number of Windows Mobile devices are also Bluetooth enabled. Consult the documentation included with your Windows Mobile device for instructions on how to create an ActiveSync connection via USB and Bluetooth (if the device is Bluetooth enabled).

Windows Mobile resources

There are extensive resources available for learning more about Windows Mobile hardware, software, and accessories. These resources include Internet sites, print publications, and books. The following list of resources is not intended to be exhaustive or to imply endorsement by ESRI but instead is intended to be a starting point for learning more about Windows Mobile.

News and information resources

There are numerous news and information Web sites that cover Windows Mobile. The following are some of the more popular sites.

Microsoft Corporation

http://www.windowsmobile.com

WindowsMobile.com is the definitive web site for Windows Mobile. The Web site includes Windows Mobile news, how-to instructions, help, downloads, and discussion forums. It also includes a list of Windows Mobile devices currently available in different regions of the world.

Brighthand Consulting, Inc.

http://www.brighthand.com

Brighthand is one of the more popular sites for mobile devices, including Windows Mobile devices. The site includes reviews on devices, accessories, and software for Windows Mobile.

Chris De Herrera's Windows CE Website

http://www.cewindows.net

Chris De Herrera's Website claims to have "the most complete set of frequently asked questions on Windows CE anywhere". The site certainly has one of the most comprehensive set of reviews, Frequently Asked Questions, how-to instructions, and troubleshooting documents available covering Windows CE version 1.0 to the current version. This is an excellent resource for troubleshooting Windows CE and Windows Mobile problems.

Software resources

There are a number of sites that have Windows Mobile software available for download, including shareware and freeware software. Here are a few of the more popular download sites:

Handango
http://www.handango.com

TUCOWS, Inc
http://pda.tucows.com

Online stores

There are numerous online stores that specialize in mobile devices, including Windows Mobile, and their associated software and accessories. The following online store provides a good list of the currently available Windows Mobile devices and accessories.

MobilePlanet, Inc.
http://www.mobileplanet.com

Magazines

Pen Computing Magazine

http://www.pencomputing.com

Pen Computing Magazine is a bimonthly print magazine that covers all pen-based devices, including Windows Mobile devices and PC pen tablets.

Pocket PC Magazine

http://www.pocketpcmag.com

Pocket PC Magazine is a monthly print magazine devoted exclusively to Windows Mobile devices.

Books

There are a number of books available that cover Windows Mobile devices. You can search your favorite online book store, using the keywords “Windows Mobile”, to get a list of available books.

Quick-start tutorial

3

IN THIS CHAPTER

- **Exercise 1: Exploring your data**
- **Exercise 2: Working with geographic features**
- **Exercise 3: Capturing GPS Data**
- **Exercise 4: Editing features**
- **Sample data acknowledgments**

The best way to learn ArcPad is to try it yourself. This tutorial guides you through some basic ArcPad skills. ArcPad enables you to locate features, update attribute information, and edit layers—live and in the field. With ArcPad your fieldwork is more efficient and immediately productive.

The scenario: Imagine you are a farmer, and your task is to manage the fertilization of a number of properties in a given area. This tutorial takes you through your day's work and focuses on typical field data collection tasks that you can perform using ArcPad.

This tutorial is designed to let you explore the capabilities of ArcPad at your own pace and without the need for additional assistance. You'll need about 30–40 minutes of focused time to complete the tutorial. However, you can also perform the exercises one at a time if you wish.

Exercise 1: Exploring your data

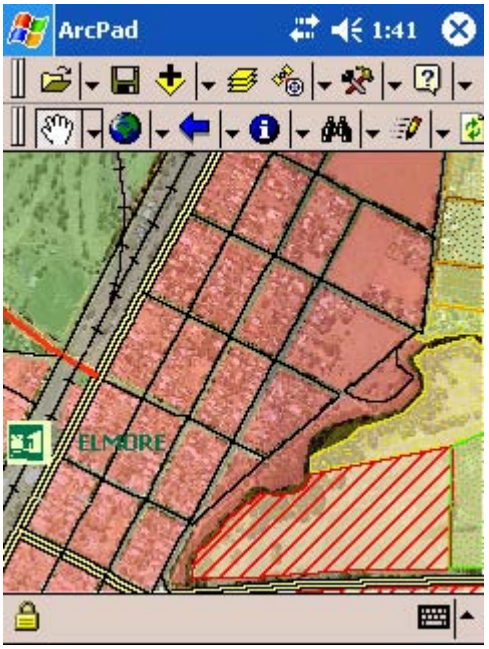
In this tutorial, you will use several layers to complete your work order. The primary layer that you will use is the land use layer; however, you will also use additional layers to make it easier to locate yourself and to find the parcel of land that needs to be identified. The following table provides descriptions of these layers.

Layer	Description
aerial_elmore.jp2	25 cm pixel aerial photograph of Elmore, Victoria, Australia
customers.shp	Fictitious customers connected to the sewer network
land_use.shp	Fictitious land use types
parcel.shp	Cadastral parcels
Rail.shp	Railway lines
Rail Infrastructure.shp	Railway stations
Road.shp	Roads

The exercises in this chapter use the sample data distributed with ArcPad. The layers are located under the Samples\Elmore folder in the ArcPad install directory. The sample data is automatically loaded on your desktop PC if you selected the automatic install when you installed ArcPad. To install the sample data onto your Windows Mobile computer use the Start menu on your desktop PC. The Elmore folder is installed in the My Documents folder on your Windows Mobile computer. The exercises require that you have write access to this data. If you don't, you'll need to copy the data to a location that you do have write access to.

The exercises that follow are fictitious, and they do not in any way represent real occurrences in Elmore. For information about the complete Elmore sample data, refer to the end of this chapter.

In this tutorial, the word tap is used when selecting an item, as opposed to the word click. On computers that have a touch screen and pen interface, items are selected by tapping the pen on the screen. This performs the same action as clicking does when using a mouse on computers without a pen interface. In the interest of brevity, the word tap will be used, but this should also be taken to mean click.

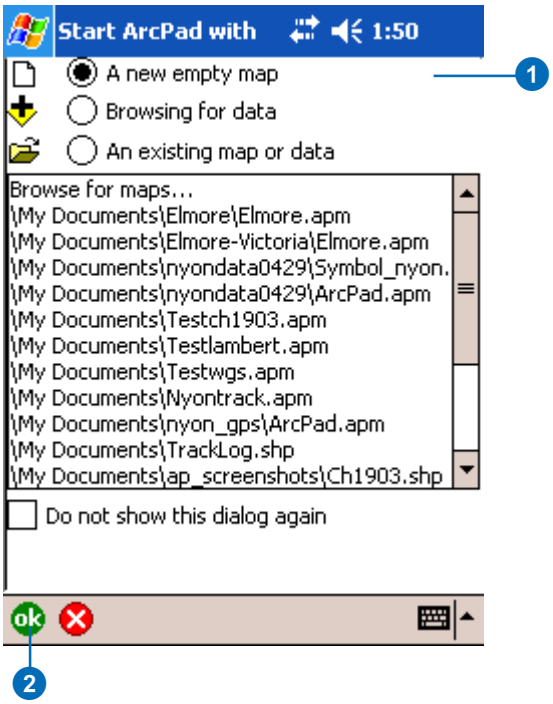


The Elmore sample data in ArcPad

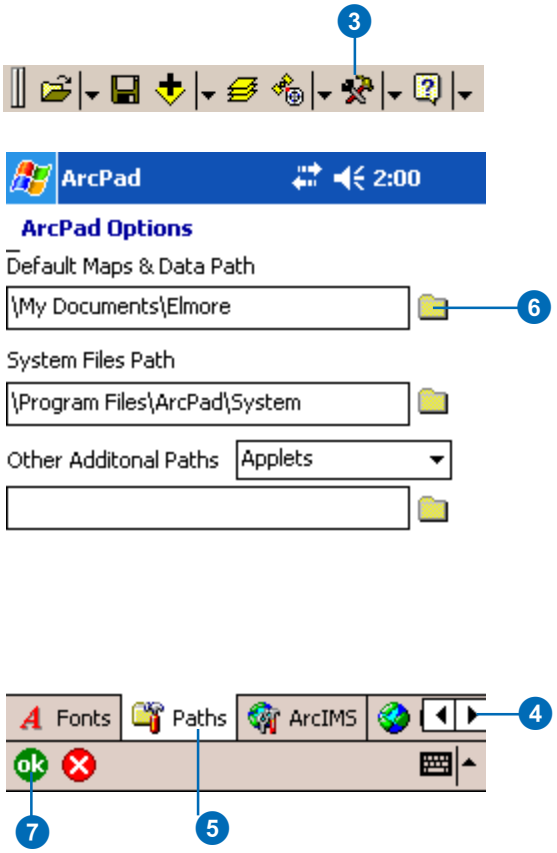
Selecting the appropriate layers

Let's begin by starting ArcPad and setting the default Map Path to where the Elmore sample data is located. You will then add the layers that you need.

1. On your Windows Mobile computer, start ArcPad by tapping Start>Programs, then tap ArcPad 7.0. You will see the ArcPad splash screen briefly, and ArcPad will open with the Startup dialog box.
2. Tap ok to open ArcPad with a new empty map.

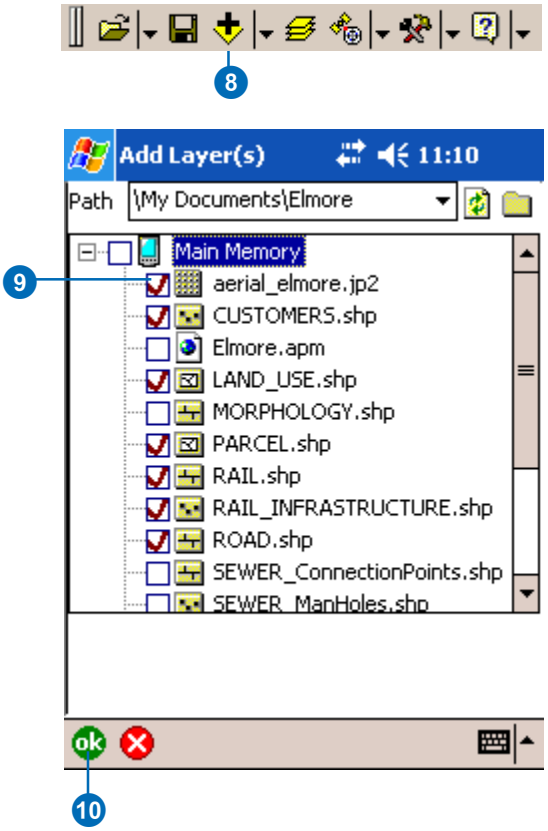


3. Tap the Tools button on the Main toolbar. This opens the ArcPad Options dialog box.



4. Tap the right arrow button.
5. Tap the Paths tab.
6. Tap the Folder button next to the Default Maps & Data Path. This will open the Directory Browser. Navigate to the Elmore folder and tap the folder to select it. By default the Samples folder is installed in the My Documents folder on Windows Mobile computers.
7. Tap OK.

8. Tap the Add Layer button on the Main toolbar. The Add Layer(s) dialog box opens. Notice that the Path is set to the Elmore folder that you set in the previous steps.



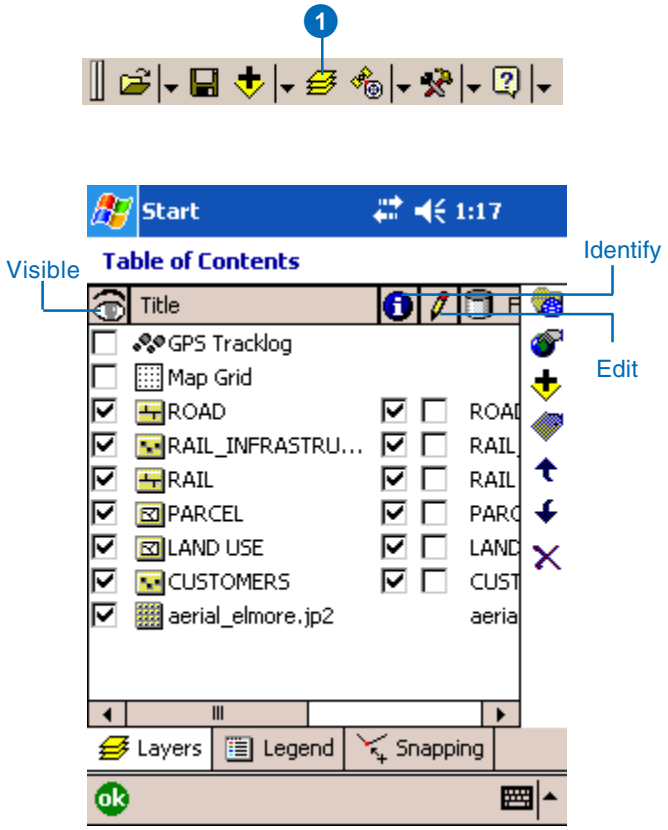
9. Select aerial_elmore.jp2, customers.shp, land_use.shp, parcel.shp, rail.shp, rail_infrastructure.shp, and road.shp by checking the check box to the left of the layer. A red check indicates that a layer has been selected.

10. Tap OK. The selected layers are drawn in the ArcPad Map window.

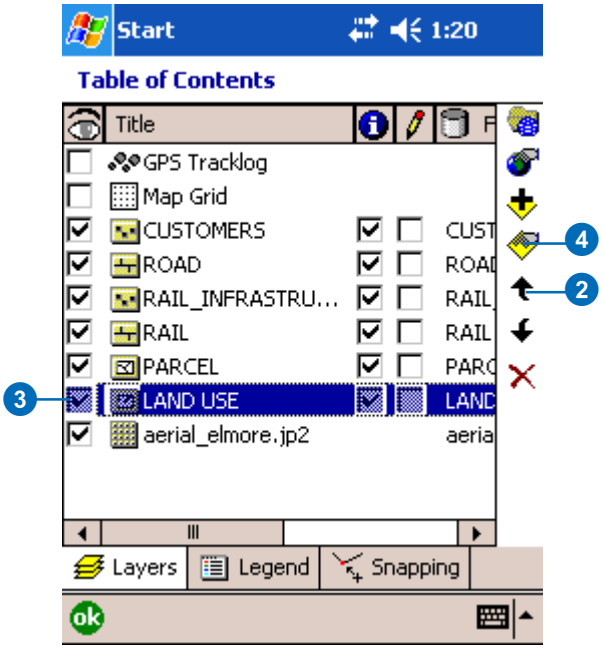
Exploring your selected layers

Explore the Elmore layers provided for this tutorial. Understanding the properties associated with each layer will help you to quickly navigate around the map.

1. Tap the Table of Contents button. The layers you selected previously are listed, each with a check in the Visible check box and the Identify check box. The Edit check box is, by default, unchecked.

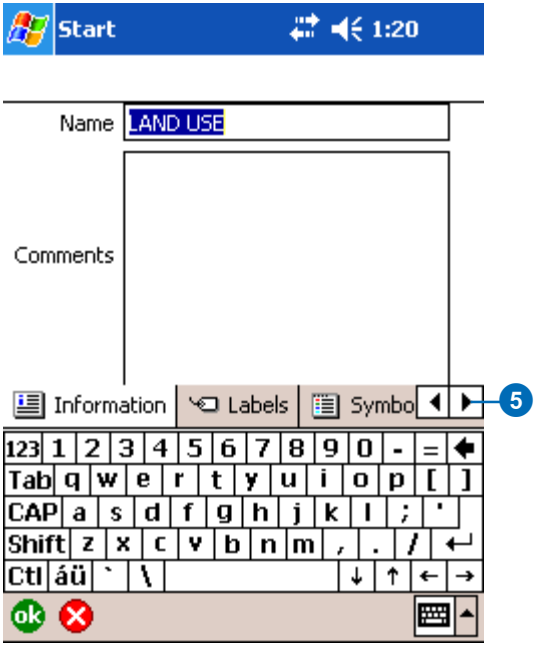


2. You can change the order in which layers are drawn by tapping on the Move Up or Move Down arrow buttons. The layers at the bottom are drawn before the layers at the top. Move the Customers layer up so that it is drawn after and on top of the Roads layer.

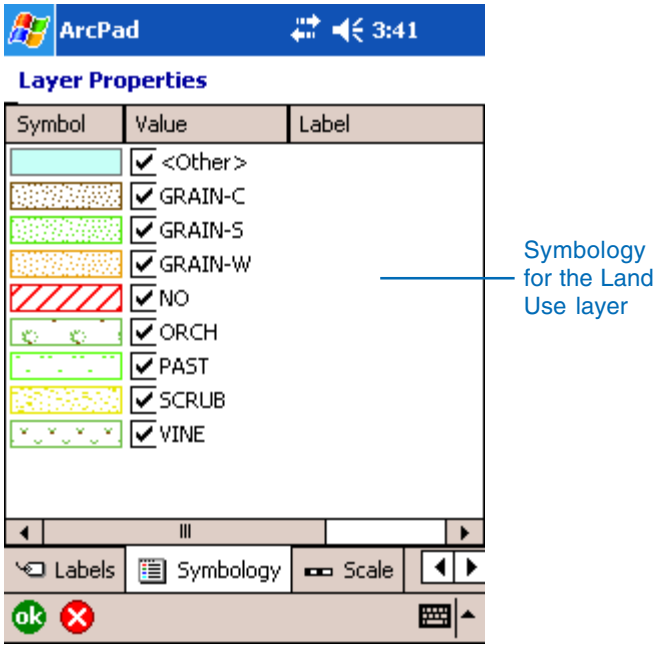


3. Tap the Land Use layer to select it; the layer is highlighted in blue.
4. Double-tap the Land Use layer or tap the Layer Properties button. The Layer Properties dialog box is displayed for the Land Use layer.

The Information page is displayed first; you can see that the Title field has the name Land Use in it. This is also the title that is used to name the layers in the Table of Contents.

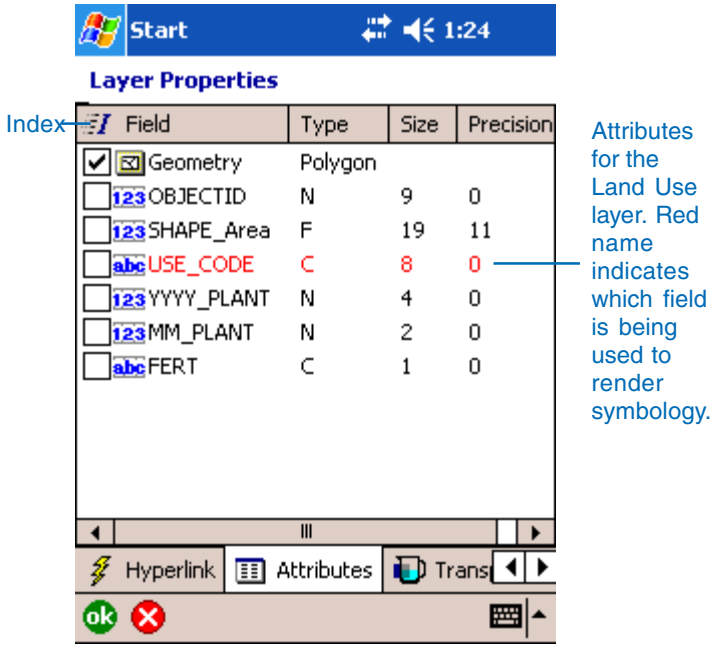


5. Tap the right arrow and then tap the Symbology tab to view the layer symbology. You can change symbology directly in the field using ArcPad or via the ArcPad tools for ArcGIS Desktop. For more information about symbolization, see Chapter 7, ‘Symbolizing your data’.



6. Tap the Attributes tab to see the fields associated with the Land Use layer. The USE_CODE field is displayed in red to indicate which field is being used to render the attribute base symbology. Later, you will change the values of these fields after you have inspected a plot of land.

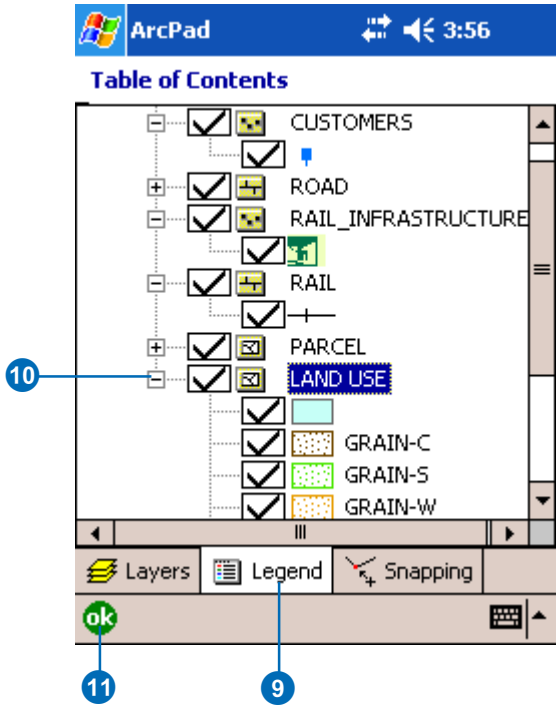
   The "I" checkbox column indicates whether the layer has an index. If the checkbox for Geometry is checked, the layer has a spatial index. If the checkbox for a field is checked, an attribute index exists for the corresponding field. To add an index, simply check the Index checkbox for that attribute field.



7. Explore the additional tabs to learn more about the Land Use layer. Tap ok when you are ready to return to the Table of Contents.
8. Explore each of the layers that you will use to help you locate the land that needs to be fertilized.

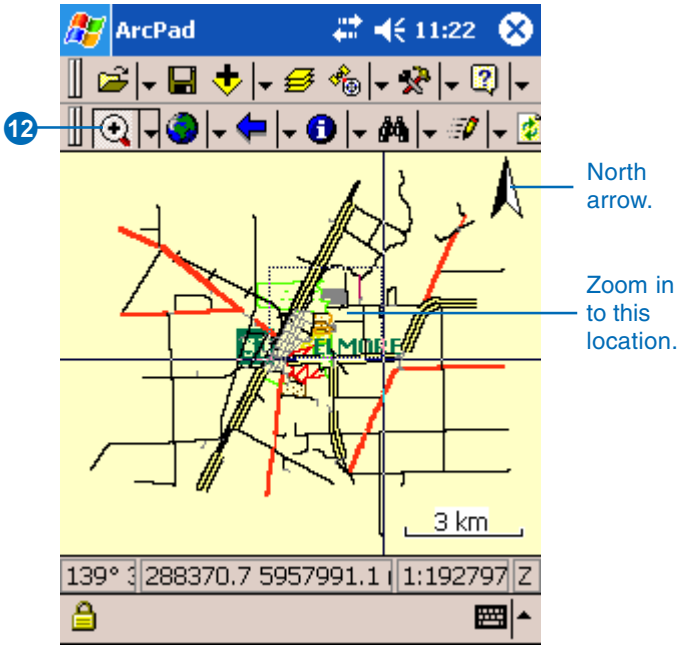
9. Tap the Legend tab in the Table of Contents. The Legend allows you to view and access the symbology properties for all the layers in your ArcPad map.

10. Tap the +/- icon next to each layer to display/hide its symbology.



11. Tap ok in the Table of Contents when you are ready to return to your ArcPad map.

12. Tap the Zoom In button, then tap and drag a box around the area of the image file. The rest of the exercises are concentrated in the area of Elmore northeast of the Railway station.



Exercise 2: Working with geographic features

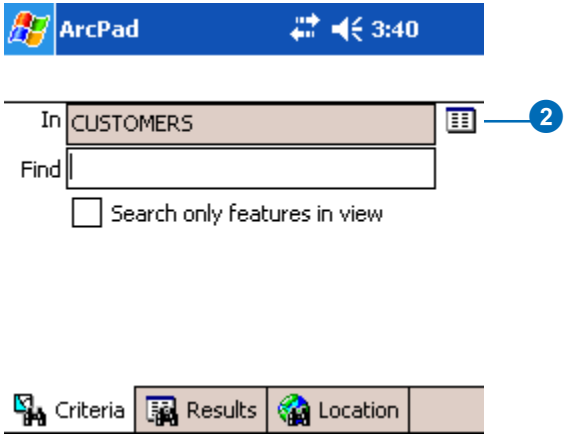
In this exercise you will locate a vineyard that needs to be fertilized. You will locate the vineyard and then update its attribute information, noting that it has been fertilized. Once that task is complete you will select other sectors of land neighboring the fertilized vineyard to determine if any of those also need to be fertilized.

Locating a feature

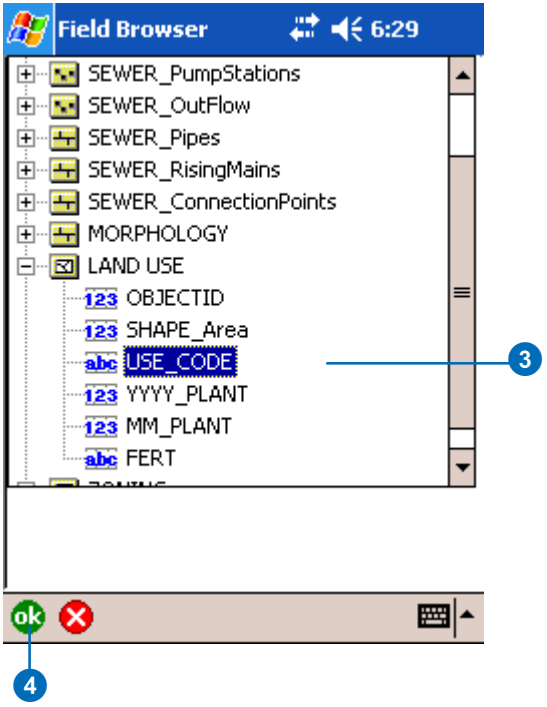
In this exercise, you will use the Find tool to locate the vineyard you are looking for. Your work order tells you that there is only one vineyard in the suburb of Elmore so it should be quite easy to locate.

1. Tap the Find button on the Browse toolbar.

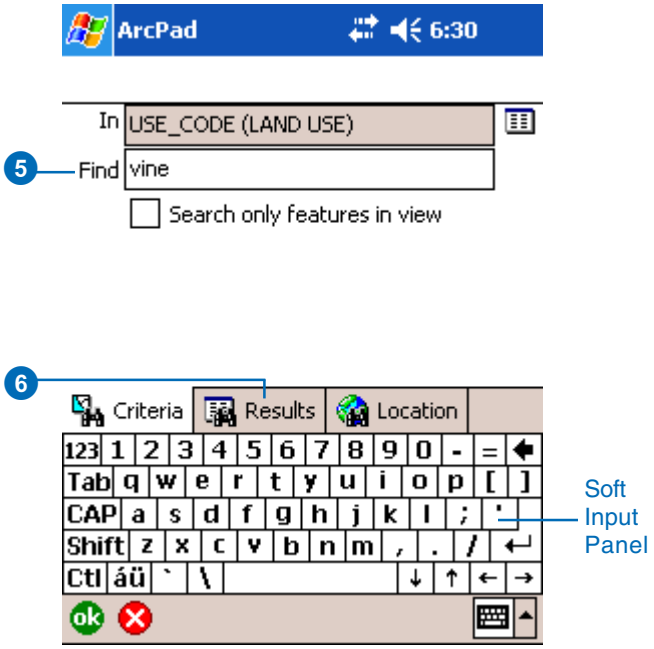
2. Tap the Select Layers button on the Criteria page.



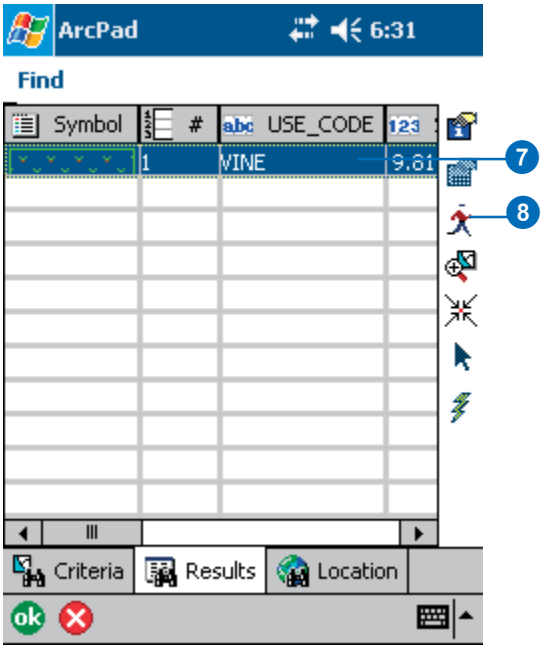
3. Tap the + symbol next to the LAND USE layer and tap USE_CODE. The USE_CODE field identifies the type of land for the area (e.g., vine, scrub, and so on).
4. Tap OK.



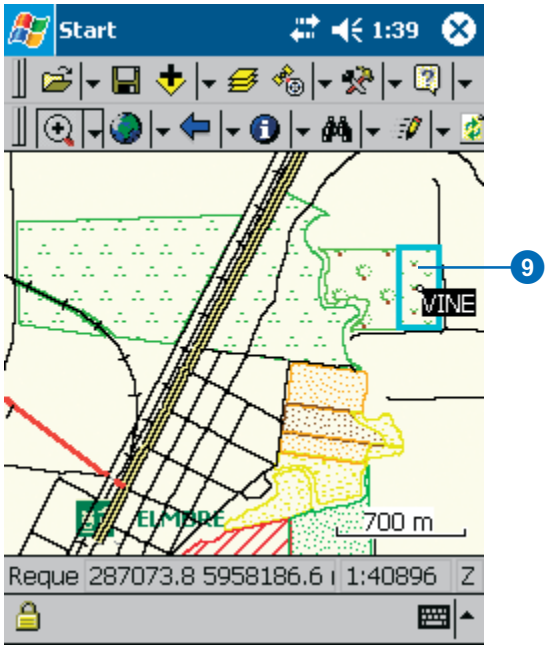
5. Use the Soft Input Panel to type the land use type “vine” in the Find box.
6. Tap the Results tab to execute the search and to view the results.



7. Scroll to view the attributes of the feature. Tap the matched feature.
8. Tap the Go To button.



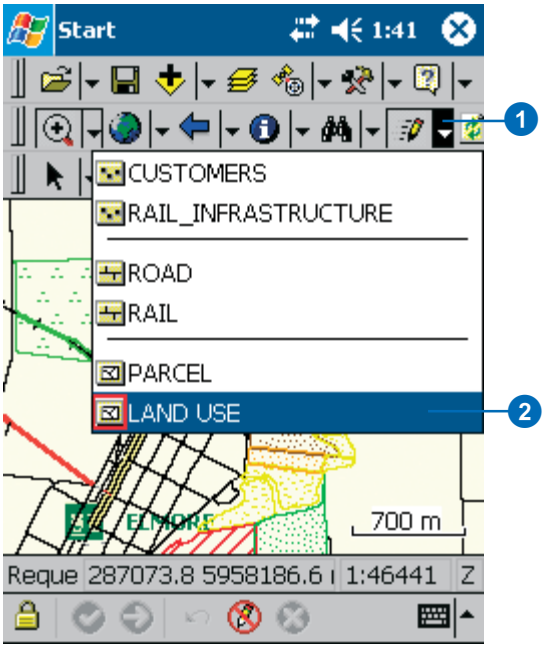
9. ArcPad zooms to the Vine parcel of land. The selected plot is highlighted and set as the current navigation destination. The vineyard is also labeled using the value of the field that was searched on—in this case, the use code of the plot of land.
10. Your vineyard is clearly labeled, and with your ArcPad map you can go to the vineyard and fertilize it.



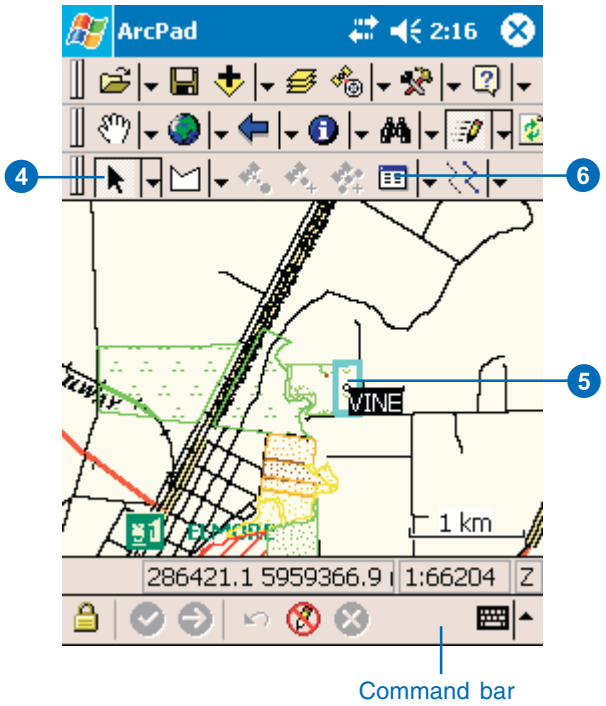
Updating your data

In this section, you will change the attributes of the vineyard that you fertilized in the previous section.

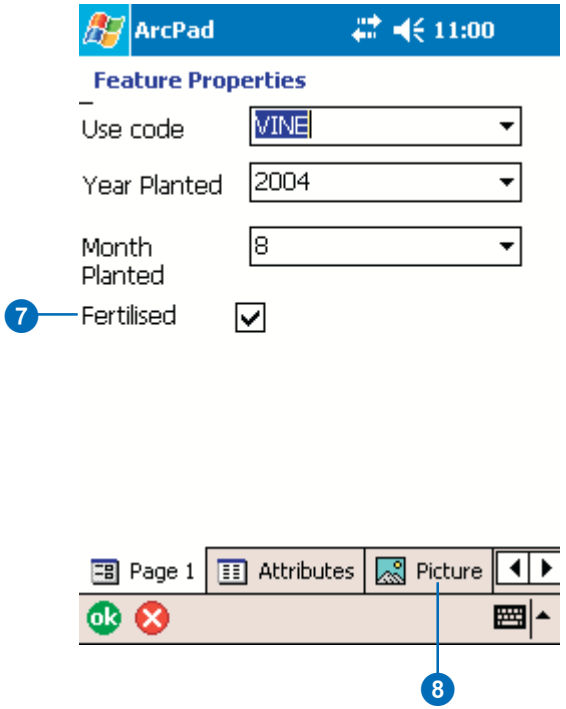
1. You need to make the Land Use layer editable before you can edit its attributes. Tap the drop down arrow next to the Start/Stop Editing button.
2. Tap the Land Use layer to select it. A red box around the layer indicates that it is editable. The Edit toolbar and the Command bar are automatically displayed once a layer is made editable.



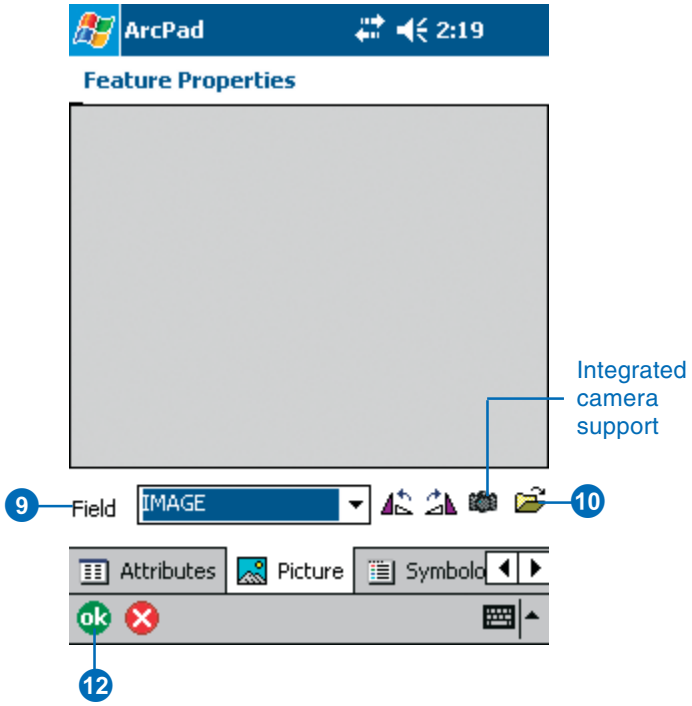
4. Tap the Select button.
5. Tap the vineyard you identified in the previous section to select it.
6. Open the selected features properties by tapping the Feature Properties button.



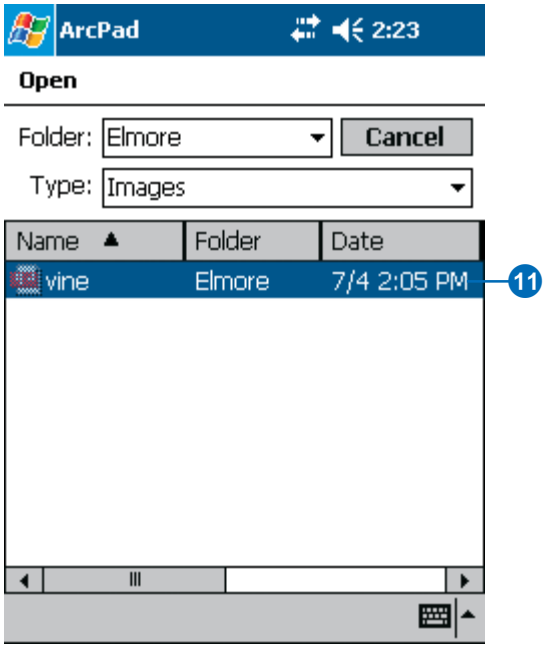
7. Change the form to reflect that the site has now been fertilized.



8. Tap the Picture tab. If you had a digital camera connected to your Windows Mobile device, you could take a picture and associate it with this feature. In this case we will simply select a picture from an existing folder.



9. Using the Field drop down list, select the field that the location of your photo will be stored in. In this case, it is the IMAGE field.
10. Tap the open folder button.
11. Navigate to the picture entitled “vine.jpg” and select it. The picture is now associated with this feature and it is displayed on the Picture page of the Feature Properties dialog box.



Alternatively, if you have a camera connected to your device, tap the camera icon. A picture is taken and automatically associated with the feature. See Chapter 13, ‘Using your digital camera’, for more information.

12. Once you have completed updating your form, tap ok.

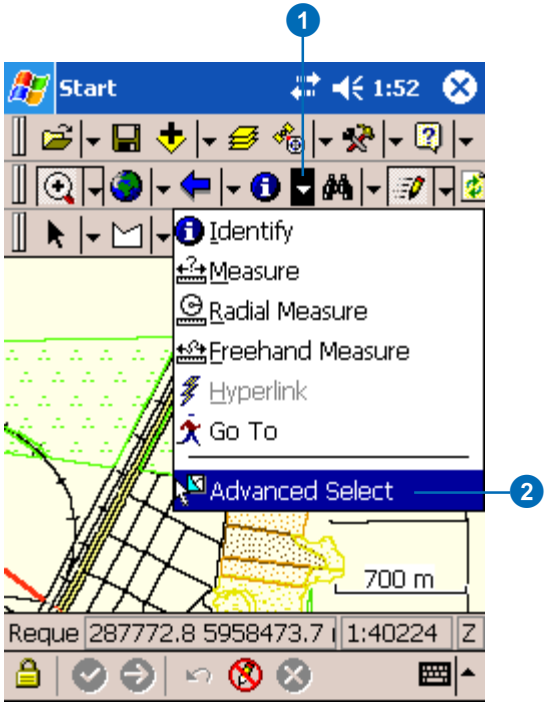
    The information about the vineyard has been updated and a picture of the area has been associated with the feature.

    In the next section we will select other plots of land surrounding the vineyard to determine whether or not they also need fertilizing.

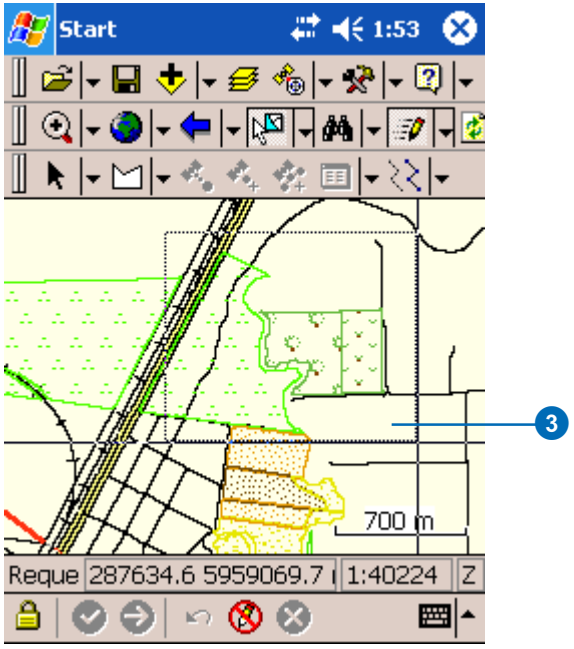
Using the Advanced Select tool

Use the Advanced Select tool to locate all the fields in the immediate vicinity of the newly fertilized vineyard.

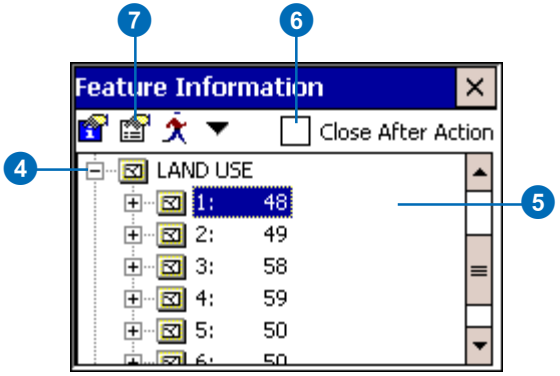
1. With the Land Use layer in Edit mode, tap the arrow to the right of the Identify tool.
2. Tap Advanced Select.



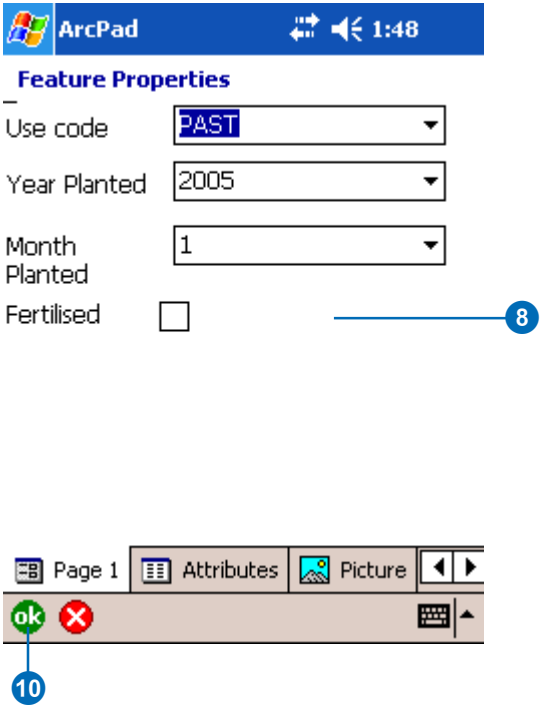
3. Tap and drag a selection box to select all the fields in the vicinity of the vineyard. A list displays the selected features.



4. Expand the list of features selected within the Land Use layer by tapping the +/- icon.
5. Tap the first feature.
6. Uncheck the Close After Action check box.
7. Tap the Feature Properties button.



8. The form for the selected feature appears. Make the necessary changes and close the form.



9. Follow the same procedure as outlined above for all the features selected.
10. Tap OK. You have successfully completed your field maintenance duties for the day!

Exercise 3: Capturing GPS data

There is a road that has recently been constructed. It is up to you to capture the new road using a GPS receiver. With your GPS activated, you will walk the length of the new road segment and capture vertices for the length of the new road. This task is being done in Elmore, Australia but you can easily perform the same steps for a street or road in your local area. If you happen to be in Elmore than you can perform the exercise as is!

1. Find the area where we are going to add the new road. It is located at the end of Strawthorn, west of the Vineyard we located in the previous exercise.

   Tip: Use the Find tool described in Exercise 2.

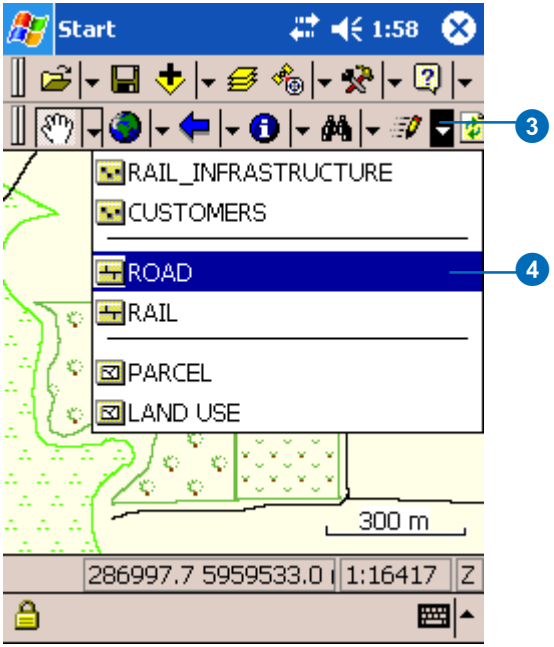
2. Activate your GPS receiver if you have not already done so.

   Refer to Chapter 9, 'Connecting your GPS receiver', for information on activating your receiver.

3. Tap the dropdown arrow to the right of the Start/Stop Editing button.

4. Tap the Road layer to select it for editing.

   The Edit toolbar and Command bar are automatically displayed.

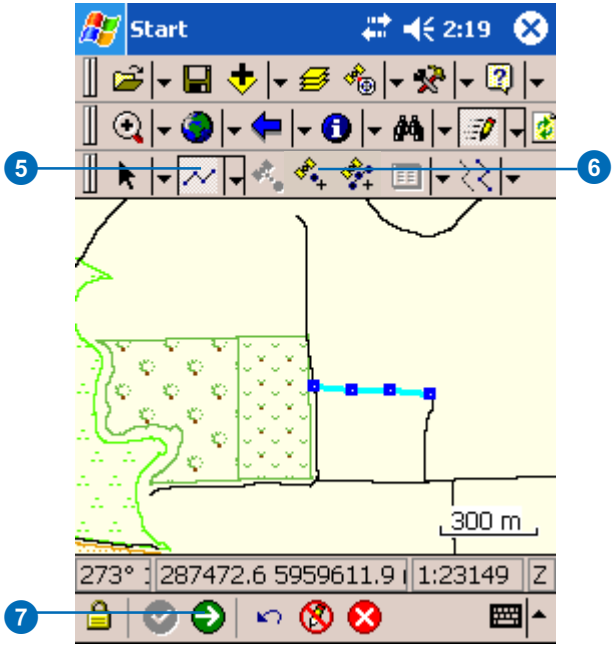


5. Tap the Polyline feature tool.

   The Add GPS Vertex and Add GPS Vertices Continuously buttons are enabled.

6. Tap the Add GPS Vertex button to capture a new vertex. Continue to do so until you have reached the end of the extended road. Alternatively, use the Add GPS Vertices Continuously button to capture vertices in streaming mode. Vertices are captured according to the specified streaming vertices interval which is set in the GPS Preferences dialog box.

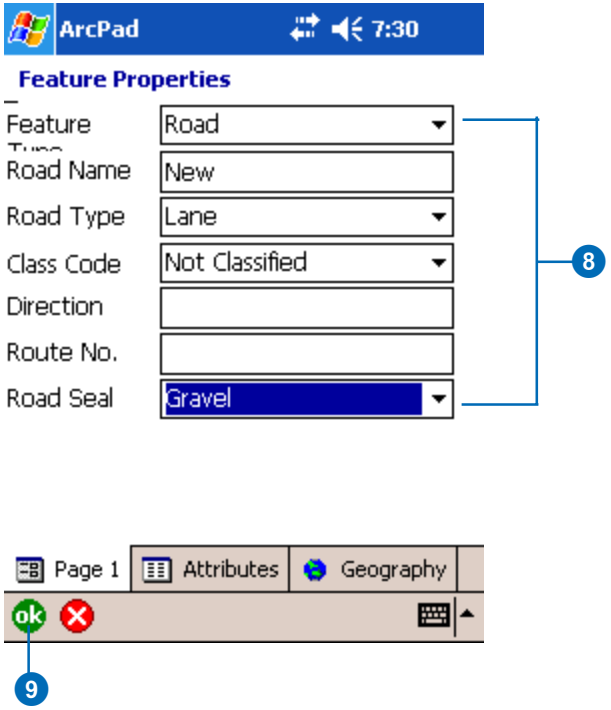
   Tip: Use snapping to snap the end of your new road to the end of the existing road. See Chapter 14, 'Editing basics' for information on snapping.



7. Tap the Proceed tool on the Command bar when you are finished adding your road.

   The feature dialog box opens so that you can immediately enter information about the new road.

8. Fill in the form as follows: Feature Type = Road; Road Name =New; Road Type= Lane, Class Code= Not Classified, and Road Seal = Gravel.



9. Tap OK.

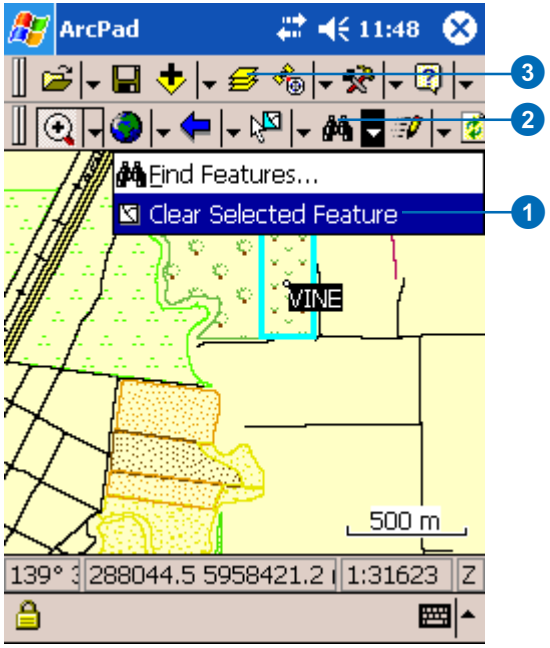
   Your new road has been added and you are ready to move on to the next task.

Exercise 4: Editing features

The owner of the vineyard is thinking of expanding her plot of land. The neighboring plot is vacant and was recently put up for sale so she has asked you to map the potential expansion of the land. She is trying to determine whether expanding her vineyard to the adjoining space will increase her net profits.

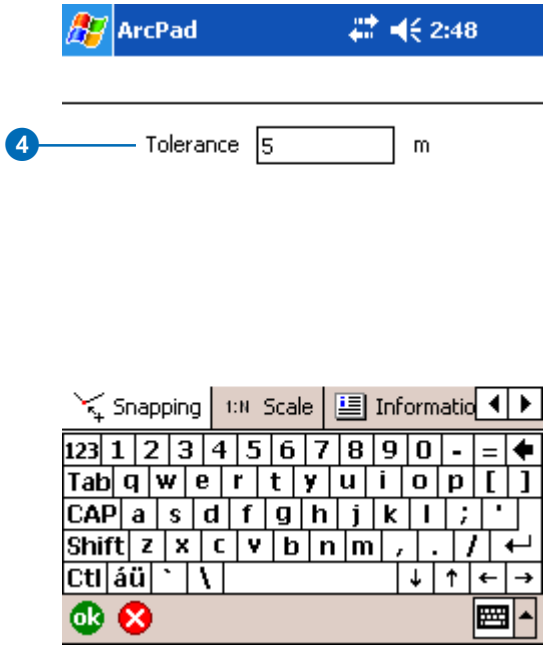
1. Tap the Clear Selected button, located in the dropdown list next to the Find tool, to clear the previously selected feature.
2. Locate the vineyard.

   Tip: Use the Find tool described in Exercise 2.

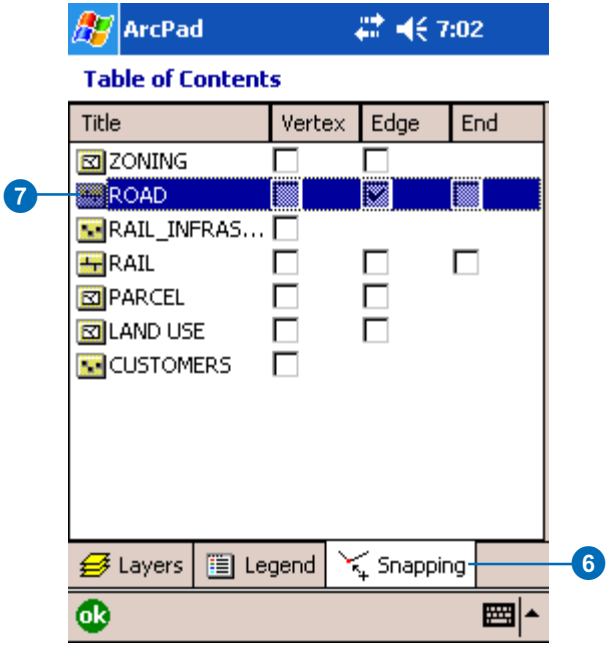


Next, we will set the snapping properties for our layers. You will notice that to the right of the vineyard, there is a road, some vacant land, and another road. The second road will become the new boundary of your vineyard. In order to ensure that you are expanding your vineyard to its full extent, you will snap the vertices of your new plot of land to the edge of the short road. We must first begin by setting the snapping tolerance in the Map Properties dialog box.

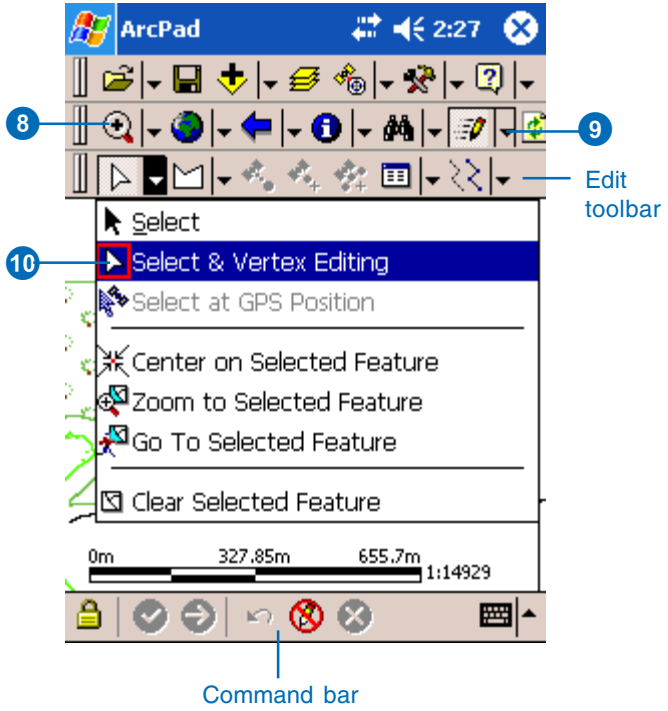
3. Tap the dropdown arrow next to the Open Map button and tap Map Properties.
4. On the Snapping page set the tolerance to 5 m. Refer to the scale bar to determine an appropriate tolerance.



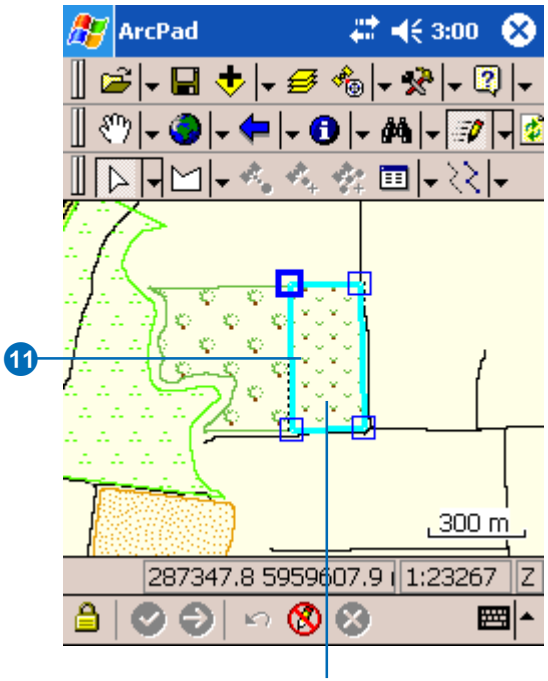
5. Tap the Table of Contents button.
6. Tap the Snapping tab on the Table of Contents.
7. Check the Edge check box for the Roads layer. The Roads layer is the target layer that we want our Land Use layer to snap to.



8. Tap the Zoom In button and zoom closer to the vineyard.
9. Make the Land Use layer editable by tapping the dropdown arrow to the right of the Start Editing button and selecting Land Use. The Edit toolbar and the Command bar are displayed.
10. Tap the Select and Vertex Editing button in the dropdown list to the right of the Select tool.



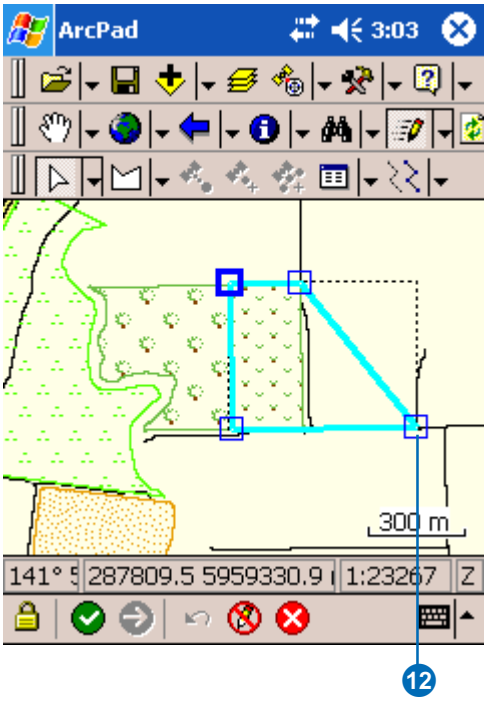
11. Tap the plot of land. The vineyard is highlighted, and its vertices are outlined with squares around them.



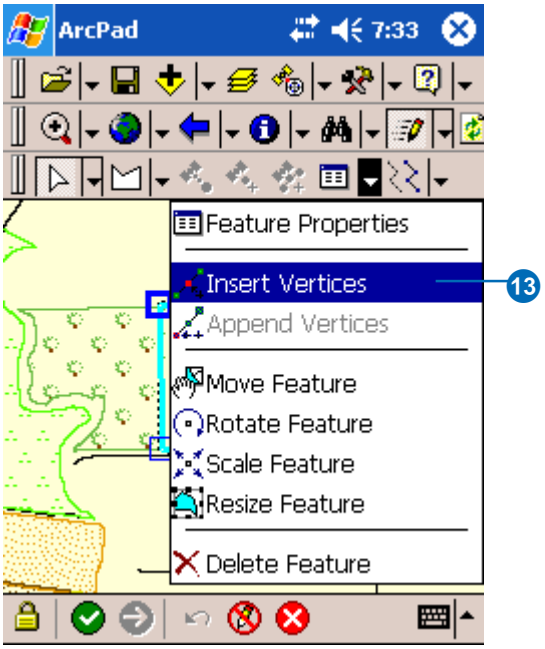
The vineyard is highlighted, and the vertices are outlined.

12. Tap and drag the bottom right vertex to the boundary of the road. As you approach the road, you will notice ArcPad snaps to the road's edge. If your sound is on, ArcPad will make a noise indicating that it is snapping to the feature.

Tip: To display the snapping buffers, on your Windows Mobile device, tap the center key, and on your desktop PC, tap the CTRL key.



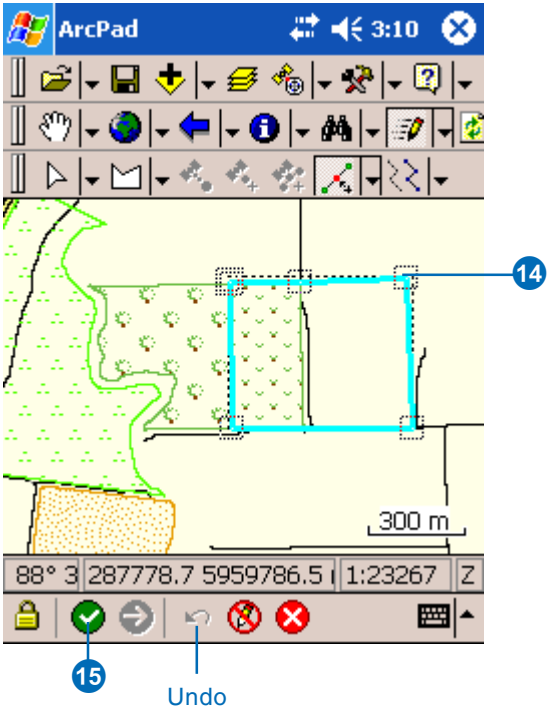
13. Tap the dropdown arrow next to the Feature Properties tool and select Insert Vertices. This will allow you to add vertices and extend the plot of land.



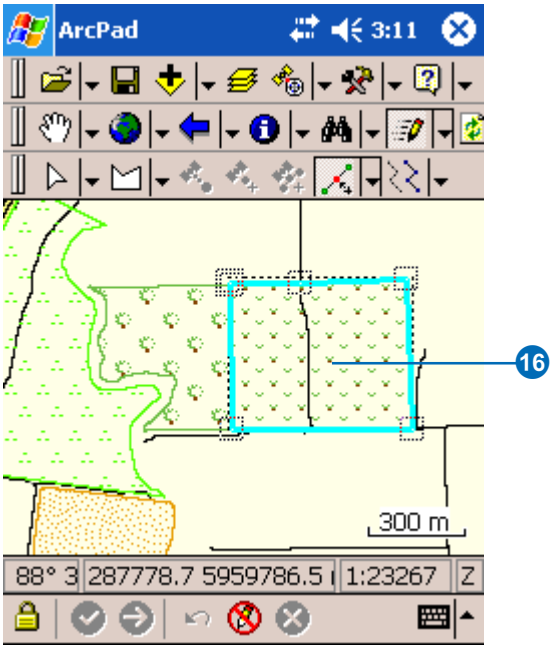
14. Tap the top right corner of the new vineyard outline. ArcPad inserts a vertex where you tapped the map.

    Tip: Use the Undo button to go back to the previous step if you make a mistake.

15. When you are finished adding your vertices and expanding the vineyard, tap the Commit Geometry Changes button.



16. Your new vineyard is complete. Exit ArcPad. Your workday is over!



Note: Once a change is made in ArcPad, it can only be undone using the Undo tool. However, the Undo tool can only be used to Undo one step. Once you commit your changes, even if you exit ArcPad without saving your changes, edits such as changing the shape of the vineyard still remain. If you would like to go back to your original vineyard structure, you can use the editing tools to change it back or reinstall the sample data using the ArcPad CD. You can do an install that will only add the sample data.

Tutorial sample data acknowledgments

The township of Elmore is located on the junction of the Midland and Northern Highway in Central Victoria, Australia. Elmore is an easy two hour drive from Melbourne.

The utilities and property related datasets and the aerial photograph are provided by Colliban Autority, Bendigo, Victoria, Australia. The land use dataset is fictitious. The coordinate system used is the Australian Geodetic Datum 66 (AGD66), Australian Map Grid Zone 55 (AMG z55).

Data Disclaimer

The Coliban Region Water Authority ("The Authority") believes that the information supplied is correct, however it does not warrant the accuracy of that information. The Authority disclaims responsibility for any omissions, inaccuracies, discrepancies, errors of scale or any inconsistencies, which may exist between the actual and the digital data supplied. The Authority further disclaims responsibility for any loss or damage including consequential loss or damage, suffered by any person relying upon such information, whether that loss or damage is caused by negligence, or from any other cause whatsoever, on the part of the Authority, its employees agents and contractors.

Most of the datasets originally supplied by Coliban Region Water Authority have been modified by ESRI in the interests of reducing file size and to simplify the sample dataset as a whole. The main modifications have involved removal of attribute fields that are specific and relevant to Coliban Region Water Authority but do not hold any further information value for users of the sample dataset.

ArcPad basics

4

IN THIS CHAPTER

- Maps and layers
- Starting ArcPad
- The ArcPad map window
- Opening a map
- ArcPad toolbars
- Map properties
- Layer properties
- Moving around the map
- Rotating the map orientation
- Setting spatial bookmarks
- Locking the ArcPad application
- Setting ArcPad options
- Getting help
- Saving a map and exiting ArcPad
- Working with ArcPad files

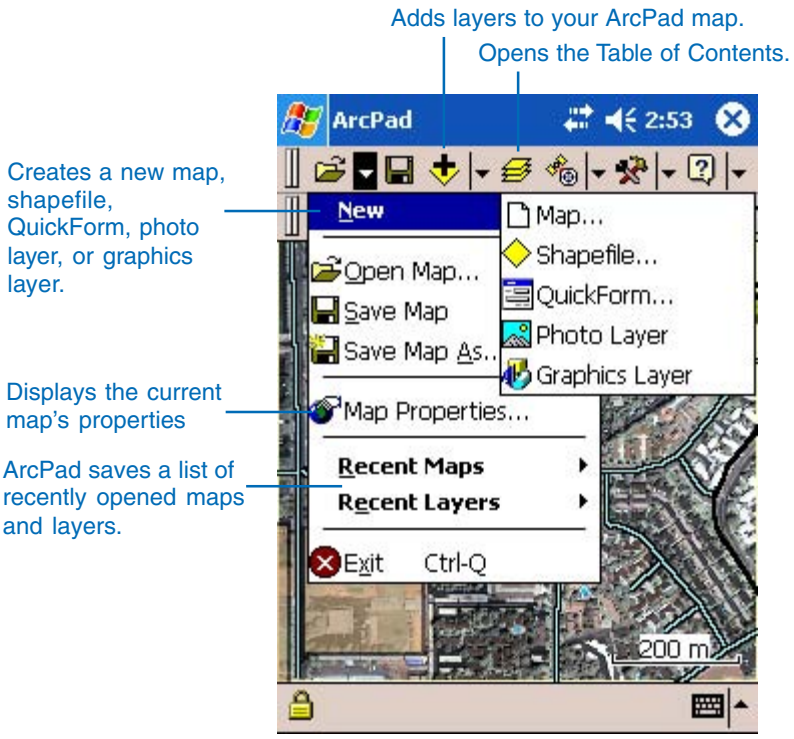
ArcPad is a field-based extension to your mapping and GIS system. The ability to compare your data directly to geographic features in the real world adds a deeper sense of reality to your GIS database. It also opens many new avenues for field data collection, display, and analysis.

Whether you need to add new pump station locations, take a measurement or locate an address, you can do it in the field with ArcPad. This chapter will guide you through the basics of ArcPad and the ArcPad interface and illustrate how to use the tools provided.

Maps and layers

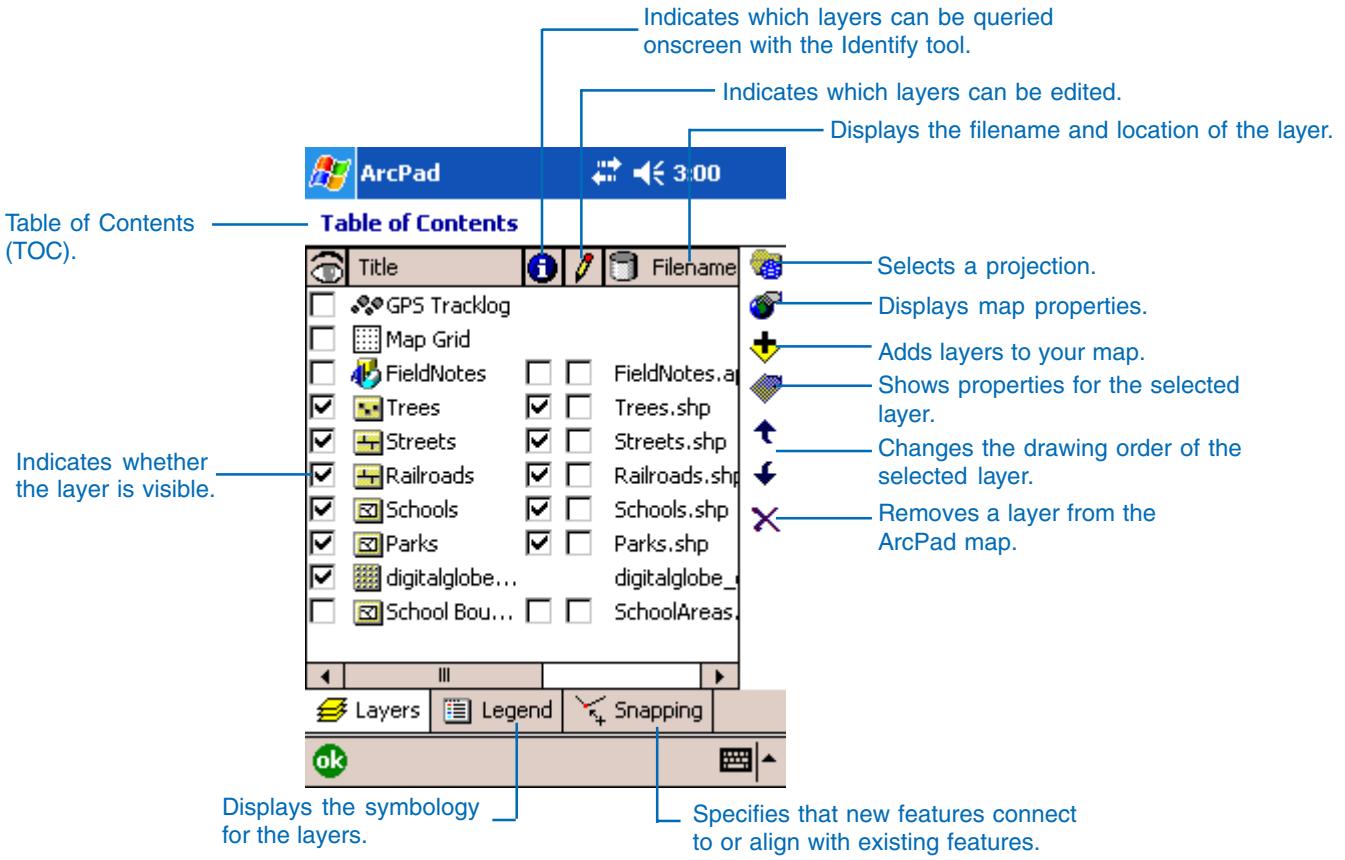
A *map* is the fundamental component you work with in ArcPad. Maps help you visualize geographic data in the field by showing you where things are, telling you what they are, and helping you understand why they are that way.

The ArcPad map file (.apm) stores a list of the map layers and their properties in your ArcPad session. A map lists all your layers together with the geographic extent and projection of the map. When you begin an ArcPad session, you can open an existing map or create a new map by adding layers of data or information.



You can display geographic information on a map as *layers*. Each layer represents a particular type of feature, such as streams, lakes, highways, political boundaries, or lightposts. A layer does not store the actual geographic data; instead, it references the data contained in shapefiles or images. The Table of Contents (TOC) button becomes active once a layer or layers have been added to the current ArcPad map.

The Table of Contents displays all layers loaded in the current map, the GPS Tracklog, and the Map Grid layer. Within the Table of Contents, you can also change symbology using the legend, set snapping properties for editing, and select whether or not each layer can be identified or edited.



Starting ArcPad

Starting ArcPad is the first step to field data collection and management. However, before you can start, ArcPad must be installed on your computer. If you don't know whether it's installed, check with your system administrator. For more information about installing ArcPad, see the *ArcPad Installation Guide*.

Tip

Windows Mobile Start Menu

The Start Menu on your Windows Mobile device can only contain 7 programs. If ArcPad 7 is not listed, you can tap Start>Settings >Menus to add ArcPad as one of your Start Menu programs.

Tip

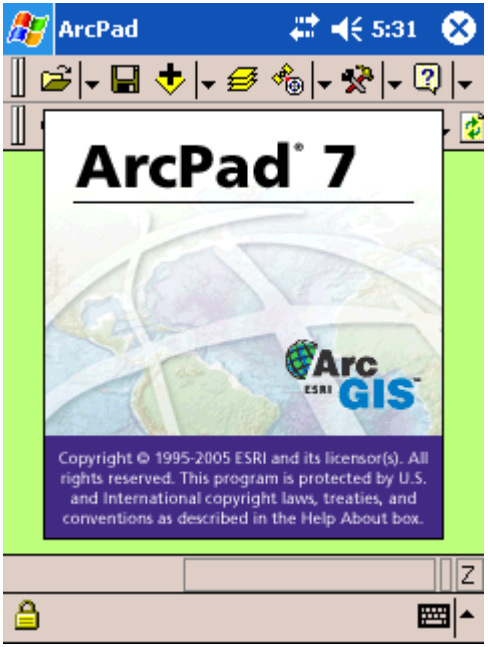
Click versus Tap

On Windows Mobile or Tablet PC computers, you will tap the screen with your pen stylus to select buttons and/or features rather than click a mouse button, as is done on a desktop PC.

Starting ArcPad from the Windows Mobile Start menu

1. Tap Start on the Windows taskbar.
2. Tap Programs
3. Tap ArcPad 7.0.

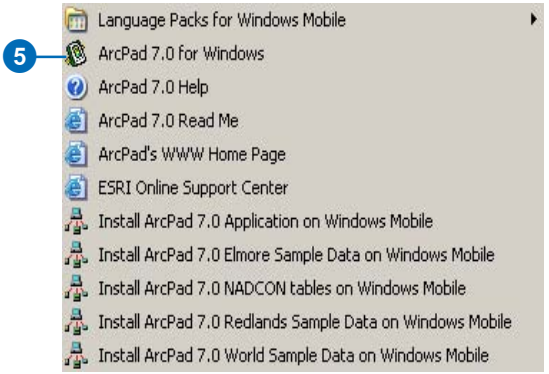
   You will see the ArcPad splash screen briefly, and ArcPad will open with the Startup dialog box.



Starting ArcPad on a desktop PC

1. Click Start on the Windows taskbar.
2. Click All Programs.
3. Click ArcGIS.
4. Click ArcPad 7.
5. Click ArcPad 7.0 for Windows.

   You will see the ArcPad splash screen briefly, and ArcPad will open with the Startup dialog box.



Using the Startup dialog box

By default when ArcPad begins, the Startup dialog box will appear. This allows you to quickly get started with ArcPad. Using the Startup dialog box, you can start using ArcPad with an empty map, browse for data, or open an existing map or data.

You can check the "Do not show this dialog again" checkbox if you do not want to see the Startup dialog box again when starting ArcPad. To turn the Startup dialog box on, go to the Startup page in the ArcPad Options dialog box.

Tip

Performing an action in the Startup dialog box

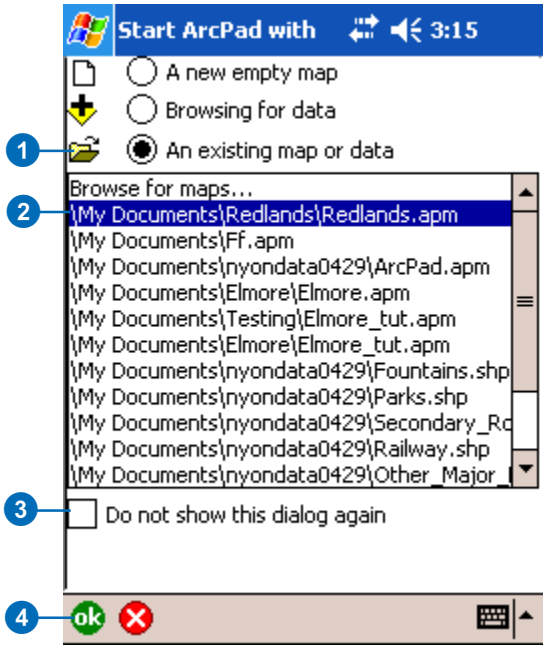
You can either tap the button or the corresponding radio button and ok to perform the desired action in the Startup dialog box. For example, tap the Add data button and the Add Layer(s) dialog box opens. You can also tap an existing map from the list of previous maps without having to first tap the Open map radio button.

Open an existing ArcPad map from the Startup dialog box

1. On the ArcPad Startup dialog box, tap An existing map or data radio button.
2. Select an ArcPad map from the list of available maps.

   ArcPad displays a list of previously used maps and data.
3. If you do not wish to see this dialog box again when you start ArcPad, tap Do not show this dialog again.
4. Click OK.

   ArcPad starts with the selected map.



Running ArcPad within a skin

Running ArcPad within a skin allows you to view the software on your desktop PC within a picture or skin of a Windows Mobile device.

The purpose of the skin is for demonstrating ArcPad on a desktop PC while giving the audience an indication of what ArcPad looks like on a mobile device.

ArcPad skins consist of a standard Windows bitmap file (.bmp), 8- or 24-bit format, and a corresponding skin definition file (.skn). Both filenames must have the same prefix, for example, IPAQ.bmp and IPAQ.skn.

Refer to the next section in this chapter to learn how to create your own skin definition file.

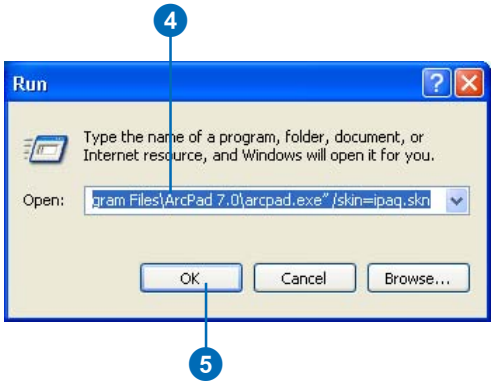
Tip

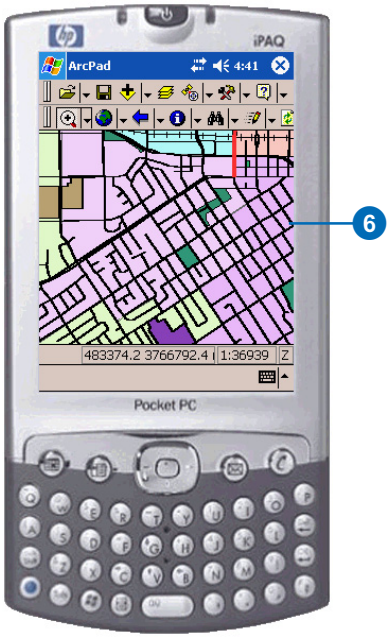
Including quotation marks in ArcPad pathname

When running a skin from the Run Command, use quotation marks around the location of the ArcPad application file, for example, "C:\Program Files\ArcPad 7.0\arcpad.exe".

Running ArcPad within a skin on desktop PCs

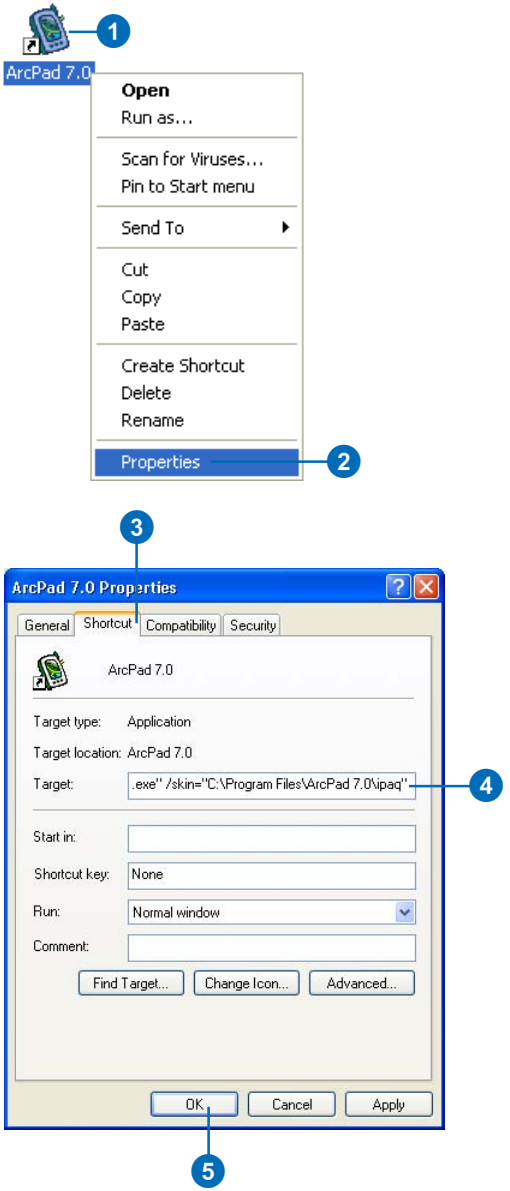
1. Copy and paste the bitmap file and skin definition file to the same location as the ArcPad application file, arcpad.exe.
2. Click Start on the Windows taskbar.
3. Click Run.
4. Type the pathname for the location of ArcPad followed by /skin="name of skin" (for example, "C:\Program Files\ArcPad 7.0\arcpad.exe" /skin=ipaq.skn).
5. Click OK.
6. ArcPad will open within the confines of the skin.





Running a skin directly from the ArcPad desktop icon

1. Right-click on the ArcPad desktop icon.
2. Click Properties.
3. Click the Shortcut tab.
4. Type the following path in the Target field: “C:\Program Files\ArcPad 7.0\arcpad.exe” /skin=“C:\Program Files\ArcPad 7.0\ipaq”.
5. Click OK.
6. Double-click on the ArcPad desktop icon.
7. ArcPad will open within the confines of the skin.



Creating a skin definition file

ArcPad skins are easily created using a standard Windows bitmap file (.bmp), 8- or 24-bit format, and a corresponding skin definition file (.skn). Both filenames must have the same prefix, for example, IPAQ.bmp and IPAQ.skn.

The skin definition file is a simple text file created using a text editor such as Notepad. The values specified for HorzOffset and VertOffset are the offsets in pixels from the top-left corner of the skin image to the screen area where ArcPad will be shown. The values for HorzRes and VertRes specify the screen area size in pixels to which ArcPad will be limited. They correspond to the actual resolution of the device, for example, 240 x 320 for a standard Windows Mobile device.

Tip

Creating your own skin

Scan your Windows Mobile device using a desktop image scanner. For best results, set your scanning resolution to 100 dots per inch (dpi). Alternatively, visit www.esri.com/arcscripts for any available skins.

1. Open a text editor such as Notepad.
2. Type the following information for a Pocket PC:

   [ArcPad Skin]

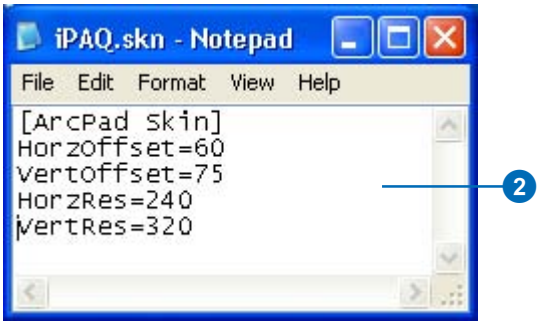
   HorzOffset=60

   VertOffset=75

   HorzRes=240

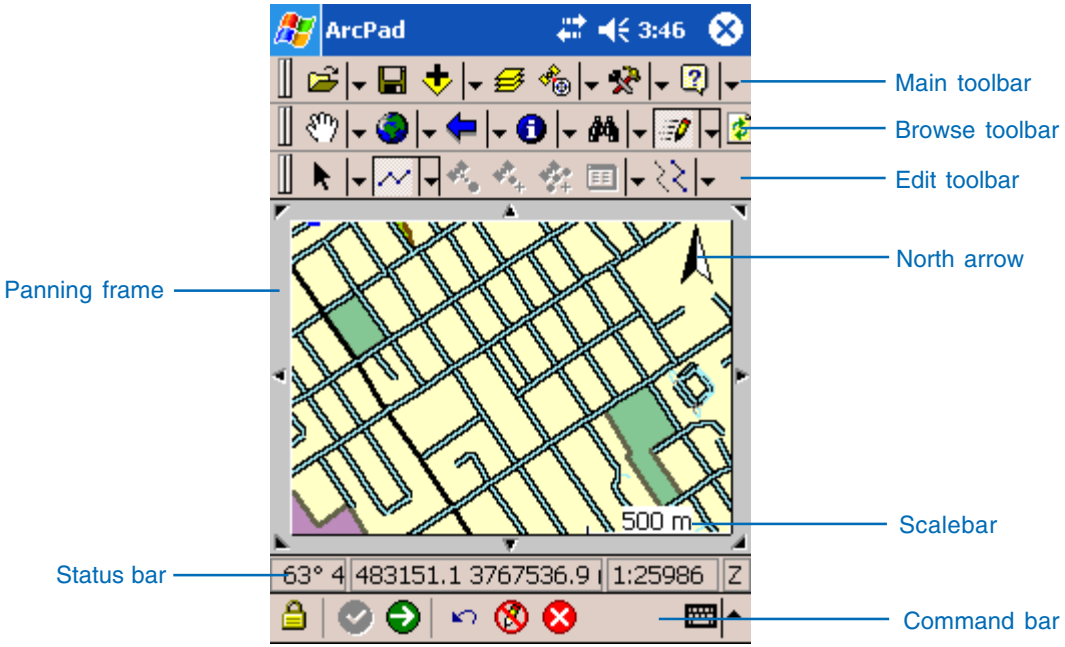
   VertRes=320

   These settings will change depending on the device you would like to represent.
3. Save as “filename”.skn.



The ArcPad map window

The ArcPad user interface provides a simple and intuitive approach to the underlying functionality. It is possible to perform a wide range of functions through controllable toolbars. The ArcPad map window includes three toolbars that are located at the top of the window: the Main toolbar, the Browse toolbar, and the Edit toolbar. The Command bar is added to the bottom of the ArcPad map window when the Edit toolbar is added for additional editing functionality. The map window also includes a panning frame, a scalebar, a north arrow, and a status bar, all of which can be turned on or off.



Opening a map

Once you have started ArcPad, you can create a new map file or open an existing one using the tools on the Main toolbar or as previously discussed using the Startup dialog box. A new map is automatically created if no default map is specified.

The ArcPad map file (.apm) stores a list of the map layers in your ArcPad map. A map lists all your layers together with the geographic extent and projection of the map.

Tip

Starting ArcPad with a default map

When ArcPad starts, it looks for the default map, ArcPad.apm. ArcPad will open this map on startup if it exists. The location of the default map is specified on the Paths page of the ArcPad Options dialog box.

Tip

ArcPad logo

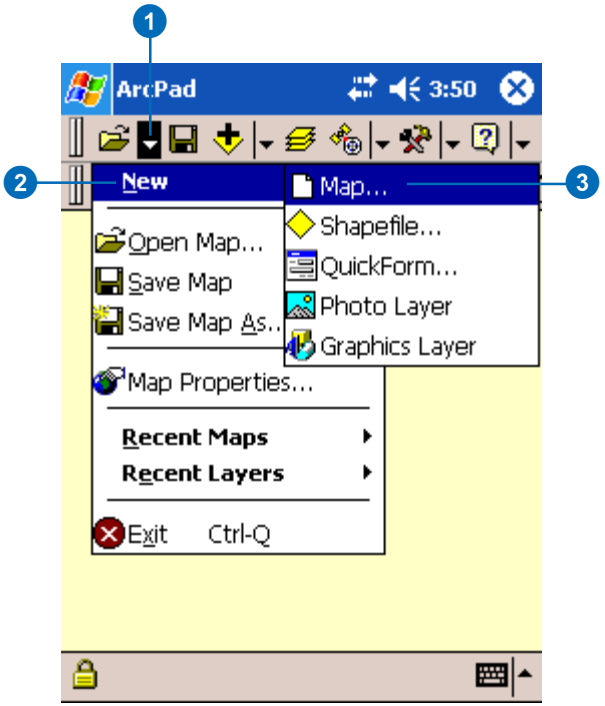
The ArcPad logo is displayed in the System taskbar when ArcPad is running. Tap the logo to bring ArcPad to the foreground at any time. On Window Mobile devices, the System taskbar is only displayed on the Today screen.

Creating a new map

1. Tap the dropdown arrow to the right of the Open Map button on the Main toolbar to display the dropdown list.
2. Tap New.

   The New submenu is displayed.
3. Tap Map.

   ArcPad will create a new map. You can then add data and create your own ArcPad map file.



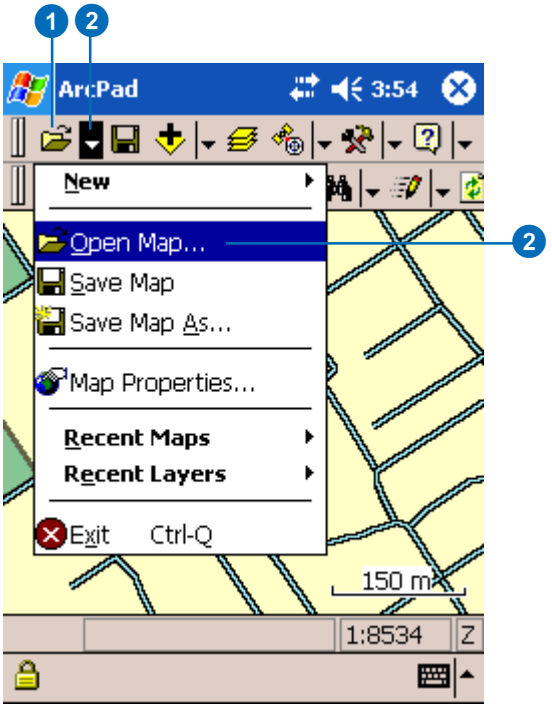
Tip

Setting path options

ArcPad allows you to specify a default map and data, system files, and applet file paths. See the 'ArcPad Reference Guide' for more information.

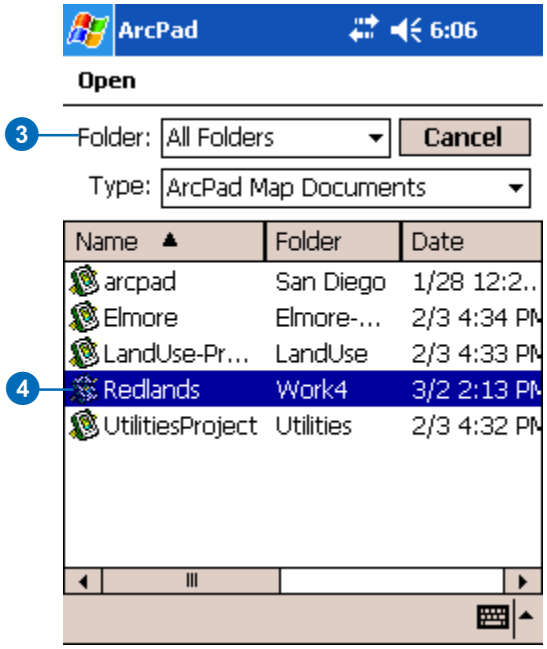
Opening an existing map

1. Tap the Open Map button on the Main toolbar.
2. Alternatively, tap the dropdown arrow to the right of the Open Map button on the Main toolbar to display the dropdown list.
3. Tap Open Map. ▸



4. Navigate to the location of your existing map file.
5. Tap the ArcPad map file you would like to open.

   ArcPad opens the selected map document.



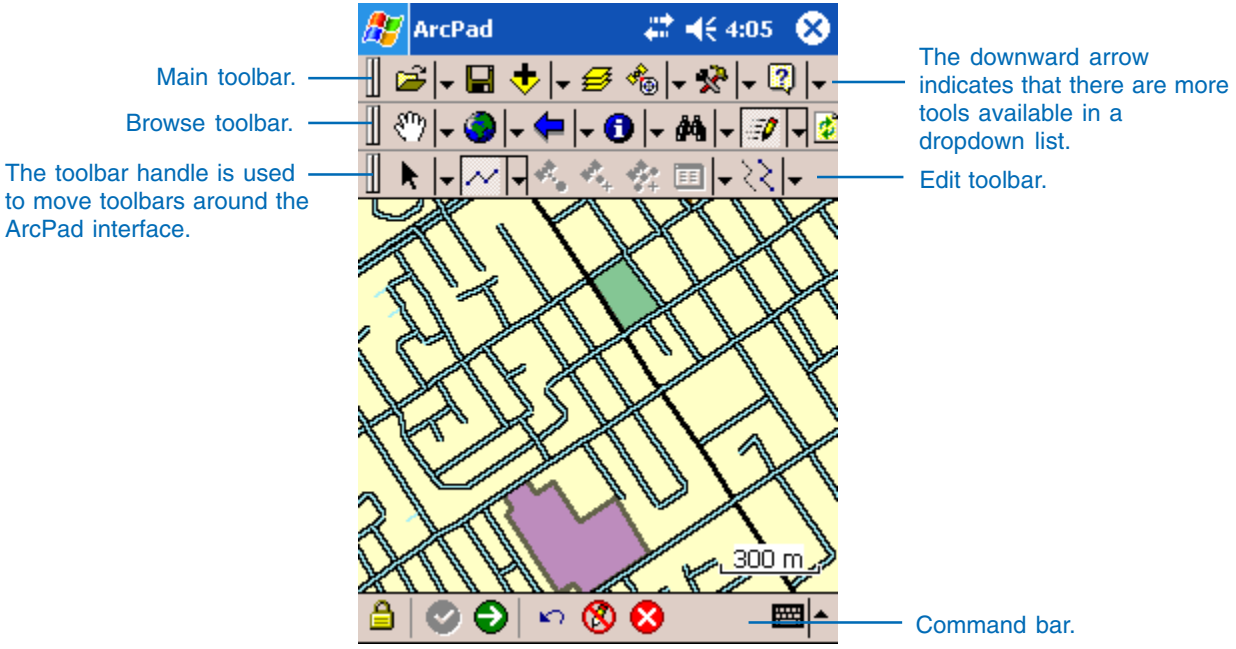
ArcPad toolbars

All of the ArcPad tools are located on four toolbars: the Main toolbar, the Browse toolbar, the Edit toolbar, and the Command bar which is located at the bottom of the ArcPad window.

The Main toolbar contains the tools necessary for managing your data. The Browse toolbar allows you to explore your data by panning, zooming, and retrieving information. The Edit toolbar and the Command bar activate the editing tools so you can add new data or update existing data.

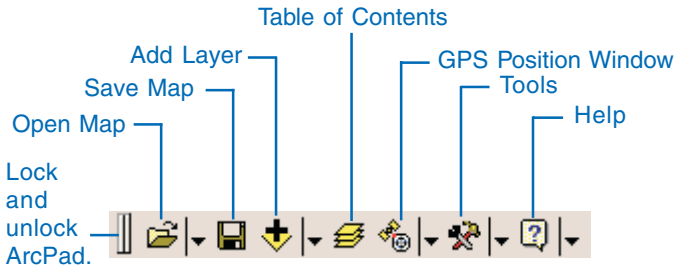
By default, only the Main and Browse toolbars are displayed when ArcPad starts. The Edit toolbar and the Command bar are automatically displayed when a layer is selected for editing. The Browse and Edit toolbars can be toggled on or off from the Tools dropdown list. Toolbars can also be moved using the toolbar handle.

You can also create new toolbars that contain built-in and custom tools using ArcPad Application Builder.



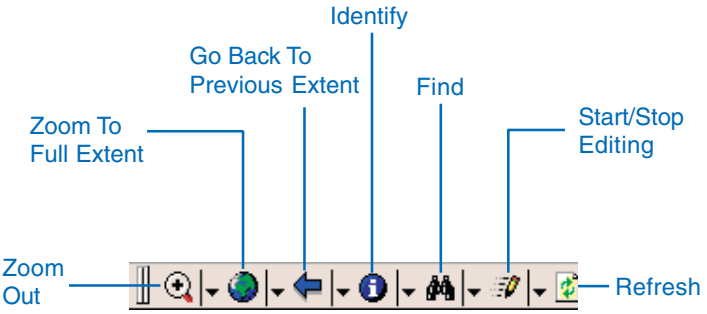
Main toolbar

The Main toolbar provides the tools to manage your map, its layers, and their associated properties. You will also find the options to connect to a GPS, rangefinder, or camera; set your display preferences, such as color or pen size; and establish your default map and system file paths. The Main toolbar cannot be toggled off.



