User Guide

GPS Field Data Collection

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Introduction

The purpose of this reference is to provide field staff with basic guidance in using the USDA service center GPS to collect field data. The pre-requisites for using this reference are a basic understanding of the principles and terminology of GPS as well as familiarity with the USDA GPS equipment.
The scope of this document includes pre-field preparation of the GPS equipment as well as general instructions for data gathering using that equipment. No specific programs are addressed here. Instead, the guide describes the process steps for collecting position information for generic types of geospatial data: points, lines and polygons.

Conventions used in this guide

The following conventions will be used throughout this user guide.

The titles of dialog boxes and screen names will be written in **Bold**. The illustration to the left shows the **Mark Waypoint** screen of the Map76 GPS unit.

On screen buttons will be written in bold text and in square brackets: **[Button]**. The illustration shows the **[Delete]**, **[Goto]**, **[Map]**, and **[OK]** buttons. The **[OK]** button is selected.

The names of fields in a window will be written in *Italics*. The *Location* field displays the latitude and longitude of the waypoint being marked.

Choices available from lists will also be written in “quotation marks”. The “Average Location” choice is selected from the list in the illustration to the left.

Physical buttons on the GPS will be referred to as **keys** and their names written in **Bold** text. For example, press and hold the **Power** key on the GPS to turn it on.

Pre-Field

Proper preparation for data collection is critical to ensure successful and productive fieldwork. At a minimum, the GPS user should do the following before leaving for data collection:

- Ensure that the system battery is charged by charging over night
- Inventory the components of the GPS configuration
- Power up the system at the office location to ensure that it is working
- Check the GPS memory to ensure that there is enough free to store the data you need to collect. Optimally, the memory should be empty.
- Upload any reference data that you need for your fieldwork. This would cover base maps from MapSource and is covered in the Setup user guide. Track and waypoint data can be uploaded using DNRGarmin

Additionally, in areas of the country where satellite coverage is less dense, it is advisable to plan data gathering for times with good satellite coverage.

Field Data Collection

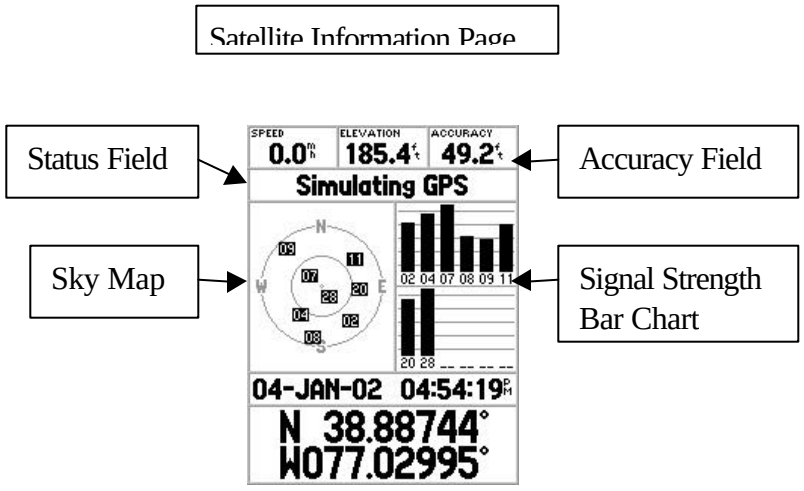
The GPS units will be used to determine the location as well as shape and size of features on the ground. In other words, the GPS can be used both to measure the size of a feature, such as a field or a fence line, and to create a georeferenced map of that feature.

Once you have arrived at the location where you need to collect data, power up your GPS configuration and check the following items on the **Satellite Information** page of the GPS unit:

- Check that you are receiving signals from enough satellites to obtain your position. Generally you will need four, in limited circumstances three will be enough.
    - Satellites that you are receiving are shown as black boxes on the sky map and will have black signal strength bars.
    - If the receiver is communicating with the satellite but is not yet locked on to the signal, the boxes in the sky map and the signal strength bars will be gray.
    - If the unit is not receiving any signal from a satellite, there will be no box around the satellite number in the sky map and no signal strength bar.

