This document describes the format of the SubClass element in Garmin GPX files. It is only valid for the subclass in Route points. (Excluding the end point) In the XML this is element <RtePt>.

Terminology:

BaseCamp	GPX file (XML Format)	Zumo XT
Route	<RTE>	Trip
Via Point	<RTEPT>	
Via Points, or <RTEPT> can be either:		
• Via point (Alert on arrival)	• <trp:ViaPoint	Will alert, don't skip, can be chosen as destination when starting trip.
• Via point (Don't alert on arrival)	• <trp:ShapingPoint	Will not alert, can be skipped, can not be chosen when starting trip.

Objective:

- Some problems found with the Zumo XT are, or at least seem to be, related to the SubClass.
  - Shaping points get renamed when importing.
  - The routing works different for Shaping points and Via. It should be the same.
  - CEP. (Closest Entry Point). When starting a route with CEP, sometimes Shaping points are ignored. Via Points seem to work more predictable.
- Knowing what info this SubClass contains, might help resolve them.

Notes:

- This info was collected by 'reverse engineering'. It is not 100% complete, and may not be correct in all cases. Sources of info, tools used:
  - GPSBabel
  - GPSMapedit
  - JaVaWa GMTK
  - TypViewer
  - https://www.memotech.franken.de/FileFormats/Garmin_GPI_Format.pdf (Lat/Lon conversion)

- A special value exists '000000000000FFFFFFFFFFFFFFFFFFFFFFFF'. Once this is assigned it is never changed. I call it 'Empty', others suggest it is 'Direct Routing'. This can be accomplished by exporting a route, modifying the subclass with an XML editor, and importing it back in Basecamp. Or by importing a GPX file created by another app like MyRoute App, Kurviger, Calimoto etc..

- The Subclass is assigned when adding (inserting) a Via Point in Basecamp. Once assigned it is not always changed, even when it would be expected. (See Tests performed)

Additional tests performed:

- Create a route with start, end, and 1 shaping point. Export gpx.
  Move the 2nd shaping point. Export gpx
  Compare shows the same subclass!

- Change Map product from City Navigator to Open Street Map or vice versa. Recalculate route. Subclass changes. Sometimes to 'Empty'.

- Change an initial Shaping point to Via. Subclass remains the same.

- Change an initial Via point to Shaping. Subclass changes!

- Moving a Shaping point to another location, Subclass remains the same.

- Moving an initial Via point. Subclass remains the same. Then change to shaping, subclass changes.

- When importing a GPX file without SubClasses in Basecamp, and subsequently exporting it then the SubClass is reset to 'Empty'. An example of this is MyRoute App. MyRoute App has no knowledge of subclass. When importing a route exported from MRA all the subclasses are reset to 'Empty'.

The results from these tests show that Basecamp does not always update the Subclass, although it would be expected. Furthermore the 'Empty' value gets assigned in some scenario's, and does not seem to have a negative effect. Not in Basecamp nor in the XT.

Layout:

Because no documentation is available containing the layout, and I lack inspiration, I named the fields 1 to 9.