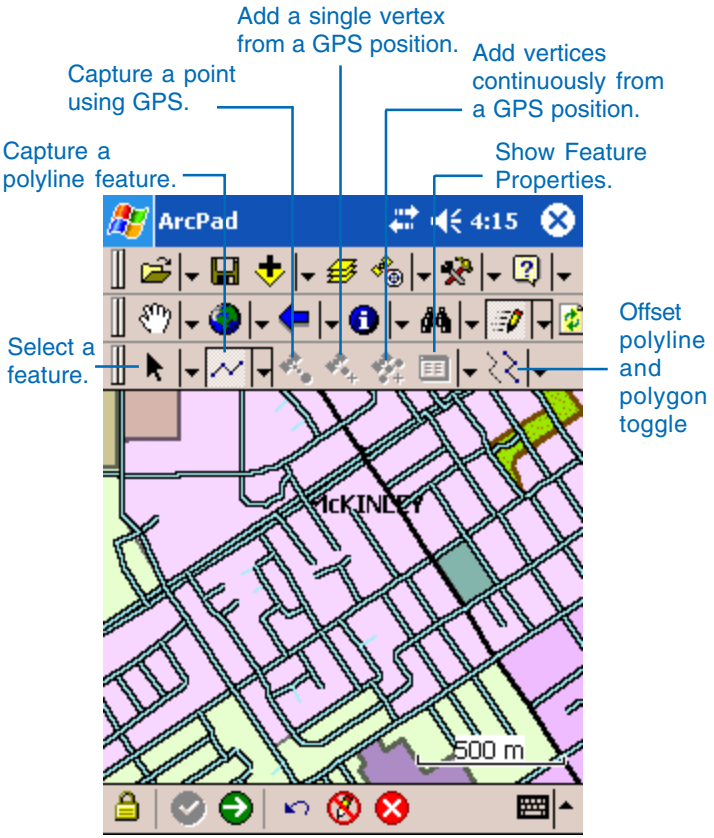
Browse toolbar

The Browse toolbar includes tools for resizing, reframing, information retrieval, spatial bookmarks, and panning and zooming of your display. In addition, the Browse toolbar is used to select a layer for editing which then automatically displays the Edit toolbar and Command bar. The Browse toolbar can be toggled on or off from the Tools dropdown list.



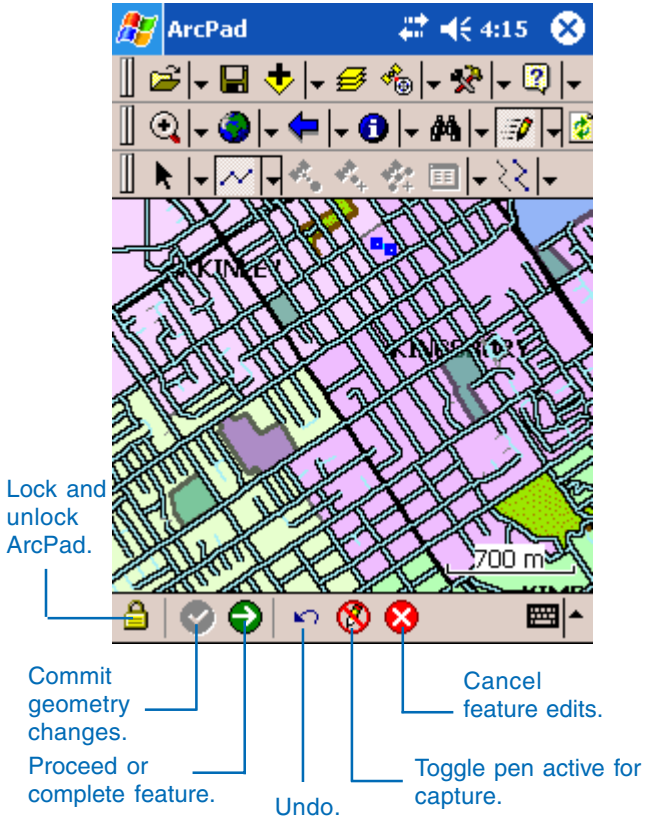
Edit toolbar

All editing takes place after a data layer is selected from the Start/Stop Editing tool on the Browse toolbar or from the Table of Contents. Once a layer is set as editable, the Edit toolbar is automatically added. The Edit toolbar can also be toggled on or off from the Tools dropdown list or by unselecting all layers for editing with the Start/Stop Editing tool. A GPS needs to be activated in order for the GPS buttons to be enabled.



Command bar

The Command bar is also automatically added when a data layer is selected for editing. It includes tools for geometry capture and editing including completing a feature, committing or cancelling changes to a feature, and undoing edits. The Command bar toggles on and off with the Edit toolbar.



Map properties

Properties for the current map can be viewed, defined, and changed in the Map Properties dialog box. Properties include scale, title of the map, geographic extent, spatial bookmarks, projection information, and snapping tolerance.

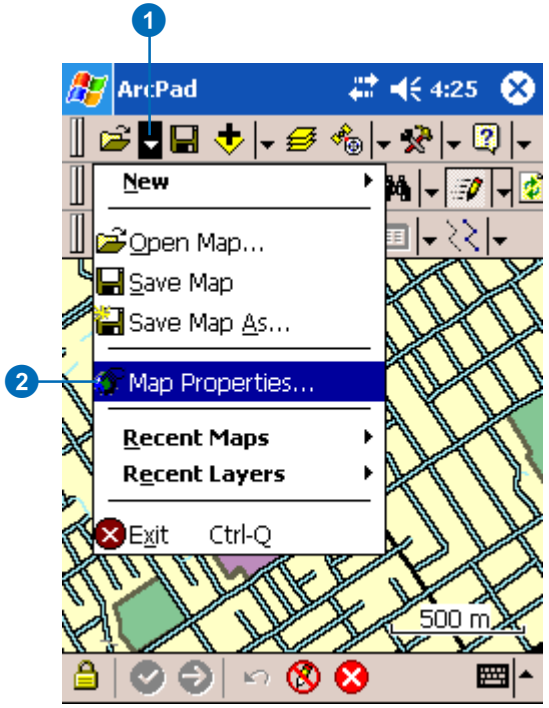
Tip

View map properties via the TOC

You can also view a map's properties via the Table of Contents. On the Layers page, tap the Map Properties button.

Setting map properties

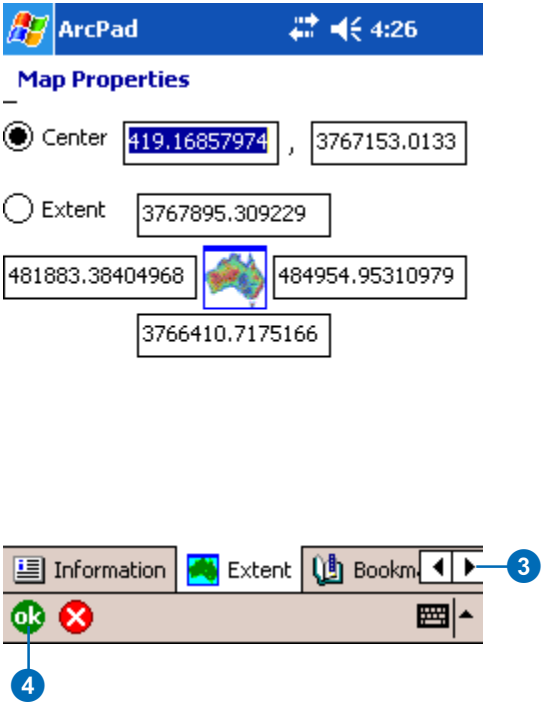
1. Tap the dropdown arrow to the right of the Open Map button on the Main toolbar.
2. Tap Map Properties. ▸



See Also

For more information on map properties, see the ArcPad Reference Guide.

3. Scroll through the different tabs using the left and right arrow buttons. Set your properties.
4. When finished, tap OK.



Map projections

Each layer in ArcPad should have a projection information file (.prj) associated with it. Projection information can also be stored in the ArcPad map file (.apm). You can view the map's projection information in the Map Properties dialog box.

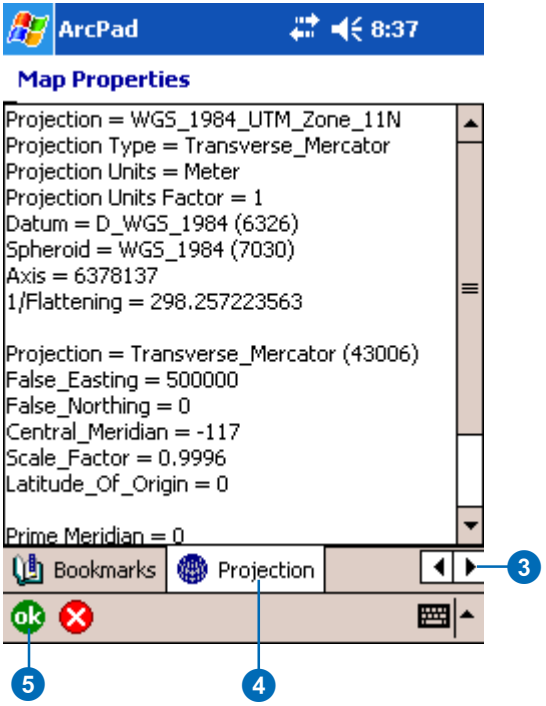
See Also

For more information on projections and coordinate systems, see Chapter 5, 'Displaying data', and the ArcPad Reference Guide.

Viewing a map's projection

1. Tap the dropdown arrow to the right of the Open Map button on the Main toolbar.
2. Tap Map Properties.
3. Scroll through the different tabs using the left and right arrow buttons.
4. Tap Projection.

   The projection information for the map is displayed.
5. When finished, tap OK.

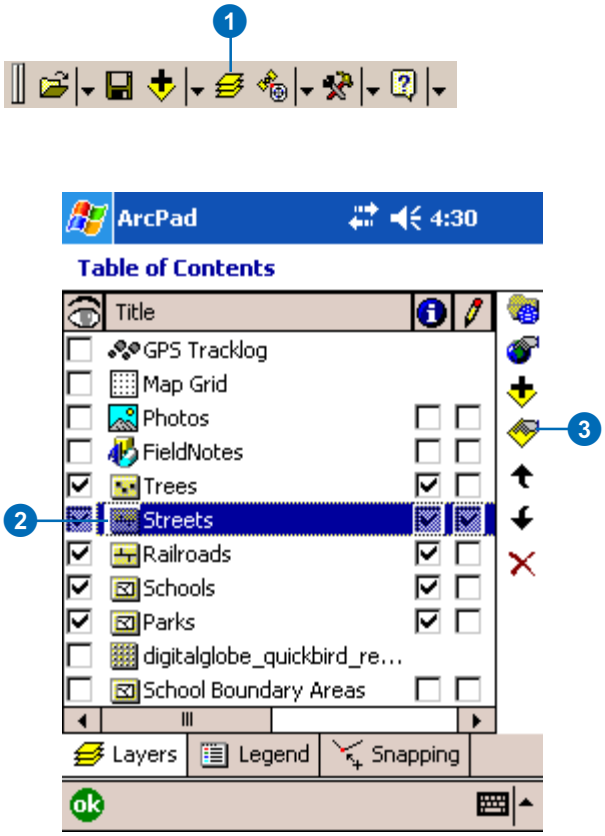


Layer properties

Properties for a selected layer can be defined and changed on the Layers page of the Table of Contents. Properties include information on the selected layer, symbology used to draw the layer's features, a hyperlink field, attributes for the layer, display scale, and the geographic extent of the layer.

Setting layer properties

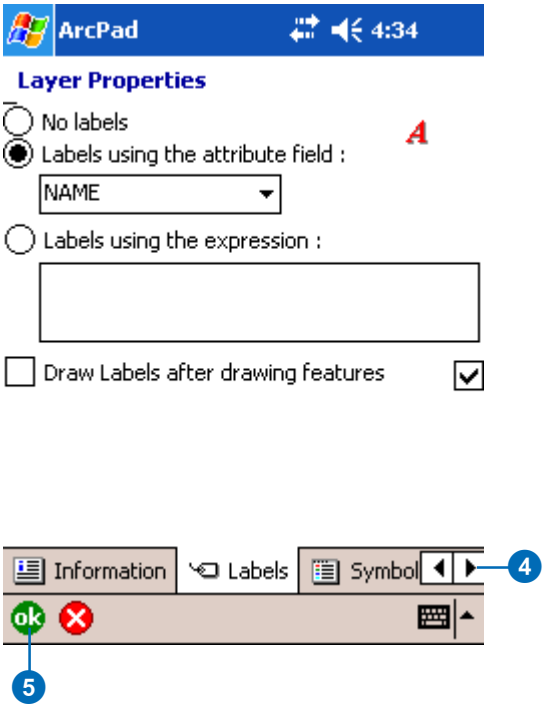
1. Tap the Table of Contents button on the Main toolbar.
2. On the Layers page, tap the layer of interest.
3. Open the Layer's properties dialog box by either double-tapping on the selected layer or tapping the Layer Properties button. ▸



See Also

For more information on layer properties, see Chapter 6, 'Managing layers', and the ArcPad Reference Guide.

4. Scroll through the different tabs using the left and right arrow buttons. Set your properties.
5. When finished, tap OK.



Moving around the map

The Browse toolbar provides tools to move around your map and investigate different areas and features.

ArcPad has a number of map navigation tools including variable zoom/pan, fixed zoom, zoom to a specific layer or bookmark, map rotation, and center on the current GPS position.

Tip

Active tools

Any button that requires tapping on the map can be activated including Zoom In, Zoom Out, Pan, and Rotate Map buttons.

A tool is activated by tapping the button, either on the toolbar or from a dropdown list. When a tool is active, the tool's icon is displayed on the toolbar in a depressed mode, and the icon in the dropdown list is highlighted with a red square. Only one tool can be active at a time. A tool is deactivated by tapping a different button.

Tip

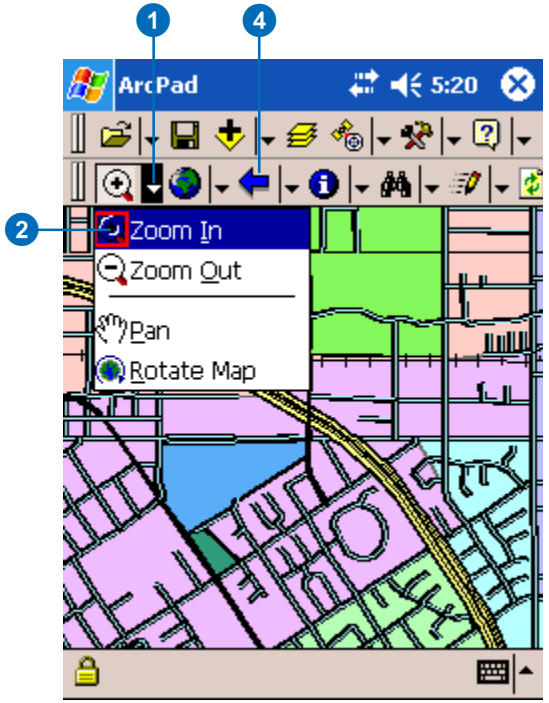
Interrupting drawing

If you activate a tool, such as zoom or pan, while your map is drawing, ArcPad interrupts the draw. Similarly, if a tool is already activated, and you draw on the screen, ArcPad interrupts the draw.

Zooming and panning

1. Tap the dropdown arrow to the right of the Zoom In button to display the dropdown list.
2. Tap either the Zoom In, Zoom Out, or Pan tool, depending on what you would like to do.
3. Zoom In or Out by drawing a rubberband box. Pan by dragging the pen along the map.

   Alternatively, with the Zoom In, Zoom Out, or Pan tool active, tap the map and ArcPad will perform the action and recenter the map at that location.
4. Tap the Go Back To Previous Extent button to undo your last zoom or pan.



Tip

Zooming and panning techniques

After selecting the appropriate zoom option, tap the screen at the edge of the required area, then without lifting the pen, slide the pen diagonally across the map until the required area is enclosed by a dashed rectangle. Lift the pen, and the zoom will be effected. A similar action is used to pan across the map at the current zoom level.

This action can also be performed with the action button, or rocker switch, located on the left-hand side or front of some Windows Mobile devices. Pushing the rocker in toggles the mode. Moving the rocker up or down performs the zoom or pan. In Z mode the rocker is a fixed zoom in/out, H indicates horizontal pan, and V indicates vertical pan.

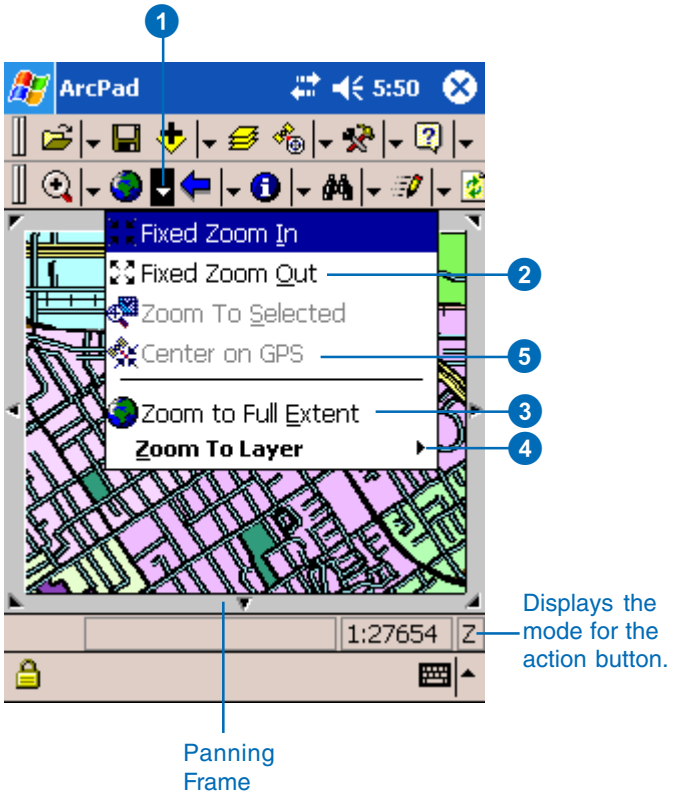
Tip

Panning frame

ArcPad includes a panning frame that can be added to your display. Tap the dropdown arrow to the right of the Tools button and tap the Panning Frame button. Once the panning frame is activated, tap the arrows located on the frame, and ArcPad pans your map display accordingly.

Zooming with the fixed zoom tool

1. Tap the dropdown arrow to the right of the Zoom to Full Extent button to display the dropdown list.
2. Tap the Fixed Zoom In/Out tools to perform an incremental zoom in or zoom out.
3. Tap Zoom to Full Extent to zoom to the extent of all the layers in the map.
4. Tap Zoom To Layer to select a layer to zoom to. ArcPad zooms to the geographic extent of the selected layer.
5. Tap Center on GPS when you want to center the display on the current GPS position. Your GPS receiver needs to be activated for this tool to be enabled.



Rotating the map orientation

ArcPad enables you to rotate the map based on your own orientation. Map orientation is extremely useful in the field when you want to angle the map to match what you are observing or collecting or to navigate with your GPS receiver.

Tip

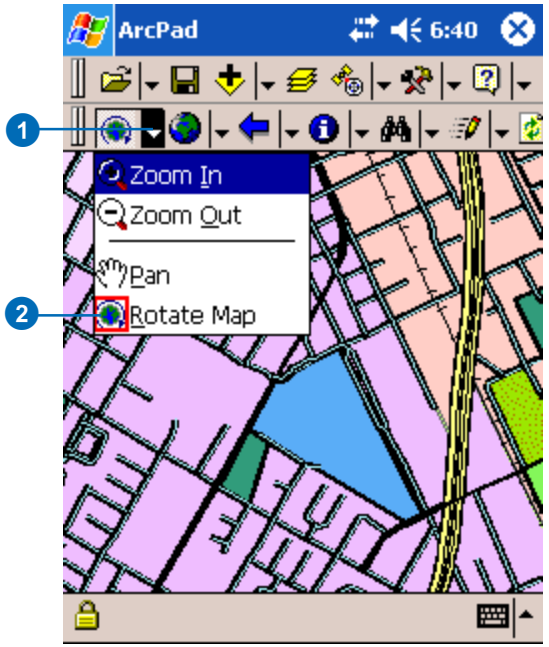
Automatic map rotation using a GPS

You can set the rotation of the map to automatically update when connected to a GPS receiver so that the map is orientated in the direction of travel. See Chapter 11, 'Navigating with your GPS', for more information.

Rotating the map

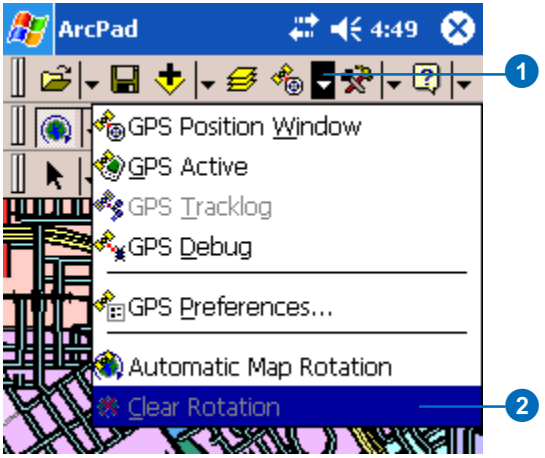
1. Tap the dropdown arrow to the right of the Zoom In button to display the dropdown list.
2. Tap the Rotate Map tool.
3. Tap, hold, and drag the pen clockwise on the screen to the desired map orientation.

   A black arrow is displayed to guide you with your map rotation.



Clear map rotation

1. Tap the dropdown arrow to the right of the GPS tools button to display the dropdown list.
2. Tap Clear Rotation.



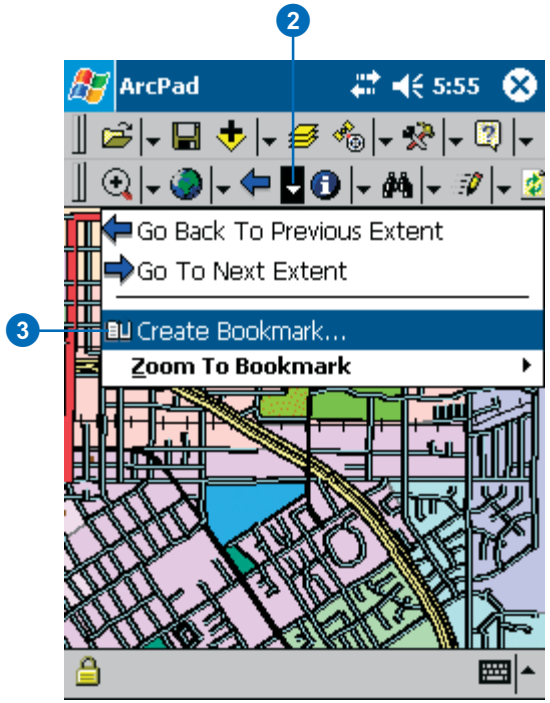
Setting spatial bookmarks

A *spatial bookmark* identifies a particular geographic extent that you want to save and return to later. For example, you might create a spatial bookmark that identifies a study area. That way, as you pan and zoom around your map, you can easily return to the study area by accessing the bookmark. You can also use spatial bookmarks to highlight areas on your map that you want others to see.

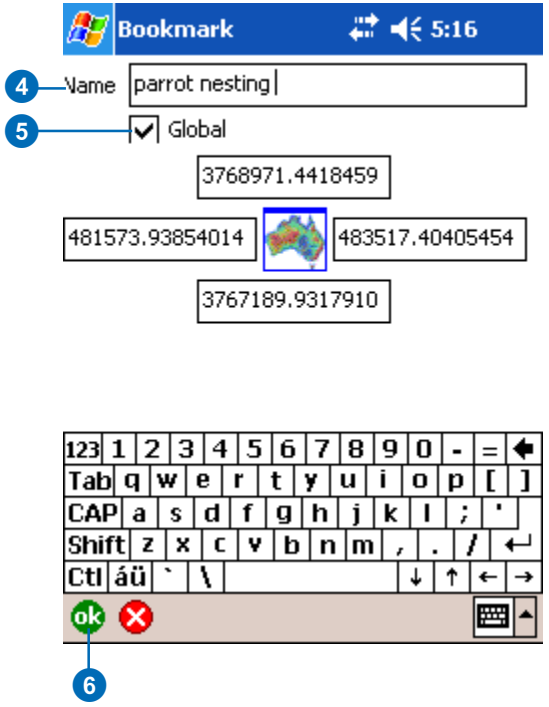
Creating a spatial bookmark

1. Pan and zoom the map to the area in which you want to create a bookmark.
2. Tap the dropdown arrow to the right of the Go Back To Previous Extent button to display the dropdown list.
3. Tap Create Bookmark.

   The Bookmark dialog box is displayed. ►



4. Type a name for your bookmark in the Bookmark dialog box.
5. Check the Global check box if you want the bookmark to be saved in your ArcPad preferences file. Global bookmarks can be accessed within any map. Local bookmarks are saved in the current map file.
6. Tap OK.



Tip

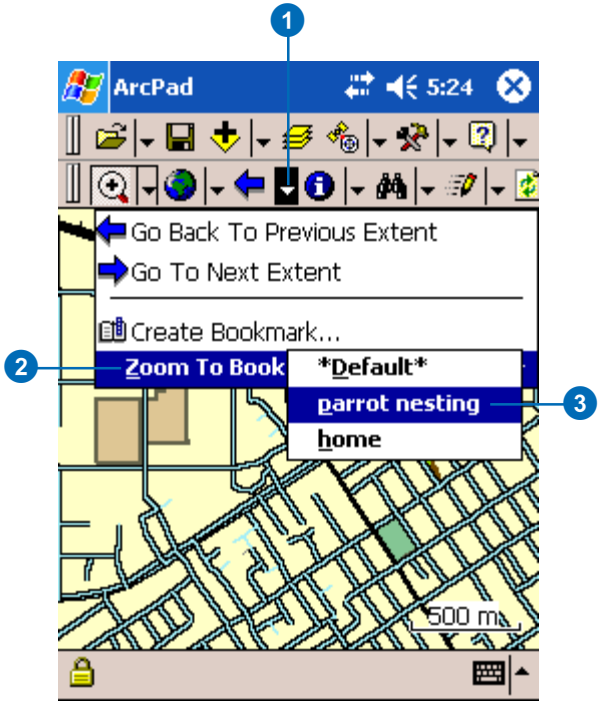
Managing bookmarks

Bookmarks are managed via the Map Properties dialog box. You can delete a bookmark, change the name of a bookmark, or set a bookmark to be global. For more information, see the Map Properties section earlier in this chapter.

Zooming to a spatial bookmark

1. Tap the dropdown arrow to the right of the Go Back To Previous Extent button to display the dropdown list.
2. Tap Zoom To Bookmark.
3. Tap the bookmark that you would like to zoom to.

   ArcPad will zoom to the extent of the bookmark you selected.



Locking the ArcPad application

ArcPad lets you lock the application so that no tools can be accidentally selected when your device is not in use or if you simply want to view a map in the field.

When locked, ArcPad cannot receive input from a mouse or pen; the keyboard, however, remains unlocked. The Lock tool applies to ArcPad only and does not lock the entire system. You can therefore access other applications on your device or computer.

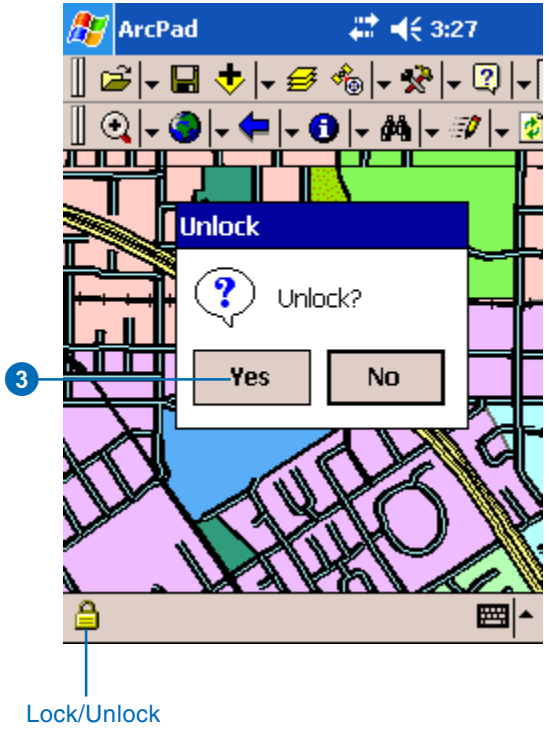
Tip

Locating the Lock tool

The Lock tool is located on the Command bar at the bottom of the ArcPad screen on a Windows Mobile device. On a Windows desktop computer, the lock tool is also located on the Main toolbar.

Using the lock tool

1. To lock the ArcPad screen, tap the Lock tool.
2. To unlock the ArcPad screen, tap the Lock tool.
3. At the prompt screen, tap Yes.



Setting ArcPad options

The ArcPad Options dialog box allows you to set a number of options, including display preferences and quality, map and data paths, ArcIMS requests, and camera settings. These options are saved in the ArcPad preferences file (ArcPadPrefs.apx), located under the My Documents folder. Once set, these preferences are applied to all your maps created in ArcPad. You are not required to set them for each new map you create.

Tip

Restoring ArcPad defaults

To restore all ArcPad default parameters, close ArcPad, delete the ArcPad preference file (ArcPadPrefs.apx), and restart ArcPad.

Tip

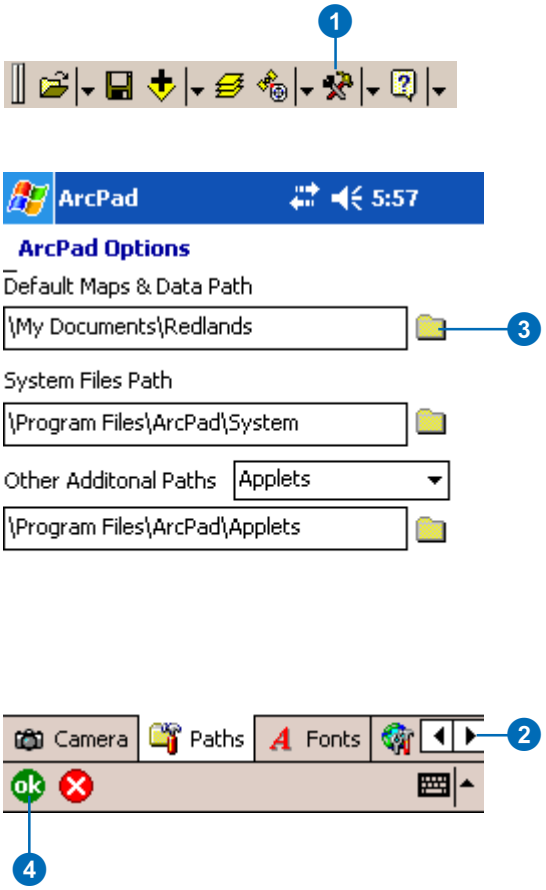
Setting GPS and rangefinder preferences

You can set GPS options in the GPS Preferences dialog box and rangefinder options in the Rangefinder Preferences dialog box.

Setting ArcPad 0ptions

1. On the Main toolbar, tap the Tools button.
2. Navigate through the tabs and search for the option you would like to set.
3. Set your options.

   For detailed information on setting ArcPad options, refer to the *ArcPad Reference Guide*.
4. Tap OK.



Getting help

A quick way to learn what ArcPad can do is to get help about the buttons and tools you see on the ArcPad interface.

The ArcPad online help system is organized by toolbar: Main toolbar, Browse toolbar, Edit toolbar, and Command bar. Each button on each toolbar has a description in the online help system.

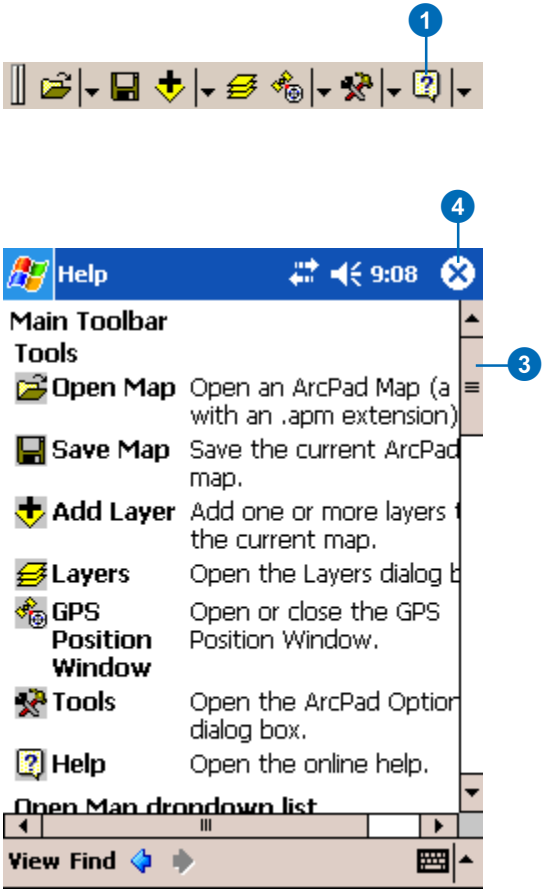
See Also

Visit the ArcPad Web site for updated information:
www.esri.com/arcpad.

Visit the Online Support Center for FAQs, Knowledge Base, and discussion forums:
http://support.esri.com/arcpad.

Getting help in the ArcPad window

1. Tap the Help button.
2. Select the toolbar you wish to learn more about.
3. Scroll down and view the different buttons pertaining to that toolbar.
4. Tap OK or X.



Saving a map and exiting ArcPad

After you finish working on a map, you can save it and exit ArcPad. You save it as an ArcPad map file and store it on your computer or your mobile device. ArcPad automatically appends a file extension (.apm) to your map document name when saved.

Tip

Compact Flash and Secure Digital Memory Cards

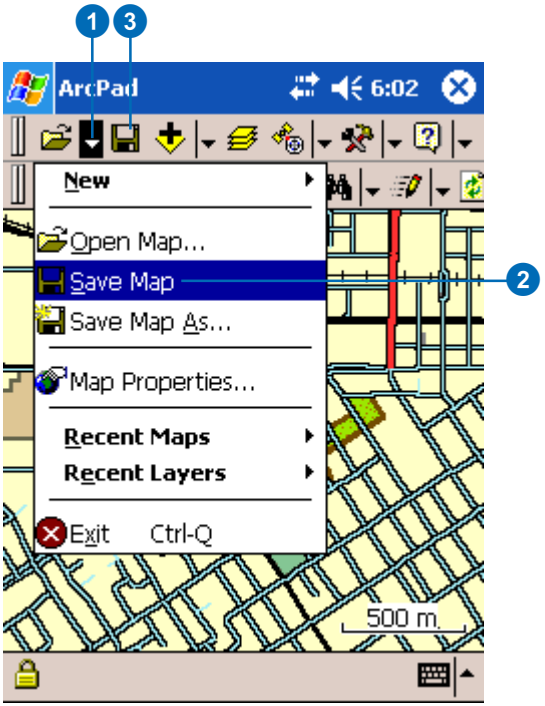
Consider storing your data on Compact Flash (CF) or Secure Digital (SD) Memory Cards. This will ensure that your data is not lost if the battery on your mobile device is drained.

See Also

See Chapter 2, 'Introduction to Windows Mobile', for information on device accessories.

Saving a map

1. Tap the arrow to the right of the Open Map button to display the dropdown list.
2. Tap Save Map.
3. Alternatively, tap the Save Map button on the Main toolbar. If you haven't saved the map before, you'll need to provide a name for it.

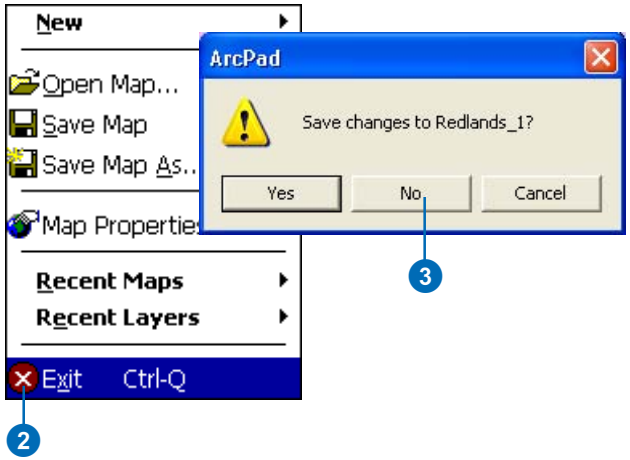


Saving as a new map

1. Tap the dropdown arrow to the right of the Save button to display the dropdown list.
2. Tap Save Map As.
3. Type a name for your map.
4. Navigate to the location of the folder where you would like to save the map file.
5. Tap OK.

Exiting ArcPad

1. Tap the dropdown arrow to the right of the Save button to display the dropdown list.
2. Tap Exit.
3. Tap Yes to save any changes, No to discard any changes, or Cancel to continue working on your map.



Working with ArcPad files

With ArcPad, you work with several different types of files. Each file type plays a specific role in ArcPad and is differentiated by a unique file extension.

The key file types include:

- Custom Default Configuration File (ArcPad.apx)

This file is loaded by default each time ArcPad starts and must be located in the ArcPad installation directory. ArcPad.apx can contain custom toolbars, forms, and system object event handlers. In addition, it can contain other parameters that override the ArcPad default such as which toolbars are initially visible when the application starts.

- Global Bookmark File (ArcPadBookMarks.apx)

This file contains spatial bookmarks that can be used in ArcPad regardless of the current map. It is saved in the My Documents folder on your device.

- ArcPad Preference File (ArcPadPrefs.apx)

This file contains ArcPad default parameters, such as GPS settings, default symbology, default file paths, and so on. It is saved in the My Documents folder on your device.

- ArcPad Layer Definition File (*.apl)

Layer definitions are stored in a file associated with a shapefile, with the same filename as the shapefile but with the extension .apl. Layer definition files provide a way of developing customizations that are delivered and loaded with data. Layer definition files may also contain custom symbology exported from ArcGIS Desktop.

- ArcPad Map File (*.apm)

An ArcPad map file, or map, stores a list of the map layers for your ArcPad session. A map lists all of your feature layers together with their display settings, including the extent of your map, color, and projection environment.

- ArcPad Graphics Layer file (*.apg)

The ArcPad Graphics Layer file is an XML file that can store text, points, lines, and polygons. It is used to make freehand georeferenced edits in the field which can then be imported into ArcGIS Desktop.

- ArcPad Photo Layer file (*.aph)

The ArcPad Photo Layer file is an XML file that references a folder containing georeferenced images. Images contained in the folder are projected on-the-fly to the current map projection coordinates when displayed in ArcPad. The ArcPad Photo Layer file supports JPEG images. The default symbol for features in this layer is a camera.

- ArcPad Stylesheet (*.aps)

An ArcPad Stylesheet is a file that provides symbol definitions for the symbol styles used by ArcPad. ArcGIS Desktop stylesheet files can be exported to ArcPad Stylesheet files.

Displaying data

Section 2

Creating maps

5

IN THIS CHAPTER

- Creating a new map
- Adding layers
- Adding shapefiles
- Adding images
- Adding graphics layers
- Adding an ArcIMS Internet Server
- Adding ArcIMS layers
- About coordinate systems
- Specifying a coordinate system

In order to create efficient maps for use in the field, ArcPad leverages existing mapping and GIS software systems and databases. There is no need to convert data to unique portable data formats. ArcPad supports a multilayer environment with industry-standard vector map and raster image display that includes aerial photographs and satellite imagery. Maps created in the field can easily be uploaded into the master database in the office.

In addition, ArcPad supports wireless data acquisition. ArcPad can act as a client to ArcIMS, ESRI's Internet mapping and GIS software or to the Geography Network (*www.geographynetwork.com*). Data is downloaded to ArcPad using a TCP/IP connection, such as a wireless local area network, cellular phone, or a wireless modem.

Creating a new map

A map is the fundamental component you work with in ArcPad. The ArcPad map file (.apm) stores a list of the map layers and their properties in your ArcPad session. A map lists all your layers together with the geographic extent and projection of the map. When you begin an ArcPad session, you must first open an existing map or create a new map by adding layers of data or information.

Once shapefiles, images, graphics layers, or Internet data are added to your ArcPad map, you determine whether or not they are displayed, edited, updated, or moved. Each file appears in ArcPad as a layer in the map.

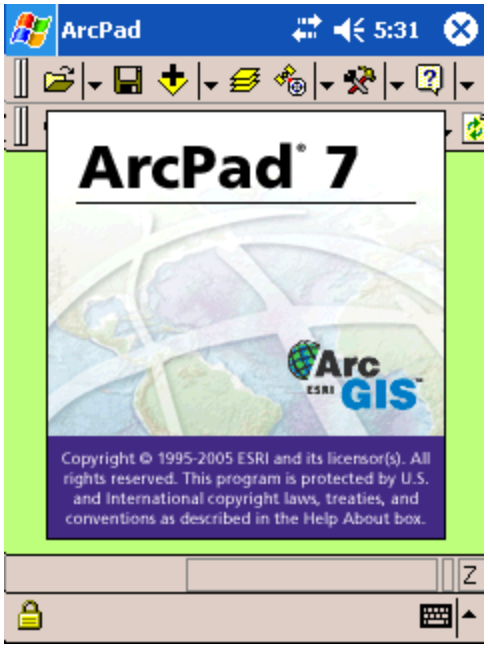
See Also

For more information about supported ArcPad data formats, refer to the ArcPad Reference Guide.

Creating a new map from the Windows Mobile Start menu

1. Tap Start on the Windows taskbar.
2. Tap Programs
3. Tap ArcPad 7.0.

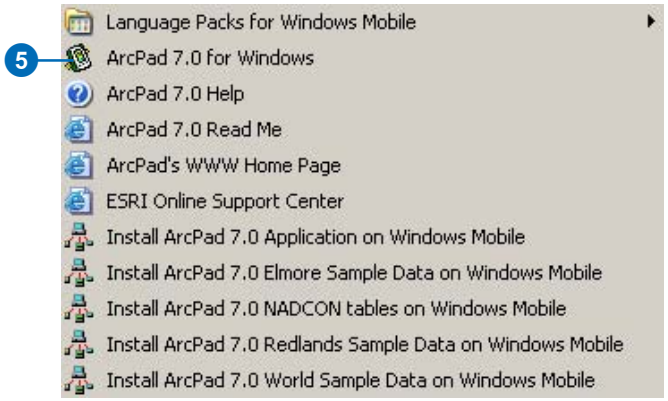
   You will see the ArcPad splash screen briefly and ArcPad will open with the Startup dialog box.



Creating a new map on a desktop PC

1. Click Start on the Windows taskbar.
2. Click All Programs.
3. Click ArcGIS.
4. Click ArcPad 7.
5. Click ArcPad 7.0 for Windows.

   You will see the ArcPad splash screen briefly and ArcPad will open with the Startup dialog box.



Tip

Turning the Startup dialog box on or off

You can check Do not show this dialog again if you do not want to see the Startup dialog box again when starting ArcPad. To turn the Startup dialog box on, go to the Startup page in the ArcPad Options dialog box.

Tip

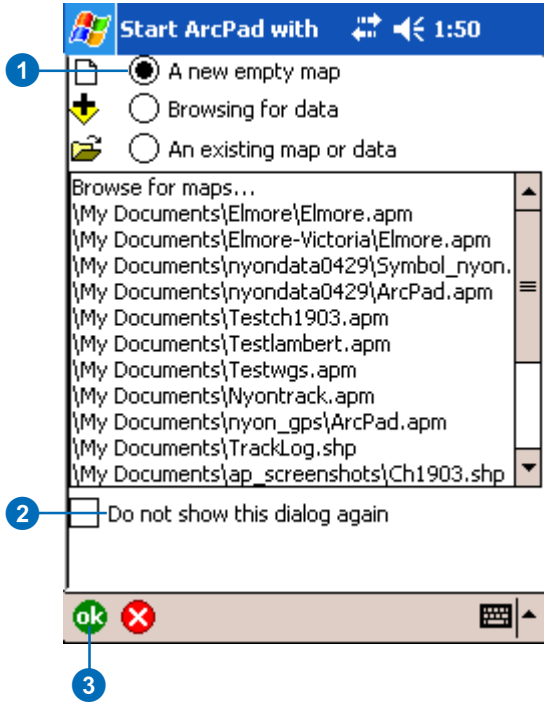
Start with browsing for data

If you select Browsing for data on the Startup dialog box, ArcPad will automatically navigate to your My Documents folder so that you can immediately begin to add data.

Creating a new map using the Startup dialog box

1. By default, ArcPad begins with the Startup dialog box. When it appears, tap A new empty map.
2. If you do not wish to see the Startup dialog box again when ArcPad starts, tap Do not show this dialog again.
3. Tap OK.

   ArcPad will open a new blank map.



Tip

Prepare your Data

Use ArcGIS Desktop to prepare your data for ArcPad. With these desktop tools, you can create subsets of your data, convert data to shapefiles, and export legend symbology.

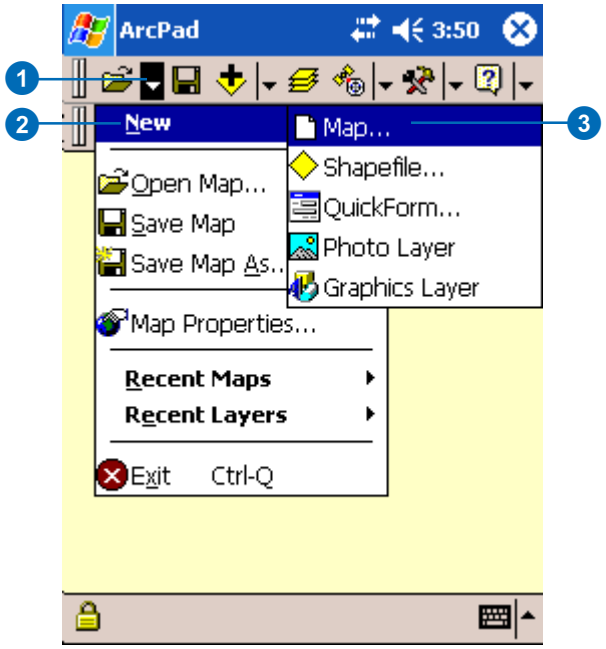
See Also

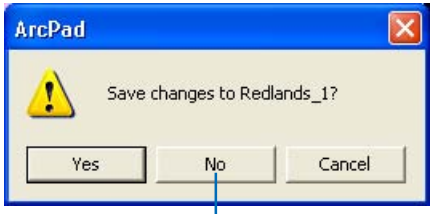
See Chapter 18, 'ArcPad Tools for ArcGIS'.

Creating a new map in ArcPad

1. If you do not wish to use the Startup dialog you can also open a new map from the Main toolbar in ArcPad. Tap the dropdown arrow to the right of the Open Map button.
2. Tap New.
3. Tap Map.

   ArcPad will open a new blank map. If you have another map open, ArcPad will ask you if you would like to save any changes.





If you have another map open, ArcPad will ask if you would like to save your changes.

Adding layers

You can display geographic information on a map as layers. Each layer represents a particular type of feature, such as streams, lakes, highways, or light posts. A layer does not store the actual geographic data; instead, it references the data contained in shapefiles, images, graphics layers, or ArcIMS services.

Tip

Distinguishing layer types

The different layers supported by ArcPad are represented by the following icons:

- *for point shapefiles*
- *for line shapefiles*
- *for polygon shapefiles*
- *for image layers*
- *for graphics layers*
- *for ArcIMS layers*
- *for photo layers*

Tip

Layer projection conflicts

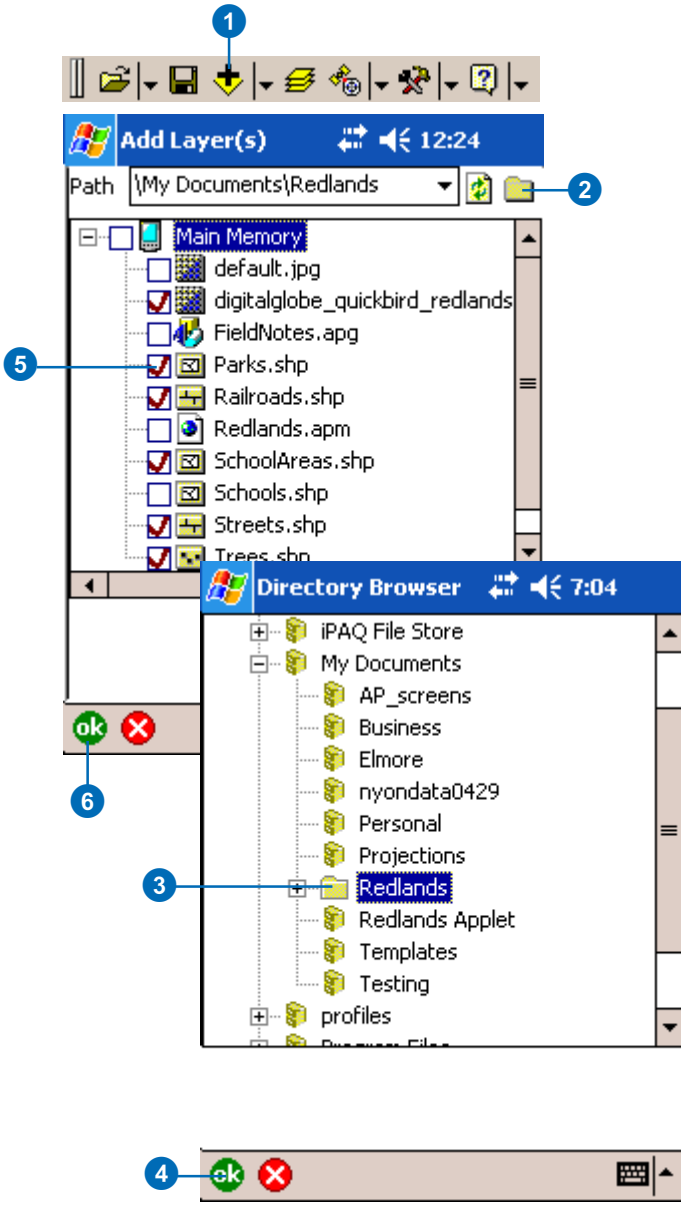
Only add layers with the same projection. ArcPad will not add layers with different projections to the same map. Projection information for each layer is contained in the layer's projection (.prj) file. In addition, each map has an associated projection that can be stored in the ArcPad map (.apm).

Adding layers to your ArcPad map

1. Tap the Add Layer(s) button on the Main toolbar.
2. Tap the Folder button to navigate to the directory that you would like to add data from.
3. Tap the folder in the Directory Browser dialog box that contains the layers you wish to add to your map.
4. Tap OK.
5. Check the check box beside the datafile(s) you would like to add.

   The Add Layer(s) dialog box only displays layers that are supported by ArcPad. A red check mark indicates selected files.
6. Tap OK.

   Your data layers are now added to the existing ArcPad map.



Adding shapefiles

ArcPad uses vector data in shapefile format, as does ArcView, ArcEditor, ArcInfo, ArcIMS, and other ESRI software programs. A shapefile (.shp) is a vector file format for storing the location, shape, and attributes of geographic features. Shapefiles can support point, line, and polygon features. Attributes are held in a dBASE® (.dbf) format file.

Tip

Prepare your shapefiles

Use ArcGIS Desktop to prepare your data for ArcPad. With these desktop tools, you can create subsets of your shapefiles and export ArcGIS Desktop stylesheets. ArcPad also supports spatial and attribute indexes of shapefiles. Create attribute indexes in ArcPad via the Attributes tab in the LayerProperties dialog box. Create a spatial index for large shapefiles in ArcGIS Desktop to improve performance in ArcPad. For more information on indexing, see Chapter 8, 'Querying your data', and ArcGIS Desktop Help.

See Also

For more information on creating shapefiles in ArcPad, see Chapter 15, 'Creating new features'.

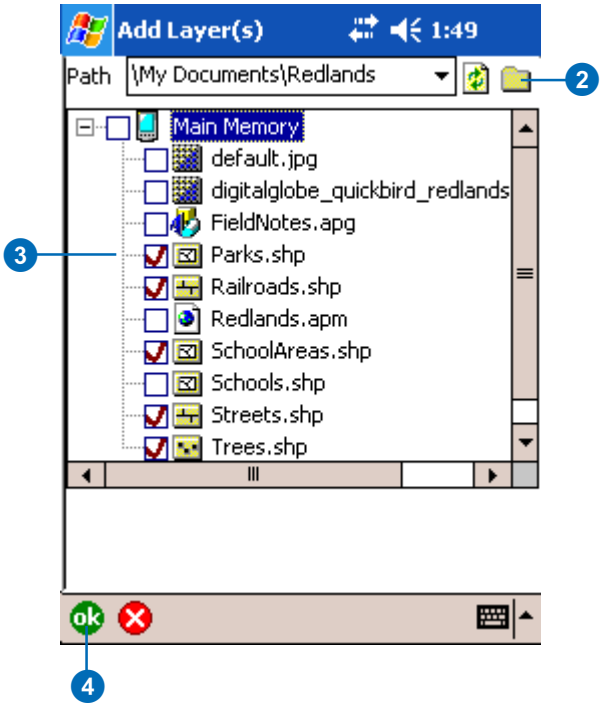
Adding shapefiles to your ArcPad map

1. Tap the Add Layer(s) button on the Main toolbar.
2. Tap the Folder button to navigate to the shapefile you would like to add.

   Shapefiles have a .shp suffix.
3. Check the checkbox beside the datafile(s) you would like to add.

   A red check mark indicates selected files.
4. Tap OK.

   Your shapefiles are now added as layers to the existing ArcPad map.



Adding images

ArcPad directly supports the use of the following raster image formats: GIF, JPEG, JPEG2000, MrSID, PNG, TIFF (including GeoTIFF and LZW compression), Windows Bitmap, and CADRG raster maps.

ArcPad requires the georeferencing information and coordinate system information in order to correctly display images on a map.

Georeferencing information can be included in the header of the image, associated .aux file, or world file.

Coordinate system information can also be included in the header of the image, associated .aux file, or projection (.prj) file.

See Also

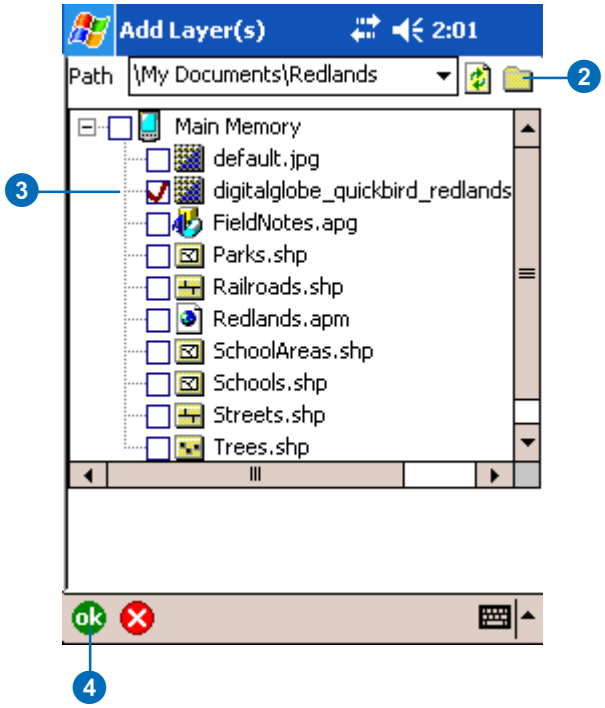
For more information about supported raster image formats, refer to the ArcPad Reference Guide.

Adding images to your ArcPad map

1. Tap the Add Layer(s) button on the Main toolbar.
2. Tap the Folder button to navigate to the raster image you would like to add.
3. Check the checkbox beside the datafile(s) you would like to add.

   A red check mark indicates selected files.
4. Tap OK.

   Your images are now added as another layer to the existing ArcPad map.



Adding graphics layers

ArcPad supports graphics layer files. The ArcPad Graphics Layer (.apg) is an XML file that can store annotation, points, lines, and polygons. It is used for redlining or to make freehand georeferenced edits in the field. Graphics layer files can be easily imported to ArcGIS Desktop.

See Also

For more information about creating ArcPad Graphics Layers, refer to Chapter 16, 'Creating new features'.

Tip

Adding layers via the Table of Contents

The Add Layer(s) tool is also available on the Layers page of the Table of Contents.

Tip

Adding photo layers

ArcPad Photo layers (.aph) can also be added using the same method as a graphics layer. A photo layer displays a camera icon at the location of a hyperlinked photograph. See Chapter 13, 'Using your digital camera', for more information.

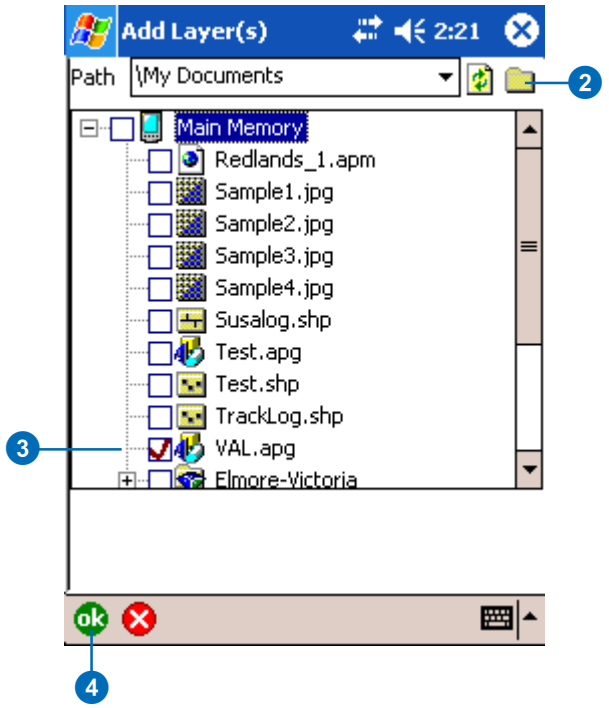
Adding graphics layers to your ArcPad map

1. Tap the Add Layer(s) button on the Main toolbar.
2. Tap the Folder button to navigate to the graphics layer you would like to add.

   Graphics layers have a .apg suffix.
3. Check the checkbox beside the datafile(s) you would like to add.

   A red check mark indicates selected files.
4. Tap OK.

   Your graphics layer is now added as another layer to the existing ArcPad map.



Adding an ArcIMS Internet Server

ArcPad supports wireless data acquisition. ArcPad acts as a client to ArcIMS, ESRI's Internet Mapping and GIS software. Data is downloaded to ArcPad using a TCP/IP connection, such as a wireless local area network (LAN), cellular phone, or a wireless modem. ArcPad supports ArcIMS image services.

Tip

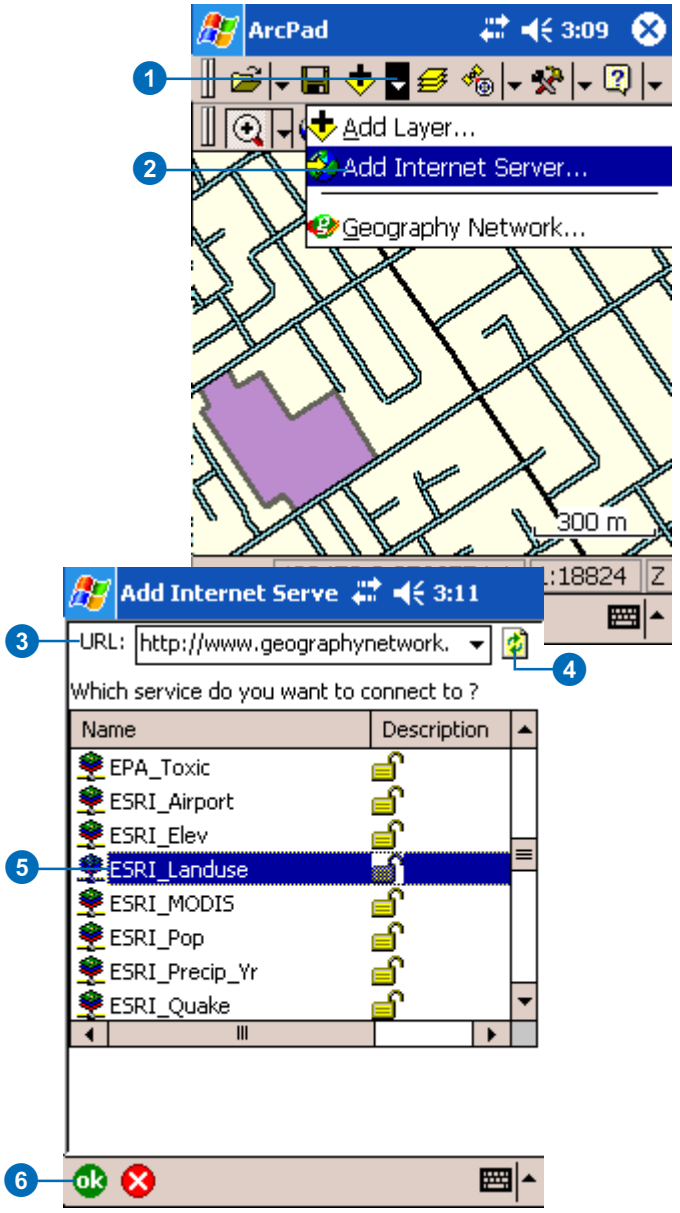
The Geography Network

With ArcPad, you can easily access ESRI's Geography Network (www.geographynetwork.com)*. The Geography Network is a rich source for geographic data. Use the Geography Network button under the Add Layer(s) tool for a direct connection, if your TCP/IP connection is active.*

1. Tap the arrow to the right of the Add Layer(s) button.
2. Tap Add Internet Server.
3. Type the URL of the ArcIMS Internet Server you would like to connect to.
4. Tap the Refresh button.

   ArcPad lists the supported services that are available to you.
5. Tap the service you would like to connect to.
6. Tap OK.

   ArcPad creates a .gnd file (Geography Network Definition) which stores the reference to the ArcIMS host URL and the chosen map service.
7. Navigate to the location you want to save the file in and tap Save.
8. ArcPad will ask you whether or not you would like to add the service to your current project. Tap Yes to add it. If you tap No, you can add it later with the Add Layer(s) tool.



Adding ArcIMS layers

A Geography Network Definition file (.gnd) is created when an ArcIMS Internet Server is added (see previous page). Once added, the ArcIMS layer can be added to ArcPad via the Add Layer(s) tool. ArcPad automatically establishes a connection to the server and retrieves data for the current view—if an active TCP/IP connection exists. The ArcIMS layer is downloaded and stored locally as an image. ArcPad also supports the Identify tool on ArcIMS layers, if the layer contains attributed vector data on the host server.

Tip

Refresh button

Tap the Refresh button on the Browse toolbar to refresh the ArcIMS layer when the map extent changes. You can also set ArcPad to automatically refresh ArcIMS layers in the ArcIMS page of the ArcPad Options dialog box or in the ArcIMS page of the Layer Properties dialog box.

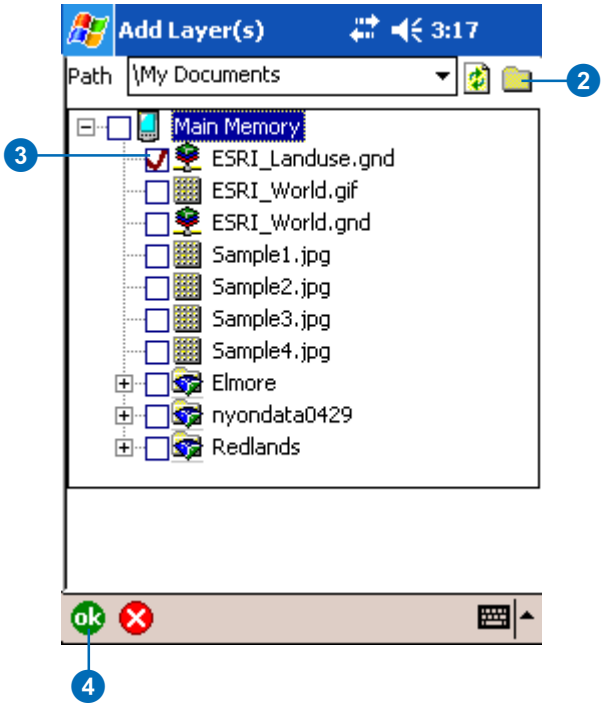
Adding ArcIMS layers to your ArcPad map

1. Tap the Add Layer(s) button on the Main toolbar.
2. Tap the Folder button to navigate to the ArcIMS layer you would like to add.

   ArcIMS layers are displayed as Geography Network Definition files with a .gnd suffix. These allow you to refresh the layer from the Internet server where you originally retrieved it. The image layer received from the ArcIMS image service is stored locally.
3. Check the check box beside the datafile(s) you would like to add.

   A red check mark indicates selected files. If you check the .jpg layer, you are adding the last image requested from the ArcIMS service. If you check the .gnd layer, you can refresh the layer for the most current data. You should only select one.
4. Tap OK.

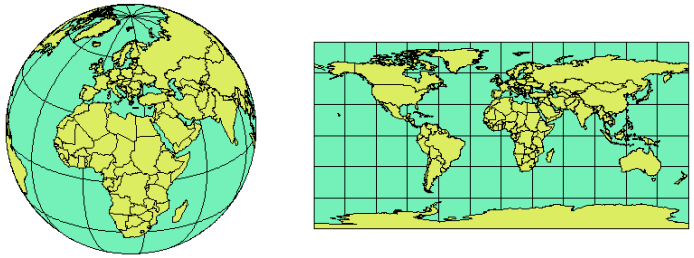
   Your ArcIMS layers are added to the existing ArcPad map.



About coordinate systems

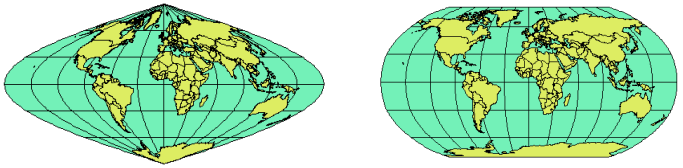
The features on a map reference the actual locations of the objects they represent in the real world. The positions of objects on the earth's spherical surface are measured in degrees of latitude and longitude, also known as *geographic coordinates*. While latitude and longitude can locate exact positions on the surface of the earth, they are not uniform units of measure; only along the equator does the distance represented by one degree of longitude approximate the distance represented by one degree of latitude. To overcome measurement difficulties, data is often transformed from the three-dimensional geographic coordinate system to the two-dimensional planar surface in a *projected coordinate system*. Projected coordinate systems describe the distance from an origin (0,0) along two separate axes, a horizontal x-axis representing east–west, and a vertical y-axis representing north–south.

Because the earth is round and maps are flat, getting information from the curved surface to a flat one involves a mathematical formula called a *map projection*. A map projection transforms latitude and longitude to x,y coordinates in a projected coordinate system.



Locations are expressed as latitude and longitude on a globe and as x,y coordinates on a map.

This process of flattening the earth will cause distortion in one or more of the following spatial properties: distance, area, shape, and direction. No projection can preserve all these properties and, as a result, all flat maps are distorted to some degree. Fortunately, you can choose from many different map projections. Each is distinguished by its suitability for representing a particular portion and amount of the earth's surface and by its ability to preserve distance, area, shape, or direction. Some map projections minimize distortion in one property at the expense of another, while others strive to balance the overall distortion. As a mapmaker, you can decide which properties are most important and choose a projection that suits your needs.



Displaying the world using the Albers projection (left) and the Robinson projection (right).

Specifying a coordinate system

In order for ArcPad to display the layers of your data correctly, they need to be in the same coordinate system or projection. Projection information is stored in a separate file named after the data source but with a .prj file extension—for example, citytrees.prj. In addition, each map has an associated projection that can be stored in the ArcPad map (.apm).

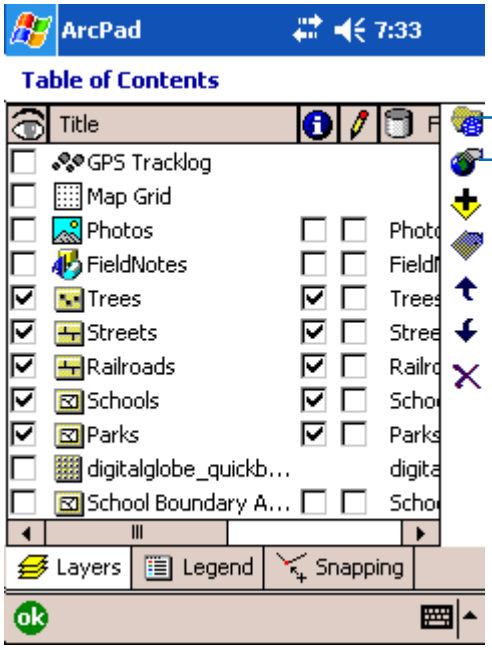
The default projection for a new map in ArcPad is latitude–longitude WGS84. If you have an arcpad.prj file in your My Documents folder, then it replaces latitude–longitude WGS84 as the default map projection. When you add a layer or map with a different projection to a new map, the data's projection replaces the default projection. ▸

Tip

Convert GPS input data

ArcPad supports on-the-fly projection and datum conversion from the (geographic) GPS input map datum to the projection of the current map.

1. Tap the Table of Contents button.
2. Tap Choose Map Projection Definition File. ▸



If you add a layer with no projection (.prj file) to a map with a geographic projection, ArcPad checks if the data appears to be latitude–longitude (i.e., geographic). If it appears to be geographic, ArcPad asks if you would like to assume the data is in the same geographic projection as the map. If it does not appear to be geographic, ArcPad removes the default projection and the map has no projection.

Tip

Convert your data

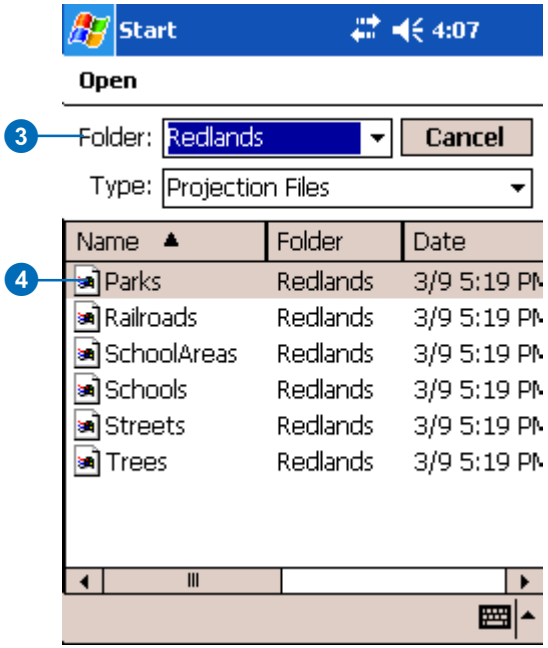
Use ArcGIS Desktop to change the projection of your data before adding it to your ArcPad map.

See Also

For information about supported projections and datums, refer to the ArcPad Reference Guide.

3. Navigate to the location of your projection file (.prj) on the Choose Map Projection Definition File dialog box.
4. Select the projection file that matches the projection of the layers in your current map.

   The coordinate system has been specified. View the Projection page in the Map Properties dialog box to display the coordinate system of the current map.



Managing layers

6

IN THIS CHAPTER

- Turning a layer's visibility on or off
- Changing a layer's drawing order
- Removing a layer from the map
- Selecting a layer for the Identify tool
- Selecting a layer for editing
- Layer properties
- Changing layer properties
- Creating a transparent layer
- The Map Grid layer

ArcPad displays geographic information on a map as layers. Each layer represents a particular type of feature, such as streams, lakes, highways, political boundaries, or light posts. A layer does not store the actual geographic data; it references the data contained in shapefiles, images, graphics and photo layers, or ArcIMS services.

As you saw in the previous chapter, it's easy to add layers to a map. Once they are on your map, you will want to organize them to make your map look the way you want it to. You organize and manage layers through the Table of Contents. The Table of Contents allows you to turn a layer's visibility on or off, change a layer's drawing order, remove layers, select layers for editing, change a layer's properties, and set snapping properties for editing.

Turning a layer's visibility on or off

Once a layer has been added to your map, you have the option of turning it on or off without having to completely remove it from your map. If a layer is turned off, it does not display on your map. You can, however, view a layer's properties and edit and identify a layer even if it is turned off.

Tip

Making all the layers visible

On the Layers page of the Table of Contents, tap the visible icon to make all the layers visible. Tap it again to turn off all the layers.

Tip

Editing layers are visible

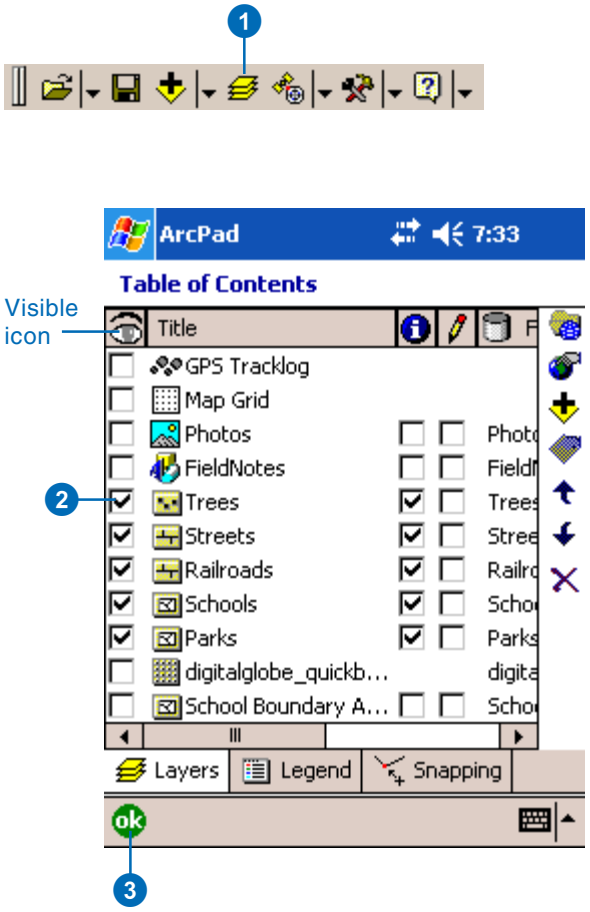
If a layer is checked for editing in the Table of Contents, it is always visible. In order to turn off that layer, you must ensure that it is not checked for editing.

1. Tap the Table of Contents button.

   The Table of Contents opens on the Layers tab and displays a list of the layers that have been added to your map.

2. Check the visible check box to turn the layer on. Uncheck the check box if you want to turn the layer off.

3. Tap OK.



Changing a layer's drawing order

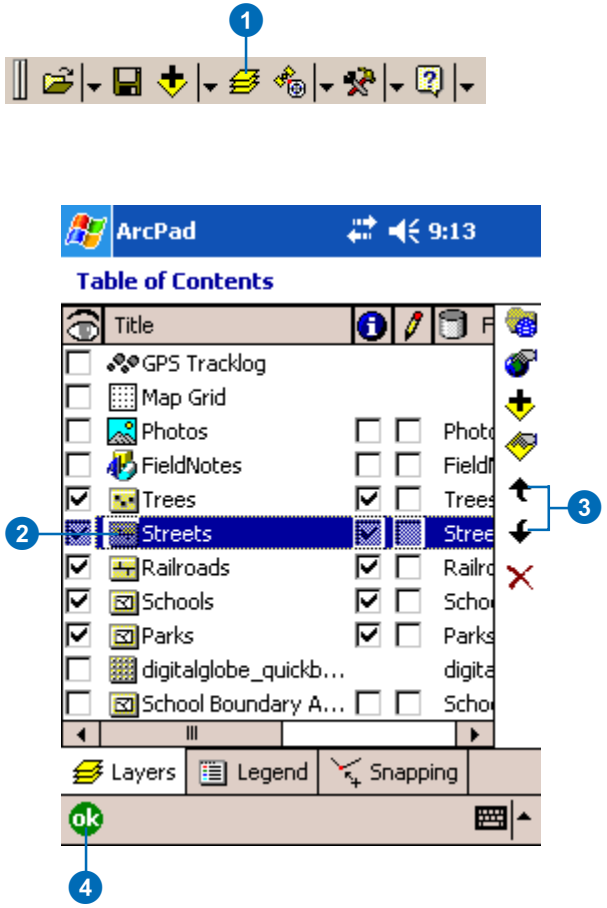
The order in which a layer appears in the Layers section of the Table of Contents corresponds to the opposite order in which it is drawn on the map. Layers at the bottom of the list are drawn first, and the layers at the top are drawn last.

By default, ArcPad inserts point layers at the top, line layers second, and polygon layers third. Raster images are placed at the bottom of the list and hence are drawn first.

1. Tap the Table of Contents button.

   The Table of Contents opens on the Layers page and displays a list of the layers that have been added to your map.

2. Tap the layer whose order you would like to change.
3. Tap the arrows to change the order of the selected layer.
4. Tap OK.

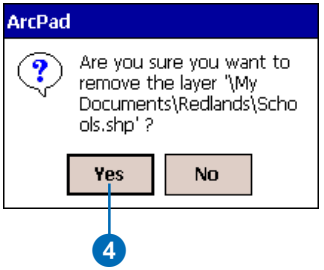


Removing a layer from the map

When you are finished using a layer, you can simply remove it from the map. In the Table of Contents, select the layer you would like to remove and tap the delete button. When you remove a layer, you are not deleting the data from your device; you are only deleting it from the current map.

1. Tap the Table of Contents button.
2. Tap the layer you would like to remove.
3. Tap the delete button.
4. Tap Yes.

   The layer is removed from your map.
5. Tap OK.



Selecting a layer for the Identify tool

The Identify tool lets you view attribute information for a particular feature. Once a layer is selected for the Identify tool, make the Identify tool active, then tap the feature, and the Feature Properties dialog box appears. By default, the Feature Properties dialog box includes pages for Attributes, Picture, Symbology—if defined—and Geography. If a custom form exists for the feature, it will be displayed. You cannot edit your data using the Identify tool; you can only view it.

Tip

Select all layers for the Identify tool

In the Table of Contents, tap the Identify tool to activate all layers. Tap again to deactivate all layers.

See Also

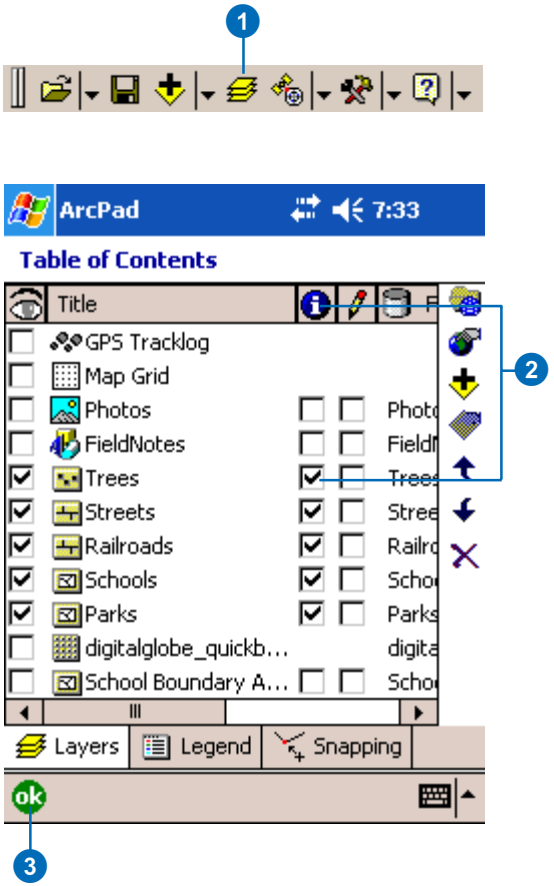
For more information on how to use the Identify tool, see Chapter 8, 'Querying your data'.

1. Tap the Table of Contents button.

   The Table of Contents opens on the Layers page and lists all of the layers in the current ArcPad map.

2. Check the Identify tool check box for the layer(s) you would like to retrieve information for.

3. Tap OK.



Selecting a layer for editing

Layers are selected for editing by enabling the Start/Stop Editing tool on the Browse toolbar or by checking the layer's Edit check box on the Layers page in the Table of Contents.

In ArcPad, you can have up to three shapefiles active for editing—one shapefile for each feature type: one point shapefile, one line shapefile, and one polygon shapefile. Alternatively, if you are editing the Graphics Layer, you can only have that layer active.

Tip

Determining the layer type

ArcPad allows you to edit point, line, and polygon shapefiles, and graphics layers. Photo layers can only be identified. The layer type is indicated by the following icons:

- *for point shapefiles*
- *for line shapefiles*
- *for polygon shapefiles*
- *for graphics layers*
- *for photo layers*

See Also

Refer to Chapter 14, 'Editing basics', for more information on editing your data.

1. Tap the arrow to the right of the Start/Stop Editing button on the Browse toolbar.

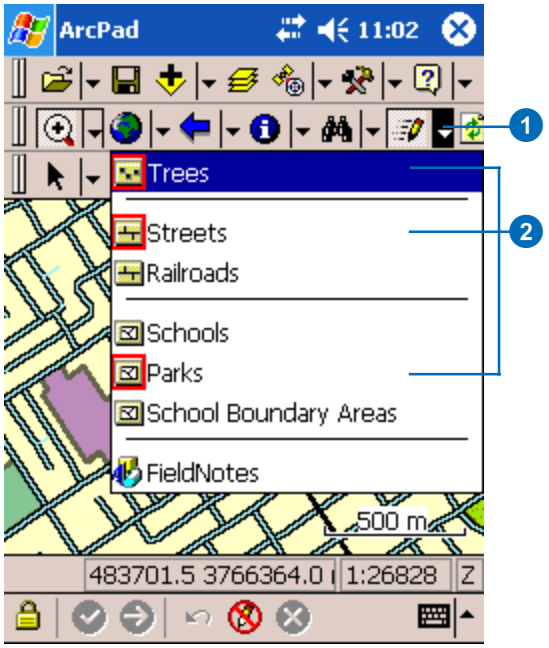
   The dropdown list displays all of the editable layers in the current ArcPad map with a corresponding icon to indicate the type of layer.

2. Tap the layer that you want to edit.

   The Edit toolbar and the Command bar will be displayed if they are not already displayed.

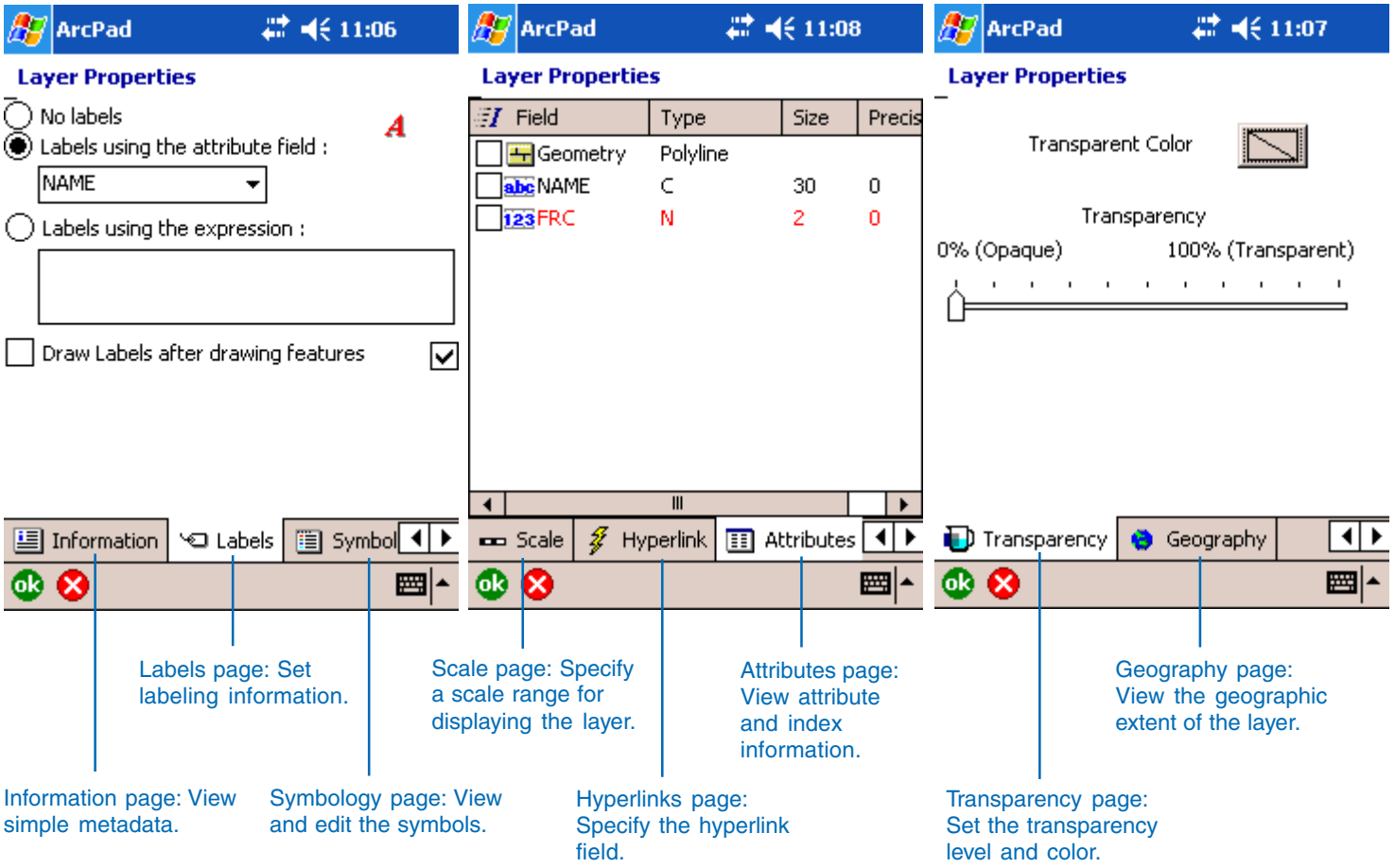
   In order to select more than one layer you will need to repeat steps 1 and 2. You can select one point, one line, and one polygon layer for editing, at one time, or the graphics layer.

   A red box around the layer icon indicates that the layer has been selected for editing.



Layer properties

Properties for a selected layer can be defined and changed in the Layer Properties dialog box. Properties include information about the selected layer, symbology used to draw the layer's features, a hyperlink field, attributes for the layer, a display scale, transparency options for the layer, and the geographic extent of the layer. A complete list of possible layer properties is available in the *ArcPad Reference Guide*.



Changing layer properties

You can change the properties for a selected layer using the Layer Properties dialog box. You can set labels, specify hyperlinks, change symbology, view attribute information, and specify a scale range for displaying layers.

See Also

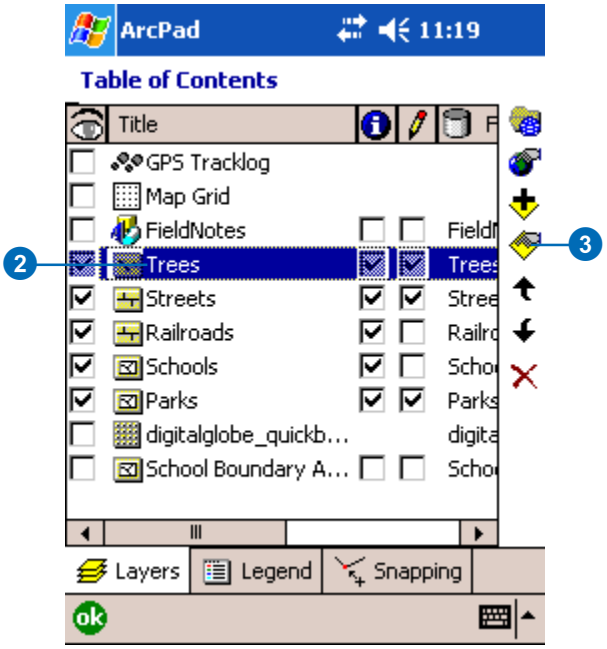
For detailed information about each of the pages of the Layer Properties dialog box, refer to the ArcPad Reference Guide.

See Also

Refer to Chapter 11, 'Navigating with your GPS', for information on the GPS Tracklog.

1. Tap the Table of Contents button.
2. Tap the layer of interest.
3. Open the Layer's properties by either double-tapping the selected layer or tapping the layer properties button.

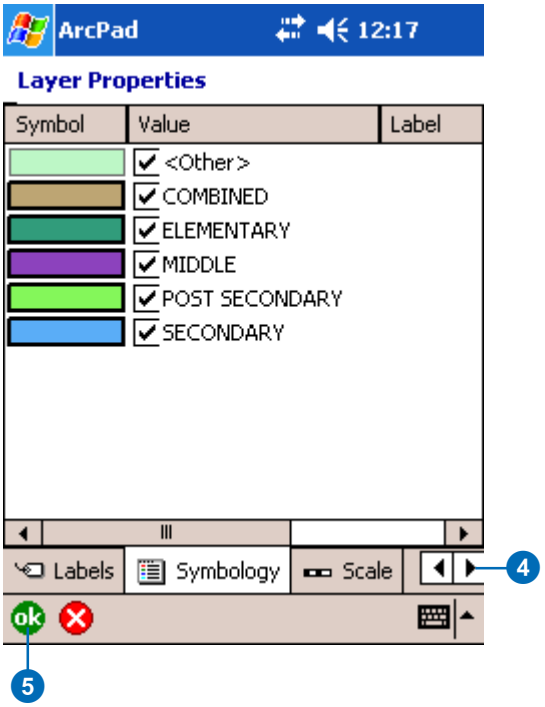
   The Layer Properties dialog box opens. ▸



See Also

Refer to Chapter 7, 'Symbolizing your data', for information on labeling and symbology properties.

4. Scroll through the different tabs depending on what you would like to set.
5. When finished, tap OK.



Creating a transparent layer

Giving a layer transparency is a simple way of showing varying and overlapping information. This is crucial when you are displaying many layers in ArcPad on a small portable screen. Transparency is set for an entire layer in the Layer Properties dialog box.

Tip

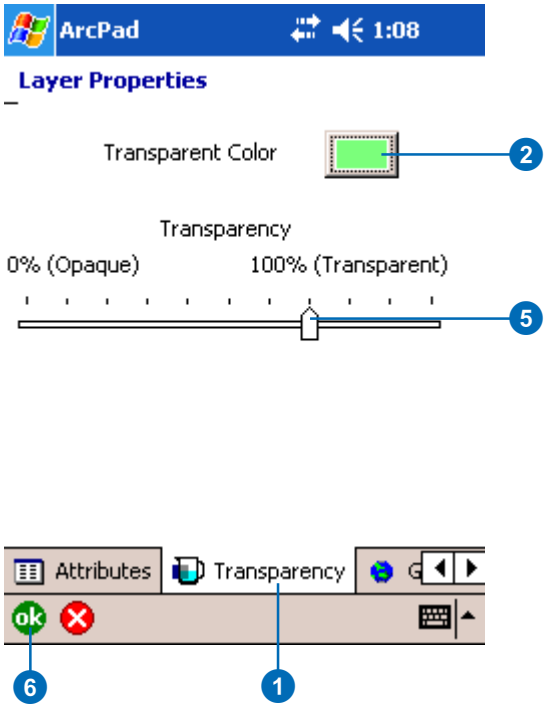
Setting transparency color

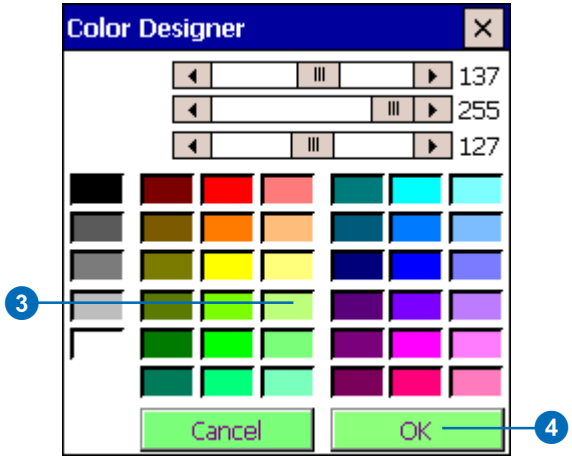
Some compression techniques do not provide exact colors and therefore could alter the result of your transparency color. For optimal transparency results use pure images such as TIFF, BMP, or PNG.

Setting transparency for a layer

1. From the Layer Properties dialog box, tap Transparency.
2. To change the transparency color, tap the color box.

   The Color Designer opens and displays a selection of colors.
3. Tap the appropriate color on the Color Designer.
4. Tap OK.
5. Use the slider bar to select the percent transparency you want for this layer.
6. Tap OK to close the Table of Contents.





The Map Grid layer

ArcPad allows you to include a Map Grid layer for your map. ArcPad displays the grid based on the current map projection. The size of each grid cell is automatically calculated by ArcPad, based on the current map scale. You can change the style of the lines and text using the Layer Properties dialog box for the Map Grid layer.

Activating the Map Grid layer

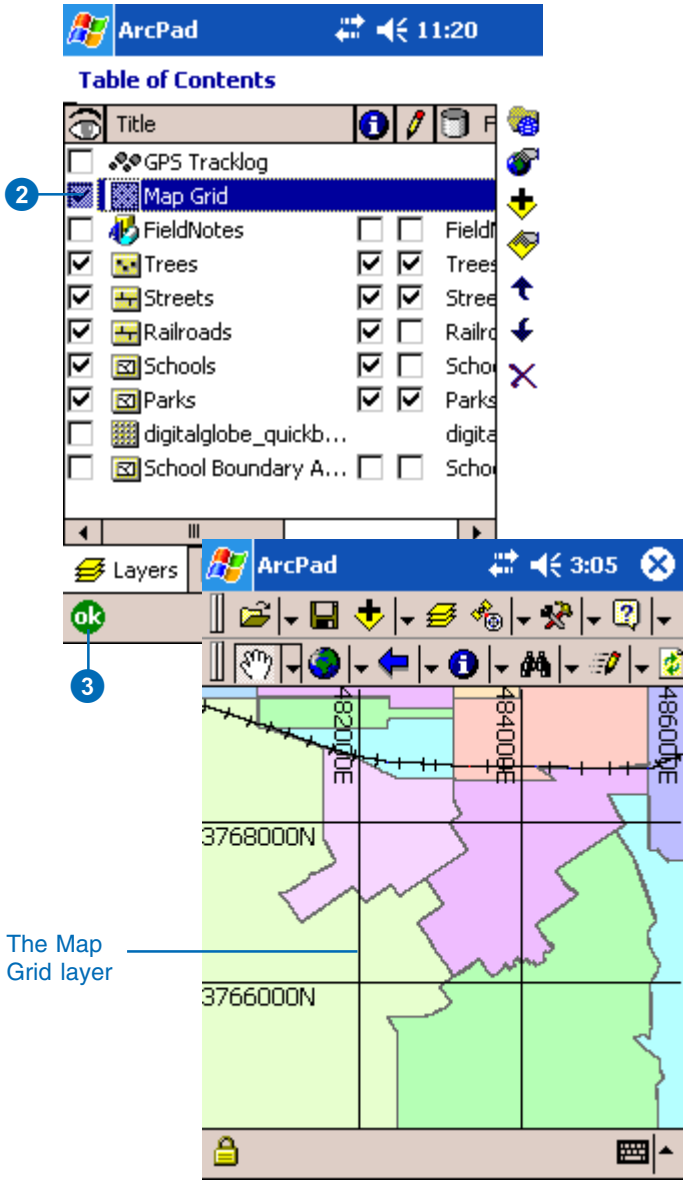
1. Tap the Table of Contents button.

   The Table of Contents opens on the Layers page.

2. Check the checkbox for the Map Grid layer.

3. Tap OK.

   The Map Grid layer is automatically generated for your ArcPad map.



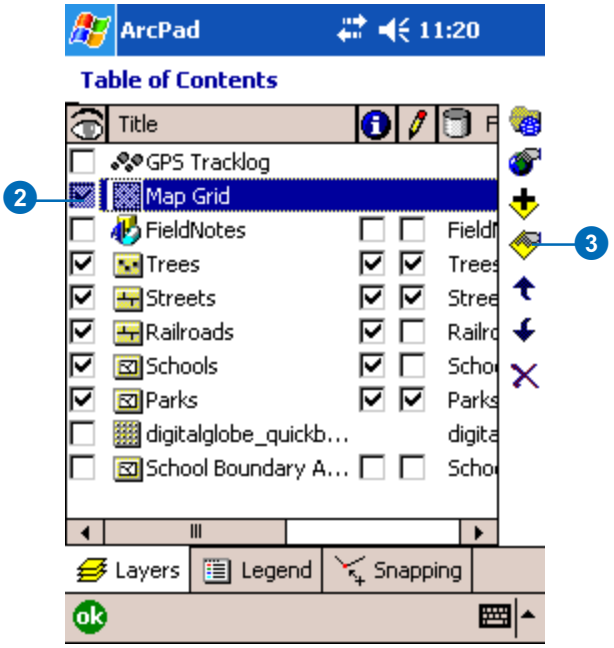
Setting the style of the Map Grid layer

1. Tap the Table of Contents button.

   The Table of Contents opens on the Layers page.