- Check that you are receiving differential correction. Most program applications require that data be gathered using differential correction.
    - The *Status* field message will indicate if you are receiving differential correction.
    - Additionally, the letter "D" will be displayed in the signal strength bar of any satellite for which you are receiving differential correction.

- Check that the estimated accuracy displayed on the GPS is sufficient to meet program guidelines, if such guidelines exist. The accuracy of the current position is displayed in the *Accuracy* Field.



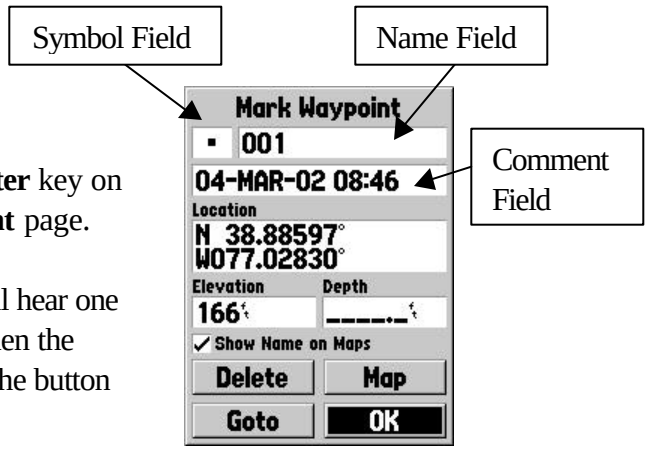
Point data collection

Certain geographic features will be mapped and their location captured as point data. Examples of point features include well heads and grain bins as well as facilities that are included in the Food and Feed Facility Listings.

Using waypoints to define point features

Point features will be captured in the field by marking a waypoint with the GPS in the following manner:

- Place the antenna of the GPS over or near the point feature. In the case of a point taken to represent something like a grain bin, place the antenna near enough to the feature that it will be represented near to the correct place on a map.



- Mark a waypoint by pressing and holding the **Enter** key on the Map76, this will bring up the **Mark Waypoint** page.

Hint - If the beeper in your GPS is turned on, you will hear one beep when you press the button and another beep when the **Mark Waypoint** page opens. Take your finger off the button after you hear the second beep.

- Name the Waypoint:
  - Use the **Rocker** key to highlight the *Name* field of the **Mark Waypoint** page
  - Press **Enter** to begin editing the waypoint name.
  - Each of the characters in the waypoint name can be edited by selecting a space on the name line by moving left or right with the **Rocker** key and then pressing up or down on the **Rocker** key to select a character.
  - Characters are listed in order from a - z, blank, +, -, then 0-9.
  - Waypoint names can be up to 10 characters long.

- Choose among the 10 characters using the left and right directions on the **Rocker** key.

- Press the **Enter** key to accept a name for the point.

- Give the waypoint a unique name that will be interpretable later. Do not rely on your memory.

Keep good notes in the field! Your notes will allow you or other users to figure out what feature each waypoint represents.

- The most recent version of the Map76 firmware also includes a *Comment* field to be populated for each waypoint. The default value for the *Comment* field is the date and time the waypoint was recorded. This value can be edited in the same way as the *Name* field

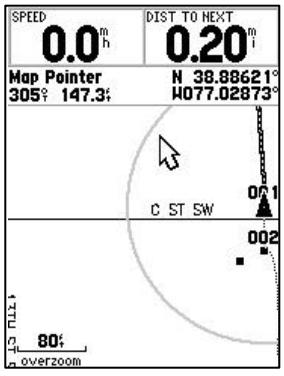
- Save the waypoint by highlighting the **[OK]** button and pressing the **Enter** key.

