

Volume

3

TRACKS4AFRICA

Overland Navigation

Standards for Field Data Collection

OVERLAND NAVIGATION

Standards for Field Data Collection

© Tracks4Africa Enterprises (PTY) Ltd
Millennia Park, 16 Stellantia Avenue
Stellenbosch, 7600, SOUTH AFRICA
Phone +27 (0)21 883 9212 • www.tracks4africa.com

Garmin® is a registered trademark of Garmin Ltd. Or its subsidiaries, registered in the USA and other countries.
MapSource®, MapInstall®, Zumo™, Nuvi™, Quest™, StreetPilot™ and eTrex™ are trademarks of Garmin Ltd or its
subsidiaries. Windows® is a registered trademark of Microsoft Corporation.

Table of Contents

Table of Contents	i
Introduction	2
Definitions	3
The 4-dimensional Navigation Picture	6
T4A Waypoint Data	9
T4A Track Log Data	19
Improving Track Log Resolution/Quality.	25
T4A Classification of ROADS/TRACKS.	26
Category: FREE WAYS	26
Category: ROADS.....	26
Category: STREETS.....	26
Category: OFF ROADS	26
Category: BIKE TRAILS	26
Category: HIKING/MBT TRAILS.....	26
Category: BOAT TRACKS.....	26
Submitting Your Data	27
How do I send my data to T4A?	27
Where do I send my Data?	27
Verification and Confirmation of Data.....	27
Corrections and Updates to this document.....	27

Introduction

This document is a working document for T4A data contributors. Its purpose is to:

- Explain basic definitions and basic navigation concepts;
- Give practical hints and guidelines for field data collection;
- Explain the T4A standards for field data collection and requirements for data submissions;
- Explain the working mechanism of T4A data management.

This document has several Authors. Special thanks to Eric Sommer, Graham Wild, Johann Grobler, Robert Shadforth, Graham Bowring, Peter Levey, Wouter Brand, Mike Lauterbach, Willem de Waal and Hans Scheffler.

Definitions

Term	Description
GIS	Geographic Information Systems - uses POINTS, LINES and POLYGON vectors to model maps of places.
GPS	Global Positioning System. The basic purpose of GPS is to accurately give your position in latitude and longitude coordinates. Recent GPS receiver models are map capable, making it possible to show where you are in respect of your surroundings. (See "How the Global Positioning System works" later in this document.)
GPS MAP	A GPS Map is a VECTOR map and is made up of lines, points and polygons, and which is compiled using specialised software. There are several such commercial GPS MAPPING products available. Only a MAP-CAPABLE GPS can handle GPS maps.
GPS MEMORY	The memory specification of a GPS (e.g. 8Mb or 18Mb) refers to the storage space available for GPS MAPS only. GPS's have a limited capacity for storing various types of data, for example WAYPOINTS (500), TRACK LOGS (10,000) and ROUTES (50). The exact capacities vary from model to model.
GPS	GPS RECEIVER. The term "GPS" refers to the <i>system</i> of satellites emitting radio signals. These signals are then <i>received</i> by a GPS RECEIVER, which uses to the information contained in the emitted radio signals to calculate the receiver's position.
MAGNETIC VARIATION	The difference between TRUE north and MAGNETIC north (See section 9 for more details)
MAP-CAPABLE GPS	Early model GPS's offered only waypoint and route navigation. All recent GPS models are map capable and can handle GPS MAPS which makes navigation much more user friendly.
OEM GPS	An OEM (Original Equipment Manufacturer) GPS uses product components from one or more other manufacturers, built into a new product that it sells under its own company name and brand.
PDA	PERSONAL DIGITAL ASSISTANT - also known by brand names such as "Palm OS" and "Windows CE".
ROUTE	A series of straight LINES connecting WAYPOINTS and offering a general navigation path to go from WAYPOINT A to WAYPOINT B to WAYPOINT C.
ROUTE NAVIGATION	Still used, but with recent map-capable GPS models ROUTE NAVIGATION is seldom utilized.
TRACK LOG, TRACK POINTS, TRACK VERTICES	A LINE recorded by GPS that follows the track or spoor that was travelled. A TRACK LOG consists of TRACK POINTS (or bread crumbs) with short TRACK VERTICES connecting consecutive TRACK POINTS.
TRACK NAVIGATION	As in following a spoor or GPS track. TRACK NAVIGATION is the only safe and environmentally conscious way to travel in remote areas.

