

GPS (or GNSS) Navigation Terminology in 2026

Some concepts are vital, but unfortunately they are confused through usage of the same terminology with slightly different meanings by different software developers:

Waypoint ([GPX](#) <wpt>)

A waypoint is a point in space. It is typically identified by a name and a set of coordinates in a prescribed geographic coordinate system and datum (*eg* latitude, longitude and altitude in WGS84), and the time or date at which it applied.

When shown on a map, the location of a waypoint is commonly indicated by an icon (which may be ‘generic’ or ‘customised’ to reflect the nature of the feature at that location or the intended purpose of the waypoint).

When it is recorded in a database, additional comments, features about the location, the recording of the waypoint, or the intended use of the waypoint may be also be recorded. In some GPS tools, some of these fields are populated automatically upon waypoint creation, sometimes with surprising results.

Waypoints go under various names, distinguished mainly by their intended uses:

- points of interest
- track points
- route points
- via points (or viapoints)
- course points (or course_points)
- intermediate points
- map markers
- shaping points
- fly-over points
- *etc*

A distinction between <wpt>, <trkpt> and <rtept> is historical in the GPS field. It is implicit in the GPX specification, but not explained or made explicit there. Some names are defined in other formats such as KML. Some are just used (with or without definition) by particular developers. Many tools produce a GPX file in which <wpt> is restricted to one kind of waypoint - locations of sufficient interest to a user to be marked for future use, excluding those used only to record the geometry of a track (all <trkpt>s) or route (some <rtept>s).

Often the same term is used by different ([or even the same](#)) tool in different ways (*eg* “ Tracks offer powerful tools for recording, creating, and managing routes ...”). Some terrestrial GPS software does not respect the <wpt>, <trk>, <rte> paradigm at [all](#); or [varies it](#) to suit the developer.

Track (GPX <trk>)

Conceptually, a track started as a collection of waypoints defining a path that had been followed. Because such paths were often recorded at short intervals for accuracy, tracks typically contained many data points (track points). In GPX files, any <trk> is generally named and includes one or more segments <trkseg>; but <trkpt>s (always listed in sequence along their path) are generally not named, and they need not appear in the <wpt> list.

As software was developed to follow a path on a (digital) map, and to plan a journey given a complex set of alternative paths, the concepts of track and route became less distinct. With such software, any track could be used fairly easily as a route.

Route (GPX <rte>)

Conceptually, a route started as collection of waypoints defining a path to be followed. Typically, only key locations such as turning points were included, so routes tended to contain few data points (route points or via points). Some developers distinguished between (i) shaping points used only to help define the route and (ii) waypoints kept for additional purposes. In GPX files, any <rte> is generally named, as is any <rtept>. But those distinguished as ‘shaping points’ generally are not listed as <wpt>s. This is also variable in other file formats or in GPX files from format converters. Waypoints may be sorted or listed under <wpt> in various orders (eg alpha-numeric); but route points should only be listed (under <rtept>) in their sequence in the corresponding route.

The distinctions between tracks and routes became less clear once routes could be planned along complex paths including tracks. In a further complication, some developers introduced terms like ‘itinerary’. Some developers now even use route definitions based on lists of coordinates, without naming these points (as in tracks). This usually causes later confusion. Although <name> is optional for all types of waypoints in GPX, it can not be considered best practice under the motivation for GPX (to serve as a simple but rich way to share GPS information about waypoints, tracks and routes) to provide no name for a <wpt> or <rtept>.

Perhaps it is time to:

- (i) Restore the idea of GPX <rte> to a sparse set of waypoints (<rtept>s) marking major turn points or locations along a planned course.
- (ii) Agree that all <rte>s should include designated <rtept>s, and that all <rtept>s should be named. There is still a place for the human brain to fill in the gaps: deciding on a detailed course based on topography, vegetation, weather, tides or whatever is relevant, to get to that next <rtept>. It remains very useful to export a GPX file including list of named <rtept>s, and after import of such a file to use the <rtept> list (not the <wpt> list which may be unordered and may not include route shaping points) for assistance with navigation (called ‘direct’ or ‘straight-line’ navigation in many GPS tools). Unfortunately, some GPS tools offer only “waypoint navigation” from an imported GPX route file (and may then attempt to navigate in non-route order), possibly because the <wpt>s are more often named than the <rtept>s.
- (iii) Recognise that many tracks are not actually records of paths taken, but rather complex sets of locations used to define a path, often taken from a map and used for subsequent navigation. So <trk> is distinguished (from <rte>) as a complex series of points that define the detailed geometry of a path. And <trkpt>s can merely be listed in sequence, without names. Time and elevation are often less relevant, they can remain optional.