- Pressing the **Quit** key before the waypoint information is edited will prevent the waypoint from staying in the memory.

- Select the **[Delete]** button on the waypoint screen and press **Enter** to delete a waypoint that you have created in error. The GPS unit will ask you for a confirmation before it deletes the waypoint.

Viewing the waypoint on the map

- The **Mark Waypoint** screen gives you the option to view the waypoint that you are creating on the GPS unit's map. This feature allows you to check the location that you are marking during the editing process.



  - Select the **[Map]** button and press the **Enter** key. This action will save the waypoint and show its location labeled with its name on the GPS map.

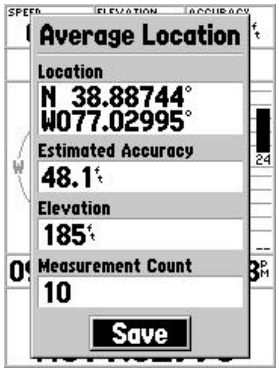
  - Press the **Quit** key to return to the **Mark Waypoint** page where you can continue editing or delete the current waypoint.

  - Press the **Page** key to return to the page you were on when you started the mark waypoint process.

Point Averaging

If additional accuracy is needed or desired, use point averaging to determine the position of the waypoint. To use averaging:

- Press the **Menu** key with the **Mark Waypoint** screen displayed to bring up a dialog box with three choices.



- Select the "Average Location" item using the **Rocker key**. Press the **Enter** key to accept this choice and open the **Average Location** screen, **keep the antenna in the same place**.
- The **Average Location** screen will show the following fields:
  - *Location* – the coordinates of the position
  - *Estimated Accuracy* – this number should go down as you watch. The general rule is that averaging is useful until the accuracy number stabilizes
  - *Elevation* – The height of the waypoint above mean sea level
  - *Measurement Count* – the number of positions that are being used to determine the average position

Once the accuracy number has stabilized, press the **Enter** key to accept the point and return to the **Mark Waypoint** page

Entering User Coordinates

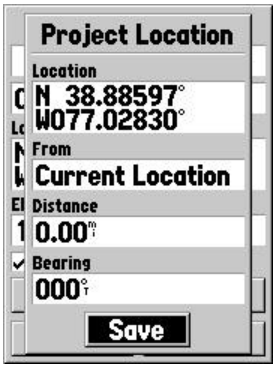
- Waypoints can be created without actually visiting a location by manually entering the coordinates in the *Location* field of the **Mark Waypoint** page.
- The *Location* field is edited in the same way as the *Name* field.
- This feature is useful if you need to navigate to waypoints whose coordinates you have obtained from a map or other source. Navigation is covered in a later section of this guide.

Advanced – Marking an offset waypoint

There will be situations where you will not be able to stand on the actual point where you need to mark a waypoint or where the GPS will not be able to receive satellite signals when it is actually on the point that you need to mark. To get around this situation, you can mark a waypoint using an offset. To use an offset, you will need to know the bearing and distance to the waypoint from your current position. There are two ways that this can be accomplished using the Garmin Map76.

Marking an offset waypoint using the "Project Location" method:

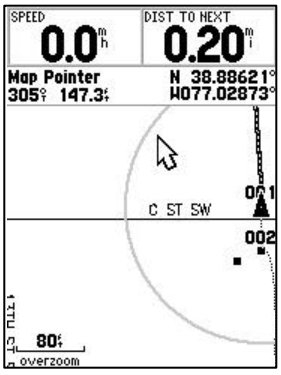
- Begin marking a waypoint in the normal fashion, by pressing and holding the **Enter** key. When the **Mark Waypoint** screen appears, press the **Menu** key and choose "Project Location" from the dialog box to open the **Project Location** page.



- The Distance and Bearing fields on the **Project Location** page allow you to enter a compass direction (referenced to **true** north) and distance (in miles) from where you are standing to the point you need to mark.