Term	Description
TRACK RESOLUTION	An indication of the quality setting of the TRACK LOG. Track resolution is better with many TRACK POINTS. GPS models offer several TRACK LOG SETTINGS e.g. TIME (marking a track point every 10 seconds); DISTANCE (marking a track point every 25 meters) or AUTOMATIC (or RESULTION) which is the preferred setting. AUTO and MOST OFTEN gives the best quality track.
VECTOR maps vs RASTER maps	<p>The difference between VECTOR maps and RASTER maps is analogous to the difference between a word processing document and a scanned document. The word processing document is a whole lot easier to change, move words around, add new paragraphs, or run a spell checker than a scanned document. Likewise, it is much easier to modify, move, add new entities, or analyze a vector map than the corresponding scanned map</p> <p>A RASTER map is made up of 'pixels' of graphics. A VECTOR map comprises of LINES, POINTS and POLYGONS which can be edited easily.</p> <p>To create a RASTER image from a VECTOR map is easy, but to construct a VECTOR equivalent from a RASTER map is complex, time consuming and prone to accuracy errors as result of map projection, geographic datum and tracing resolution errors.</p>
WAYPOINT	A point in space. A virtual mark, pole or beacon on the ground that indicates a specific and identifiable place. The purpose is to use GPS to navigate to this waypoint or place.
WAYPOINT NAVIGATION	Using the GO-TO function on a GPS to navigate to a waypoint. Waypoint navigation is for specialised applications, for pilots, skippers and for geo-cache games. Waypoint navigation is not for serious remote travel. It is damaging to the environment, and it has caused catastrophic 'getting lost' situations in the deserts of Namibia

Overland and Off-road Travel in Africa

There are 7 critical aspects in the handbook of safe and environmentally conscious overland and off road travel in Africa.

- Communication (HF radio or satellite phone)
- Information (the many risks associated with ‘not knowing’)
- Navigation (the risks of running out of fuel)
- Water and food
- Shelter and clothing
- Vehicle and recovery gear
- Off road driving skills.

The Overland Forum website www.overland.co.za specialises in promoting safe, environmentally conscious, independent cross border travel using 4x4 vehicles. The overland community also shares travel tips, destination details and information related to kitting out 4x4 vehicles for this type of travel. The Overland Forum website has a section where detailed trip reports, submitted regularly by its many subscribers, are available for reading. In addition, there is an archive section on which searches on any topic related to overland travel can be carried out.

The website www.tracks4africa.com and its Data Community specialises in GPS assisted travel to remote Africa. The T4A User group at http://www.tracks4africa.co.za/t4a_community.asp is used for feedback and confirmation of data, communication and exchange of experiences.

The website www.madmappers.com (launched 2005.02.01) is home to possibly the best and most complete vault on scanned/calibrated paper maps and satellite imagery covering Sub Saharan Africa.