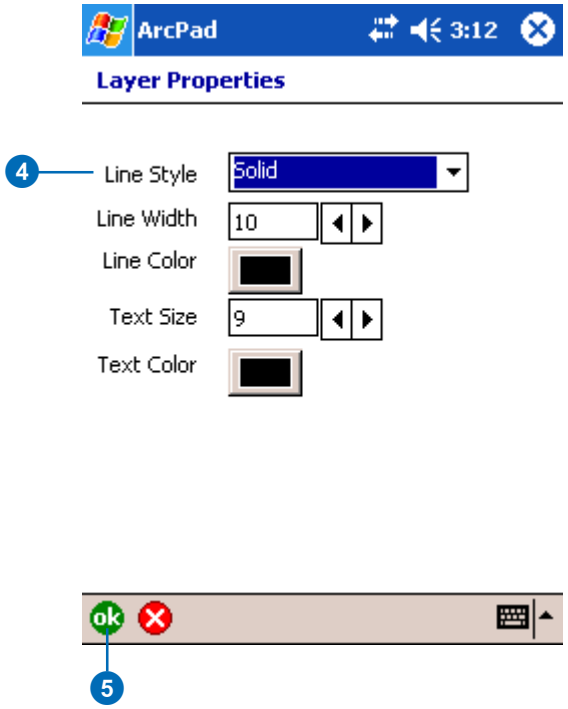
2. Tap the Map Grid layer and check its check box.

3. Open the Map Grid layer's properties by either double-tapping on the layer or tapping the Layer Properties button. ▸



4. Set the line and text properties for the grid layer.
5. Tap OK.
6. Tap OK on the Table of Contents.

   The Map Grid layer is added using the properties you defined.



Symbolizing your data

7

IN THIS CHAPTER

- How symbology works in ArcPad
- Supported symbols
- Display quality
- Displaying symbology
- Defining simple symbology
- Defining complex symbology
- Working with scale-dependent symbology
- Labeling features with text

Choosing the correct symbology for ArcPad is important for effectively displaying your data in the field. You want to be certain that you specify symbology that has sufficient contrast for the expected field lighting conditions. The artificial light and large monitors used in an office environment enable the use of a wide range of colors and symbols; whereas, only a limited number of colors and symbols provide sufficient contrast when used in the field with small computer screens and strong sunlight.

The large range of supported symbols for ArcPad enables you to display layers in the field using the symbology standards of your organization. The use of familiar symbology makes it easier for field users of ArcPad to transition from using paper maps, or desktop PCs, to using mobile devices with small, quarter-VGA screens.

ArcPad supports simple and complex symbology. Complex symbology will result in slower draw performance on a Windows Mobile device. For example, a simple red line with a width of 1 will draw quicker than a freeway line symbol that has a red line drawn over a thicker black line. To improve performance, you can select a more simple symbol and/or set display scale ranges for your layers.

How symbology works in ArcPad

ArcPad has two levels of symbology: simple and complex. Simple symbology refers to the basic style of the symbol. For example, a line layer's simple symbology can be set in ArcPad as a dashed line, a thickness of three pixels, and the color red. Complex symbology refers to symbology that is specified using a choice of marker (point), line, and fill (polygon) symbols from standard Style sheets or in the ArcPad Layer file (.apl) using the ArcPad Tools for ArcGIS Desktop. ArcPad supports most of the symbols available in ArcGIS Desktop therefore making the transition from your desktop GIS to the field much easier.

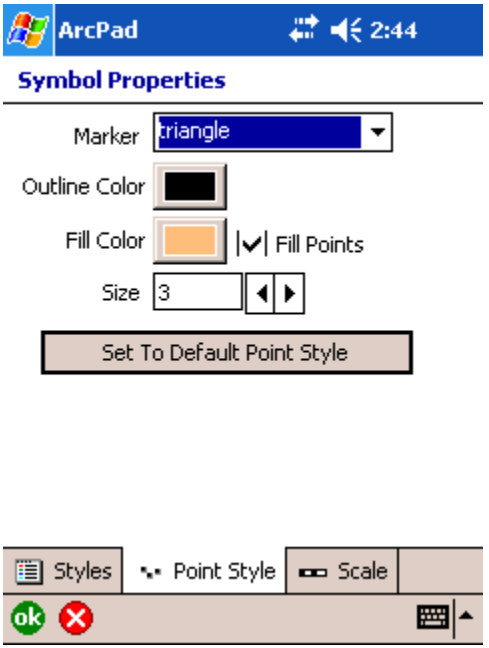
Simple symbology

Simple symbology is specified and changed in ArcPad using the Point, Line, or Polygon Style page of the Symbol Properties dialog box. The Symbol Properties dialog box is accessed via the Legend in the Table of Contents or via the Symbology tab in the Layer Properties dialog box.

The Style page can be defined for point (marker), line, and polygon (fill) layers. Once the style is set for a layer or for a subset of features within a layer, all the features in that category will have the same symbol.

The following styles can be set depending on the type of layer:

- Point Layer: In ArcPad, you can set the point marker to be a circle, square, triangle, cross, star, or diamond. In addition, you can set the outline color, the fill color, and the size of the marker.
- Line Layer: In ArcPad, you can set the line style to be solid, dash, dot, dash dot, or dash dot dot. In addition, you can set the thickness and the color of the line.



Style page for a point layer

- Polygon Layer: In ArcPad, you can set the polygon to be filled or unfilled. In addition, you can set the outline style (solid, dash, dot, dash dot, dash dot dot), thickness, and color, as well as the fill color of the polygon.

Use the Set to Default Point (Line, Polygon) Style button to clear any symbology setting for the layer before setting new simple symbology settings.

Complex symbology

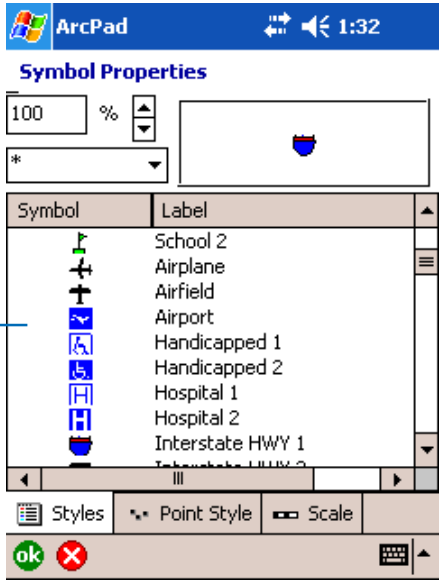
ArcPad supports a wide range of complex symbols making the transition from your desktop to the field much easier. With the capbility to use the same symbology from your desktop GIS in the field with ArcPad, you can maintain a mapping standard across your office and mobile GIS applications.

ArcGIS Desktop (ArcView 9, ArcEditor 9, or ArcInfo 9) includes more than 18,000 predefined symbols, the majority of which can be used in ArcPad either via predefined styles or via styles exported with ArcPad Tools for ArcGIS Desktop.

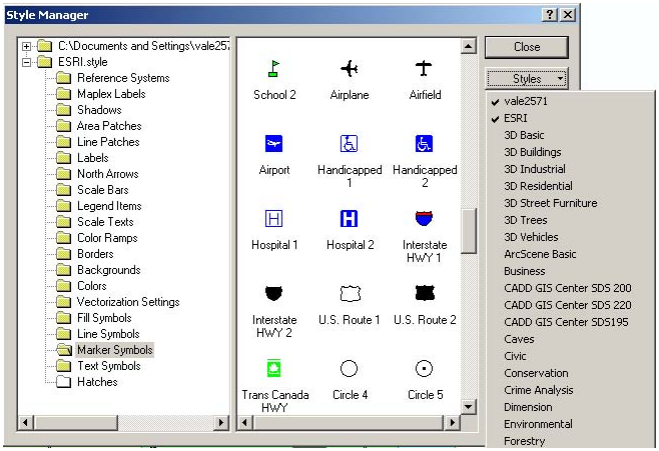
Working with styles and symbols

Styles are a collection of pre-defined colors, symbols, and properties of symbols that allow you to maintain a mapping standard and promote consistency in your organization's mapping products, whether you are working on the desktop or in the field. By default, ArcPad includes the text, marker, line, and fill symbols from the ESRI.Style, allowing you to select from an extensive list of commonly used symbols. Changes to symbology can be made directly in ArcPad with the use of Styles.

Select from an extensive list of available point symbols in ArcPad.



Point symbol properties from a style sheet.

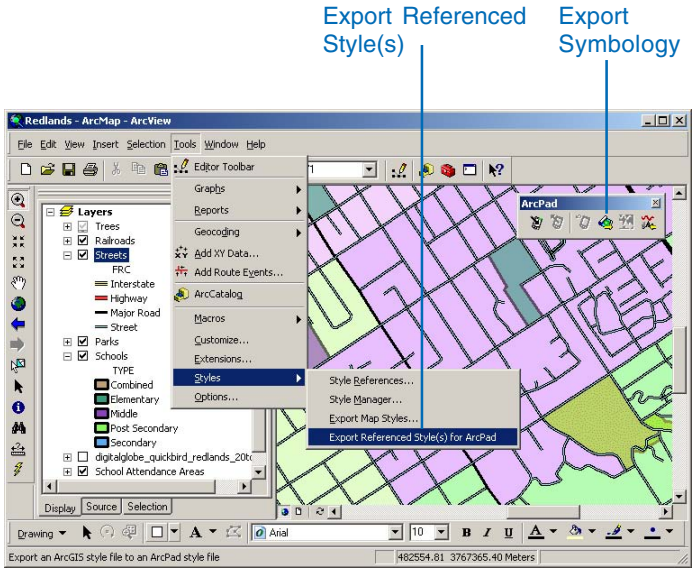


The Style Manager in ArcGIS Desktop includes a comprehensive selection of symbols and styles which can be exported for use in ArcPad.

In addition, you can create your own styles or export any of the other styles that are available in ArcGIS Desktop including commonly used symbols for conservation, forestry, and utility applications or projects. This gives you field access to almost all of the symbology available in your desktop GIS applications. Refer to *Using ArcMap* for more information about styles and the range of symbols supported by ArcGIS Desktop.

Exporting symbology from ArcGIS Desktop

Complex symbology can also be created by exporting the legend information from ArcGIS Desktop to an ArcPad Layer file (.apl) using the Export Symbology or Get Data for ArcPad (7) tools in the ArcPad Tools for ArcGIS Desktop. This enables a seamless integration between the maps you create on your desktop to ArcPad and the field. Refer to Chapter 18, 'ArcPad Tools for ArcGIS', for more information on how to export symbolgy from ArcGIS Desktop.



ArcPad Tools for ArcGIS Desktop

Supported symbols

ArcPad supports the majority of the 18,000 predefined symbols that are included with ArcGIS Desktop. Refer to *Using ArcMap* for more information about styles and the range of symbols supported by ArcGIS Desktop.

Symbology categories

Simple symbology can be defined in ArcPad and complex symbology categories can only be defined using the ArcPad tools for ArcGIS Desktop. For point, line, and polygon layers, ArcPad supports the following symbology categories:

- Single Symbol: Drawing your data with a single symbol gives you a sense of how features are distributed—whether they are clustered or dispersed. An extensive list of complex symbols are available to you in ArcPad. Alternatively, you can define simple symbology in ArcPad or you can define complex symbols using the ArcPad Tools for ArcGIS Desktop.
- Graduated Color: When you need to map quantities of things, you might choose to use a graduated color map. Graduated color maps have a series of symbols whose colors change according to the values of a particular attribute.
- Graduated Symbol: Another way to represent quantities is to vary the size of the symbol with which a feature is drawn. Like graduated color maps, graduated symbol maps are most useful for showing rank or progression values. However, instead of using color to represent the differences in values, the size of the symbol varies.
- Unique Symbol: On a unique values map, you draw features based on an attribute value or characteristic that identifies them. Typically, each unique value is symbolized with a different color.

Display quality

The display quality of your symbols directly affects the speed at which ArcPad draws them. Under certain conditions, you may want to sacrifice the display quality of your symbology in exchange for a faster drawing speed. ArcPad uses greeking to quickly display symbols at a lower threshold of quality so that they draw faster.

Greeking is a method of displaying small text or symbols by software programs. Because some text or symbols are too small to display, more simple characters or lines are used to display that text. The color and the general shape of the symbol are maintained but the details of the symbol are simplified. Greeking for points, lines, polygons, and multipoint features can be turned on or off via the Display Quality page of the ArcPad Options dialog box. These properties are stored in the ArcPadPrefs.apx file.

Display Thresholds

Display thresholds or greeking can be enabled or disabled in the ArcPad Options dialog box for points, lines, polygons, and mulitpoints. You can also change the greeking thresholds by editing the ArcPadPrefs.apx file. Refer to the ArcPad Studio Help for more detailed information on greeking thresholds.

The following display thresholds exist for each geometry type:

Point

- Threshold 1: Draw as a single pixel.
- Threshold 2: Draw using the real symbol's greeking style.

Line

- Threshold 1: Draw as a single pixel.
- Threshold 2: Draw as a greeking colored hairline.
- Threshold 3: Draw using the real symbol's greeking style.

Polygon

- Threshold 1: Draw as a single pixel
- Threshold 2: Draw as a rectangle.
- Threshold 3: Draw as a greeking colored polygon (no outline).
- Threshold 4: Draw using the real symbol's greeking style.

Multipoint

- Threshold 1: Draw as a single pixel.
- Threshold 2: Draw using the real symbol's greeking style.

Greeking for each geometry type can be turned on or off in the ArcPad Options dialog box

Displaying symbology

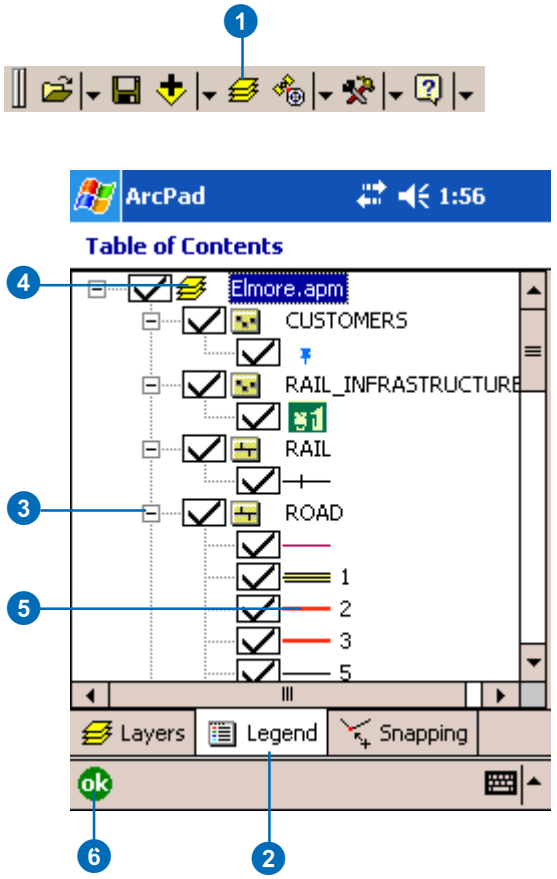
The Legend page in the Table of Contents displays the layers of the current ArcPad map with their associated symbology. Within the Legend, you can turn layers or subset of layers on and off based on their symbology. The Symbol Properties dialog box is accessed via the Legend by tapping on individual symbols.

Alternatively, you can view an individual layer's symbology by selecting a layer in the Table of Contents and opening its properties.

Displaying the current map's symbology

1. Tap the Table of Contents button.
2. Tap the Legend tab in the Table of Contents.
3. To display/hide the details of a layer's symbology, tap on the plus/minus, +/-, symbol next to the layer name or double tap the layer's icon.
4. To open the legend for all layers, tap the Layers icon at the top of the legend.
5. To view a symbol's properties, tap on the symbol.

   The Symbol Properties dialog box opens and enables you to define your simple and complex symbology.
6. Tap OK when you are finished.



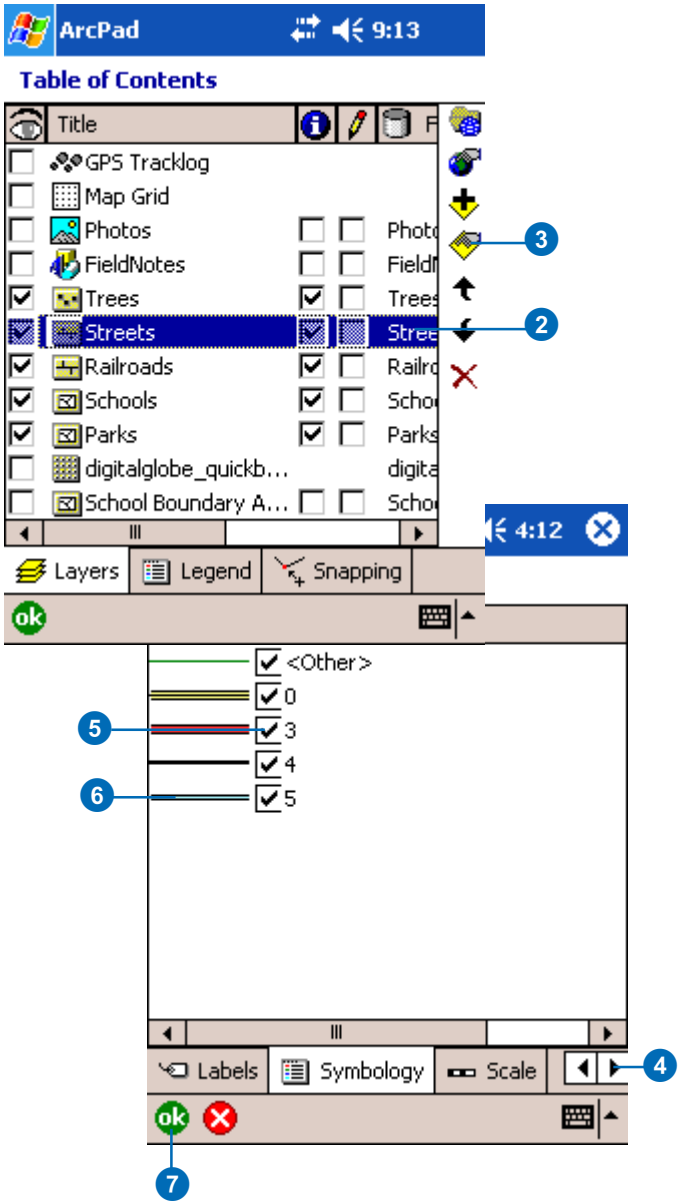
Displaying a layer's symbology

1. Tap the Table of Contents button.
2. Tap the layer you wish to display symbology for.
3. Open the Layer's properties by either double-tapping on the selected layer or tapping the Layer Properties button.
4. Tap the arrows to navigate to the Symbology page and tap on the Symbology tab.

   ArcPad displays the layer's symbology.
5. Uncheck the Value check box.

   When checked, the symbol shown will be used to display features with the corresponding attribute values. When unchecked, no symbol will be displayed for features with the corresponding attribute value.
6. To view a symbol's properties, tap on the symbol.

   The Symbol Properties dialog box opens and enables you to define your simple and complex symbology.
7. Tap OK.



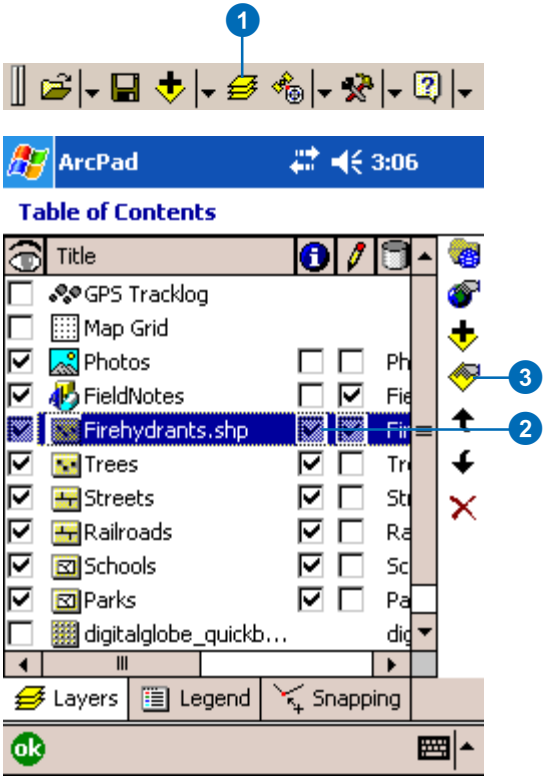
Defining simple symbology in ArcPad

Simple symbology is specified and changed in ArcPad using the Point, Line, or Polygon Style page of the Symbology Properties dialog box. The Symbol Properties dialog box is accessed via the Legend or the Symbology tab in the Layer Properties dialog box.

The Symbology can be defined for point, line, and polygon layers. Once the symbology is set for a layer or for a subset of features within a layer, all the features in that category will have the same symbol.

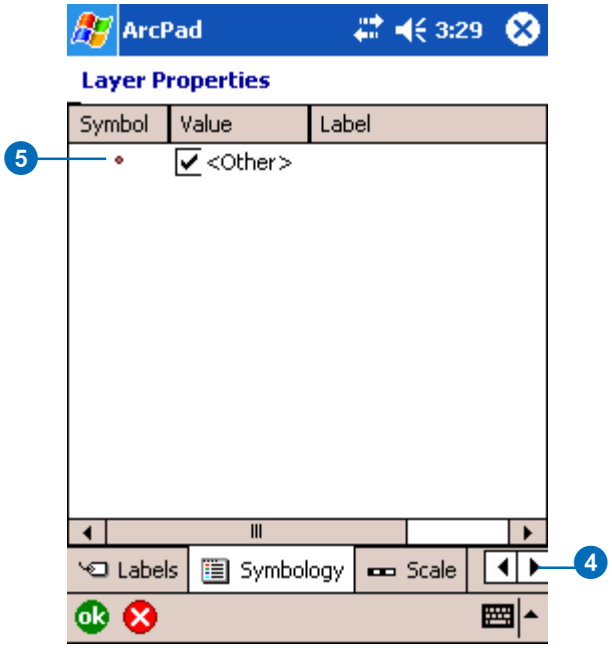
Defining a point layer's simple symbology

1. Tap the Table of Contents button.
2. Tap the layer you would like to set a style for.
3. Open the Layer Properties dialog box by either double-tapping on the selected layer or tapping the Layer Properties button. ▸



4. Tap the arrows to navigate to the Symbology page.
5. Tap the displayed symbol.

   The Symbol Properties dialog box opens. ▶



Tip

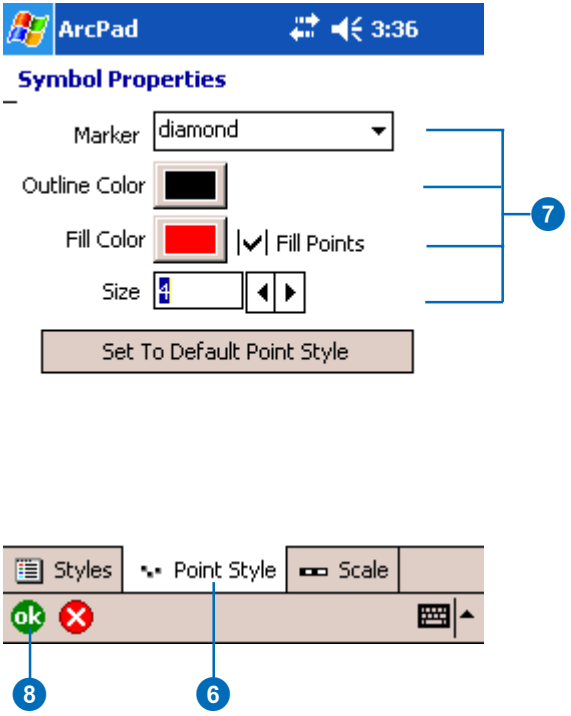
Set to Default Style

If you tap Set to Default Point (Line, Polygon) Style, ArcPad will set the point (or line or polygon) marker to the default settings. You can then make any necessary adjustments to the default.

6. Tap the Point Style page on the Symbol Properties dialog box.

   There are also Line and Polygon Style pages to set the style for line and polygon layers, respectively.

7. Select the marker type and set the outline and fill color, and size of the point symbol.
8. Tap OK on the Symbol Properties dialog box.
9. Tap OK on the Layer Properties dialog box.



Defining complex symbology in ArcPad

The Symbol Properties dialog box is used to define complex symbology in ArcPad. From the Styles page, you can select from an extensive list of point, line, or polygon (fill) symbols. ArcPad enables you to select a symbol but you cannot change the properties of a complex symbol in ArcPad.

Complex symbols are imported into ArcPad via ArcPad Tools for ArcGIS Desktop. By default, ArcPad includes the text, marker, line, and polygon symbols from the ESRI.Style sheet.

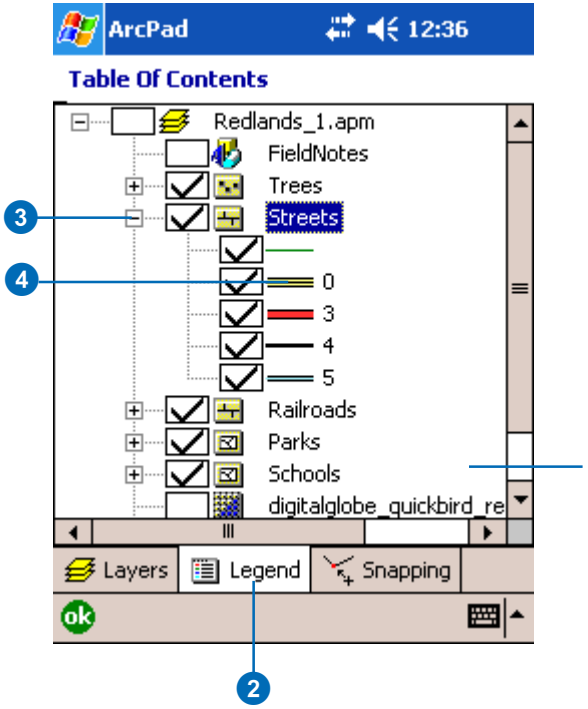
Tip

Displaying symbol properties

You can also display the Symbol Properties dialog box by tapping on a symbol from the Symbology page of the Layer Properties dialog box.

1. Tap the Table of Contents button.
2. Tap the Legend tab.
3. To display/hide the details of a layer's symbology, tap on the plus/minus, +/-, symbol next to the layer name.
4. Tap the symbol you would like to change.

   The Symbol Properties dialog box opens and enables you to define your simple and complex symbology. ▸



Tip

Arranging the list of symbols

By default, the symbols are displayed in the same order as their respective stylesheet. Tapping the Label colum heading will sort the symbols in ascending order based on the name of the label. To sort in descending order, tap the Label heading column again. Tapping the Symbol column heading will display the symbols in icon view. By default, they are displayed in list view.

5. To select a new symbol, tap on the appropriate symbol.

   The new symbol is displayed in the showcase box at the top right of your screen.

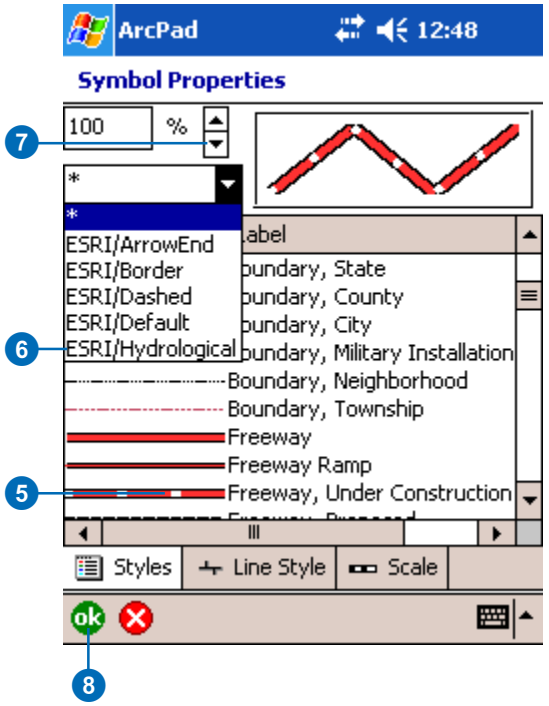
6. To view the symbols from a specific style, tap the appropriate style in the selection box.

   By default, the symbols from all imported styles are displayed, designated by the * symbol.

7. The percent box illustrates what the symbol will look like at the specified size. This setting is useful if you have defined a reference scale for the layer's symbology. Use the scroll bars or type the new percentage in the given box.

8. Tap OK on the Styles page of the Symbol Properties dialog box.

9. Tap OK on the Table of Contents.



Working with scale-dependent symbology

The Scale page of the Symbology Properties dialog box is used to specify the minimum and maximum display scales for a layer's symbology. When Show at all scales is selected, the layer's symbology will be displayed regardless of the current map scale. When Don't show when zoomed: is selected, the symbol will only be displayed when the map scale is within the range specified in the In beyond 1: and Out beyond 1: fields.

The Reference 1: scale specifies at which scale the symbol will be displayed at the defined size. The symbol will be shown larger when zoomed in, and smaller when zoomed out.

The 1:N scale button is used to capture the scale of the current map's view in ArcPad.

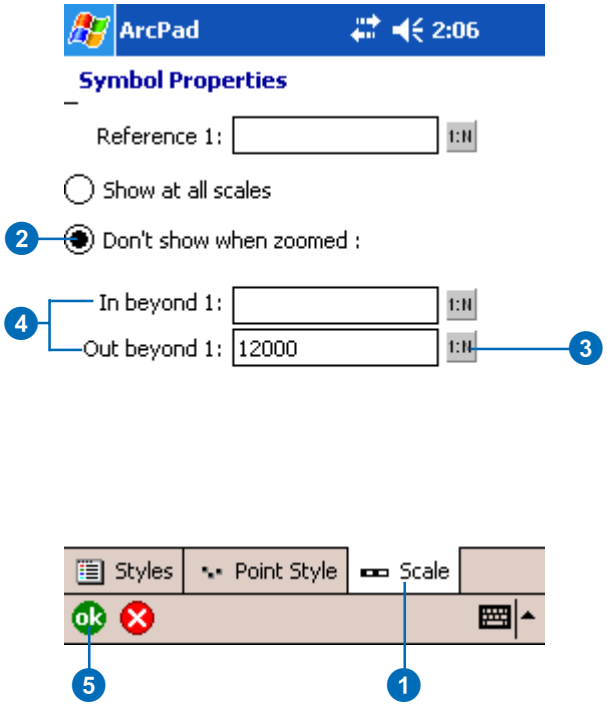
Tip

Set scale-dependent layers and labels

You can also set minimum and maximum display scales for an entire layer and for the labels of a layer. See the ArcPad Reference Guide *for more information.*

Defining scale-dependencies to display symbology

1. From the Symbol Properties dialog box, tap Scale.
2. Tap the Don't show when zoomed: radio button.
3. Tap the 1:N button to capture the current map's scale.
4. Set the minimum and maximum scale ranges, as needed.
5. Tap OK.



Labeling features with text

ArcPad allows you to label features with text. The Text Label field is supported for point, line, and polygon layers.

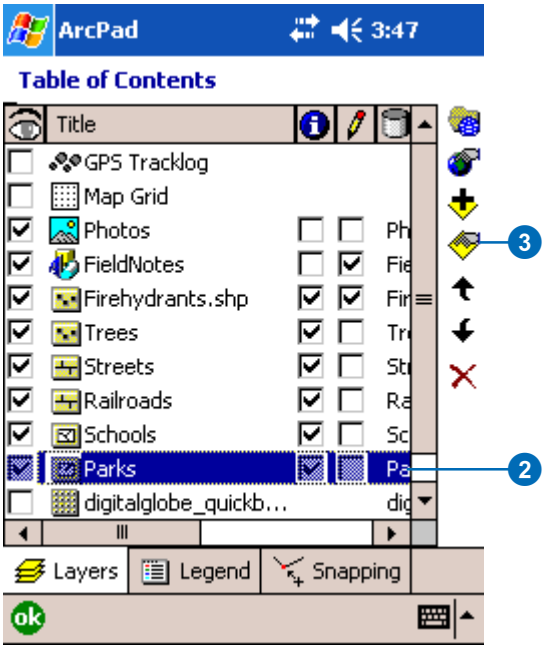
The Labels page of the Layer Properties dialog box is used to specify display settings for labels of a point, line, or polygon layer. You can specify the attribute field for the label text; the size, color, and type of font; the reference scale for the label text; the placement for point and line features; and the display scale range of the label text.

Tip

Importing text symbols from ArcGIS Desktop styles

The text symbols from the ArcGIS Desktop Styles can be imported into ArcPad using ArcPad Tools for ArcGIS. See Chapter 18, 'ArcPad Tools for ArcGIS', for more information.

1. Tap the Table of Contents button.
2. Tap the layer you wish to label with text.
3. Open the Layer's properties by either double-tapping on the selected layer or tapping the Layer Properties button. ▸



Tip

Using an expression to label your features

ArcPad enables you to use an expression to label your features. Expressions can be any valid script in the default script language (e.g. VBScript).

Following standard scripting notation, string literals must be enclosed in quotation marks, attribute fields are accessed via the [fieldname] technique, and the CStr function can be used to concatenate numeric fields. ArcPad automatically converts any resultant expression into a string.

For example, the following VBScript expression will result in a stacked label of two fileds, NAME and YEAR..

[NAME] & vbCrLf & [Year]

The following VBScript expression will result in a label showing a caption followed by the area. The area is calculated from two fields, WIDTH and LENGTH.

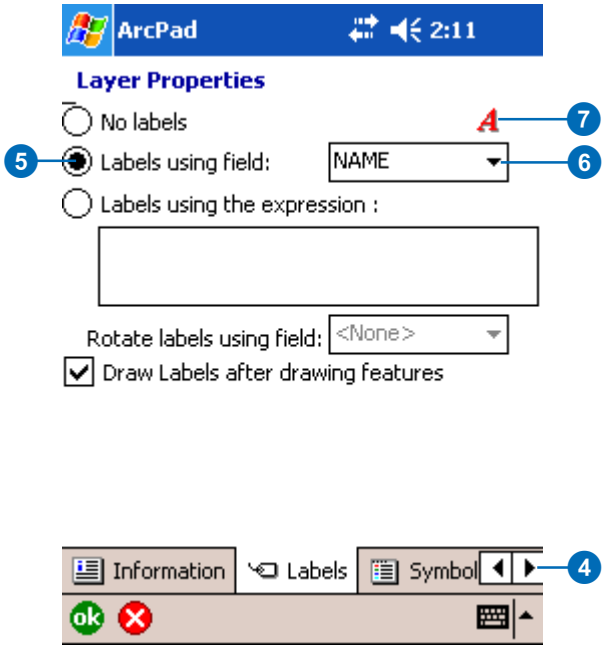
"Area=" [WIDTH] * [LENGTH]

See Also

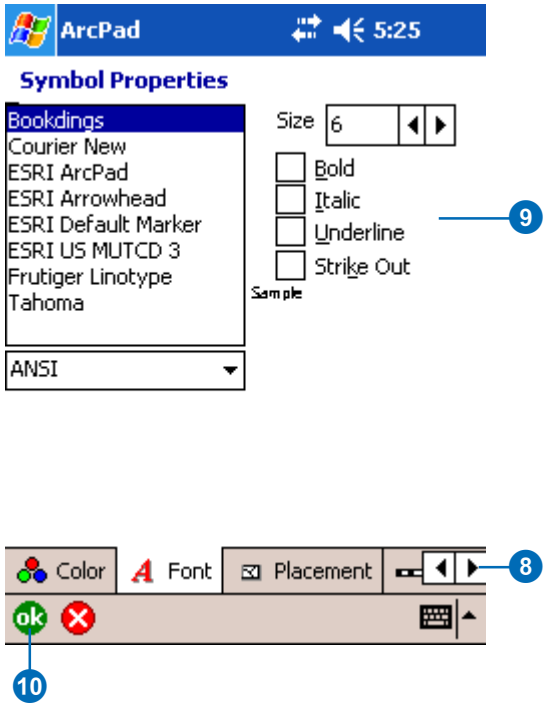
For more information on Layer Properties, see the ArcPad Reference Guide.

4. Tap the arrows to navigate to the Labels page and tap the Labels tab.
5. Check the Labels using field: radio button.
6. Select an attribute field for the label text or, optionally, enter an expression to specify your labels.
7. Tap the Label properties button.

   The Label Properties dialog box opens. ▸



8. Tap the arrows to navigate through the label properties.
9. Set your label properties including color, font type, size, style, placement, and scale.
10. When finished, tap OK.
11. Tap OK to close the Layer Properties dialog box.



Querying data

Section 3

Querying your data

8

IN THIS CHAPTER

- Identifying features
- Hyperlinks
- Finding features
- Using other tools on your query
- Finding a location
- Spatial and attribute indexes
- Using the Advanced Select tool
- Using other tools with the Advanced Select tool
- Measuring distance, area, and bearings on a map

When you are out in the field, ArcPad gives you the ability to compare your data directly to geographic features in the form of a map. More importantly ArcPad provides the tools to query your data to solve problems and retrieve information directly in the field.

With ArcPad you can:

- Uncover information about features by tapping on them.
- Display additional information about features through a picture, video, or voice recording.
- Locate a feature within the extent of your map, label it, and zoom to it.
- Find a location and zoom to it.
- Measure the distance between features.
- Determine the area of a polygon feature.

Identifying features

The Identify tool lets you view attribute information for a particular feature. Once a layer is selected for the Identify tool, make the Identify tool active and tap the feature, and the Feature Properties dialog box is displayed. By default, the Feature Properties dialog box includes pages for Attributes, Picture, Symbology—if defined—and Geography. If a custom form exists for the feature, it will be displayed. You cannot edit your data using the Identify tool; you can only view it.

Tip

Selecting layers for the Identify tool

Tap the Identify button *on the Layers page in the Table of Contents to activate all layers. Tap again to deactivate all layers.*

Selecting a layer for the Identify tool

1. Tap the Table of Contents button.

   The Table of Contents opens on the Layers page and lists all of the layers in the current ArcPad map.

2. Check the Identify tool check box for the layers you would like to retrieve information for.
3. Tap OK.

Tip

Increasing the pen tolerance to select features

Increase your pen tolerance if you are having difficulty selecting a feature. The pen tolerance can be set in the Display page of the ArcPad Options dialog box.

Tip

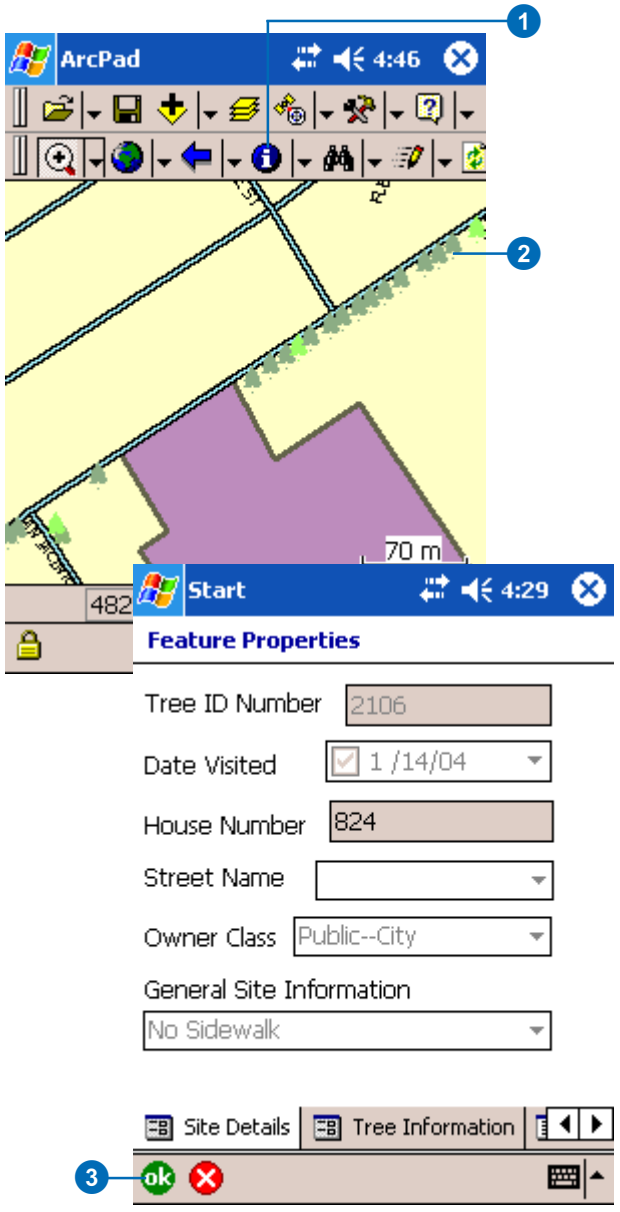
What is included in the Feature Properties dialog box?

By default, the Feature Properties dialog box includes pages for Attributes, Picture, Symbology, if defined, and Geography. If a custom form exists for the feature, it will be displayed. You cannot edit your data using the Identify tool; you can only view it.

Using the Identify tool

1. Tap the Identify button on the Browse toolbar.
2. Tap the feature you would like to identify.

   The Feature Properties dialog box or, if it exists, a custom form, is displayed.
3. Tap OK.



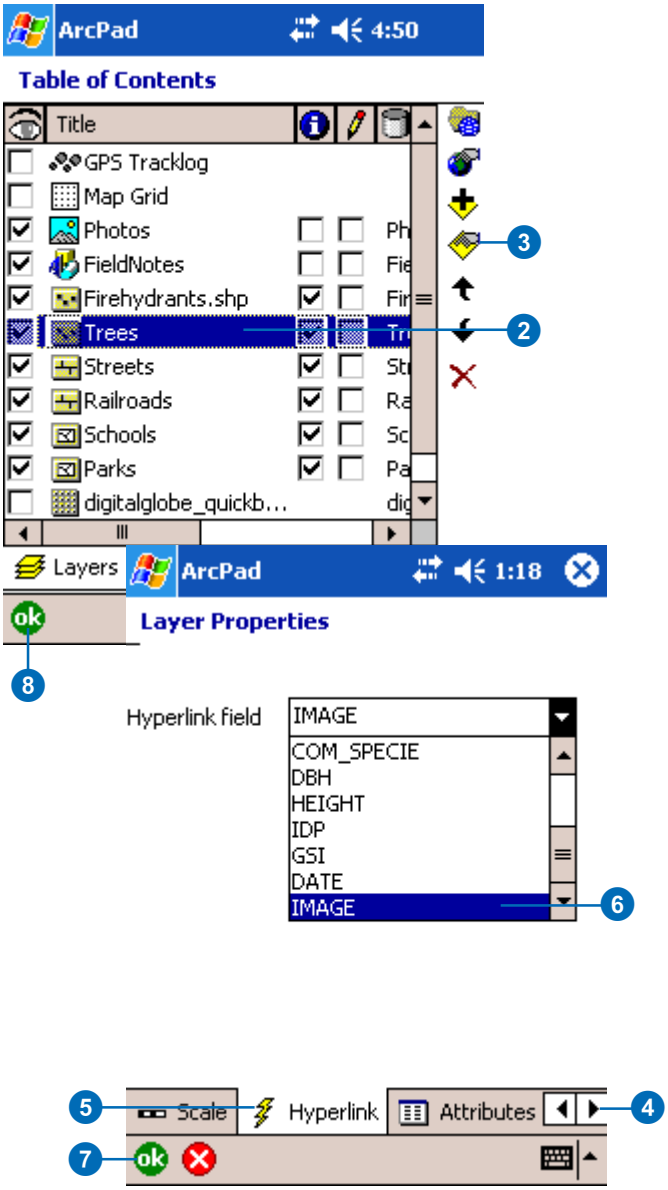
Hyperlinks

Hyperlinks provide an additional way to present information about your map features. With hyperlinks, you can display photographs, play videos, and access Web pages over the Internet for a particular feature on your map.

A hyperlink is a document path and name or a Web page address stored with the feature. A hyperlink field within a layer can be any text field which contains a file name or URL. To activate a hyperlink in ArcPad, select a field to be assigned to the Hyperlink tool in the Layer Properties dialog box.

Activating hyperlinks

1. Tap the Table of Contents button.
2. Tap the layer that you wish to activate a hyperlink for.
3. Tap the Layer Properties button.
4. Tap the right arrow to navigate to the Hyperlink page.
5. Tap the Hyperlink tab.
6. Select the Hyperlink field where the file path or Web address is stored.
7. Tap OK.
8. Tap OK on the Layers page of the Table of Contents.



Tip

Displaying hyperlinked documents

Hyperlinks in ArcPad are links to external programs. They are not opened directly in ArcPad. If you specify a Web address as a hyperlink, you must start the address with http://—for example, http://www.esri.com. ArcPad then launches your default Web browser and displays the Web page, if you are connected to the Internet. If you specify a photograph or video as a hyperlink, ArcPad will launch the associated program that will then open the document.

Tip

Troubleshooting hyperlinks

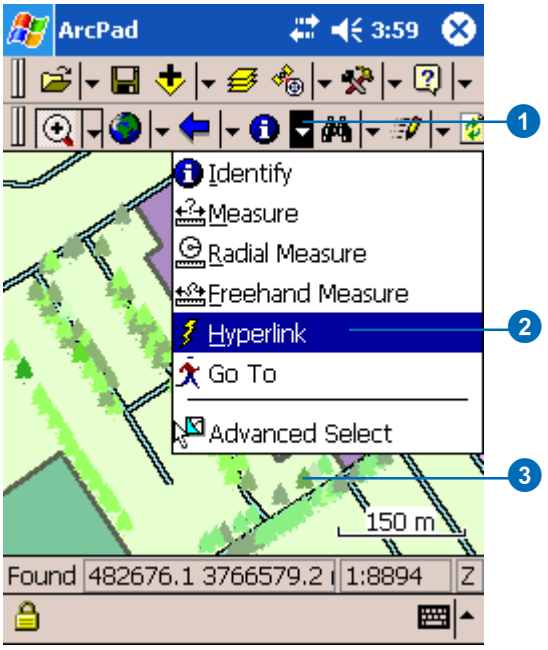
Hyperlinks will fail to launch for one of the following reasons:

- *There is no program associated with the hyperlink file.*
- *The associated program cannot find the file.*
- *The Web address does not start with http://.*
- *The Internet connection is unavailable.*

Using hyperlinks

1. Once hyperlinks have been activated for a layer, tap the dropdown arrow to the right of the Identify button.
2. Tap Hyperlink.

   The hyperlink tool is activated, and the Hyperlink button is depressed and promoted onto the toolbar.
3. Tap the feature for which you would like to display a hyperlink.
4. ArcPad launches the program associated with your hyperlink, and it is displayed on the screen.
5. Tap X to close the external application and return to ArcPad.



Finding features

The Find tool can be used to select features from a layer using a search query. The results of the query are displayed in a list. Once a list of queried features is displayed, select a feature and perform one of the following actions on that feature:

- View information about the feature using the Identify tool.
- Edit the feature's properties through the Feature Properties dialog box or a custom form, if one exists.
- Zoom to the feature and label it.
- Select a feature and make it the current navigation target.
- Center the selected feature on the screen.
- Select the feature for editing.

Using the Find tool to query data

1. Tap the Find button on the Browse toolbar.

   The Find dialog box opens.

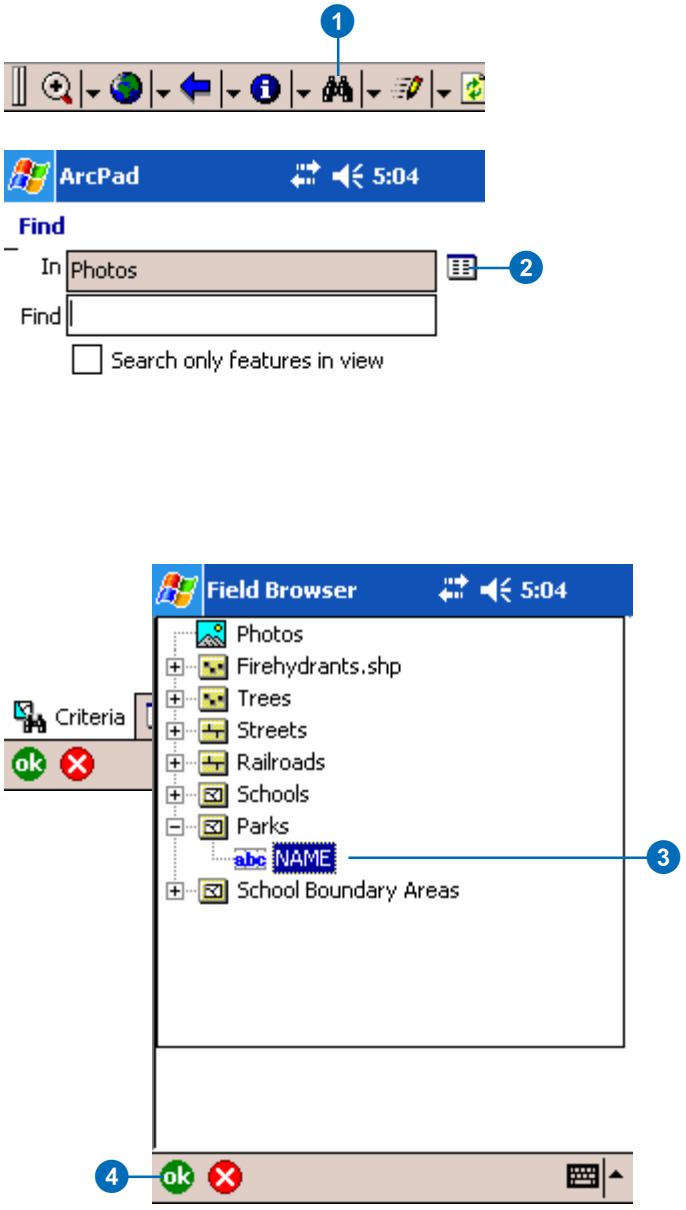
2. Tap the Select Layers button on the Criteria page of the Find dialog box.

   The Field Browser dialog box opens.

3. Tap the layer that you wish to search on and, optionally, the field.

   To select an optional field, tap on the plus, +, symbol next to the layer name to display the list of available fields.

4. Tap OK. ▸



Tip

Refining your search

Check the Search only features in view checkbox in the Find dialog box for ArcPad to only query those features that are within your screen's view.

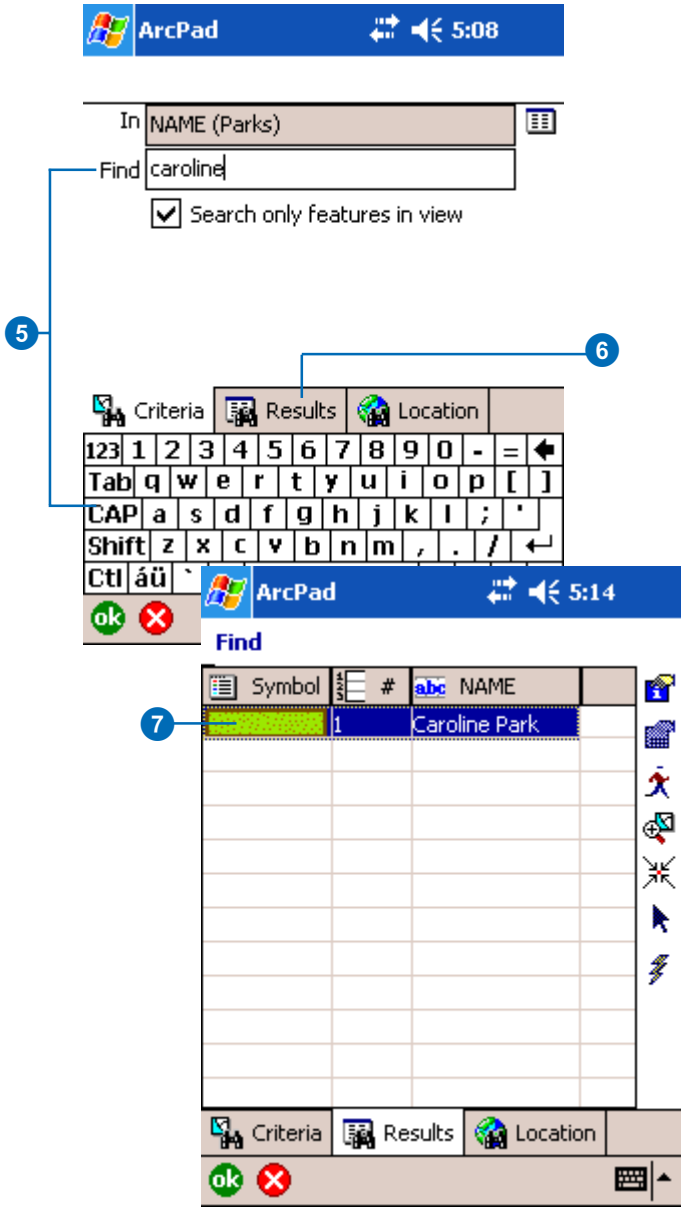
5. Use the Soft Input Panel to type the value that you want to find.

   If you do not enter a value, ArcPad will display a list of all the features in that layer when you execute the search (see Step 6).

6. Tap the Results tab to execute the search.

   ArcPad displays a list of features based on your query on the Results page of the Find dialog box.

7. Tap the feature you are searching for.

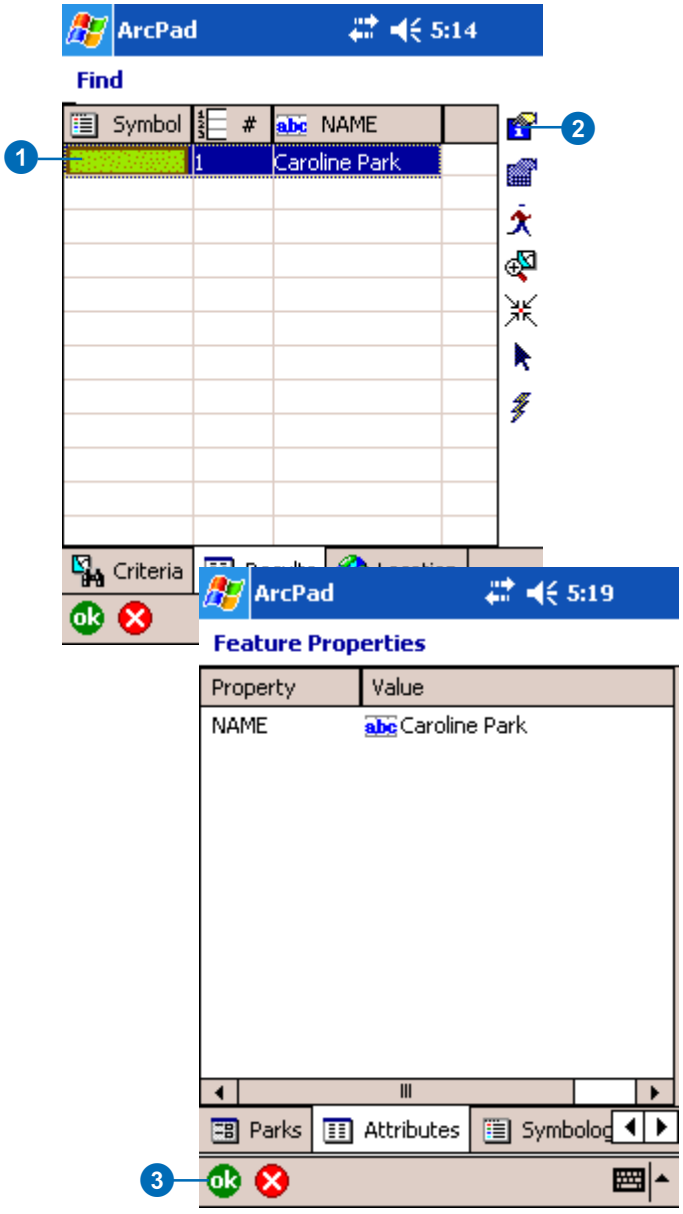


Using the Identify tool on your query

1. Tap the feature you would like to find information about.
2. Tap the Identify tool.

   ArcPad displays the Feature Properties dialog box for that feature or a custom form if it exists. You can simply view the information and not edit it.
3. Tap OK.

   ArcPad returns to the list of queried features.



Tip

Editing with the Find tool

If the Feature Properties button is unavailable once you have selected your feature, you have not selected this feature to be editable via the Start/Stop Editing tool on the Browse toolbar or in the Table of Contents. You can only display and edit features with the Feature Properties dialog box once the layers have been made editable.

Tip

Sorting the results

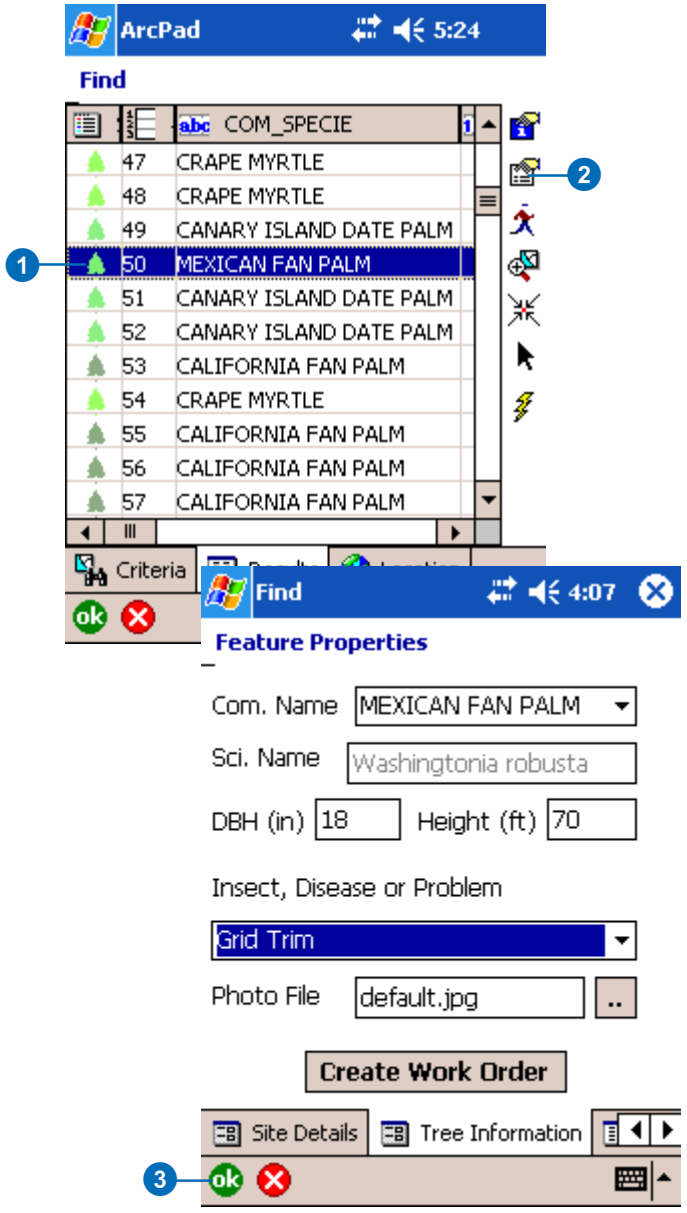
To sort the results of your search in ascending or descending order, tap the column heading on the Results page of the Find dialog box.

Using the Feature Properties tool on your query

1. Tap the feature for which you would like to display its properties.
2. Tap the Feature Properties button.

   The Feature Properties dialog box or custom form displays, if one exists. The feature properties can be edited through this method. the layer must be set as editable in order for the Feature Properties button to be enabled.
3. Tap OK.

   ArcPad returns to the list of queried features.



Tip

Changing the highlight color of selected features

Use the Display page of the ArcPad Options dialog box to change the highlight color and thickness of the box that highlights your selected feature.

Tip

Clearing the selected feature

Tap the Clear Selected Feature tool on the dropdown list to the right of the Find button on the Browse toolbar to clear the selected destination and remove its label. The feature is not deleted, it is simply unselected and therefore unhighlighted.

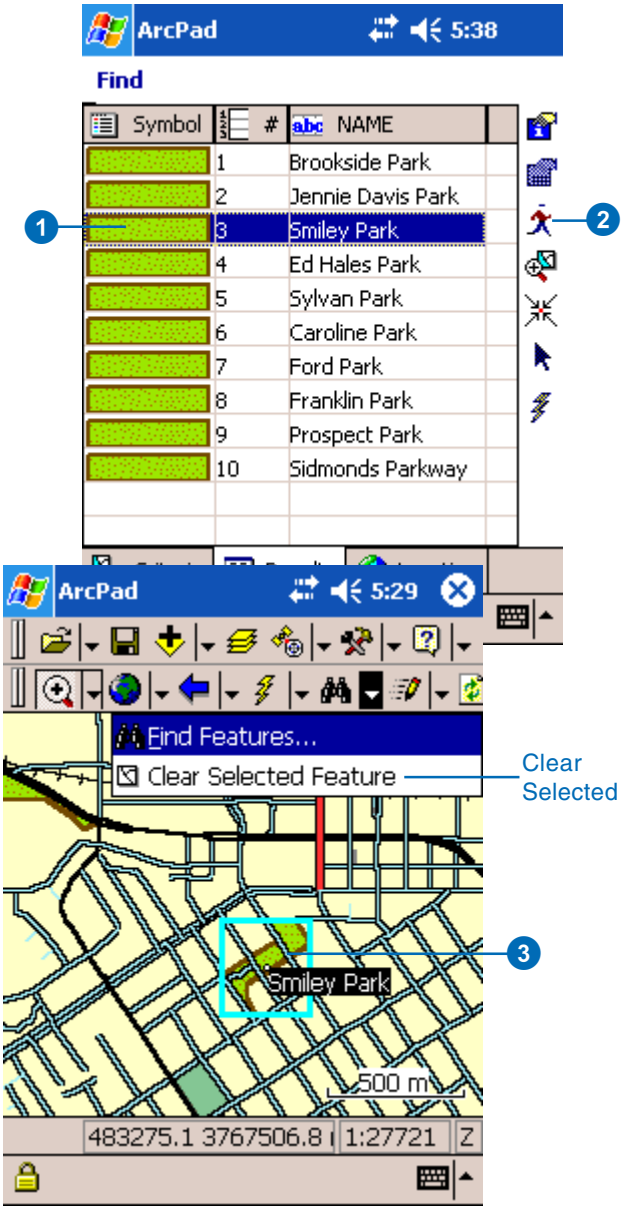
See Also

See Chapter 11, 'Navigating with your GPS', to learn how to use the Find tool and the Go To tool to select a navigation destination for your GPS.

Using the Go To tool on your query

1. Tap the feature you would like to select as a destination.
2. Tap the Go To button.
3. ArcPad zooms to the selected feature.

   The feature is highlighted using the current highlight color and set as the current navigation destination. The feature is also labeled using the value of the field that was searched on. If no field was specified, then the label will use the field that has any part of the word 'name' in the field name.



Using other tools on your query

ArcPad also includes the following tools you can perform on your query:

- Zoom to Feature

  ArcPad will zoom to the extent of the selected feature.

- Center

  ArcPad centers the selected feature on the screen. The current map scale is maintained.

- Select

  The feature is highlighted—and selected—on the map.

- Hyperlink

  A hyperlink for the feature is displayed. The Hyperlink button will be unavailable if the feature has no active hyperlink.

Tip

Resizing columns in the table of matched features

Tap and drag the column border in the field name row of the table to change the size of the columns.

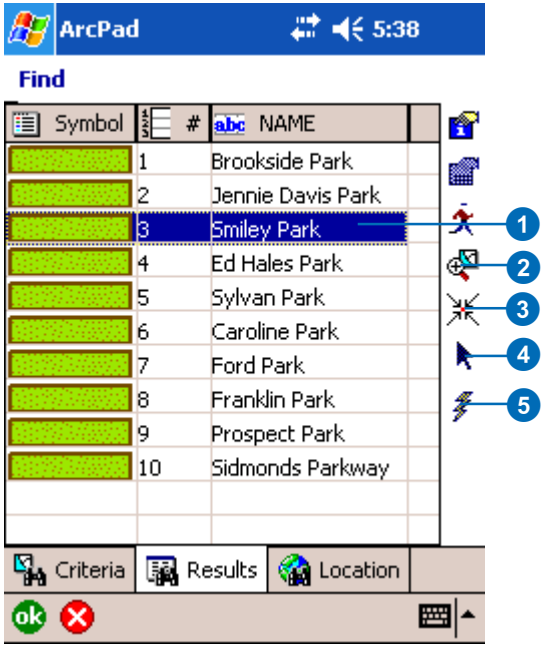
1. Tap the feature you would like to query. Follow Steps 2, 3, 4, or 5 depending on what action you would like to perform.
2. Tap the Zoom to Feature tool.

   ArcPad will zoom to the extent of the selected feature.
3. Tap the Center tool.

   ArcPad will center the selected feature on the screen. The current map scale is maintained.
4. Tap the Select tool.

   The feature is highlighted and selected.
5. Tap the Hyperlink tool.

   The hyperlink for the feature is displayed if there is one.



Finding a location

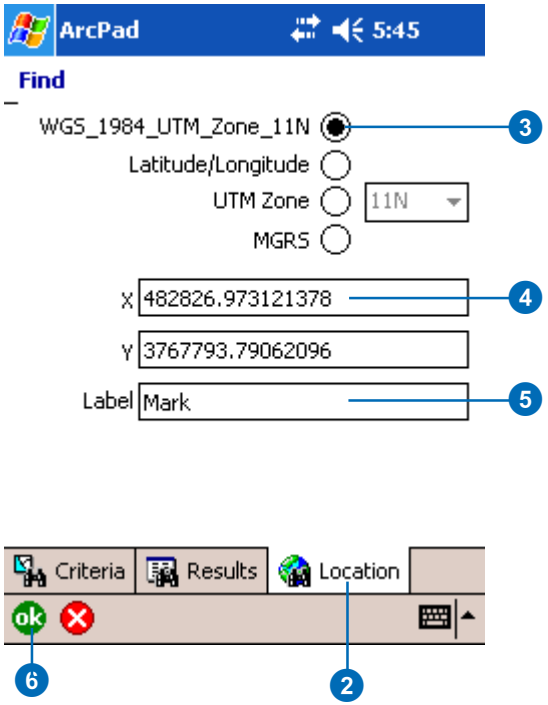
The Find dialog box also enables you to find a location based on a set of coordinates. You can select from the following coordinate systems: WGS84, Latitude/Longitude, UTM Zone, and MGRS. Simply enter the required information and ArcPad will go to the location and label it. The default label is Mark.

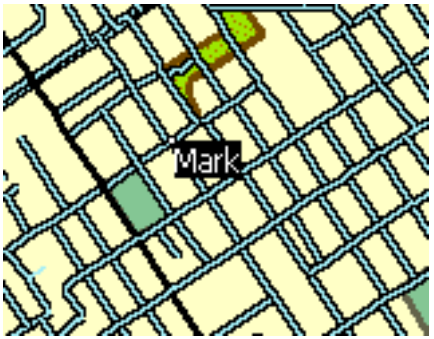
Using the Find tool to locate a place

1. Tap the Find button on the Browse toolbar.

   The Find dialog box opens.
2. Tap the Location tab.
3. Tap the appropriate radio button from the available selection.
4. Enter the required coordinate information.
5. Enter a name for the label. The default is Mark.
6. Tap ok.

   The location is labeled on your map.





Spatial and attribute indexes

An index is a data structure used to speed the search for records in a database or for spatial features in geographic datasets. Attribute indexes are used with data in tables. Spatial indexes are used with graphical queries of spatial features. Having a current spatial index ensures that a high level of performance is maintained when drawing and working with the shapefile's features and that the shapefile's extent is accurate.

ArcPad supports spatial and attribute indexes of shapefiles. You can create spatial and attribute indexes in ArcPad via the Attributes tab in the Layer Properties dialog box. ArcGIS Desktop is used to create spatial indexes for large shapefiles.

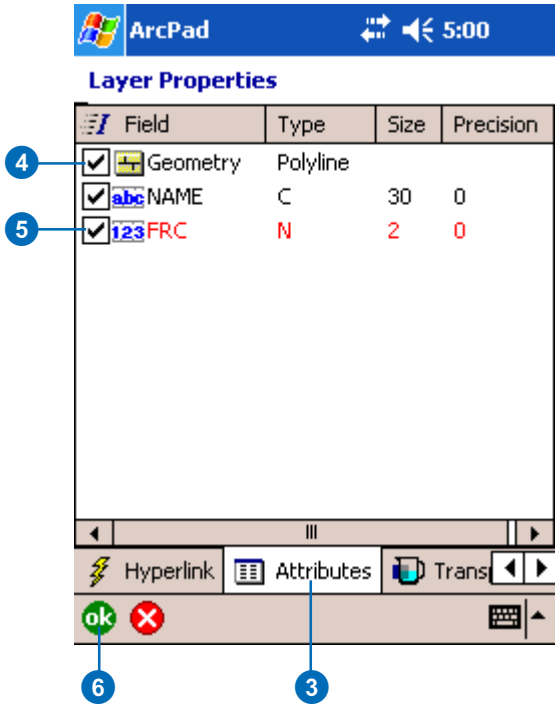
See Also

For more information on spatial and attribute indexing, see Using ArcCatalog *and the ArcGIS Desktop Help.*

Creating a spatial and/or attribute index in ArcPad

1. In the Table of Contents, select the layer you would like to create an index for.
2. Open the Layer Properties dialog box by double-clicking the layer or by tapping the Layer Properties button.
3. Tap the Attributes tab.
4. Check the Geometry checkbox under the Index column to create a spatial index for the layer.
5. Check the appropriate field checkbox under the Index column to create an attribute index for that field.
6. Tap ok.

   Your indexes are created.



Using the Advanced Select tool

The Advanced Select tool can be used to select multiple features at once. Features are selected from the active layers for the Identify tool in the Table of Contents. One, many, or all vector layers can be activated for the Advanced Select tool. The selected features are displayed in a list.

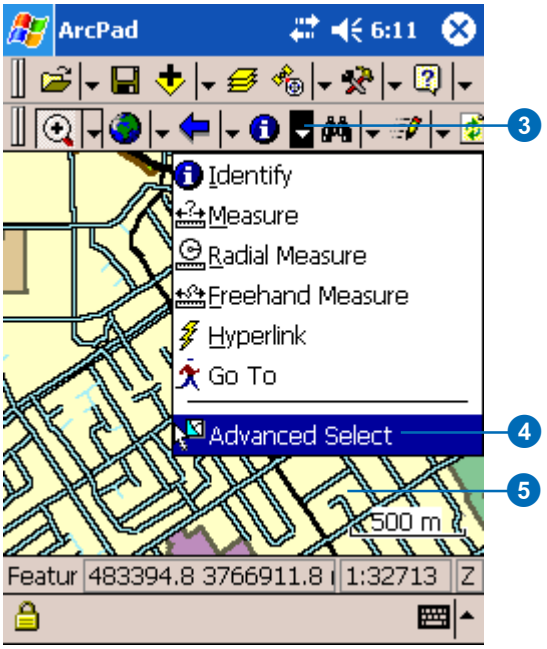
See Also

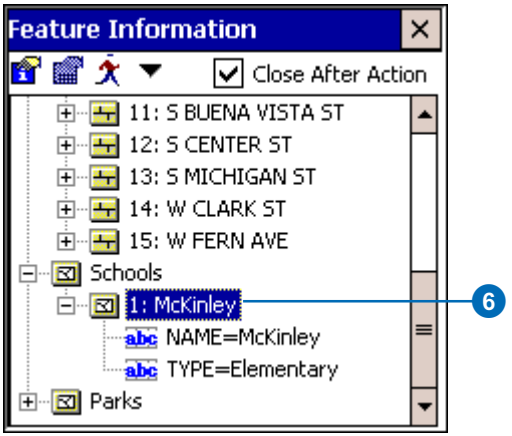
Refer to Chapter 11, 'Navigating with your GPS', for information on using the Advanced Select tool with your GPS.

1. Tap the Table of Contents button.
2. Check the Identify check box for the layers you would like to use with the Advanced Select tool and tap OK.
3. Tap the dropdown arrow to the right of the Identify button.
4. Tap Advanced Select.

   A red box around the Advanced Select tool indicates that it is active.
5. Tap the map to select a feature, or tap and drag a selection box to select multiple features from the active layers.

   A list displays the coordinates where the map was tapped and the selected features. Tap the + icon to display the attributes of the selected feature.
6. Tap the feature you wish to select.

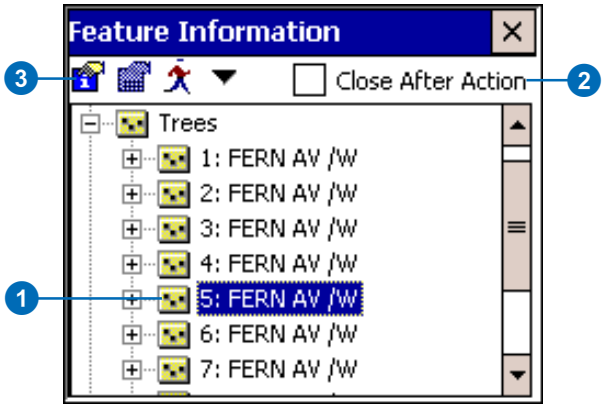


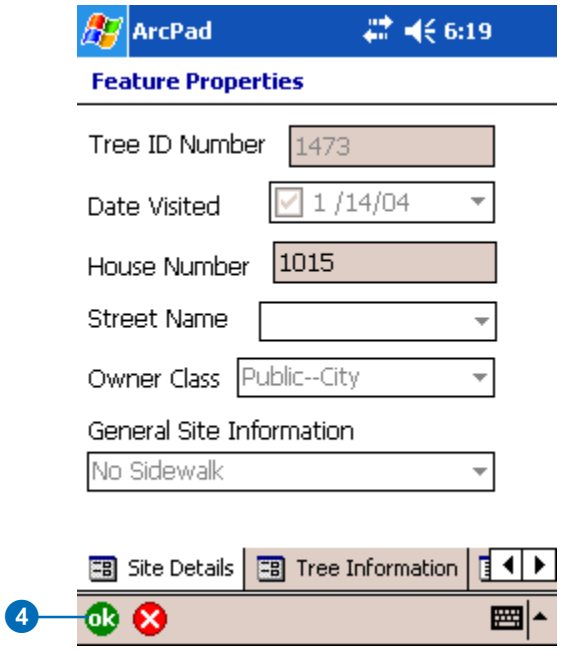


Using the Identify tool with the Advanced Select tool

1. Tap the feature you would like to find information about.
2. Uncheck the Close After Action check box if you wish to keep the Feature Information dialog box open after you Identify the feature.
3. Tap the Identify tool.

   ArcPad displays the Feature Properties dialog box for that feature or a custom form, if it exists. With the Identify form, you can only view the attribute information but you cannot edit it.
4. Tap OK.

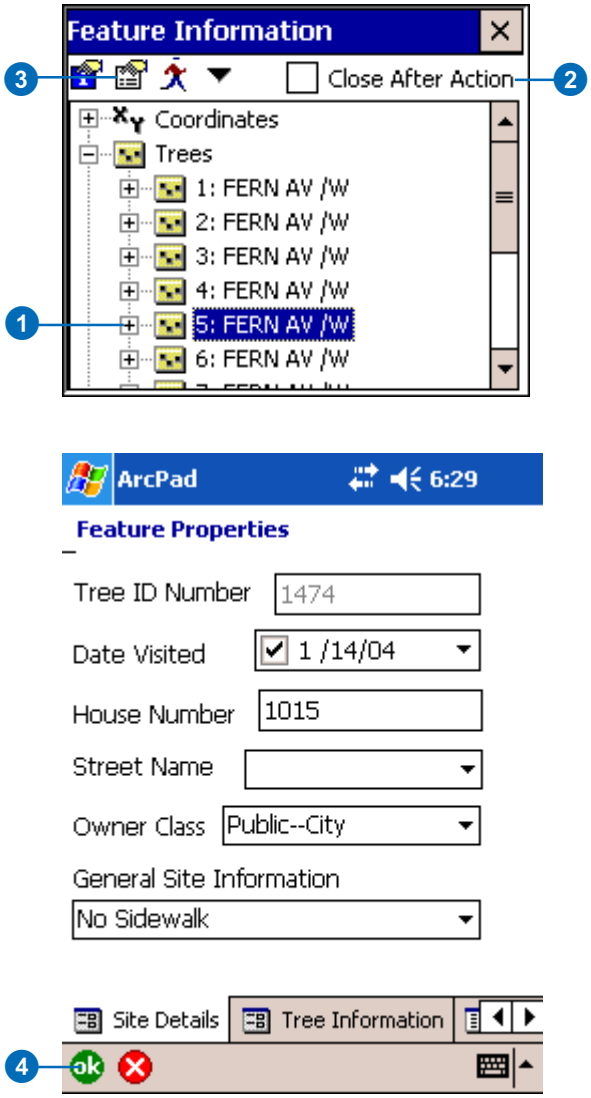




Using the Feature Properties tool with the Advanced Select tool

1. Tap the feature for which you would like to display its properties.
2. Uncheck the Close After Action check box if you wish to keep the Feature Information dialog box open after you view the feature's properties.
3. Tap the Feature Properties button.

   The Feature Properties dialog box or custom form displays, if one exists. The feature properties can be edited or viewed through this method. In order to edit the layer, it must be set as editable in the Table of Contents or via the Start/Stop Editing dropdown list on the Browse toolbar.
4. Tap OK.



Tip

Changing the highlight color of selected features

Use the Display page of the ArcPad Options dialog box to change the highlight color and thickness of the box that highlights your selected feature.

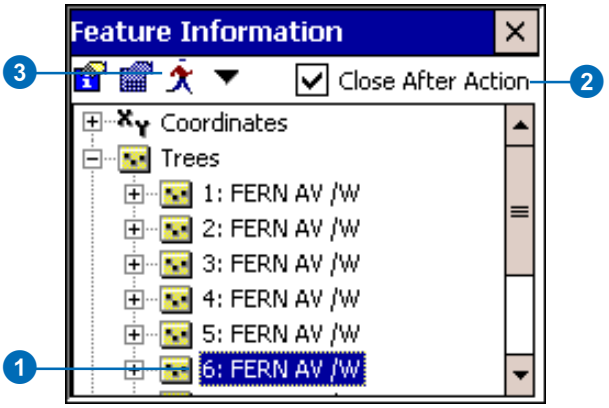
Using the Go To tool with the Advanced Select tool

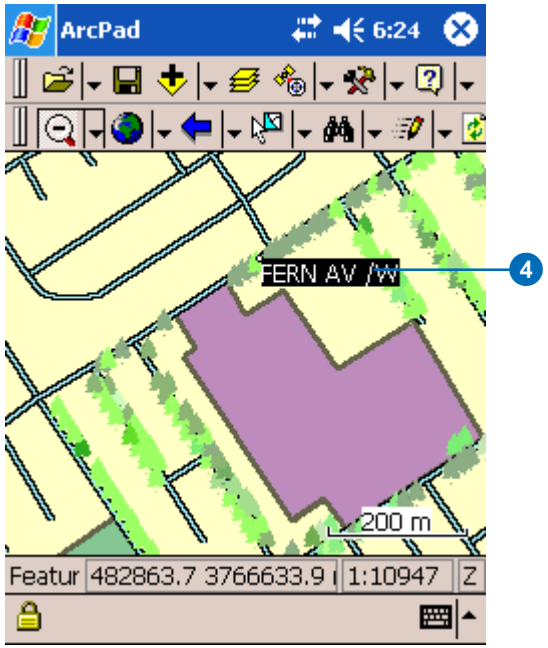
1. Tap the feature you would like to go to and select as a destination.
2. Check the Close After Action check box.

   The Feature Information dialog box will close after you go to the feature.
3. Tap the Go To button.

   ArcPad zooms to the selected feature.
4. The feature is highlighted using the current highlight color and set as the current navigation target.

   The feature is also labeled using the value of the field that was searched on. If no field was specified, then the label will use the field that has any part of the word 'name' in the field name.





Using other tools with the Advanced Select tool

ArcPad also includes the following tools that you can use with the Advanced Select tool:

- Zoom to Feature

  ArcPad will zoom to the extent of the selected feature.

- Center

  ArcPad centers the selected feature on the screen. The current map scale is maintained.

- Select

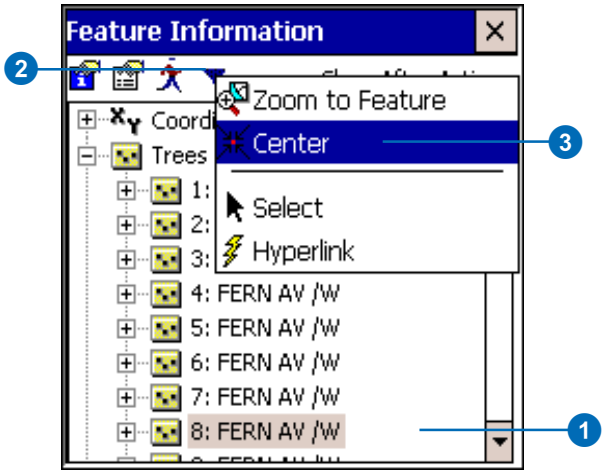
  The feature is highlighted—and selected—on the map.

- Hyperlink

  A hyperlink for the feature is displayed. The Hyperlink button will be unavailable if the feature has no active hyperlink.

1. Tap the feature you wish to select.
2. Tap the dropdown arrow on the Feature Information dialog box.
3. Tap Center.

   ArcPad centers the selected feature on the screen. The current map scale is maintained.



Measuring distance, area, and bearings on a map

ArcPad lets you measure distance, area, and bearings on your map. ArcPad has three principal measuring tools: the Measure tool, the Freehand Measure tool, and the Radial Measure tool. The Measure tool allows you to measure distance in a straight line or a series of lines to form a polygon. The Freehand Measure tool enables you to draw a line or object freely on your map. The Radial Measure tool measures the radius of a circle. Each of these tools also allows you to determine area, view coordinates for the from and to locations, and measure bearings.

Tip

Changing measuring units

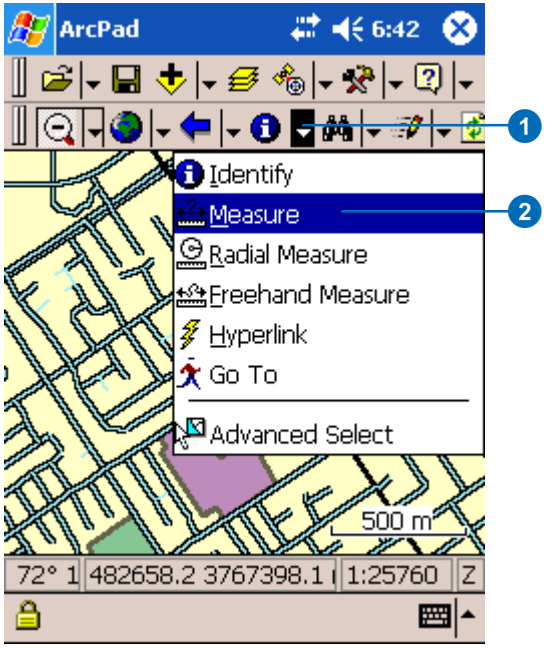
You can change the units used for measuring in the ArcPad Options dialog box under the Display page.

Using the Measure tool

1. Tap the arrow to the right of the Identify tool to display the dropdown list.
2. Tap Measure.

   The Measure tool is activated, and the Measure button is depressed and promoted onto the toolbar. A red box around the Measure tool also indicates that it is active.

   The Command bar is displayed at the bottom of the map window. ►

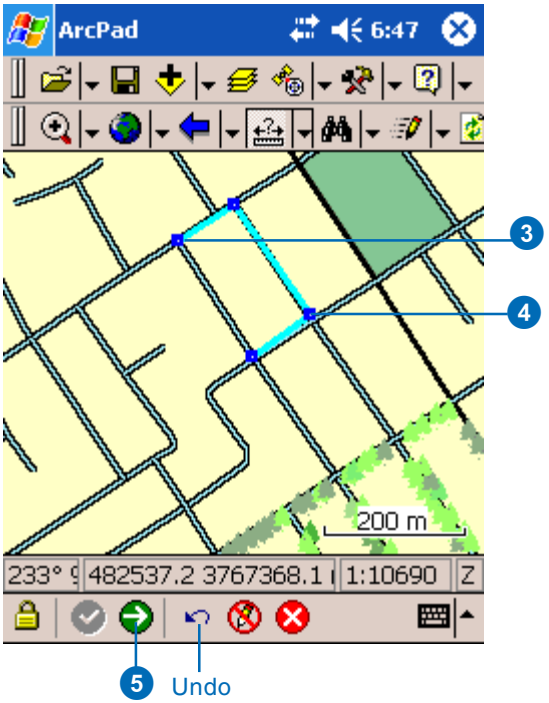


Tip

Undoing or cancelling your measurement reference points

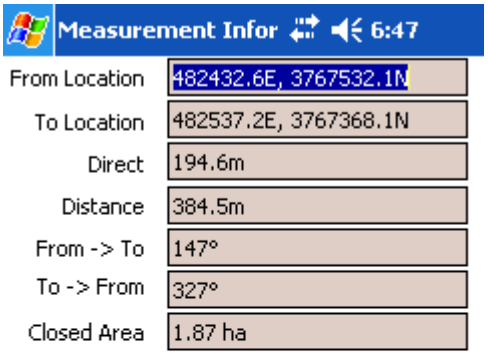
Use the Undo tool *on the Command bar to go back a step to the previously captured point for your measurement or use the Cancel Edits tool* *to erase all points for your measurement.*

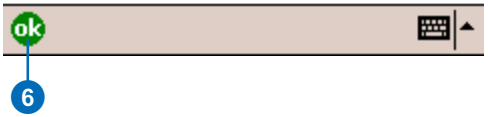
3. Tap the map where you would like to begin to measure.
4. Tap again to end the distance or continue to tap to create a polyline or polygon.
5. Tap the Proceed button on the Command bar when you are finished. ►



The Measurement Information dialog box displays with the following data: the coordinates (from and to location); the direct distance (from start to end); the actual distance drawn; the bearings; and if you drew more than two vertices, the estimated closed area of the shape.

6. Tap OK to close the Measurement Information dialog box.

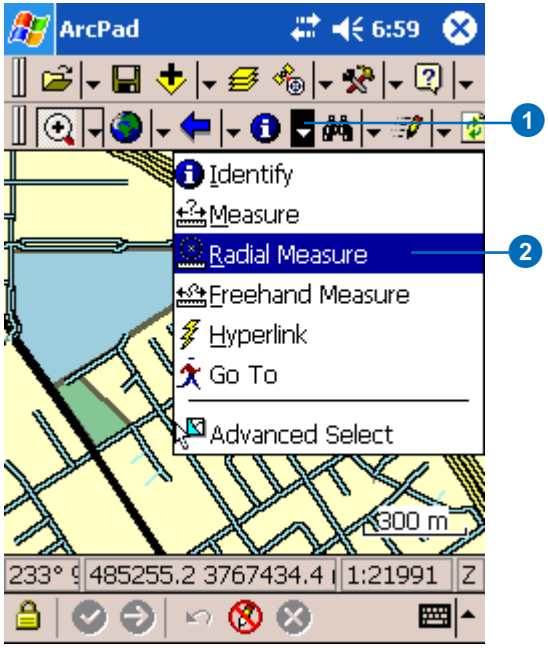




Using the Radial Measure tool

1. Tap the arrow to the right of the Identify tool to display the dropdown list.
2. Tap Radial Measure.

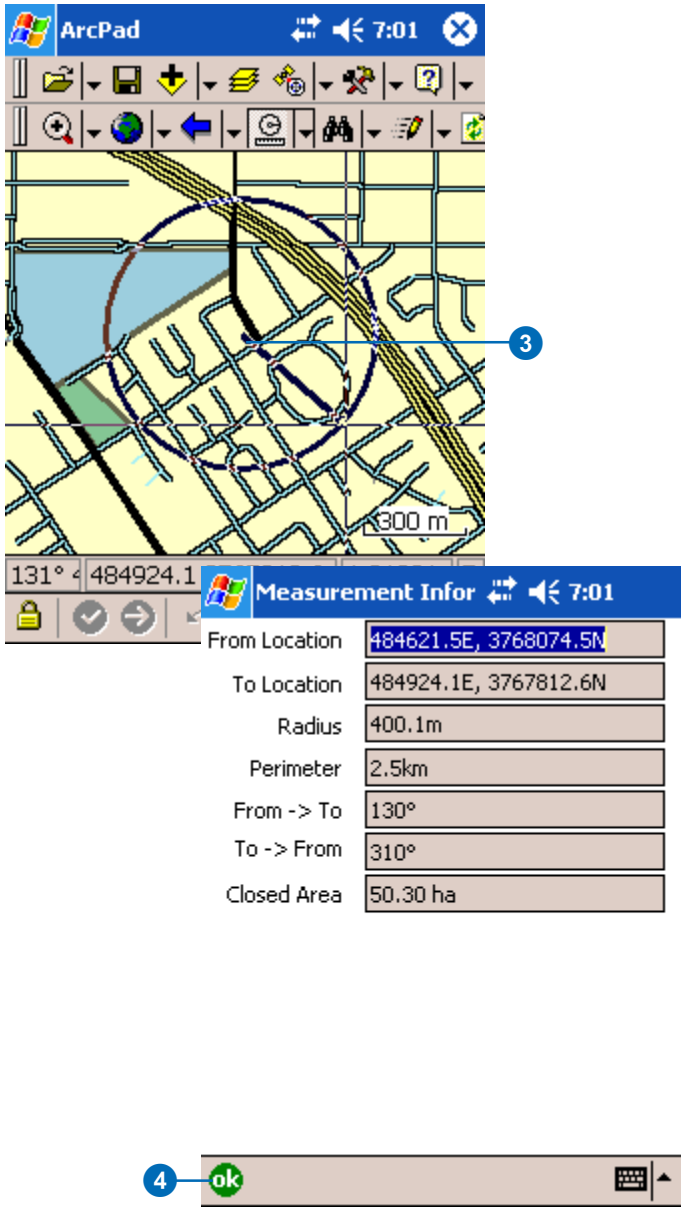
   The Radial Measure tool is activated, and the Radial Measure button is depressed and promoted onto the toolbar. A red box around the Radial Measure tool also indicates that it is active. ►



3. Tap and hold the radial length you wish to measure.

   ArcPad displays the Measurement Information dialog box with the following data: the coordinates (from and to location), the radius, the perimeter, the bearings, and the area.

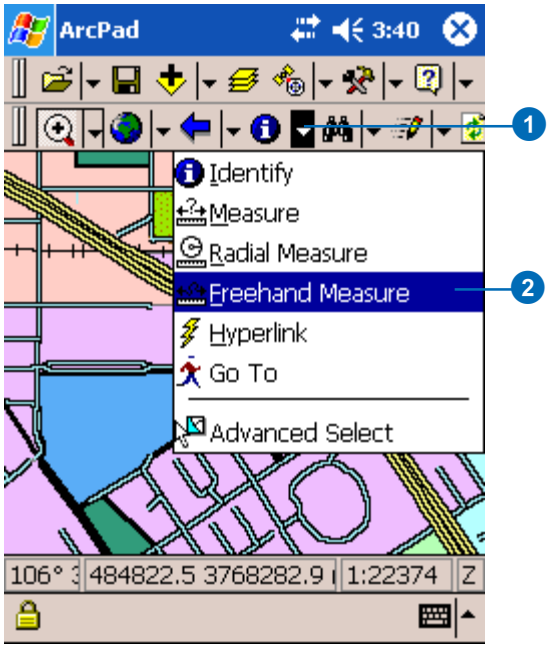
4. Tap OK to close the Measurement Information dialog box.



Using the Freehand Measure tool

1. Tap the dropdown arrow to the right of the Identify button to display the dropdown list.
2. Tap Freehand Measure.

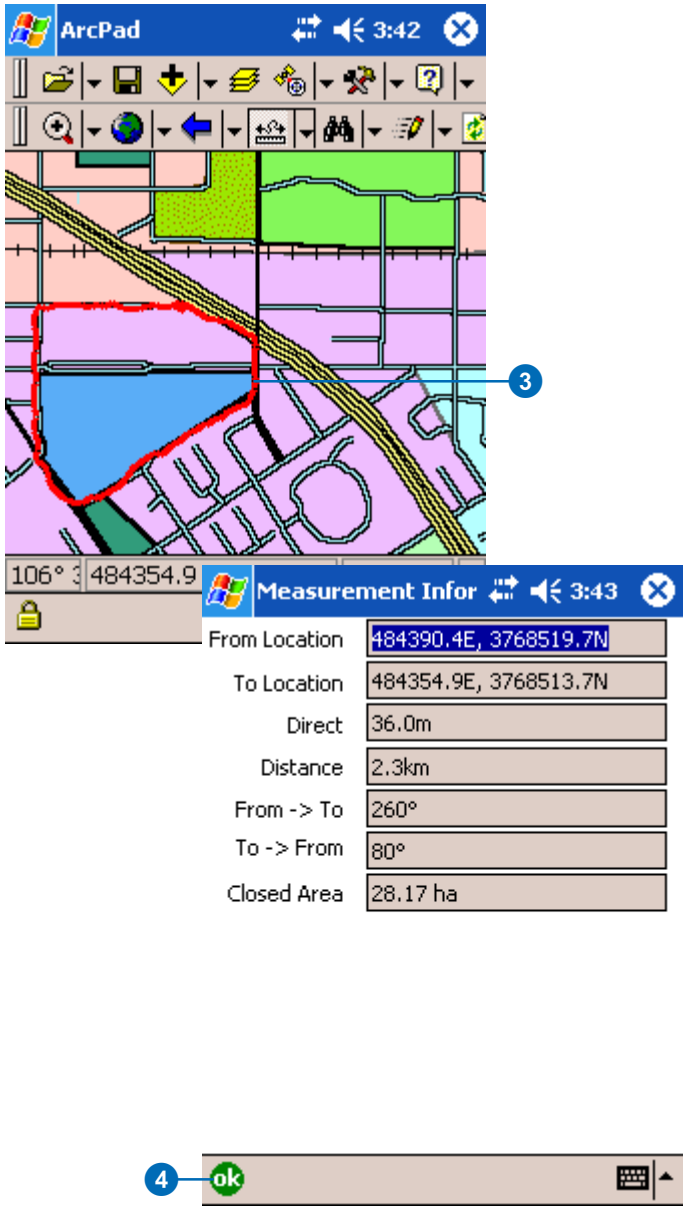
   The Freehand Measure tool is activated, and the Freehand Measure button is depressed and promoted onto the toolbar. A red box around the Freehand Measure tool indicates that it is active. ▸



3. Draw the line you wish to measure by tapping and holding the pen on the map.

   ArcPad displays the Measurement Information dialog box with the following data: the coordinates (from and to location), the direct distance (from start to end), the actual distance drawn, the bearings, and the area.

4. Tap OK to close the Measurement Information dialog box.



Using data capture devices

Section 4

Connecting your GPS receiver

9

IN THIS CHAPTER

- Introduction to GPS
- Supported GPS protocols
- Connecting your GPS receiver
- Setting communication parameters
- Activating your GPS
- The GPS/Rangefinder Debug tool
- Troubleshooting your GPS connection
- NMEA 0183 sentences recognized by ArcPad
- TSIP packets recognized by ArcPad

This chapter begins with an introduction to the global positioning system (GPS) and describes how to connect your GPS receiver to ArcPad. This chapter also discusses which GPS protocols are supported by ArcPad and how to use the GPS/Rangefinder Debug tool to verify or troubleshoot your GPS connection.