- One of the problems with this method is that it requires that you enter the offset distance in increments of 1/100th of a mile, approximately 52ft. This problem can be avoided by entering the offset using the **Map** page.

Marking an offset waypoint using the Map page method:



- Open the **Map** page on the GPS unit. Your current location will be displayed as a black triangle.

- The page also displays a Map Pointer that looks like an outlined arrow and that can be moved around the page by using the **Rocker** key. The pointer and the pointer information will not be displayed unless you use the **Rocker** key to move away from your current location.

- The position of the pointer and the bearing and distance of the pointer from your current position is displayed above the map display on the page.

- Position the pointer over the position of the waypoint that you need to mark and press the **Enter** key to open the **Mark Waypoint** page.

- Accept the new waypoint by highlighting the **OK** button and pressing the **Enter** key.

Line Data Collection

Lines can be used to represent features such as fences, pipelines, and power lines. GPS can be used to capture line features by collecting a group of points that all lie on the line. This data can be captured in two ways, by using waypoints or tracks.

Using Waypoints to define line features

Waypoints can be used to capture a line feature by placing a waypoint at the start and finish of the line as well as at any bend that the line makes. A start and an end point will define the simplest straight line. More complicated lines have additional waypoints between the start and finish that define the shape of the line, much like fence posts define the shape of a wire fence. Like a line feature, a wire fence needs to have a post every time it changes direction and anchors at the start and finish.

To capture a line feature using waypoints:

- Collect waypoints at the start of the line feature, at each successive turn in the line, and at the end of the line feature.

- Give each waypoint with a unique and identifiable name that also indicates the order in which the points fall. For example, name the first point 100, the second 101, the third 102 and so on. Take accurate notes so that your data will be interpretable when it is taken back to the office.

Using Routes to define line features

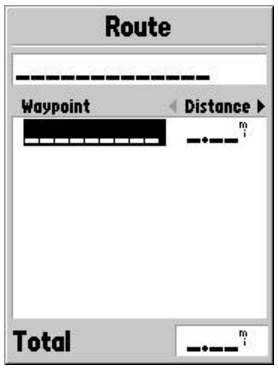
The length of a line feature defined by a series of points can be calculated in the field by adding those points to a route. A route is an ordered collection of points, meaning that points in a route are listed from first to last. Once the points are added to a route, the Map76 will show the distance between each point on the line as well as the overall length of the route. To calculate the length of a line in the field:

- Open the **Main Menu** page by pressing the **Menu** key twice from any page

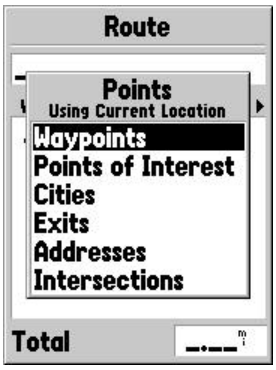
- Open the **Routes** page by selecting the "Routes" option from the **Main Menu** page and pressing the **Enter** key.

- Create a new route by selecting the **[New]** button on the **Routes** page and pressing the **Enter** key

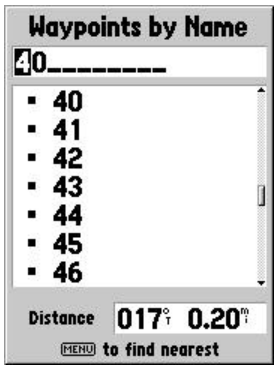
- A blank **Route** page will open.



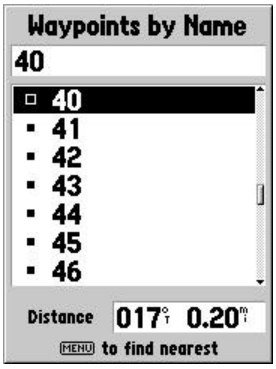
- Add waypoints to the route by highlighting the blank line in the lower portion of the screen and pressing the **Enter** key. This will open a **Points** dialog.