The 4-dimensional Navigation Picture

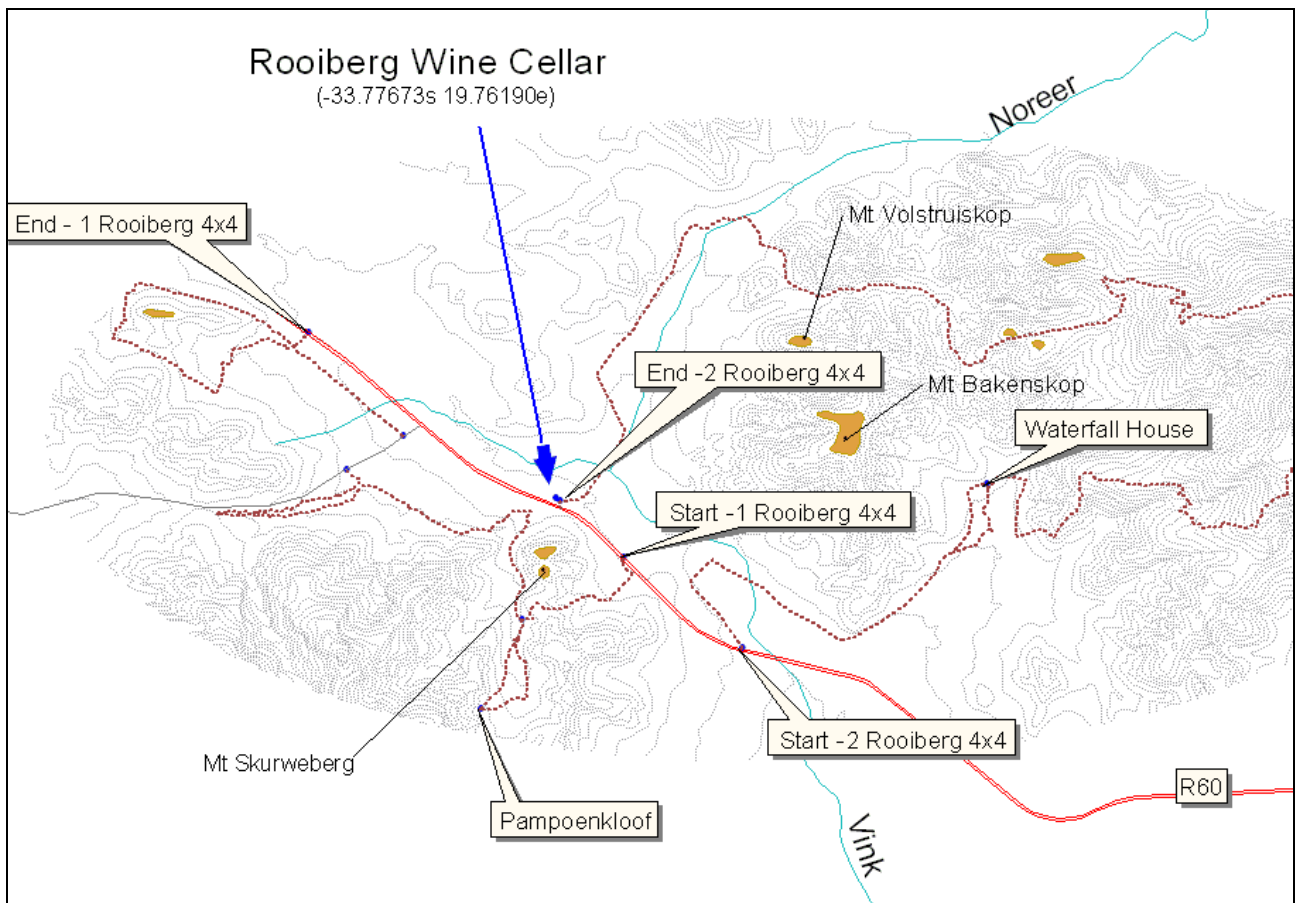
The T4A GPS maps and T4A paper maps are VECTOR maps.

Tracks and Waypoints offer a 2-dimensional navigation picture.

- Tracks (with suitable track or road names)
- Waypoints (with proper descriptions)

Geo-features add the 3rd dimension.

- Geographic features include rivers, lakes, dams, mountains, contour lines etc.



Geographic features consume a large amount of GPS memory. T4A GPS Maps will show geographic features only where it is necessary and where it enhances the

navigation picture, e.g. 20m contour lines are shown only on dangerous mountain passes and certain eco-trails; rivers that are home to riverbed tracks, etc.

INFORMATION adds the 4th dimension.

Information is the key to not expose oneself, one's travel companions and the environment to unnecessary risk. Information about roads, road conditions, security risks, the environment and the history of places must be accurate, reliable and current. It is crucial to understand the "rules of travel in Africa". Information is the key to SAFE and ENVIRONMENTALLY conscious overland and off road travel.

For example:

- To *know* not to camp near or at animal watering points (as it is the logical thing to do) in the Kaokoland (Namibia), because the Himba cattle here have adopted to feed as far as 35km away from their watering points, returning to drink every second day. This return usually happens at dawn, but often much later. Over the last few kilometres, with the smell of water in their nostrils, it becomes a stampede - often through and all over unsuspected tourist overnight campsites.
- To know not to camp near or at natural fountains (as it is the logical thing to do) in the Damaraland (Namibia), because mother rhino and baby - having walked many kilometres in the heat of desert - will not drink here, because of the presence of people. She has to now walk another 40 km to the next water hole, only to find tourists camping there as well. Baby rhino is no more. Obviously the little one couldn't keep up.
- Not to throw sweets at the village children, because it is only a matter of time before they will throw stones back at the tourists, for more or less the same reasons as it is happening in Lesotho.
- Not to pay bribes - not only because it is wrong, but because it certainly will jeopardise the safety of fellow and future travellers.
- Not to "drive wildly through villages". Self-reliant vehicle groups, geared to the teeth and speeding to the next 'advance booking' - often with little or no interest in who these people in the villages are: How do they make a living? Who calls the shots around here? Do we need to make friends here?
- Information to know the difference between "How to handle situations" and "How to avoid situations".

This INFORMATION is abundant, and can be found in many good publications, on trip reports on www.overland.co.za and on postings on the Overland Forum. Maybe it is time to define a standard for Overland trip reports.

T4A Waypoint Data

The Basic Rules.