Introduction to GPS

GPS is a radio-based navigation system capable of providing an exact three-dimensional position (latitude, longitude, and altitude) anywhere on the earth, 24 hours a day, in any weather condition. GPS consists of three components: space, control, and user segments. The *space segment* is a constellation of 24 active satellites—as well as a few spares—orbiting the earth at a height of approximately 12,600 miles in six evenly distributed orbital planes. The *control segment* consists of five tracking stations spread out around the earth that monitor the satellites' orbits and send precise orbital data and clock corrections back to the satellites. The *user segment* is made up of GPS receivers and the user community. GPS was originally developed by the U.S. Department of Defense (DoD) for military use. However, GPS has also proven to be a very useful tool for civilian use and is available to anyone with a GPS receiver.

Each GPS satellite transmits signals on two frequencies: L1 (1575.42 MHz) and L2 (1227.60 MHz). The L1 frequency contains the civilian Coarse Acquisition (C/A) Code as well as the military Precise (P) Code. The L2 frequency contains only the P code. The P code is encrypted by the military—using a technique known as anti-spoofing—and is only available to authorized personnel. The encrypted P code is referred to as the Y Code. Civilian GPS receivers use the C/A Code on the L1 frequency to compute positions—although high-end survey grade civilian receivers use the L1 and L2 frequencies' carrier waves directly. Military GPS receivers use the P (Y) Code on both L1 and L2 frequencies to compute positions.

GPS receivers monitor these signals from multiple satellites—at least three for a two-dimensional position and at least four for a three-dimensional position—and through a process called trilateration, they compute a position. This position is accurate from about 10 to15 meters—now that selective availability, an intentional degradation of the satellite signals, has been turned off—down to a centimeter or less, depending on equipment and conditions.

GPS accuracy

Although GPS receivers give you exact positions—for example, 34° 28' 18.8765"N, 122° 15' 34.0832"W, 302.56 meters elevation—it is important to understand that there is some amount of uncertainty, or error, inherent in these positions. A number of factors contribute to this error including satellite clock drift, atmospheric conditions, measurement noise, and multipath. In addition, due to the satellite geometry, vertical accuracy (elevation) is generally one and a half to three times worse than horizontal accuracy. You should consider each GPS position as a box, and you are somewhere within that box. The size of that box depends on the overall accuracy of your GPS receiver.

Differential GPS

The accuracy of GPS receivers can be improved by using a technique known as differential correction, or differential GPS (DGPS), to reduce some of the error. DGPS involves using a stationary GPS receiver, called a base station, at a known location—an accurately surveyed point—to calculate corrections for each satellite it is tracking. The corrections can be calculated by comparing the known location of the base station to the GPS location determined by using the satellites. These corrections are then applied to the satellite data received by your GPS receiver, resulting in positions that are accurate from about five meters down to less than one meter for civilian C/A Code receiver, depending on the receiver.

There are two approaches to DGPS: postprocessing, in which the corrections are stored on a disk and then applied to the field GPS data back at the office after the data collection is complete, and real-time, in which the corrections are broadcasted from the base

station to the field GPS receiver as soon as they are calculated. Real-time DGPS allows the corrections to be applied almost instantly so that you can begin to work with the more accurate GPS positions immediately. In addition, accurate in-field GPS navigation requires real-time DGPS. Many modern GPS receivers have built-in real-time DGPS capabilities or support add-on real-time DGPS components. There are various sources of real-time DGPS signals, including Coast Guard beacons; *Wide Area Augmentation System (WAAS)*, a U.S. Federal Aviation Authority (FAA) system of equipment and software that supplements GPS accuracy, availability, and integrity; FM-based services; and satellite-based services. The U.S. Coast Guard beacons and WAAS services are free of charge. Other services may require a subscription fee. Since real-time DGPS calculations are handled internally by the GPS receivers themselves, ArcPad supports this form of DGPS. Postprocessing requires additional file formats, proprietary protocols, and additional software and therefore is not supported directly by ArcPad.

Another way to improve the accuracy of GPS positions is by averaging multiple fixes at the same location over time. For example, instead of taking a single GPS position at a particular location, you can stand in the same position for 30 seconds and average all the GPS positions you receive during that time to produce one final position. An averaged position tends to be more accurate than one single position.

Measures of accuracy

There are several indicators of the potential accuracy of particular GPS positions. Dilution of Precision (DOP) is probably the most common indicator and is output by most, if not all, modern GPS receivers. DOP indicates the quality of the geometry of the GPS satellite constellation at a particular time. A higher DOP indicates poor satellite geometry and a potentially less accurate position than a lower DOP. There are several expressions of DOP—for example, HDOP-horizontal DOP, TDOP-time DOP—but position PDOP (PDOP) is the most commonly used. A PDOP value of six or less is generally acceptable. By only capturing GPS positions with a low DOP, you tend to capture more accurate positions.

Supported GPS protocols

ArcPad supports the following protocols for communicating with GPS receivers:

- National Marine Electronics Association. (NMEA) 0183, version 2.0
- Trimble Standard Interface Protocol (TSIP)
- Rockwell PLGR Protocol
- Delorme® Earthmate®

Any GPS receiver that outputs any of the above protocols should work with ArcPad, as long as the GPS receiver is correctly configured and properly connected to the device being used with ArcPad.

ESRI does not publish a list of supported GPS receivers for ArcPad. ArcPad supports the above list of GPS protocols rather than specific GPS receivers.

Selecting a GPS receiver

ESRI does not publish a list of recommended GPS receivers since there are many factors that need to be considered when selecting an appropriate GPS receiver for your specific field GIS needs. Factors that need to be considered include:

Supported protocols

Does the GPS receiver output a protocol that is supported by ArcPad?

Accuracy

What accuracy do you require for your GPS positions?

Is autonomous GPS with 5–15 meters accuracy sufficient, or do you require differential correction to achieve higher accuracy?

Does the GPS receiver have the ability to differentially correct the GPS positions when connected to a differential receiver or using the WAAS differential system?

How well does your GPS receiver work under a canopy or in environments that are susceptible to multipath errors?

Differential correction

What type of real-time differential correction is available and reliable in the area where you will be working: beacon, satellite, or WAAS?

GPS receiver functionality

Can the GPS receiver be configured to set such factors as elevation mask, position interval, and SNR mask?

Does the GPS receiver have its own display to configure the receiver and use the receiver in a standalone mode?

Cost

How much do you want to spend on a GPS receiver? More accurate GPS receivers cost more than less accurate receivers.

Size and configuration

Do you require a compact GPS receiver or a backpack GPS receiver? Ultra-compact GPS receivers tend to be less expensive but also less accurate than larger GPS receivers. GPS receivers are available in various configurations including Compact Flash receivers, PC Card receivers, Bluetooth receivers, specialized built-in receivers, add-on expansion packs, handheld receivers, integrated receivers and mobile devices, all-in-one antennas and GPS receivers, and backpack GPS receiver systems.

Are cables an issue? Bluetooth is a good alternative for wirelessly connecting an external GPS receiver to your mobile device.

Availability and support

What GPS receivers are available in your local area, and is the local GPS vendor's support adequate?

There is no perfect GPS receiver for use with ArcPad. You should consider all of the above factors when deciding which GPS receiver best meets your field GIS and GPS needs.

For more information on selecting a GPS receiver you can download the ESRI Whitepaper, *ArcPad 7 Devices and Accessories*, from the Literature link on *www.esri.com/arcpad*, or from *support.esri.com/arcpad.*

Connecting your GPS receiver

Connecting your GPS receiver to ArcPad is a simple process that involves the following steps:

1. Determine what cables, adapters, and gender changers, if any, are needed to connect your GPS receiver to the mobile device being used to run ArcPad.
2. Connect the GPS receiver to the mobile device.
3. Configure the GPS receiver.
4. Set the GPS Preferences in ArcPad.

There is no standard method for connecting a GPS receiver to ArcPad since most GPS receivers have unique configurations. However, by using this section and the documentation for your GPS receiver and mobile device, it is fairly easy to successfully connect your GPS receiver to ArcPad.

Determining what items are needed

In general, you will need one or more of the following items to connect your GPS receiver to the mobile device being used to run ArcPad:

- A serial cable to connect to the GPS receiver
- A serial cable to connect to the mobile device
- A male-to-male gender changer
- A null modem adapter

You will not need any of the above items if you are connecting your GPS receiver to your mobile device via Bluetooth.

Many GPS receivers and mobile devices have unique fittings for their serial ports and hence require their own proprietary serial cables. This is particularly true for handheld GPS receivers and Windows Mobile devices. However, not all GPS receivers require all of the above items to connect to the mobile device. For example, the Leica GS5, GS5+, and Trimble Pathfinder Pocket GPS receivers connect directly to the serial cable for the mobile device and do not require their own proprietary serial cable, null modem adapter, or gender changer. Some GPS receivers do not require any cables or adapters—for example, GPS receivers which support Bluetooth, Compact Flash and built-in GPS receivers.

Most serial cables that connect to the GPS receiver on one end are designed to connect directly to a PC serial port on the other end using a standard DB9 serial connector. This is not the case when connecting to most Windows Mobile since these devices usually have nonstandard, proprietary serial ports. Consequently, a proprietary serial cable is usually also required when connecting a GPS receiver to a Windows Mobile device. This dependency on proprietary serial cables makes Bluetooth an attractive option for connecting serial devices, including GPS receivers, to Windows Mobile devices—although not all Windows Mobile devices support Bluetooth.

Most GPS serial cables and Windows Mobile device proprietary serial cables have 9-pin DB9 female connectors on the ends that need to be connected together. Consequently, a 9-pin male-to-male gender changer is required to connect the two female serial cables.

Ultra-thin style DB9 male-to-male gender changer

Finally, a null modem adapter or cable is usually needed when connecting a GPS receiver to a Windows Mobile device, using the device's sync cable.

Null modem adapters and cables

The following paragraph explains why you usually need a null modem adapter when using a sync cable to connect a GPS receiver to a Windows Mobile device.

PCs and Windows Mobile devices use the serial port's pin 2 to receive data and pin 3 to transmit or send data. Devices that output data via serial ports, such as GPS receivers, use pin 2 to transmit or send data and pin 3 to receive data. This works since the GPS receiver sends data on pin 2, while the PC receives data on pin 2. However, a Windows Mobile device will not be able to communicate with a PC when connected using a standard serial cable since both the Windows Mobile device and PC will be trying to send data on the same pin 3. To solve this problem, most Windows Mobile devices have sync cables that reverse pins 2 and 3 so that the device can communicate with a PC. This sync cable works for communicating between a Windows Mobile device and a PC. It does not work, however, when communicating between a Windows Mobile device and a GPS receiver since both devices are now sending data on the same pin. Consequently, you need a null modem adapter, or cable, when using a sync cable to connect a Windows Mobile device to a GPS receiver. The null modem adapter also reverses pins 2 and 3 and therefore cancels the pin reversal in the sync cable.

DB9 male-to-female null modem adapter

How do you know whether the Windows Mobile serial cable is a sync cable and therefore requires a null modem adapter? In most cases, if the Windows Mobile serial cable has a female DB9 connector on one end, it is likely to be a sync cable, and thus a null modem adapter will be required to connect to a GPS receiver.

Connecting your GPS receiver

Using the information in the preceding discussion you should now be able to determine which cables, null modem adapters, and gender changers you will need to connect your GPS receiver to the device that is running ArcPad. Obviously, you will not need any cables or adapters if connecting via Bluetooth. Assemble and connect the required items before moving to the next step of configuring your GPS receiver. Also, make sure that the batteries on your GPS receiver are fully charged!

Configuring your GPS receiver

By default, most handheld GPS receivers are configured to not output any GPS data. You need to configure your GPS receiver to output data, generally via the NMEA protocol unless your GPS receiver supports additional protocols such as TSIP. ArcPad supports the NMEA 0183 version 2.0 standard protocol, so make sure that you select at least version 2.0 of NMEA on your GPS receiver if the receiver supports multiple NMEA versions.

You also need to verify the communication parameters that your GPS receiver is configured for, specifically the baud rate, parity, data bits, and stop bits. You will need this information for the next step of setting the GPS Preferences in ArcPad.

If you are using Bluetooth, you will need to use the Bluetooth Manager on your mobile device to discover the GPS receiver, and possibly to pair your GPS receiver with your mobile device. Consult the documentation for your GPS receiver and mobile device for more information on connecting via Bluetooth.

Setting the GPS Preferences in ArcPad

Before you can activate your GPS, you need to set the GPS communication parameters in ArcPad to match the parameters set on your GPS receiver. The GPS protocol and communication parameters are set in the GPS page of the GPS Preferences dialog box.

The task later in this chapter describes how to set the communication parameters in ArcPad.

Setting communication parameters

Before you can activate your GPS, you need to set the GPS communication parameters in ArcPad to match the parameters set on your GPS receiver. The most common communication parameters are located in the GPS page of the GPS Preferences dialog box. Less common communication parameters are located in the Serial Port Parameters dialog box, which is opened by tapping the Serial Port Parameters button, .

You can use the Find GPS tool, to search for your GPS if you do not know which port on your mobile device your GPS is connected to. However, you need to make sure that your GPS is connected and turned on in order for the Find GPS tool to detect your GPS. The Port and Baud dropdown list options will be updated as the Find GPS searches for a connected GPS.

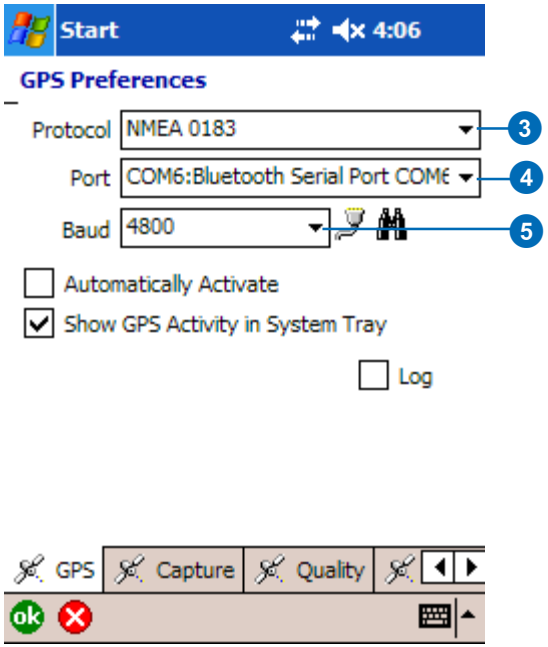
See Also

Refer to your GPS receiver's manual for information on how to set the output GPS protocol and port communication parameters on the GPS receiver.

Setting the GPS protocol, port, and baud rate

1. Tap the arrow to the right of the GPS Position Window button, on the Main toolbar, to display the dropdown list.
2. Tap GPS Preferences to open the GPS Preferences dialog box.

   The GPS page is the first page displayed.
3. Tap the Protocol dropdown arrow to select the protocol used by your GPS receiver to output data.
4. Tap the Port dropdown arrow to select the port used by your GPS receiver to output data.
5. Tap the Baud dropdown arrow to select the baud rate used by your GPS receiver to output data.



See Also

Refer to Chapter 4 of the ArcPad Reference Guide *for more information on the fields in the GPS Preferences and Serial Port Parameters dialog boxes.*

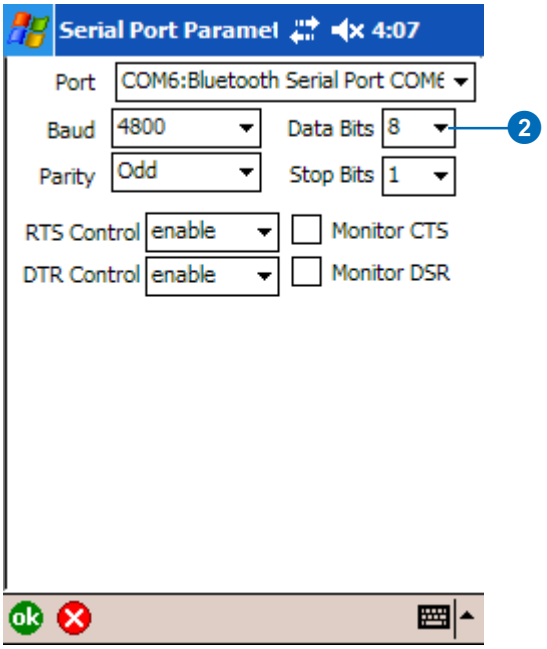
Setting the advanced serial port parameters

1. Tap the Serial Port Parameters button, , on the GPS page of the GPS Preferences dialog box, to open the Serial Port Parameters dialog box.

   The Port and Baud rate selected in the GPS page will automatically be selected in the Serial Port Parameters dialog box.

2. Tap the Data Bits dropdown arrow to select the number of data bits used by your GPS to output data.

3. Set the remaining communication parameters to match the settings on your GPS receiver.



Activating your GPS

Before you activate your GPS in ArcPad, you need to ensure that the GPS receiver is correctly connected to your mobile device and that the GPS protocol and communication parameters in ArcPad match the settings on the GPS receiver. You also need to turn your GPS receiver on before activating it in ArcPad.

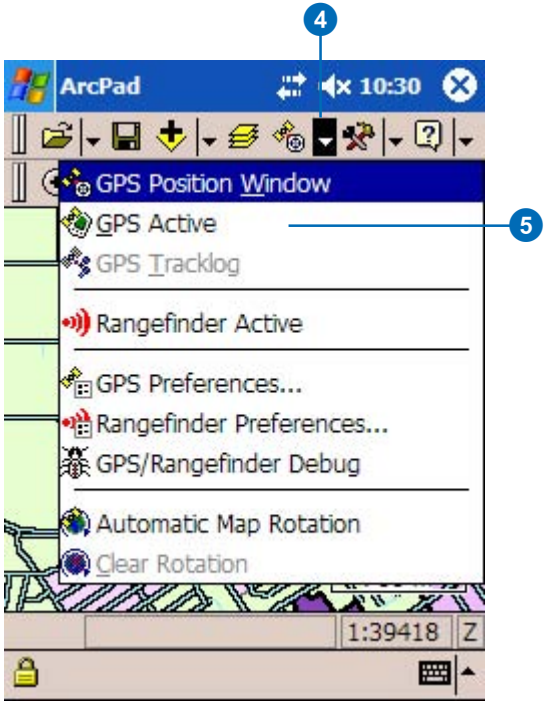
The GPS can only be activated if there is a projection defined for the current ArcPad map. The GPS Active tool is disabled if the current ArcPad map does not have a projection defined. The default projection in ArcPad is latitude–longitude using the WGS84 datum. The default projection can be changed by placing an arcpad.prj file in your \My Documents folder.

Tip

Activating your GPS with the GPS Position Window button

You can also activate the GPS by tapping the GPS Position Window button. A message box will be displayed if the GPS is not active. Tap Yes to activate the GPS and open the GPS Position Window.

1. Configure your GPS receiver to output data using one of the GPS protocols supported by ArcPad.
2. Connect your GPS receiver to your mobile device using the appropriate cables, null modem adapters, and gender changers—or, if using Bluetooth, via the Bluetooth Manager.
3. Set the GPS Protocol and communication parameters in the GPS Preferences dialog box to match the settings on the GPS receiver.
4. Tap the arrow to the right of the GPS Position Window button to display the dropdown list.
5. Tap GPS Active. ▸



Tip

Deactivating your GPS

If the GPS is activated, you can deactivate it by tapping GPS Active.

Tip

Activating your GPS with the worldmap.jpg sample data

ArcPad includes WorldMap.jpg, a sample JPEG image. The WorldMap.jpg file has an associated worldfile and aux file (with projection information) and covers the whole world in latitude–longitude coordinates. This is useful when activating a GPS for the first time since it provides a quick method for determining if the GPS communication parameters are set correctly.

The WorldMap.jpg file is automatically installed on your PC under the C:\Program Files\ArcPad \7.0\Sample\World folder. The WorldMap.jpg file is only installed on your Windows Mobile device when the sample world data is installed. To install the world sample data on your Windows Mobile device:

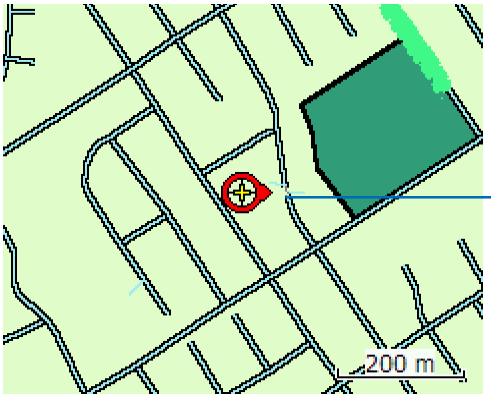
1. Establish an ActiveSync session between your PC and Windows Mobile device.

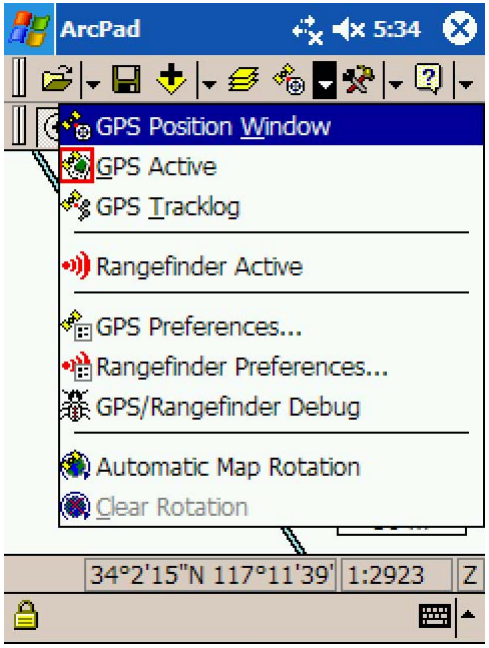
2. On your PC, click Start, All Programs, ArcGIS, ArcPad 7, Install ArcPad 7.0 World Sample Data on Windows Mobile.

3. Follow the prompts.

The GPS cursor is displayed when the GPS is active and is initially located at the last known or current GPS position. The GPS cursor is shown with a slash when using the last known GPS position.

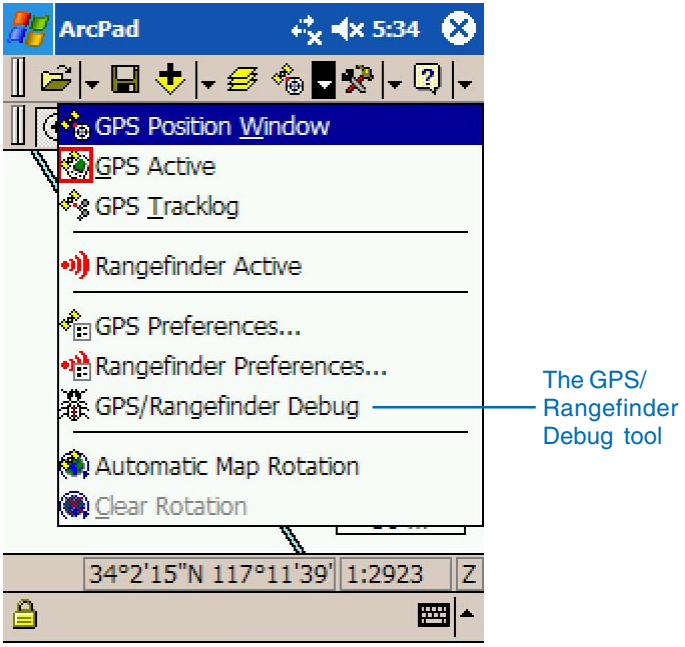
The GPS Active icon is also highlighted with a red box when the GPS is active.





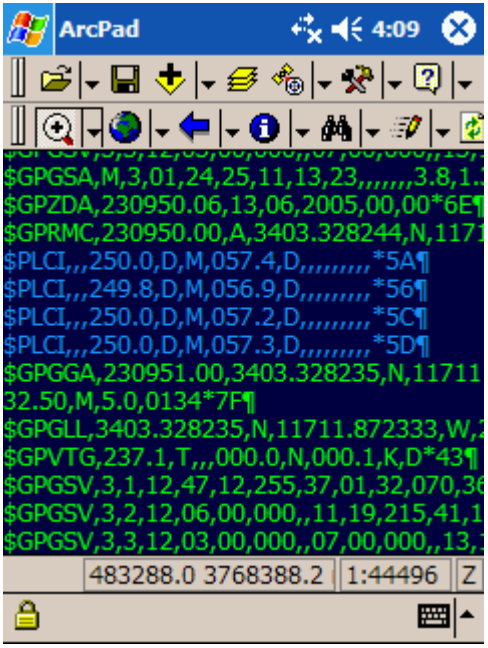
The GPS/Rangefinder Debug tool

GPS/Rangefinder Debug is a useful tool for troubleshooting GPS connection problems. The GPS/Rangefinder Debug tool is opened by tapping the arrow to the right of the GPS Position Window button and then tapping GPS/Rangefinder Debug. The GPS Debug tool is only opened when a GPS or rangefinder is currently active.



The GPS/Rangefinder Debug tool opens a window that displays data from either the GPS receiver or rangefinder, or both. ArcPad uses the settings for the GPS and rangefinder communication parameters to parse, or interpret, the GPS and/or rangefinder data being received on the serial port of your device. The information displayed in the GPS/Rangefinder Debug window is dependent on the GPS and rangefinder protocols being used to communicate with your GPS receiver or rangefinder. ArcPad then displays information in the GPS/Rangefinder Debug window that indicates the status of the GPS and/or rangefinder connection.

Valid GPS data is displayed in green text, and valid rangefinder data is displayed in blue text. Invalid data is displayed in red text. Valid data is data that is constructed properly, in accordance with the selected GPS or rangefinder protocol, and has a valid checksum.



The GPS/Rangefinder Debug window for NMEA 0183 GPS and rangefinder data. Valid GPS data is displayed using green text, and valid rangefinder data is displayed using blue text.

Chapter 12, 'Using your rangefinder', includes a section on using the GPS/Rangefinder Debug tool for troubleshooting your rangefinder connection. This section will focus on using the tool for troubleshooting your GPS connection.

No information displayed in the GPS\Rangefinder Debug window

Irrespective of which GPS protocol is being used, the first observation to make when opening the GPS/Rangefinder Debug window is whether any information is being displayed at all. No information displayed in the GPS/Rangefinder Debug window indicates a GPS connection or configuration problem. Problems are caused by any one of the following factors:

- Your GPS receiver is not turned on or has not been configured to output data in a protocol such as NMEA 0183.
- The batteries on your GPS receiver may be low; some GPS receivers stop outputting data via the NMEA 0183 protocol when the battery power gets too low.
- The GPS Protocol selected in the GPS Preferences dialog box does not match the protocol being used by your GPS receiver to output data. For example, your GPS receiver may be configured to output data using the TSIP protocol, but the NMEA 0183 protocol has been selected in the GPS Preferences dialog box.
- The cable connection between your GPS receiver and the device running ArcPad may be incorrect. Add a null modem adapter if you are not using one, or remove the null modem adapter if you are using one.
- The GPS port communication parameters selected in the GPS Preferences dialog box do not match the serial communication parameters set on your GPS receiver. For example, your GPS receiver may be set to output at a baud rate of 4800, while a baud rate of 9600 has been selected for the GPS port settings in ArcPad.
- If using Bluetooth, your Bluetooth connection to your GPS receiver is not defined correctly. Make sure that you can connect to your GPS receiver from the Bluetooth Manager on your mobile device.

Test each of these factors one by one to isolate the problem and determine why no information is being displayed in the GPS/Rangefinder Debug window.

If you have not already done so, run the Find GPS tool—which is located on the GPS page of the GPS Preferences dialog box.

It is worthwhile to note that some GPS receivers have quality controls set—such as PDOP, HDOP, and Elevation Mask angles—which could affect the output of the GPS receiver. Although these settings would not typically be the reason for no information displayed in the GPS/Rangefinder Debug window, these settings could explain why your GPS receiver is not reporting a coordinate to ArcPad. It may be useful to confirm that these parameters on your GPS receiver are set to minimal levels when experiencing difficulties obtaining a coordinate from your GPS.

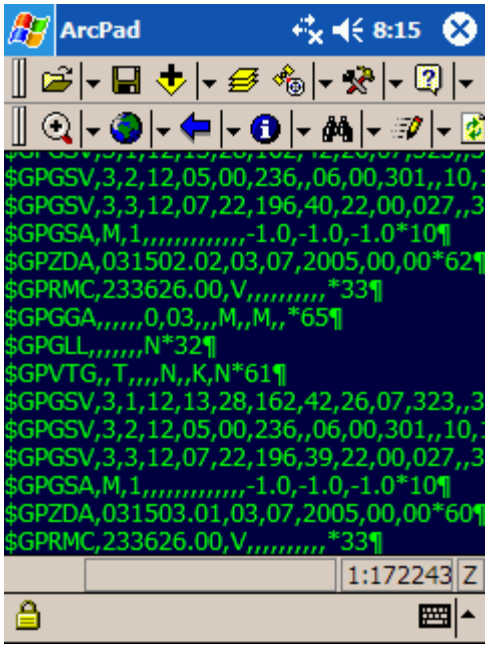
Illegible information displayed in the GPS\Rangefinder Debug window

In some instances you may see illegible characters displayed in the GPS/Rangefinder Debug window. This is usually caused by GPS port communication parameters selected in the GPS Preferences dialog box that do not match the serial communication parameters set on your GPS receiver.

GPS Debug information for the NMEA 0183 protocol

If you are using the NMEA 0183 protocol, you should see the NMEA 0183 sentences displayed in the GPS/Rangefinder Debug window as ASCII text. Each NMEA sentence that ArcPad reads from the serial port is displayed in the GPS Debug window. Valid GPS data is displayed using green text, while invalid GPS data is displayed using red text.

The displayed NMEA 0183 sentences can be used to troubleshoot your GPS connection. In the following example, a number of the NMEA 0183 sentences are displayed showing empty fields with commas and no preceding information.



The GPS/Rangefinder Debug window for NMEA 0183 GPS data

For instance, the $GPGGA sentence (in the middle of the GPS/ Rangefinder Debug window) is displayed as:

$GPGGA,,,,,,0,03,,,M,,M,,*65

The $GPGGA NMEA 0183 sentence includes the GPS fix data, with the first field containing the UTC time, the second and third fields containing the latitude, the fourth and fifth fields containing the longitude, the sixth field containing the fix quality, and the seventh field containing the number of satellites being tracked. In the above example $GPGGA NMEA 0183 sentence, the UTC time, latitude, and longitude values are empty. The fix quality field is 0, which means there is no GPS fix. The number of satellites being tracked is 3, which is insufficient to calculate a position (4 satellites are needed to calculate a position. So the absence of latitude and longitude values and the fix quality of 0—that is, no fix—indicate that the GPS receiver has not locked on to sufficient satellites to calculate a GPS position and consequently is not outputting a GPS position to ArcPad. This would explain why, in this situation, ArcPad does not display a GPS position in the GPS Position Window.

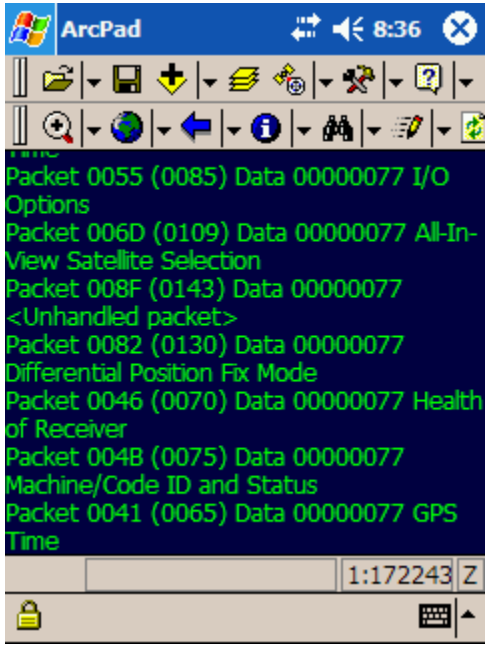
Similarly, empty fields in other NMEA 0183 sentences can explain why the corresponding information is not displayed in the GPS Position Window.

GPS Debug information for the TSIP protocol

The TSIP protocol is quite different to the NMEA 0183 protocol. First, the TSIP protocol is a binary protocol in which the GPS data is sent in a binary format as data packets of information. This binary data is illegible and needs to be decoded by a computer program. Consequently, the TSIP packet contents are not shown in the GPS/Rangefinder Debug window, but instead a message is displayed showing the TSIP packet number, a description of the

contents of the packet, and whether ArcPad has received the packet without errors. Packets that have been successfully received are displayed using green text. Packets that have not been successfully received are displayed using red text.

Second, with the TSIP protocol, some of the GPS data is only sent by the GPS receiver when it receives a request to do so. For example, ArcPad needs to send the TSIP packet 0x003C, Request Tracking Status, to the GPS receiver to receive the packet 0x005C, Satellite tracking status, in return.



The GPS/Rangefinder Debug window for TSIP GPS data

In the example above, all of the TSIP packets have been successfully received, and are all displayed using green text.

The TSIP packet messages in the GPS/Rangefinder Debug window can be used to troubleshoot your GPS connection in the same way as the NMEA 0183 sentences. Missing information in the GPS Position Window can usually be explained by a TSIP packet that ArcPad has requested but has not yet received.

Troubleshooting your GPS connection

The preceding sections of this chapter help identify and solve most of the problems encountered when connecting a GPS receiver to ArcPad. However, situations may arise in which you continue to encounter problems connecting your GPS receiver despite verifying that both your GPS and ArcPad have been configured correctly, and your GPS is connected to the device with the correct cables. This section discusses some of these situations, as well as tools to help troubleshoot your GPS connection.

"Error 55 opening COM1" message when activating the GPS

This error may occur when ArcPad attempts to open the serial port, such as COM1, when the port has already been opened by another application. Any application that uses the serial port could be responsible for this situation. On Windows Mobile devices, however, the application is usually Microsoft ActiveSync, drivers for keyboards, or programs used to configure GPS receivers. It is common on Windows Mobile devices for applications to not release the serial port even though the application may no longer be running.

The solution on Windows Mobile devices is to perform a soft reset, or reboot, of the device. In practice, it is a worthwhile habit to always perform a soft reset of the Windows Mobile device when switching from ActiveSync to using a GPS and vice versa.

This error message may also occur on PCs that have Microsoft ActiveSync running in the background. The solution in this case is to open the Connection Settings dialog box in ActiveSync and uncheck the Allow serial or infrared connection to this COM port check box. This will disable ActiveSync from locking the serial port.

Pocket Outlook's Inbox opens when connecting your GPS receiver to a Windows Mobile device

This situation may occur if you are using a portable keyboard that connects to the serial port of your Windows Mobile device. The portable keyboard usually has an associated program that runs in the background and regularly checks the serial port for the keyboard.

The solution is to disable or exit the keyboard software before connecting your GPS receiver. You may also need to do a soft reset of your Windows Mobile device.

Using HyperTerminal to test your GPS connection

HyperTerminal can be a very useful tool for testing your GPS connection communication parameters and cables and verifying that the GPS receiver is outputting data using the selected GPS protocol. HyperTerminal can also be a useful tool for determining whether or not the cause of the connection problem is ArcPad. In most cases ArcPad should be able to connect to your GPS receiver if HyperTerminal connects successfully.

Opening HyperTerminal on PCs

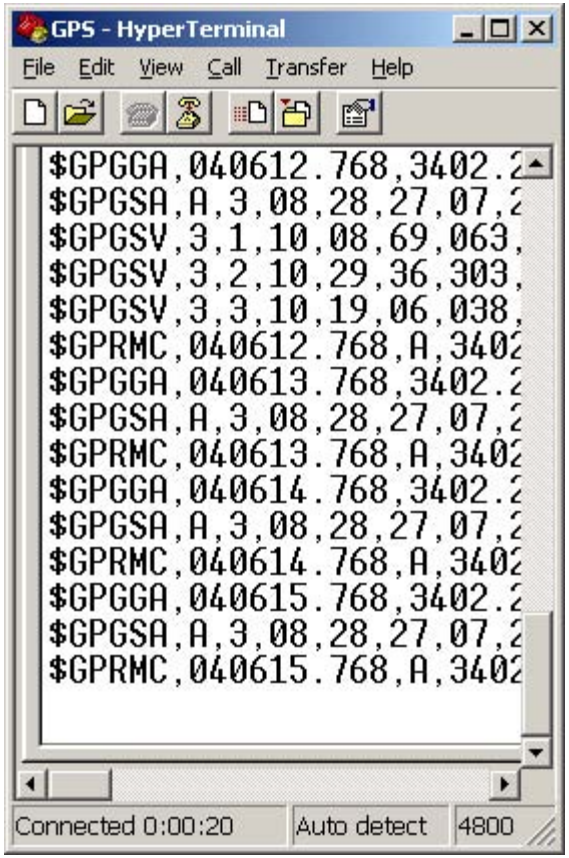
To open HyperTerminal on PCs running Windows XP or 2000; click Start> Programs> Accessories> Communications> HyperTerminal. This opens Hyperterminal with the New Connection dialog box. Type GPS in the Name field of the New Connection dialog box and click OK. Click OK in the Connect To dialog box.

In HyperTerminal, click the Properties button to open the properties dialog box.

In the Properties dialog box (which will be titled 'GPS Properties') select the COM port you are using to connect to your GPS from the list in the Connect Using dropdown list.

Click the Configure button to open the selected COM port's properties. On the COM Properties dialog box, select the communication parameters to match the settings on your GPS receiver.

Click OK to save your settings and return to the main HyperTerminal window. Click the Call ('telephone') button to connect to your GPS receiver.



The HyperTerminal window should show the data being received from your GPS receiver—for example, ASCII NMEA sentences or illegible TSIP binary data. No data displayed in the HyperTerminal window indicates a connection problem to your GPS receiver.

NMEA 0183 sentences recognized by ArcPad

ArcPad supports a number of protocols for communicating with GPS receivers, one of which is the NMEA 0183 version 2.0 standard protocol defined by the National Marine Electronics Association. The NMEA 0183 standard definition is available from http://www.nmea.org.

The NMEA 0183 standard defines sentences that are used to transmit data. These sentences consist of printable ASCII text (plus carriage return and line feed). Each sentence consists of the following data sequence:

- A $ always starts an NMEA 0183 sentence.
- A two-letter talker ID—for example, GP for global positioning system receiver.
- A three-letter sentence ID—for example, GGA.
- Several data fields separated by commas.
- An optional checksum to terminate the sentence and a carriage return or line feed.

The NMEA 0183 standard allows individual manufacturers to define proprietary sentence formats. These sentences start with $P, then a 3-letter manufacturer ID, followed by data from the manufacturer that follows the general format of the standard sentences.

A sample NMEA 0183 sentence for the GPS fix data might be as follows:

$GPGGA,121505,4807.038,N,01131.324,E,1,08,0.9,133.4,M,46.9,M, , *42

where

- $GPGGA is the NMEA 0183 sentence ID for the GPS fix data.
- 121505 is the fix taken at 12:15:05 UTC.
- 4807.038,N is latitude 48° 07.038' N.
- 01131.324,E is longitude 11° 31.324' E.
- 1 is the fix quality. The fix quality can have a value between 0 and 3, defined as follows:
  - 0 = no fix
  - 1 = GPS or standard positioning service (SPS) fix
  - 2 = DGPS fix
  - 3 = Precise positioning service (PPS) fix
- 08 is the number of satellites being tracked.
- 0.9 is the horizontal dilution of position (HDOP).
- 133.4,M is the altitude, in meters, above mean sea level.
- 46.9,M is the height of the geoid (mean sea level) above the WGS84 ellipsoid.
- (empty field) is the time in seconds since the last DGPS update.
- (empty field) is the DGPS station ID number.
- *42 is the checksum field.

The NMEA 0183 version 3.0 standard adds the following additional values for the $GPGGA fix quality, which ArcPad recognizes:

- 4 = Real Time Kinematic (RTK) fixed solution
- 5 = Real Time Kinematic (RTK) float solution
- 6 = Estimated dead reckoning
- 7 = Manual input mode
- 8 = Simulation mode

NMEA 0183 sentences recognized by ArcPad

ArcPad recognizes the following NMEA 0183 version 2.0 or higher sentences:

Sentence	Description
$GPGGA	GPS fix data
$GPGLL	Geographic position, latitude and longitude
$GPGSA	GPS Dilution of Precision (DOP) and active satellites
$GPGSV	GPS satellites in view
$GPRMC	Recommend minimum specific GPS/TRANSIT data
$GPRRE	Range residual error
$GPVTG	Track made good and ground speed
$GPZDA	Time and date
$PGRME	Estimated error information (Garmin Proprietary)
$PGRMT	Sensor Information (Garmin Proprietary)
$PMGNVER	GPS hardware and software version numbers (Magellan Proprietary)
$PASHR,POS	Position information (Ashtech Proprietary)
$PASHR,SAT	GPS satellite tracking status information (Ashtech Proprietary)
$PRWIRID	Version Information (Rockwell Proprietary)
$PRWIZCH	Channel Status (Rockwell Proprietary)
$SDDPT	Depth, in meters
$SDMTW	Water Temperature, in degrees Celcius

Most GPS receivers output a limited number of NMEA 0183 sentences. ArcPad uses data from a number of NMEA 0183 sentences to display all of the information in the GPS Position Window as well as to populate the fields associated with the GPS Tracklog. When information is not displayed in the GPS Position Window it is usually the result of ArcPad not receiving the required NMEA 0183 sentence from the GPS receiver.

TSIP packets recognized by ArcPad

The Trimble Standard Interface Protocol (TSIP) is a Trimble proprietary protocol for communicating with Trimble GPS receivers and some GPS receivers which use Trimble GPS boards.

The TSIP protocol consists of a number of binary packets which are used to request and receive information from the GPS receiver. Many TSIP packets are not sent by the GPS receiver unless specifically requested to do so via the receipt of a request TSIP packet. In contrast, most NMEA sentences are automatically sent by the GPS receiver once the receiver has been configured to output the NMEA 0183 sentence.

TSIP packets recognized by ArcPad

ArcPad recognizes the following TSIP packets sent by the GPS receiver:

Packet	Description
0x13	Packet send error
0x41	GPS Time
0x42	XYZ ECEF, single precision
0x43	Velocity XYZ ECEF
0x44	Satellite selection
0x45	Software version
0x46	Health of receiver
0x47	Signal levels for all satellites tracked
0x4A	Single precision LLA
0x4B	Machine code/status
0x55	Input/Output options
0x56	Velocity fix (ENU)
0x5C	Satellite tracking status
0x6D	All-in-view satellite selection
0x82	Differential status
0x83	XYZ ECEF, double precision
0x84	Double precision LLA
0xBC	Protocol configuration

TSIP packets sent by ArcPad to GPS device

ArcPad sends the following TSIP packets to the GPS receiver in order to request a TSIP packet from the receiver:

Packet	Description
0x1F	Receiver Firmware Information Request
0x21	Current Time Request
0x24	GPS Position Fix Mode Request
0x26	Health Request
0x27	Signal Levels Request
0x35	I/O Option Flags Command
0x3C	Satellite Tracking Status Request

Using the GPS Position Window 10

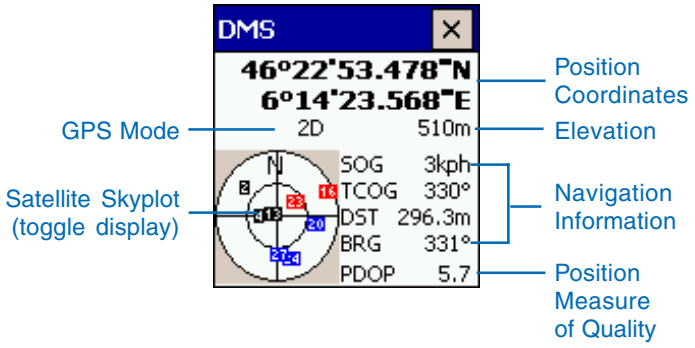
IN THIS CHAPTER

- Opening and closing the GPS Position Window
- The GPS Position Window
- Selecting the position coordinate system
- Selecting the position measure of quality
- Toggling between the Skyplot, Signal Chart, and Compass

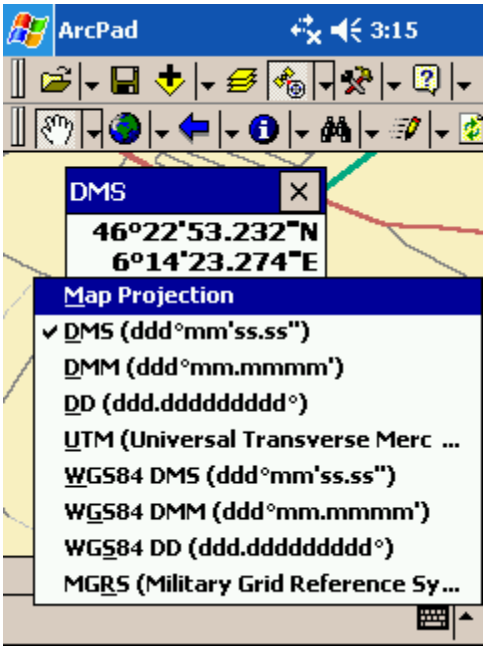
The GPS Position Window is used to display information about the GPS satellites and the GPS position, as well as navigational information. Most of the information displayed in the GPS Position Window is calculated by the GPS receiver and output to ArcPad via the selected GPS protocol. Although many GPS receivers also display this information on the receiver's screen, it is useful and convenient to use the ArcPad GPS Position Window. Using ArcPad reduces the need to view information on two different devices. In addition, the GPS Position Window provides a means of displaying key information if the GPS receiver has no display screen.

The GPS Position Window

The GPS Position Window displays a rich variety of information about the GPS satellites, position coordinates, and navigational information.



Some of the display fields have context or tap and hold menus; if you tap and hold the field, a menu list will be displayed with alternative information or data formats, to be displayed in the associated field. In the following example, the position coordinate display field has been tapped and held, using the cursor or stylus, to display the menu of coordinate systems. The current selection in the tap and hold menu is indicated by a check mark to the left of the selection—for example, DMS in the following screenshot.



Position Coordinates tap and hold menu

The GPS Position Window displays the following information:

GPS Mode

The GPS Mode displays the type of position being calculated by the GPS receiver. There are three groups of GPS modes that can be displayed: NOFIX, 2D/3D, and differential modes.

NOFIX

NOFIX indicates that ArcPad is not receiving a position from the GPS receiver. No position coordinate will be displayed if the initial GPS Mode is NOFIX. Also, the 2D/3D or differential modes will not be displayed during the NOFIX mode.

2D/3D

2D indicates that only three satellites are available and are being used to calculate the x,y position coordinates.

3D indicates that at least four satellites are available and are being used to calculate the x, y, and z (elevation) position coordinates.

Differential

DGPS indicates that real-time differential correction is being used to calculate the x, y, and z position coordinates.

RTK fix indicates that a real-time kinematic (RTK) fixed solution is being used to calculate the x, y, and z position coordinates.

RTK flt indicates that a real-time kinematic (RTK) float solution is being used to calculate the x, y, and z position coordinates.

PPS indicates that a Precise Positioning Service is being used.

Multiple GPS modes can be displayed simultaneously; for example, the 2D or 3D mode can be displayed simultaneously with the differential DGPS or PPS modes.

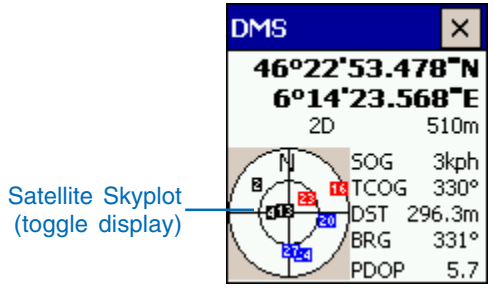
Satellite Skyplot

The Satellite Skyplot shows the almanac of which satellites should be visible or available to the GPS receiver. The PRN (PseudoRandom Noise) number and position of each satellite are displayed using a color to indicate the availability of the satellite:

Black indicates the satellite is available and used for calculating the GPS position.

Blue indicates the satellite is available but not used.

Red indicates the satellite is unavailable.



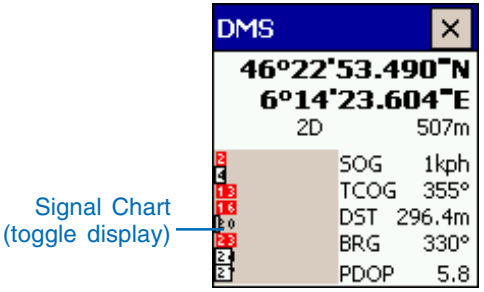
The Satellite Skyplot view shows a bird's-eye view of the position of each satellite according to the satellite almanac. The outer circle represents the horizon (north is up); the inner circle represents 45° above the horizon; and the center point represents what is directly overhead.

The Satellite Skyplot is a toggle field; tapping the skyplot changes the display to the Signal Chart.

Signal Chart

The Signal Chart shows a horizontal bar chart of the PRN numbers and relative signal strengths of the satellites in the almanac. A red bar indicates that the satellite is unavailable.

The Signal Chart is a toggle field; tapping the Chart changes the display to the Compass.

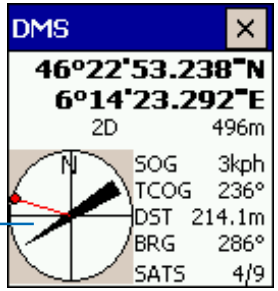


Compass

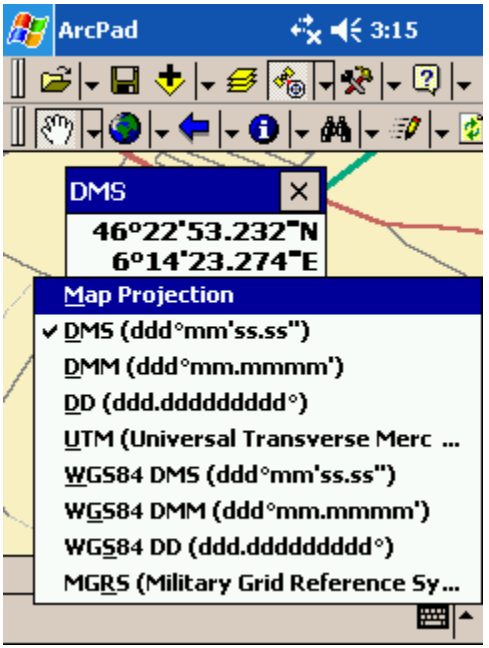
The Compass shows the GPS direction with a black arrow and the direction to the selected destination in red. The GPS direction corresponds to the COG (Course Over Ground) direction displayed in the navigation section of the GPS Position Window, and the direction to the destination corresponds to the BRG (Bearing).

The Compass is a toggle field; tapping the Compass changes the display back to the Satellite Skyplot.

Position Coordinates



Position Coordinates is a tap and hold menu field; tapping and holding on the coordinates display the following menu list of alternate coordinate systems, or projections, to be used for displaying the current GPS position:



Position Coordinates tap and hold menu

Map Projection: the projection of the current map, which may be in latitude–longitude or UTM—or any other projection supported by ArcPad.

DMS: latitude–longitude in degrees, minutes and decimal seconds (ddd°mm'ss.ss").

DMM: latitude–longitude in degrees and decimal minutes (ddd°mm.mmmm').

DD: latitude–longitude in decimal degrees (ddd.ddddddddd°).

UTM: the current UTM (Universal Transverse Mercator) coordinates and zone.

WGS84 DMS: latitude–longitude in degrees, minutes, and decimal seconds (ddd°mm'ss.ss"), using the WGS84 datum.

WGS84 DMM: latitude–longitude in degrees and decimal minutes (ddd°mm.mmmm'), using the WGS84 datum.

WGS84 DD: latitude–longitude in decimal degrees (ddd.ddddddddd°), using the WGS84 datum.

MGRS: The Military Grid Reference System coordinate.

Elevation

Elevation is a tap and hold menu field; tapping and holding on the elevation displays the following menu list of altitude or depth units to show in the elevation field:

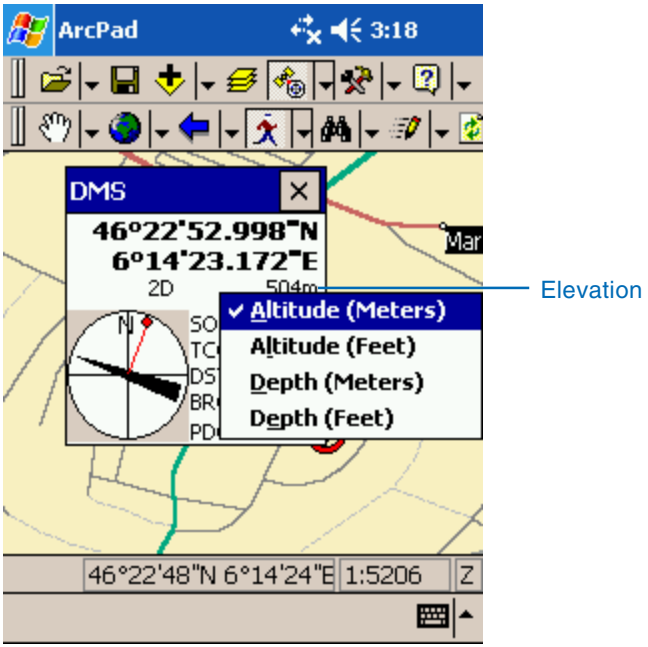
Altitude (Meters)

Altitude (Feet)

Depth (Meters)

Depth (Feet)

The depth information is obtained from the standard NMEA message $SDDPT which provides the depth below the transducer and the offset of the transducer to the water line. This NMEA message is typically output by marine GPS devices such as depth sounders.



Elevation tap and hold menu

Navigation Information

The Navigation Information displays the following information:

SOG: Speed Over Ground, as calculated by the GPS. SOG is the actual speed the GPS receiver is moving over the ground.

COG: Course Over Ground, as calculated by the GPS. COG is the direction the GPS receiver is moving and corresponds to the direction of the black Compass arrow.

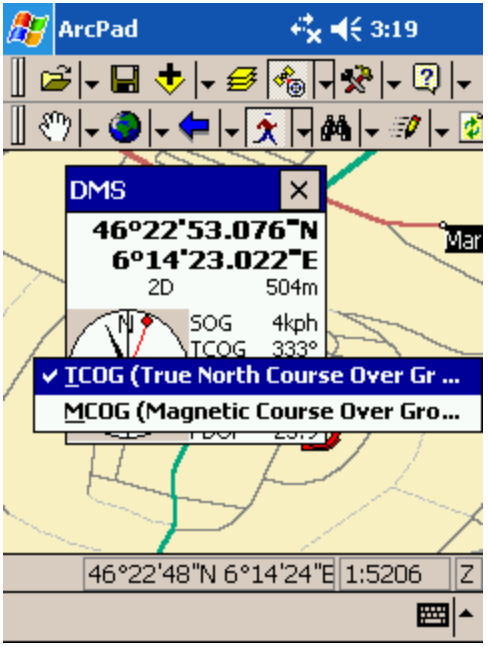
DST: The distance from the current GPS position to the selected destination. The DST is calculated by ArcPad.

BRG: The bearing from the current GPS position to the selected destination. The BRG corresponds to the red destination direction on the Compass. The BRG is calculated by ArcPad.

COG is also a tap and hold menu field that provides the option of displaying the COG in one of the following formats:

TCOG: True North Course Over Ground

MCOG: Magnetic North Course Over Ground



COG tap and hold menu

Position Measure of Quality

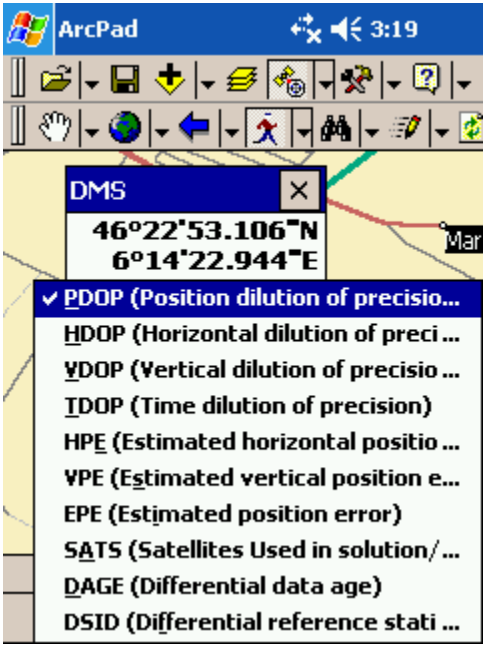
Position Measure of Quality is a tap and hold menu field. Tapping and holding on the Position Measure of Quality displays the following menu list of information to be displayed in the field:

PDOP: Position Dilution of Precision.

DOP: Horizontal Dilution of Precision.

VDOP: Vertical Dilution of Precision.

TDOP: Time Dilution of Precision.



Position Measure of Quality tap and hold menu

HPE: Estimated Horizontal Position Error.

VPE: Estimated Vertical Position Error.

EPE: Estimated Position Error.

SATS: Satellites used in solution. The number of satellites used by the GPS receiver to calculate the GPS position.

DAGE: Differential data age. The age, in seconds, of the differential signal and correction used by the GPS receiver to differentially correct the GPS position.

DSID: Differential reference station ID. The ID of the differential reference station used by the GPS receiver.

Opening and closing the GPS Position Window

The GPS Position Window can only be opened if the GPS has been activated. The GPS Position Window can be opened, moved, and closed at any time—as long as the GPS remains active. The GPS Position Window is automatically closed when the GPS is deactivated.

Tip

Activating the GPS

The GPS can only be activated if there is a projection defined for the ArcPad map.

Tip

GPS Position button

The GPS Position button remains depressed as long as the GPS Position Window is open.

Tip

Moving the GPS Position Window

The GPS Position Window can be moved around by tapping and holding the blue title bar.

See Also

Refer to Chapter 9, 'Connecting your GPS receiver', for help on activating the GPS.

Opening the GPS Position Window

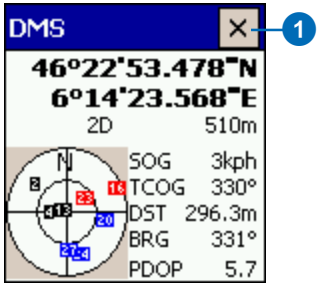
1. Tap the GPS Position button to open the GPS Position Window.

   A message box will be displayed if the GPS is not active.

2. Tap Yes to activate the GPS and open the GPS Position Window.

Closing the GPS Position Window

1. Tap the X button on the GPS Position Window, or tap the depressed GPS Position button on the Main toolbar to close the GPS Position Window.



Selecting the position coordinate system

The GPS Position Window displays the current GPS position coordinates in one of a number of different projections or coordinate systems.

The latitude–longitude position is obtained from the GPS messages, while the other projection coordinates are calculated by ArcPad.

Tapping and holding the Position Coordinate lists a menu of coordinate systems to be used for displaying the current GPS position.

Tip

GPS Position Window coordinates

The GPS Position Window coordinates are for display only; changing the displayed coordinate system does not affect the projection of the coordinates used for GPS data capture.

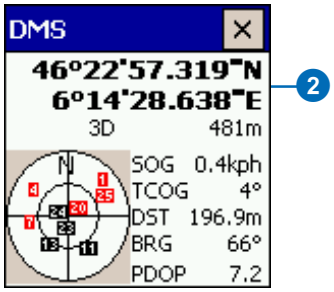
1. Tap the GPS Position button to open the GPS Position Window.

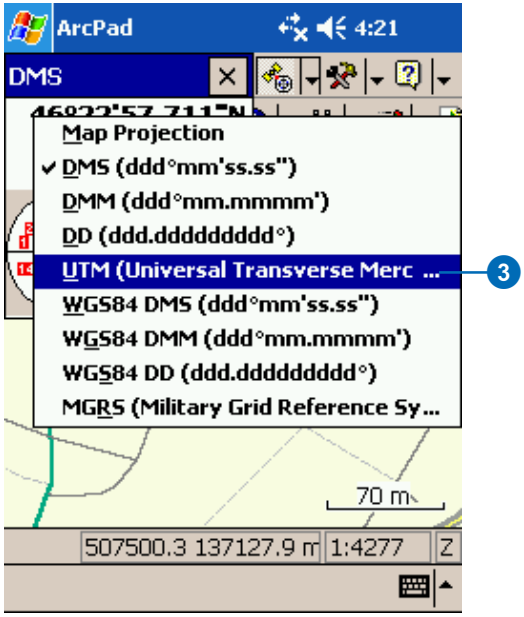
   By default, the position coordinate display shows the position in DMS—latitude and longitude in degrees, minutes and decimal seconds.

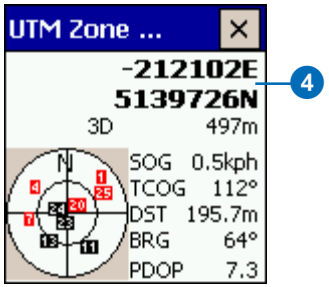
2. Tap and hold the position coordinate display field to display the menu list of available coordinate systems.

3. Tap the required coordinate system to be used for displaying the current GPS position—for example, UTM.

4. The current GPS position will be displayed using the selected coordinate system.







Selecting the position measure of quality

GPS receivers calculate various measures of position quality to quantify the accuracy of the GPS position. Most GPS receivers only calculate a limited number of these quality measures, and not all measures are output by the GPS receiver via the selected GPS protocol—for example, NMEA. The GPS Position Window simply displays the measure received from the GPS. N/A indicates that no value for the corresponding measure has been received by ArcPad from the GPS.

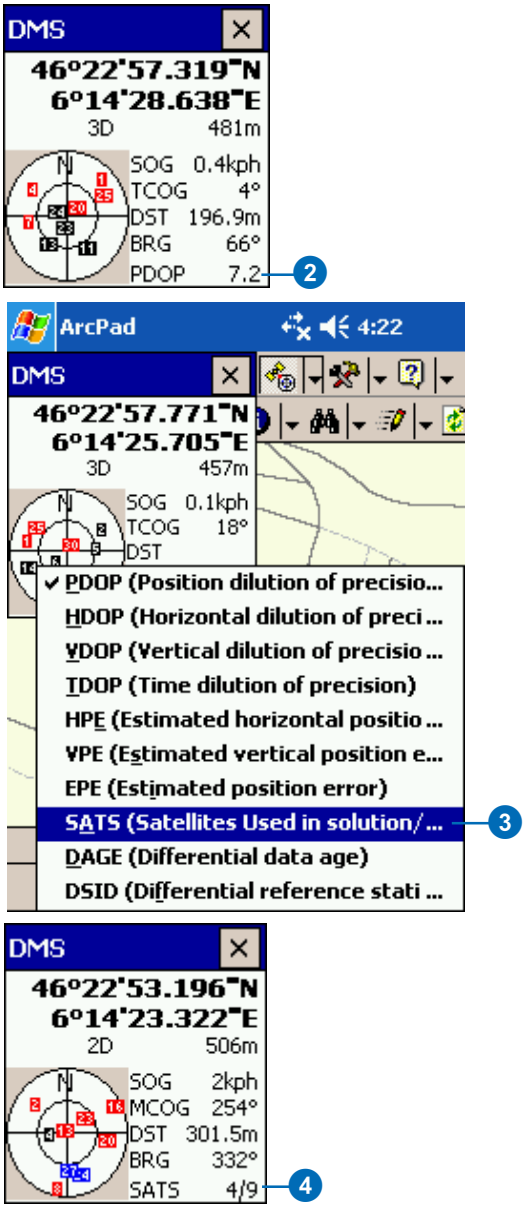
Dilution of precision (DOP) is a measure of the receiver–satellite geometry quality (i.e., the number of satellites received and where they are relative to each other) on a scale of one to 10. The lowest numbers are the best quality, and the highest numbers are the worst quality. DOP is a description of the purely geometric contribution to the uncertainty in a position fix.

See Also

Refer to your GPS receiver's manual to determine which measures of quality your GPS receiver outputs.

1. Tap the GPS Position button to open the GPS Position Window.

   By default, the position measure of quality shows the current PDOP value (Position dilution of precision) if available.
2. Tap and hold the position measure of quality field to display the menu list of available measures of quality.
3. Tap the required measure of quality to be displayed.
4. The selected measure of quality will be displayed in the GPS Position Window.



Toggling between the Skyplot, Signal Chart, and Compass

The GPS Position Window by default displays the GPS Satellite Skyplot.

Tapping the Skyplot changes the display to a horizontal bar chart of the relative satellite signal strengths.

Tapping the Signal Chart changes the display to a compass. The compass shows the direction angle received from the GPS and the bearing to the destination, if selected.

The Skyplot, Signal Chart, and Compass direction information are received from the GPS. The compass bearing to the destination is calculated by ArcPad.

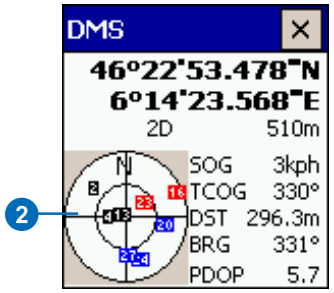
See Also

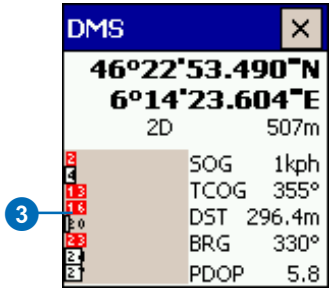
Refer to Chapter 11, 'Navigating with your GPS', for help on selecting a destination.

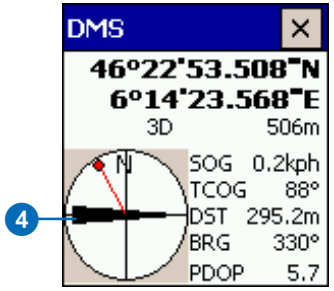
1. Tap the GPS Position button to open the GPS Position Window.
2. The Skyplot shows the PRN numbers and positions of the satellites that should be available based on the almanac. The color used to show the satellite indicates the availability of the satellite:
   Black is available and used for calculating the GPS position.
   Blue is available but not used.
   Red is unavailable.
3. Tap the Skyplot to display the Signal Chart.

   The Signal Chart shows the PRN numbers and relative signal strengths of the satellites. A white bar indicates sufficient signal strength, while a red bar indicates an insufficient signal strength.
4. Tap the Signal Chart to display the Compass.

   The Compass shows the GPS direction with a black arrow and the direction to the selected destination in red. The GPS direction corresponds to the COG displayed on the GPS Position Window, and the direction to the destination corresponds to the BRG.







Navigating with your GPS

11

IN THIS CHAPTER

- Selecting a navigation destination using the Go To tool
- Selecting a navigation destination using the Find tool
- Selecting a navigation destination using the Advanced Select tool
- Selecting a navigation destination using the Go To Selected Feature tool
- Setting the distance alert
- Displaying the distance and bearing to the destination
- Displaying the bearing on the compass
- Using the Map Rotation tool
- The GPS Tracklog
- Starting and stopping the GPS Tracklog

ArcPad offers two methods for basic navigation when using a GPS connected to ArcPad.

First, ArcPad provides navigational information from the current GPS position to the destination. This information includes the distance and bearing to the destination (calculated by ArcPad) and the speed and course over ground, which ArcPad obtains from the GPS receiver.

The term navigation destination is similar to the term *waypoint* used by the GPS industry, with the exception that waypoints generally refer to destination points, whereas ArcPad navigation destinations can include coordinates on a map as well as point, line, or polygon features. ArcPad provides four tools for selecting a navigation destination:

- Go To tool
- Find tool
- Advanced Select tool
- Go To Selected Feature tool

The second basic navigation method that ArcPad provides is a GPS Tracklog. A GPS Tracklog is an electronic breadcrumb trail that illustrates the path you have traveled. The GPS Tracklog can help you backtrack from your current GPS position to your starting point.

Selecting a navigation destination using the Go To tool

The Go To tool can be used to select a navigation destination. Simply activate the tool and tap anywhere on the map to select your destination.

Tip

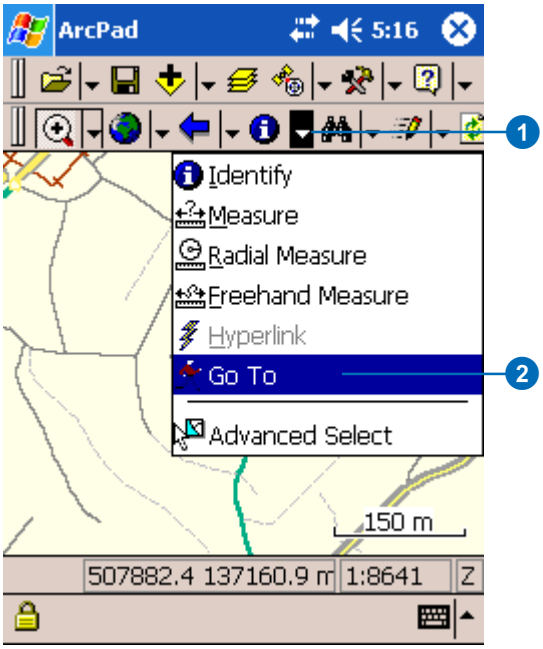
Activating the GPS

It is not necessary to activate the GPS before selecting a navigation destination. However, the GPS does need to be activated in order to open the GPS Position Window and view the distance and bearing to the destination.

See Also

Refer to Chapter 9, 'Connecting your GPS receiver', for help on activating the GPS.

1. Tap the arrow to the right of the Identify button to display the dropdown list.
2. Tap Go To. ▸



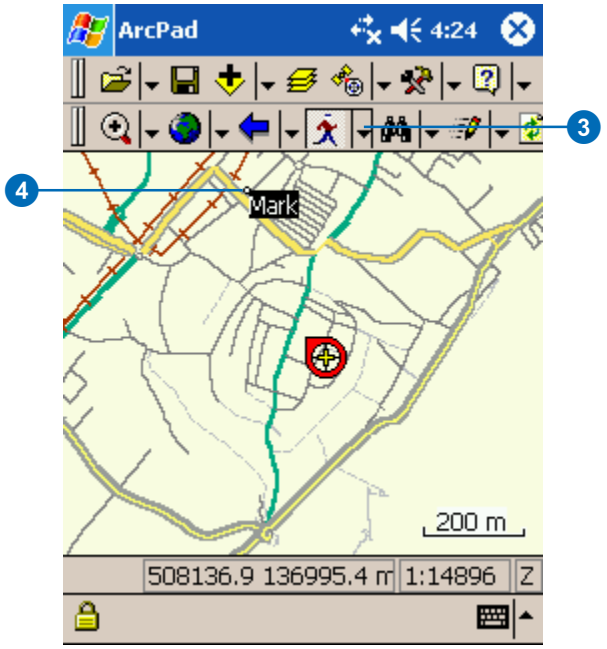
Tip

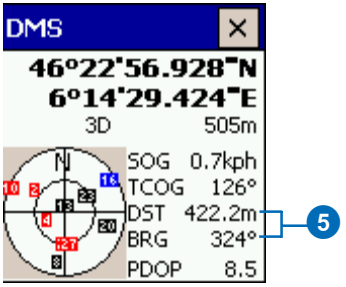
Clearing the selected destination

To clear the selected destination and remove the destination Mark label, tap the Clear Selected tool located on the dropdown list to the right of the Find Features button on the Browse toolbar. The Mark label is displayed when a destination has been selected.

3. The Go To button is displayed on the Browse toolbar and is depressed to indicate that the tool is active.
4. Tap the map to select a navigation destination.

   The destination is displayed with a Mark label.
5. Use the GPS Position Window to view the distance (DST) and bearing (BRG) from your current GPS position to your selected destination.





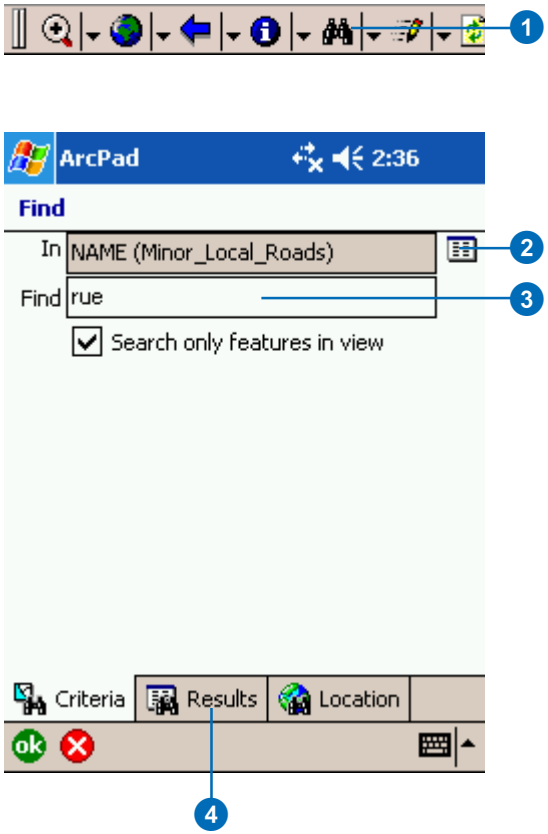
Selecting a navigation destination using the Find tool

The Find tool can be used to select features from a layer using a search query. The results of the query are displayed in a list. The Go To button in the Find dialog box can be used to select a feature as the navigation destination.

1. Tap the Find button to open the Find dialog box.
2. Tap the Select Layers button to select the layer and optional field to search on.
3. Use the Soft Input Panel or keyboard to type the value that you want to search for in the Find box.

   If you leave the Find box blank, ArcPad will list all features in the selected layer.
4. Tap the Results tab to execute the search.

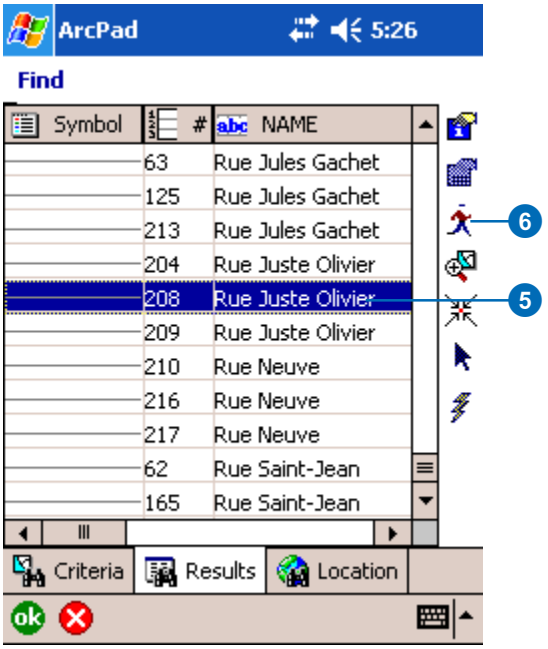
   A table is displayed listing all of the selected features. ►



See Also

Refer to Chapter 8, 'Querying your data', for help on using the Find tool.

5. Tap the feature that you want to navigate to.
6. Tap the Go To button to make the selected feature your destination. ▸



Tip

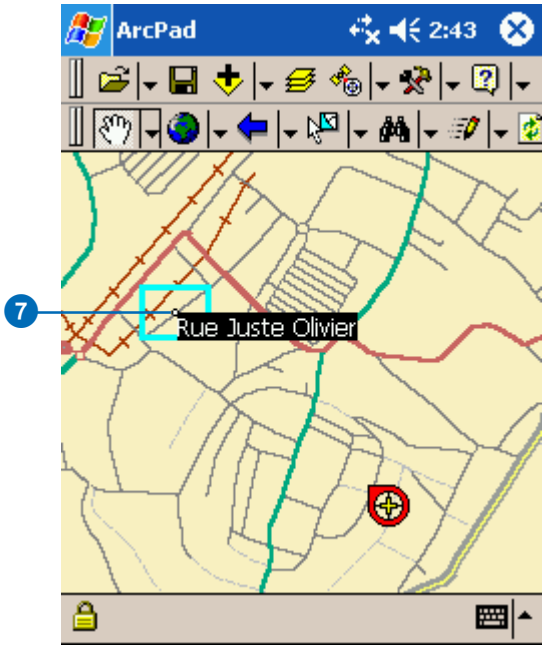
Changing the highlight color

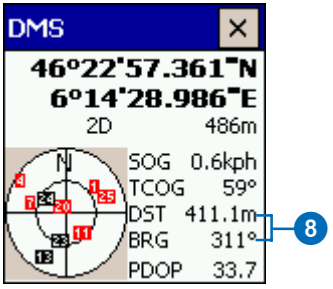
You can change the highlight color of a selected feature on the Display page of the ArcPad Options dialog box.

7. The selected feature is highlighted using the current highlight color.

   The destination is displayed and labeled using the value of the field that was searched on. If no field was specified, the label will use the value of the first field that has any part of the word 'name' in the field name.

8. Use the GPS Position Window to view the distance (DST) and bearing (BRG) from your current GPS position to your selected destination.





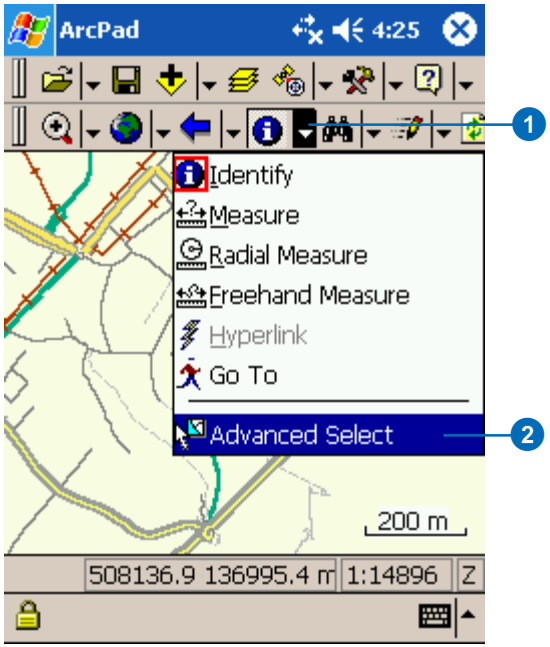
Selecting a navigation destination using the Advanced Select tool

The Advanced Select tool can be used to select multiple features. Only layers that have been activated for the Identify tool will be selected. Layers are activated for the Identify tool in the Layers page of the Table of Contents dialog box. The selected features are displayed in a list. The Go To button in the Advanced Select dialog box can be used to select the coordinate or feature as the navigation destination.

See Also

Refer to Chapter 8, 'Querying your data', for more help on using the Advanced Select tool.

1. Tap the dropdown arrow to the right of the Identify button to display the dropdown list.
2. Tap Advanced Select. ▸



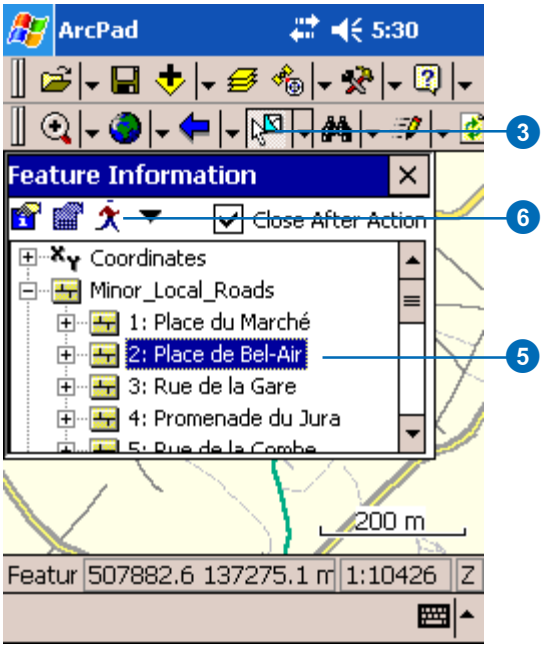
Tip

Selecting the coordinates for the navigation destination

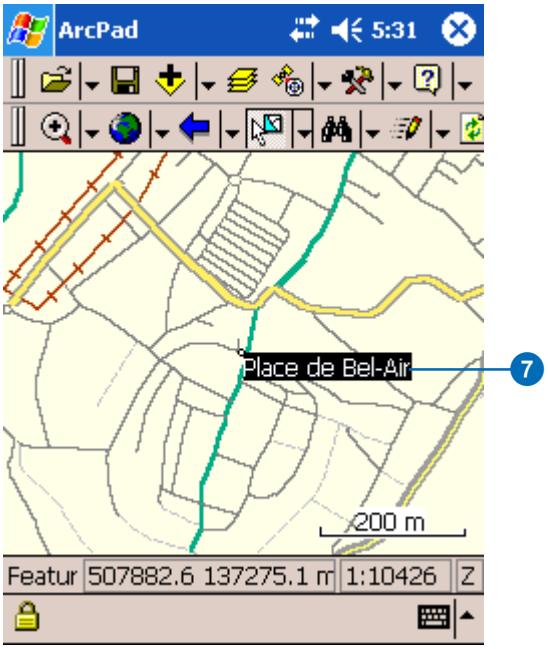
The coordinates displayed at the top of the Advanced Select list can also be selected for the navigation destination. Tap the Coordinates label, then tap the Go To button.

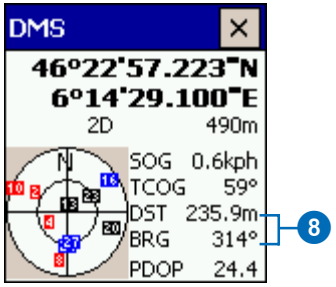
3. The Advanced Select button is displayed on the Browse toolbar and is depressed to indicate that the tool is active.
4. Tap the map to select a feature or tap and drag a selection box to select multiple features from the active layers.

   A list is displayed showing the coordinates and the selected features where the map was tapped. The + icon can be tapped to display the attributes of the selected feature.
5. Tap the feature that you want to navigate to.
6. Tap the Go To button to make the selected feature your destination. ►



7. The destination is displayed and labeled with the same feature attribute shown in the Advanced Select list.
8. Use the GPS Position Window to view the distance (DST) and bearing (BRG) from your current GPS position to your selected destination.





Selecting a navigation destination using the Go To Selected Feature tool

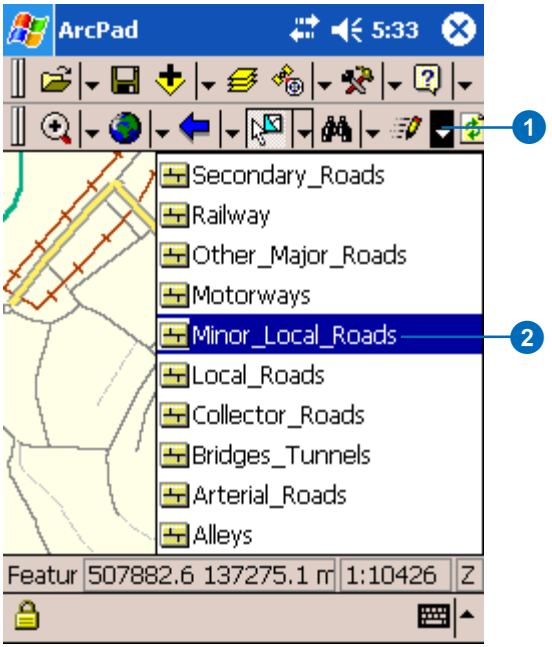
The Go To Selected Feature tool can be used to select a navigation destination by using the Select tool on the Edit toolbar. Select a feature from an editable layer and tap the Go To Selected Feature tool.

See Also

Refer to Chapter 14, 'Editing basics', for more information on the editing tools and editing features.

1. Tap the drop down arrow next to the Start Editing button.
2. Activate a layer for editing, by selecting it from the available list.

   The Edit toolbar is displayed.▸



Tip

Selecting vertical or horizontal lines

Increase the Pen Tolerance if you are having difficulty selecting a horizontal or vertical line feature. The Pen Tolerance can be set in the Display page of the ArcPad Options dialog box.

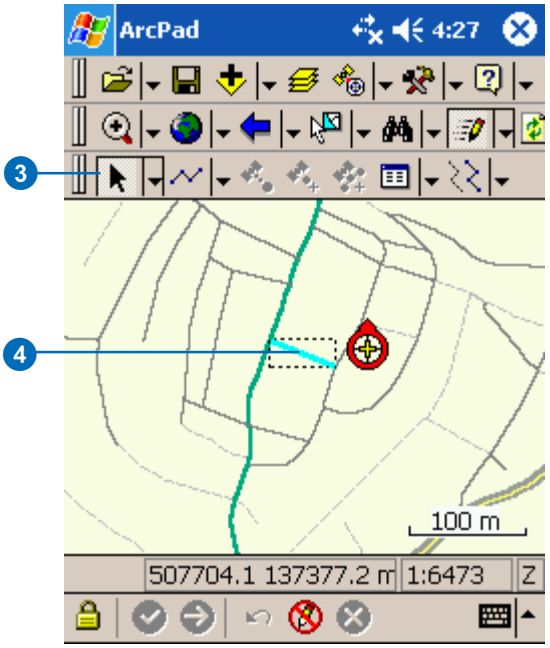
Tip

Displaying the Edit toolbar

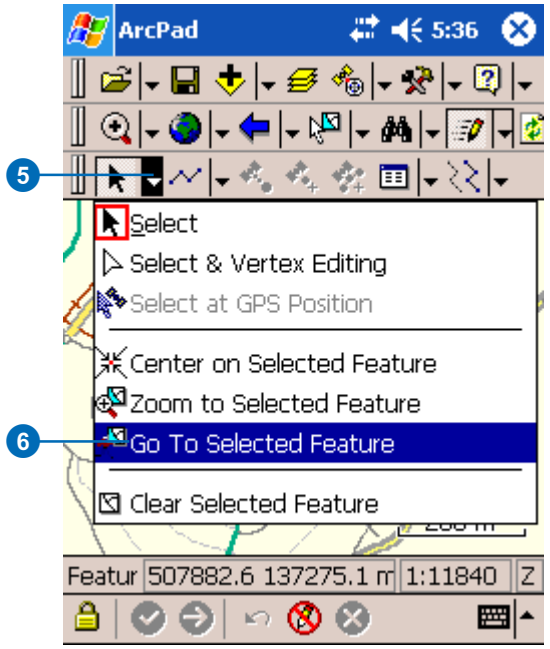
The Edit toolbar is automatically displayed when a layer is checked for editing. You can also open the Edit toolbar by using the Toolbars list, located on the dropdown list to the right of the Tools button on the Main toolbar.

3. Tap the Select tool on the Edit toolbar.
4. Tap the feature on the map that you want to select for your navigation destination.

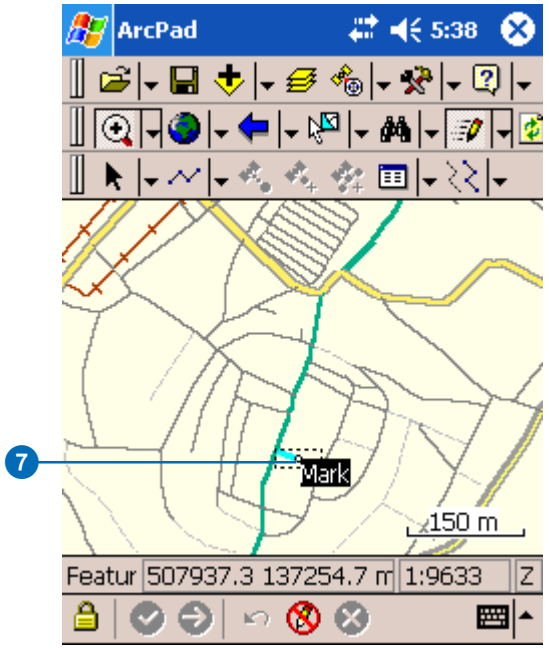
   The selected feature is highlighted with a dashed box, showing the extent of the feature. ▸

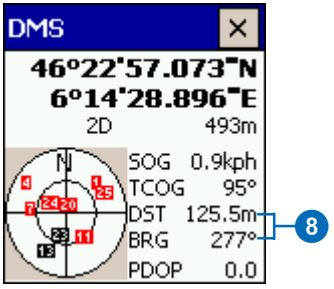


5. Tap the arrow to the right of the Select button to display the dropdown list.
6. Tap Go To Selected Feature. ▸



7. The destination is displayed with a Mark label.
8. Use the GPS Position Window to view the distance (DST) and bearing (BRG) from your current GPS position to your selected destination.





Setting the distance alert

You can set an alert message—and sound—to be displayed when the distance from the current GPS position to the selected destination is less than a specified distance. The alert message and sound are specified in the Alerts page of the GPS Preferences dialog box. The distance is specified on the Location page of the GPS Preferences dialog box.

Tip

Creating a custom alert message

You can create your own Alert message by creating a .wav file on your Windows Mobile device or desktop PC. To activate it, go to the Alerts page in the GPS Preferences dialog box.

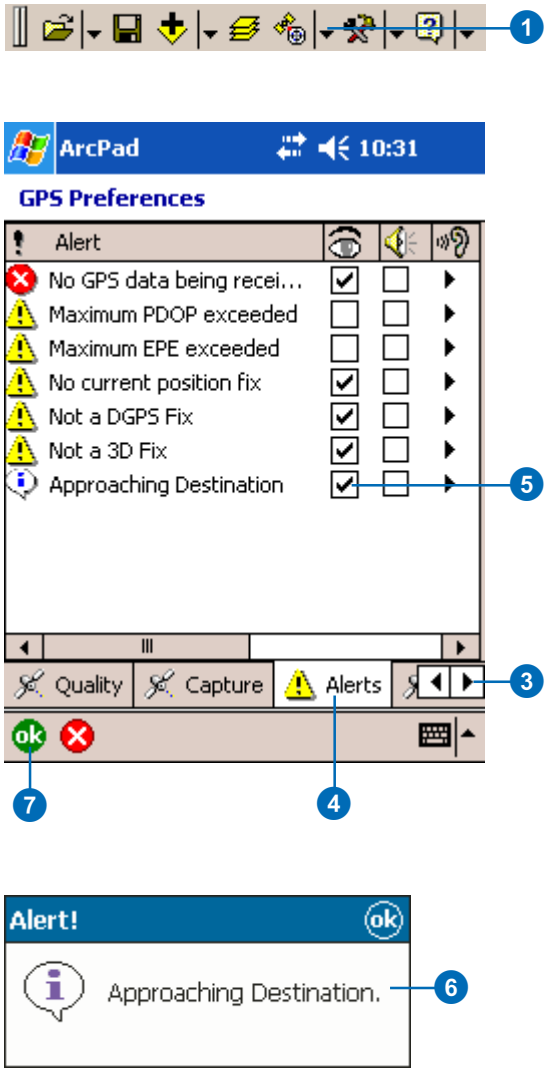
See Also

See the ArcPad Reference Guide *on the GPS Preferences dialog box for more information on alerts and sounds.*

Setting the alert message and sound

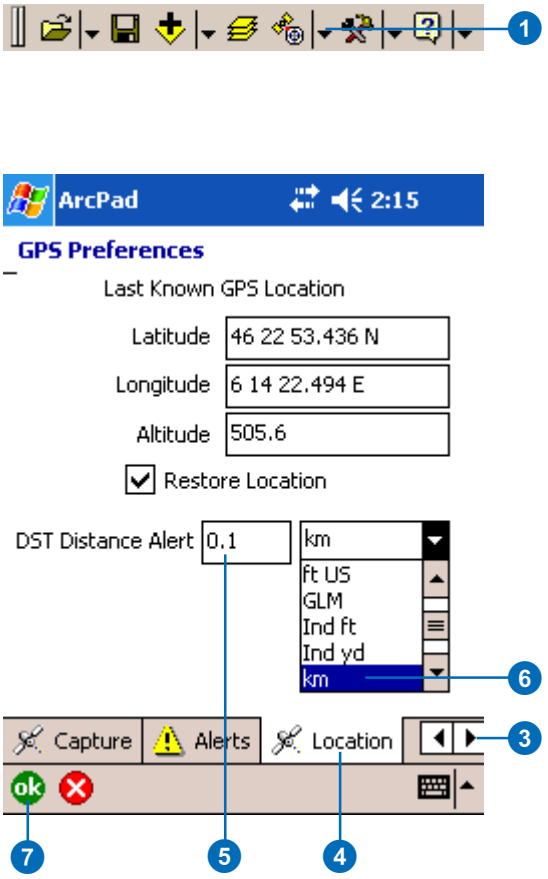
1. Tap the arrow to the right of the GPS Position Window button to display the dropdown list.
2. Tap GPS Preferences.
3. In the GPS Preferences dialog box, tap the right arrow button until the Alerts tab is displayed.
4. Tap the Alerts tab to display the Alerts page.
5. Check the Visible check box for the Approaching Destination alert to display a message box, when the alert is activated.

   Check the Sound check box to play a sound when the alert is activated.
6. If the Visible check box is checked, the Approaching Destination message box will be displayed when the distance to the destination is less than the specified alert distance.
7. Tap OK.



Setting distance alert

1. Tap the arrow to the right of the GPS Position Window button to display the dropdown list.
2. Tap GPS Preferences.
3. In the GPS Preferences dialog box, tap the right arrow button until the Location page is displayed.
4. Tap the Location tab to display the Location page.
5. Enter a distance value to be used for the Approaching Destination alert in the DST Distance Alert input field.
6. Select the type of units you would like to use for your destination value.
7. Tap OK.



Displaying the distance and bearing to the destination

The GPS Position Window displays the distance (DST) and bearing (BRG) from the current GPS position to the selected navigation destination.

Tip

Changing the distance units

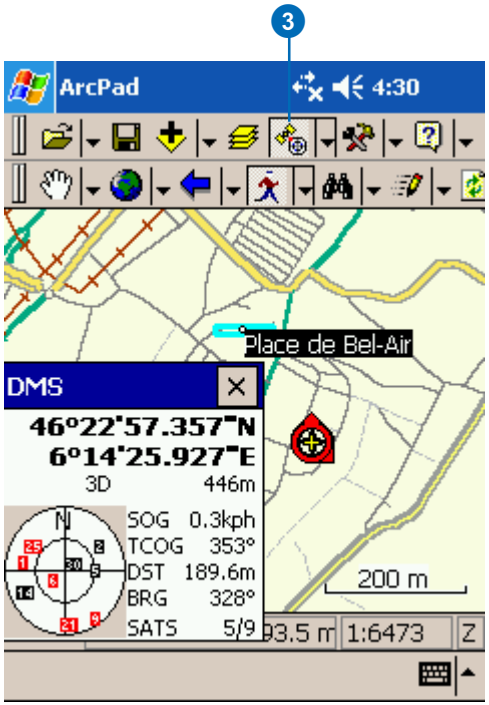
The distance is displayed in the units specified for the display units. You can change the units on the Display page of the ArcPad Options dialog box.

See Also

Refer to Chapter 9, 'Connecting your GPS receiver', for help on activating the GPS.

1. Activate your GPS if you have not already done so.
2. Select a destination using the Go To, Find, Advanced Select, or Go To Selected Feature tools.
3. Tap the GPS Position Window button to open the GPS Position Window.

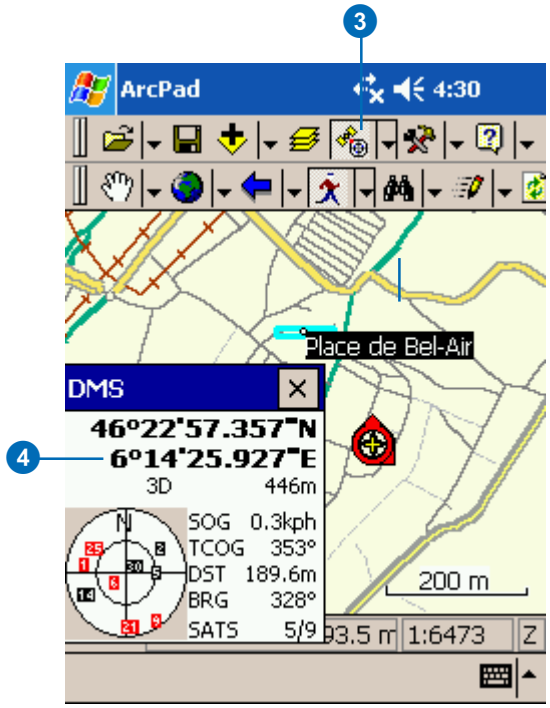
   The GPS Position Window displays the distance (DST) and bearing (BRG) from the current GPS position to the selected destination.

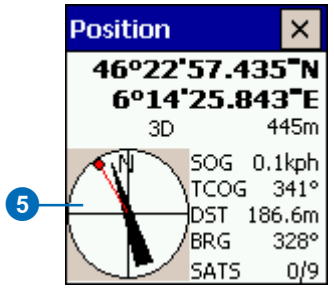


Displaying the bearing on the compass

The compass in the GPS Position Window displays the GPS direction, or course over ground (COG), with a black arrow and the direction or bearing from the current GPS position to the selected destination with a red line.