- Select the "Waypoints" option from the **Points** dialog to open the **Waypoints by Name** screen.



- Select a point from this screen by entering or beginning to enter a waypoint name into the top field of this page and then pressing the **Enter** key to send the cursor to the lower field of the screen.

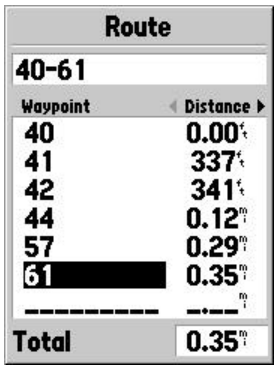


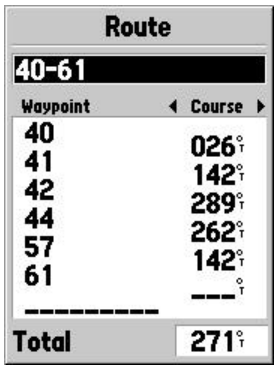
- Add a point to the route by selecting it from this list by highlighting it using the **Rocker** key and pressing the **Enter** key.

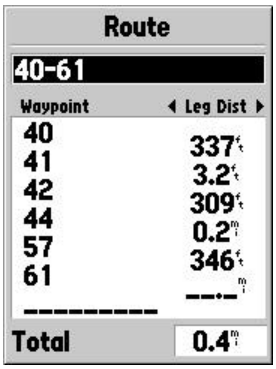
- The **Waypoint** page will open to display the properties of the waypoint that you wish to add to your route.
- Highlight the **[OK]** button and press the **Enter** key to accept the waypoint.
- Press the **Quit** key to decline the point and go back to the **Waypoints by Name** page.

- Repeat this process until you have added all the waypoints that define the measured line feature.

- Once all of the waypoints have been added to the route, the total route distance will be displayed on the route page. Leg distance between waypoints as well as other route characteristics can be displayed by highlighting the route name (in the top field of the **Route** page) and then pressing left or right with the **Rocker** key.







Using tracks to define line features

Tracks can also be used to capture line features. A track automatically collects points at a user-specified interval, either time or distance, as you travel with the GPS. Tracks are often referred to as a "bread crumb trail" that the GPS leaves behind you as you walk with it. The advantage of using tracks to define a line is that the user does not have to decide on, capture and name waypoints to capture a line. Segments of the track log are identified by the time that they are captured and cannot be individually named. Thus it is important to note the times when you turn on and off track recording.

To capture a line using tracks:

- Check the track recording method to ensure that it is appropriate to the feature that you are capturing. A small feature with many turns in it is best capture using a small interval. Using a longer collection interval best captures a large feature with few turns in it.
  To check the track recording method:

  - Press the **Menu** key twice from any screen to bring up the **Main Menu** page.

  - Use the **Rocker** key to select the "Tracks" item and press the **Enter** key to accept this choice and open the **Tracks** page.

  - Press the **Menu** key to bring up the **Tracks** page menu. Use the **Rocker** key to select "Setup Track Log" and press the **Enter** key to accept this choice and open the **Track Log Setup** page.

  - Set the record method by using the **Rocker** key to highlight the *Record Method* field and pressing the **Enter** key to bring up the record method choices: "Time", "Distance", or "Auto". Select one of the method choices and press the **Enter** key to accept that choice. Each of these record methods has a number of interval settings that can be set in the "Interval" field of this page. The recommended setting for track recording is the "Auto" method with the "Most Often" interval unless there is policy guidance to the contrary.

- Accept the choice that you have made for the **Track Log Setup** page by highlighting the **[OK]** button and pressing the **Enter** key.

- Track recording must be started at the start location for the line. Once you have reached the start of the line, turn on track recording. If track recording was on when you reached the starting point, turn it off then turn it on again.