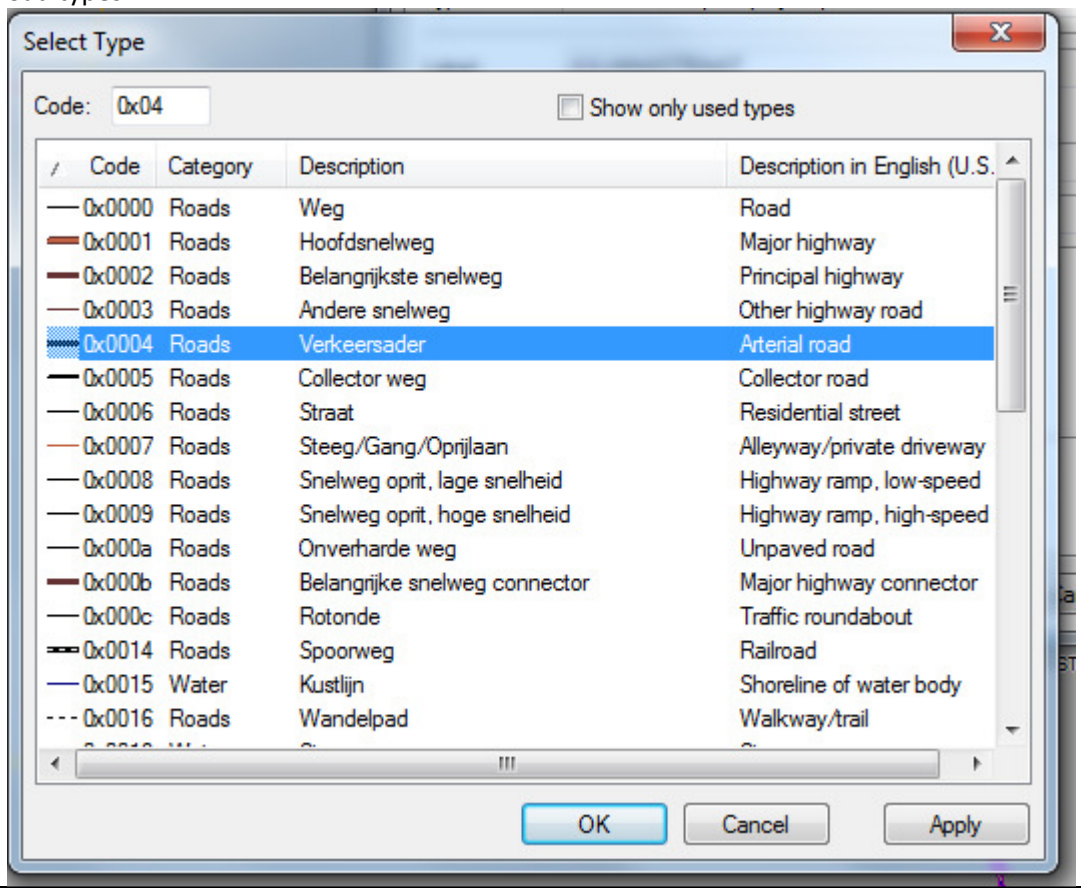
Field 1	2 Bytes	Can refer to a 'line/road', or a 'point'. See the road and point types. Screen shot from GPSMAPEDIT.
Field 2	4 Bytes	An integer specifying the map segment nbr.
Field 3	4 Bytes	This field is most likely a unique id of the road segment. Placing points along the same road this nbr. remains the same. But when passing a junction for example this nbr. changes.
Field 4	1 Byte	Looks like a type field. Values found: 0F = Begin 0D = Shaping point 01 = Via Point
Following fields are only valid for Shaping Points. See the explanation in the sample.		
Field 5	1 Byte	Lat Byte 0
Field 6	1 Byte	Lon Byte 0
Field 7	1 Byte	Reserved = 00
Field 8	2 Bytes	Lat Bytes 1 & 2
Field 9	2 Bytes	Lon Bytes 1 & 2
For Via Points		
Field 5-9	7 Bytes	To be determined.

Integers have to read 'backwards'. Little Endian.