1. Activate your GPS if you have not already done so.
2. Select a destination using the Go To, Find, Advanced Select, or Go To Selected Feature tools.
3. Tap the GPS Position Window button to open the GPS Position Window.
4. Tap the GPS Position Window Satellite Skyplot twice to toggle to the Compass display.
5. The GPS Position Window displays the GPS COG with a black arrow and the bearing to the selected destination with a red line.





Using the Automatic Map Rotation tool

By activating the Automatic Map Rotation tool, ArcPad will reorientate the map based on the direction of travel. With the Automatic Map Rotation tool active, ArcPad redraws the map as you move and change your orientation so that the direction of travel is always up. The GPS must be active to use this tool.

Tip

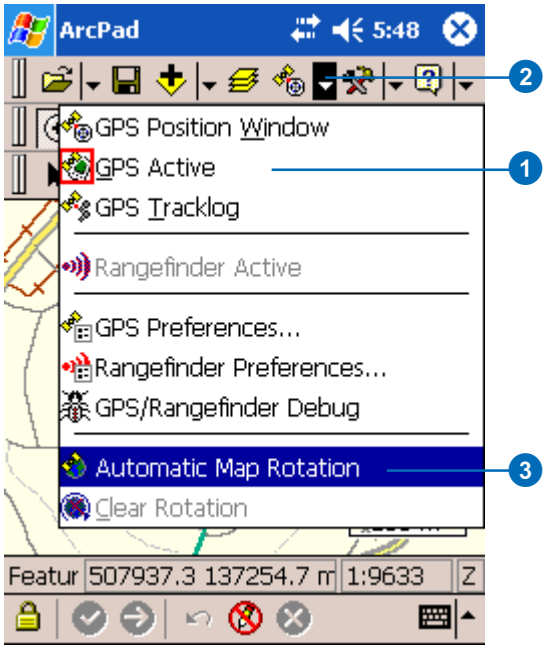
Rotating the map orientation

Use the Map Rotate tool to orientate the map without the use of the GPS receiver. See Chapter 4, 'ArcPad Basics', for more information.

Activating the Automatic Map Rotation tool

1. Activate your GPS if you have not already done so.
2. Tap the drop down arrow next to the GPS Position Window button.
3. Tap Automatic Map Rotation.

   As you begin to travel and change directions, ArcPad will automatically redraw the map so that the direction of travel is always up.

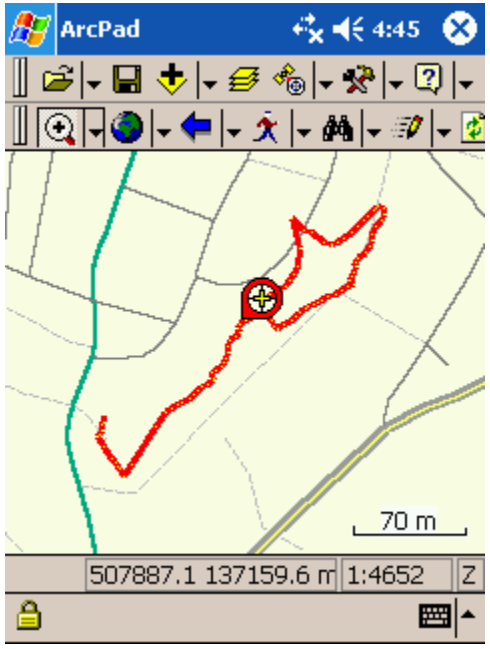


Stopping or clearing automatic map rotation

1. Tap the arrow to the right of the GPS Position Window button to display the dropdown list.
2. Tap Automatic Map Rotation to disable the tool.
3. To clear the map rotation and set it back to its original northern orientation, tap Clear Rotation, .

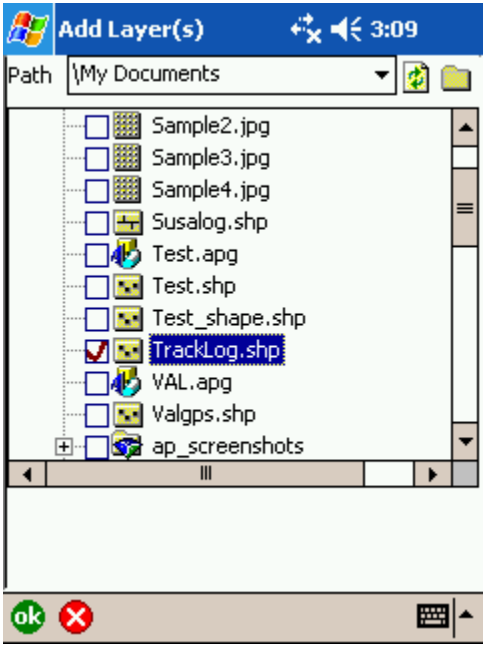
The GPS Tracklog

The GPS Tracklog in ArcPad is stored in a shapefile format. The GPS Tracklog can be started or activated when the GPS is active. ArcPad automatically records each GPS position it receives as a point feature in the GPS Tracklog shapefile, as long as the GPS Tracklog is running and the GPS is active. The GPS Tracklog is an electronic breadcrumb trail that shows the path that you have traveled. ArcPad uniquely displays these GPS positions, or points, in the tracklog as a red line.



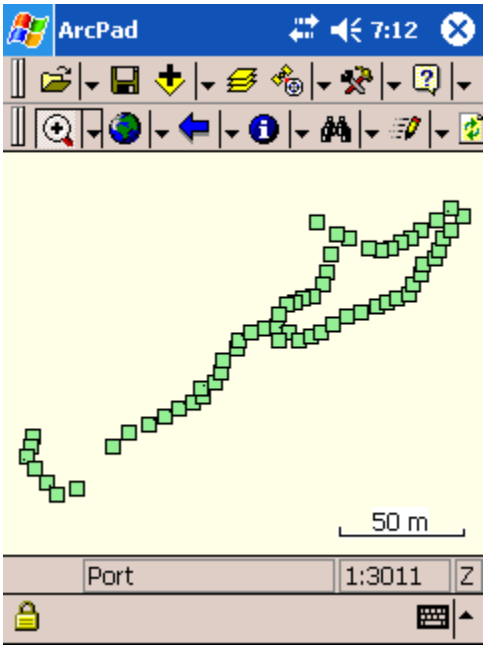
The GPS Tracklog

The GPS Tracklog points are always captured in latitude and longitude degrees using the WGS84 datum. ArcPad automatically projects the tracklog points using the projection of the current ArcPad map when displaying the tracklog. Although ArcPad treats the GPS Tracklog point shapefile in a unique way, the tracklog is still a standard PointZM shapefile that can be used in the same way as other PointZM shapefiles. The Tracklog shapefile can be added to an ArcPad map by using the Add Layer(s) dialog box.



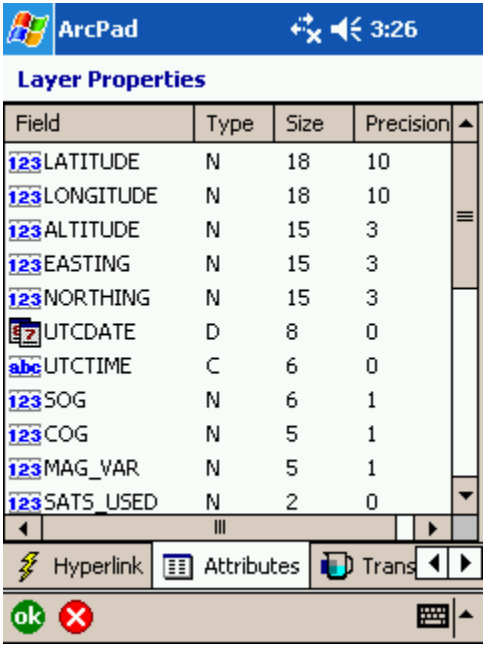
The Add Layer(s) dialog box

When adding the tracklog shapefile with the Add Layer tool, ArcPad treats the shapefile as a standard point shapefile. ArcPad displays the points as points and does not perform on-the-fly projection of the tracklog's point data—which is in latitude and longitude degrees using the WGS84 datum.



The GPS Tracklog shapefile displayed as points

For each point in the tracklog shapefile, ArcPad captures an x, y, and z coordinate with a user-specified m value. ArcPad also captures a variety of information received from the GPS receiver and stores this information in the attributes associated with the point. These attributes can be viewed by using the Add Layer tool to add the tracklog shapefile to an ArcPad map and then by using the Identify tool to display the selected point's attributes.



The feature attributes for the GPS Tracklog

The GPS information captured for each point in the tracklog, and the associated field, is as follows:

LATITUDE: Latitude in the datum of the GPS receiver

LONGITUDE: Longitude in the datum of the GPS receiver

ALTITUDE: Altitude in the datum of the GPS receiver (in meters)

EASTING: UTM easting

NORTHING: UTM northing

UTCDATE: UTC date

UTCTIME: UTC time

SOG: Speed over ground (in km/h)

COG_TRUE: True Course Over Ground (in decimal degrees)

COG_MAG: Magnetic Course Over Ground (in decimal degrees)

SATS_USED: Number of satellites used

HPE: Horizontal position error (in meters) (only when using a Garmin GPS receiver)

VPE: Vertical position error (in meters) (only when using a Garmin GPS receiver)

EPE: Estimated position error (in meters) (only when using a Garmin GPS receiver)

HDOP: Horizontal Dilution of Precision

VDOP: Vertical Dilution of Precision

PDOP: Position Dilution of Precision

QUALITY: GPS fix quality, where:
0 represents no fix.
1 represents GPS or SPS (Standard Positioning Service) fix.
2 represents DGPS (Differential GPS) fix.
3 represents PPS (Precise Positioning Service) fix.

DIFF_AGE: Age of DGPS fix (in seconds)

DIFF_ID: ID of DGPS station used

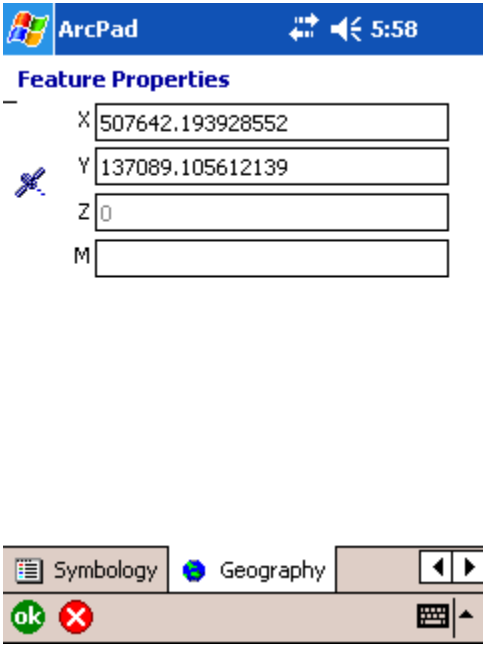
DEPTH : Depth (in meters)

DEPTH_OFF: Depth offset (in meters)

WATERTEMP: Water temperature (in degrees Celsius)

The size of the GPS Tracklog shapefile's dBASE® table can get fairly large if the Tracklog is active for a long period of time. You can reduce the size by deleting fields from the tracklog shapefile's dBASE (*.dbf) table. You can use ArcGIS Desktop (ArcView, ArcEditor, or ArcInfo) to delete fields in the shapefile's dBASE table.

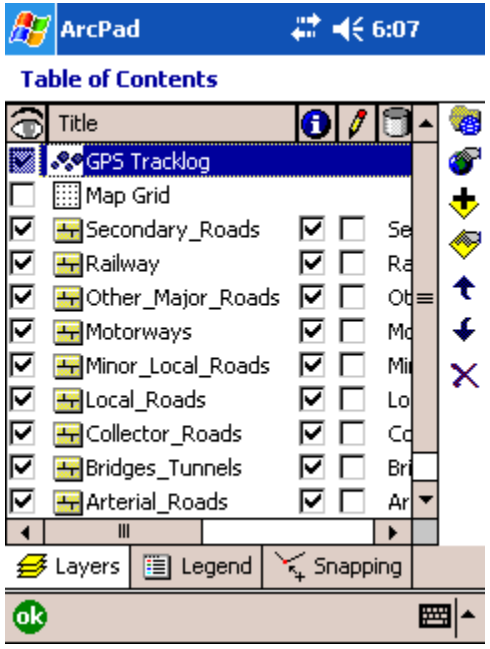
The x, y, and z coordinates, together with the m value, can be viewed by using the Geography tab of the point feature's properties.



The tracklog point feature's x, y, and z coordinates and m value

The GPS Tracklog points can be captured simultaneously while using the incoming GPS positions to capture other point, line, or polygon features. Consequently, the GPS Tracklog captures points independently from the ArcPad editing tools.

The GPS Tracklog layer is always displayed as the first layer on the Layers page of the Table of Contents.



The Layers page of the Table of Contents

The GPS Tracklog layer can be displayed, or made visible, whether the GPS is active or not. The GPS Tracklog has its own set of unique properties, which can be displayed by using the Layer Properties button in the Table of Contents.

The GPS Tracklog's layer properties

Using these properties you can:

- Change the name and location of the Tracklog shapefile.
- View the number of GPS positions or points in the tracklog.
- Clear or delete all of the points in the tracklog.

- Specify the interval to be used by ArcPad when recording the GPS positions in the tracklog. An interval of 2, for example, means that ArcPad will only use every second incoming GPS position to record a tracklog point.
- Specify whether or not ArcPad must use the GPS Quality rules when capturing points in the Tracklog. The GPS Quality rules are specified on the Quality page of the GPS Preferences dialog box.
- Select which GPS information ArcPad must use to store in the tracklog point's measure value. Available options are PDOP, HDOP, VDOP, TDOP, EPE, HPE, VPE, TIME, DEPTH, and SOG.

Any changes to the tracklog properties only take effect the next time the tracklog is started. Changes do not take effect if the tracklog is currently running.

Starting and stopping the GPS Tracklog

The GPS Tracklog is started and stopped by tapping the GPS Tracklog tool from the GPS tools dropdown list. Starting the GPS Tracklog automatically sets the tracklog layer's display status to visible.

GPS positions are automatically saved as points in the GPS Tracklog point shapefile, according to the interval specified in the GPS Tracklog's layer properties.

Tip

Disabled or grayed-out GPS Tracklog tool

The GPS Tracklog tool, in the GPS tools dropdown list, will be disabled or unavailable if the GPS is not active. The GPS Tracklog button is enabled when the GPS is activated.

Tip

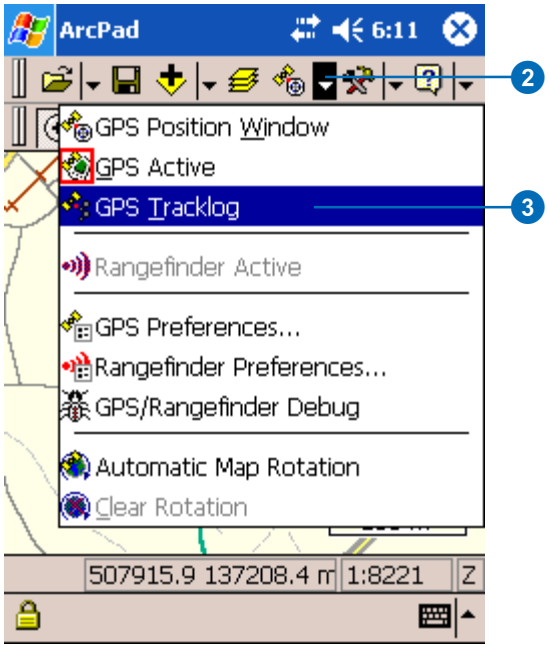
Starting a new GPS Tracklog

Use the Clear button in the GPS Tracklog's layer properties to delete any previous tracklog points or to start a new tracklog shapefile. You can also type a new filename to capture a new GPS Tracklog.

Starting the GPS Tracklog

1. Activate your GPS if you have not already done so.
2. Tap the arrow to the right of the GPS Position Window button to display the dropdown list.
3. Tap GPS Tracklog to start capturing the tracklog.

   The GPS Tracklog layer display status is automatically changed to visible when the GPS Tracklog is started. ▸



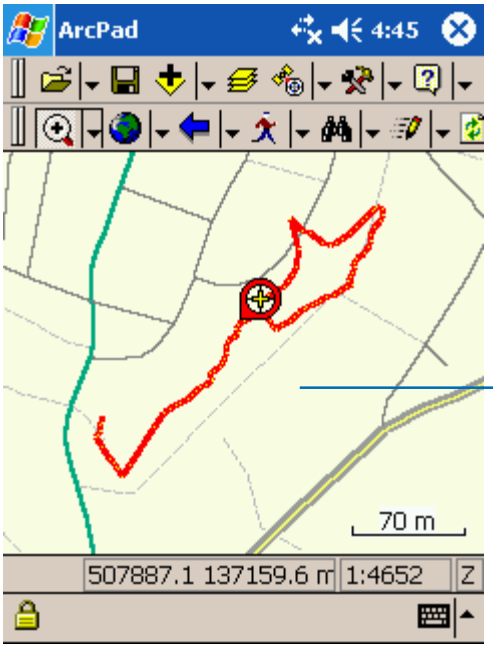
Tip

Deactivating the GPS while the GPS Tracklog is running

Deactivating the GPS while the GPS Tracklog is running will automatically stop the GPS Tracklog.

New GPS Tracklog positions are captured in the Tracklog shapefile and added to any previous points that may exist.

The tracklog positions are captured as a point shapefile; however, ArcPad displays the tracklog points as a red line.



Stopping the GPS Tracklog

1. Tap the arrow to the right of the GPS Position Window button to display the dropdown list.
2. Tap GPS Tracklog to stop capturing the tracklog points.

Using your rangefinder

12

IN THIS CHAPTER

- Introduction to rangefinders
- Supported rangefinder protocols
- Connecting your rangefinder
- Setting communication parameters
- Activating your rangefinder
- The GPS/Rangefinder Debug tool

This chapter begins with an introduction to rangefinders and describes how to connect your rangefinder to ArcPad. This chapter also discusses which rangefinder protocols are supported by ArcPad and how to use the GPS/Rangefinder Debug tool to verify or troubleshoot your rangefinder connection.

Introduction to rangefinders

Rangefinders are devices which, at a minimum, measure distance from a rangefinder, or observer, to a target. There are a variety of rangefinders available for different purposes, including rangefinders for measuring distances for construction, golf shots, speeding vehicles, and GIS data collection. Rangefinders are also known as laser rangefinders, distancemeters, and laser locators. In ArcPad, the term 'rangefinder' will be used for ease of communication.

In addition to different terms used for rangefinders there are also different terms used for the measurements made by rangefinders. Distance is also referred to as range, and can also be more accurately described as horizontal distance, slope distance, or vertical distance. Bearing is also referred to as azimuth or angle. Bearing can be relative to Magnetic north or True north. Inclination is also often referred to as pitch.
In ArcPad, we will use the terms distance, bearing, and inclination.

Rangefinders are typically used for GIS data collection for the following situations:

- When mapping the location of an object which is inaccessible, either because it is difficult to get to or it is not safe to get to the object. For example, a tree on an island, or a manhole in the middle of a busy road.
- When mapping the location of an object where it is not possible to get a GPS signal, or a GPS position of sufficient accuracy. For example, under a large tree or in a narrow street or 'urban canyon'.

Rangefinders designed for GIS data collection typically measure distance and inclination, while more expensive rangefinders also measure bearing. With ArcPad, you can use a rangefinder which only measures distance, or which measures a combination of distance plus inclination and/or bearing. You can also use a 'rangefinder' which only measures bearing—also known as a compass!

Rangefinders are used to take measurements that are then used to calculate the offset of the target relative to one or two known reference points. The offset is used to calculate the location, or coordinates, of the target based on the coordinates of the rangefinder or observer. Inclination is used to calculate the vertical distance, or elevation difference, between the observer and the target. The vertical distance can then used to calculate the Z-coordinate of the target—based on the Z-coordinate of the observer's reference point.

The easiest rangefinders to use for GIS data collection are those that measure distance and bearing. In this case only a single distance plus bearing measurement is needed to compute the location of the target. Inclination is also needed if the Z-coordinate of the target is to be calculated. This is referred to as a distance-bearing offset measurement. However, rangefinders which measure both distance and bearing tend to be more expensive than rangefinders which only measure distance (and, optionally, inclination).

Rangefinders which only measure distance or only measure bearing can also be used to map the offset location of an object. In this case, two distance (or bearing) measurements are needed to compute the location of the target, from two known reference points to the target. This is referred to as a distance-distance (or bearing-bearing) offset measurement.

Rangefinder accuracy

Although rangefinders report measurements to at least one decimal place it is important to understand that there is some amount of error inherent in these measurements. A number of factors contribute to this error, including the quality of the rangefinder, the distance to the target, stability of the rangefinder

when taking the measurement, magnetic interference, charactersitics of the target, poor weather, and daytime solar conditions. Some rangefinders have options to minimize error, such as a poor weather setting to minimize the impact of rain, snow, smoke, or airborne dust particles. The best approach to minimizing errors, however, is to be aware of the above factors, and to select a rangefinder that is appropriate for your application needs.

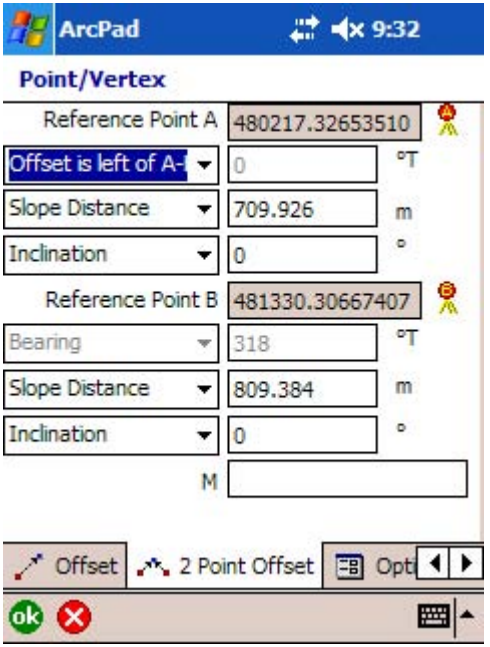
The three most important factors for introducing error are:

1. The quality of the rangefinder: The quality of the rangefinder is directly proportional to the cost of the rangefinder. More expensive rangefinders use better quality components and as a result provide more accurate measurements at greater distances. Less expensive rangefinders provide less accurate measurements, and are only suitable for measuring shorter distances.
2. The distance to the target: The measurement error increases as the distance from the observer to the target increases. For example, a compass error of 1 degree for a bearing measurement results in a horizontal error of 1.75 feet at a distance of 100 feet, and 8.73 feet at a distance of 500 feet.
3. The pointing stability: To achieve maximum accuracy, it is recommended that you use a rangepole, monopole, or tripod to stabilize the rangefinder—especially when measuring large distances. It can sometimes be difficult to target small objects at large distances when holding the rangefinder in your hand without any stabilizing support.

Working with rangefinders

Rangefinder measurements are used by ArcPad in the Point/Vertex dialog box to calculate the coordinates of the target object. Rangefinders output distance and angle (bearing or inclination) measurements using different units. When ArcPad receives data from the rangefinder, it converts all distance measurements to meters, and all angle measurements to degrees. ArcPad then displays the distance measurements using the units of the current map projection, or the display units for Geographic projections. The rangefinder protocol and communications parameters are set in the Rangefinder Preferences dialog box.

When ArcPad receives data from the connected and activated rangefinder, a sound is played to notify the user. ArcPad also automatically opens and populates the Point/Vertex dialog box if the point, polyline, or polygon tools are active and the corresponding Offset Point, Linear Traverse, or Radial Traverse modes are enabled.



The Point/Vertex dialog box with the 2 Point Offset page active

The 2 Point Offset page of the Point/Vertex dialog box is automatically displayed and populated if Reference points A and B have been specified. The first measurements from the rangefinder will be used to fill in the measurement fields for Reference point A. The next set of measurements received from the rangefinder will be used to fill in the measurement fields for Reference point B. At any time you can edit the measurements in the fields in the Point/Vertex dialog box. Tap OK when you are satisfied with the measurements and are ready to use them to create a point or vertex.

Supported rangefinder protocols

ArcPad supports rangefinder protocols rather than specific rangefinders. In practice, however, most rangefinders use proprietary protocols that are not supported by other vendors' rangefinders. Consequently, many of the rangefinder protocols supported by ArcPad are often used by a single vendor's rangefinders.

ArcPad supports the following rangefinder protocols:

- Laser Atlanta $LA1KA (original)
- Laser Atlanta $LA1KD (extended)
- Laser Atlanta $LA1KC (CMT, Corvallis MicroTechnology)
- LaserCraft Contour $PLCI
- Laser Technology Criterion 400 format ($PLTIT)
- Leica DISTO interface protocol
- Leica Vector/Laser Locator data transfer format
- Measurement Devices Ltd. $PMDLA

Any rangefinder that outputs any of the above protocols should work with ArcPad, as long as the rangefinder is correctly configured and properly connected to the device being used with ArcPad.

ESRI does not publish a list of supported rangefinders for ArcPad. ArcPad supports the above listed rangefinder protocols rather than specific rangefinders.

Connecting your rangefinder

Connecting your rangefinder to ArcPad is a simple process that involves the following steps:

1. Determine what cables, adapters, and gender changers, if any, are needed to connect your rangefinder to the mobile device being used to run ArcPad.
2. Connect the rangefinder to the mobile device.
3. Configure the rangefinder.
4. Set the Rangefinder Preferences in ArcPad.

There is no standard method for connecting a rangefinder to ArcPad since most rangefinders have unique configurations. By using this section and the documentation for your rangefinder and mobile device, it is fairly easy to successfully connect your rangefinder to ArcPad.

Determining what items are needed

In general, you will need one or more of the following items to connect your rangefinder to the mobile device being used to run ArcPad:

- A serial cable to connect to the rangefinder
- A serial cable to connect to the mobile device
- A male-to-male gender changer
- A null modem adapter

You will not need any of the above items if you are connecting your rangefinder to your mobile device via Bluetooth.

Many rangefinders and mobile devices have unique fittings for their serial ports and require their own proprietary serial cables. This is particularly true for Windows Mobile devices. Not all rangefinders, however, require all of the above items to connect to the mobile device.

Many serial cables that connect to the rangefinder on one end are designed to connect directly to a PC serial port on the other end using a standard DB9 serial connector. This is not true when connecting to many Windows Mobile devices since these devices usually have nonstandard, proprietary serial ports. Consequently, a proprietary serial cable is usually required when connecting a rangefinder to a Windows Mobile device. This dependency on proprietary serial cables makes Bluetooth an attractive option for connecting serial devices, including rangefinders, to Windows Mobile devices—although not all Windows Mobile devices support Bluetooth.

Most rangefinder serial cables and Windows Mobile device proprietary serial cables have 9-pin DB9 female connectors on the ends that need to be connected together. Consequently, a 9-pin male-to-male gender changer is required to connect the two female serial cables. Finally, a null modem adapter or cable is usually needed when connecting a rangefinder to a Windows Mobile, using the device's sync cable.

Connecting your rangefinder

Using the information in the preceding discussion you should now be able to determine which cables, null modem adapters, and gender changers you will need to connect your rangefinder to the device that is running ArcPad. Assemble and connect the required items before moving to the next step of configuring your rangefinder. No assembly of cables and adapters is needed if you are using Bluetooth! Also, make sure that the batteries on your rangefinder are fully charged!

Configuring your rangefinder

You need to configure your rangefinder to output data in a protocol supported by ArcPad. You also need to verify the communication parameters that your rangefinder is configured

for, specifically the baud rate, parity, data bits, and stop bits. You will need this information for the next step of setting the Rangefinder Preferences in ArcPad.

If you are using Bluetooth, you will need to use the Bluetooth Manager on your mobile device to discovery the rangefinder, and possibly to pair your rangefinder with your mobile device. Consult the documentation for your rangefinder and mobile device for more information on connecting via Bluetooth.

Setting the Rangefinder Preferences in ArcPad

In order to activate your rangefinder, you first need to set the rangefinder communication parameters in ArcPad to match the parameters on your rangefinder. The rangefinder protocol and communication parameters are set in the Rangefinder Preferences dialog box.

The task later in this chapter describes how to set the communication parameters in ArcPad.

Setting communication parameters

In order to activate your rangefinder, you first need to set the rangefinder communication parameters in ArcPad to match the parameters on your rangefinder. The communication parameters are set in the Rangefinder Preferences dialog box.

Tip

Setting advanced serial port parameters

You can tap the Serial Port Parameters button, ,to open the Serial Port Parameters dialog box in order to set advanced port parameters.

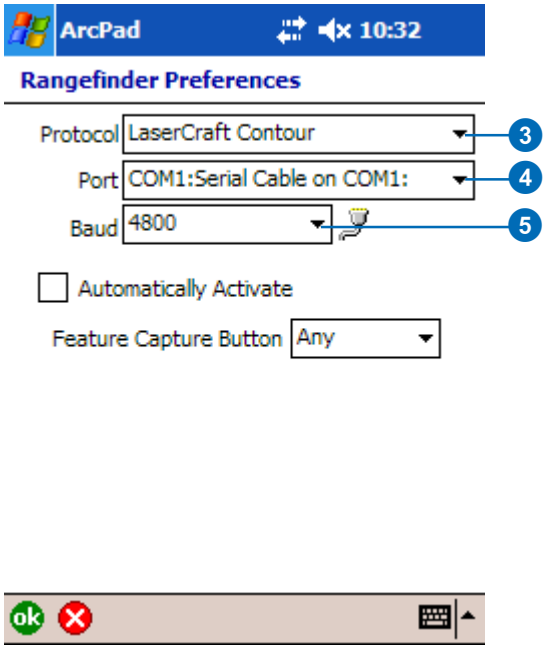
See Also

Refer to Chapter 4 of the ArcPad Reference Guide *for more information on the fields in the Rangefinder dialog box.*

See Also

Refer to Chapter 9, 'Connecting your GPS receiver', for information on how to set the advanced Serial Port Parameters.

1. Tap the arrow to the right of the GPS Position Window button, on the Main toolbar, to display the dropdown list.
2. Tap the Rangefinder Preferences tool to open the Rangefinder Preferences dialog box.
3. Tap the Protocol dropdown arrow to select the protocol used by your rangefinder to output data.
4. Tap the Port dropdown arrow to select the serial port on your mobile device, which is connected to your rangefinder.
5. Tap the Baud dropdown arrow to select the baud rate of your rangefinder's output.



Activating your rangefinder

In order to activate your rangefinder in ArcPad, you first need to ensure that the rangefinder is correctly connected to your mobile device and that the rangefinder protocol and communication parameters in ArcPad match the settings on the rangefinder. You also need to turn your rangefinder on before activating it in ArcPad.

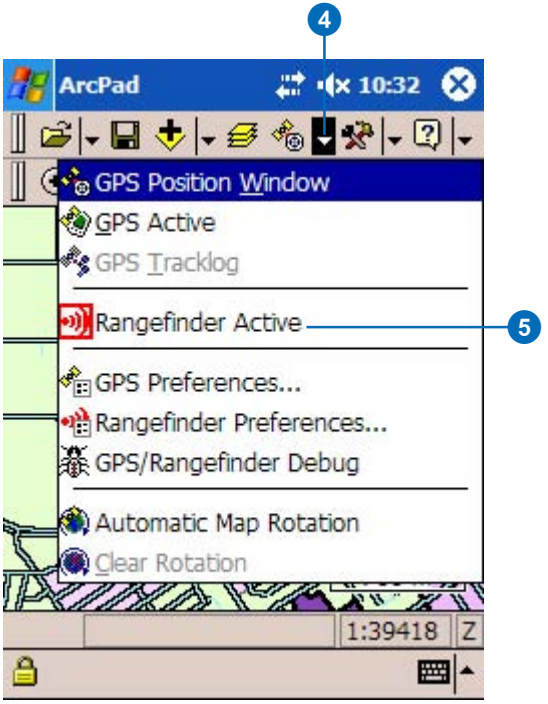
Tip

Deactivating your rangefinder

If the rangefinder is activated, you can deactivate it by tapping Rangefinder Active.

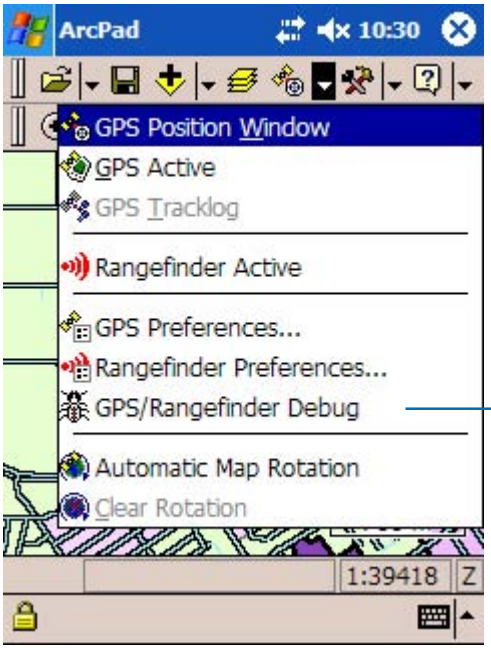
1. Configure your rangefinder to output data using one of the rangefinder protocols supported by ArcPad.
2. Connect your rangefinder to your mobile device using the appropriate cables, null modem adapters, and gender changers, or Bluetooth communication settings.
3. Set the rangefinder protocol and communication parameters in the Rangefinder Preferences dialog box to match the settings on the rangefinder.
4. Tap the arrow to the right of the GPS Position Window button to display the dropdown list.
5. Tap Rangefinder Active.

   The Rangefinder Active icon is highlighted with a red box when the rangefinder is active.

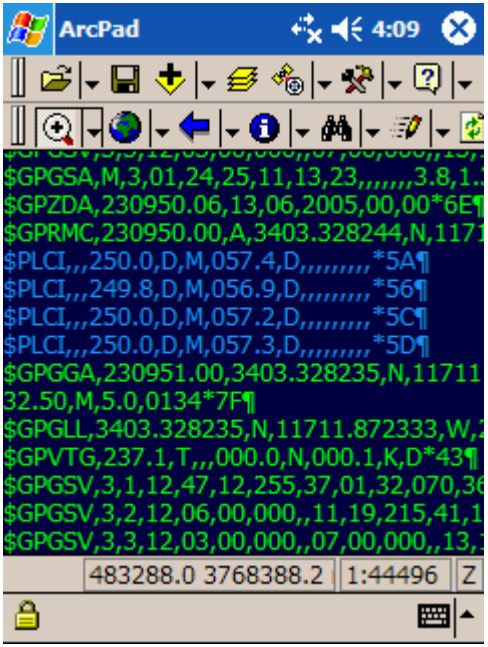


The GPS/Rangefinder Debug tool

GPS/Rangefinder Debug is a useful tool for troubleshooting GPS and rangefinder connection problems. The GPS/Rangefinder Debug tool is opened by tapping the arrow to the right of the GPS Position Window button and then tapping GPS/Rangefinder Debug. The GPS/Rangefinder Debug tool is only opened when a GPS or rangefinder is currently active.



The GPS/Rangefinder Debug tool opens a window that displays data from either the GPS receiver or rangefinder, or both. Valid GPS or rangefinder data is displayed in green text, and valid GPS or rangefinder data is displayed in blue text. Invalid data is displayed in red text. Valid data is data that is constructed properly, in accordance with the selected GPS or rangefinder protocol, and has a valid checksum.



The GPS/Rangefinder Debug window with NMEA 0183 GPS and rangefinder data

Chapter 9, 'Connecting your GPS receiver', includes a section on using the GPS/Rangefinder Debug tool for troubleshooting your GPS connection. This section will focus on using the tool for troubleshooting your rangefinder connection.

ArcPad uses the settings for the rangefinder Protocol and port communication parameters to parse, or interpret, the rangefinder data being received on the specified serial port of your device. ArcPad then displays information in the GPS/Rangefinder Debug window that indicates the status of the rangefinder connection.

No information displayed in the GPS/Rangefinder Debug window

Irrespective of which rangefinder protocol is being used, the first observation to make when opening the GPS/Rangefinder Debug window is whether any information is being displayed at all. No information displayed in the GPS/Rangefinder Debug window indicates a rangefinder connection or configuration problem. Problems are caused by any one of the following factors:

- Your rangefinder is not turned on or has not been configured to output data in the protocol specified in the Rangefinder Preferences.
- The cable connection between your rangefinder and the device running ArcPad may be incorrect. Add a null modem adapter if you are not using one, or remove the null modem adapter if you are using one.
- The rangefinder port communication parameters selected in the Rangefinder Preferences dialog box do not match the serial communication parameters set on your rangefinder. For example, your rangefinder may be set to output at a baud rate of 4800, while a baud rate of 9600 has been selected for the rangefinder port settings in ArcPad.
- If using Bluetooth, your Bluetooth connection to your rangefinder is not defined correctly. Make sure that you can connect to your rangefinder from the Bluetooth Manager on your mobile device.

Test each of these factors one by one to isolate the problem and determine why no information is being displayed in the GPS/Rangefinder Debug window.

Illegible information displayed in the GPS/Rangefinder Debug window

In some instances, you may see illegible characters displayed in the GPS/Rangefinder Debug window. This is usually caused by rangefinder port communication parameters selected in the Rangefinder Preferences dialog box that do not match the serial communication parameters set on your rangefinder.

Rangefinder Debug information

Most rangefinders output data as ASCII text. Some rangefinders output data using the NMEA 0183 protocol, which is also an ASCII based protocol. In either case, you should see the data from the rangefinder displayed in the GPS/Rangefinder Debug window as ASCII text. Each data string or NMEA sentence that ArcPad reads from the serial port is displayed in the GPS/Rangefinder Debug window. Valid rangefinder data is displayed using blue text, and invalid rangefinder data is displayed using red text.

The displayed data can be used to troubleshoot your rangefinder connection. In the example on the previous page, a number of NMEA 0183 sentences from a GPS and a LaserCraft Contour XLR rangefinder are displayed. For instance, the rangefinder $PLCI sentence is displayed in blue text as:

$PLCI,,,250.0,D,M,057.4,D,,,,,,,,*5A

Using the documentation for the LaserCraft Contour XLR, we can determine that the bearing is 250.0 degrees, and the inclination, or pitch, is 057.4 degrees. The fields for distance, or range, are empty

indicating a possible problem with the measurement taken with the rangefinder. In this case, the distance fields are empty because the target was within the minimum range.

Studying the rangefinder data displayed in the GPS/Rangefinder Debug window can help to explain why information is not displayed in the Offset dialog box when using a rangefinder.

Using your digital camera

13

IN THIS CHAPTER

- Supported digital cameras
- Setting camera options
- Taking a photo
- Creating a photo layer

This chapter begins with a discussion of supported cameras, and how these cameras can be used with ArcPad. This chapter also discusses how to set various camera options in ArcPad, and how to take a photo with the digital camera connected to your mobile device. Finally, this chapter describes how you can view georeferenced digital photos as a Photo Layer within ArcPad.

Supported digital cameras

ArcPad supports digital cameras at two levels:

1. Georeferenced photos can be displayed as a photo layer.
2. ArcPad provides a Camera tool which can be used to capture photos with a camera which is connected to your mobile device.

Digital photos which have GPS coordinates embedded in the EXIF header of the image can be displayed on the ArcPad map as a photo layer. These georeferenced photos can be created with any camera which can interface with a GPS, such as the Ricoh Caplio Pro G3 camera. There are also software tools available which can insert GPS coordinates into the EXIF header. This is typically done by matching the time and date of the photo with the time and date of positions captured by a GPS. When creating a photo layer, ArcPad reads the GPS coordinates in the EXIF header, and automatically projects the latitude and longitude coordinates into the projection of the current ArcPad map. For more information on the EXIF header of digital photo image files, visit www.exif.org.

ArcPad includes "drivers" for cameras which are connected directly to a mobile device. "Connected" cameras include cameras that are integrated in mobile devices such as the HP iPAQ Windows Mobile devices, and cameras that are connected via the USB port on a mobile device.
ArcPad 7.0 includes drivers for the following connected digital cameras:

- Cameras integrated into some of the HP® iPAQ® Windows Mobile device models. These include the HP iPAQ rx3700® and hx6300® series devices.
- On PCs, ArcPad includes a driver for cameras which interface via the standard Windows Multimedia API (MCI). These cameras usually connect to the PC via a USB cable, and typically include PCcam and Webcam cameras which are capable of taking still photos—although some standard digital cameras can also operate as a Webcam. There are a number of Webcam cameras available from various vendors. Creative Labs and Logitech® are two of the more well-known vendors of Webcams.
- Cameras integrated into Windows Mobile 5 devices and use the standard Windows Mobile 5 camera API.

Support for additional connected cameras can be provided via custom camera modules.

The Camera tool in ArcPad is used to take a photo with a connected camera. The camera tool is located in two places in ArcPad: on the Tools dropdown menu, and on the Picture page of the Feature Properties dialog box. When taking a photo with the Camera tool, ArcPad verifies if you have a GPS active and a valid GPS position. If there is a valid GPS position then ArcPad will insert the GPS coordinates into the EXIF header of the resultant photo image file. These "georeferenced" photos can then be viewed as a photo layer in ArcPad. Whether or not a photo is georeferenced, photos that are associated with a feature can be viewed via the Picture page of the Feature Properties dialog box or by using the Hyperlink tool.

Setting camera options

In order to use a digital camera with ArcPad, you must first select the appropriate driver for the camera. The dropdown list on the Camera page in the ArcPad Options dialog box only displays supported cameras for your mobile device.

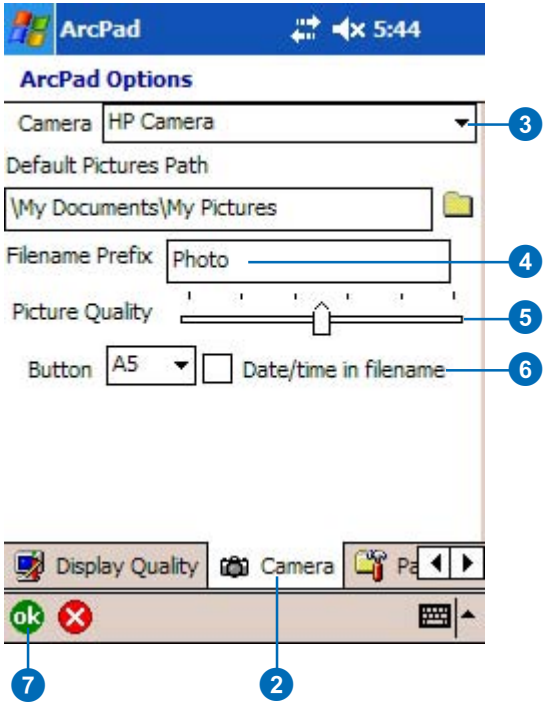
You can also set the following camera options:

- Default path for standalone photos captured with the camera tool.
- Prefix, and date/time suffix, for the output image file when using the Camera tool to capture photos that are not associated with a feature.
- Picture quality for the output JPEG photo files. The slider ranges from a quality of 50% to 100%. Higher picture quality settings use less compression for the output JPEG photo file. ▸

See Also

Refer to Chapter 3 of the ArcPad Reference Guide *for more information on the fields in the Camera dialog box.*

1. On the Main toolbar, tap the Tools button to open the ArcPad Options dialog box.
2. Navigate through the tabs and tap the Camera tab.
3. Tap the Camera dropdown arrow to select the driver for the camera connected to your mobile device.
4. Optionally enter a prefix for ArcPad to use for naming the image files created with your digital camera.
5. Optionally set the picture quality for the output JPEG photo files.
6. Optionally check the Date/time in filename checkbox for ArcPad to use a date and time suffix for naming the image files created with your digital camera.
7. Tap OK.



- Hardware button to launch the camera tool. This button is specific for each device.

The hardware button labels and assignments vary across devices. On Windows Mobile devices, you can view and change the button labels and assignments by tapping Settings, Personal, and then Buttons.

Taking a photo

In ArcPad, there are two methods to take a photo with the digital camera connected to your mobile device:

1. By using the Camera tool located on the Tools dropdown menu, on the Main toolbar. This Camera tool is used to take a stand alone photo, that is a photo which is not associated with a feature.
2. By using the Camera tool located on the Picture page of the Feature Properties dialog box. This Camera tool is used to take a photo which is associated with a feature. The photo filename is stored as an attribute in the selected field of the feature.

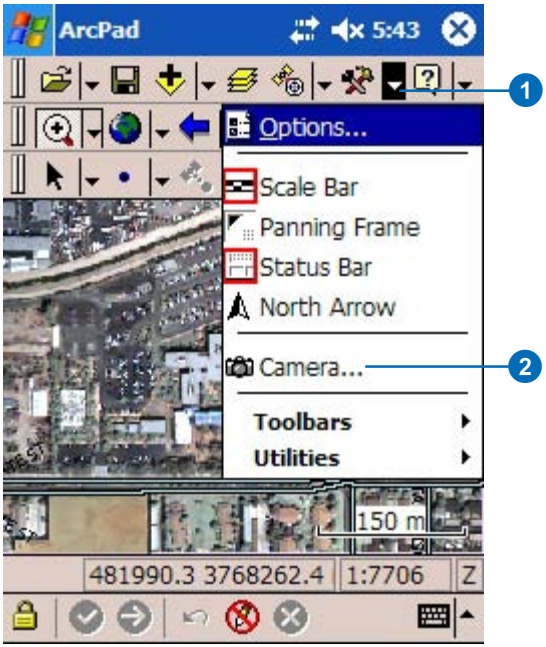
When activated, both of the Camera tools open the same dialog box for interacting with your digital camera and for taking the photos.The camera dialog box will vary according to the camera driver selected in the ArcPad Options.

Taking a standalone photo

1. On the Main toolbar, tap the Tools dropdown menu.
2. Tap the Camera icon to open the camera tool.

   You can also use the hardware button, specified in the Camera page of the ArcPad Options, to launch the Camera tool.

   Proceed to 'Taking a photo with the camera tool'.



Tip

The Picture page is missing

If you are using a custom form, your Feature Properties dialog box may not show the Picture page. Custom input forms can optionally hide the default pages of the The Feature Properties dialog box, including the Picture page.

Tip

Creating field names for photo filenames

ArcPad automatically populates the Field dropdown list with field names which appear to be suitable for storing photo filenames. To do this, ArcPad looks for any text field—in the shapefile's dBase® table—which has a name that contains the words "photo", "image", or "picture". The text field also needs to have a minimum length of 20 characters.

See Also

Refer to Chapter 3 of the ArcPad Reference Guide *for more information on the fields in the Camera dialog box.*

Taking a photo associated with a feature

1. Open the Feature Properties dialog box for the feature that you want to associate the photo with.

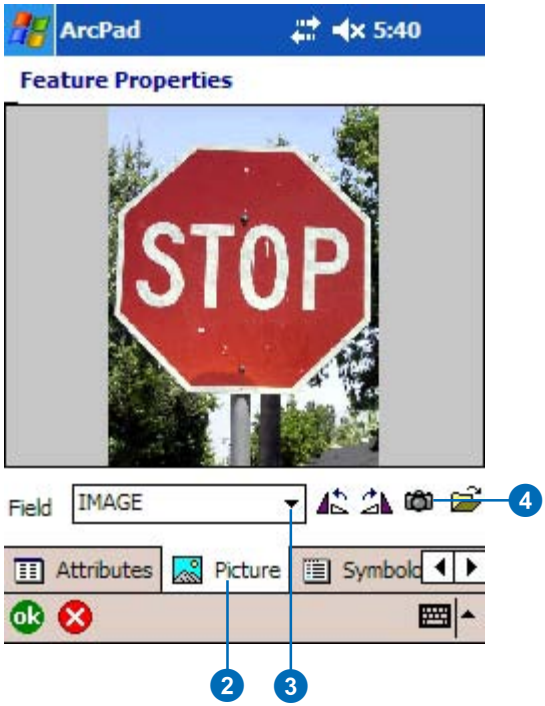
   The Feature Properties dialog box is automatically displayed after a new feature is created. To display the Feature Properties dialog box for an existing feature, use the Select tool to select the feature and tap the Feature Properties button on the Edit toolbar.

2. Navigate through the tabs and tap the Picture tab.

3. Tap the Field dropdown list to select the field to be used for storing the filename of the photo to be taken. The selected field name will be used as the prefix for the photo's filename.
   You can use the folder button to select an existing photo on your device to associate with the feature. Once a photo has been captured, you can use the rotate left or rotate right buttons to change the orientation of the photo.

4. Tap the Camera icon to open the camera tool.

   Proceed to the following task describing how to use the camera tool.



Tip

My camera tool looks different to the camera tool shown

The tools available in the camera tool are dependent on the camera driver selected, as well as the capabilities of the camera connected to your mobile device.

For example, the camera tool shown for this task is for the HP camera integrated in some models of HP iPAQ Windows Mobile devices. The greyed out tools indicate that this particular camera does not support these tools or options.

Tip

Specifying photo filenames

For standalone photos, the photo filename will use the prefix specified in the Camera page of the ArcPad options. The photo filename will also include a unique number, or if specified in the ArcPad Options, the date and time at which the photo was taken.

For photos associated with a feature, the photo filename will use the selected field name in the Picture page of the Feature Properties dialog box. The photo filename will also include a unique number, or if specified in the ArcPad Options, the date and time at which the photo was taken.

Taking a photo with the camera tool

1. Tap the available camera tools to set any options for the camera and resultant photos.

   The green arrow in the photo preview window indicates the orientation of the output photo.

2. Tap the Camera icon to take the photo.

   On some Windows Mobile devices, you can also press assigned hardware buttons to take the photo.

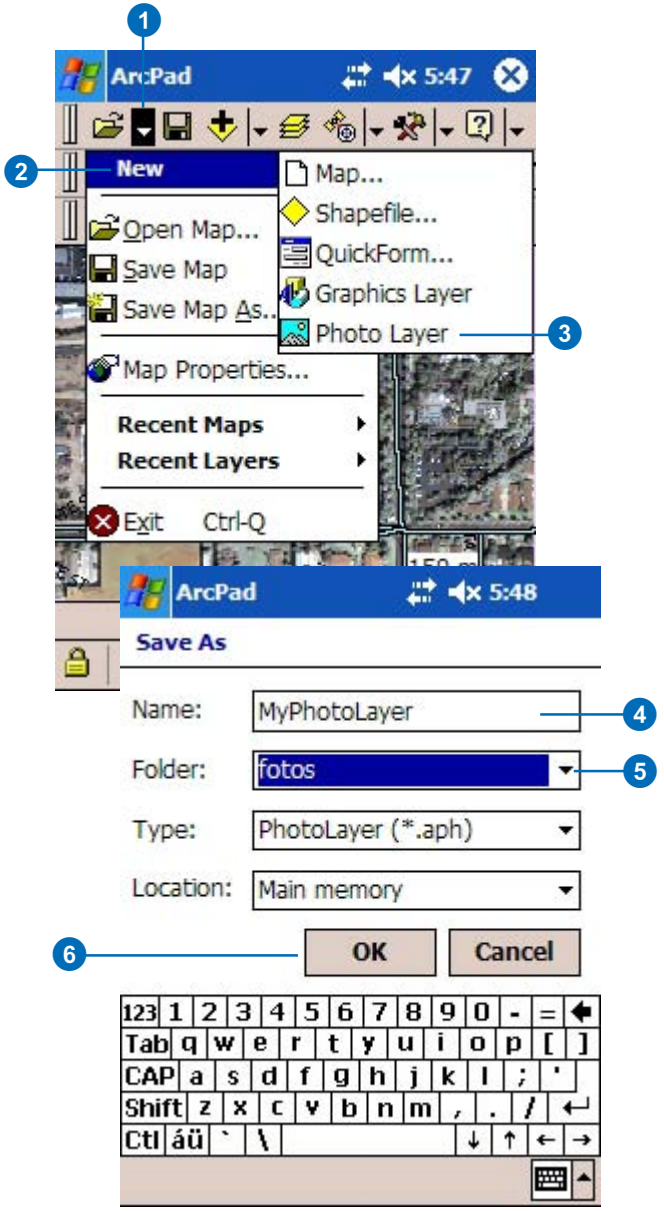
Creating a photo layer

ArcPad supports photo layers. A photo layer is a file that contains photos with GPS coordinates in the EXIF header of each photo file. The photo layer file, which has an .APH extension, specifies how the photo layer should be displayed in ArcPad.

To create a new photo layer you use the Photo Layer tool in the New sub-menu. Once a photo layer has been created it can be added to the ArcPad map in the same way that other layers are added. ►

1. On the Main toolbar, tap the Open Map dropdown menu.
2. Tap New to open the New sub-menu.
3. Tap Photo Layer.

   The Save As dialog box will be displayed.
4. Enter the name for your new photo layer in the Name input field.
5. Tap the Folder dropdown list to select the folder on your device which contains the photos for your photo layer.
6. Tap OK when you have entered all the necessary information. ►



Tip

Changing the symbol and label settings for the photo layer

A photo layer is an XML file, with an .APH extension, that can be edited with a text editor. You can specify the symbol used to display the location of the photos by editing the .APH file. You can also specify whether or not the symbol is labeled with the photo filename.

See Also

Visit www.exif.org for more information on EXIF, the Exchangeable Image File Format.

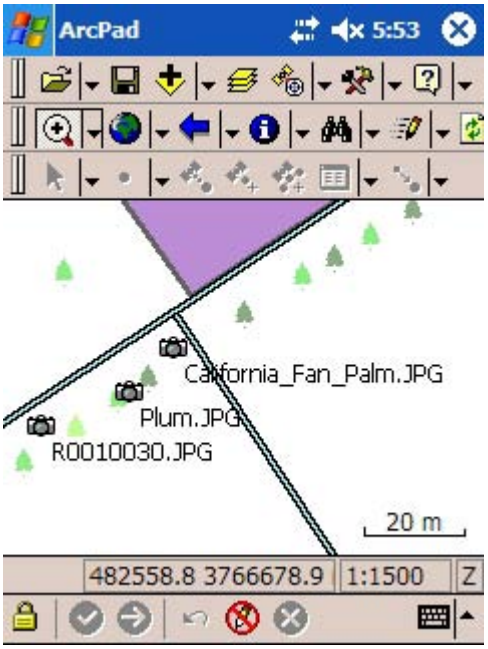
The Identify and Hyperlink tools can be used with the photo layer.

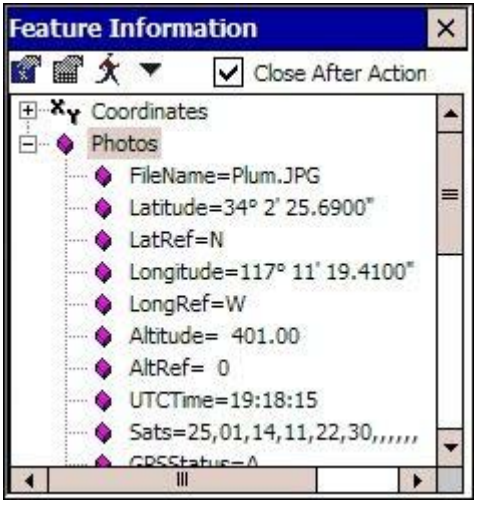
The Identify tool displays the photo's attributes, or EXIF information, in the Feature Information dialog box.

The Hyperlink tool displays the photo, using the external application associated with JPEG files.

The new photo layer will be added and displayed on the map. By default, a camera symbol is used for each photo position, and is labeled with the photo file name.

Optionally use the Identify tool to select a photo and view the photo's attributes in the Feature Information dialog box.





Editing data

Section 5

Editing basics

14

IN THIS CHAPTER

- An overview of the editing process
- Editing with a GPS
- The Edit toolbar
- The Command bar
- Creating new shapefiles for editing
- Creating a QuickForm
- Displaying the Edit toolbar
- Selecting a layer for editing
- Selecting features for editing
- Setting snapping options
- Moving features
- Undoing and canceling edits
- Deleting features

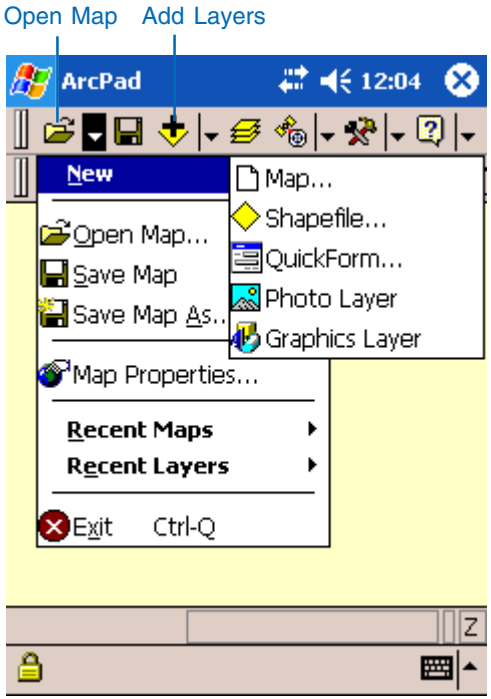
In addition to displaying and querying spatial data, ArcPad allows you to create and edit spatial data using input from either the mouse pointer, pen, global positioning system (GPS), or rangefinder.

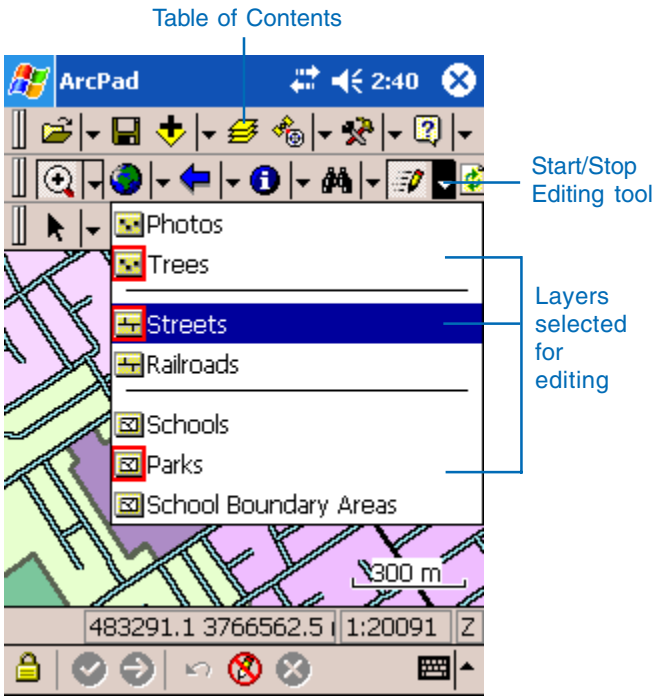
This chapter provides an introduction on how to edit in ArcPad and describes the basic tasks you need to know before you can start to create and edit spatial data. This chapter includes information on basic editing tasks, such as displaying the Edit toolbar and Command bar; creating new layers; and selecting, moving, and deleting features.

An overview of the editing process

The following is a general overview of how to use ArcPad, the Edit toolbar, and the Command bar to edit your data. Each of the following steps is outlined in detail in this chapter or other chapters in this section:

1. Start ArcPad.
2. Create a new map, browse for data, or open an existing map.
3. Add data to your map.
4. Select the shapefile layers that you want to edit. You can only select one layer of each shapefile type (point, line, or polygon) for editing at a time. Alternatively, the Graphics layer can be selected for editing. The dropdown menu next to the Start/Stop Editing tool displays the layers that are available for editing.





5. Display the Edit toolbar and the Command bar.

If the Edit toolbar and Command bar are not already visible, they will automatically be displayed when a layer is selected for editing. The buttons on the Edit toolbar and the Command bar will only be enabled if a layer has been selected for editing. The GPS buttons will only be enabled if the GPS has been activated.

6. Select the feature that you want to edit or select a feature type to create a new feature.

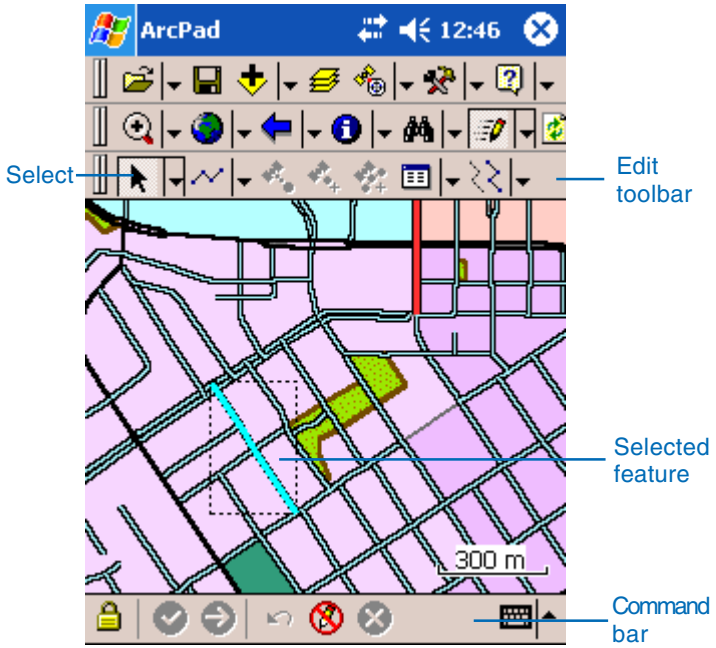
The GPS buttons will only be enabled if the GPS has been activated and the selected feature type is point, polyline, or polygon. You can activate the GPS whenever you want to use the GPS coordinates for creating or modifying features.

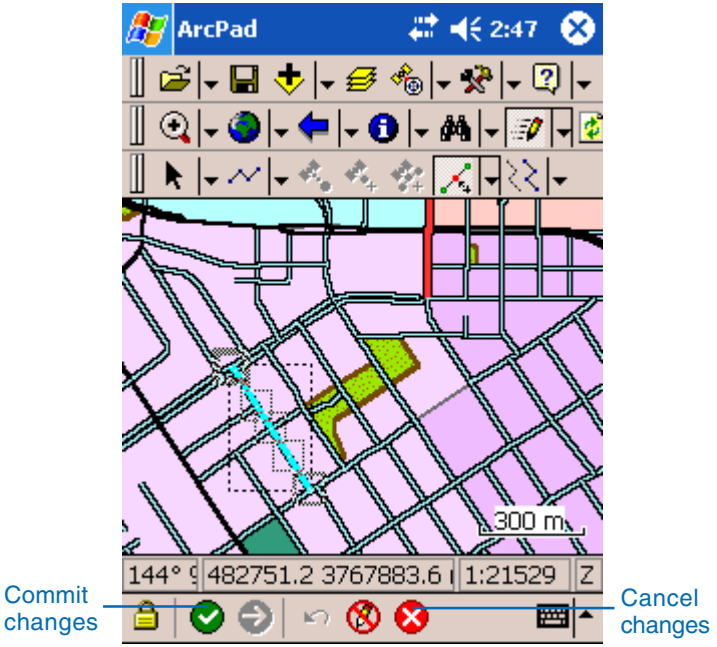
7. Create or modify features and their attributes.

8. Commit geometry changes or undo changes made to a feature.

The Command bar is also displayed at the bottom of the screen when a layer is selected for editing. Once a change has been made, it enables you to commit geometry changes, capture attribute information for a new feature, and undo and cancel edits to a recently edited feature.

There is no need to save your edits; all edits are made directly on the original or source shapefile. Once you have commited your changes, there is no undo function. Your edits have been made. Prior to committing your changes, you can still undo changes step by step with the Undo tool or all at once with the Cancel Changes tool.





Editing using a GPS

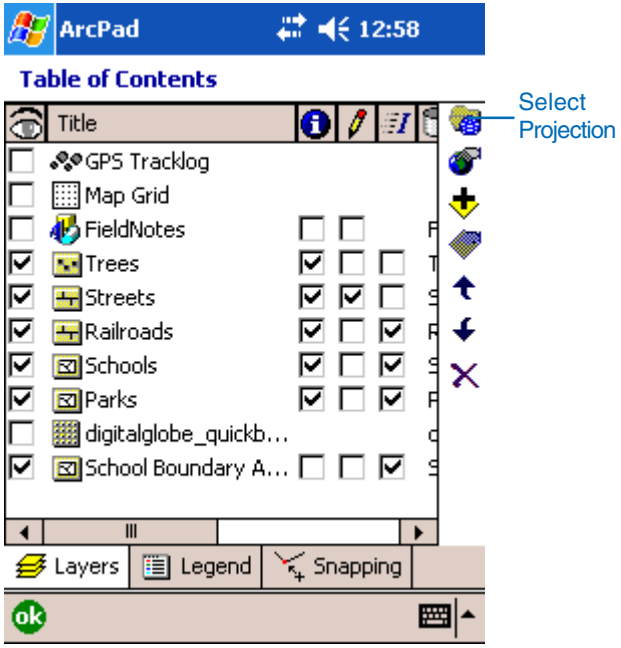
Editing in ArcPad with a GPS is very similar to editing with the mouse pointer, pen, or stylus; the main difference is that the GPS is the source of coordinates instead of the mouse pointer. Using the incoming GPS coordinates, you can capture point, polyline, and polygon features. You can also move existing points and vertices to the current GPS position.

There are, however, some differences when using the GPS coordinates to capture and edit with ArcPad:

- Your ArcPad map needs to have a projection defined before you can activate the GPS.

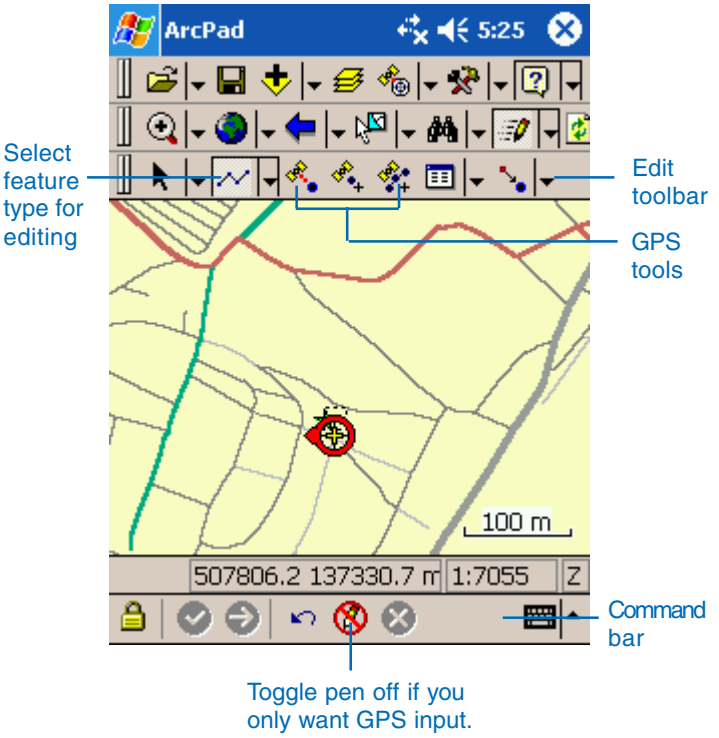
  The projection can be defined using two methods:

  1. Associate a projection file (.prj) with each layer in your ArcPad map

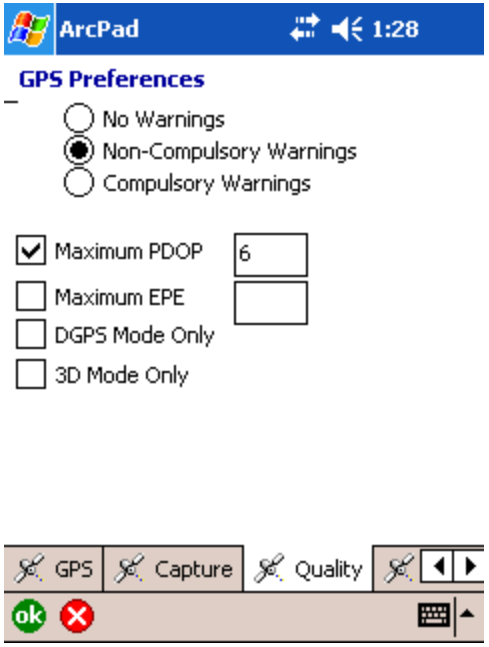


  2. Use the Select Projection button in the Table of Contents to select a projection file on your computer that matches the projection of the data in your ArcPad map.

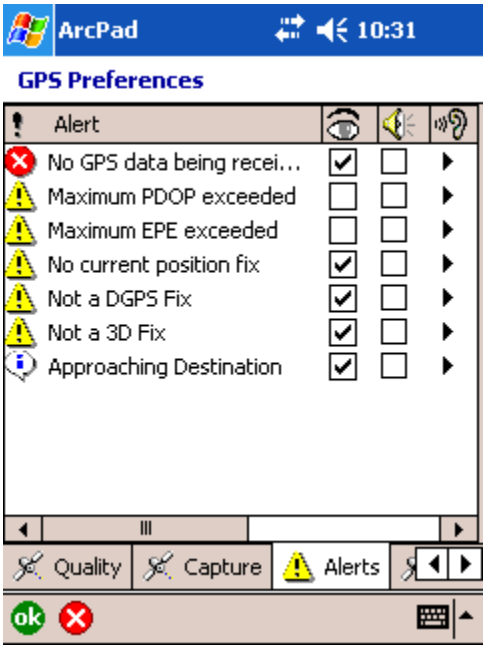
- The GPS needs to be activated before any of the GPS buttons on the Edit toolbar are enabled. Furthermore, the GPS Point button is only enabled when a point layer is active for editing. The Add GPS Vertex and Add GPS Vertices Continuously buttons are only enabled when either the polyline or polygon feature type has been selected.



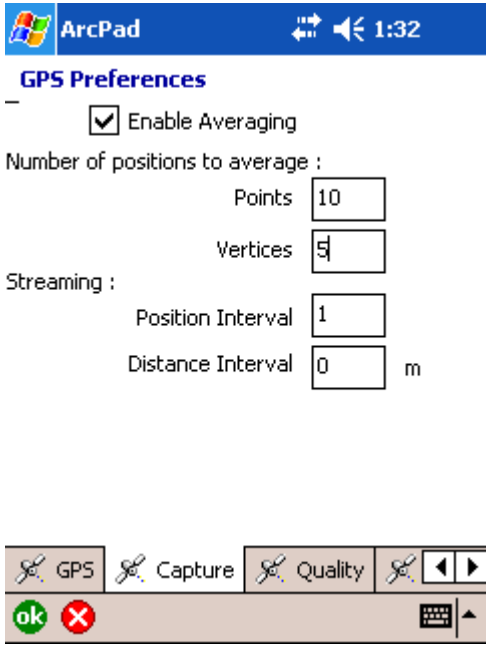
- Optionally, you can specify various quality control parameters to filter out less accurate GPS coordinates. For example, you can specify maximum PDOP or EPE values or limit ArcPad to only use 3D or DGPS GPS coordinates.



- You can also specify alert messages and sounds, which ArcPad displays and plays, respectively, when the specified quality control parameters have been exceeded.



- You can optionally use the average x,y, and z coordinates of multiple GPS positions to capture point features or vertices of polyline or polygon features.



You can also specify the position interval, or frequency and distance interval, of GPS position coordinates for ArcPad to use when capturing polyline or polygon vertices in streaming mode.

The GPS Quality, Alerts, and Capture options are all specified in the GPS Preferences dialog box. These options are discussed in more detail in Chapter 15, 'Creating new features', and in the *ArcPad Reference Guide*.

In most cases, the GPS coordinates received by ArcPad are in latitude and longitude degrees, typically using the WGS84 datum. This may be different to the projection and datum of the data in your map. In this case, ArcPad automatically does on-the-fly projection and datum transformation of the incoming GPS coordinates to the projection and datum of your map data.

The Edit toolbar

Select dropdown list: Tools to select features using the pointer or GPS and navigation tools for the selected feature.

Feature dropdown list: Sets the feature type for data capture.

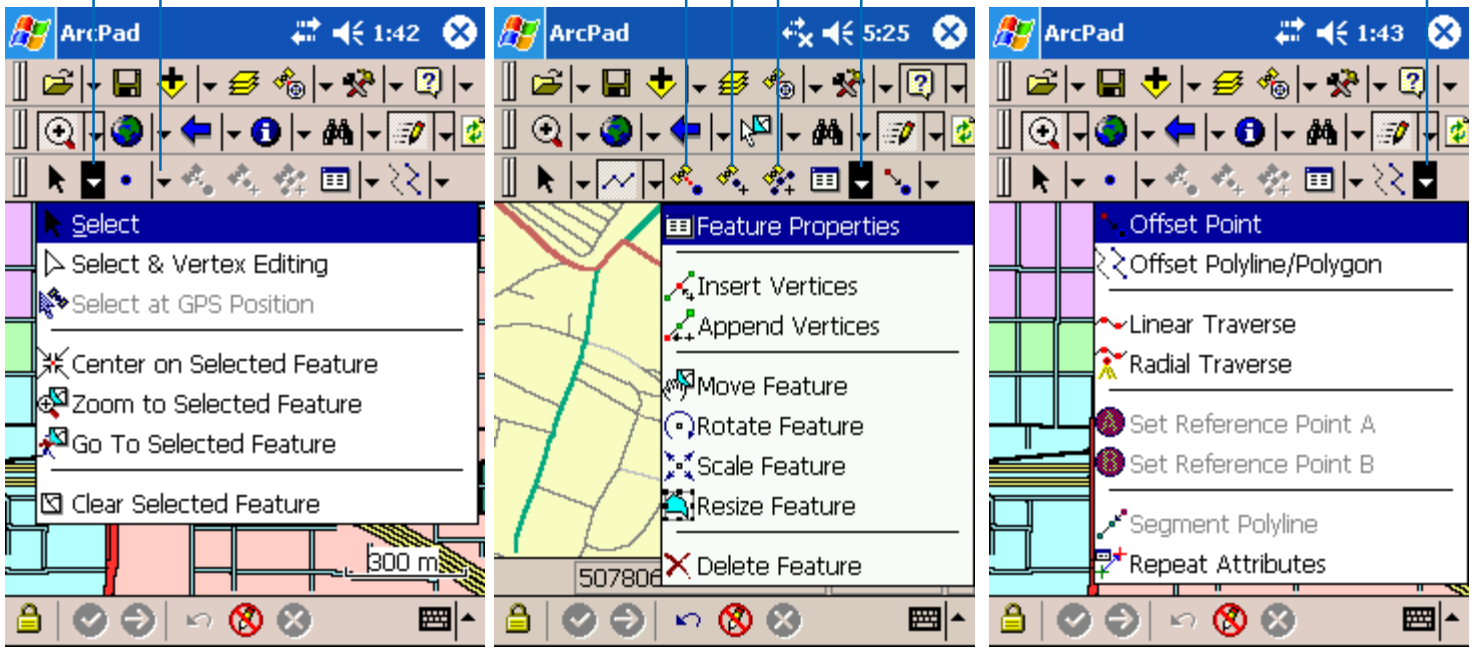
Add GPS vertex: Captures a single vertex in the selected line or polygon feature using the current GPS position.

Capture Point Using GPS: Captures a point feature in the editable point layer using the current GPS position.

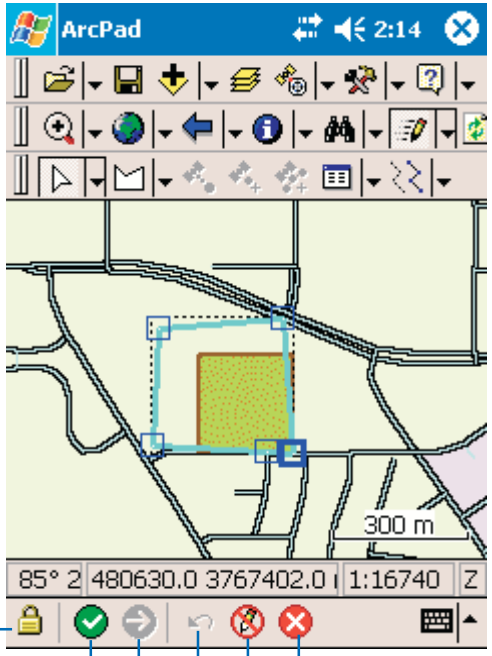
Add GPS vertices continuously: Continously captures vertices in the selected line or polygon feature using the current GPS position.

Selected Feature dropdown list: Tools that let you view properties and perform several tasks on the selected feature.

Offset Point dropdown list: Tools that let you work with offsets, traverses, segments, and repeated attributes.



The Command toolbar



Lock/Unlock tool: Lock ArcPad to prevent inadvertent edits to your data.

Commit Geometry Changes tool: Once a change has been made to your feature, use this tool to save the change.

Proceed tool: Completes the geometry capture of a new polyline/polygon and enables you to capture attribute information for the feature.

Cancel Feature Edits tool: If you do not want to commit your changes, use this tool to cancel all recent edits to the selected feature.

Pen toggle tool: Toggle pen active for data capture.

Undo tool: Use to undo the last step performed, prior to commiting your changes.

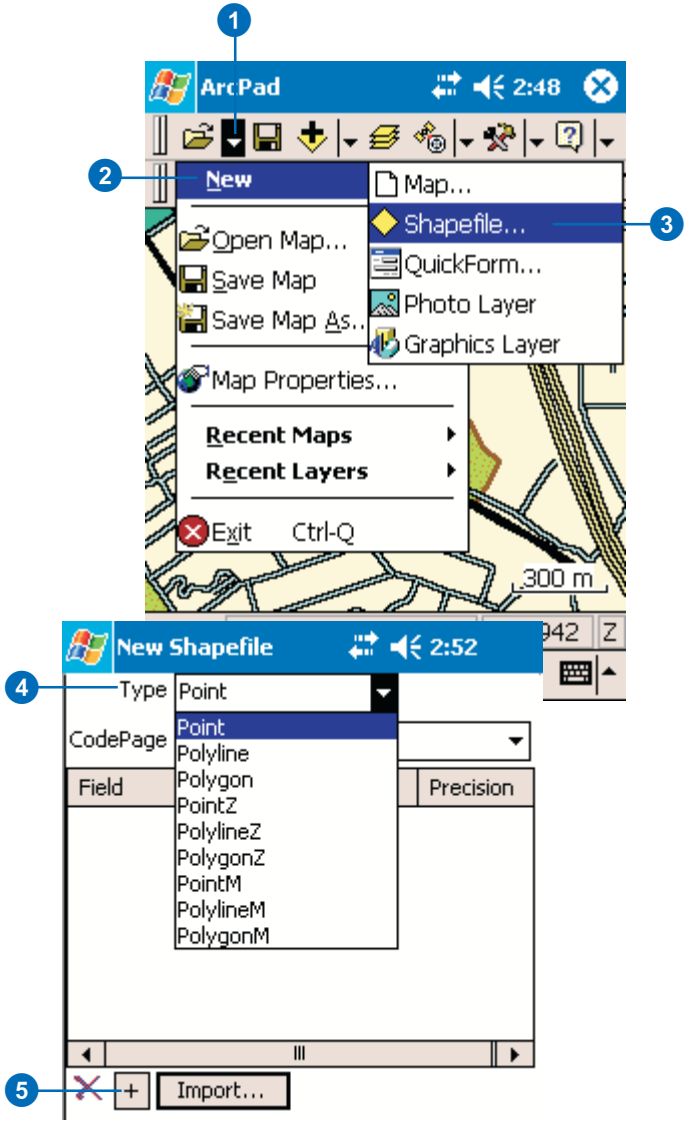
Creating new shapefiles for editing

Occasionally you might want to capture data into a new shapefile rather than into an existing shapefile. You can use the New Shapefile tool to define the attribute fields and create a new shapefile. You can also create a QuickForm for your new shapefile. The new shapefile and QuickForm, if available, are automatically added to the current ArcPad map and checked for editing in the Layers page of the Table of Contents.

1. Tap the dropdown arrow to the right of the Open Map button to display the dropdown list.
2. Tap New.

   The New submenu is displayed.
3. Tap Shapefile.

   The New Shapefile dialog box is displayed.
4. Choose the type of shapefile that you want to create from the Type dropdown list.
5. Tap the + button to open the Field dialog box and define the fields for your new shapefile's dBASE table. ▸



Tip

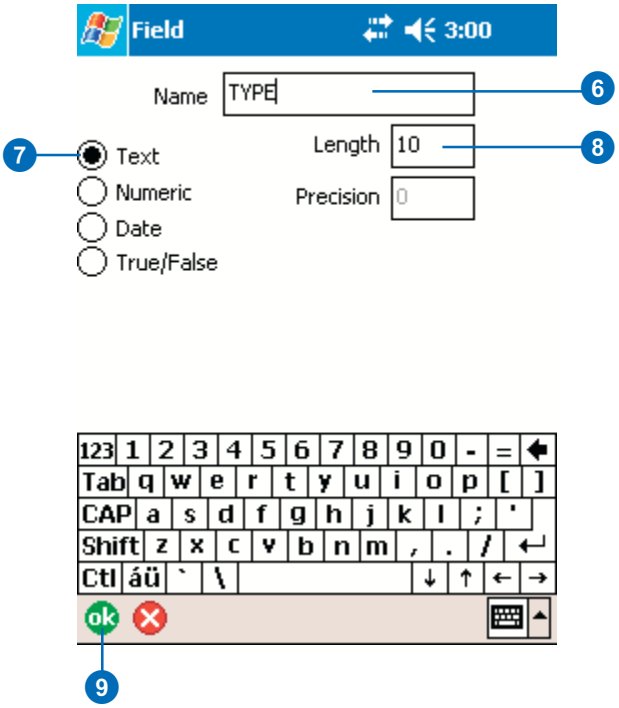
Specifying the type of shapefile

You need to select the type of shapefile you want to create from a list of available types. Point, Polyline, and Polygon types are 2D shapefiles that only store x,y coordinates. PointZ, PolylineZ, and PolygonZ types are 3D shapefiles that store x,y, and z coordinates, as well as m—measure—values. PointM, PolylineM, and PolygonM types are 2D shapefiles that store x,y coordinates and m values.

See Also

See Chapter 4, 'ArcPad basics', and Chapter 5, 'Creating maps', to learn how to add layers for editing.

6. Type the name of the first field that you want to create in the new dBASE table.
7. Choose the field type: Text, Numeric, Date, or True/False.
8. Type the length of the new field and optionally the precision for Numeric fields.
9. Tap OK to create the new field. ▶



Tip

Importing field definitions from an existing dBASE table

To import the field definitions for your new shapefile from an existing dBASE (DBF) table, which may or may not be associated with a shapefile, tap the Import button to open the Import Fields From dialog box, and select the source dBASE table.

Tip

Specifying the codepage for the attribute data

A codepage maps character codes to individual characters. You can select the available codepage from the dropdown list on the New Shapefile dialog box.

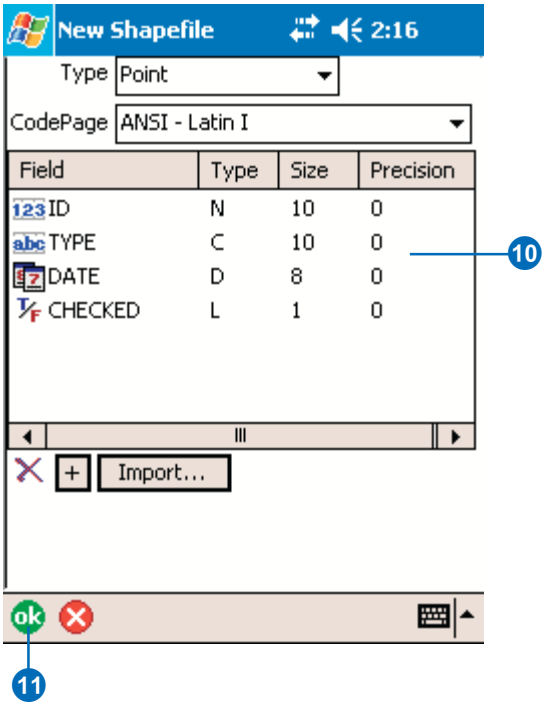
See Also

Refer to the Glossary for a definition of codepage and to the ArcPad Reference Guide *for more information on codepages.*

10. Repeat steps 4 through 8 if you want to define additional fields.

    The new fields and their definitions are listed in the New Shapefile dialog box.

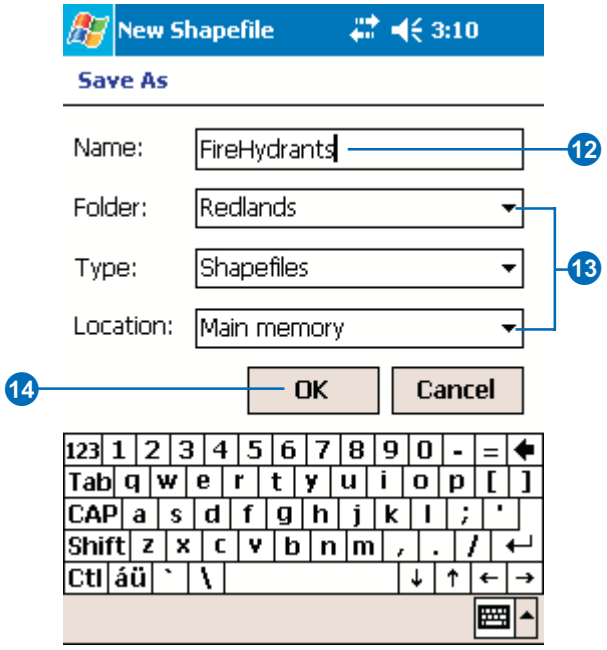
11. Tap OK when you have defined all of the required fields for the shapefile's dBASE table. ▸

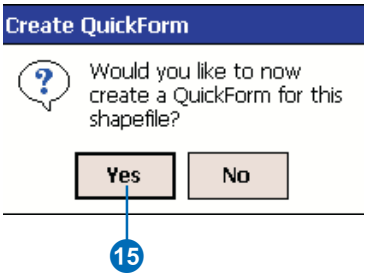


12. Type the name of the new shapefile.
13. Choose the folder and location where you want to save the new shapfile.
14. Tap OK to complete the task and create the new shapefile.

    The shapefile will be created and you will be asked if you would like to create a QuickForm for this shapefile.

    The added shapefile will also be checked for editing, and the Edit toolbar and the Command bar will be displayed.
15. Tap Yes and proceed to the next section to learn how to create a QuickForm for your new shapefile. If you tap No you can always come back and create a QuickForm later.





Creating a QuickForm

In order to facilitate data capture in the field, you can create custom input forms for any shapefile in ArcPad. QuickForms contain basic functions and options for creating forms in the field when you do not have access to your desktop PC.

When creating a QuickForm you can select from the following options:

- Layout: Determine the name, size, page types, text and background color of the form.
- Fields: Select the fields to appear on the form.
- Controls: Manage required fields including settings for minimum and maximum values, and create list values and tooltips.

Alternatively, you can use ArcPad Application Builder to further edit your QuickForm or to create custom input forms that include more complex controls, numerous design options, and advanced scripting tools.

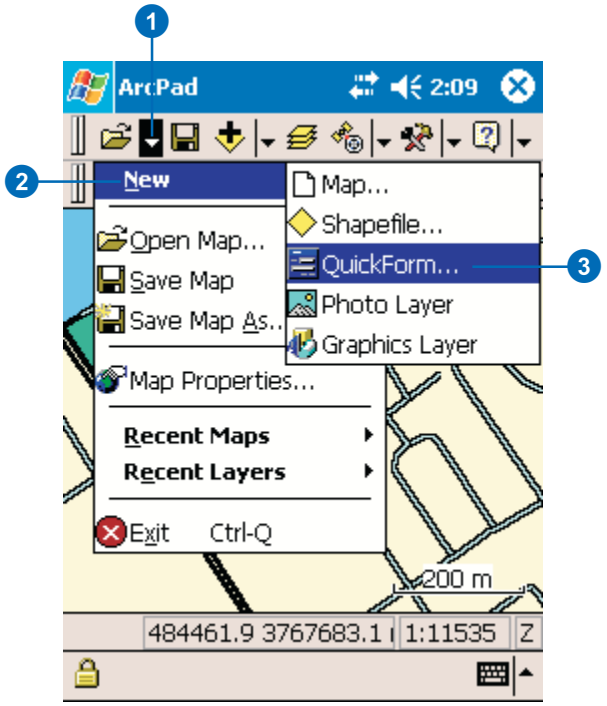
If you selected to create a QuickForm directly after creating a new shapefile, skip to step 5.

1. Tap the dropdown arrow to the right of the Open Map button to display the dropdown list.
2. Tap New.

   The New submenu is displayed.
3. Tap QuickForm.

   A dialog box opens to allow you to select the shapefile you would like to add a QuickForm to.
4. Tap FireHydrants, the shapefile you created in the previous exercise.

   The QuickForm dialog box opens. ▸



Tip

Selecting a smaller form size than your device screen size

You may want to select a smaller height dimension than your device screen size so that when the Soft Input Panel (SIP) is displayed, it will not obscure any of the controls. When creating a QuickForm, ArcPad places a single control and label on each line. Therefore, for example, on a 1/4 VGA screen, 6 fields can be displayed without being obscured by the SIP.

5. On the Layout page, type a Caption for the form.

   By default, ArcPad uses the name of the shapefile the form is associated with.

6. Using the dropdown list, select the screen size of the device you would like your form to be optimized for.

   ArcPad automatically enters a width and height for your form based on the screen size you selected.

7. If needed, alter the default settings for height and width.

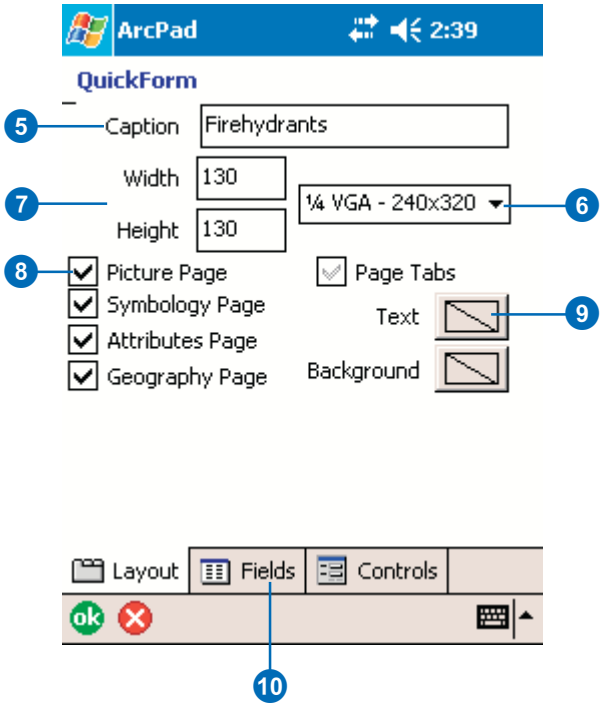
8. Select the default pages you would like to include on your form in addition to the pages created for your QuickForm.

   You can add Picture, Symbology, Attributes, and Geography pages.

   If there are no default pages checked, and the selected fields fit on one page, and the Page Tabs is unchecked, then the QuickForm only has one page and no tabs will be displayed.

9. Optionally, you can set the text and background color of the form. By default, it uses black text on a white background

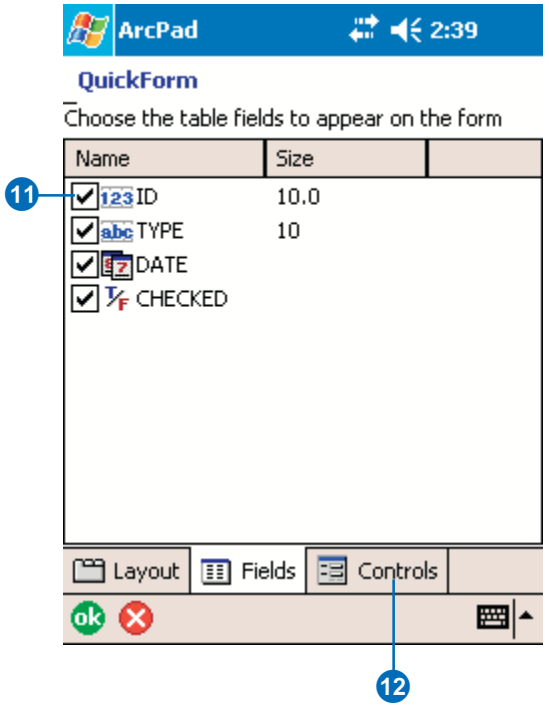
10. Tap the Fields tab. ▸



See Also

See the Appendix to learn more about creating forms using ArcPad Application Builder.

11. On the Fields page, select the fields you would like to include on your form by checking their checkbox.
12. Tap the Controls tab. ▸



13. On the Controls page, you can set other properties for your form controls:

    Required: check if you would like to make the field required.

    Label: Caption that appears on the form.

    Minimum/Maximum: Set minimum and maximum values to set the limits of your data capture values.

    List Values: Enter values to include in a dropdown list. Items must be separated by a comma (e.g., red, yellow, brown).

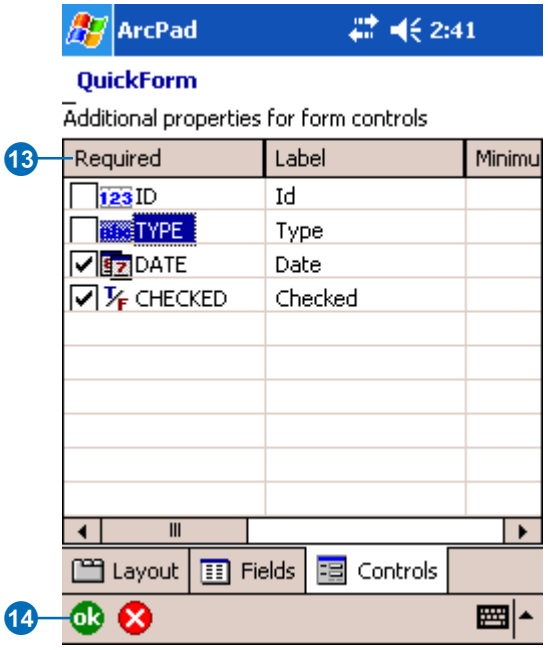
    Tooltip: Add a description for your fields.

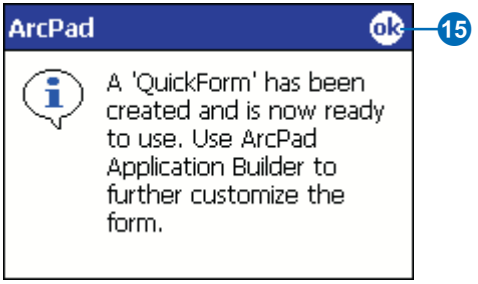
14. Tap OK.

    ArcPad confirms the creation of your QuickForm.

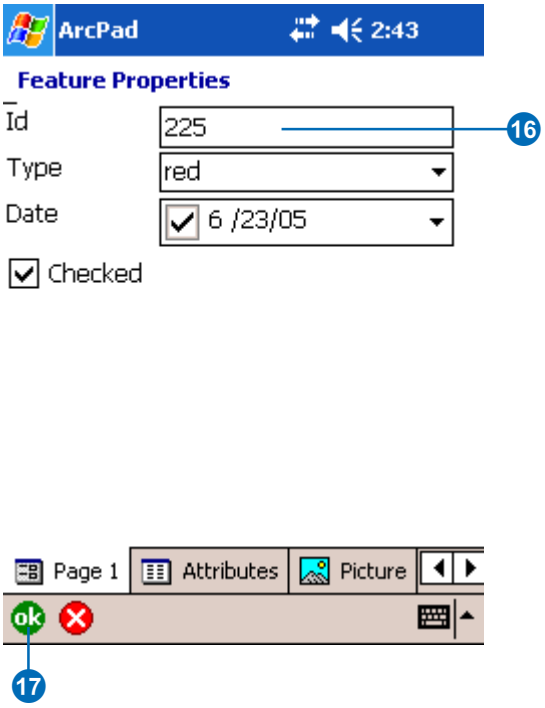
15. Tap OK.

    The shapefile and form are loaded into your ArcPad map as an editable layer. The Edit toolbar and Command bar are automically displayed if they are not already. ▸





16. Use your new QuickForm to add features to your shapefile.
17. Tap OK when you are finished.



Displaying the Edit toolbar

Before editing geographic feature data within ArcPad, you must first display the Edit toolbar. You can display the Edit toolbar by selecting it in the Toolbars list. The Edit toolbar is automatically displayed when a layer is selected for editing in the Start/Stop Editing dropdown list or by opening the Table of Contents and checking one or more layers for editing.