Path

Path (or way) is a generic term for any course that can be represented on a map. It may include a track, a route, a street, a foot pad, an air or sea lane, a rough imaginary course, or any other way of connecting various locations on the map. It may or may not be trafficable or visible in reality.

Data formats

A light-weight, text-editable, open, XML format called [GPX](#) was developed to share GPS data. The GPX format is versatile because it provides standards for the core material (<wpt>, <trk>, <rte> and their sub-fields) while allowing GPS developers to add their own <extensions>.

Because they are not limited by an agreed standard, GPX <extensions> commonly fail to translate between GPS tools. Nevertheless, GPX remains the most reliable way to share waypoint, track and route data between GPS tools.

Other [formats](#) exist for geospatial data, of course, and some can overlap with GPX. Entire maps can be shared in raster and vector formats such as [geospatial PDF](#). [KML](#) can share graphic styles and even pictures often used as overlays. Some are now essentially public, though they were originally proprietary. This became very useful when most devices could render colours and shapes for graphic elements detailed in the file. Other formats (like [FIT](#)) are aimed at specific GPS device types or brands, and may include added waypoint types (like course points) and capabilities. Such formats do not [convert](#) easily or always neatly into [GPX](#), and some information will almost certainly be lost in the process.

There are some caveats about GPX as a ‘standard’ format:

- (1) Many tools change GPX file contents between import and export. This applies not only to the <extensions>, but to data within fields more fully defined by the GPX specification. The result is still a valid GPX file, but the information may be very different. Although some elements and attributes are compulsory (and their order if present is fixed), many are optional in the GPX specification. Optional fields may be deleted. Data may be changed - provided it complies with the type of data specified for the field.
- (2) Many tools exploit the possibilities of various GPX data fields (tags or parent elements and their attributes) and sub-fields (child elements) in different ways. For example, some software uses the <sym> and <type> sub-fields under each <trkpt> for instructions on navigating the ‘[track](#)’. Other software may use <sym> or <type> to define waypoint icons. The GPX specification is about how fields should be completed; not how they should be used. There is some widely-ignored [advice](#) about best practice. Although developers are ‘asked’ to “*Use the GPX tags the way they were intended*”, those intentions are not documented. Perhaps it is time to develop a more complete description of GPX best practice. Even when attempted, validation of a particular GPX file is often complicated by changing locations for the schemas that define namespaces used in extensions.

Two different GPS tools may interpret the same GPX file very differently! They may also yield very different contents after the same GPX file is simply imported then exported!

GPX is sometimes criticized as being too large a format. Yet many .gpx files could be much smaller if <![CDATA [...]]> was used only where confusion with marked-up content was possible. Now there is Zip. Why not have a ‘standard’ format like .gpz for zipped GPX files?

Extracts from [GPX](#) files (modified from [samplelib.com](#) and [topographix](#)):

```
<?xml version="1.0" encoding="UTF-8"?>
<gpx version="1.1" creator="samplelib.com" xmlns="http://www.topografix.com/GPX/1/1">
  <metadata>
    <name>Full GPX sample</name>
    <desc>Waypoints, a route and a track in one file.</desc>
  </metadata>

  <wpt lat="46.0" lon="7.0">
    <ele>100</ele>
    <name>Start</name>
  </wpt>

  <rte>
    <name>Planned route</name>
    <rtept lat="46.001" lon="7.001"></rtept>
    <rtept lat="46.003" lon="7.004"></rtept>
  </rte>

  <trk>
    <name>Recorded track</name>
    <trkseg>
      <trkpt lat="46.000743" lon="7.000732">
        <ele>98.3</ele>
        <time>2025-02-18T07:33:20Z</time>
      </trkpt>
      etc...
    </trkseg>
  </trk>
</gpx>
```