- Turning the track on and off signals the GPS that a new feature is beginning. Note the time displayed on the GPS when the track log is started. This will help interpret your data back in the office. To turn track recording on and off:

  - From the **Track Log Setup** page, select the "Recording" field and press the **Enter** key.

  - Turn track recording off by selecting the "Off" option and pressing the **Enter** key.

  - Turn track recording on by selecting the "Stop When Full" option and pressing the **Enter** key.

  - The "Wrap When Full" option should not be used because it will start overwriting collected data once the track point memory has been filled

- Walk or drive along the line feature with the antenna as close as possible to the actual line.

- Any time that you must deviate from traveling along the feature, turn off the track recording while the antenna is not near the feature. Turn on the track recording and note the GPS time when you return to the line that you are trying to capture.

- Turn off the track and note the time when you have reached the end to the line feature.

Choosing to use waypoints or tracks to collect line features

Both methods of capturing line features have advantages and disadvantages. Waypoints give the user control of each bend of the line feature, which is good on features that have well defined turns. Waypoints are hard to use on very curvy features like stream meanders. Tracks are good at capturing all the curves of a feature, but they are also very good at capturing every curve of the path that you travel. The method that you use to capture a line feature should be determined by the nature of that feature and the requirements of the program for which you are capturing that data.

Area Data Collection

Areas, or polygons, can be used to represent features such as farm fields, wetlands or other two dimensional features. Similarly to lines, GPS can be used to capture polygon features by collecting either waypoints or tracks. The same strengths and weaknesses that each method has for capturing line features apply to polygon features.

Using waypoints to define area features

To capture a polygon feature using waypoints:

- Collect a waypoint at a starting point on the perimeter of the polygon feature that you will recognize when you return to it. Collect waypoints at each successive corner of the polygon. You do not need to re-collect the position of the start point of the polygon feature.

- Give each waypoint a unique and identifiable name that also indicates the order in which the points fall. For example, name the first point 100, the second 101, the third 102 and so on. Take accurate notes so that your data will be interpretable when it is taken back to the office.

Using tracks to define area features

To capture a polygon feature using tracks:

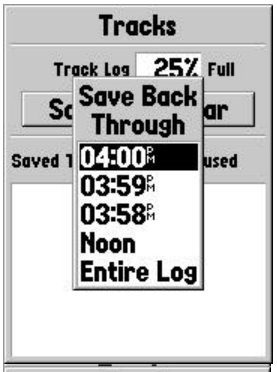
- Set the track recording method in the same way that you would for collecting a line feature.

- Turn on track recording at a recognizable starting point for the polygon and begin navigating along the area boundary. Turn off track recording when you return to the start point or when boundary of the area is a straight line from where you stand back to the start point.

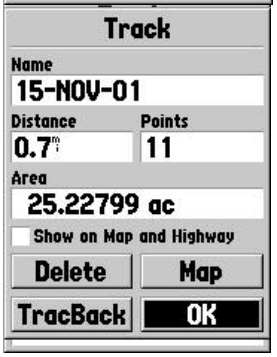
Creating "Saved Tracks" and calculating areas in the field

The Map76 has the ability to calculate the acreage of an area enclosed by a saved track. To use this feature:

- Open the **Tracks** page, select the **[Save]** button and press the **Enter** key
- You will be given the choice to save the entire track log or to save a portion of the log from the most recent track point to one of the breaks in the log caused by turning track recording on. **Remember**, you put these breaks in on purpose by turning track recording on at the start of a feature and whenever you returned to the boundary of the feature after making a detour.



- Choose one of the break points in the drop down list by highlighting it with the **Rocker** key and then pressing the **Enter** key
- Saving that portion of the track log as a track will bring up the **Track** page. The **Track** page will display the acreage and perimeter of the saved track.