The Command bar at the bottom of the ArcPad window automatically displays when the Edit toolbar displays.

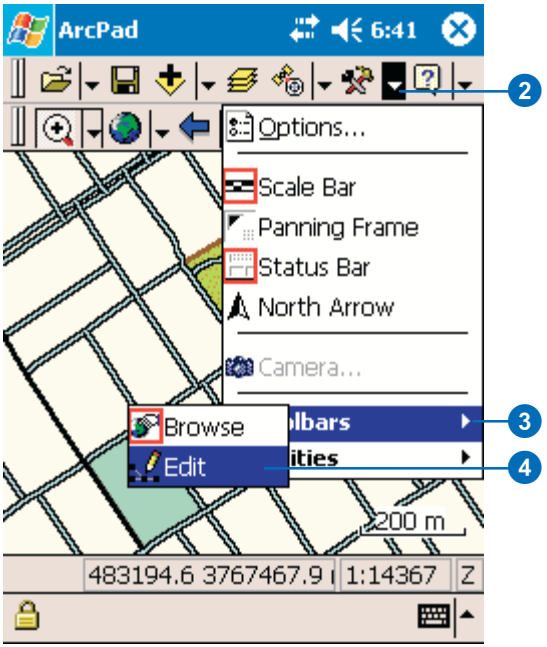
Tip

Enabling the buttons on the Edit toolbar

The buttons on the Edit toolbar will only be enabled if one or more layers have been selected for editing. In addition, the Capture GPS Vertex buttons will only be enabled if the GPS has been activated and the selected feature type is polyline or polygon. The Capture GPS Point button will be enabled if the GPS has been activated and a point layer has been selected for editing.

1. Start ArcPad.
2. Tap the dropdown arrow to the right of the ArcPad Options button to display the dropdown list.
3. Tap Toolbars to display the list of available toolbars.
4. Tap Edit.

   The Edit toolbar and the Command bar are displayed.



Selecting a layer for editing

Layers are selected for editing by enabling the Start/Stop Editing tool on the Browse toolbar or by checking the layer's Edit check box on the Layers page in the Table of Contents.

In ArcPad, you can have up to three shapefiles active for editing—one shapefile for each feature type: one point, one line, and one polygon shapefile.

If you select the Graphics Layer for editing, all previously selected layers are deselected. However, with the Graphics layer selected, you can select up to two shapefiles for editing. The shapefiles take precedence when editing, but you can still add sketches and notes to the Graphics layer.

Tip

Determining the layer type

ArcPad allows you to edit point, line, and polygon shapefiles, and graphics layers. The shapefile type or graphics layer is indicated by the following icons:

- *for point shapefiles*
- *for line shapefiles*
- *for polygon shapefiles*
- *for graphics layers*

1. Tap the arrow to the right of the Start/Stop Editing button on the Browse toolbar.

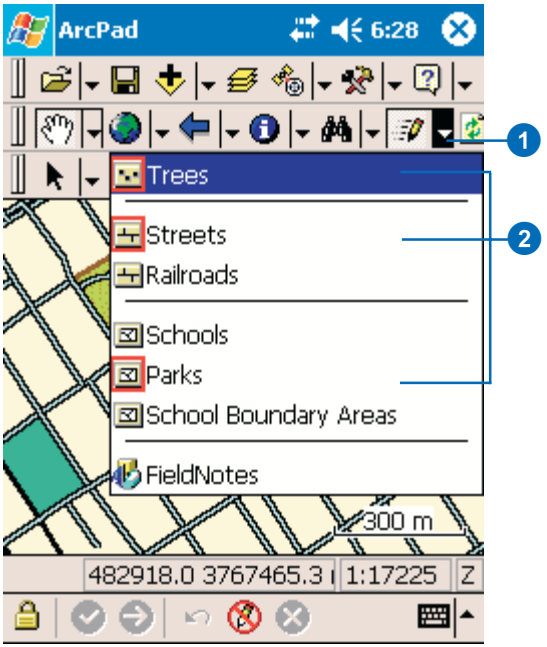
   The dropdown list displays all of the editable layers in the current ArcPad map with a corresponding icon to indicate the type of layer.

2. Tap the layer that you want to edit.

   The Edit toolbar and the Commnad bar will be displayed if they are not already displayed.

   In order to select more than one layer you will need to repeat steps 1 and 2. You can select one point, one line, and one polygon layer for editing, at one time, or the graphics layer.

   A red box around the layer icon indicates that the layer has been selected for editing.



Selecting features for editing

A feature needs to be selected before certain operations can be performed on it. For example, before you move, edit, or delete a feature, you must select it.

You can select a feature for editing by using the Select, Select & Vertex Editing, or Select at GPS Position tools. The Select tools are located on the Edit toolbar. In addition, the Select tool is located on the Advanced Select dialog box and the Find tool dialog box.

The Select and Select at GPS Position tools are used to change a feature's attributes; insert and append vertices; and move, rotate, scale, resize, and delete features. ►

Tip

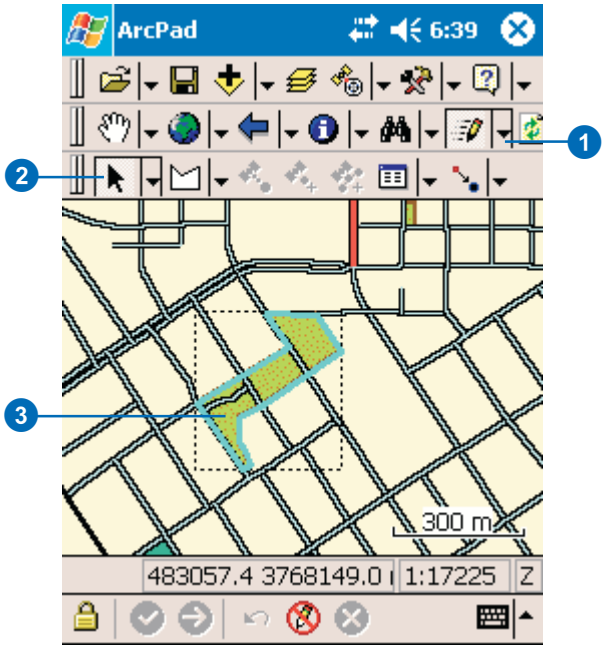
Selecting vertical or horizontal lines

The Select tool uses the Pen Tolerance for the search radius when selecting features. The default pen tolerance may be too small when selecting vertical or horizontal lines, making it difficult to select these features. You can increase the pen tolerance on the Display page of the ArcPad Options dialog box.

Selecting features for editing using the Select tool

1. Select the layer for editing in the dropdown list next to the Start/Stop Editing tool—as described in the previous task.
2. Tap the Select button.
3. Tap the feature that you want to select for editing.

   The selected feature is highlighted using the specified highlight color (cyan) and with a rectangle using a dashed line, outlining the geographic extent of the feature.
4. Tap the Clear Selected Feature button located on the dropdown list under the Select tool to clear the selected feature.



The Select and Vertex Editing tool is used to move (by pen, GPS, or offsets) and delete a feature's vertices.

A layer must be made editable before a feature in that layer can be selected using any of the Select tools.

Tip

The Select at GPS Position tool is grayed out

The Select at GPS Position tool will be unavailable if the GPS is not active. Activate the GPS to use the Select at GPS Position tool.

Tip

How do I know if I have selected a feature?

Using the Select and Select at GPS Position tools, the selected feature is highlighted using the specified highlight color and with a rectangle, using a dashed line, outlining the geographic extent of the feature. However, the bounding box rectangle may not always be visible if the feature's extent is outside of the current view's extent.

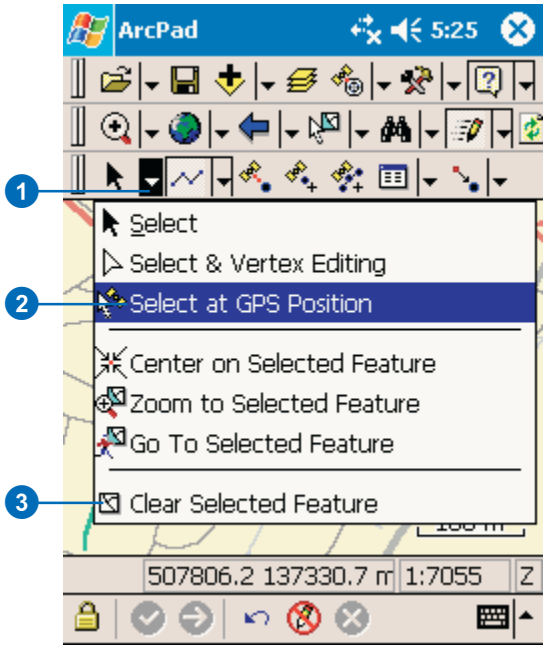
Using the Select & Vertex Editing tool, the extent of the selected feature is highlighted and each vertex of the feature is bound using a blue square.

The highlight color can be selected on the Display page of the ArcPad Options dialog box.

Selecting features for editing using the Select at GPS Position tool

1. Tap the dropdown arrow to the right of the Select button to display the dropdown list.
2. Tap Select at GPS Position.

   The selected feature is highlighted with a rectangle, using a dashed line, outlining the geographic extent of the feature.
3. Tap the Clear Selected Feature button located on the dropdown list under the Select tool to clear the selected feature.



Tip

Changing the Display Highlight color

You can change the Highlight color of selected features in the Display page of the ArcPad Options dialog box.

Tip

The Select tool is not responding

The Select tool *in the Find dialog box will be unavailable if the layer has not been set as editable.*

See Also

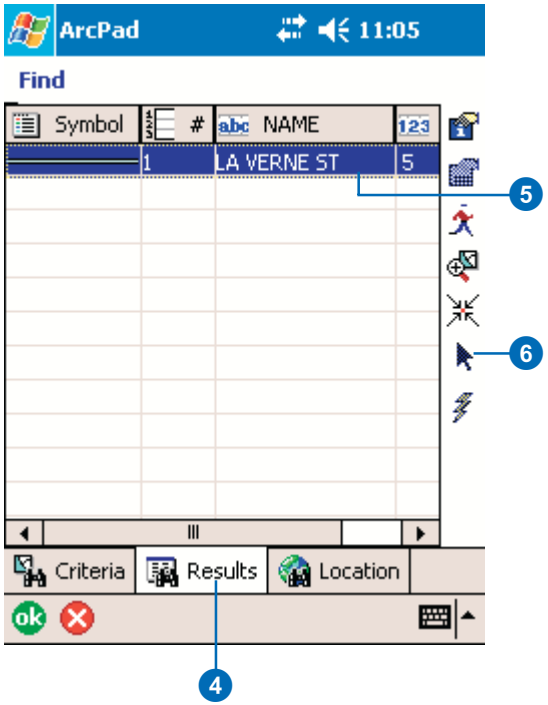
Refer to Chapter 8, 'Querying your data', for help on using the Find tool.

Selecting features for editing using the Find tool

1. Tap the Find button to open the Find dialog box.
2. Tap the Layers button to select the layer and optional field to search on.
3. Use the Soft Input Panel to type in the value that you want to search for.
4. Tap the Results tab to execute the search and view the results.

   A table is displayed listing all of the found features.
5. Tap the feature that you want to select for editing.
6. Tap Select.

   The selected feature is highlighted using the Display Highlight color and a rectangle is displayed, outlining the geographic extent of the feature.



Tip

Selecting the layers for the Advanced Select tool to search

The Advanced Select tool operates on all layers checked for Identify in the Table of Contents. The Select tool in the Advanced Select dialog box is only enabled for layers that have been checked for editing.

See Also

Refer to Chapter 8, 'Querying your data', for more information about using the Advanced Select tool.

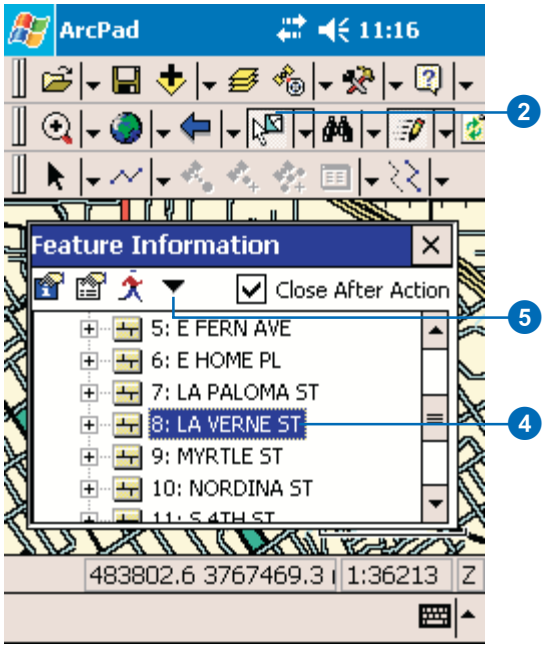
Selecting features for editing using the Advanced Select tool

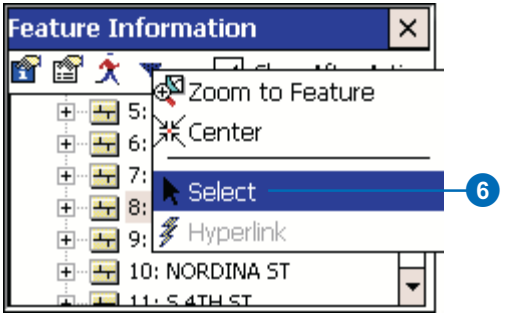
1. Tap the dropdown arrow to the right of the Identify button to display the dropdown list.
2. Tap Advanced Select.

   Notice that the Advanced Select tool has been activated on the Browse toolbar.
3. Tap the map to select a feature or drag a selection box to select multiple features from the active layers.

   A list is displayed showing the coordinates where the map was tapped and the selected features. Tap the + icon to display the attributes of the selected feature.
4. Tap the feature you want to select for editing.
5. Tap the Dropdown Arrow button to display the additional tools.
6. Tap Select.

   The selected feature is highlighted using the Display Highlight color and a rectangle is displayed, outlining the geographic extent of the feature.





Setting snapping properties

The snapping environment can help you create points or vertices at more exact locations relative to other features. When you use the snapping environment in ArcPad, you must choose which part of the existing features -vertex, edge, or endpoint - you want your feature to snap. These choices are called layer snapping properties.

In ArcPad, you can select to snap to an existing point, the vertex of a line or polygon, edge of a line or polygon, or the endpoint of a line.

Snapping properties are selected under the Snapping tab in the Table of Contents.

Tip

Specifying the snap tolerance

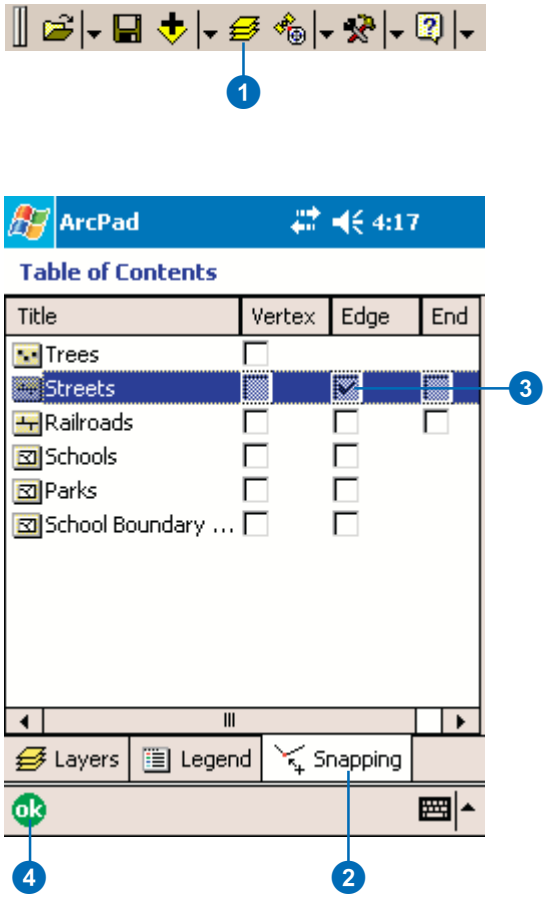
The snap tolerance is specified on the Snapping page of the Map Properties dialog box.

Using the snapping environment to create new features

1. Tap the Table of Contents button.
2. Tap the Snapping tab on the Table of Contents.

   A list of editable layers is displayed.
3. Check the Edge check box for the Streets layer.

   The Streets layer is the target layer that we want our new feature to snap to.
4. Tap OK. ►



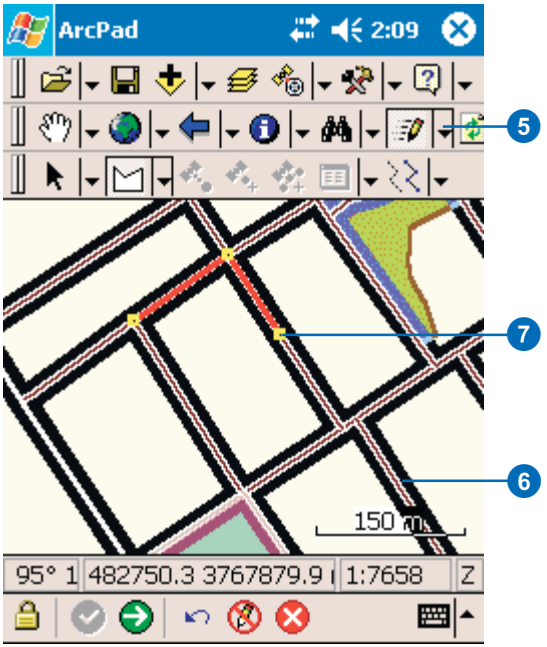
Tip

Snapping shortcut key

To display the snapping buffers, tap the center button on a Windows Mobile device or the Ctrl key on a desktop PC. With this tool active, you are also forcing all pen actions for the following tools to also be snapped: Identify, Measure, and Advanced Select.

5. Make a layer editable using the methods described in this and the other editing chapters.
6. Display the snap buffers by tapping the center button on a Windows Mobile device or the Ctrl key on a desktop PC.
7. Create a new point feature or vertex using the methods described in this and the other editing chapters.

   Points and vertices are snapped to other points, vertices, edges, or ends of existing features as specified on the Snapping page of the Table of Contents.



Moving features

To move a feature, you must first select it using one of the Select tools. With the Select and Select at GPS Position tools you can move the feature by dragging it. In order to move a point feature or vertex to a specific x, y coordinate or to the current GPS position, you must use the Select & Vertex Editing tool. Once changes have been made, you must commit the changes before they are saved. These steps eliminate the possibility of accidentally moving features in the field.

You can move features and vertices in three different ways:

1. Drag the feature.
2. Type in new x,y coordinates.
3. Move to the current GPS position coordinates. ►

Tip

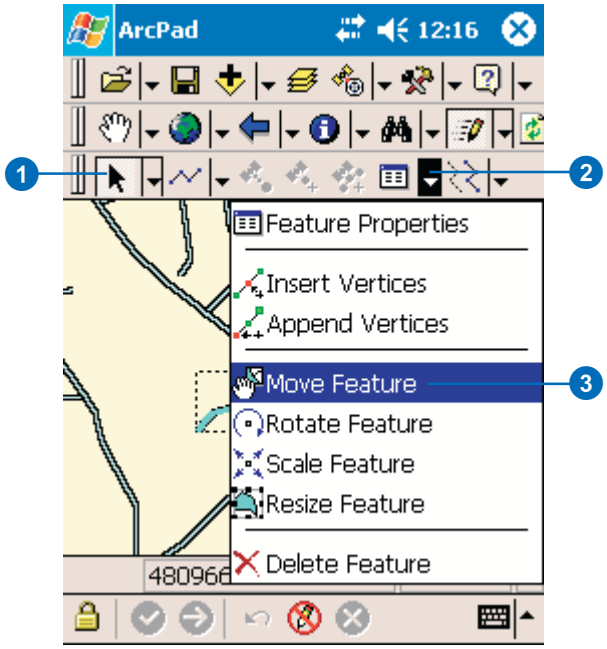
Changing the size of the vertex symbols

Vertices are displayed using a square symbol. You can change the size of the square by changing the Pen Tolerance in the Display page of the ArcPad Options dialog box.

Dragging a feature

1. Select the feature using the Select or Select at GPS Position tool.
2. Tap the dropdown arrow to the right of the Feature Properties button to display the dropdown list.
3. Tap Move Feature to enable feature dragging.

   The Move Feature button will be promoted to the Edit toolbar and be depressed while it is active. To deactivate it, activate another tool in its place. ►



Dragging is the easiest way to move a feature. Use this method when you have a general idea of where you want to move the feature. You can drag point, line, or polygon features.

You can type in new x,y coordinates or use the current GPS position coordinates when you want to move a point feature or line and polygon vertices to a precise location.

Tip

Cancel feature move

Use the Cancel Feature Edits tool to undo any changes you have made, such as dragging a feature. You can only use the Cancel Feature Edits tool before you tap the Commit Geometry Changes button.

See Also

Refer to Chapter 17, 'Editing existing features', for more information on moving a vertex of line or polygon features.

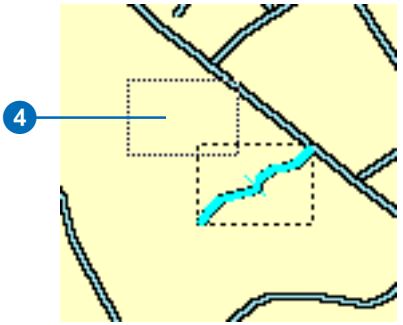
4. Tap and drag the selected feature to the desired location.

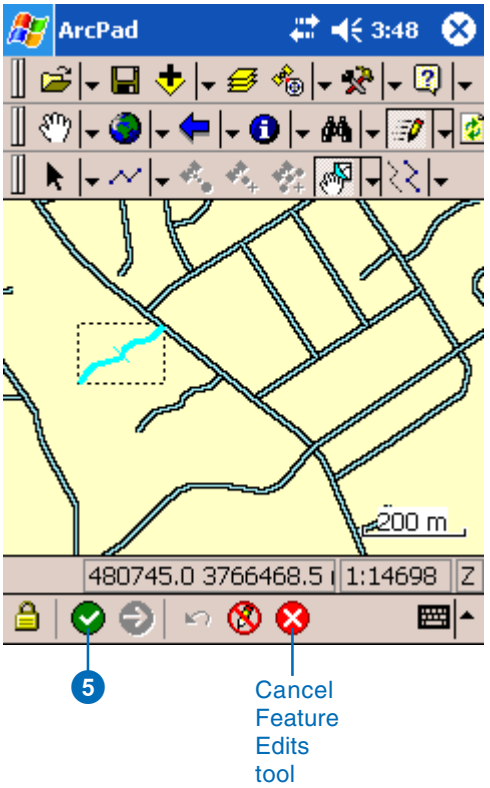
   The feature's bounding box is displayed while the feature is being dragged.

   The selected feature is displayed in its new location.

5. Tap the Commit Geometry Changes button on the Command bar.

   The selected feature is now moved to the new location. Once you commit your changes, they cannot be undone. To undo the change, prior to tapping the Commit Geometry Changes button, tap the Cancel Feature Edits button.





Tip

Using the Move To GPS tool

Tap the Move To GPS tool in the Move To menu to move the selected point to the current GPS position.

Tip

Using the Move To Menu with line and polygon vertices

The Move To and Move To GPS tools can be used to move line and polygon vertices to a new position. Use the Select & Vertex Editing tool to select a feature. A blue square is displayed around each vertex of the selected feature. Tap and hold (on a desktop PC, use the right mouse button click) within the blue square to display the Move To menu. Use the methods described to move point features to move your vertices.

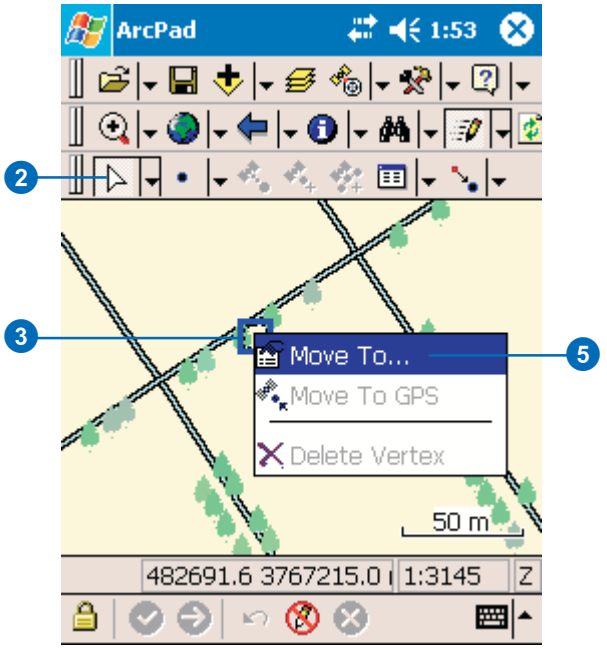
Moving a point feature to an x,y location using Move To

1. Tap the dropdown arrow to the right of the Select button to display the dropdown list.
2. Tap Select & Vertex Editing.

   If you already have a feature selected using one of the methods described earlier in this chapter, tapping the Select and Vertex Editing button will display the point or vertices of your already selected feature using a blue square. Skip to task step 4.
3. Tap the feature you would like to select.

   The point symbol or vertices of your line and polygon feature will be displayed using a blue square.
4. Tap and hold within the blue square to display the Move To menu.
5. Tap Move To.

   If you have a GPS connected and activated, tap Move to GPS, to move the point feature to the current GPS position. ►



Tip

Moving a point to the current GPS position

Tapping the GPS button, , on the Vertex dialog box or the Geography page of the Feature Properties dialog box will move the selected point feature to the current GPS position.

Tip

Using offsets to move a point to a new location

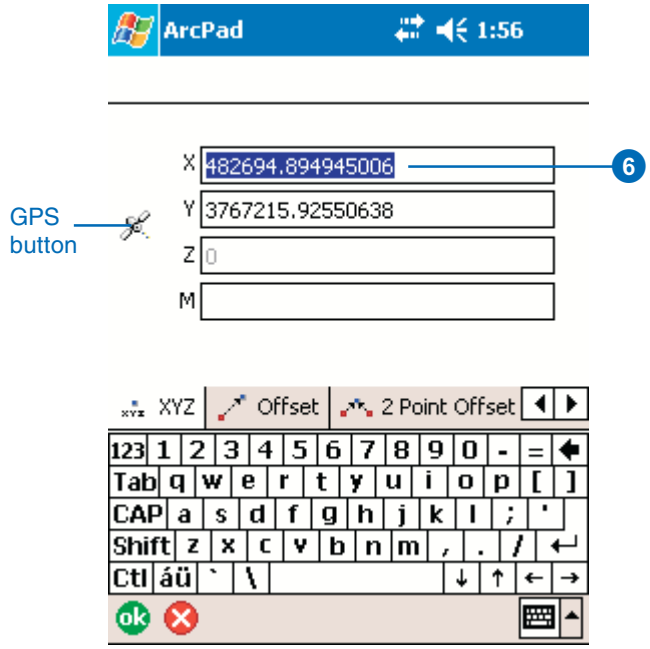
You can use one point and 2 point offsets to move point features to a new location.

See Also

Refer to Chapter 15, 'Creating new features', for more information about using offsets.

6. Type the desired coordinates.
7. Tap OK.

   The selected point feature is moved to the specified coordinates.



Tip

Displaying the Geography page tab

The Geography page is used to display and edit the coordinates of point features or vertices of line and polygon features. The layer that you are editing may have an associated custom input form. The Custom Form dialog box will have additional tabs displayed to the left of the Attributes tab, as well as Left and Right arrow buttons for navigating between the tabs. Tap the Right arrow button until the Geography tab is displayed. The Geography tab is always the last tab displayed.

Tip

What if the Geography tab does not exist?

The layer that you are editing may have an associated Custom Input Form that hides the Attributes or Geography pages of the Feature Properties dialog box. If this is the case, then you will need to use the Move To tool to move the point to an x,y location.

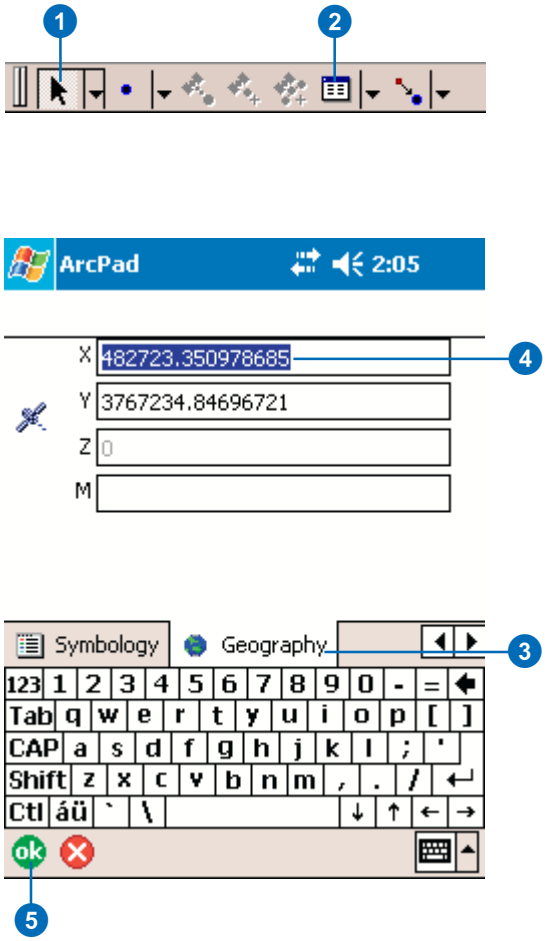
Moving a point feature to an x,y location using the Geography page of the Feature Properties dialog box

1. Select the feature using one of the methods described earlier in this chapter.

   The Feature Properties button is enabled once a feaure is selected.

2. Tap the Feature Properties button—or double-tap the feature—to open the Feature Properties dialog box.
3. Tap the Geography tab to display the Geography page.
4. Type the desired coordinates.
5. Tap OK.

   The selected point feature is moved to the specified coordinates.



Undoing and canceling edits

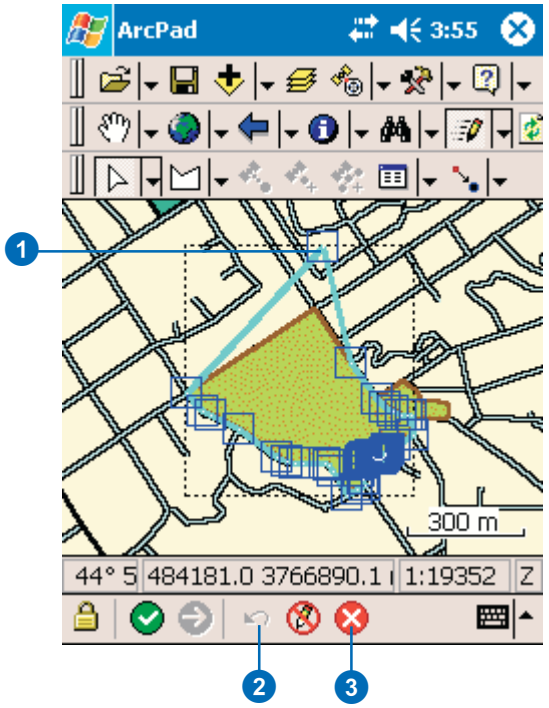
You can undo edits made to the geometry of a feature using the Undo and/or the Cancel Feature Edits tools. The Undo and Cancel Feature Edits tools can only be used prior to saving your changes using the Commit Geometry Changes tool. All these tools are located on the Command bar.

The Undo tool goes back to the previous change. If you make several changes to a line vertex, the Undo tool enables you to go back one step. You can keep stepping back until all your edits are undone.

The Cancel Feature Edits tools goes back to the original shape of the feature you modified.

1. Begin editing your feature using the methods described earlier in this chapter.

   The Undo and Cancel Feature Edits tools are activated once you have made your first change such as insert vertex or move feature.
2. Tap the Undo button to undo the last change.
3. Tap the Cancel Feature Edits button to revert back to the original shape or location of the feature.



Deleting features

To delete a feature from the map and from your dataset, use the Delete Feature tool on the Feature Properties button dropdown list. ArcPad edits the original, or source, shapefile; it does not operate on a copy of the file. Once a change has been committed, you cannot undo it.

When a feature is deleted, ArcPad converts the feature to a null shape and then subsequently ignores the null shape.

Tip

Packing shapefiles

In order to pack a shapefile, or permanently delete the features, use the Utilities>Pack Shapefile utility located under the Tools dropdown menu on the Main toolbar. In order to successfully pack your shapefile and remove the null shapes, there must be sufficient free memory on your mobile device for ArcPad.

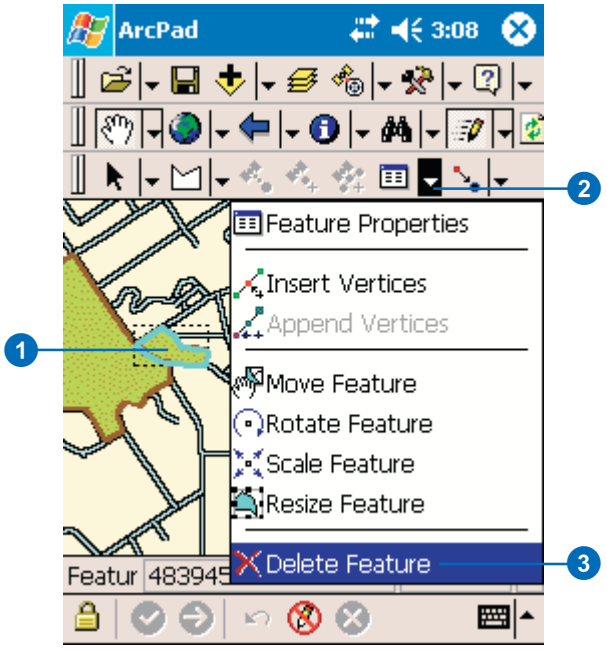
Tip

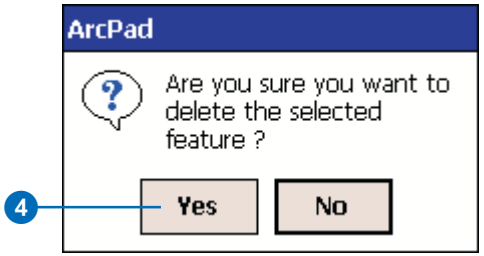
Deleting features using the Delete key

You can also press the Delete key on your keyboard—or Soft Input Panel on a pen-based computer—to delete the selected feature.

1. Select the feature using one of the methods described earlier in this chapter.
2. Tap the dropdown arrow to the right of the Feature Properties button to display the dropdown list.
3. Tap Delete Feature.
4. Tap Yes to confirm that you really want to delete the selected feature.

   The selected feature is deleted.





Creating new features

15

IN THIS CHAPTER

- Creating point features
- Creating line features
- Creating polygon features
- Working with a graphics layer
- Creating repeated features
- Creating segmented polyline features
- Working with offsets
- Working with traverses
- Performing simple offsets
- Using a 1 point offset
- Using a 2 point offset
- Creating a linear traverse
- Creating a radial traverse

It's easy to create new features using the editing tools in ArcPad. First, select the layers for which you want to create the new features. Then select the appropriate tool and use the mouse pointer, pen, or incoming GPS coordinates to digitize the feature.

You can use the editing tools to create new point, line, or polygon features. To create point features, tap once on the map or tap the GPS Point button. To create line or polygon features, use the mouse pointer, pen, or incoming GPS coordinates to digitize the vertices that make up that feature. The new feature is saved in the selected layer of the same feature type.

Creating point features

You can create point features using the mouse pointer, pen, or incoming GPS coordinates. Creating a point feature involves the following steps:

1. Select a point layer for editing using the Start/Stop Editing dropdown list.
2. Tap the Point button, or the GPS Point button, on the Edit toolbar.
3. Tap the map to create a new feature.
4. Type in attributes for the new point feature. ▸

Tip

Enabling the Point button

The Point button on the Edit toolbar is only enabled if a point shapefile layer has been selected for editing. You can select a layer for editing via the Start/Stop Editing dropdown list or in the Table of Contents.

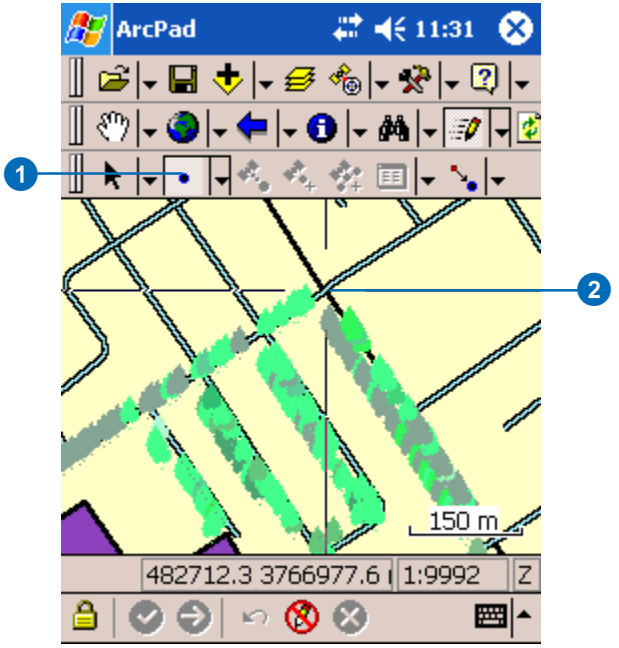
See Also

Refer to Chapter 16, 'Creating new features with a GPS and rangefinder', for more information on using incoming GPS coordinates to capture a point feature.

Creating point features with the pen

1. Tap the Point button on the Edit toolbar.

   The Point button is now active, and ArcPad is in point capture mode. Any tap on the screen will create a new point feature at the corresponding coordinates.
2. Tap the map at the location where you want to create the new point feature. ▸



The Feature Properties dialog box lets you view and edit the attributes of the feature you have selected. The Feature Properties dialog box is automatically displayed once any new feature is created.

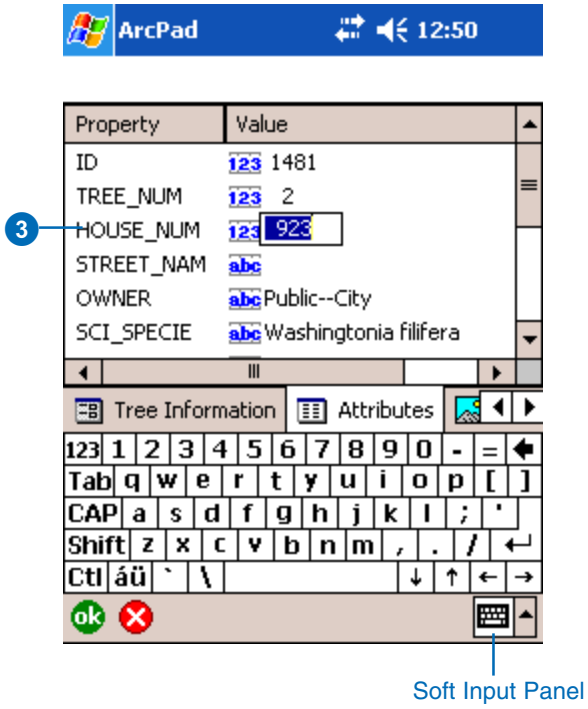
By default, the Feature Properties dialog box includes pages for Attributes, Picture, Symbology, and Geography; a custom edit form and Picture page will also be displayed if they exist. The custom edit form may change the title of the Feature Properties dialog box. For example, "Redlands Trees".

The Feature Properties dialog box is automatically displayed after the new point feature has been created.

3. On the Attributes page, tap the Property field to open the associated Value text box for typing in attribute data.

   For example, tapping the Property field HOUSE_NUM will open the associated Value text box for typing in the house number value of "923".

   The Soft Input Panel is displayed when a Value text box is opened. If is not displayed, tap the SIP icon on the Title bar to activate it. ▸



Tip

Creating custom edit forms

QuickForms and custom edit forms can be created using ArcPad or ArcPad Application Builder, respectively. Both type of forms are saved in an ArcPad Layer file (.apl), which is associated with a shapefile.*

QuickForms and custom edit forms can have multiple tabs, or pages, each with multiple controls. These controls can include text boxes, date controls, and list boxes. Scripts associated with the form perform initialization and validation, enforcing correct data entry before continuing to another page or closing the form. Scripts cannot be added to forms using the QuickForm capability in ArcPad.

See Also

See Chapter 14, 'Editing Basics', to learn how to create QuickForms in ArcPad to edit your features.

Tip

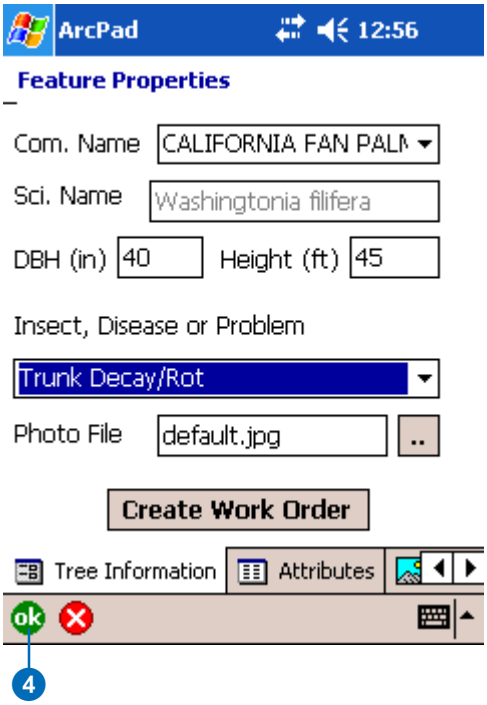
Using a barcode scanner to input your data

Use a barcode scanner connected to your Windows Mobile device to easily input data into your edit forms or Attributes page.

The Feature Properties dialog box will display the custom edit form if it exists.

4. Tap OK to save the attributes, close the edit form, or the Feature Properties dialog box, and complete the capture of the new point feature.

   You can also tap the X button if you want to cancel the capture of the new point feature. The point feature, and any attributes that have been typed in, will be deleted. ▸



Tip

Deactivating the Point button

The Point button is active when it is displayed in a depressed mode. Tapping any other tool in its place will deactivate the Point button.

See Also

Refer to Chapter 7, 'Symbolizing your data', for more information on symbology.

Tip

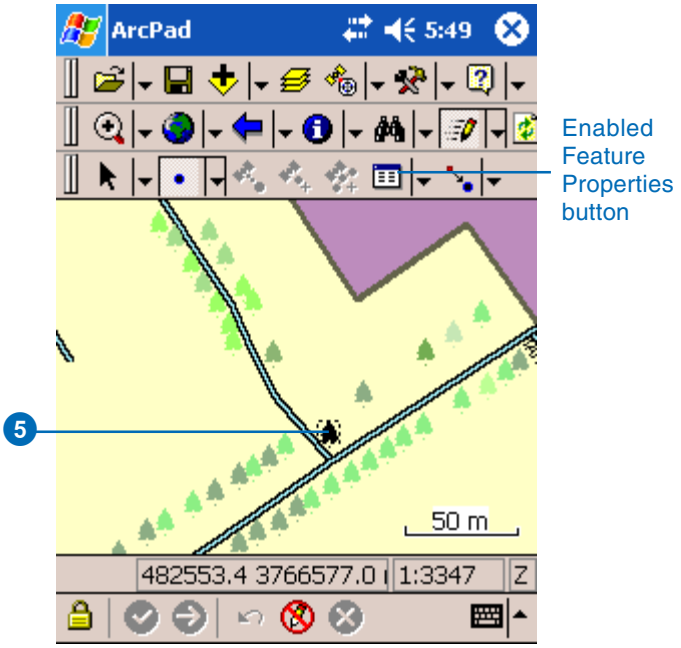
Working with scale-dependent layers

If you add a feature to a layer that has a scale-dependency set, it may not be visible if you are zoomed out beyond the set extent.

In order to see the feature, whether you are adding a new or displaying an existing feature, you will need to zoom in beyond the set scale. Scale dependencies are set on the Scale page of the Layer Properties dialog box.

5. The new point feature is created and displayed using the selected symbology. The point feature is also selected for editing, as indicated by the dashed selection box and the activated Feature Properties button.

   The Point button is still active for capturing additional point features when it is displayed in depressed mode.



Creating line features

ArcPad has the following tools for creating line features:

- Line
  This tool creates a straight line joining the coordinates from where the pen first touches the screen and ends where the pen is lifted.
- Polyline
  This tool captures a vertex each time the pen taps the screen or each time the Add GPS Vertex button is tapped. The Add GPS Vertices Continuously button can also be used to capture vertices continuously from the GPS. Offsets can also be used to create vertices for a polyline. The line is completed when the Proceed tool on the Command bar is tapped . ►

See Also

Refer to Chapter 16, 'Creating new features with a GPS and range finder', for more information on using the Add GPS Vertex and Add GPS Vertices Continuously buttons.

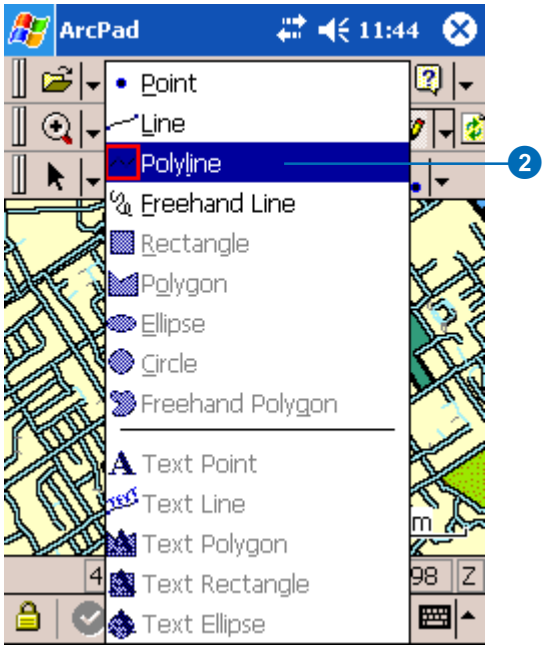
See Also

Refer to Working with Offsets in this chapter for more information on using offets to create vertices.

Selecting the line feature tool

1. Tap the dropdown arrow to the right of the feature button to display the dropdown list of feature types. By default, the Point feature button is displayed on the Edit toolbar.
2. Tap the required line feature type—for example, Polyline.

   The selected feature type will be highlighted with a red square, and the feature's button will be displayed and depressed on the Edit toolbar.



- Freehand Line
  This tool creates a sketch based on the line drawn with the pen. The line is completed when the pen is lifted.

The Line, Polyline, and Freehand Line tools can be used with the mouse pointer or pen. The Polyline tool can also be used with the incoming GPS coordinates or with offsets.

All of the line features are created in a line shapefile or in a graphics layer. The new line feature is stored as x,y, and, optionally, z coordinates.

Tip

Deactivating the feature button

The selected feature button is active when it is displayed in a depressed mode. Tapping any other button or tool will deactivate the selected feature button.

Tip

Using the snapping options

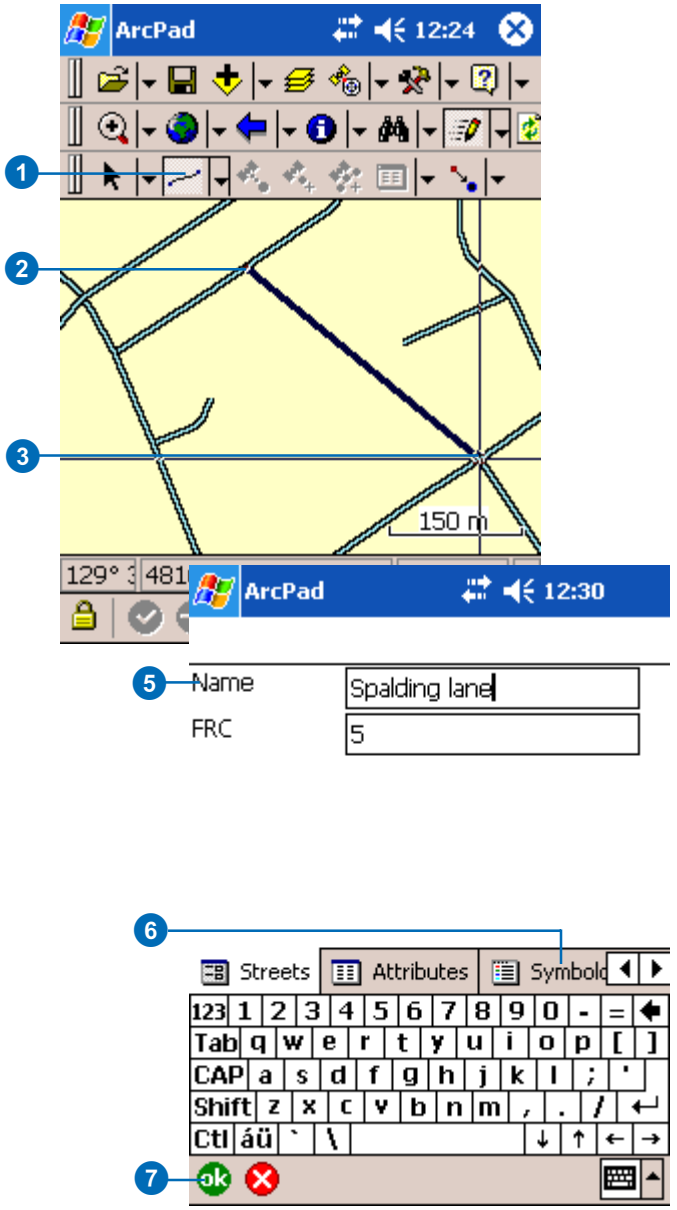
Set snapping options in the Table of Contents to snap new features or vertices to existing ones.

Creating a line feature using the Line tool and the pen

1. Tap the arrow to the right of the feature tool to display the dropdown list. Tap the Line feature tool.
2. Tap the map to specify the start position for the line.
3. While still holding the pen on the map—or screen—drag the pen to where the line should end.
4. Lift the pen to create the new line feature.

   The Feature Properties dialog box or custom edit form is automatically displayed after the new line feature has been created.
5. On the form, type the required information or on the Attributes tab, tap the Property field to open the associated Value text box for typing in attribute data.
6. Tap the Symbology tab to select the appropriate symbol for your new line.
7. Tap ok when you are finished.

   Your new line is drawn using the symbology you defined.



Tip

Using the Undo tool

Use the Undo tool on the Command bar to delete the last vertex captured. You can continue to delete all the vertices that have been captured for the line feature.

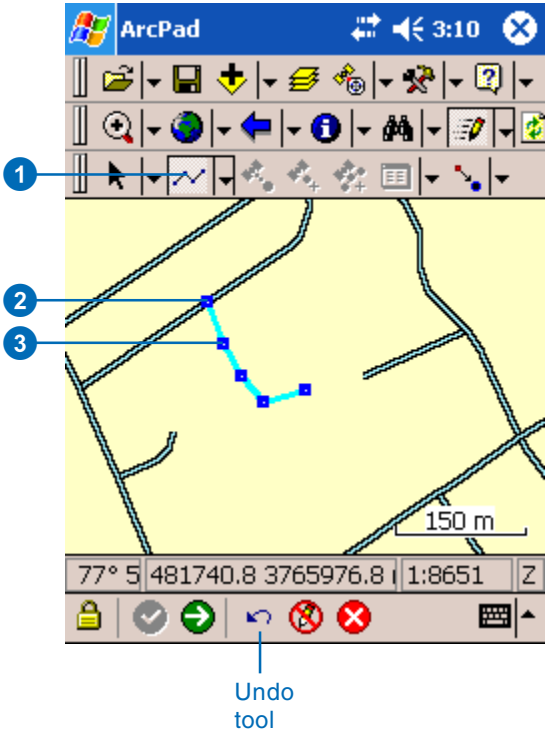
Creating a line feature using the Polyline tool and the pen

1. Tap the arrow to the right of the feature tool to display the dropdown list. Tap the Polyline feature tool.
2. Tap the map to specify the position for the first vertex of the new line.

   The vertices are drawn with a blue box.
3. Tap the map again to specify the position for the second vertex of the new line.

   Continue to tap the map to capture additional vertices.

   Go to Step 7 to complete the capture of the new line feature, or continue to Step 4 to use the capture menu to add more vertices. ▸



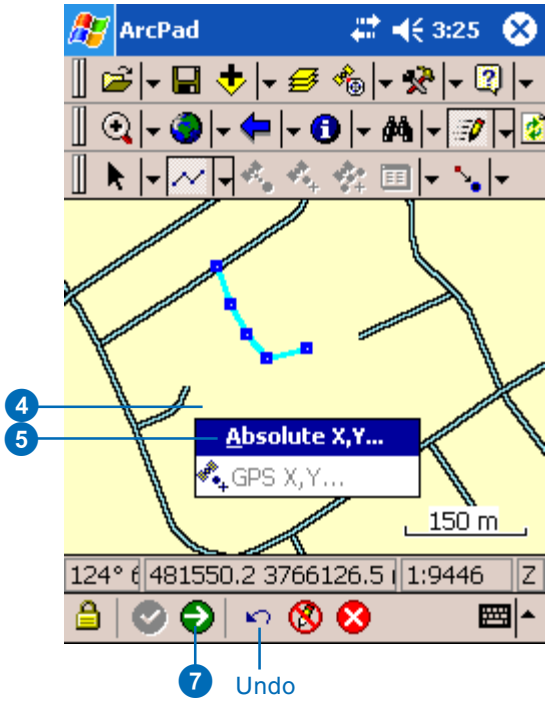
See Also

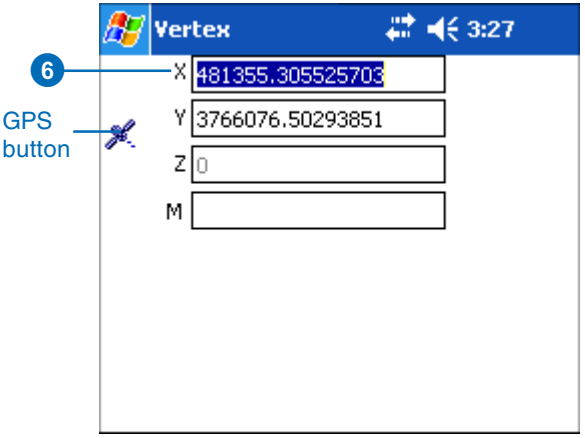
Refer to Chapter 16'Creating new features with a GPS and rangefinder' for help using the GPS X,Y tool to capture vertices.

See Also

Refer to'Working with traverses' in this chapter for help with using the Polyline tool with offsets.

4. At any time, you can tap and hold anywhere on the map to display the Capture menu.
5. Tap Absolute X,Y to display the Vertex dialog box for typing in the x,y coordinates and, optionally, the z coordinate and m value for the next vertex.
6. Type the coordinates for the next vertex or if the GPS is active, tap the GPS button on the Vertex dialog box to use the current GPS position.
7. Tap the Proceed button on the Command bar to complete the capture of the new line feature. ▸





Tip

Determining the length of a line feature

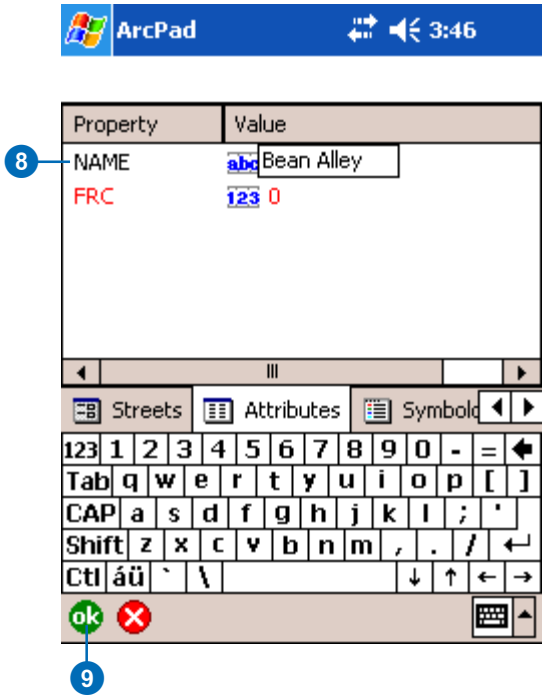
You can determine the length of a selected line feature by opening the Geography page of the Feature Properties dialog box. ArcPad dynamically calculates the length of the selected line and displays it in the Geography tab using the Display Units. The length is not stored with the feature's attributes.

The Feature Properties dialog box or custom edit form is automatically displayed after the new line feature has been created.

8. On the Attributes page, tap the Property field to open the associated Value text box for typing in attribute data.

   For example, tap the Property field NAME to open the associated Value text box and type the street name value of "Bean Alley".

9. Tap ok when you are finished entering your attribute and symbology information.

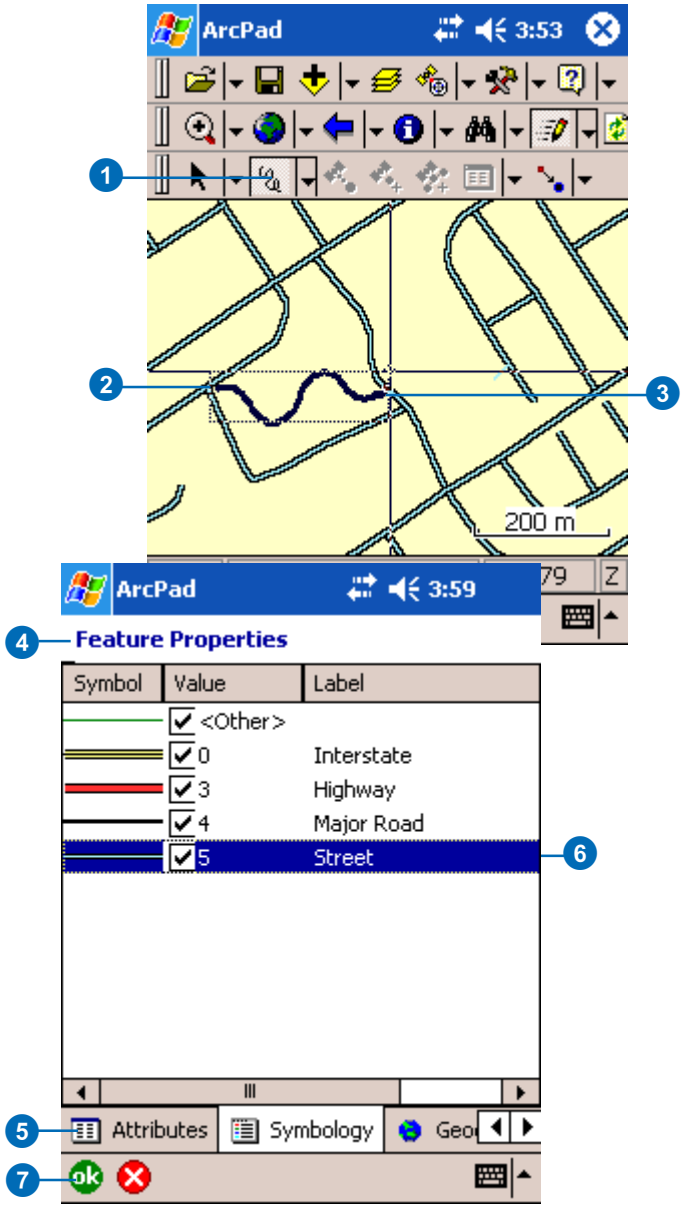


Creating a line feature using the Freehand Line tool

1. Tap the arrow to the right of the feature tool to display the dropdown list. Tap the Freehand Line feature tool.
2. Tap the map to specify the start position for the line.
3. While still holding the pen on the map—or screen—use the pen to draw the line.
4. Lift the pen to end the new line feature.

   The Feature Properties dialog box or custom edit form is automatically displayed after the new line feature has been created.
5. On the Attributes tab, tap the Property field to open the associated Value text box for typing in attribute data.
6. On the Symbology tab, select the symbol for the new line feature.

   Symbology is based on the attribute value, therefore by selecting the symbology, you are also selecting the associated attribute value for this feature.
7. Tap OK when you are finished entering the required information.



Creating polygon features

ArcPad has the following tools for creating polygon features:

- Rectangle
  This tool creates a rectangle using the coordinates from where the pen first touches the screen to where the pen is lifted. The rectangle is automatically completed when the pen is lifted.
- Polygon
  This tool captures a vertex each time the pen taps the screen or each time the Add GPS Vertex button is tapped. The Add GPS Vertices Continuously button can also be used to capture vertices from the GPS. Offsets can also be used to create vertices for a polygon. The polygon is completed when the Proceed tool on the Command bar is tapped. ▶

Tip

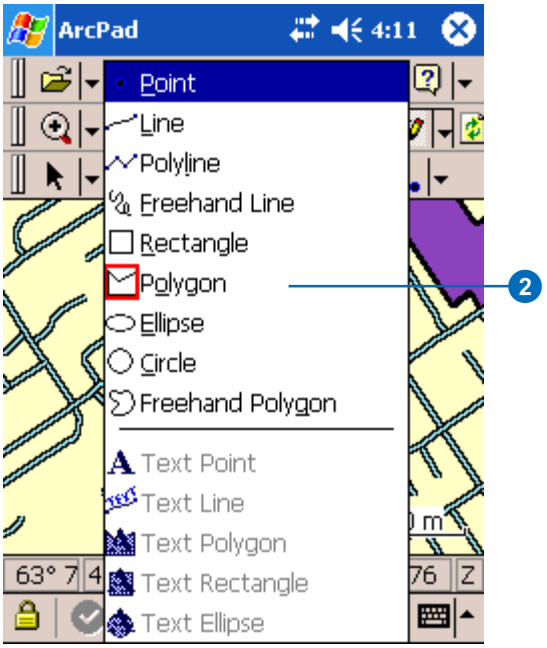
Deactivating the feature button

The selected feature button is active when it is displayed in a depressed mode. Tapping any other button will deactivate the selected feature button.

Selecting the polygon feature tool

1. Tap the dropdown arrow to the right of the feature button to display the dropdown list of feature types—by default, the Point feature button is displayed on the Edit toolbar.
2. Tap the required polygon feature type—for example, Polygon.

   The selected feature type will be highlighted with a red square, and the feature's button will be displayed and activated on the Edit toolbar.



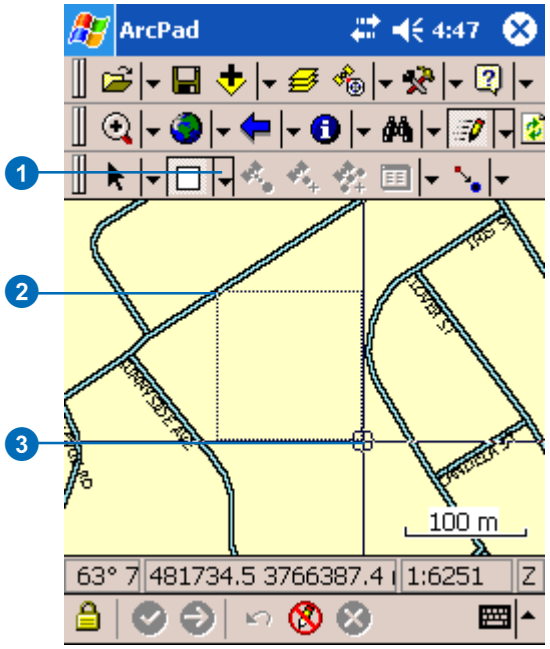
- Ellipse
  This tool creates an ellipse using the coordinates from where the pen first touches the screen (the origin) to where the pen is lifted (the radius). The polygon is automatically completed when the pen is lifted.
- Circle
  This tool creates a circle using the coordinates from where the pen first touches the screen (the origin) to where the pen is lifted (the radius). The polygon is automatically completed when the pen is lifted.
- Freehand Polygon
  This tool creates a sketch polygon based on the line drawn with the pen. The polygon is automatically completed when the pen is lifted.

All of the polygon tools can be used with the mouse pointer or pen. The Polygon tool can also be used with the incoming GPS coordinates or with offsets.

All of the polygon features are created in a polygon shapefile or in a graphics layer. The new polygon feature is stored as x,y and, optionally, z coordinates.

Creating a polygon feature using the Rectangle, Ellipse, Circle, or Freehand tool

1. Tap the arrow to the right of the feature tool to display the dropdown list. Tap one of the polygon tools, such as the Rectangle feature tool.
2. Tap the map to specify the position for the origin of the polygon —whether you are creating a rectangle, ellipse, circle, or freehand polygon.
3. While still holding the pen on the map—or screen—drag the pen to select the position of the opposite corner of the rectangle, to increase the radius of the ellipse or circle, or to use the pen to draw the freehand polygon.
4. Lift the pen to create the new polygon feature. ▸



The Feature Properties dialog box or custom edit form is automatically displayed after the new polygon feature has been created.

5. On the Attributes tab, tap the Property field to open the associated Value text box for typing in attribute data.

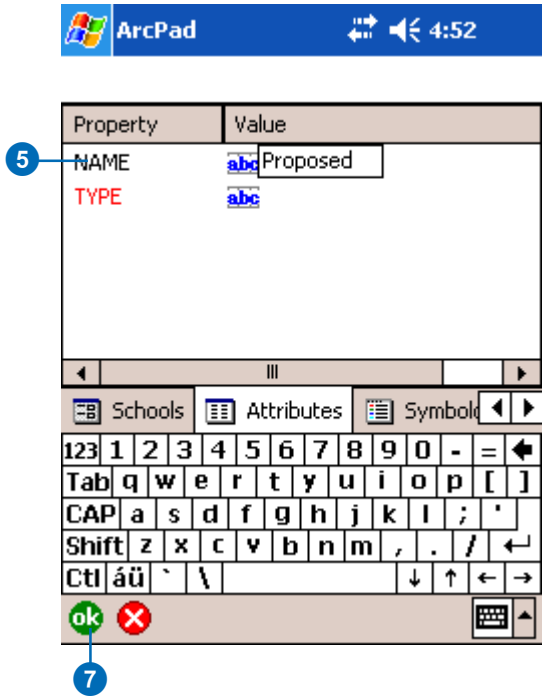
   For example, tap the Property field NAME to open the associated Value text box and type the school name value of “Proposed”.

6. On the Symbology tab, select the symbol for the new feature.

   Symbology is based on the attribute value, therefore by selecting the symbology, you are also selecting the associated attribute value for this feature.

7. Tap ok when you are finished capturing the feature properties for your new polygon.

   Tapping the X button cancels the creation of your new feature.



Tip

Using the snapping options

Set snapping options in the Table of Contents to snap new vertices to existing features.

Tip

Using the Undo tool

Use the Undo tool on the Command bar to delete the last vertex captured. You can continue to delete all the vertices that have been captured for the polygon feature.

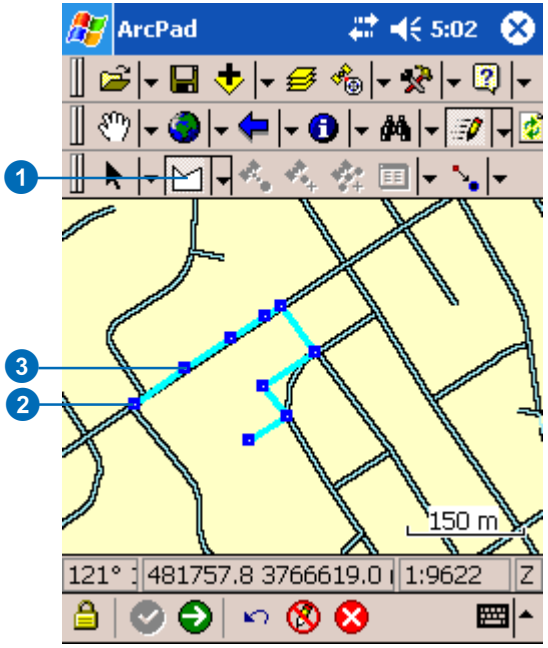
Creating a polygon feature using the Polygon tool and the pen

1. Tap the arrow to the right of the feature tool to display the dropdown list. Tap the Polygon feature tool.
2. Tap the map to specify the position for the first vertex of the new polygon.

   The vertices are drawn with a blue box, and a line joins the vertices.
3. Tap the map again to specify the position for the second vertex of the new polygon.

   Continue to tap the map to capture additional vertices.

   Go to Step 7 to complete the capture of the new polygon feature, or continue to Step 4 to use the capture menu to add more vertices. ▸



See Also

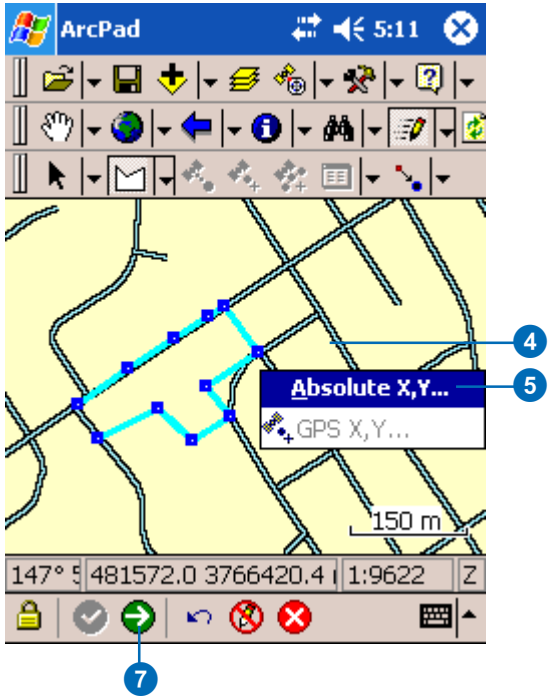
Refer to Chapter 16'Creating new features with a GPS and rangefinder' for help using the GPS X,Y tool to capture vertices.

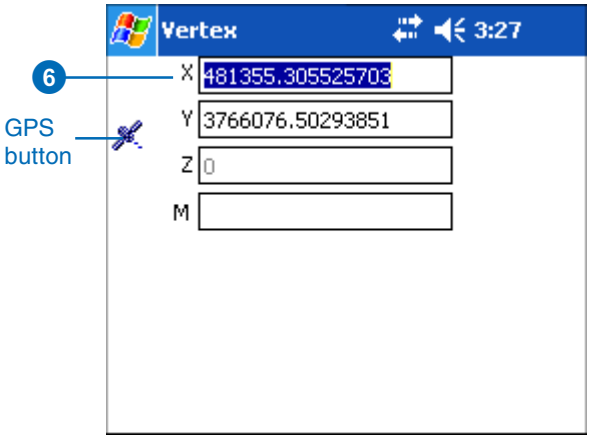
See Also

Refer to'Working with traverses' in this chapter for help with using the Polygon tool with offsets.

4. At any time you can tap and hold anywhere on the map to display the Capture menu.
5. Tap Absolute X,Y to display the Vertex dialog box for typing in the x,y coordinates and, optionally, the z coordinate and m value for the next vertex.
6. Type the coordinates for the next vertex or tap the GPS button—if the GPS is active—on the Vertex dialog box to use the current GPS position.
7. Tap the Proceed button on the Command bar to complete the capture of the new line polygon.

   ArcPad will automatically close the polygon by adding a final vertex with the same coordinates as the first vertex. ►





Tip

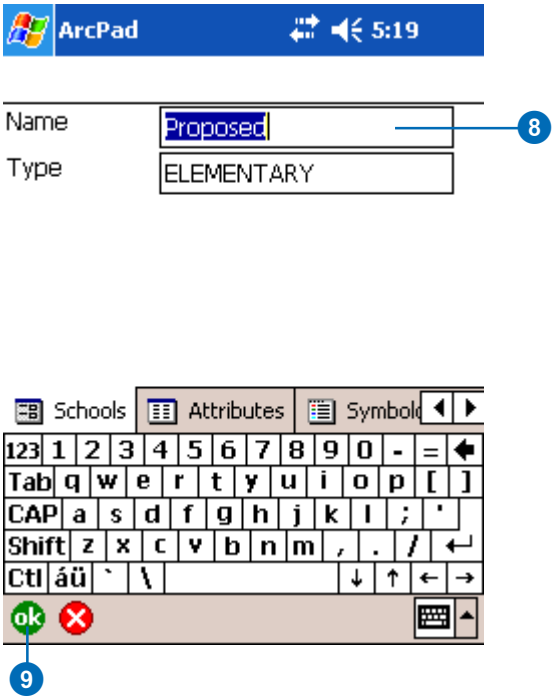
Determining the perimeter and area of a polygon feature

You can determine the perimeter—or length—and area of a selected polygon feature by opening the Geography page of the Feature Properties dialog box. ArcPad dynamically calculates the perimeter and area of the selected polygon and displays it in the Geography tab using the Display Units. The perimeter and area are not stored with the feature's attributes.

The Feature Properties dialog box or custom edit form is automatically displayed after the new polygon feature has been created.

8. On the custom edit form, type in the required elements. If an edit form does not exist, on the Attributes page, tap the Property field to open the associated Value text box and type in attribute data. Use the Symbology page to select a symbol for your new feature.
9. Tap OK when you are finished entering your attribute and symbology information.

   Tapping the X button cancels the creation of your new feature.



Working with a graphics layer

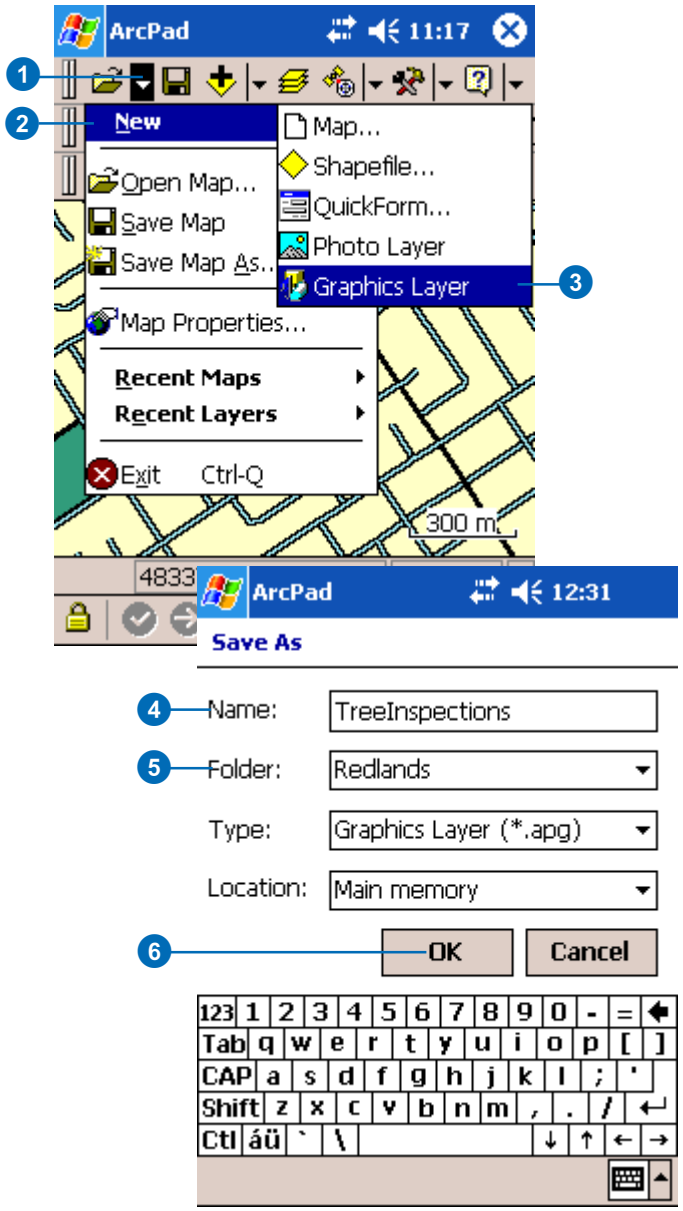
ArcPad supports graphics layer files. The ArcPad Graphics Layer (.apg) is an XML file that can store text, points, lines, and polygons. It is used for redlining or to make freehand georeferenced edits in the field. Graphics layer files can be easily imported into ArcGIS Desktop. ►

Creating a new graphics layer

1. Tap the dropdown arrow to the right of the Open Map button to display the dropdown list.
2. Tap New.

   The New submenu appears.
3. Tap Graphics Layer.
4. Type the name of the new graphics layer.
5. Choose the folder and location where you want to save the new graphics layer.
6. Tap OK to complete the task and create the new graphics layer.

   The graphics layer will be created, added to your map, and checked for editing. The Edit toolbar and Command bar will be displayed, if they are not already.



If you select the Graphics Layer for editing, all previously selected layers are deselected. However, with the Graphics Layer selected, you can then select up to two shapefiles for editing. In this case, the shapefiles take precedence over the Graphics Layer when editing, but you are still able to add sketches and notes to your ArcPad map while adding or updating features.

A graphics layer is different than a shapefile or vector layer. You can have many features of different types in one layer such as a point feature, a freehand polygon feature, a line feature, and text.

When editing a graphics layer, you can use any of the feature types—point, line, polyline, freehand line, rectangle, polygon, ellipse, circle, freehand polygon—to create features for your layer. ▸

See Also

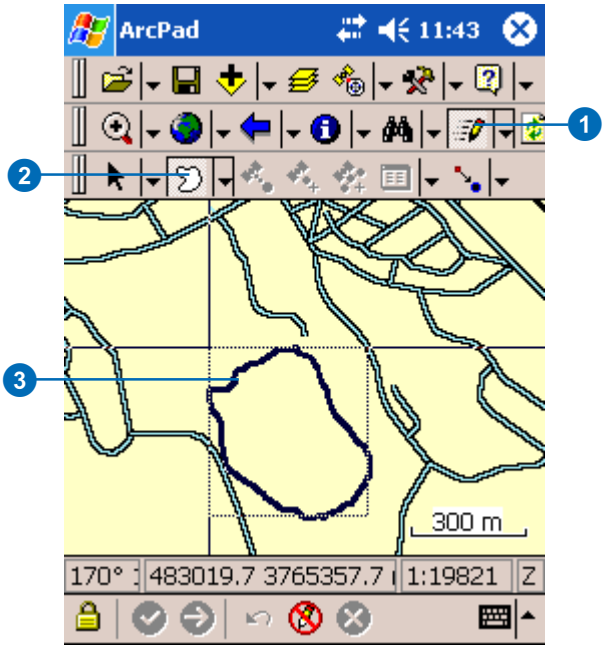
Refer to the sections on creating point, line, and polygon features in this chapter for help creating features in your graphics layer.

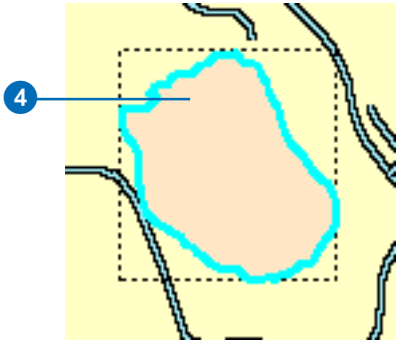
Creating a feature in your graphics layer

1. Use the Start/Stop Editing dropdown list to make the graphics layer editable if it is not already.
2. Select the feature type from the dropdown list, such as Freehand Polygon.
3. Draw the feature using the methods described in this chapter.

   For Freehand Polygon, use the pen to draw the polygon, while still holding the pen on the map, or screen.
4. Lift the pen to create the new feature in your graphics layer.

   Your polygon feature is created as a graphic.





In addition, you can associate text to any feature you create in your graphics layer including - text point, text line, text polygon, text rectangle, and text ellipse.

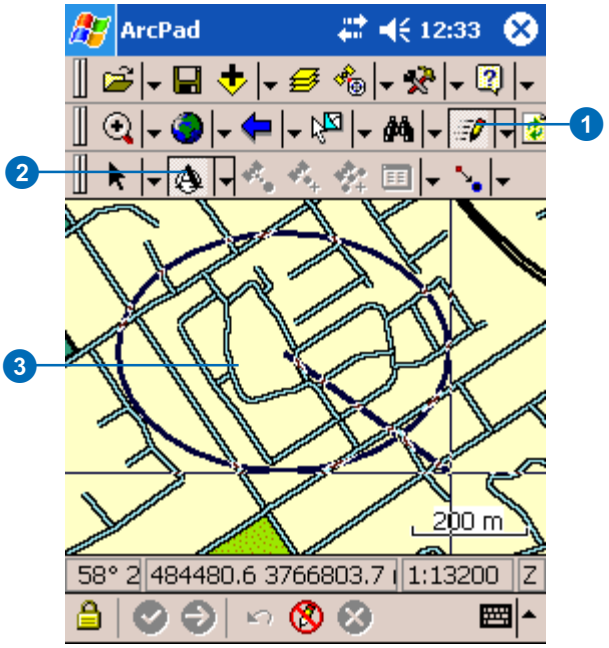
Tip

Using the editing tools on features in your graphics layer

Use any of the feature editing tools, such as move, rotate, resize, scale, and delete, on the features in your graphics layer. Use the vertex tools, such as insert and append vertices, on your polyline and polygon features in your graphics layers. Offsets and traverses can also be used on your features. In order to use these feature editing tools on your graphics layer; the graphics layer can be the only selected layer for editing.

Using text on a feature in your graphics layer

1. Use the Start/Stop Editing dropdown list to make the graphics layer editable if it is not already.
2. Select the text feature type (text point, text line, text polygon, text rectangle, text ellipse) from the dropdown list, such as text ellipse.
3. Draw the feature using the methods described in this chapter.
4. Lift the pen to create the new feature in your graphics layer.▸



Tip

Creating polyline and polygon features in your graphics layer

When you create a polyline or polygon feature for your graphics layer, you will need to use either the Commit Geometry Changes to create the feature without text or the Proceed button to display the Text dialog box. Both these buttons will become enabled on the Command bar once you have captured your first vertex.

Tip

Adding text to your polyline and polygon features in your graphics layer

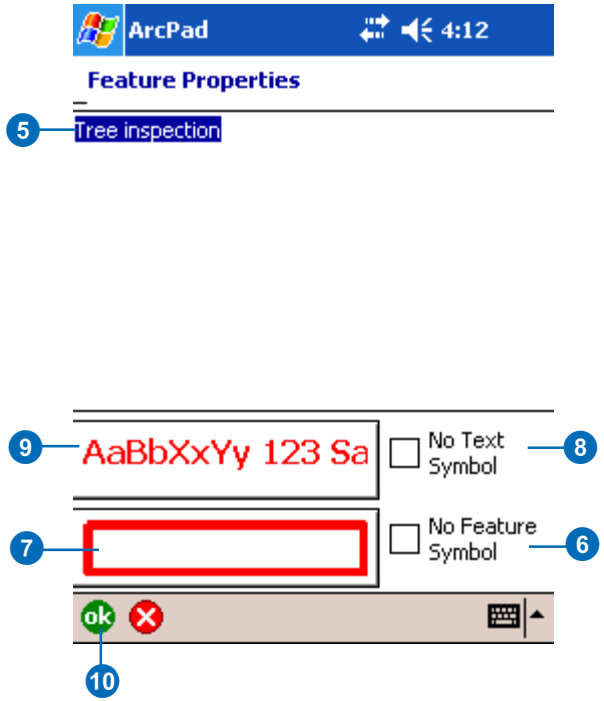
ArcPad gives you the option to add text to your polyline and polygon features created in your graphics layer. Select text polyline or text polygon tool from the feature type dropdown list before creating your feature. Alternatively, select any graphic, open the feature properties dialog box for the graphic, and add text using the dialog displayed.

See Also

Refer to Chapter 7 'Symbolizing your data', for help using the Symbology and Labeling dialog boxes.

A text dialog box is displayed for the feature.

5. Type the text you would like to include with your feature.
6. Uncheck the No Feature Symbol checkbox to apply symbology to the graphic.
7. Tap the box for the feature symbol. Use the Symbology Properties dialog box to select the symbol for your graphics feature.
8. Uncheck the No Text Symbol checkbox.
9. Tap the box for the text symbol. Use the Labelling Properties dialog box to select the font type for the feature.
10. Tap OK.
11. Your feature is created using the text and feature symbology you selected.



Creating repeated features

ArcPad enables you to create a new feature, or a series of features, based on the attribute information of another feature. This capability is very useful for capturing a series of new features that have attribute information in common.

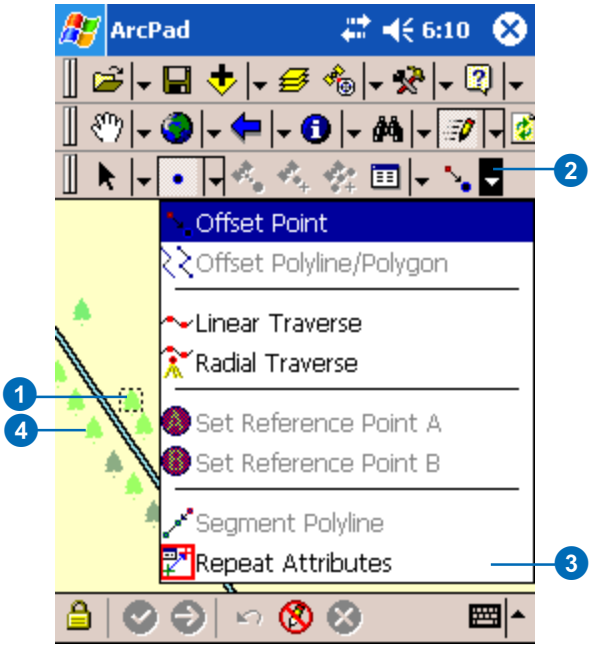
Using the Repeat Attributes button, ArcPad will populate the attribute information of any new feature you create using the attribute information of a previously selected feature. The Repeat Attributes button can be used on any feature type.

It is not necessary to use the Repeated Attributes tool with a previous feature of the same feature type. For example, you can capture points and polygons, both with an Inspection_date field. All common fields for the new point features will be repeated for the polygon features, and vice versa.

1. Create a new feature or select a feature whose attributes you would like repeated when creating new features.
2. Tap the dropdown arrow to the right of the Offset Point button to display the dropdown list.
3. Tap Repeat Attributes.

   A red box around the button indicates that the tool is active.
4. With the feature type selected, such as the Point feature button, tap the screen to create a new point feature.
5. The Feature Properties dialog box, or custom edit form, is displayed and the attribute information is populated with the previously selected feature's information.
6. Make any necessary changes to the edit form or the Attribute page.
7. Tap OK.

   Your new feature is created.



Creating segmented polyline features

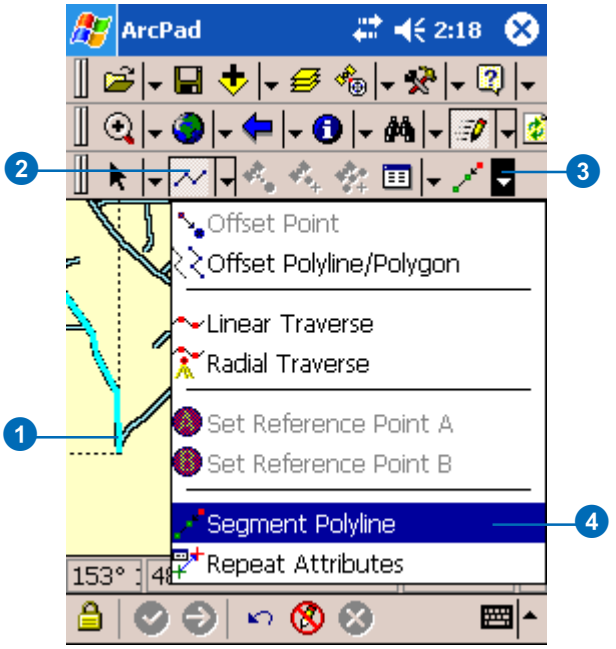
ArcPad enables you to create segmented polyline features. With the Segment Polyline button activated, any new polyline feature you create begins at the end of your previously selected line feature. This capability is very useful for capturing line features in succession that may have different attributes. For example, using the Segment polyline feature you can easily capture a continuous road that has been segmented based on its pavement conditions. This tool is only available on the Polyline feature type.

See Also

Refer to Chapter 16 'Creating new features with a GPS and rangefinder', for help using the Segment Polyline tool with the Add GPS Vertex and Add GPS vertices continuously buttons.

1. Select the line feature whose end you would like to be the start of your new feature.
2. Tap the dropdown arrow to the right of the Point feature type button to display the dropdown list and tap Polyline.
3. Tap the dropdown arrow to the right of the Offset Point button to display the dropdown list.
4. Tap Segment Polyline

   The Segment Polyline tool is promoted to the Edit toolbar. ▸



Tip

Undoing or cancelling your edits

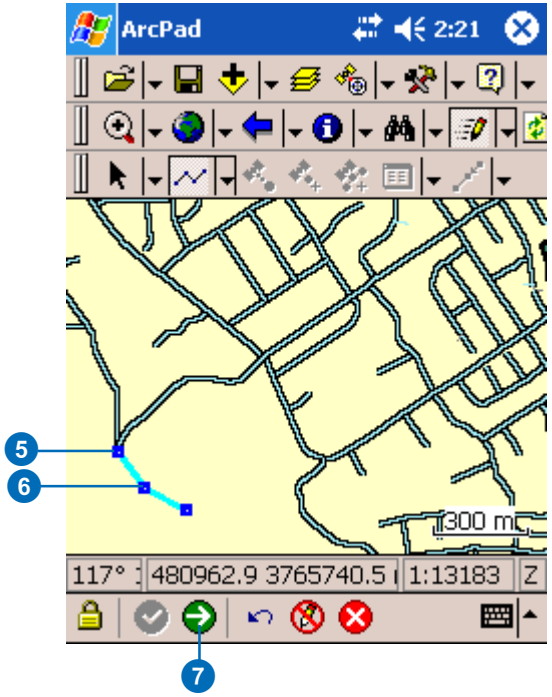
Use the Undo tool to go back a step to the previously captured vertex or use the Cancel Edits tool to erase all edits. These tools are only enabled prior to tapping the Proceed button. Once you tap the Proceed button and tap ok on the Feature Properties dialog box, your edits cannot be undone.

5. The last vertex of the previously selected feature is highlighted using a blue box. This is the start vertex of your new feature.
6. Tap the map at the location of the next vertex or vertices.
7. Tap Proceed to finish the line segment.
8. Enter the information for the segment using the Feature Properties dialog box.

   If a custom edit form exists, it will be displayed. You can also select the symbology for the line feature or segment.
9. Tap OK.

   The Segment Polyline tool will be enabled on the Edit toolbar.
10. Tap the Segment Polyline tool.
11. Repeat Steps 5–10 to continue your segmented polyline.

    Each time you capture a segmented feature, the next feature will begin at the end of the previously created, or selected, feature.



Working with Offsets

Offsets are used for GIS data collection in the following situations:

- When mapping the location of an inaccessible feature because it is either difficult to reach or it is in not safe to reach. For example, a tree on an island, or a manhole in the middle of a busy road.
- When mapping the location of a feature where it is not possible to get a GPS signal, or a GPS position of sufficient accuracy. For example, under a large tree or in a narrow street or 'urban canyon'.

Offsets combine the use of use distance, bearing (or angle), and/or inclination (or slope) to determine the location of features. In ArcPad, there are two types of offsets: simple and complex.

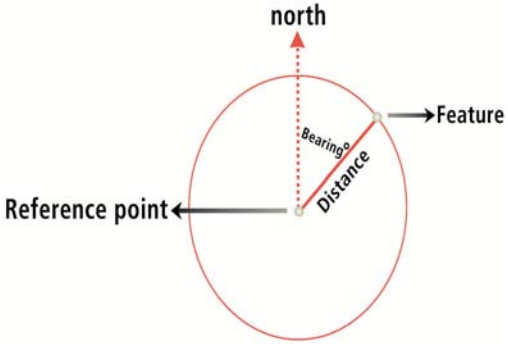
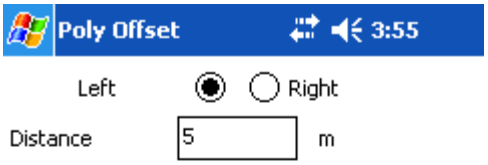


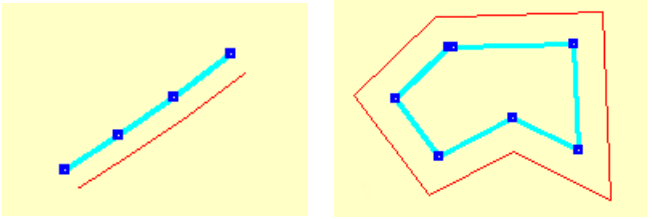
Diagram illustrating how distance from a known reference point to a feature and bearing to the feature in relation to north are calcualted.

Simple offsets

A simple offset is performed on a polyline or polygon and only uses a distance measurement. Using a simple offset, you would map a feature that is a constant distance away from a polyline captured via pen or GPS. You would also specify whether the new feature is left or right of the captured polyline. For example, you could map the distance of a new sidewalk to the left of and at a distance of 5 meters from the center of an existing road.



Simple polyline and polygon offset dialog box.



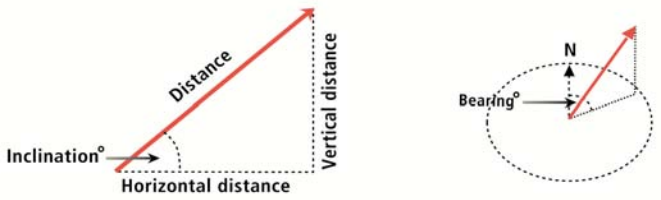
Polyline (left) and polygon (right) using simple offsets in ArcPad. The blue line is the line captured. The red line is the offset line that becomes the resultant feature when the feature is completed.

Complex offsets

Complex offsets can be used for point features and vertices of polylines and polygons. Complex offsets use a combination of distance, bearing, and inclination measurements. ArcPad supports 1 point offsets and 2 point offsets. A 1 point offset uses distance and bearing measurements (distance-bearing) to determine the offset. A 2 point offset uses either 2 distance measurements (distance-distance) or 2 bearing measurements (bearing-bearing) to calculate the offset. Inclination can be used in combination with any of these offsets, if a height value is known and you are storing your results in a shapefile that supports a z value.

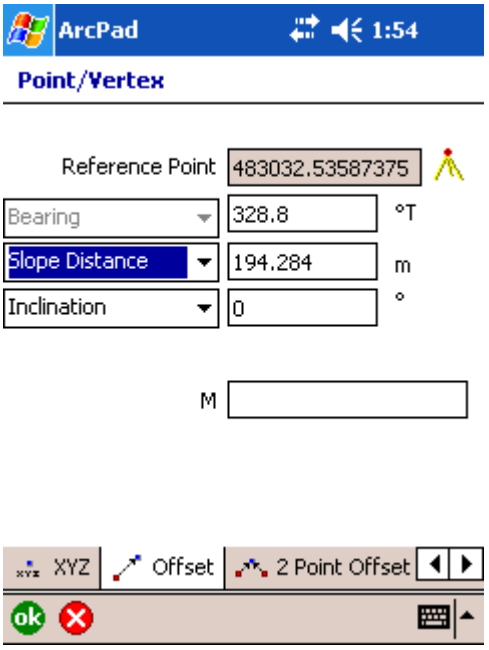
1 point offset

A 1 point offset enables you to create a point or vertex offset from a single reference point. The reference point can be set using a pen, GPS, or manually entered coordinates. A 1 point offset uses bearing and two other parameters such as slope distance, horizontal distance, vertical distance, or inclination to calculate the offset. Refer to the diagrams below for an illustration of the distance and bearing parameters.



Illustrations of how the three distance parameters (left) and bearing (right) measurements are calculated for a 1 point offset.

Typically you would select a 1 point offset if you were using a rangefinder that included a built-in compass. For example, you could capture a tree (target) that was a distance of 15m and had a bearing of 45 degrees from True North from your location, a known reference point.



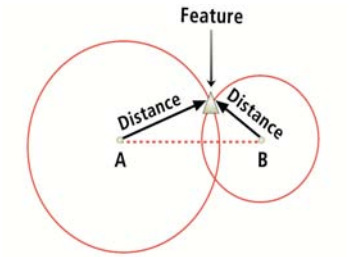
The Point/Vertex dialog box displaying the 1 point offset parameters.