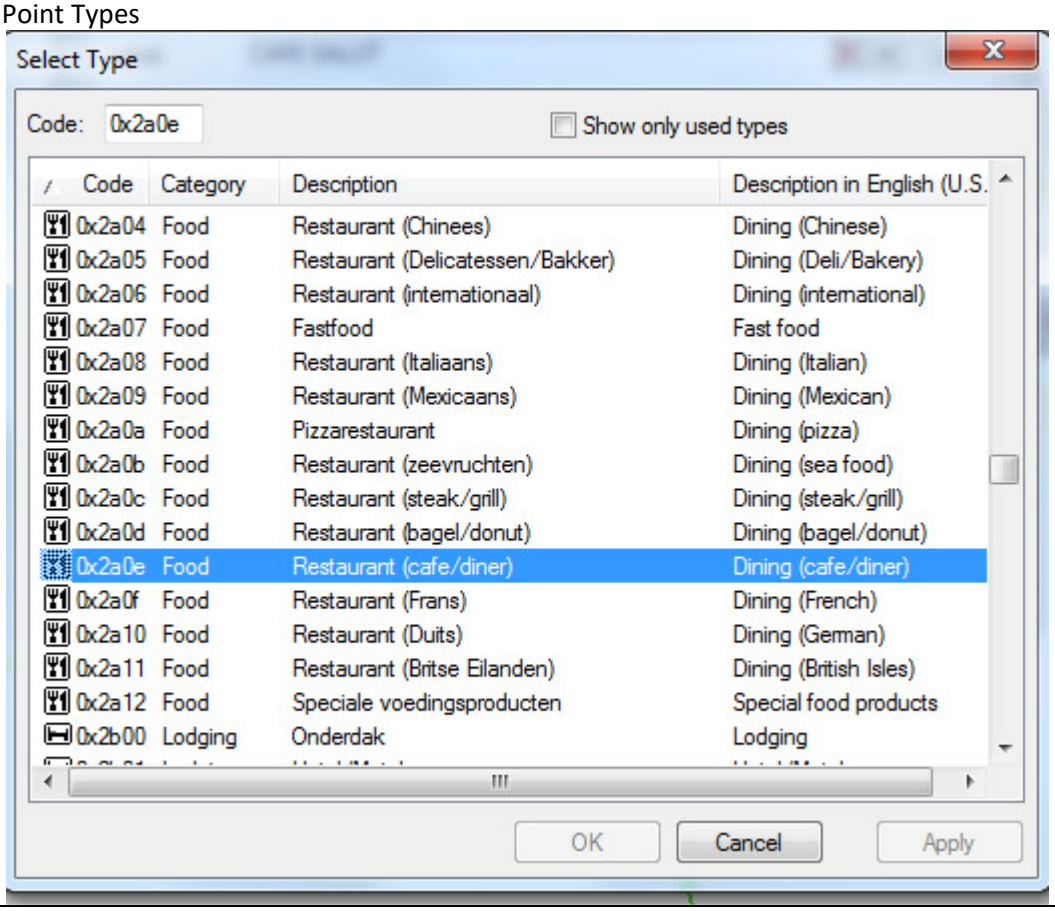
Sample RtePt:

```
 <rtept lat="51.600542971864343" lon="5.660406164824963">
      <time>2022-10-09T17:45:21Z</time>
      <name>Erpseweg1</name>
      <sym>Waypoint</sym>
      <extensions>
        <trp:ShapingPoint />
        <gpxx:RoutePointExtension>
          <gpxx:Subclass>040089969800050026010D24040097B17206</gpxx:Subclass>
<!-- Note that the empty Subclass does not conflict with the fields found! -->
               0000 00000000 FFFFFFFF FF FFFFFFFFFFFF
<gpxx:Subclass>0400 89969800 05002601 0D 24040097B17206</gpxx:Subclass>
<!—
Field 1 (Little Endian)
00 04         = Road type, or Point Type. ‘polyline arterial road’ (See Road types)
Field 2 (Little Endian)
00 98 96 89 = 10000009  = Map Segment. (Sample is not City Navigator, but Open Street Map)
Field 3 (Little or Big Endian?)
05002601   = Unknown, probably road id for shaping point
             The values remain the same for each road segment. (Between junctions)
Field 4
0D           = RtePt  0F = Begin, 0D = Shaping point, 01 = Via Point

Only valid for Shaping points. These bytes contain (part of) the Lat/Lon values of the next <gpxx:rpt node, not the Lat/Lon values of the <rtept node.
Fields 5 to 9
24          = Lat Byte 0
04          = Lon Byte 0
00          = Unknown, probably reserved for RtePt
97B1        = Lat Bytes 1, 2
7206        = Lon Bytes 1, 2

24(1) 04(2) xx 97(3) B1(4) 72(5) 06(6)

First the ‘real/decimal’ values have to be converted to ‘integer’ (4 bytes).  Multiply by 2^32 and divide by 360
E.g.: 51,600542971864343 * 2^32 = 221622644520 / 360 = 615618457 = 24B19799 (hex)
Bytes 1,2 and 3 are used like this.

24(1) B1(4) 97(3) 99(.) = 615618457 * 360 = 221622644520 / 2^32 = 51,600542971864343

04(2) 06(6) 72(5) 07(.) =  67531271 * 360 =  24311257560 / 2^32 = 5,660405745729804

(.) Not used....
-->
          <gpxx:rpt lat="51.600542971864343" lon="5.660405745729804">
            <gpxx:Subclass>040089969800BC3D0000211600009A000E00</gpxx:Subclass>
          </gpxx:rpt>
```

Road types



Point Types



Map segment nbrs. can be found with JaVaWa GMTK. Sorry screenshot only in Dutch.