In this example, <rtept>s are unfortunately not named. The header / metadata are minimal.

```

xml-stYLESHEET type="text/xsl" href="details.xsl"?>
<gpx
  version="1.0"
  creator="ExpertGPS 1.1b1 - http://www.topografix.com"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns="http://www.topografix.com/GPX/1/0"
  xmlns:topografix="http://www.topografix.com/GPX/Private/TopoGrafix/0/1"
  xsi:schemaLocation="http://www.topografix.com/GPX/1/0 http://www.topografix.com/GPX/1/0/gpx.xsd">
  <name><![CDATA[Mystic River Basin Short Trail]]></name>
  <desc><![CDATA[Both banks of the lower Mystic River have paved trails, allowing for a short loop.]]></desc>
  <author><![CDATA[Dan Foster]]></author>
  <email>trails@topografix.com</email>
  <url><![CDATA[http://www.tufts.edu/mystic/amra/pamphlet.html]]></url>
  <urlname><![CDATA[Lower Mystic Basin Trails]]></urlname>
  <time>2002-03-12T21:13:27Z</time>
  <keywords><![CDATA[mystic river, medford, tufts, biking, trail]]></keywords>
  <bounds minlat="42.392077" minlon="-71.107983" maxlat="42.407100" maxlon="-71.074267"/>

  <wpt lat="42.398467" lon="-71.090467">
    <name><![CDATA[BLESSING]]></name>
    <cmt><![CDATA[BLESSING OF THE BAY]]></cmt>
    <desc><![CDATA[The Blessing of the Bay Boathouse, now run by the Somerville Boys and Girls Club.]]></desc>
    <url><![CDATA[http://www.everydaydesign.com/ourtown/bay.html]]></url>
    <urlname><![CDATA[Boat-building on the Mystic River]]></urlname>
    <sym>Boat Ramp</sym>
    <type><![CDATA[Boat Launch]]></type>
  </wpt>
  <wpt lat="42.405495" lon="-71.098364">
    <name><![CDATA[LOOP]]></name>
    <cmt><![CDATA[STARTING POINT FOR LOOP TRAILS]]></cmt>
    <desc><![CDATA[Starting point for the Mystic River loop trails.]]></desc>
    <sym>Trail Head</sym>
    <type><![CDATA[Junction]]></type>
  </wpt>
  etc...

  <rte>
    <name><![CDATA[SHORT LOOP]]></name>
    <desc><![CDATA[Short Mystic River loop.]]></desc>
    <number>3</number>
    <topografix:color>00d7ff</topografix:color>
    <rtept lat="42.405495" lon="-71.098364">
      <name><![CDATA[LOOP]]></name>
      <cmt><![CDATA[STARTING POINT FOR LOOP TRAILS]]></cmt>
      <desc><![CDATA[Starting point for the Mystic River loop trails.]]></desc>
      <sym>Trail Head</sym>
      <type><![CDATA[Junction]]></type>
    </rtept>
    <rtept lat="42.398467" lon="-71.090467">
      <name><![CDATA[BLESSING]]></name>
      <cmt><![CDATA[BLESSING OF THE BAY]]></cmt>
      <desc><![CDATA[The Blessing of the Bay Boathouse, now run by the Somerville Boys and Girls Club.]]></desc>
      <url><![CDATA[http://www.everydaydesign.com/ourtown/bay.html]]></url>
      <urlname><![CDATA[Boat-building on the Mystic River]]></urlname>
      <sym>Boat Ramp</sym>
      <type><![CDATA[Boat Launch]]></type>
    </rtept>
    etc...
    <rtept lat="42.405495" lon="-71.098364">
      <name><![CDATA[LOOP]]></name>
      <cmt><![CDATA[STARTING POINT FOR LOOP TRAILS]]></cmt>
      <desc><![CDATA[Starting point for the Mystic River loop trails.]]></desc>
      <sym>Trail Head</sym>
      <type><![CDATA[Junction]]></type>
    </rtept>
  </rte>

  <trk>
    <name><![CDATA[SHORT TRACK]]></name>
    <desc><![CDATA[Bike path along the Mystic River in Medford.]]></desc>
    <url><![CDATA[http://www.tufts.edu/mystic/amra/pamphlet.html]]></url>
    <urlname><![CDATA[Lower Mystic Basin Trail]]></urlname>
    <number>4</number>
    <topografix:color>00ffff</topografix:color>
    <trkseg>
      <trkpt lat="42.405381" lon="-71.098108">
        <ele>42.916016</ele>
        <time>2002-03-07T20:42:28Z</time>
        <sym>Waypoint</sym>
      </trkpt>
      etc...
    </trkseg>
  </trk>
</gpx>

```

In most cases in this example, `<![CDATA[text]]>` could have been replaced by `text`, as there was no conflict in meaning with marked-up content. Metadata in the header are extensive.