2 point offsets

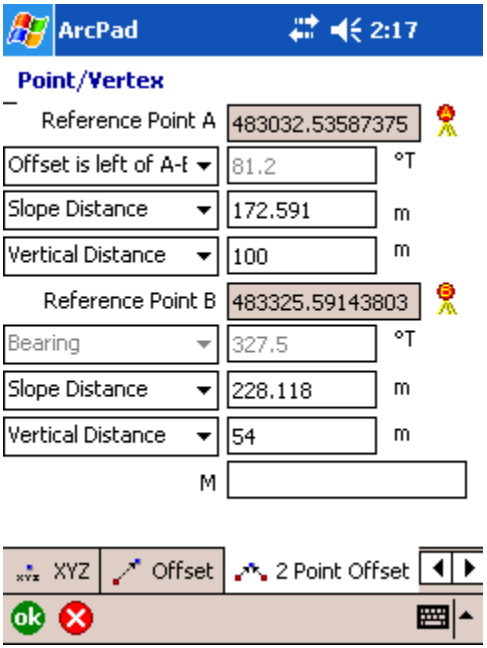
A 2 point offset enables you to create a point based on two reference points (A & B). The reference points can be set using a pen, GPS, or manually entered coordinates. There are two variations available in ArcPad for the 2 point offset: distance-distance and bearing -bearing. Typically you would use a 2 point offset to calculate point features rather than vertices for a polyline or polygon.

Distance-distance

A distance-distance offset is used when the bearings are not known from the reference points but the distances are. For example, when you are using a rangefinder without a compass. The distance between the feature and the two reference points A & B are used to calculate the location of the feature. The feature's location is at the point where the two circles centered around reference points A and B intersect. Without a bearing, there are two possible solutions to this type of offset. You must, therefore, determine (and set) if the offset point is to the left or right of an imaginary line between Reference points A & B. Vertical distance or inclination are required if a correct 3- dimensional solution is to be calculated.



With a distance-distance offset, the feature is located at the point where two circles centered on reference points A & B intersect.



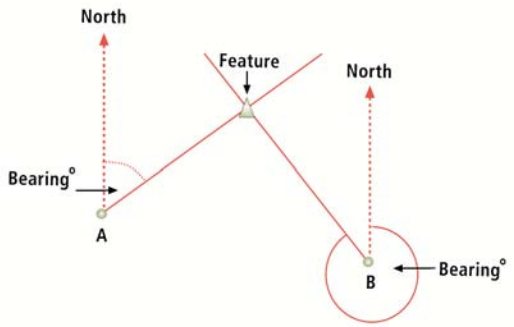
The Point/Vertex dialog box displaying the 2 point offset parameters.

M or Measure field

The Offset and 2 Point Offset pages in the Point/Vertex dialog box include a box to enter a measure, or M, value for the target point. The x, y, and optionally z coordinates are calculated automatically but the M value needs to be entered manually. The M field is not a default field in a shapefile, and therefore must be created when the shapefile is created. Data can only be entered in this input box if the editable shapefile contains an M field.

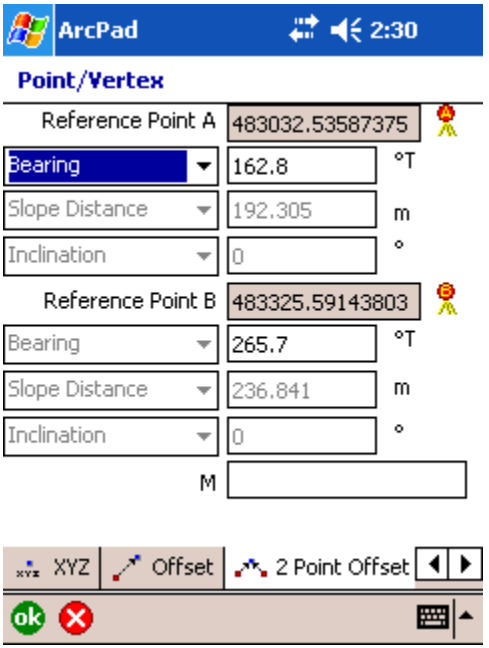
Bearing-bearing

A bearing-bearing offset is used when two bearings are known for the reference points but the distances are not. For example, when you are using a compass without a rangefinder. The bearing from north from each of the two reference points A & B is used to calculate the location of the feature. The feature's location is at the point where the two bearing lines intersect. Vertical distance or inclination are required if a correct 3- dimensional solution is to be calculated.



With a bearing-bearing offset, the feature is located at the point where if two lines, extended from the bearing angles for reference points A & B, intersect.

By default, a 2 Point Offset in ArcPad is bearing-bearing. To activate the distance-distance solution, tap the bearing dropdown and set the location of the offset point. The distance-distance solution requires that you nominate which side of the A-B line the offset point lies. Once activated, the distance fields can be completed. With a rangefinder active, the fields are automatically populated.



The Point/Vertex dialog box displaying the 2 point offset parameters.

Working with Traverses

Traverses in ArcPad enable you to create polylines and polygons using offsets. In ArcPad, there are two types of traverses: Linear Traverse and Radial Traverse.

Linear Traverse

A linear traverse enables you to capture the vertex of a polyline or polygon from a known point as you walk along a traverse. In other words, you begin at point A, capture point B, move to point B, capture point C, move to point C, and so on. With a linear traverse, you are always using a moving reference point, that is, the last point you captured.

You can capture points in a linear traverse using foresight or backsight. With foresight, you are standing at a known coordinate, such as reference point A, and you are shooting the target, such as the vertex of your feature. With backsight, you are standing at your target, such as the vertex of your feature, and you are shooting back to a known coordinate, such as reference point A. Use the Options page in the Point/Vertex dialog box to set foresight or backsight.

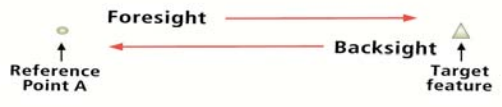


Illustration of foresight and backsight when performing a linear traverse.

Radial Traverse

A radial traverse uses 1 or 2 fixed reference points and creates a traverse relative to those fixed points. In other words, you begin at point A and capture the points around the perimeter of A. You are always standing at the same fixed point while you are capturing multiple vertices. The diagram below shows how a vertex in a line is calculated using a linear traverses versus a radial traverse, using 1 or 2 reference points.

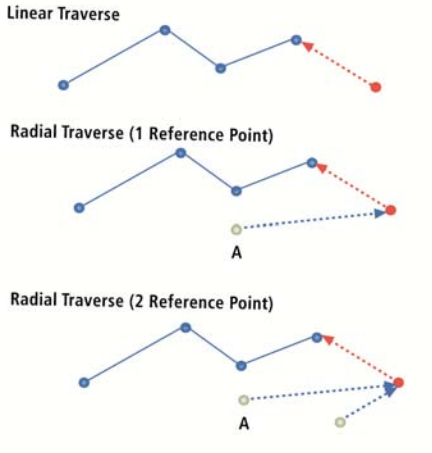


Illustration of linear traverse and radial traverse.

Other options for offsets

When working with offsets you can set other options or parameters on the Options page in the Point/Vertex dialog box or in the GPS Preferences. These parameters are typically considered constants versus the parameters that you would set to calculate individual offset such as slope distance, vertical distance, horizontal distance, and inclination.

Constant parameters might be set at the beginning of a data collection task and only changed as needed. The following are set on the Options page of the Point/Vertex dialog box:

- Foresight: Looking forward to and shooting at your target from a known reference point.
- Backsight: Looking back at and shooting from your target to a known reference point.
- North Reference: Set your bearing to be calculated from True north or Magnetic declination read from a GPS (if available).
- Observer Height: Height of rangefinder in relation to a reference point at ground level.
- Target Height: Height of target above ground. By default, the target height is 0 or unknown. If the target height is known and specified, the resulting coordinate will be the XYZ value of the feature at ground level; the target height is subtracted. If the target height is not known (value of 0), the resulting coordinate will be the XYZ value of the actual target.

  For example, if you are capturing insulators on power poles that always have a fixed height, you have two options. If you do not specify a target height, then the height stored with the feature is the height of the insulators. If you specify the target height, the captured feature (insulators) would have the coordinates of the power pole at ground level.

The Point/Vertex dialog box displaying the Options page.

In another scenario where you are capturing treetop heights, the target height would be set to 0 since the height of the trees is always changing. The captured heights of the treetops would therefore be the height of the treetops above ground.

- GPS Height: Height of GPS in relation to ground level. The GPS Height is set in the GPS Preferences dialog box.

Performing simple offsets

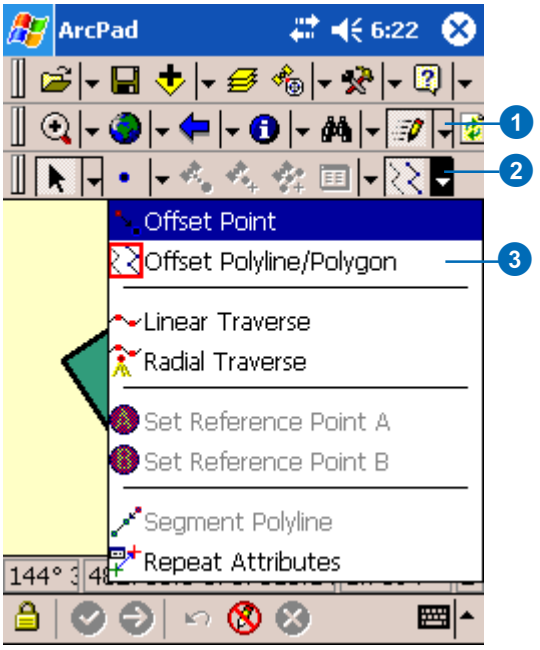
A simple offset is performed on a polyline or polygon and uses a specified offset distance. The offset distance can be based on an existing feature or other criteria such as distance from a the current GPS position.

Using a simple offset, you could, for example, map a line feature that is a given distance away from an existing line feature. You would then specify whether the new feature is left or right of the captured line.

Using simple offsets to create new polyline and polygon features

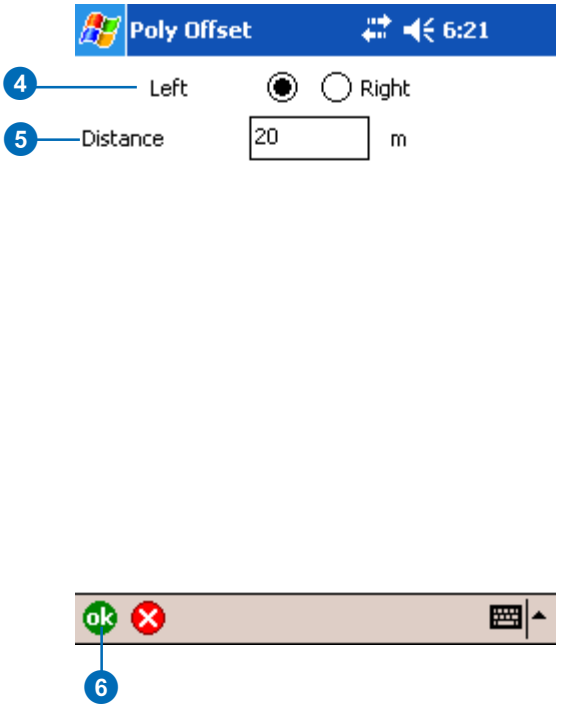
1. Make the target layer editable using the Start/Stop Editing dropdown list.
2. Tap the dropdown arrow to the right of the Offset Point button.
3. Tap Offset Polyline/Polygon.

   A red box around the Offset Polyline/Polygon button indicates that it is active. ▸



The Poly Offset dialog box is displayed.

4. Tap the left or right checkbox to determine the relative position of the offset.
5. Specify the Distance value.
6. Tap OK. ▶



Tip

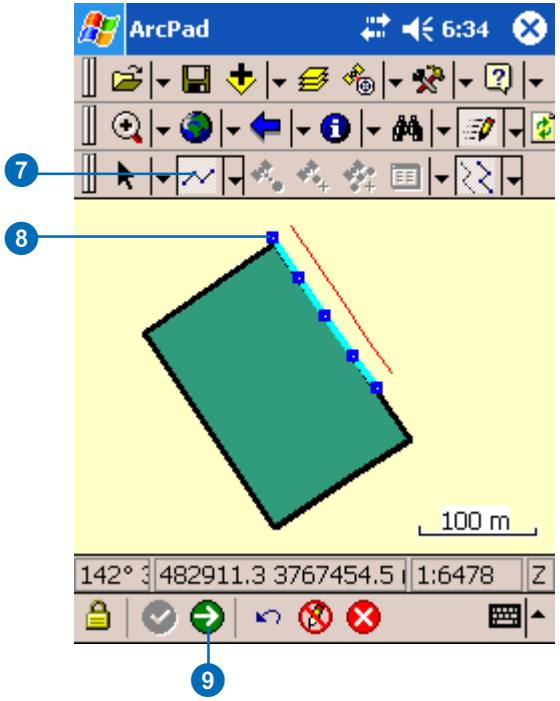
Using the snapping environment with offsets

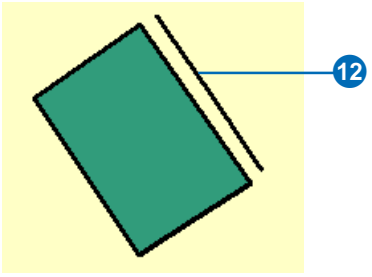
You can set the snapping options so that your reference line, or capture line, snaps to an existing feature.

7. Tap the polyline—or polygon—button from the Feature Type dropdown list.
8. Tap the screen where you want to begin your new feature and continue adding the required vertices.

   As you add vertices to your new line or polygon, a red line at the offset distance will be displayed. This is where your new feature will be created.
9. Tap Proceed when you are finished capturing your new feature.

   The Feature Properties dialog box is displayed.
10. Enter the information for the new feature.
11. Tap OK.
12. Your new feature is drawn at the specified distance of 20m from the existing polygon feature.





Using a 1 point offset

A 1 point offset enables you to create a point or vertex offset from a single reference point. The reference point can be set using a pen, GPS, or manually entered coordinates. A 1 point offset uses bearing and two other parameters such as slope distance, horizontal distance, vertical distance, or inclination to calculate the offset.

Tip

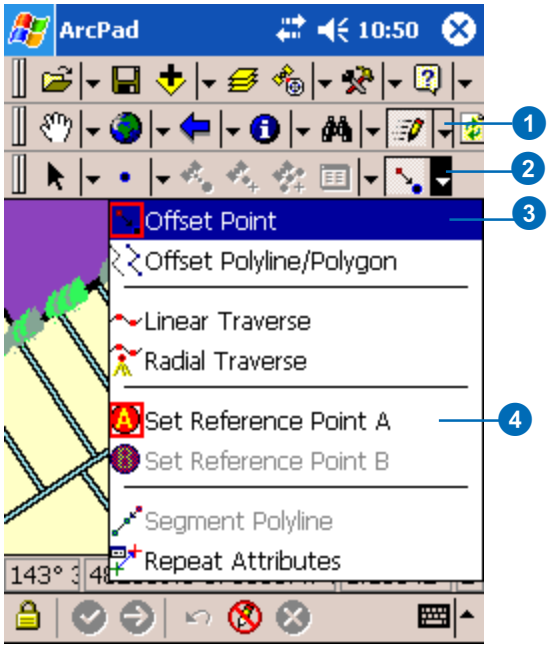
Using the snapping environment with reference points

Use snapping to create your reference point at the location of an existing point feature or vertex of a line or polygon feature.

Creating a new point feature using a 1 point offset

1. Make the point layer editable using the Start/Stop Editing dropdown list.
2. Tap the dropdown arrow next to the Offset Point button to display the dropdown list. By default, the Offset Point button is displayed on the Edit toolbar.
3. Tap the Offset Point button.
4. Tap Set Reference Point A.

   A red box around the Offset Point and Set Reference Point A buttons indicates that they are active. ►



Tip

Using a GPS to set the reference points

ArcPad will automatically use the current GPS position for the reference point if data is received from a rangefinder and there is no current reference point defined, and either Offset Point, Linear Traverse, or Radial Traverse are enabled.

See Also

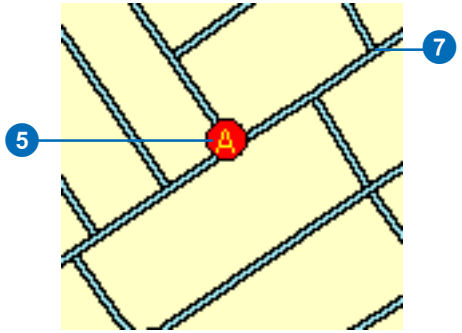
Refer to Chapter 12, 'Using your rangefinder', for information on how to use your rangefinder with ArcPad.

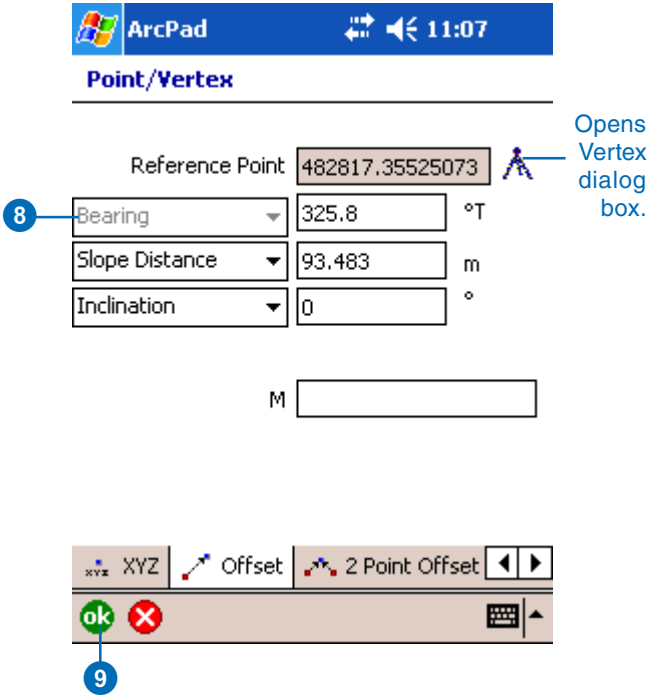
5. Tap the screen to set reference point A.
6. Tap the Point feature button.
7. If you have a rangefinder activated, shoot your target or simply tap the screen at the location of your feature.

   The Point/Vertex dialog box opens on the Offset page.
8. Verify that the information in the fields is accurate.
9. Tap OK.

   The Feature Properties dialog box is displayed with an edit form, if it exists. Enter the information for the new feature.
10. Tap OK.

    Your new feature is created.





Using a 2 point offset

A 2 point offset enables you to create a point based on two reference points (A & B). The reference points can be set using a pen, GPS, or manually entered coordinates. There are two variations available in ArcPad for the 2 point offset: distance-distance and bearing-bearing. ▸

Tip

Using a GPS to set the reference points

ArcPad will automatically use the current GPS position for the reference point if data is received from a rangefinder and there is no current reference point defined, and either Offset Point, Linear Traverse, or Radial Traverse are enabled.

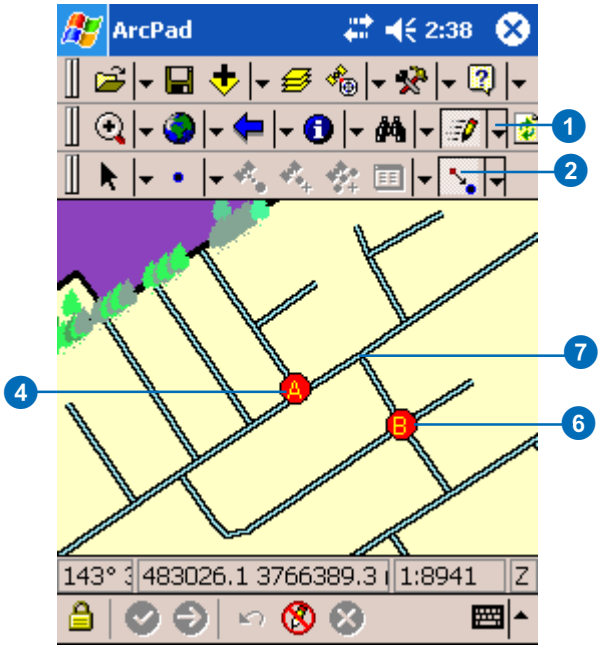
See Also

Refer to Chapter 12, 'Using your rangefinder', for information on how to connect your rangefinder and use it with ArcPad.

Creating a new point feature using a 2 point offset

1. Make the point layer editable using the Start/Stop Editing dropdown list.
2. Tap the Offset Point button.

   The Offset Point button is depressed on the Edit toolbar and a red box is placed around the Offset Point button in the dropdown list to indicate that it is active.
3. Tap the dropdown arrow next to the Offset Point button and tap Set Reference Point A.
4. Tap the screen to set reference point A.
5. Tap the dropdown arrow next to the Offset Point button and tap Set Reference Point B.
6. Tap the screen to set reference point B.
7. If you have a rangefinder activated, shoot your target from each reference point or simply tap the screen at the location of your feature. ▸



A distance-distance offset is used when the bearings are not known from the reference points but the distances are. For example, when you are using a rangefinder without a compass.

A bearing-bearing offset is used when two bearings are known for the reference points but the distances are not. For example, when you are using a compass without a rangefinder.

The Point/Vertex dialog box opens on the 2 Point Offset page.

8. Make any necessary changes to the information that is displayed.

   If you are using a rangefinder without a compass, you will need to specify whether the point you are capturing is to the left or to the right of an imaginary line between reference points A & B. You will also need to shoot a measurement twice, once for each distance from each reference point.

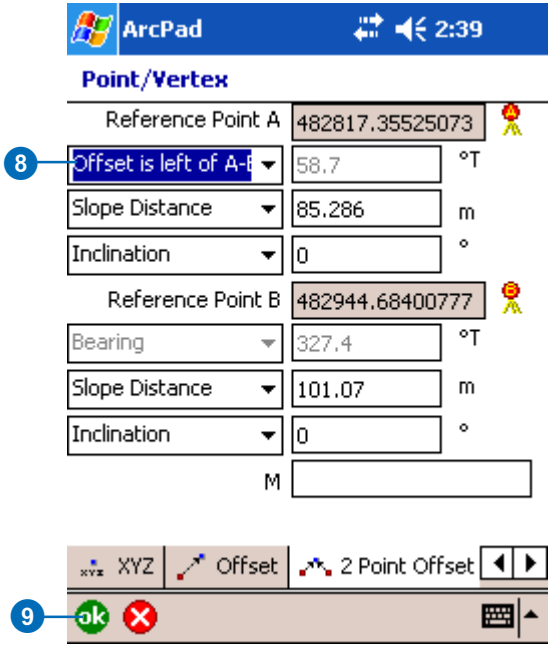
   If you are only using a compass, you will be using two bearing measurements to calculate the offset.

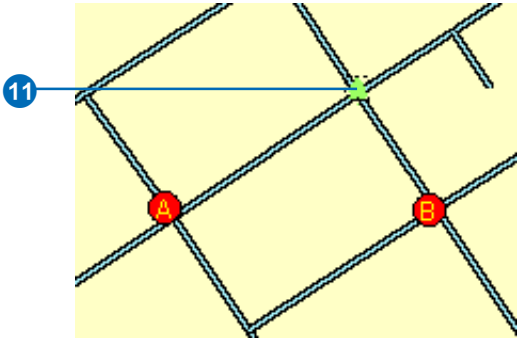
9. Tap OK.

   The Feature Properties dialog box is displayed with an edit form, if it exists. Enter the information for the new feature.

10. Tap OK.

11. Your new feature is created.





Creating a linear traverse

A linear traverse enables you to capture the vertex of a polyline or polygon from a known point as you walk along a line. In other words, you begin at point A, capture point B, move to point B, capture point C, move to point C, and so on.

You can capture points in a linear traverse using foresight or backsight:

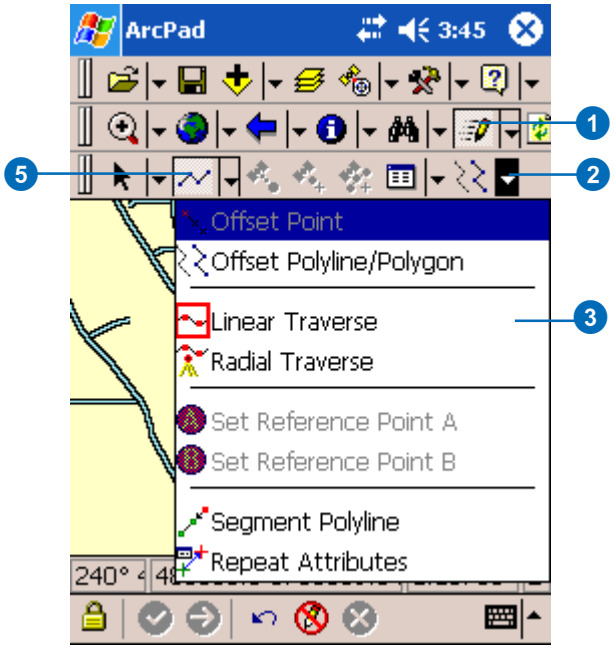
- Foresight: Looking forward to and shooting at your target from a known reference point.
- Backsight: Looking back at and shooting from your target to a known reference point.

Tip

Enabling the traverse tools

The Linear and Radial Traverse tools will only be enabled if a polyline or polygon layer is set as editable.

1. Make the polyline or polygon layer editable using the Start/ Stop Editing dropdown list.
2. Tap the dropdown arrow next to the Offset Point button.
3. Tap Linear Traverse.
4. Tap the dropdown arrow next to the Point button.
5. Tap the Polyline -or polygon- feature type. ▸



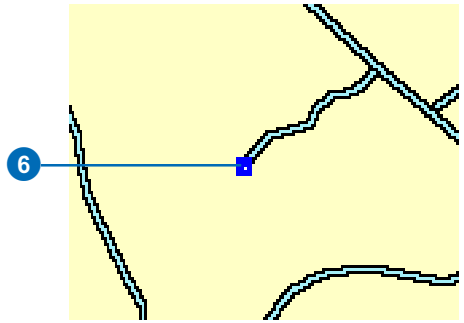
Tip

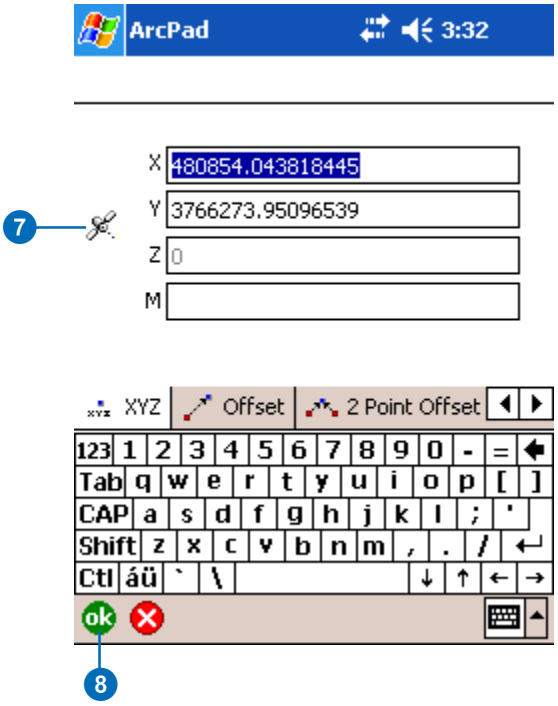
Undoing or cancelling your edits

Use the Undo tool to go back a step to the previously captured vertex or use the Cancel Edits tool to erase all edits. These tools are only enabled prior to tapping the Proceed button. Once you tap the Proceed button and tap ok on the Feature Properties dialog box, your edits cannot be undone.

6. Tap the screen to capture the first vertex of the line -or polygon.
7. The XYZ page of the Point/ Vertex dialog box is displayed.

   If you have a GPS activated, tap the GPS button to capture the incoming coordinates.
8. Tap OK. ▸





Tip

Foresight versus backsight

You can use foresight or backsight to capture vertices in your traverse. Set foresight or backsight on the Options page of the Point/Vertex dialog box.

Tip

Using the measure tool with offsets

You can use the measure tool in 'traverse' mode to perform an accurate measure in the field without capturing a feature. To do so, simply activate the Linear Traverse tool before enabling the Measure tool.

See Also

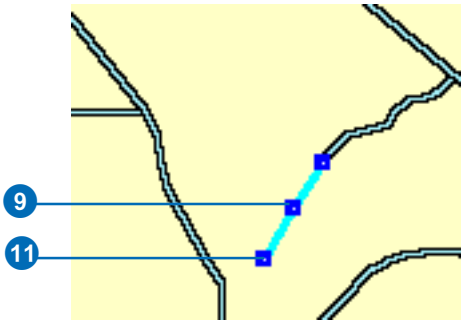
Refer to Chapter 12, 'Using your rangefinder', for information on how to connect your rangefinder and use it with ArcPad.

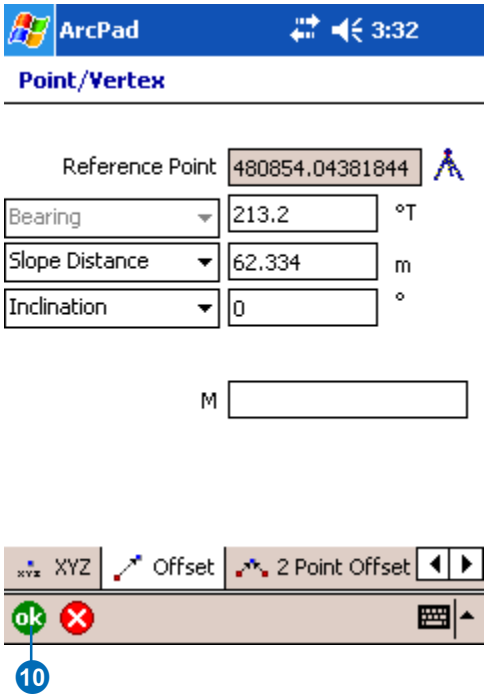
9. With a rangefinder, shoot the next feature from the location of the first feature (foresight). Alternatively, shoot back to the first vertex (target) from the location of the second vertex (backsight). Simply tap the screen if you do not have a rangefinder connected.

   The Point/Vertex dialog box is displayed on the Offset page.

10. Tap OK.

11. Continue adding vertices until your line or polygon is finished. ▸





Tip

Undoing or cancelling your edits

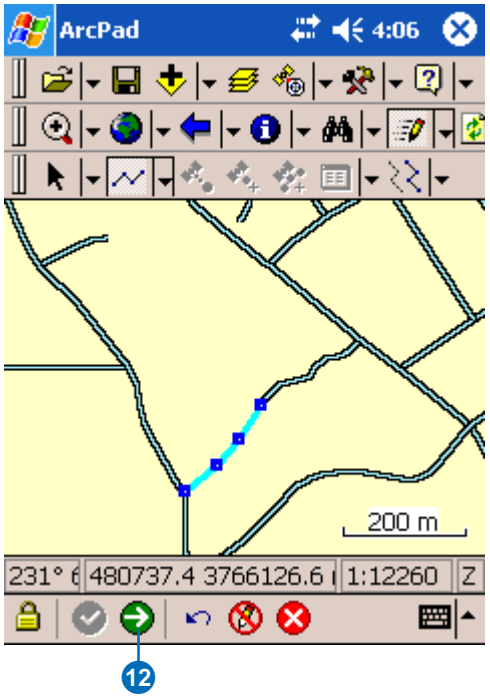
Use the Undo tool to go back a step to the previously captured vertex or use the Cancel Edits tool to erase all edits. These tools are only enabled prior to tapping the Proceed button. Once you tap the Proceed button and tap ok on the Feature Properties dialog box, your edits cannot be undone.

12. Tap Proceed when you are finished creating your line or polygon.

    The Feature Properties dialog box is displayed with an edit form, if it exists. Enter the information for the new feature.

13. Tap OK.

14. Your new feature is created.



Creating a radial traverse

A radial traverse uses 1 fixed reference point to create a traverse relative to that fixed point. In other words, you begin at point A and capture the points around the perimeter of A. You are always standing at the same fixed point but you are capturing multiple vertices.

Tip

Enabling the traverse tools

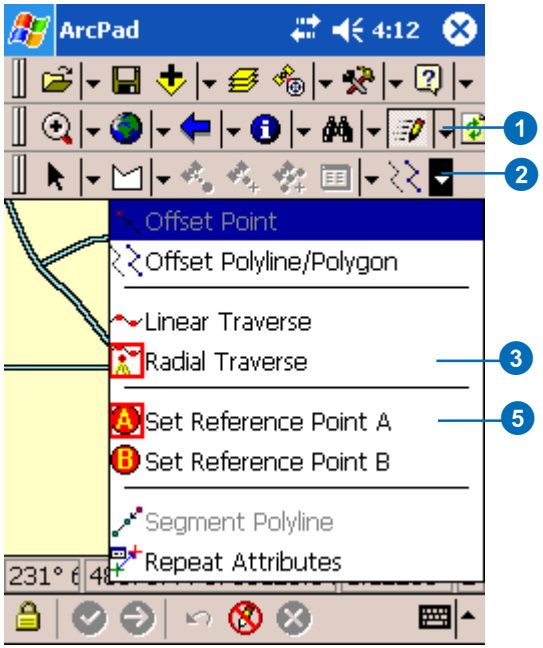
The Linear and Radial Traverse tools will only be enabled if a polyline or polygon layer is set as editable.

Tip

Using a GPS to set the reference points

ArcPad will automatically use the current GPS position for the reference point if data is received from a rangefinder and there is no current reference point defined, and either Offset Point, Linear Traverse, or Radial Traverse are enabled.

1. Make the polyline or polygon layer editable using the Start/ Stop Editing dropdown list.
2. Tap the dropdown arrow next to the Offset Point button.
3. Tap Radial Traverse.
4. Tap the dropdown arrow next to the Offset Point button.
5. Tap Set Reference Point A.
6. Tap the screen to set the reference point. ▸



Tip

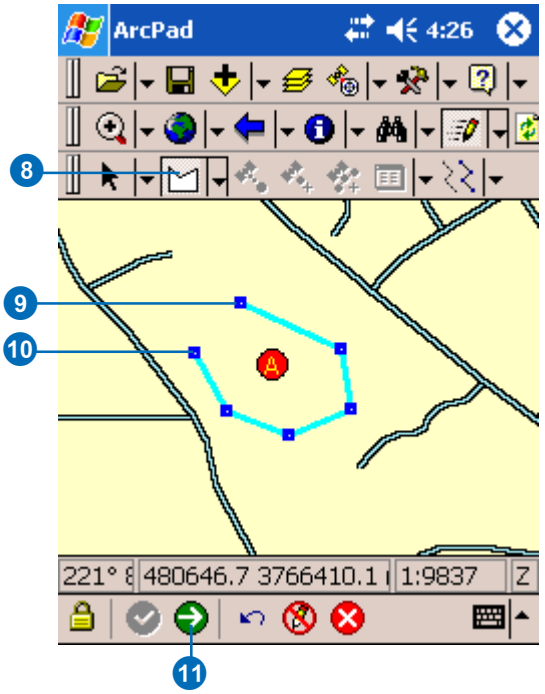
Undoing or cancelling your edits

Use the Undo tool to go back a step to the previously captured vertex or use the Cancel Edits tool to erase all edits. These tools are only enabled prior to tapping the Proceed button. Once you tap the Proceed button and tap ok on the Feature Properties dialog box, your edits cannot be undone.

8. Tap the dropdown arrow next to the Point button and select the Polygon -or Polyline - feature type.
9. With a rangefinder, shoot the target (first vertex) from Reference Point A.

   The Point/Vertex dialog box is displayed on the Offset page.
10. Continue shooting your vertices from Reference A.
11. Tap Proceed when you are finished creating your line or polygon.

    The Feature Properties dialog box is displayed with an edit form, if it exists. Enter the information for the new feature.
12. Tap OK.
13. Your new feature is created.



Creating new features with a GPS and rangefinder

16

IN THIS CHAPTER

- GPS Quality, Capture, and Alerts options
- Creating point features with a GPS
- Creating line features with a GPS
- Creating polygon features with a GPS
- Creating a point feature using a 1 point offset and a rangefinder

It's easy to create new features using the editing tools in ArcPad. First, select the layers for which you want to create the new features. Then select the appropriate tool and use the mouse pointer, pen, or incoming GPS coordinates to digitize the feature.

You can use the editing tools to create new point, line, or polygon features. To create point features, tap once on the map or tap the GPS Point button. To create line or polygon features, use the mouse pointer, pen, or incoming GPS coordinates to digitize the vertices that make up that feature. The new feature is saved in the selected layer of the same feature type.

You can specify various quality and capture options when using the incoming GPS coordinates. You can also set alert messages and sounds to be activated when a specific GPS quality setting is not met. In addition, you can use offsets and a rangefinder to determine the location of your point feature.

GPS Quality, Capture, and Alerts options

ArcPad includes a number of user-specified options that can be used to control which of the incoming GPS coordinates are used for creating and editing features. You can use these options to ensure that ArcPad only uses those GPS coordinates that meet your accuracy requirements for data capture. ArcPad uses the specified options to filter the incoming GPS coordinates and ignores those coordinates that do not meet the requirements. The specified options have no influence on how the GPS receiver actually computes the position coordinates, nor do they affect the way ArcPad displays the GPS position or coordinates, in the GPS Position Window, for example.

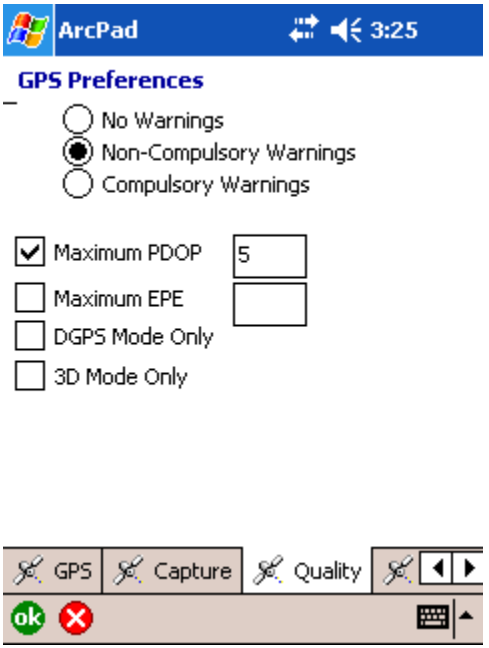
The GPS Quality, Capture, and Alerts options can be specified in the respective pages in the GPS Preferences dialog box.

Quality options

The Quality options allow you to specify the following parameters:

- Maximum Position Dilution of Precision (PDOP) and Estimated Position Error (EPE) values for the GPS position coordinates.

  Suitable maximum values will depend on the environment in which you are using the GPS receiver. For example, a PDOP of 5 could be appropriate when working in an open field but may be too low when working in an urban environment. It is best to refer to your GPS receiver's manual for an appropriate maximum PDOP or EPE value. In general, a maximum PDOP value of 6 is acceptable.
- DGPS Mode Only: only uses incoming GPS coordinates that have been real-time differentially corrected.
- 3D Mode Only: at least four satellites are available and are used by the GPS receiver to calculate the x,y, and z position coordinates.



Quality options

More than one quality parameter can be active at any time. A quality parameter is active when the parameter's check box is checked and either Non-Compulsory or Compulsory Warnings have been selected.

The GPS Quality options are enabled, or disabled, by selecting one of three different warning levels:

- No Warnings (default) disables any selected Quality parameters. ArcPad ignores the Quality parameters and uses any incoming GPS coordinate for creating and editing features.

- Non-Compulsory Warnings display a message box when an active Quality parameter has not been met and give you the option of whether or not to use the substandard GPS coordinate.
- Compulsory Warnings display a message box when an active Quality parameter has not been met. No option is provided to use the substandard GPS coordinate, thereby enforcing the specified GPS Quality setting.

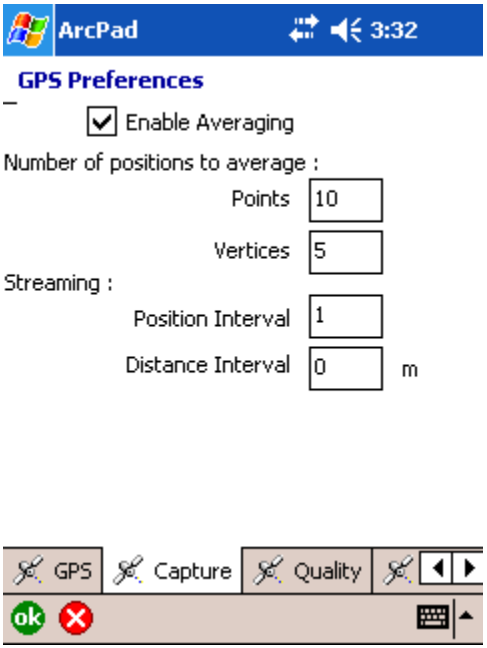
The Non-Compulsory and Compulsory Warnings message boxes are only displayed when ArcPad is in the process of using the incoming GPS coordinates for creating or editing a point or vertex. However, the corresponding alerts for each of the four Quality parameters can be activated at any time if the Non-Compulsory or Compulsory Warnings have been selected.

Capture options

The Capture options allow you to specify position averaging and streaming interval parameters.

The averaging parameters specify the number of incoming GPS position coordinates that ArcPad should use for calculating an average coordinate. The resultant average coordinate is then used by ArcPad for creating the point or vertex. The number of positions to average can be specified for points and vertices. Averaging is enabled when the Enable Averaging check box is checked.

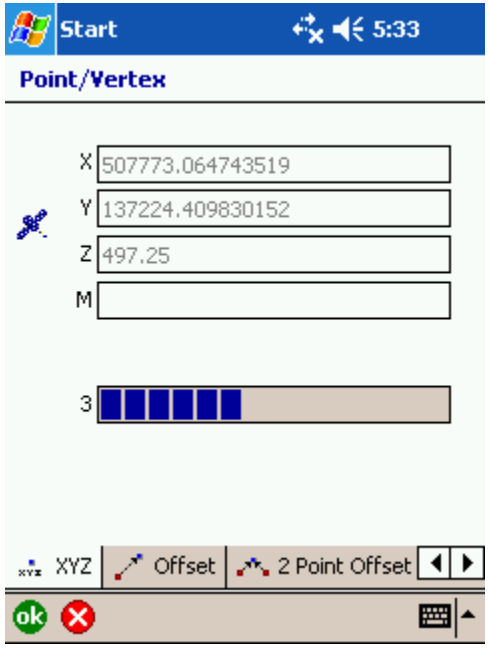
It is best that you refer to your GPS receiver's manual for an appropriate number of GPS positions to average; however, it is recommended that you average at least 20 GPS positions and preferably up to 180 positions.



Capture options

The Streaming Vertices Interval parameters allow you to specify how frequently ArcPad should use the incoming GPS coordinates when creating vertices with the Add GPS Vertices Continuously tool. For example, a Position Interval of 2 means that ArcPad will use every second-incoming GPS coordinate when creating vertices. The default Position Interval is 1. A Distance Interval of 2 means that ArcPad will only use the incoming GPS coordinate when the distance from the last coordinate is 2 meters or more.

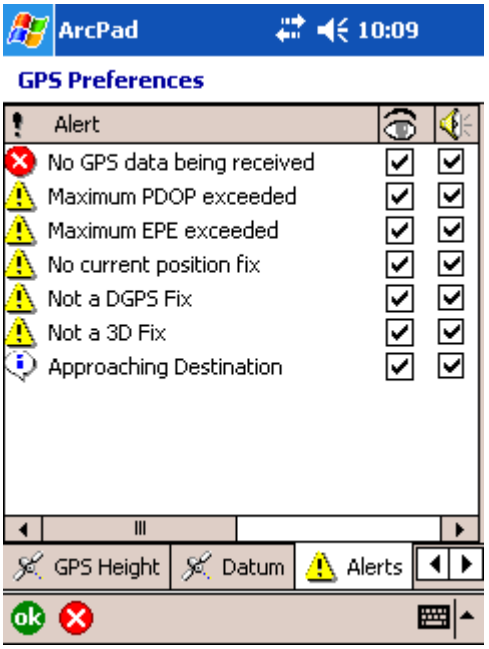
A dialog box is automatically displayed each time ArcPad averages GPS coordinates. The dialog box shows a progress bar, which counts down from the specified number of GPS positions to average to zero. For example, the following dialog box is displayed while averaging to create a vertex:



Point/Vertex dialog box

Alerts options

The Alerts options allow you to specify which message boxes are displayed and which sounds are played when an alert condition is encountered by ArcPad.



Alerts options

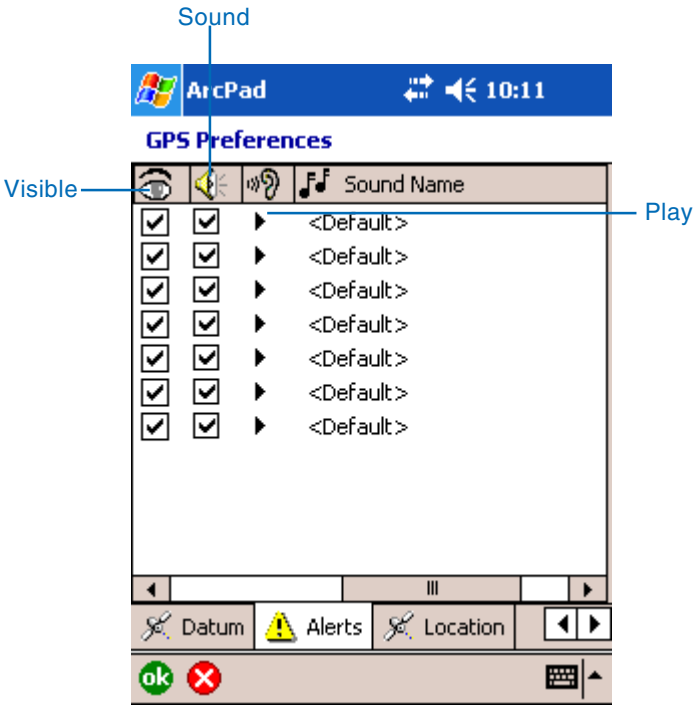
You can enable the following alerts:

- No GPS data being received
  This alert is activated when the GPS has been activated but ArcPad is not receiving any messages from the GPS receiver.

- Maximum PDOP exceeded
  This alert is activated when the specified maximum PDOP has been exceeded and the Non-Compulsory or Compulsory Warnings have been selected. The maximum PDOP and warnings are specified in the Quality options.
- Maximum EPE exceeded
  This alert is activated when the specified maximum EPE has been exceeded and the Non-Compulsory or Compulsory Warnings have been selected. The maximum EPE and warnings are specified in the Quality options.
- No current position fix
  This alert is activated when the GPS is not able to calculate a position fix, and therefore ArcPad is not currently receiving position coordinates from the GPS. The GPS may not be able to calculate a position fix if, for example, the number of visible satellites is less than 3.
- No DGPS fix
  This alert is activated when the incoming GPS position coordinates are not differentially corrected and the DGPS Mode Only and the Non-Compulsory or Compulsory Warnings have been selected. These warnings are specified in the Quality options.
- Not a 3D fix
  This alert is activated when the incoming GPS position coordinates are x,y coordinates—with no z coordinate—and the 3D Mode Only and the Non-Compulsory or Compulsory Warnings have been selected. These warnings are specified in the Quality options.
- Approaching Destination
  This alert is activated when the distance from the current GPS position to the selected navigation destination is less than the specified DST Distance Alert. The DST Distance Alert is specified in the Location options.

The alert message boxes are enabled by checking the alert's visible check box. The sounds are enabled by checking the alert's sound check box. You can enable the message box or sound or both for any number of alerts. The Play button plays the sound for the associated alert. You can change the sound for any alert by tapping on the alert's Sound Name column and selecting a Wave Sound (*.wav) file located on your computer.

The *ArcPad Reference Guide* provides more information on the GPS Quality, Capture, and Alerts options for ArcPad.



Options for alert message boxes

Creating point features with a GPS

Creating a point feature using the incoming GPS coordinates involves the following steps:

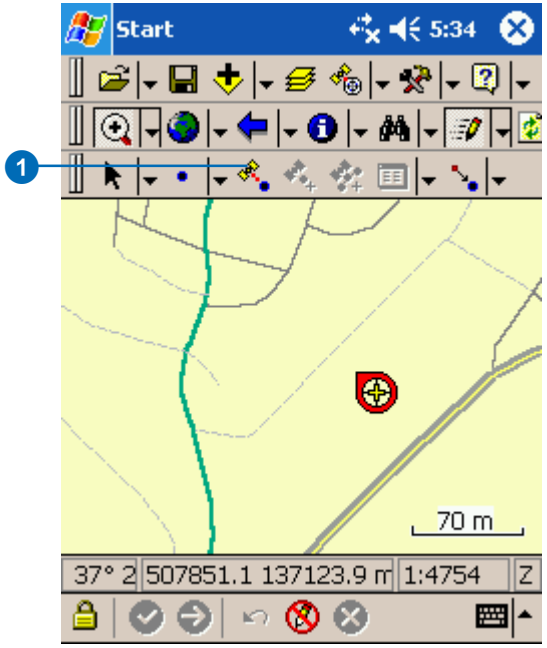
1. Select a point layer for editing via the Start/Stop Editing dropdown list or the Table of Contents.
2. Activate the GPS.
3. Tap the GPS Point button on the Edit toolbar to create a point feature.
4. Type in attributes for the new point feature.

See Also

Refer to Chapter 9, 'Connecting your GPS receiver', for help on activating the GPS.

1. Tap the GPS Point button to capture a new point feature at the current GPS position.

   The Feature Properties dialog box or custom edit form is automatically displayed after the new point feature has been created. ►



Tip

Enabling GPS position averaging for points

GPS position averaging for points is enabled in the Capture page of the GPS Preferences dialog box. You can also specify the number of GPS positions for ArcPad to average.

Tip

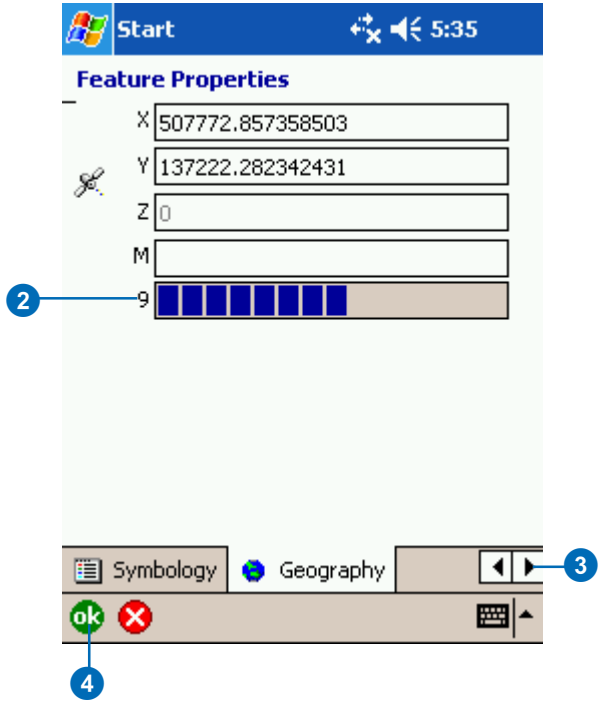
Typing in attributes during position averaging

You can type in attributes (in the Attributes page or a custom edit form) without waiting for the position averaging to be completed. This is particularly useful if you have specified a large number of GPS positions to average. ArcPad will continue averaging even after the required number of GPS positions has been received and averaged. Averaging will stop once you have tapped the ok button.

2. The Geography page shows a progress bar, which counts down from the specified number of GPS positions to average to zero.
3. Scroll and tap Attributes to display the Attributes page. Type the attributes for the new point feature.
4. Tap OK to save the attributes, close the edit form—or the Feature Properties dialog box—and complete the new point feature.

   If you tap OK before the averaging is complete, a dialog box will display asking whether you want to terminate the GPS position averaging.

   You can also tap the X button if you want to cancel the capture of the new point feature. The point feature and any attributes that have been typed in will be deleted.



Creating line features with a GPS

Creating a line feature using the incoming GPS coordinates involves the following steps:

1. Select a line layer for editing via the Start/Stop Editing dropdown list or the Table of Contents.
2. Activate the GPS.
3. Tap the Polyline button to start capturing a line feature.
4. Tap the Add GPS Vertex button to capture a single vertex, or tap the Add GPS Vertices Continuously button to capture streaming vertices.
5. Tap the Proceed button on the Command bar to complete the capture of the line feature.
6. Type in attributes for the new line feature.

Tip

Enabling GPS position averaging for vertices

GPS position averaging for vertices is enabled in the Capture page of the GPS Preferences dialog box. You can also specify the number of GPS positions for ArcPad to average.

1. Tap the arrow to the right of the Feature tool to display the dropdown list. Tap the Polyline feature tool.

   The Add GPS Vertex and Add GPS Vertices Continuously buttons are enabled if the GPS is activated.

2. Tap the Add GPS Vertex button each time you want to use the current GPS position coordinates to capture a vertex.

   The vertices are drawn with a blue box and joined with a line using the current selection color.

   At any time, tap and hold anywhere on the map to display the Capture menu. Refer to the Creating line features task for more information on the Capture menu. Use the Capture menu to create vertices at specified x,y coordinates or relative to the last vertex or the current GPS position. You can also delete the last vertex.

3. The Point/Vertex dialog box is automatically displayed if GPS position averaging is enabled for vertices.

   The Point/Vertex dialog box shows a progress bar, which counts down from the specified number of GPS positions to average until it reaches zero. ▸

Tip

Changing the streaming vertices position and distance intervals

By default, the Add GPS Vertices Continuously mode captures a vertex each time ArcPad receives a coordinate from the GPS. This may be too frequent and result in the capture of unnecessary vertices. You can increase the streaming vertices position and distance intervals in the Capture page of the GPS Preferences dialog box.

Tip

Creating GPS point features while capturing a polyline feature

The GPS Point button will be enabled—if a point layer is active for editing—even while the Polyline button is active and a line feature is in the process of being captured. While capturing a polyline, you can tap the GPS Point button to capture a point feature without having to first end the capture of the line feature. You will need to pause streaming GPS data capture if it is active.

Tip

Pausing streaming GPS data capture

ArcPad continuously captures vertices in a streaming mode when the Add GPS Vertices Continuously tool is active. Tap the Add GPS Vertices Continuously button to pause or stop capturing vertices. Tap the button again to resume capturing vertices.

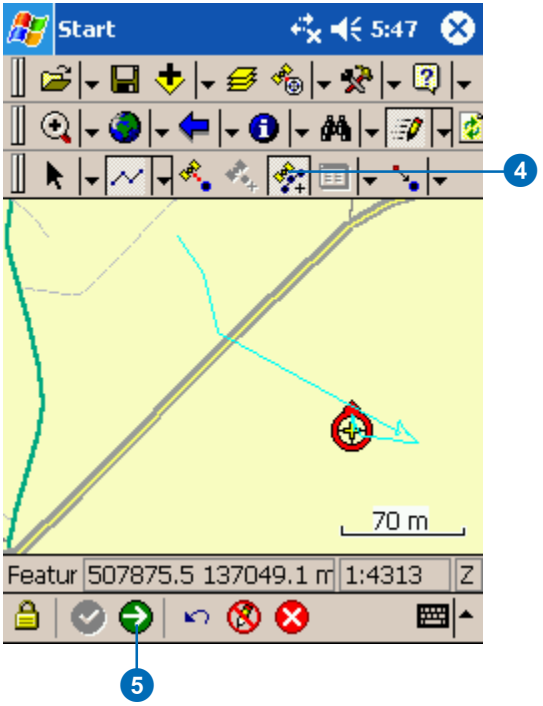
If you tap OK before the averaging is complete, a dialog box will display asking whether you want to terminate the GPS position averaging.

Tap the X button to cancel the capture of the vertex.

4. Tap the Add GPS Vertices Continuously button to use the incoming GPS coordinates for capturing vertices in a streaming mode. A vertex will be captured each time ArcPad receives a coordinate from the GPS. Vertices are captured according to the specified streaming vertices position and distance intervals.
5. Tap the Proceed button to complete the new line feature.

   The Feature Properties dialog box, or custom edit form, is automatically displayed after the new line feature has been created.
6. On the Attributes tab, tap the Property field to open the associated Value text box for typing in attribute data.

   For example, tap on the Property field STREET_NAM to open the associated Value text box and type the street name value of “New”.
7. Tap OK.



Creating polygon features with a GPS

Creating a polygon feature using the incoming GPS coordinates involves the following steps:

1. Select a polygon layer for editing via the Start/Stop Editing dropdown list or the Table of Contents.
2. Activate the GPS.
3. Tap the Polygon button to start capturing a polygon feature.
4. Tap the Add GPS Vertex button to capture a single vertex or tap the Add GPS Vertices Continuously button to capture streaming vertices.
5. Tap the Proceed button to complete the capture of the polygon feature.
6. Type in attributes for the new polygon feature.

Tip

Enabling GPS position averaging for vertices

GPS position averaging for vertices is enabled in the Capture page of the GPS Preferences dialog box. You can also specify the number of GPS positions for ArcPad to average.

1. Tap the arrow to the right of the feature tool to display the dropdown list. Tap the Polygon feature tool.

   The Add GPS Vertex and Add GPS Vertices Continuously buttons are enabled if the GPS is activated.

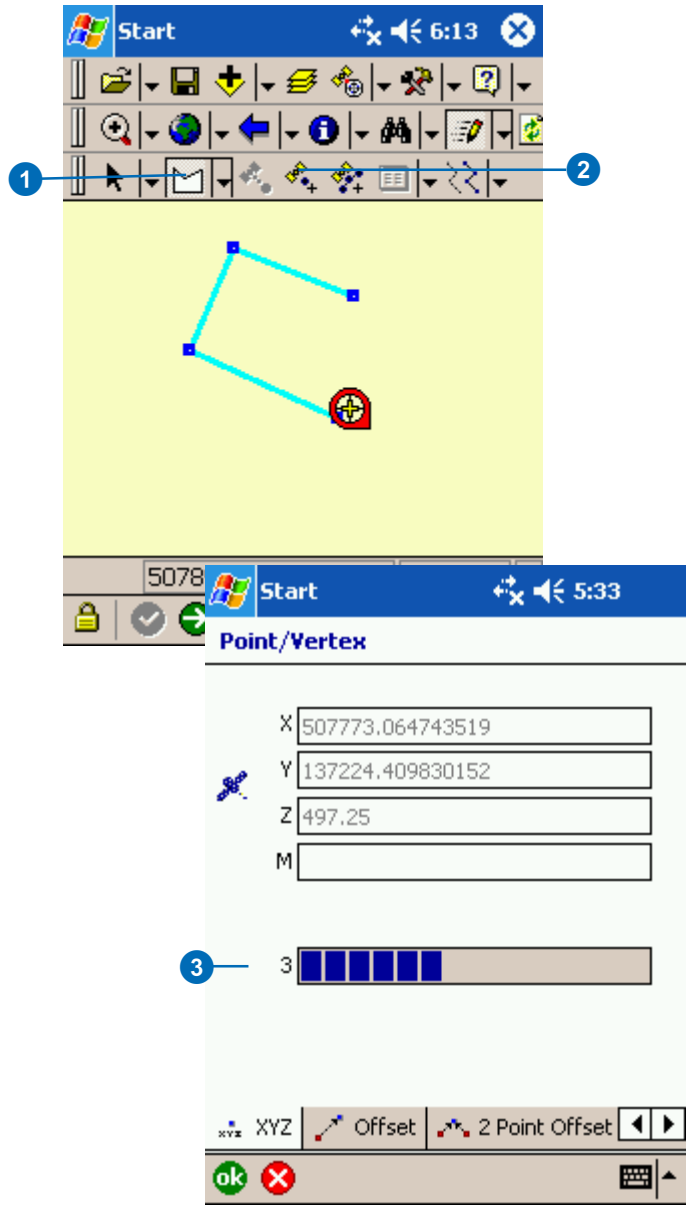
2. Tap the Add GPS Vertex button each time you want to use the current GPS position coordinates to capture a vertex.

   The vertices are drawn with a blue box and joined with a line.

   At any time, you can tap and hold anywhere on the map to display the Capture menu. Refer to the Creating line features task for more information on the Capture menu. Use the Capture menu to create vertices at specified x,y coordinates or relative to the last vertex or the current GPS position. You can also delete the last vertex.

3. The Vertex dialog box is automatically displayed if GPS position averaging is enabled for vertices.

   The Vertex dialog box shows a progress bar, which counts down from the specified number of GPS positions to average until it reaches zero. ▸



Tip

Undoing or canceling your edits

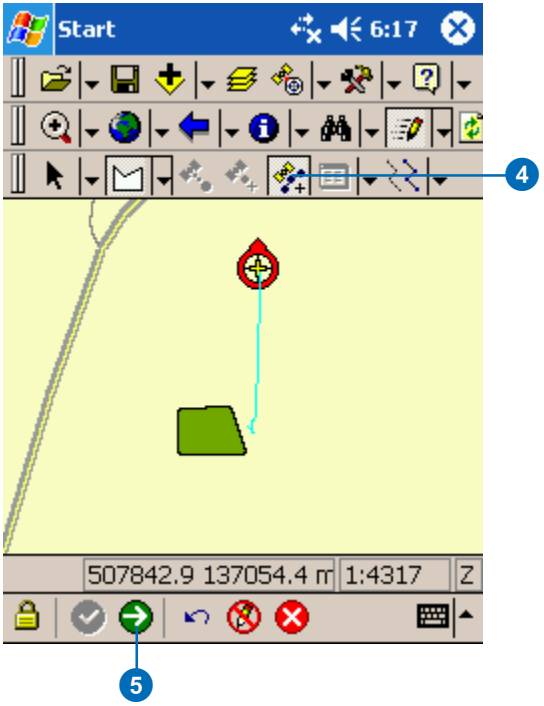
Use the Undo tool to go back a step to the previously captured vertex or use the Cancel Edits tool to erase all edits. These tools are only enabled prior to tapping the Proceed button. Once you tap the Proceed button and tap ok on the Feature Properties dialog box, your edits cannot be undone.

Tapping OK before the averaging is complete will display a dialog box asking whether you want to terminate the GPS position averaging. Tap the X button to cancel the capture of the vertex.

4. Tap the Add GPS Vertices Continuously button to use the incoming GPS coordinates for capturing vertices in a streaming mode. A vertex will be captured each time ArcPad receives a coordinate from the GPS, based on the specified streaming vertices position and streaming intervals.
5. Tap the Proceed button to complete the capture of the new polygon feature.

   ArcPad will automatically close the polygon by adding a final vertex with the same coordinates as the first vertex.

   The Feature Properties dialog box, or custom edit form, is automatically displayed after the new polygon feature has been created.
6. On the Attributes tab, tap the Property field to open the associated Value text box for typing in attribute data.
7. Tap OK.



Creating a point feature using a 1 point offset and a rangefinder

Creating a point feature using offsets and a rangefinder involves the following steps:

1. Select a point layer for editing via the Start/Stop Editing dropdown list or the Table of Contents.
2. Activate the rangefinder.
3. Tap the Offset Point button.
4. Set Reference Point A.
5. Tap the Point feature button.
6. Shoot the target from Reference Point A using a rangefinder.
7. Type in attributes for the new point feature.

See Also

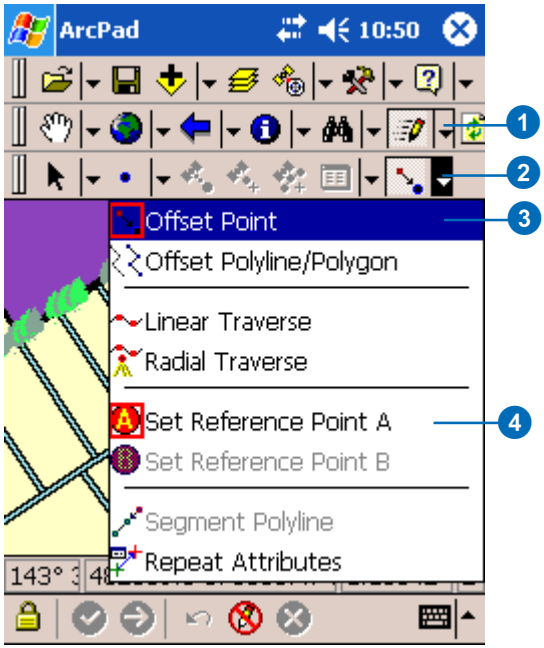
Refer to Chapter 12, 'Using your rangefinder', for help on activating the rangefinder.

See Also

Refer to Chapter 15, 'Creating new features', for help using offsets.

1. Make the point layer editable using the Start/Stop Editing dropdown list.
2. Tap the dropdown arrow next to the Offset Point button to display the dropdown list. By default, the Offset Point button is displayed on the Edit toolbar.
3. Tap the Offset Point button.
4. Tap Set Reference Point A.

   A red box around the Offset Point and Set Reference Point A buttons indicates that they are active. ▸



Tip

Using a GPS to set the reference points

If you have a GPS activated, you can set the reference point using the incoming GPS coordinates. Tap the Survey button to display the Vertex dialog box. Tap the GPS button on the Vertex dialog box to capture the incoming GPS coordinates as your reference point.

Tip

Using the snapping options to set the reference point at an existing feature

You can set the reference point to be at the location of an existing point or vertex by selecting snap to vertex or point for that layer on the Snapping page in the Table of Contents.

5. Tap the screen to set reference point A.

   To use a GPS to set the reference point, refer to the Tip on this page.

6. With your rangefinder activated, shoot your target.

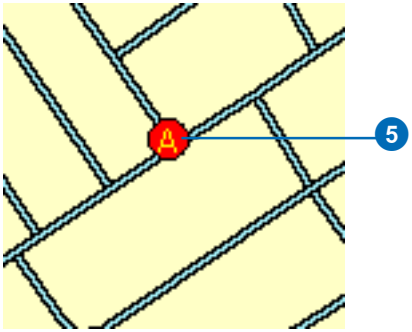
   The Point/Vertex dialog box opens on the Offset page with the bearing and slope distance information displayed from the rangefinder.

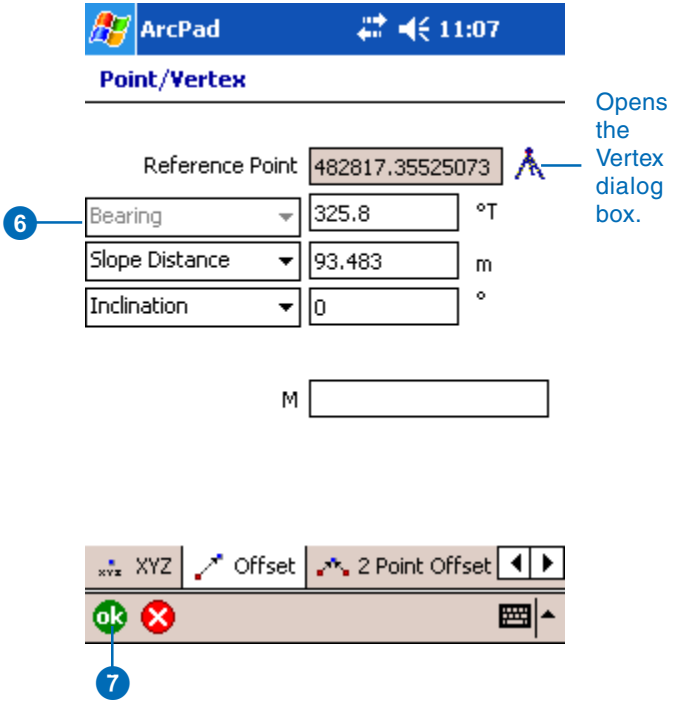
7. Tap OK.

   The Feature Properties dialog box is displayed with an edit form, if it exists. Enter the information for the new feature.

8. Tap OK.

   Your new feature is created.





Editing existing features

17

IN THIS CHAPTER

- Extending a line
- Inserting and deleting vertices
- Moving a vertex
- Moving a vertex using offsets
- Changing the size of a feature
- Editing attributes

This chapter shows you how to modify features that already exist in your vector data or shapefiles. The editing tools, commands, and tasks provide a variety of ways to make changes to the geometry and attributes of existing features. For example, you can extend a line by adding vertices to the start or end of the line. You can also reshape line and polygon features by adding, moving, or deleting vertices. Editing of existing features is done using the mouse pointer, pen, incoming GPS coordinates, or offsets.

Extending a line

You can extend a line feature by adding, or appending, vertices to the tail (end) of the line. The Append Vertices tool is selected via the Feature Properties dropdown list.

In order to extend a line feature at the head (start) of a line, you can use the Insert Vertices tool. Refer to the next exercise to learn how to use the Insert Vertices tool.

Vertices can be added by using the pen, incoming GPS coordinates, offsets, or by typing in coordinates.

Tip

Changing the size of the vertex symbols

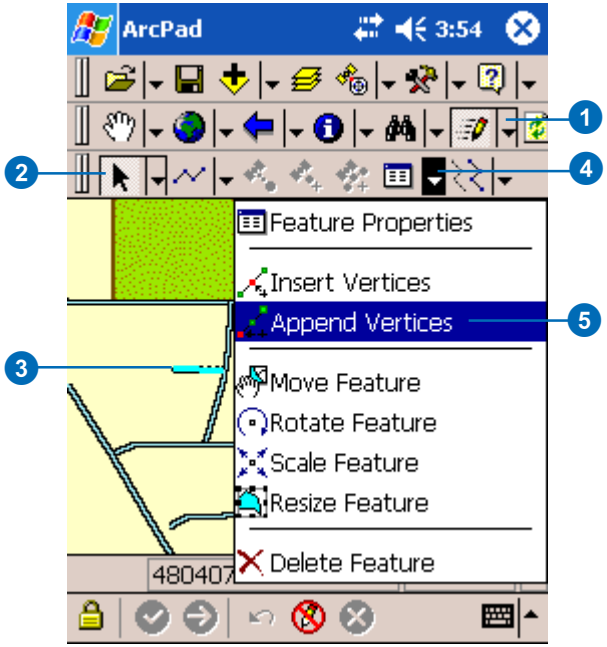
Vertices are displayed using a square symbol. You can change the size of the square by changing the Pen Tolerance in the Display page of the ArcPad Options dialog box.

See Also

Selecting features for editing is discussed in Chapter 14, 'Editing basics'.

1. Select a line layer for editing using the Start/Stop Editing dropdown list or via the Table of Contents.
2. Tap the Select tool.
3. Select the the line feature you wish to extend.
4. Tap the dropdown arrow next to the Feature Properties button to display the dropdown list.
5. Tap Append Vertices.

   The vertices will be displayed using a gray square. The head, or start, vertex is displayed with a bold square. All other vertices are displayed with normal squares.▸



Tip

Adding vertices with a GPS

You can also use the Add GPS Vertex and Add GPS Vertices Continuously buttons to add vertices. These buttons are only enabled if you have a GPS receiver connected and activated.

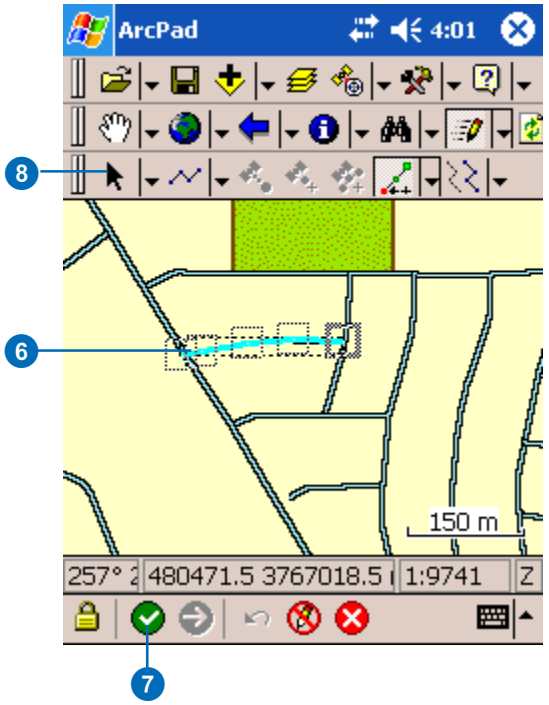
6. Tap the map to add vertices and extend the line.

   You can only append vertices to the end or tail of the line.

7. Tap the Commit Geometry Changes button on the Command bar when you are finished extending the line.

   The new vertices are added to your line feature.

8. To exit the append vertices mode, tap any other tool to activate it and deactivate the Append Vertices tool.



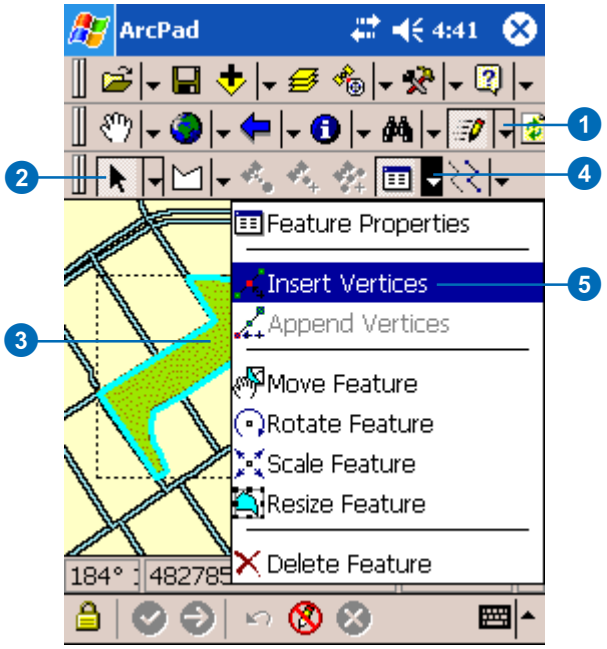
Inserting and deleting vertices

You can easily add (insert) vertices to or delete vertices from a selected line or polygon feature using the Insert Vertex and Delete Vertex commands. By adding or deleting vertices, you can reshape a feature when changes in your geographic data are necessary.

Inserting a vertex

1. Select a line or polygon layer for editing using the Start/ Stop Editing dropdown list or via the Table of Contents.
2. Tap the Select tool.
3. Select the line—or polygon—feature.
4. Tap the dropdown arrow next to the Feature Properties button to display the dropdown list.
5. Tap Insert Vertices.

   The vertices will be displayed using a gray square. ▸



Tip

Adding vertices with a GPS

You can also use the Add GPS Vertex and Add GPS Vertices Continuously buttons to add vertices. These buttons are only enabled if you have a GPS receiver connected and activated.

Tip

Inserting vertices using the snapping environment

You can turn snapping on in the Table of Contents so that new vertices are inserted at the edge, end, or vertex of an existing feature.

Tip

Undoing or cancelling your edits

Use the Undo tool to go back a step to the previously captured vertex or use the Cancel Edits tool to erase all edits. These tools are only enabled prior to tapping the Proceed button. Once you tap the Proceed button and tap ok on the Feature Properties dialog box, your edits cannot be undone.

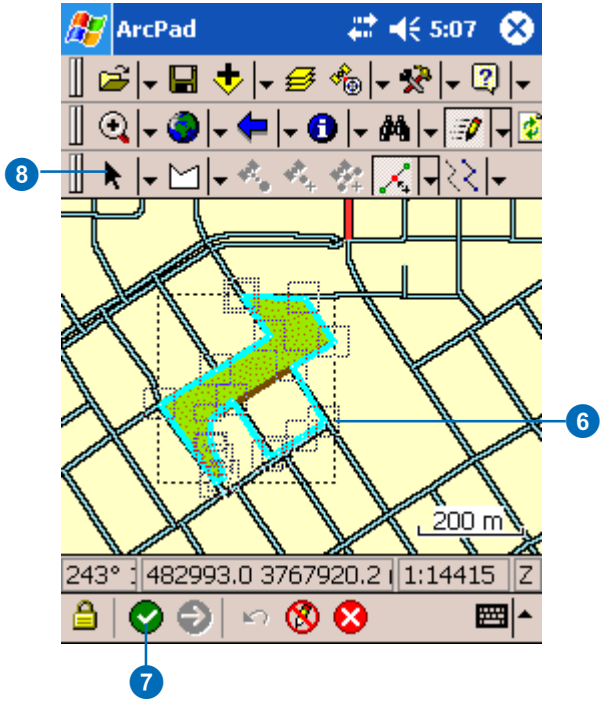
6. Tap on the map at the exact location where you want the vertex, or vertices, inserted.

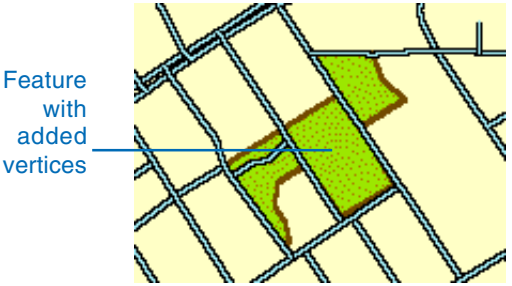
   Vertices are added to the line—or polygon—and the feature is reshaped.

7. Tap the Commit Geometry Changes button on the Command bar when you are finished adding vertices.

   The new vertices are added to your line—or polygon—feature.

8. To exit the insert vertices mode, tap any other tool to activate it and deactivate the Insert Vertices tool.





Tip

Undoing or cancelling your edits

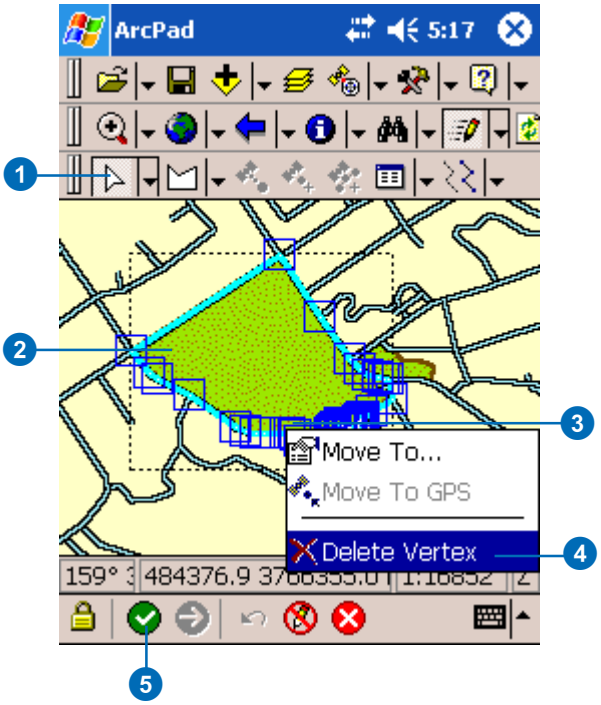
Use the Undo tool to go back a step to the previously captured vertex or use the Cancel Edits tool to erase all edits. These tools are only enabled prior to tapping the Proceed button. Once you tap the Proceed button and tap ok on the Feature Properties dialog box, your edits cannot be undone.

Deleting a vertex

1. Tap the Select & Vertex Editing button.
2. Select the line—or polygon—feature.
3. Tap and hold within the blue vertex square that you want to delete to display the Move To menu.
4. Tap Delete Vertex.

   Repeat Steps 3 and 4 for each vertex you would like to delete.
5. Tap the Commit Geometry Changes button on the Command bar when you are finished.

   The vertices are deleted from the line—or polygon—and the feature is reshaped.



Moving a vertex

Moving a vertex in a line or polygon offers another way to modify or reshape a feature.

ArcPad lets you move a vertex in several ways: by dragging it, by specifying new x,y coordinates, by moving it to the current GPS position, or by using offsets.

Tip

Snapping vertices to existing features

You can turn snapping on in the Table of Contents so that when your vertex is dragged it snaps to the edge, end, or vertex of an existing feature.

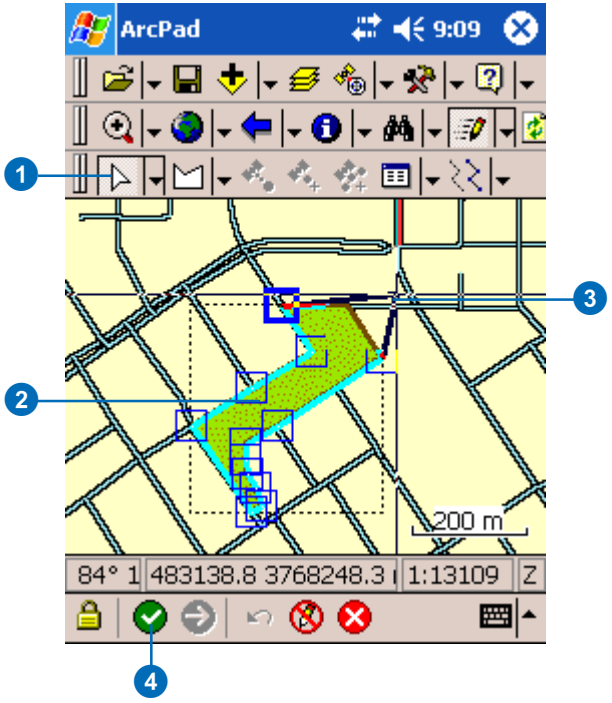
See Also

Moving points is discussed in Chapter 14,'Editing basics'.

Dragging a vertex

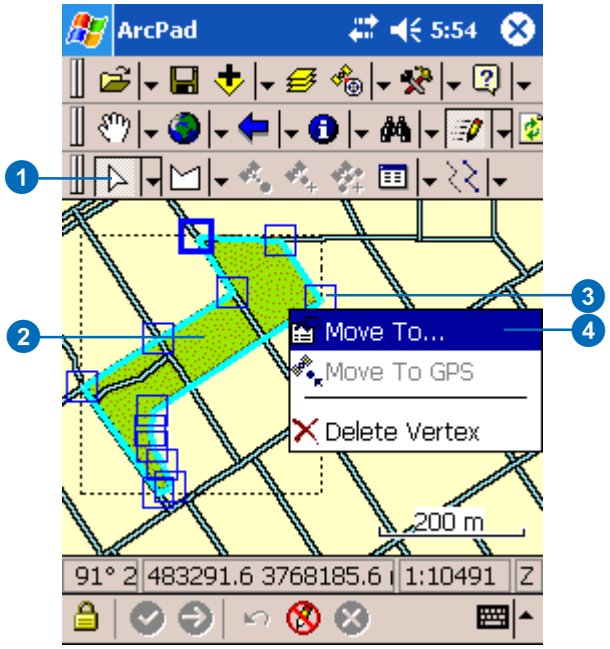
1. Tap the Select & Vertex Editing button.
2. Select the line—or polygon—feature.
3. Tap and drag the vertex to the desired location.
4. Tap the Commit Geometry Changes button on the Command bar when you are finished.

   The vertices are moved and the feature is reshaped.



Using the Move To command to move a vertex to a specific x,y coordinate or GPS position

1. Tap the Select & Vertex Editing button.
2. Select the line—or polygon—feature.
3. Tap and hold within the blue vertex square to display the Move To menu.
4. Tap Move To. ▸



Tip

Moving a vertex to the current GPS position

You can also tap the GPS button, on either the Move To dialog box or the Vertex dialog box, to move the vertex to the current GPS position. (You can open the Vertex dialog box by tapping a coordinate in the Geography page of the Feature Properties dialog box.) These GPS buttons are only enabled if a GPS receiver is connected and activated.

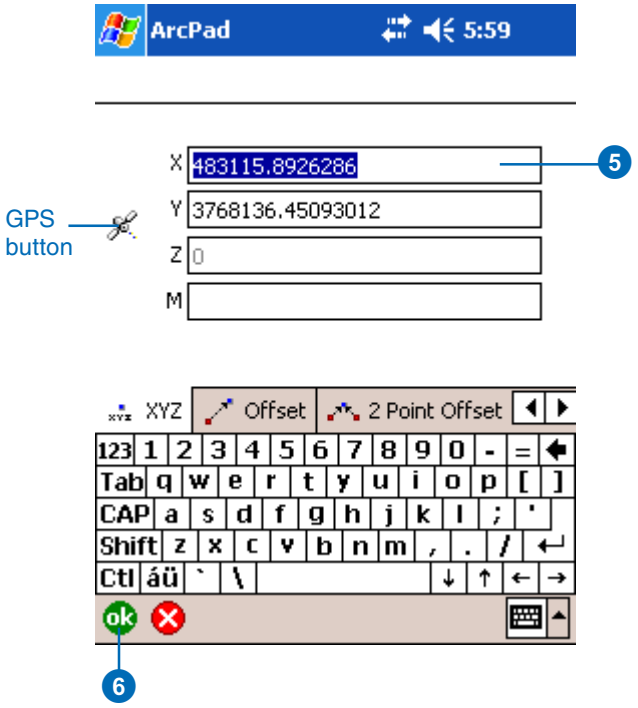
See Also

Refer to Chapter 9, 'Connecting your GPS receiver', for more information on connecting your GPS receiver.

5. Type the desired coordinates in the XYZ page of the Point/ Vertex dialog box.
6. Tap OK.

   Alternatively, tap Move To GPS in step 5 and the vertex will be moved to the current GPS position.
7. Tap the Commit Geometry Changes button on the Command bar.

   The vertex is moved to the specified coordinates, and the feature is reshaped.



Moving a vertex using offsets

If you are unable to reach the vertex, cannot receive a strong GPS signal, or are using a rangefinder, you can use offsets to move the vertex of a line or polygon.

In order to move a vertex of an existing line or polygon, you must use the Move To menu to open the Point/Vertex dialog box. In the Point/Vertex dialog box, select the Offset page to capture your offset.

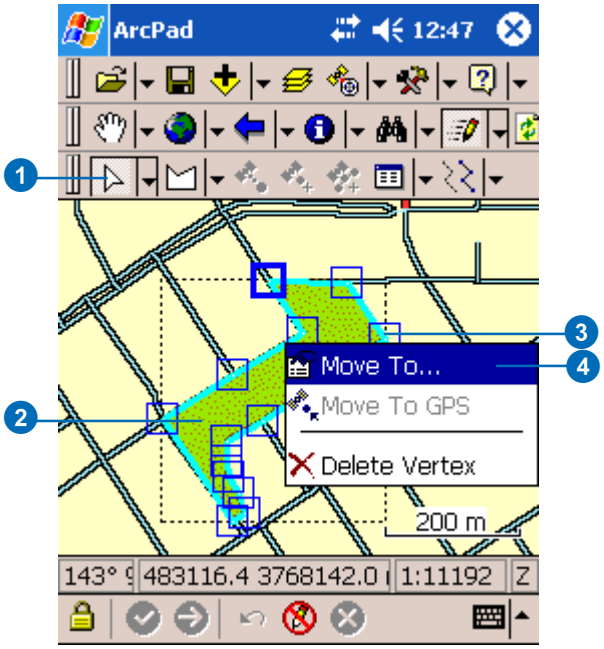
Alternatively, you can use the Radial Traverse tool. The Radial Traverse tool requires that you set a reference point, either by tapping the screen or by using a GPS receiver.

See Also

For more information about using offsets, see Chapter 15, 'Creating new features'.

Using Offsets to move a vertex

1. Tap the Select & Vertex Editing button.
2. Select the polygon—or line—feature.
3. Tap and hold within the blue vertex square to display the Move To menu.
4. Tap Move To. ►



Tip

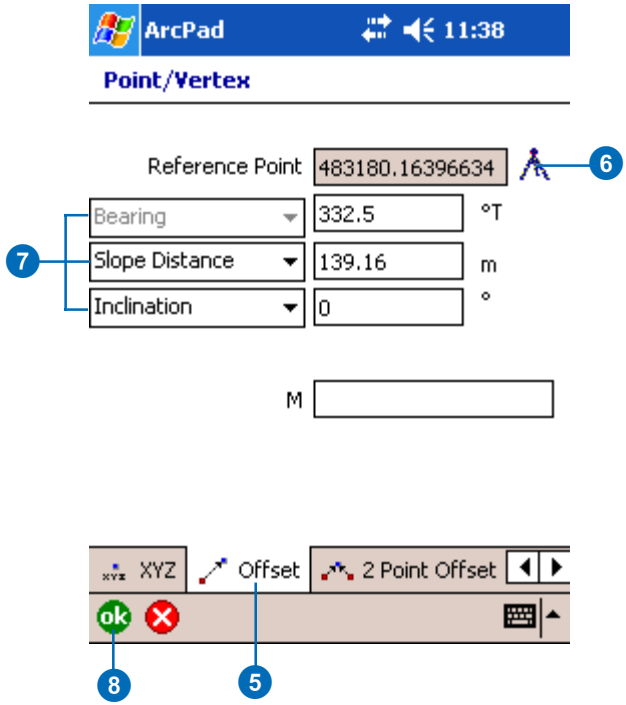
Using Radial Traverse to move a vertex

You can move the selected vertex using Radial Traverse and the 1 or 2 Point Offset capabiltity in the Point/Vertex dialog box. Set one reference point or two reference points before selecting your vertex. Setting two reference points is only required for 2 point offsets such as Distance-Distance or Bearing-Bearing.

The point/vertex dialog box is displayed.

5. Tap the Offset page.
6. Tap the Tripod button to set the reference point from the incoming GPS coordinates.
7. Capture the bearing, distance, and optionally inclination values using you rangefinder.
8. Tap ok on the Point/Vertex dialog box.

   Your vertex is moved to the new position.



Tip

Displaying the Geography page

The Geography page can be used to move a vertex to a specific x,y coordinate. The layer that you are editing may have an associated custom edit form. If it does, the Feature Properties dialog box will have additional tabs displayed to the left of the Attributes tab and left and right arrow buttons for navigating between the tabs. Tap the right arrow button until the Geography tab is displayed. The Geography tab is always the last tab displayed.

The custom edit form may hide the Attributes or Geography pages of the Feature Properties dialog box. If this is the case, then you will need to use the Move To tool to move the vertex.

Tip

Resizing the columns in the Geography page

You can resize the columns in the Geography page by tapping and dragging the vertical column separator.

Using the Geography page to move a vertex to a specific x,y coordinate

1. Select the line—or polygon—feature.

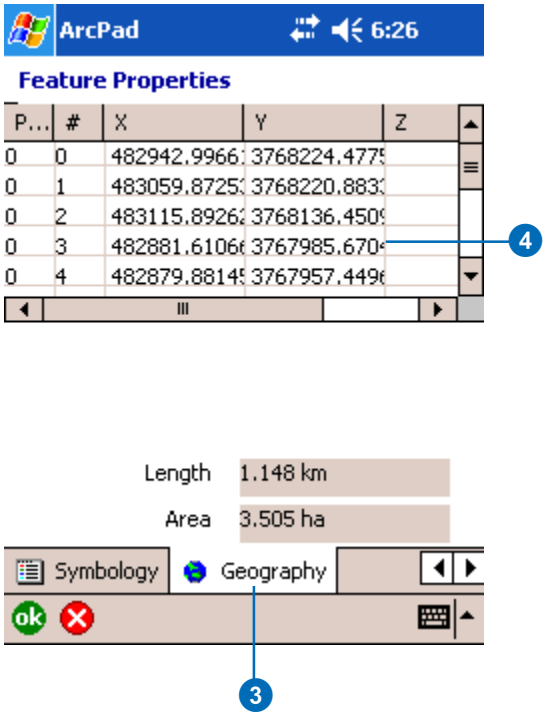
   The Feature Properties button is enabled once a feature is selected.

2. Tap the Feature Properties button—or double-tap the feature—to open the Feature Properties dialog box.

3. Tap the Geography tab to display the Geography page.

   The Geography page includes a table that lists each vertex and its x, y, and z coordinates. Vertex number 0 is the head. The last vertex in the table is the tail.

4. Double-tap the vertex coordinate that you want to change. ▸



Tip

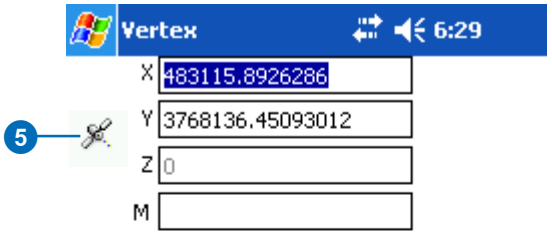
Moving a vertex to the current GPS position

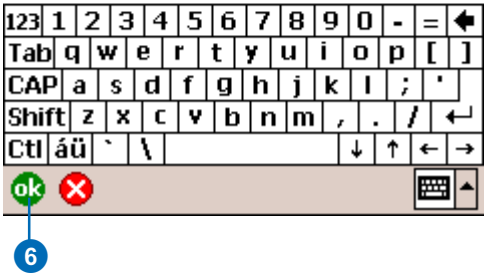
You can tap the GPS button on the Vertex dialog box to move the selected vertex to the current GPS position.

The Vertex dialog box is displayed.

5. Tap the GPS button to use the incoming GPS coordinates.
6. Tap OK.
7. Tap OK.

   The vertex is moved to the specified coordinates, and the feature is reshaped.





Changing the size of a feature

ArcPad lets you change the size of a line or polygon feature in several ways: by dragging the sizing handles (resizing); by scaling the feature; by adding, moving, or deleting a vertex; or by appending vertices to the head or tail of a line.

Tip

Scaling your feature

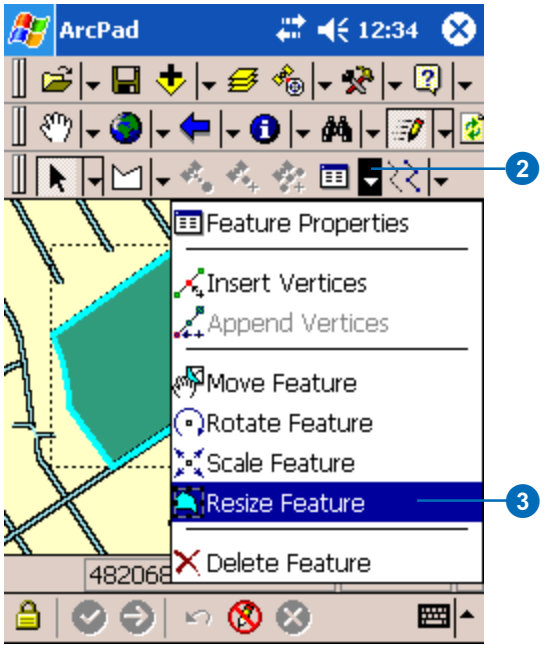
Use the Scale Feature tool on the Feature Properties dropdown list to scale your feature. Scale maintains the proportion of the feature; the size of the feature changes but the shape of the feature does not. Select a feature, activate the Scale Feature button, and tap the screen or tap and slide with the pen to see the size of the feature change. Lift the pen when the desired size is achieved. Tap the Commit Geometry Changes button to accept the change.

See Also

Adding, moving, and deleting vertices, as well as extending a line, are discussed earlier in this chapter.

Dragging the sizing handles

1. Select the line—or polygon—feature.
2. Tap the dropdown arrow next to the Feature Properties button to display the dropdown list.
3. Tap the Resize Feature button. ▸



Tip

Dragging a corner vertex versus dragging a corner sizing handle

Dragging a corner vertex will only move the selected vertex and will change the general shape of the feature. In contrast, dragging a corner sizing handle will stretch or shrink a feature's geometry proportionately, similar to scaling the feature, thereby maintaining the general shape of the feature.

Tip

Changing the size of the sizing handles

Sizing handles are displayed using a solid black square symbol. You can change the size of the square by changing the Pen Tolerance on the Display page of the ArcPad Options dialog box.

Tip

Moving and rotating features

The Move and Rotate Feature tools are also available in the Feature Properties dropdown list. With your feature selected, use these tools to drag a feature to a new location or to rotate a feature around a point.

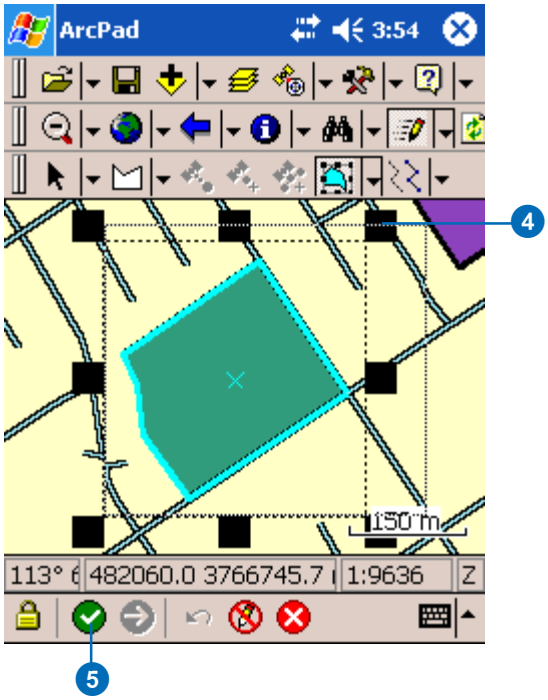
The bounding box for the selected feature is displayed using a dashed line and sizing handles.