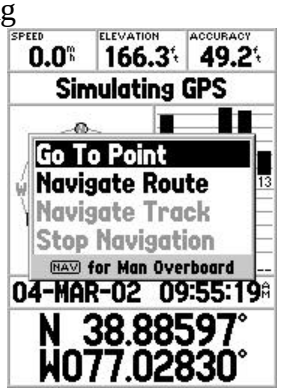
IMPORTANT: The saved track is a generalization of the track points selected from the active track log. The area calculated from the saved track may vary somewhat from the acreage obtained by using ArcView and the unfiltered track points. Individual program policy will determine if the saved track may be used for the measured acreage.

- The saved track can be left in memory and downloaded in the office. The Map76 can store up to 10 saved tracks. The saved track can also be deleted with the **Delete** button on the **Track** page.
- **Remember!** Keep good notes in the field. Field notes should include the start and stop times for each track segment and the feature or portion of the feature that they define.

Navigation using the Map76

Navigation to a point

The Map76 can be used to navigate to points that have been stored on the GPS. This feature can be used to relocate features that you have marked in the past. You can also navigate to features that you haven't been by uploading points from the GIS or by manually entering coordinates to create a waypoint. To begin navigation:



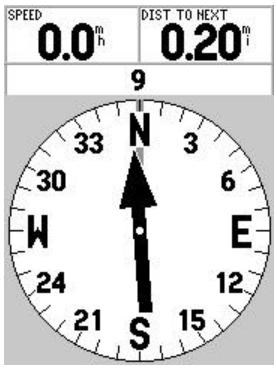
- Press and release the **Nav** key from any page to open the navigation dialog. The choices that you have available to you depend on the data stored in the GPS at the time. In the example to the right you have the option to navigate to a point or along a route because there are both routes and points stored on the GPS. The choice to navigate along a track is grayed out because there is no track data currently stored on the GPS.

- Highlight the "Go To Point" choice and press the **Enter** key to open the **Points** page. Highlight and select "Waypoints" to go to the **Waypoints by Name** page.

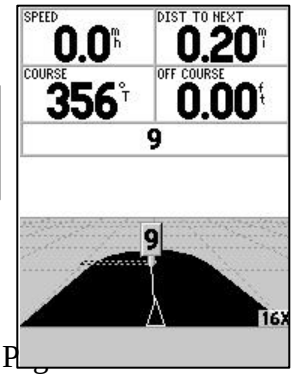
- Select a point from the **Waypoints by Name** page and press the **Enter** key to bring up the **Waypoint** page with the **Goto** button highlighted. Press the **Enter** key to begin navigation to that point.

- Once you have begun navigation, several pages on the GPS will point you to your goal.
  - The **Pointer** page will show the direction to the destination point, the direction in which you are travelling and the distance to your destination. This will be the most useful page for you in the field.
  - The **Highway** page can also be used to navigate to the point
  - The fifth page, in this case called the **Active Goto** page, will show the distance to the destination point

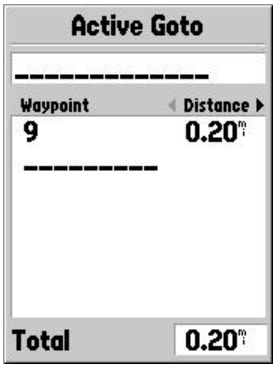
Pointer Page



Highway Page



Active Goto Page



Navigation along a route or track

The Map76 can be used to follow routes or tracks that have been saved in the unit's memory. This process is very similar to starting navigation to a point. To begin this type of navigation:

- Press and hold the **Nav** key in the same way as is described above for navigation to a point.
- Choose either "Navigate Route" or "Navigate Track" from the list that appears.
- A *Select Route* dialog will open to give you a choice of the saved routes stored on the unit.
- A *Select Route* dialog will open to give you a choice of the saved tracks stored on the unit. Once you have selected one of the saved tracks to navigate, you will be given a choice to travel in the original or reverse direction that the track was originally recorded