4. Tap and drag a sizing handle.

   The size of the bounding box is changed, and the feature is reshaped.

   Dragging a corner sizing handle will stretch, or shrink, a feature's geometry proportionately, thereby maintaining the general shape of the feature.

5. Tap the Commit Geometry Changes button to complete the change. You cannot undo the feature changes once you have commited the changes.



Editing attributes

The Feature Properties dialog box lets you view and edit the attributes of the feature you have selected. The Feature Properties dialog box is automatically displayed once any new feature is created.

By default, the Feature Properties dialog box includes pages for Attributes, Picture, Symbology, and Geography; a custom edit form will also be displayed if it exists. The custom edit form may change the title of the Feature Properties dialog box. For example, "Redlands Trees".

Tip

Typing data on devices without keyboards

Devices without keyboards—for example, Windows Mobile devices—use a Soft Input Panel (SIP) for typing in data. On Windows Mobile devices, you open the the Soft Input Panel by tapping the SIP icon on the title bar.

1. Select the point, line, or polygon feature.

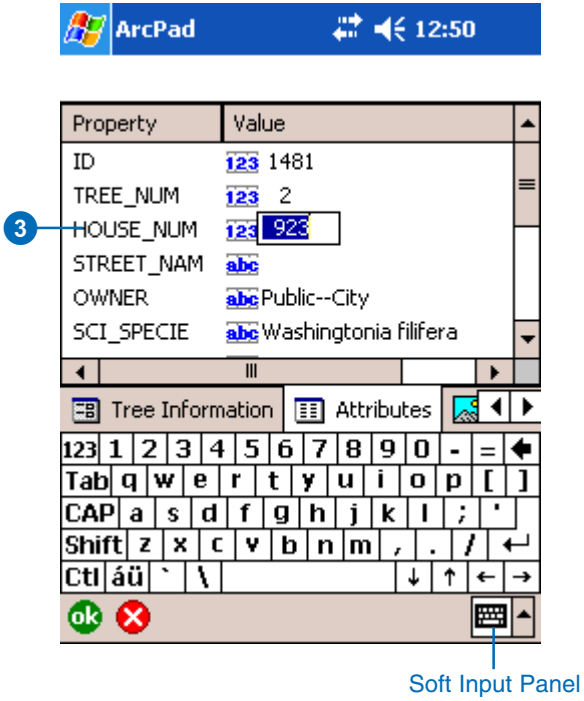
   The Feature Properties button is enabled once a feature is selected.

2. Tap the Feature Properties button—or double-tap the feature—to open the Feature Properties dialog box.

3. On the Attributes page, tap the Property field to open the associated Value text box for typing in attribute data.

   For example, tapping the Property field HOUSE_NUM will open the associated Value text box for typing in the house number value of "923".

   The Soft Input Panel is displayed when a Value text box is opened. If it does not, tap the SIP icon on the title bar.►



Tip

Creating custom edit forms

QuickForms and custom edit forms can be created using ArcPad or ArcPad Application Builder, respectively. Both types of forms are saved in an ArcPad Layer file (.apl), which is associated with a shapefile.*

QuickForms and custom edit forms can have multiple tabs, or pages, each with multiple controls. These controls could include text boxes, date controls, and list boxes. Scripts associated with the edit form perform initialization and validation, enforcing correct data entry before continuing to another page or closing the form. Scripts cannot be added to forms using QuickForms.

Tip

Using a barcode scanner to input your data

Use a barcode scanner connected to your Windows Mobile device to easily input data into your edit forms.

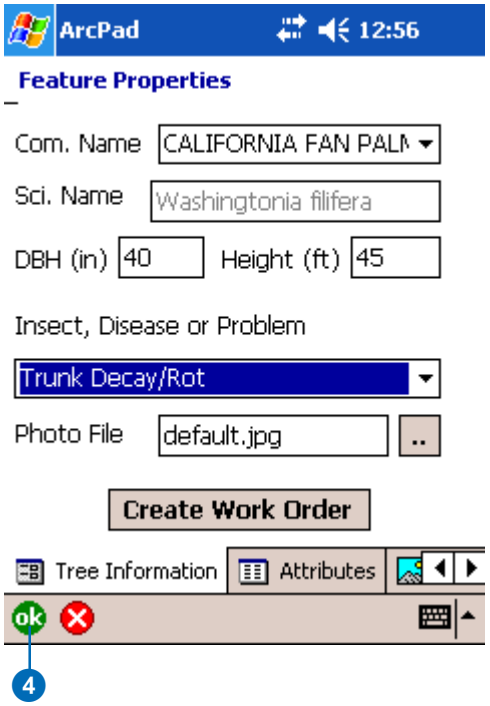
See Also

See Chapter 14, 'Editing basics', to learn how to create Quick Forms in ArcPad to edit your features.

The Feature Properties dialog box displays the custom edit form if it exists.

4. Tap OK to save the attributes and close the edit form.

   You can also tap the X button if you want to cancel any changes made to the attributes.



Preparing data

Section 6

ArcPad Tools for ArcGIS

18

IN THIS CHAPTER

- The ArcPad Tools for ArcGIS
- Preparing your data for ArcPad
- Getting data for ArcPad 7
- Exporting symbology for shapefiles
- Exporting and importing graphics layers
- Exporting ArcGIS styles

ArcGIS Desktop (ArcView, ArcEditor, or ArcInfo) includes an ArcPad toolbar which is available from within ArcMap. The ArcPad toolbar lets you manage transactions between ArcPad and ArcGIS. The toolbar includes tools to:

- Extract data for use with ArcPad and/or check data out of a geodatabase for editing.
- Check in updates that you made in ArcPad.
- Remove unwanted checkouts from the transaction log.

ArcPad 7 includes additional tools for ArcMap which are automatically installed with ArcPad. These new tools allow you to:

- Extract data for use with ArcPad 7 and/or check data out of a geodatabase for editing.
- Export symbology for selected shapefiles into ArcPad Layer files.
- Export/import an ArcGIS Graphics Layer to/from an ArcPad Graphics layer.
- Export ArcGIS styles to an ArcPad style.

The ArcPad tools included with ArcGIS Desktop and ArcPad 7 do not include all of the tools that may be needed for data preparation. Projecting your data can be done using ArcToolbox, which is available within ArcMap. Custom data input forms can be created using ArcPad Studio, which is included with the ArcPad Application Builder.

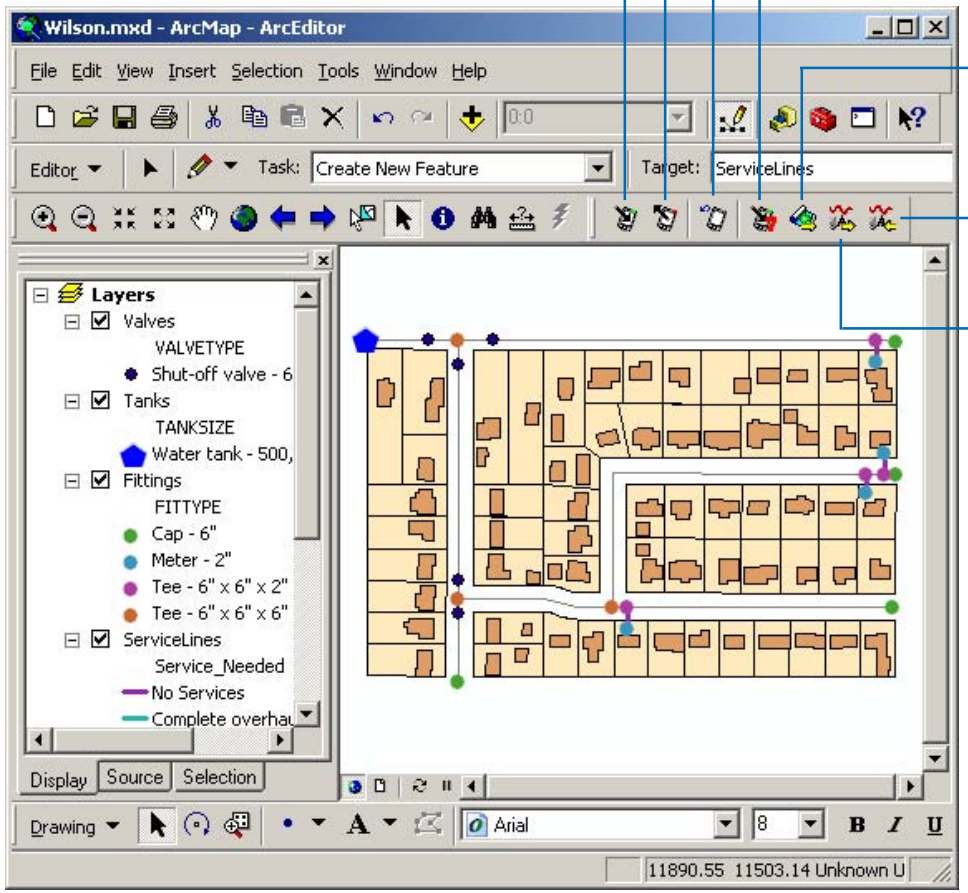
The ArcPad Tools for ArcGIS

Check In Edits From ArcPad:
Lets you update your geodatabase with the field edits that were made in ArcPad. (Included with ArcGIS Desktop)

Undo Check Out for Editing:
Lets you remove unwanted checkouts from the transaction log. (Included with ArcGIS Desktop)

Get Data For ArcPad 7:
Lets you extract data from your map document into a checkout folder, for using in ArcPad 7.

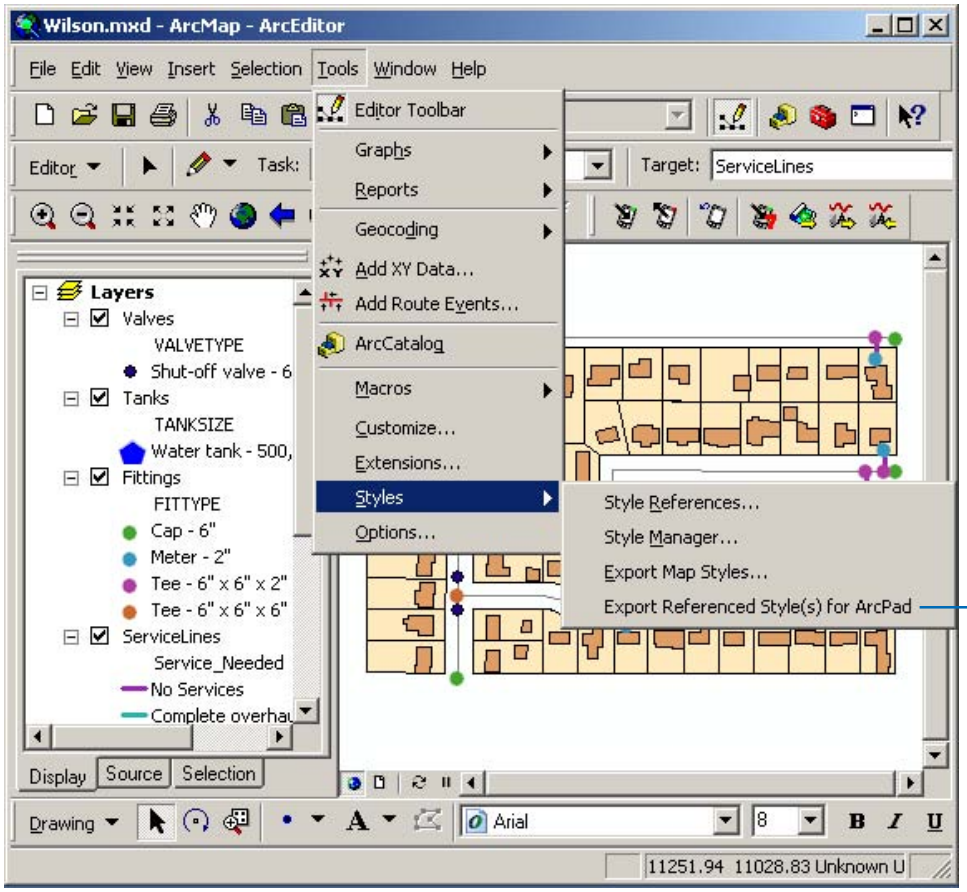
Get Data For ArcPad:
Lets you extract data from your map document into a checkout folder. (Included with ArcGIS Desktop)



Export Shapefile Symbology:
Export the symbology from the selected shapefile(s) into ArcPad Layer file(s).

Import Graphics Layer:
Import an ArcPad Graphics Layer Document into the Graphics Layer.

Export Graphics Layer:
Export the Graphics Layer to an ArcPad Graphics Layer Document.



Export ArcGIS Styles:
Export an ArcGIS Desktop style file into an ArcPad style file.

Preparing your data for ArcPad

ArcPad is a mapping tool for working with your GIS data in the field. Field GIS tasks are often quite different from the GIS tasks performed in the office, and so too are the computers used in these different environments. Desktop computers usually have fast CPUs, large amounts of RAM and disk space, and large display monitors. In contrast, field computers have relatively slow CPUs and limited RAM and storage capacity. Furthermore, the fieldwork environment ranges from working in bright sunlight to rain to subzero snow conditions, compared to the constant temperature and lighting conditions of the office environment. Consequently, you need to consider all of these factors before preparing your GIS data for use in the field with ArcPad.

Answers to the following questions will determine how you need to prepare your data for optimum use in the field:

- What tasks will be performed in the field, and what data will be needed for these tasks?
- What data will be updated, and what data will be needed for background reference?
- What is an appropriate amount of data, taking into account the field tasks as well as the field computer's CPU, RAM, and storage capacity?
- What symbology needs to be used for effectively displaying the data on the field computer in the expected weather conditions?

  This is an important issue. The artificial light and large monitors used in the office environment enable the use of a wide range of colors and symbols, whereas only a limited number of colors and symbols provide sufficient contrast when used in the field with small computer screens and strong sunlight.

There are a number of different operations that you may need to perform to prepare your data for use in the field with ArcPad, including:

- Extracting an appropriate subset of the data
- Converting the data into a format supported by ArcPad
- Projecting the data into a projection supported by ArcPad
- Specifying symbology that has sufficient contrast for the expected field lighting conditions
- Preparing data input forms and validation rules to ensure that data is captured accurately in the field

The ArcPad Tools for ArcGIS toolbar provides some of the tools for preparing data for use with ArcPad.

In summary, it is essential to always bear in mind that field computers, tasks, and conditions are very different to computers, tasks, and conditions in the office. Therefore, what works in the office environment may often not be effective in a field environment.

Getting data for ArcPad 7

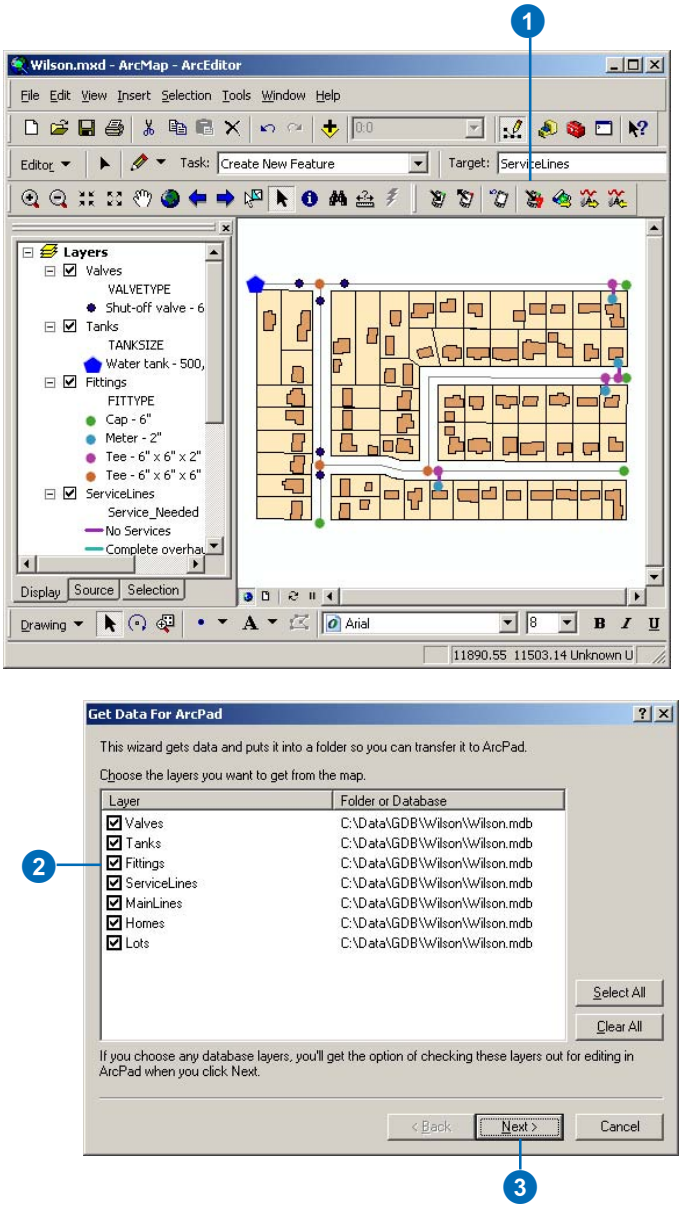
The Get Data For ArcPad 7 wizard lets you extract data from your map document into a checkout folder that can then be uploaded to a mobile device and used in ArcPad 7. The wizard contains several panels that let you define properties of the extraction.

The first panel lets you pick which layers in the map you would like to extract for use in ArcPad. The list includes layers that you cannot edit. All vector features will be written to new shapefiles, and all raster images will be compressed to MrSID format. The first panel in the Get Data For ArcPad wizard lists all of the layers in the current map and their respective folder or database location. The map may contain layers from multiple databases, different projections, and so on. At this step in the wizard, you select those layers you want to extract features from. If you plan to extract features within a given extent or bookmark, you need to zoom to that location before starting the wizard. ►

See Also

Refer to the ArcGIS Desktop Help for more information on showing and hiding toolbars.

1. Click the Get Data For ArcPad 7 button on the ArcPad toolbar.
2. Check the layers you want to extract features from.
3. Click Next. ►



The second panel lets you pick the database to check data out from. The wizard will only let you check out data from one database per transaction. If you need to edit multiple geodatabases, you will need to start the wizard again to complete additional transactions.
If you plan to collect new data in the field, you can extract just the schema of the layers you plan to update by checking the schema option directly below the list of layers in the wizard.

The third panel lets you specify the extraction criteria

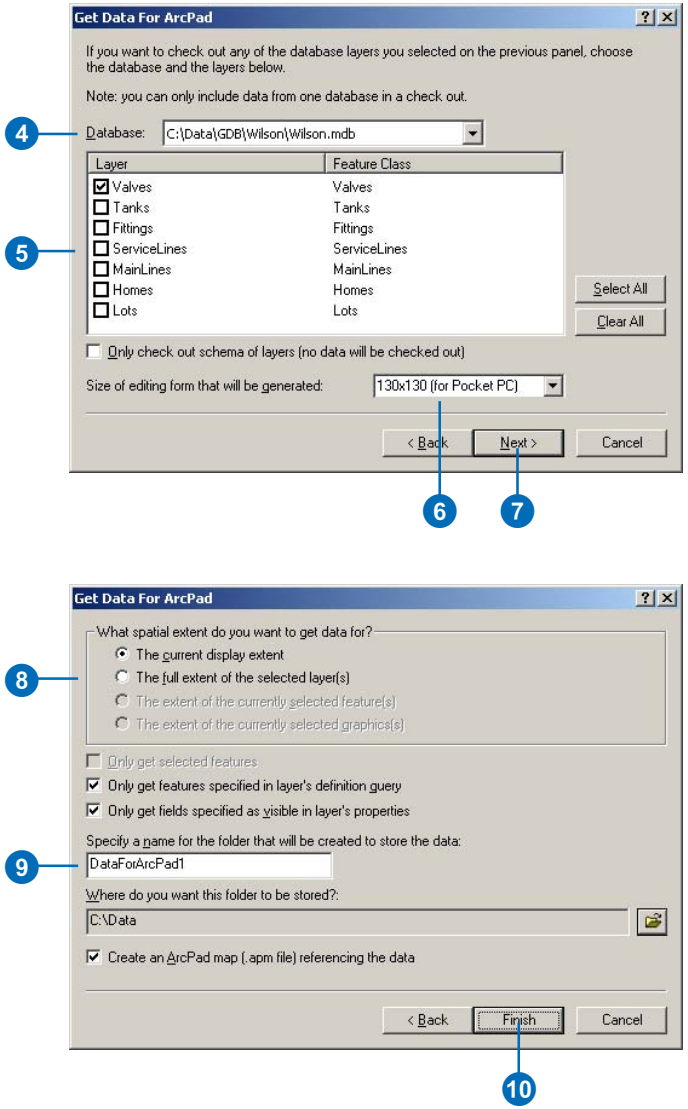
- Spatial extent—select a spatial extent to get data for. By default, this is the current display extent.
- Extract selection only—choose only the selected features from layers that have features selected.
- Definition query only—you can choose to extract only those features that meet the definition query and are within the chosen spatial extent. By default, this option is checked. ▸

See Also

Refer to the ArcGIS Desktop Help for more information on the ArcPad toolbar included with ArcMap.

4. Select a database from the Database dropdown list.
5. Select the layers to check out for editing under the Layer column.
6. Select the size from the Size of editing form that will be generated dropdown list.
7. Click Next.
8. Select the extraction criteria.
9. Type a unique folder name for the checkout folder.

   Optionally, select the location for the checkout folder. If you have a file sharing partnership with your mobile device, it will be the default location in the wizard. You can click the Folder icon to browse for a new folder location.
10. Click Finish to perform the transaction. ▸



The Get Data for ArcPad 7 wizard then checks for a Windows Mobile device connected to your PC. If a connected Windows Mobile device is detected, you will be prompted to choose to transfer the checked out files directly to your Windows Mobile Device.

Tip

Using the Summary Fonts information

Make sure that all of the fonts listed in the Summary are copied to the \Windows\Fonts folder on your mobile device. Symbology will not display correctly if the required fonts are not installed on your mobile device and therefore are not available to ArcPad.

Tip

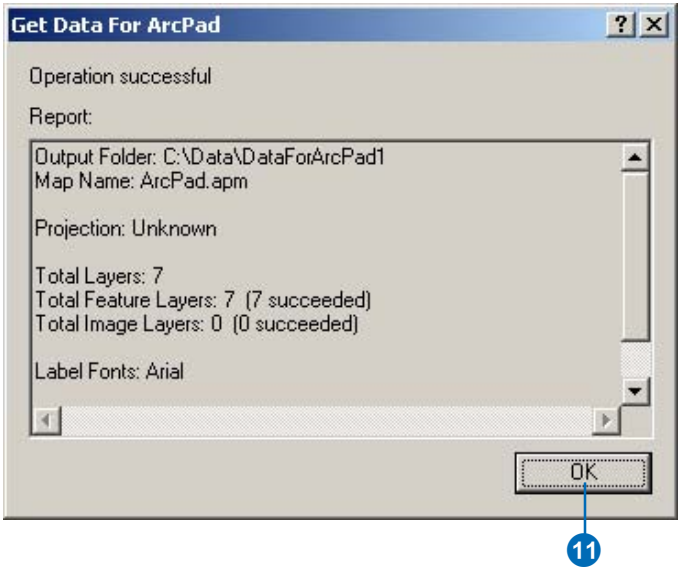
Using the Summary projection information

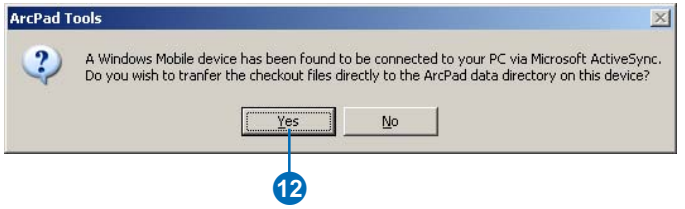
Make sure that the projection of the new ArcPad map and exported shapefiles is supported by ArcPad. The "ArcPad Reference Guide" includes a list of supported projections.

A summary dialog box appears that details a report of the completed extraction. You can select all of the text in the list and paste it into a text file.

11. Click OK to complete the extraction.
12. If a Windows Mobile device is connected to your PC you will be prompted to choose to transfer all of the checkout files directly to your device.

    Click Yes to transfer the files to your Windows Mobile device. You will be prompted to select the checkout folder on your Windows Mobile device.





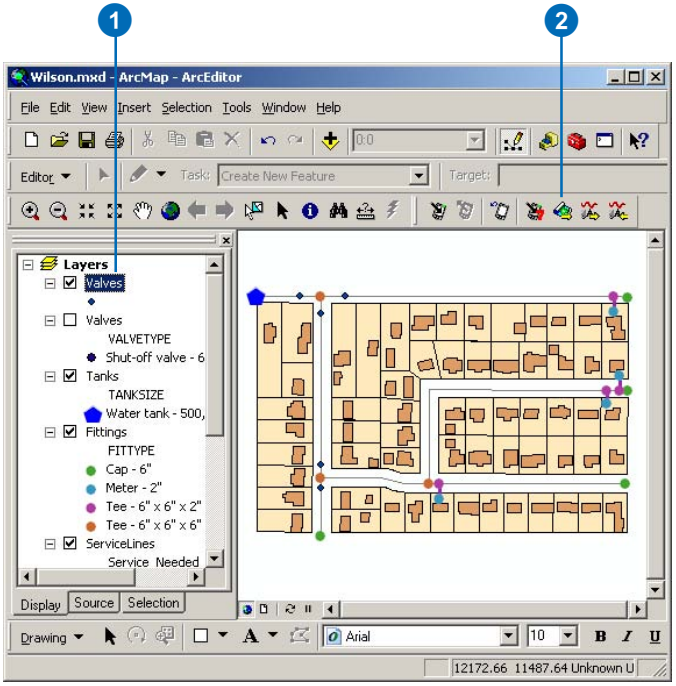
Exporting symbology for shapefiles

ArcPad 7 supports most of the layer properties and symbology supported by ArcMap. The layer properties and symbology supported by ArcPad are stored in ArcPad Layer files (*.apl) associated with shapefiles.

The Export Symbology for selected shapefile(s) tool reads the layer properties and symbology definition for each selected shapefile, and writes this information into the ArcPad Layer files.

1. Select the shapefile(s) for which you want to export the symbology.
2. Click the Export Symbology for selected shapefile(s) button.

   The symbology definitions will be added to the corresponding ArcPad Layer file (*.apl) for each selected shapefile layer. A new ArcPad Layer file is created if it does not already exist.



Exporting and importing graphics layers

The ArcPad Toosl for ArcGIS include tools to export/import graphics layers to/from ArcPad.

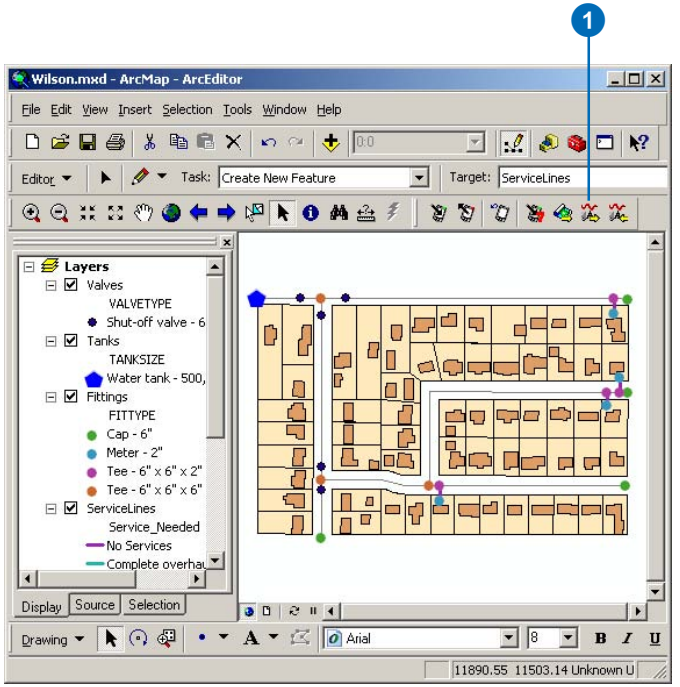
The tools detect if a Windows Mobile device is connected to your PC, and provide an option to export/import the graphics layer directly to/from your Windows Mobile device.

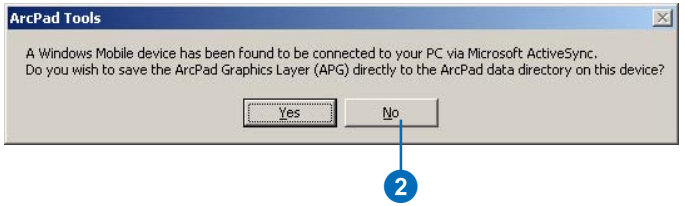
Exporting a graphics layer

1. Click the Export the Graphics Layer button.

   If a Windows Mobile device is connected to your PC you will be prompted to choose to save the ArcPad graphics layer directly to your device. Click Yes to transfer the files directly to your Windows Mobile device.

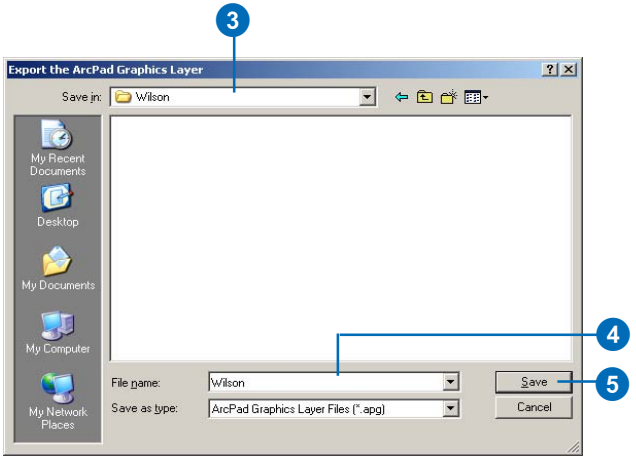
2. Click No to save the ArcPad graphics layer to a folder on your PC. ►





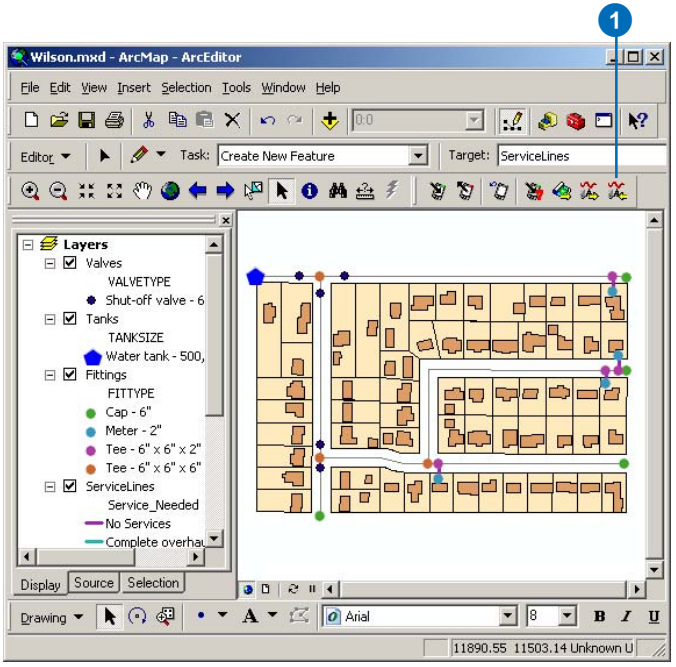
The Save As dialog box is displayed.

3. Use the Save in dropdown list to select the folder in which to save the ArcPad graphics layer.
4. Type the name of the new ArcPad graphics layer.
5. Click Save.



Importing a graphics layer

1. Click the Import an ArcPad Graphics Layer button. ►



If a Windows Mobile device is connected to your PC you will be prompted to choose the ArcPad graphics layer directly on your device. Click Yes to transfer the files directly to your Windows Mobile device.

2. Click No to import the ArcPad Graphics layer from a folder on your PC.

   The Select an ArcPad Graphics Layer file to import diialog box is displayed.

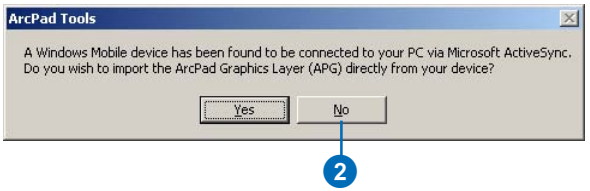
3. Use the Look in drop-down list to select the folder which contains the ArcPad graphics layer.

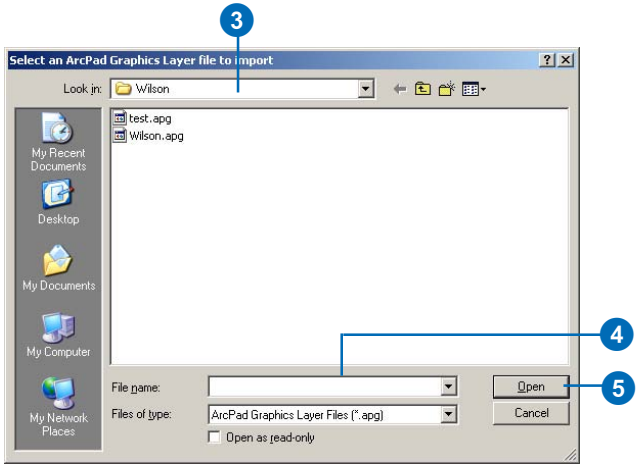
4. Select the ArcPad graphics layer, or type the name of the ArcPad graphics layer.

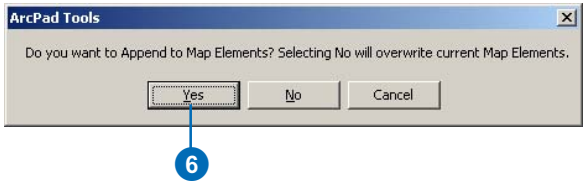
5. Click Open.

6. Click Yes to Append the ArcPad graphics layer to the current ArcGIS graphics layer.

   Click no to replace the current map elements with the elements in the ArcPad graphics layer.







Exporting ArcGIS styles

Styles are a collection of predefined colors, symbols, properties of symbols, and map elements that allow you to follow a mapping standard and help promote consistency in your organization's mapping products.

Styles help to define not only how data is drawn, but also the appearance and placement of map elements and other cartographic additions on your map. Styles provide storage for your colors, map elements, symbols, and properties of symbols. Every time you choose and apply a particular map element or symbol, you are using the contents of a style.

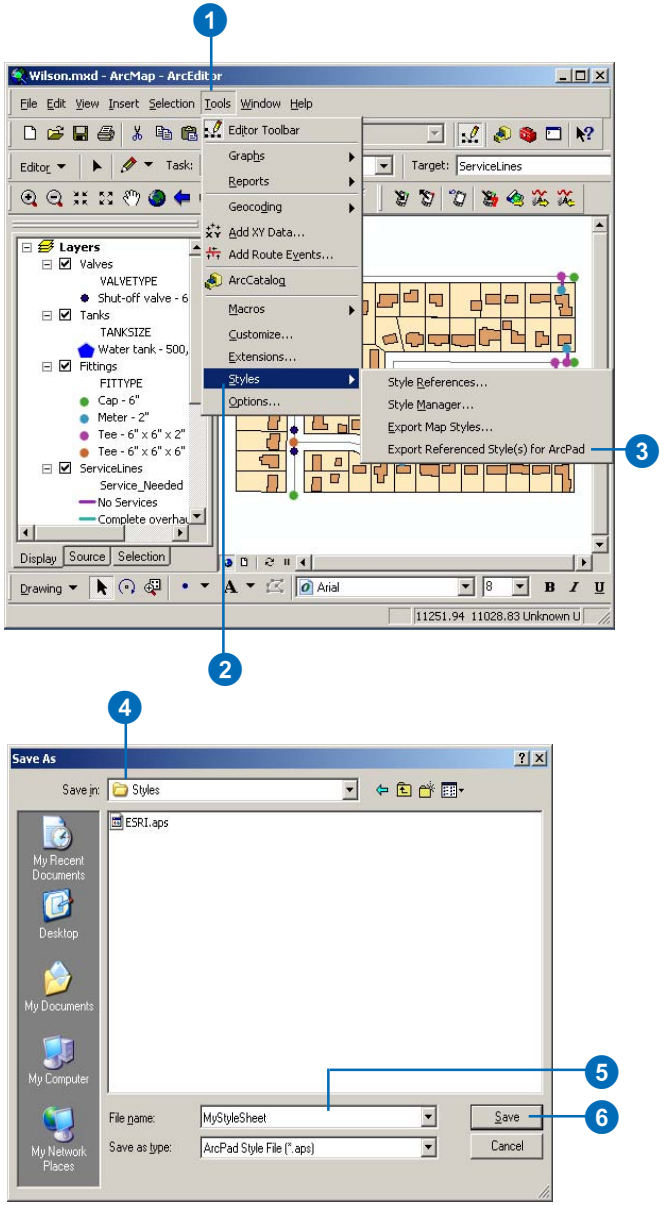
The ArcPad Tools for ArcGIS include a tool for exporting ArcGIS styles into ArcPad style files. This enables ArcPad users to have access to the same styles as in ArcGIS Desktop.

The ESRI style is automatically installed with ArcPad. Consequently, you only need to export ArcGIS styles if you use styles other than the ESRI style.

1. Click Tools.
2. Click Styles.
3. Click Export Referenced Style(s) for ArcPad.

   The Save As dialog box is displayed.
4. Use the Save in drop-down list to select the folder in which to save the ArcPad style file.

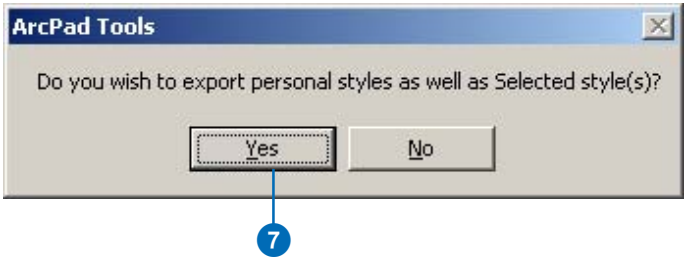
   The default folder on the PC for ArcPad styles is \Program Files\ArcPad 7.0\Styles.
5. Type the name of the new ArcPad style file.
6. Click Save. ►

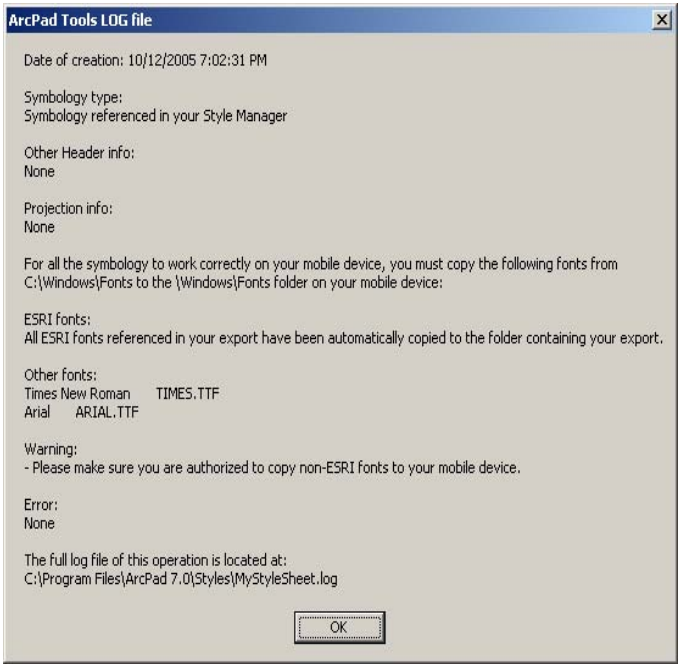


7. Click Yes to export both personal styles and selected styles.

   Click No to only export the selected styles.

   The ArcPad Tools Log file is displayed with information on the exported styles.





Appendix: Customizing ArcPad

IN THIS APPENDIX

- **Overview**
- **Default configuration files and applets**
- **Customizing ArcPad toolbars**
- **Layer definitions**
- **Customizing forms**
- **Extensions**
- **Scripts, ArcPad XML, and ArcPad Object Model**
- **ArcPad customization files**

This appendix provides an overview of how to customize ArcPad using the ArcPad Application Builder. ArcPad Application Builder provides the tools and documentation to allow you to customize ArcPad in many ways.

ArcPad Application Builder includes the following:

- ArcPad Studio, a desktop customization application
- A license of ArcPad for testing your custom applications
- Detailed documentation, an object model diagram, and developer samples
- First year's maintenance: Maintenance includes telephone and email technical support for an authorized user, and upgrades for both ArcPad Studio and ArcPad during the first twelve months. Maintenance can then be purchased as an annual subscription for subsequent years.

ArcPad Application Builder is a separate product and is not included with ArcPad. For more information on ArcPad Application Builder, visit *www.esri.com/applicationbuilder*.

Overview

ArcPad Application Builder is the development framework for building custom ArcPad applications for Mobile GIS projects. Creating a customized field solution for data collection and data maintenance is essential to ensure the integrity and value of your GIS data. The ability to accurately capture attribute and spatial data directly in the field improves efficiency and reduces time spent correcting or reentering the data into the main database back in the office.

With ArcPad Application Builder, you can:

- Design custom forms to streamline data collection
- Ensure data integrity by validating data directly in the field
- Tailor applications to user skill levels and specific fields tasks
- Write scripts that interact with ArcPad's internal objects
- Develop scripts to support data collection devices

The majority of ArcPad customizations are created using ArcPad Studio, the desktop application included with ArcPad Application Builder.

With ArcPad Studio, you can hide toolbars, create new toolbars, design custom forms, build applets, and access object properties and methods. Little or no programming is required to accomplish many of these tasks. For more advanced users, ArcPad's development environment exposes an extensive object model that can be accessed via scripts. ArcPad operates as a scripting host for Microsoft's VBScript and JScript scripting languages, enabling you to create and edit VBScript or JScript source code files.

The table below summarizes the different types of customizations that are possible, along with the level of programming and development environment required for each type.

Customization	Programming requirements	Development environment
Hide toolbars	None	ArcPad Studio
Create new toolbars	None	ArcPad Studio
Build new tools	VBScript/JScript	ArcPad Studio
Design custom forms	None	ArcPad Studio
Validate data in form controls	VBScript/JScript	ArcPad Studio
Configure the status bar	None	ArcPad Studio
Prepare symbology	None	ArcGIS Desktop
Develop applets	VBScript/JScript	ArcPad Studio
Access object properties and methods	VBScript/JScript	ArcPad Studio
Support new input devices	VBScript/JScript or C/C++	ArcPad Studio or Visual Studio/ eMbedded C++
Support new data formats	C/C++	Visual Studio/ Embedded C++
Support new coordinate systems and datum transformations	C/C++	Visual Studio/ Embedded C++

Default configuration files and applets

ArcPad customizations are primarily delivered via applets and/or default configuration files. These files are defined using ArcPad Studio and can contain custom toolbars, user-defined forms, scripts, and system object event handlers.

Default configuration files

The default configuration file affects how ArcPad looks and behaves when it is first loaded. It contains parameters that override ArcPad's default, such as which toolbars are initially visible when ArcPad starts. The default configuration file is automatically loaded when ArcPad starts and is saved as "ArcPad.apx", which is located in the ArcPad System folder. The default location of the System folder is \Program Files\ArcPad 7.0\System.

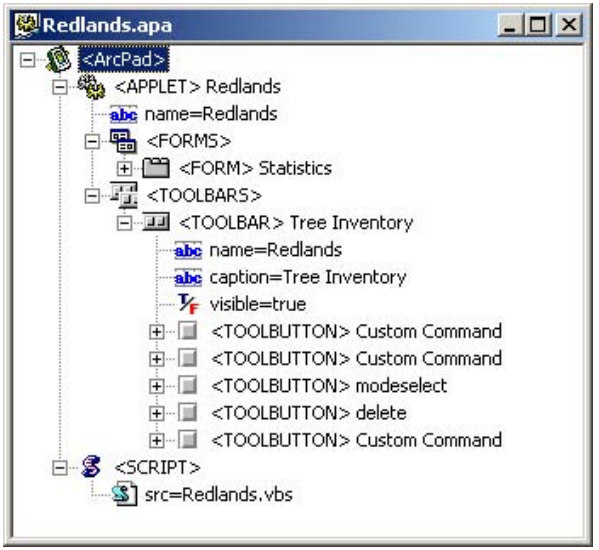
You can set the default configuration file to disable or hide the built-in toolbars (Main, Browse, and Edit) and to automatically load custom toolbars when ArcPad starts. For example, the tools on the built-in toolbars may be more than your field personnel require so you can set the default configuration file to only display the tools they will use. In addition, the default configuration file can set status bar properties such as if the status bar is initially visible or not, and if the map scale, map units, and rocker mode are displayed in the status bar.

In general, one would change the default configuration file only occasionally for common changes to the toolbars rather than for specific field tasks that require unique tools. However, a custom toolbar that is shared by many applets would be loaded through a configuration file.

The default configuration files can contain scripts, forms, and toolbars but these should be common for all your field goals. For example, you may want your field personnel to always have to log in before they start ArcPad. This task is independent of the data they are using and the field task they are performing. A script launching the login screen would therefore be stored in the default configuration file and would automatically launch every time ArcPad starts.

Applets

Applets, in contrast, can be used to meet specific field task requirements. An ArcPad applet is a small module that runs inside a full application -ArcPad. Applets provide a way of delivering mini-applications without having to alter ArcPad's configuration. An applet is automatically loaded after the default configuration file is loaded when ArcPad starts. It is saved with an .apa



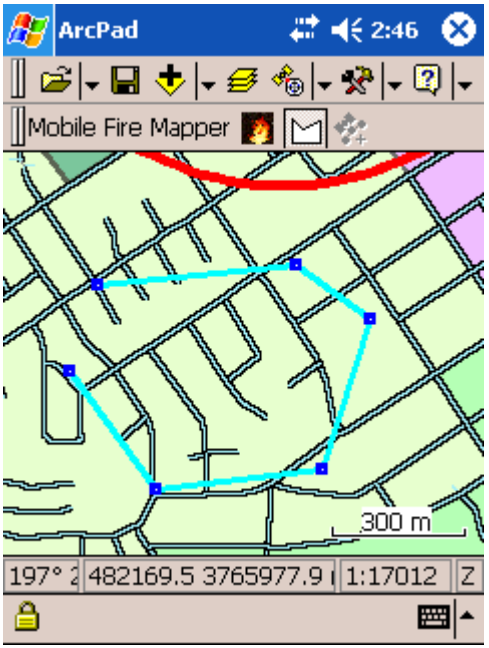
A sample applet that includes a custom form and custom toolbar for a tree inventory application.

extension in the Applets folder, which can be specified in the Paths page of the ArcPad Options dialog box. The default location of the Applets folder is \Program File\ArcPad 7.0\Applets.

Applets are targeted for use with a specific field project or task whereas the default configuration file alters ArcPad for every instance. In general, applets are closely related to changes in the user interface and the creation of custom tools and buttons. For example, an applet could contain custom tools, toolbars, and forms to perform a tree inventory that meets specific criteria, unique to the area and the data being used.

Applets are easily deployed to field personnel and it is not uncommon to have several applets for your workers to use. In contrast, ArcPad only recognizes one default configuration file (ArcPad.apx) and therefore the default configuration file should be set once for all field tasks. Applets are then created and used to meet the specific requirements of the different field projects in any given day.

There are very few functional differences between applets and default configuration files; therefore it is up to your organizational preferences and specific Mobile GIS requirements as to when you would use one over the other.



Mobile Fire Mapper applet was created to easily capture the perimeter of a fire.

Customizing ArcPad toolbars

ArcPad supports the customization for three categories of toolbars:

- Built-in toolbars

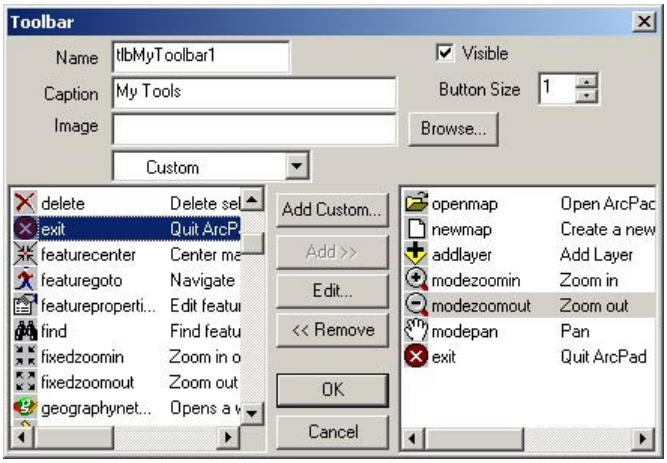
  ArcPad's built-in toolbars present a rich set of commands, organized by functionality into the Main, Browse, and Edit (or Draw) toolbars. You can set the default visibility of these toolbars via the default configuration file but you cannot alter the contents of the toolbars themselves. In order to use the tools from the built-in toolbars, you would need to create a new toolbar with the selected tools. ArcPad also has a Command bar used for editing tasks. It cannot be altered or made invisible.

- Custom toolbars consisting of only built-in commands

  If your Mobile GIS application only requires a subset of the commands offered in the built-in toolbars, presented in a different arrangement, you may want to create one or more custom toolbars and add the desired built-in commands in the order you designate. The visibility of the three built-in toolbars could be turned off and the custom toolbars displayed instead.

- Custom toolbars with user-defined commands

  In some cases, ArcPad's built-in commands may not provide the functionality you need, or you may want to automate tasks and group several actions into one command. Advanced toolbar commands are created using VBScripts or JScripts and linking them to the events of user-defined commands—for example, the OnClick event. When the user interacts with a user-defined command, the associated scripts are executed.



Using the built-in tools to create a custom toolbar in ArcPad Studio.

All toolbar customization is done in ArcPad Studio. You can create custom toolbars that work only within a specific applet or via the default configuration file so that they are always loaded when ArcPad starts. These new toolbars can contain a combination of built-in commands, that are found on ArcPad's built-in toolbars, and user-defined commands, that call custom scripts. You you can hide or display any of ArcPad's built-in toolbars and specify that toolbars include large format buttons.

Toolbars are loaded into ArcPad as follows: on startup, ArcPad loads any custom toolbars from the default configuration file (ArcPad.apx) and sets the initial visibility state of the built-in toolbars. As each applet is loaded, its toolbars are then added to the system.

Layer definitions

Layer definitions provide a way of delivering customizations that are loaded with data. Typically, this would include data entry forms with associated scripts to handle data entry validation and other features offered on the forms. The layer definition file can also contain symbology created in ArcPad or exported from the ArcGIS Desktop products: ArcView, ArcEditor, and ArcInfo.

Layer definitions are stored in a file associated with a shapefile. This file has the same filename as the shapefile, but has an .apl extension. The layer definition file lives and travels with the shapefile.

Creating a layer definition file

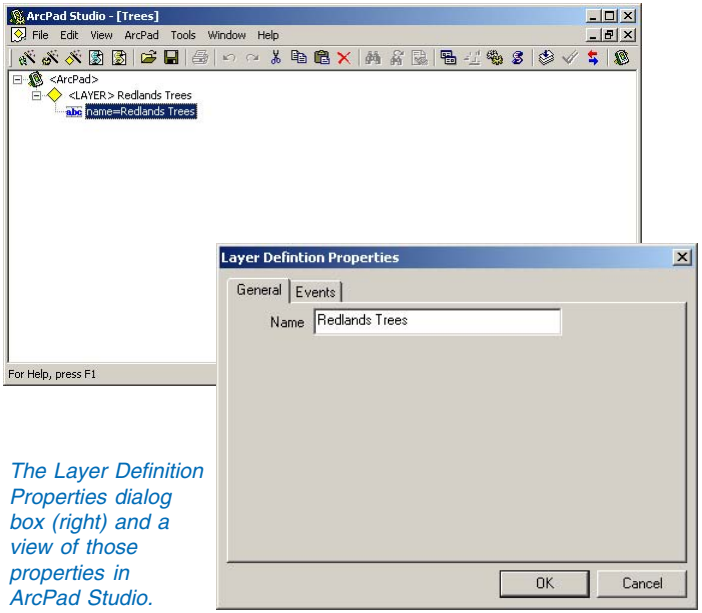
The forms and scripts portion of layer definitions are created in ArcPad Studio. The symbology portion is created in ArcPad, or ArcGIS Desktop using the ArcPad tools for ArcGIS. These two procedures can be done in either order. The layer definition file is stored in ArcPad XML format.

Once the format of a layer definition has been defined in ArcPad Studio and/or using the ArcPad tools for ArcGIS, it is possible to make changes or additions using your favorite text or XML editor, although it is more efficient to do so using ArcPad Studio.

Layer definitions are automatically loaded when the associated shapefile is added to ArcPad.

Managing symbology

Data preparation for ArcPad, such as exporting a layer's symbology, is performed in ArcGIS Desktop (ArcView, ArcEditor, or ArcInfo) using the ArcPad tools for ArcGIS. You can also set or change symbology directly in ArcPad. Symbology is stored in the layer definition file in ArcPad XML.



The Layer Definition Properties dialog box (right) and a view of those properties in ArcPad Studio.

Customizing forms

Custom forms are a way of viewing, updating, synthesizing, and collecting information in the field with ArcPad. Forms are created in ArcPad Studio and stored as ArcPad XML. ArcPad supports customization of three kinds of forms:

- Edit forms
- Identify forms
- General forms

Edit forms

Edit forms are used for data collection such as updating the values of a feature's attributes. Each edit form you create must be associated with a specific shapefile and replaces the Feature Properties dialog box for that shapefile. Each shapefile, therefore, can only have one associated edit form. The edit form can, however, contain multiple pages.

Edit form created in ArcPad Studio.

Layer definition files provide the way of delivering custom edit forms with associated scripts to handle data entry validation and other features offered on the forms. Layer definitions are stored in a file associated with the shapefile. This file has the same filename prefix as the shapefile, but has an .apl extension. The layer definition file lives and travels with the shapefile.

Identify forms

Identify forms replace the Feature Properties dialog box and are used to view, but not edit, a feature's attributes. This allows you to view data in a different style when a feature is being identified as opposed to when it is being edited. Like edit forms, each identify form you create must be associated with a specific shapefile. If no identify form is supplied, but an edit form is supplied, the edit form is displayed in identify mode.Whether you are creating an edit or identify form, you can link your form controls, such as textboxes or comboboxes, to attributes in a specified shapefile. In other words, the values that are viewed and/or edited via the form controls directly correspond to the values from the associated shapefile.

General forms

General forms are created without any association with a shapefile. That is, an applet can provide a custom toolbar with a user-defined command that displays a form. The form takes input from the user, performs several calculations, displays a message to the user, and closes.

You would use a general form, for example, if you wanted to perform and view statistics for a tree layer such as median tree height, average DBH, or tallest tree. You would create a form that provided you with on-the-fly calculation of selected data, in this case the tree layer. Once you are finished, you simply close the form.

Extensions

Extensions allow you to expand the range of data formats, positioning services, projections, datum transformations, GPS receivers, rangefinders, and cameras supported in ArcPad. For example, if your application requires data in an unsupported map projection, you can write an extension that supports the projection. Developers can also create utility extensions that expose any desired low level of functinoality, normally only accessible via C or C++ code, to ArcPad scripts.

The following types of extensions are available to developers:

- Layer extensions can provide a range of support for each new data format, including file identification, layer opening and closing, layer rendering, editing, identifying, and hyperlinking.
- GPS extensions provide support for additional GPS devices.
- Rangefinder extensions provide support for additional rangefinders.
- Camera extensions provide support for additional cameras.
- Projection extensions provide support for additional projections.
- Datum extensions provide support for additional datum transformations.
- AUX extensions provide support for any serial port device that can communicate with ArcPad's AUX port.

Implementing different sets of functions and properties enables you to select the level of support to add. Extensions are always compiled as Dynamic Link Libraries (DLLs). Once an extension is installed, the new functionality appears to an ArcPad user as any other built-in functionality.

Creating extensions

Extensions are developed as Windows DLLs and are generally written in C or C++. External tools, such as a compiler and debugger, are required to create extensions.

Loading extensions

Extensions are loaded automatically by ArcPad during startup. Extensions are usually placed in the Extensions folder, found under the ArcPad installation directory—for example, \Program Files\ArcPad 7.0\Extensions. You can specify additional extension folder in the Paths page of the ArcPad Options dialog box. To deploy an extension, simply place the .dll file in the appropriate Extensions folder and start ArcPad.

Scripts, ArcPad XML, and ArcPad Object Model

Depending on the type of customization you are doing in ArcPad Studio, you may need to become more familiar with scripts, ArcPad XML, and/or the ArcPad Object Model.

Working with scripts

Although a great deal of customization can be accomplished without writing a single line of code, the fundamental feature of ArcPad's customization environment is the ability to use scripts. ArcPad exposes an extensive object model that can be accessed via Microsoft VBScript or JScript. These objects are available to your scripts whenever the ArcPad application is running.

Active Script is a comprehensive scripting infrastructure for the Microsoft Windows platform. Microsoft provides two implementations of the script engine interfaces,Visual Basic Scripting Edition and Microsoft JScript, which can be embedded into applications such as ArcPad.

ArcPad operates as an active scripting host for Microsoft's VBScript or JScript. VBScript and JScript are standard scripting languages and relatively easy to learn.

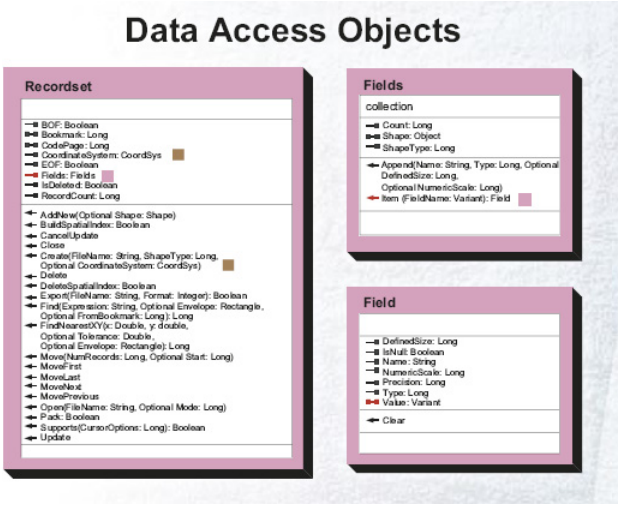
Working with ArcPad XML

Whether you use scripts or not, all of ArcPad's customization files are stored in ArcPad XML format. Familiarization with this format will allow you to work with any of ArcPad's customization files in any text or XML editor. The ArcPad XML format is designed as a protocol for automation and customization of ArcPad. It is based on the XML 1.0 specification and uses the same syntax as ArcXML wherever possible (especially for symbology). ArcPad XML files can be ANSI, UTF-8, Unicode, or Unicode Big Endian encoded.

ArcPad XML files (.apa, .apx, and .apl) are displayed as a tree diagram which is directly related to the underlying XML structure of the files. ArcPad XML elements and attributes are displayed as branches in the tree. You can edit the files very quickly by simply double-clicking elements and attributes. There are also various editors to speed up development and editing of ArcPad XML files by providing a graphical environment. The Toolbar and Form editors are examples of these.

Working with the ArcPad Object Model

ArcPad exposes an extensive object model that can be accessed via VBScript or JScript. The ArcPad object model includes approximately 50 objects that are exposed while ArcPad is running. As long as ArcPad is running, you can access and manipulate these objects via VBScript or JScript. Once ArcPad is closed, all of the objects cease to exist until ArcPad is started again.



Data Access Objects from the ArcPad Object Model

ArcPad customization files

ArcPad XML files (*.apx)

Although all of the ArcPad customization files are stored as XML text files, the .apx file extension is only used for the following files:

- Custom Default Configuration Files (ArcPad.apx)

  This file is loaded by default each time ArcPad starts and must be located in the ArcPad installation (System) directory. ArcPad.apx can contain custom toolbars, forms, and system object event handlers. In addition, it can contain other parameters that override the ArcPad default, such as which toolbars are initially visible when the application starts.

- Global Bookmark File (ArcPadBookMarks.apx)

  This file contains spatial bookmarks that can be used in ArcPad regardless of the current map. It is stored in the My Documents folder on desktop PCs as well as Windows Mobile devices.

- ArcPad Preference Files (ArcPadPrefs.apx)

  This file contains the ArcPad default parameters that are set in the ArcPad Options dialog box, such as GPS settings, default symbology, and default file paths. It is stored in the My Documents folder on desktop PCs as well as Windows Mobile devices.

Other ArcPad XML files include ArcPad Graphics Layer (*.apg), ArcPad Photo Layer (*.aph), and ArcPad Stylesheets (*.aps). For more information about these files, see Chapter 4. ‘ArcPad basics’.

ArcPad applet files (*.apa)

Applets provide a way of delivering a mini-application in a single file without having to alter the ArcPad configuration. Applets may contain toolbars, forms, and system object event handlers. Applets are loaded automatically by ArcPad after the default configuration has been loaded. Applet files are located in the Applets Files Path, which is specified in the Paths page of the ArcPad Options dialog box.

ArcPad layer definition files (*.apl)

Layer definitions are stored in a file associated with a shapefile, with the same filename as the shapefile but with the extension .apl. Layer definition files provide a way of developing customizations that are delivered and loaded with data. Most customizations delivered in this way are data entry forms with associated scripts that handle data entry validation and other features offered from the forms. Layer definition files can also contain custom symbology exported from ArcGIS Desktop.

ArcPad map files (*.apm)

An ArcPad map file stores a list of the map layers of your ArcPad session. A map lists all of your feature layers together with their display settings including the extent of your map, color, and projection environment.

VBScript (*.vbs) and JScript (*.js) files

Much of the customization in ArcPad is accomplished by writing scripts. Currently, ArcPad supports Microsoft’s VBScript and JScript scripting languages. Although scripts may be embedded within the various ArcPad customization files, it is often more efficient to place related scripts in a separate text file with a .vbs or a .js extension.

Glossary

2D Mode

A two-dimensional global positioning system (GPS) position that includes only horizontal coordinates. It requires a minimum of three visible satellites.

3D Mode

A three-dimensional GPS position that includes horizontal coordinates plus elevation. It requires a minimum of four visible satellites.

.apm file

See ArcPad Map file.

acquisition time

The time it takes for a GPS receiver to acquire a lock onto sufficient satellites—three for 2D mode and four for 3D mode—to calculate a position fix.

aerial photograph

A photograph of the earth's surface taken with a camera mounted in an airplane or balloon. Used in cartography to provide geographical information for basemaps.

almanac

File transmitted from GPS satellites to GPS receivers that contains information about the satellites' orbits. The receivers use the almanac to decide which satellites to track.

altitude

1. The elevation above a reference datum, usually sea level, of any point on the earth's surface or in the atmosphere.

2. The z-value in a three-dimensional coordinate system.

ArcPad Graphics Layer (.apg)

The ArcPad Graphics Layer file is an XML file that can store text, points, lines, and polygons. It is used to make freehand geo-referenced edits in the field which can then be imported into ArcGIS Desktop.

ArcPad Map (.apm) file

An ArcPad Map file contains information about the ArcPad Map including the layers in the map, map extent, and settings specific to the map.

ArcPad Photo Layer (.aph)

A photo layer is a file that specifies how georeferenced photos are displayed in ArcPad. Georeferenced photos contain GPS coordinates in the EXIF header of the JPEG image file.

ArcPad Stylesheet (.aps)

An ArcPad Stylesheet is a file that provides symbol definitions for the symbol styles used by ArcPad. ArcGIS Desktop stylesheet files can be exported to ArcPad Stylesheet files.

area

1. Also polygon. A closed, two-dimensional shape defined by its boundary.

2. The size of a geographic feature measured in square units.

attribute

1. A piece of information describing a map feature. The attributes of a river, for example, might include its name, length, and average depth. See attribute table.

2. Cartographic information that specifies how features are displayed and labeled on a map; the cartographic attributes of the river in (1) above might include line thickness, line length, color, and font.

attribute table

A table containing descriptive attributes for a set of geographic features, usually arranged so that each row represents a feature and each column represents one attribute. Each cell in a column stores the value of that column's attribute for that row's feature.

azimuth

The angle measured in degrees between a baseline drawn from a center point and another line drawn from the same point. Normally, the baseline points north, and the angle is measured clockwise from the baseline.

background image

A satellite image or aerial photograph over which vector data is displayed. Although the image can be used to align coordinates, it is not linked to attribute information and is not part of the spatial analysis in a geographic information system (GIS).

backsight

In ArcPad, using a rangefinder, backsight is when you are looking back at and shooting from your target to a known reference point.

bar scale

Also scalebar, graphic scale, linear scale. A line used to measure distance on a map, marked like a ruler in units proportional to the map's scale.

beacon

A stationary, nondirectional transmitter that transmits signals in all directions. In a differential global positioning system, the beacon transmitter broadcasts pseudorange correction data to nearby GPS receivers. The GPS receiver uses this correction to adjust the position fix calculated by the receiver. This process is called real-time differential correction.

bearing (BRG)

Also bearing angle. The direction of a fixed point from a point of observation on the earth, expressed as an angle from a known direction, usually north, and usually measured from 0 degrees at the reference direction clockwise through 360 degrees. The terms bearing and azimuth are sometimes interchanged, but in

navigation the former usually applies to objects on the earth while the latter applies to the direction of a point on the celestial sphere from a point on the earth.

In the ArcPad GPS Position Window, BRG is the compass direction from your current GPS position to the selected destination.

Bezier curve

A curved line whose shape is derived mathematically. In graphics programs a Bezier curve usually has two endpoints and two control points that can be moved to change the direction and the steepness of the curve.

BRG

See bearing.

button

A command that runs a script or custom code when clicked. Buttons can be added to any menu or toolbar using ArcPad Studio. When they appear in a menu, buttons are referred to as menu items.

CF Card

See CompactFlash.

codepage

A codepage maps character codes to individual characters. Different codepages include different special characters, typically customized for a language or a group of languages. The operating system uses codepages to translate keyboard input into character values for non-Unicode (i.e., multibyte) character set-based applications and to translate character values into characters for non-Unicode-based output displays.

COG

See Course Over Ground.

column

Also field, item. The vertical dimension of a table. Each column stores the values of one type of attribute for all of the records, or rows, in the table. All of the values in a given column are of the same data type (e.g., number, string, blob, date). See attribute table.

CompactFlash (CF)

Available in Type I or Type II, this is a specific form factor of accessory cards that fit into a respective CF slot. Examples of CF accessory cards include flash memory, mini hard drives, modems, network cards, and GPS receivers.

coordinates

A set of numbers that designate location in a given reference system such as x,y in a planar coordinate system or x,y,z in a three-dimensional coordinate system. Coordinates represent locations on the earth's surface relative to other locations.

coordinate system

1. A reference system used to measure horizontal and vertical distances on a planimetric map. A coordinate system is usually defined by a map projection; a spheroid of reference; a datum; one or more standard parallels; a central meridian; and possible shifts in the x- and y-directions to locate x,y positions of point, line, and polygon features.

2. In ArcPad, a system with units and characteristics defined by a map projection. A common coordinate system is used to spatially register geographic data for the same area.

Course Over Ground (COG)

The direction the GPS receiver is moving. COG can be reported in true or magnetic north values.

data frame

In ArcGIS Desktop, a frame on a map that displays layers occupying the same geographic area. You may have one or more data frames on your map depending on how you want to organize your data. For instance, one data frame might highlight a study area, and another might provide an overview of where the study area is.

data type

The characteristics of columns and variables that define what types of data values they can store. Examples include character, floating point, and integer.

datum

A set of parameters and control points used to accurately define the three-dimensional shape for the earth—for example, as a spheroid. The datum defines a geographic coordinate system that is the basis for a planar coordinate system. For example, the North American Datum for 1983 (NAD83) is the datum for map projections and coordinates within the United States and throughout North America.

DD

See decimal degrees.

decimal degrees (DD)

Degrees of latitude and longitude expressed as a decimal rather than in degrees, minutes, and seconds.

degree

A unit of angular measure represented by the symbol °. The circumference of a circle contains 360 degrees.

degrees/minutes/seconds (DMS)

A measurement of degrees of latitude and longitude in which each degree is divided into 60 minutes, and each minute is divided into 60 seconds.

desktop GIS

Mapping software that runs on a personal computer and can display, query, update, and analyze geographic locations and the information linked to those locations.

DGPS

Differential global positioning system. See differential correction.

differential correction

A technique for increasing the accuracy of GPS measurements by comparing the readings of two receivers—one roving and the other fixed at a known location.

Differential Global Positioning System (DGPS)

See differential correction.

Dilution of Precision (DOP)

Also Geometric Dilution of Precision (GDOP). An indicator of satellite geometry for a constellation of satellites used to determine a position. Positions with a higher DOP value generally constitute poorer measurement results than those with lower DOP. Factors determining the total GDOP for a set of satellites include, to name a few, Positional DOP (PDOP), Horizontal DOP (HDOP), Vertical DOP (VDOP), and Time DOP (TDOP).

directory

Also folder. An area of a computer disk that holds a set of data files and/or other directories. Directories are arranged in a tree structure in which each branch is a subdirectory of its parent branch. The location of a directory is specified with a pathname—for example, C:\gisprojects\shrinkinglemurhabitat\grids.

display resolution

The number of pixels displayed on a monitor, measured horizontally and vertically—for example, 1,024 by 768.

display scale

The scale at which digital data is rendered on a computer screen or on a printed map.

display units

The units—for example, metric (meters, kilometers), statute (feet, miles), or nautical (knots)—ArcPad uses to report measurements, dimensions of shapes, and navigational speed and distance.

distance

The amount of space between two things that may or may not be connected, such as two points. Differentiated from length, which always implies a physical connection. See also DST.

DMS

See degrees/minutes/seconds.

donut polygon

See island polygon.

DOP

See Dilution of Precision.

DST

The distance from your current GPS position to the selected destination. DST is displayed in the ArcPad GPS Position Window. See also distance.

elevation

Also altitude, height. The vertical distance of a point or object above or below a reference surface or datum (generally mean sea level).

ellipsoid

1. A closed surface, all planar sections of which are ellipses. An ellipsoid has three independent axes and is usually specified by the lengths a,b,c of the three semi-axes. If an ellipsoid is made by rotating an ellipse about one of its axes, then two of the axes of the ellipsoid are the same, and it is called an ellipsoid of revolution or spheroid. If the lengths of all three of its axes are the same, it is a sphere.

2. Also spheroid. When used to represent the earth, an oblate ellipsoid of revolution, made by rotating an ellipse about its minor axis. See also spheroid.

EPE

See Estimated Position Error.

ephemeris

A list of the predicted positions of a GPS satellite for each day of the year or for other regular intervals.

Estimated Position Error (EPE)

A measurement of horizontal and vertical position error, in feet or meters, based on a variety of factors including DOP and satellite signal quality.

feature

1. An object in a landscape or on a map.

2. A shape in a spatial data layer, such as a point, line, or polygon, that represents a geographic object.

feature class

In a shapefile, coverage, or geodatabase, a collection of spatial data with the same shape type (e.g., point, line, or polygon).

field

1. Also item. A vertical column in a table that represents some characteristic for all of the records in the table, given in numbers or words.

2. The place in a database record, or in a graphical user interface, where data can be entered.

file

Information stored on disk or tape. A file may be a collection of data, a document (text file), or a program (executable file). It generally resides within a directory and always has a unique name.

filename

The name that distinguishes a file from all other files in a particular directory. It can refer to the name of the file by itself (harold), the name plus the file extension (harold.shp), or the whole path of a file up to and including the filename extension (C:\mygisdata\shapefiles\harold.shp).

filename extension

Also file extension. The abbreviation following the final period in a filename that indicates the file's format—for example, cities.shp, soils.zip, and pigeons.tif. It is usually one to three letters long.

folder

See directory.

font

In traditional typesetting, the complete set of characters of one size (14 point) of one typeface (Centaur bold italic) of a particular type family (Centaur). In digital typesetting, font is commonly used to mean typeface.

foresight

In ArcPad, using a rangefinder, foresight is when you are looking forward to and shooting at your target from a known reference point.

GDOP

Geometric Dilution of Precision. See Dilution of Precision.

geographic coordinates

Locations on the surface of the earth expressed in degrees of latitude and longitude. See projected coordinates.

geographic north

Also true north. The direction from any point on the earth's surface to the north geographic pole. Compare magnetic north.

Geometric Dilution of Precision (GDOP)

See Dilution of Precision.

georeference

To assign coordinates from a known reference system, such as latitude–longitude, Universal Transverse Mercator, or State Plane, to the page coordinates of an image or a planimetric map.

Global Navigation Satellite System (GLONASS)

The Russian counterpart to the United States' GPS. See global positioning system.

global positioning system (GPS)

A constellation of 24 satellites, developed by the U.S. Department of Defense, that orbit the earth at an altitude of 20,200 kilometers. These satellites transmit signals that allow a GPS receiver anywhere on earth to calculate its own location. The global positioning system is used in navigation, mapping, surveying, and other applications where precise positioning is necessary.

GLONASS

See Global Navigation Satellite System.

GPS

See global positioning system.

graduated color map

A map that uses a range of colors to indicate a progression of numeric values. For example, differences in population density could be represented by increasing the saturation of a single color, and temperature changes could be represented by colors ranging from blue to red.

graduated symbol map

A map whose symbols correspond in size to the amount of the attribute they represent. For example, larger rivers could be represented by thicker lines, and denser populations could be represented by larger dots.

graphic scale

See bar scale.

graphics layer

The ArcPad Graphics Layer file is an SML file that can store text, points, lines, and polygons. It is used to make freehand georeferenced edits in the field which can then be imported into ArcGIS Desktop.

HDOP

Horizontal Dilution of Precision. See Dilution of Precision.

head vertex

The first or start vertex of a line.

heading

The direction of a moving object from a point of observation, expressed as an angle from a known direction, usually north. Bearing and heading differ in that bearing refers to a fixed position, whereas heading refers to the direction in which an object is moving.

Horizontal Dilution of Precision (HDOP)

See Dilution of Precision.

HTML

See Hypertext Markup Language.

hyperlink

A link that connects a geographic feature to an external image, text, or executable file. When the feature is clicked, the file runs or is displayed onscreen.

Hypertext Markup Language (HTML)

A hypertext document format used on the World Wide Web.

identify

To click a feature so that you can see its associated attributes.

image

Represents geographic features by dividing the world into discrete squares called cells. Examples include satellite and aerial photographs, scanned documents, and building photographs. See also raster.

initialization

The first time a GPS receiver orients itself to its current location. After initialization has occurred, the receiver remembers its location and acquires a position more quickly because it does not need to receive a large amount of information from the GPS satellites.

IP address

A server's address on the network. The address consists of four numbers, each separated by a period (.).

island polygon

Also donut polygon. A polygon enclosed by another, larger polygon.

item

Also field. A column in an attribute table that contains the values of one attribute for each record in the table. See also attribute table, record.

label

Text placed next to a feature on a map to describe or identify it.

latitude

The angular distance along a meridian north or south of the equator, usually measured in degrees. Lines of latitude are also called parallels.

latitude–longitude

Also lat/long, lat/lon. The most commonly used spherical reference system for locating positions on the earth. Latitude and longitude are angles measured from the equator and the prime meridian to locations on the earth's surface. Latitude measures angles in a north–south direction; longitude measures angles in an east–west direction.

layer

1. A set of vector data organized by subject matter, such as roads, rivers, or political boundaries. Vector layers act as digital transparencies that can be laid atop one another for viewing or spatial analysis.

2. A set of raster data representing a particular geographic area, such as an aerial photograph or a remotely sensed image. In both (1) and (2), layers covering the same geographical space are registered to one another by means of a common coordinate system.

3. A file that stores symbology and displays information for a given vector or raster dataset. The layer does not actually contain the data but stores the path to its physical location.

line

Also linear feature. A shape having length and direction but no area, connecting at least two x,y coordinates. Lines represent geographic features too narrow to be displayed as an area at a given scale, such as contours, street centerlines, or streams, or linear features with no area, such as state and county boundary lines.

linear feature

See line.

linear scale

See bar scale.

linear traverse

A linear traverse enables you to capture the vertex of a polyline or polygon from a known point as you walk along a traverse. In other words, you begin at point A, capture point B, move to point B, capture point C, move to point C, and so on. With a linear traverse, you are always using a moving reference point, that is, the last point you captured.

locale

A locale reflects the local conventions and language for a particular geographical region. A given language may be spoken in more than one country; for example, Portuguese is spoken in Brazil as well as in Portugal. Conversely, a country may have more than one official language. For example, Canada has two: English and French. Thus, Canada has two distinct locales: Canadian–English and Canadian–French. Some locale-dependent categories include the formatting of dates and the display format for monetary values.

The language determines the text and data formatting conventions, while the country determines the national conventions. Every language has a unique mapping, represented by codepages, which includes characters other than those in the alphabet, such as punctuation marks and numbers. A codepage is a character set and is related to the current locale and language. As such, a locale is a unique combination of language, country, and codepage.

location

Also position. A point on the earth's surface or in geographical space described by x,y,z coordinates or by other precise information such as a street address.

longitude

The angular distance, expressed in degrees, minutes, and seconds, of a point on the earth's surface east or west of a prime meridian—usually, the Greenwich meridian. All lines of longitude are great circles that intersect the equator and pass through the north and south poles.

m-value

Measure value. See measure.

magnetic north

Also compass north. The direction from a point on the earth's surface following a great circle toward the magnetic north pole, indicated by the north-seeking end of a compass.

map

1. A graphical presentation of geographic or spatial information.

2. The document used in ArcPad that lets you display and work with geographic data. A map contains one or more layers of geographic data and various supporting elements such as scalebars. A map has properties, such as scale, projection, and extent.

map document

In ArcGIS Desktop, the disk-based representation of a map. Map documents can be printed or embedded into other documents. Map documents have an .mxd file extension.

map projection

A mathematical model that transforms the locations of features on the earth's curved surface to locations on a two-dimensional surface. It can be visualized as a transparent globe with a lightbulb at its center casting lines of latitude and longitude onto a sheet of paper. Generally, the paper is either flat and placed tangent to the globe—a planar or azimuthal projection—or formed into a cone or cylinder and placed over the globe—cylindrical and conical projections. Every map projection distorts distance, area, shape, direction, or some combination thereof.

map units

The units—for example, Metric (meters, kilometers), or Statute (feet, miles)—in which the coordinates of spatial data are stored.

marker symbol

A symbol used to represent a point location on a map.

MBCS

See multibyte character set.

measure

A value stored along a linear feature that represents a location relative to the beginning of the feature, or some point along it, rather than as an x,y coordinate. Measures are used to map events, such as distance, time, or addresses, along linear features.

menu

A command that arranges other commands into a list.

MGRS

See Military Grid Reference System.

Military Grid Reference System (MGRS)

MGRS is an alphanumeric version of a numerical UTM (Universal Transverse Mercator) or UPS (Universal Polar Stereographic) grid coordinate.

multibyte character set (MBCS)

A multibyte character set is a set of characters in which each character is represented by one or more bytes. In two-byte characters, the first byte, or lead-byte, signals that both it and the following byte are to be interpreted as one character. The first byte comes from a range of codes reserved for use as lead bytes. The ranges of bytes that can be lead bytes depends on the code page in use. For example, Japanese codepage 932 uses the range 0x81 through 0x9F as lead bytes, but Korean codepage 949 uses a different range. Windows 95/98/Me can only use MBCS.

multichannel receiver

A GPS receiver that tracks several satellites at a time using one channel for each satellite.

multipart feature

A geographic feature composed of more than one physical part that is stored as one object. In a layer of states, for example, Hawaii could be considered a multipart feature because it is made of many polygons but only references one set of attributes in the database.

multipath

Also multipath error. Errors caused when a GPS satellite signal reaches the GPS receiver from two or more paths, one directly from the satellite and the others reflected from nearby buildings or other surfaces. Signals from satellites low on the horizon will

produce more error; many receivers can mask satellite signals coming from an angle that is too low.

multipoint feature

A feature consisting of more than one point that only references one set of attributes in the database. For example, a system of oil wells might be considered a multipoint feature, as there is a single set of attributes for the main well and multiple well holes. See multipart feature.

National Marine Electronics Association (NMEA)

A U.S. standards committee that defines data message structure, contents, and protocols to allow electronic equipment, including GPS receivers, to communicate with each other.

NMEA 0183

A standard data communication protocol used by GPS receivers and other types of navigation and marine electronics. See also National Marine Electronics Association.

North American Datum of 1927 (NAD 1927, NAD27)

The primary local geodetic datum used to map the United States during the middle part of the 20th century, referenced to the Clarke spheroid of 1866 and an initial point at Meades Ranch, Kansas. Features on United States Geological Survey topographic maps, including the corners of 7.5-minute quadrangle maps, are referenced to nad27. It is gradually being replaced by the North American Datum of 1983.

North American Datum of 1983 (NAD 1983, NAD83)

A geocentric datum based on the Geodetic Reference System 1980 ellipsoid (grs80). Its measurements are obtained from both terrestrial and satellite data.

null value

The absence of a recorded value for a geographic feature. A null value differs from a value of zero in that zero may represent the measure of an attribute, while a null value indicates that no measurement has been taken.

observer height

In ArcPad, the height of a rangefinder in relation to a reference point at ground level.

offset

An offset combines the use of distance, bearing (or angle), and/or inclination (or slope) to determine the location of features. In ArcPad, there are two types of offsets: simple and complex.

pan

To move an onscreen display window up, down, or sideways over a map or image without changing the viewing scale.

path

Also pathname. The location of a file or a directory on a disk, given as the drive, directories, subdirectories, and filename, in that order. The path is always specific to the computer operating system.

pathname

See path.

PC Card

A credit card-sized accessory—as with CompactFlash cards—that comes in Type I, Type II, and Type III formats to provide additional functions. PC Cards were formally called Personal Computer Memory Card International Association (PCMCIA) cards. Examples of PC Card accessory cards include flash

memory, mini hard drives, modems, network cards, and GPS receivers.

PCMCIA

Personal Computer Memory Card International Association. See PC Card.

PDOP

Positional Dilution of Precision. See Dilution of Precision.

Personal Computer Memory Card International Association

See PC Card.

photo layer

A photo layer is a file that contains photos with GPS coordinates in the EXIF header of each photo file. The photo layer file, which has an .APH extension, specifies how the photo layer should be displayed in ArcPad.

planimetric

1. Two-dimensional; showing no relief.

2. A map that gives only the x,y locations of features and represents only horizontal distances correctly.

PLGR

See Precision Lightweight GPS Receiver.

Pocket PC

Windows Powered devices running the Windows CE 3 operating system, Pocket Outlook, and Pocket Office. The previous generation of devices running Windows CE 2.x was referred to as the Palm-size PC.

point

Also point feature. A single x,y coordinate that represents a geographic feature such as a telephone pole.

point mode digitizing

One of two methods of digitizing, or capturing, features using the ArcPad edit tools. With point mode digitizing, you can create or edit features by digitizing, with the pen or GPS input, a series of points, or vertices. Point mode digitizing is effective when precise digitizing is required—for example, when digitizing a perfectly straight line. See also stream mode digitizing.

polygon

A two-dimensional closed feature representing an area such as a state or county.

polyline

A sequence of points, each pair of which can be connected with a straight line, a circular arc, an elliptical arc, or a Bezier curve. A polyline with a pair of points that is not connected is called a multipart polyline.

position

Also location. The latitude, longitude, and altitude (x,y,z) of a point, often accompanied by an estimate of error. It may also refer to an object's orientation—facing east, for example—without referring to its location.

Positional Dilution of Precision (PDOP)

See Dilution of Precision.

postprocessing

The process of correcting GPS field data for Selective Availability and other errors using a computer linked to a base station.

PPS

See Precise Positioning Service.

Precise Positioning Service (PPS)

The highest level of military dynamic positioning accuracy provided by a GPS receiver, using the dual frequency P-Y code. See Precision Lightweight GPS Receiver.

Precision Lightweight GPS Receiver (PLGR)

A handheld GPS receiver used by the U.S. military that incorporates Precise Positioning Service and is unaffected by Selective Availability.

PRJ file

See projection file.

project

1. To display a three-dimensional surface, such as the earth, in two dimensions. See projection.

2. In ArcView GIS 3.x, a file that organizes the views, tables, charts, layouts, and scripts used for geographic analysis and mapmaking. A project is similar to a map document in ArcView 8.x.

projected coordinate system

A reference system that defines the locations of points on a planar surface.

projected coordinates

A measurement of locations on the earth's surface expressed in a two-dimensional system that locates features based on their distance from an origin (0,0) along two axes—a horizontal x-axis representing east–west and a vertical y-axis representing north–south. A map projection transforms latitude and longitude to x,y coordinates in a projected coordinate system. See also geographic coordinates.

projection

See map projection.

projection file

Also PRJ file. A text file that stores the parameters for the map projection and coordinate system of a geographic dataset.

radial traverse

A radial traverse uses 1 or 2 fixed reference points and creates a traverse relative to those fixed points. In other words, you begin at point A and capture the points around the perimeter of A. You are always standing at the same fixed point when you are capturing multiple vertices.

rangefinder

A device for measuring the distance from a known location (device) to a target. Some rangefinders also measure the bearing and inclination to the target.

raster

A spatial data model made of rows and columns of cells. Each cell contains an attribute value and location coordinates; the coordinates are contained in the ordering of the matrix, unlike a vector structure, which stores coordinates explicitly. Groups of cells that share the same value represent geographic features. See also image; compare vector.

real-time differential GPS

Differential correction performed and transmitted from a base station to a roving receiver while it is out collecting data. Differential correction performed at a later time is often referred to as postprocessing.

record

A row in a database or in an attribute table that contains all of the attribute values for a single entity.

remote sensing

Collecting and interpreting information about the environment and the surface of the earth from a distance, primarily by sensing radiation that is naturally emitted or reflected by the earth's surface or from the atmosphere or by sensing signals transmitted from a satellite and reflected back to it. Examples of remote sensing methods include aerial photography, radar, and satellite imaging.

remote sensing imagery

Imagery acquired from satellites and aircraft. Examples include panchromatic, infrared black and white, and infrared color photographs and thermal infrared, radar, and microwave imagery.

rover

Also mobile receiver. A portable GPS receiver used to collect data in the field. The rover's position can be computed relative to a second, stationary GPS receiver.

S/A

See Selective Availability.

satellite constellation

1. The arrangement in space of a set of GPS satellites.

2. All the satellites visible to a GPS receiver at one time.

3. The set of satellites that a GPS receiver uses to calculate positions.

scale

The relationship between the dimension of the features on a map and the geographic objects they represent on the earth, commonly expressed as a fraction or a ratio. A map scale of 1/100,000 or 1:100,000 means that one unit of measure on the map equals 100,000 of the same unit on the earth. See bar scale.

scale factor

The ratio of the actual scale at a particular place on a map to the stated scale of the map.

scalebar

See bar scale.

script

A set of instructions for an application program, usually written in the application's syntax.

segment

A line that connects vertices.

select

To choose from a number or group of features or records.

Selective Availability (S/A)

The intentional degradation by the U.S. Department of Defense of the GPS signal for civilian receivers, which can cause errors in positions of up to 100 meters. Selective Availability was removed from the civilian signal in May 2000.

shade symbol

A color or pattern for filling polygons on a map.

shape

The visible form of a geographic object. Most geographic objects can be represented on a map using one of three basic shapes: points, lines, or polygons.

shapefile

A vector file format for storing the location, shape, and attributes of geographic features. It is stored in a set of related files and contains one feature class.

skin

A skin is a bitmap that has a window for an application to run within. For example, an ArcPad skin could be a bitmap of a Windows CE device so that the PC version of ArcPad can run within the screen area of the image.

skyplot

The skyplot graphically shows which GPS satellites are visible to the GPS receiver and whether or not they are being used by the GPS to calculate a position. See also satellite constellation.

snapping

An automatic editing operation in which points or features within a specified distance or tolerance of other points or features are moved to match or coincide exactly with each other's coordinates.

SOG

See Speed Over Ground.

spatial bookmark

Identifies a particular geographic location that you want to save and refer to later—for example, a study area.

SPC

See State Plane Coordinate System.

SPCS

See State Plane Coordinate System.

Speed Over Ground (SOG)

The actual speed the GPS receiver is moving over the ground.

spheroid

1. A three-dimensional shape obtained by rotating an ellipse about its minor axis, resulting in an oblate spheroid, or about its major axis, resulting in a prolate spheroid.

2. When used to represent the earth, a spheroid as defined in (1), but with dimensions that either approximate the earth as a whole or with a part that approximates the corresponding portion of the geoid.

SPS

See Standard Positioning Service.

Standard Positioning Service (SPS)

GPS information broadcasted to everyone in the world and affected by Selective Availability. The normal civilian positioning accuracy obtained by using the single frequency C/A code. Under Selective Availability conditions, SPS accuracy is guaranteed to be no worse than 100 meters 95 percent of the time.

State Plane coordinate system (SPCS, SPC)

A group of planar coordinate systems that divides the United States into more than 130 zones, so that distortion in each is less than one part in 10,000. Each zone has its own map projection and parameters and uses either the nad27 or nad83 horizontal datum. The Lambert conformal conic projection is used for states that extend mostly east–west, while transverse Mercator is used for those that extend mostly north–south. The oblique Mercator projection is used for the panhandle of Alaska.

stream mode digitizing

One of two methods of digitizing, or capturing, features using the ArcPad edit tools. Also known as streaming, stream mode

digitizing provides an easy way to capture features when you don't require much precision—for example, to digitize some roads. With stream mode, you draw the feature using the mouse, stylus, or the coordinates from the GPS receiver. See also point mode digitizing.

symbol

A graphic pattern used to represent a geographic feature on a map. Symbols can look like what they represent (trees, railroads, houses), or they can be abstract shapes (points, lines, polygons). Many characteristics define symbols, including color, size, angle, and pattern.

symbolization

Devising a set of marks of appropriate size, color, shape, and pattern and assigning them to map features to convey their characteristics or their relationships to each other at a given map scale.

symbology

The criteria used to determine symbols for features in a layer. A characteristic, or attribute, of a feature may influence the size, color, and shape of the symbol used.

table

Data arranged horizontally in rows and vertically in columns in a relational database system. A table has a specified number of columns but can have any number of rows. Rows stored in a table are structurally equivalent to records from flat files in that they must not contain repeating fields.

tail vertex

The last or end vertex of a line.

target height

The height of the target above ground. By default, the target height is 0 or unknown. If the target height is known and specified, the resulting coordinate will be the XYZ value of the feature at ground level; the target height is subtracted. If the target height is not known (value of 0), the resulting coordinate will be the XYZ value of the actual target.

TCP/IP

See Transmission Control Protocol/Internet Protocol.

TDOP

Time Dilution of Precision. See Dilution of Precision.

text label

See label.

text symbol

A text style defined by font, size, character spacing, color, and so on, used to label maps and geographic features.

Time Dilution of Precision (TDOP)

See Dilution of Precision.

toolbar

A set of commands, or buttons, that let you carry out related tasks.

Transmission Control Protocol/Internet Protocol

Transmission Control Protocol (TCP) is a communication protocol layered above the Internet Protocol (IP). These are low-level communication protocols that allow computers to send and receive data.

traverse

See linear or radial traverse.

Trimble Standard Interface Protocol (TSIP)

A Trimble proprietary protocol for communicating with Trimble GPS receivers.

true north

Also geographic north. The direction from any point on the earth's surface to the north geographic pole. Compare magnetic north.

TSIP

See Trimble Standard Interface Protocol.

Unicode

A 16-bit character encoding, providing enough encodings for all languages. All ASCII characters are included in Unicode as widened characters. Windows NT/2000/XP can use Unicode or MBCS but use Unicode natively. Windows CE can only use Unicode. See Unicode transformation format 8-bit encoding form.

Unicode transformation format 8-bit encoding form

An encoding system that uses a string of bytes to represent a 16-bit Unicode string. Specifically, ASCII text (<=U+007F) remains unchanged as a single byte, U+0080-07FF (including Latin, Greek, Cyrillic, Hebrew, and Arabic) is converted to a 2-byte sequence, and U+0800-FFFF (Chinese, Japanese, Korean, and others) becomes a 3-byte sequence.

Universal Polar Stereographic (UPS)

A projected coordinate system that covers all regions not included in the Universal Transverse Mercator coordinate system—that is, regions above 84 degrees north and below 80 degrees south. Its central point is either the North or South Pole. See also Universal Transverse Mercator.

Universal Time Coordinated (UTC)

A universal time standard referencing the time in Greenwich, England. Also referred to as GMT or Zulu time.

Universal Transverse Mercator (UTM)

A commonly used projected coordinate system that divides the globe into 60 zones, starting at -180 degrees longitude. Each zone extends north–south from 84 degrees north to 80 degrees south, spans 6 degrees of longitude, and has its own central meridian. See also Universal Polar Stereographic.

unprojected coordinates

See geographic coordinates.

UPS

See Universal Polar Stereographic.

UTC

See Universal Time Coordinated.

UTF-8

See Unicode transformation format 8-bit encoding form.

UTM

See Universal Transverse Mercator.

VDOP

Vertical Dilution of Precision. See Dilution of Precision.

vector

1. A data structure used to represent linear geographic features. Features are made of ordered lists of x,y coordinates and represented by points, lines, or polygons; points connect to become lines, and lines connect to become polygons. Attributes are associated with each feature—as opposed to a raster data structure, which associates attributes with grid cells. Compare raster.

2. Any quantity that has both magnitude and direction.

vertex

One of a set of ordered x,y coordinates that constitutes a line or polygon feature.

Vertical Dilution of Precision (VDOP)

See Dilution of Precision.

WAAS

See Wide Area Augmentation System.

waypoint

A GPS term for a permanently stored and named position in the GPS receiver's memory.

In ArcPad, any selected feature is essentially a waypoint, which can be used for GPS navigation.

Wide Area Augmentation System (WAAS)

A U.S. Federal Aviation Authority system of equipment and software that supplements GPS accuracy, availability, and integrity.

Windows CE

A 32-bit operating system from Microsoft, built to run on embedded devices such as Personal Digital Assistants, tablet PCs, and Auto PCs.

world file

A text file containing the coordinate and scaling information for converting the coordinates in an image—which usually start at [0,0] and extend to the image's size in pixels—to map coordinates such as latitude–longitude or State Plane. A world file allows an image to be overlaid with vector data of the same geographic area.

World Geodetic System of 1972 (WGS72)

A geocentric datum and coordinate system designed by the United States Department of Defense that is no longer in use. See World Geodetic System of 1984.

World Geodetic System of 1984 (WGS84)

The most widely used geocentric datum and geographic coordinate system today, designed by the U.S. Department of Defense to replace wgs72. GPS measurements are based on wgs84.

XML

Extensible Markup Language. A markup language similar to HTML. With XML you define data using tags that add meaning. For example, <title>California geology</title> declares the text 'California geology' to be a title, perhaps for a map. XML is well formed if an opening tag, such as <title>, and a closing tag, such as </title>, appear before and after each piece of data.

x,y coordinates

A pair of numbers expressing a point's horizontal and vertical distance along two orthogonal axes, from the origin (0,0) where the axes cross. Usually, the x-coordinate is measured along the east–west axis, and the y-coordinate is measured along the north–south axis.

x,y,z coordinates

In a planar coordinate system, three coordinates that locate a point by its distance from an origin (0,0,0) where three orthogonal axes cross. Usually, the x coordinate is measured along the east–west axis, the y coordinate is measured along the north–south axis, and the z coordinate measures height or elevation.

z coordinate

See z-value.

z-value

Also altitude, z coordinate. The value for a given surface location that represents an attribute other than position. In an elevation or terrain model, the z-value represents elevation; in other kinds of surface models, it represents the density or quantity of a particular attribute.

zoom

To display a larger or smaller region of an onscreen map or image. See also pan.

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