- Stop if you want to make a waypoint. If you are not prepared to stop before marking a waypoint then rather not mark it at all. The accuracy of points made on the go can be out by hundreds of meters.
- Always ensure that you are totally confident about the details and accuracy of each recorded waypoint.
- Collect 10 or 20 valuable and accurate waypoints with proper descriptions, rather than 150 waypoints that require extensive editing later on.
- Always have a 'Waypoint Book' in the car. Mark the waypoint on the GPS, take notes next to the number that the GPS unit assigns to it, and leave the description editing in the GPS unit for later. Always note these details at the time you record the waypoint – never leave it till later.

Criteria for T4A waypoints.

- Waypoints must complete the navigation picture. They must explain the road/track and condition of the road/track and potential danger ahead.
- A waypoint must add value – it must make sense and have meaning to more people than just the creator thereof. Meaningless waypoints are of the type “Two lions mating”; or “Hit rabbit on road”; or “Lost spare wheel here”; or “Stop en ons ry nou voor”.
- Waypoints must communicate. They must inform you of the following:
 - Where to find interesting places, fauna and flora, etc.
 - Where the road or tracks are bad, and how bad it is
 - Where a fuel stop is
 - Where to find drinking water
 - Where is a safe place to sleep tonight
 - Where to buy good meat and biltong, where the super market is
- It is the task of Contributors to submit waypoints with as complete and specific DESCRIPTIONS as possible. It is the task of the Data Management team to edit/reduce these descriptions to fit the limitations of GPS's.

Editing your waypoints

Most GPS and mapping software systems provide waypoint fields for a NAME and a COMMENT/DESCRIPTION. When marking a waypoint, the GPS will usually automatically allocate a 'waypoint number', which is stored in the NAME field. It also automatically stores the time stamp (date & time) in the COMMENTS (or DESCRIPTION) field.

- T4A will not use the 'NAME', but it will be stored as a Contributor reference. The reason for this is that the names of waypoints must be unique in the T4A "data vault". Thus, all waypoints are assigned a regional + numerical value by the Data Management team, which guarantees that these values will be unique and comply with GPS import capabilities.
- T4A requires a complete waypoint description, which will be stored in the COMMENT (or DESCRIPTION) field. In order to do this effectively and to reduce errors, etc., a few simple steps/rules:
 - When recording the waypoint, remove the time stamp which is stored in the COMMENT (or DESCRIPTION) field, and type in a complete waypoint description compliant with the criteria explained above.
 - Waypoint descriptions must be in mixed case. "THIS IS NOT A GOOD WAYPOINT DESCRIPTION", and "this is not a good waypoint description" - but "This is a good waypoint description".
 - Verify (verify, verify, and verify again) the spelling of towns, villages, resorts, etc. before submitting them. Many mistakes have come about as a result of 'quickly' jotting down the name and not double checking it.
 - It will be nice (but it is not a requirement) if a suitable waypoint SYMBOL can be added. For example, an intersection would be a "Waypoint" (default on most GPS's), and a Petrol Station would be a "Gas Station".
 - Do not concoct waypoint descriptions by adding information like contact details, telephone numbers, recommendations and opinions. Please keep this in a separate file and submit this to the T4A Data Warehouse. Here it will be processed in the T4A POI (Points Of Interest) list, which is searchable on most GPS models. Additional information should include - if possible - contact details, telephone number, e-mail addresses, web sites, and what it is. (Don't just tell us "John's" - is it a restaurant, a pub, a petrol station, a scenic area, etc.)

The Wrong Way

The 'Waypoint Properties' dialog box shows the following fields and values:

- Name: En-pet
- Symbol: [Red dot icon]
- Position: 533.96320 E18.85105
- Altitude: [Empty] m Unknown
- Depth: [Empty] m Unknown
- Proximity: [Empty] km Unknown
- Temperature: [Empty] °C Unknown
- Comment: [Empty]
- Display: Symbol & Name
- Date Modified: Unknown
- Link: File/URL: [Empty] Browse...
- Categories: [List of 9 categories, all unchecked]

The Right Way

The 'Waypoint Properties' dialog box shows the following fields and values:

- Name: PM0001
- Symbol: [Fuel pump icon]
- Position: 533.96320 E18.85105
- Altitude: 143 m Unknown
- Depth: [Empty] m Unknown
- Proximity: [Empty] km Unknown
- Temperature: [Empty] °C Unknown
- Comment: PM Fuel stop Engen 24h
- Display: Symbol & Name
- Date Modified: Unknown
- Link: File/URL: [Empty] Browse...
- Categories: [List of 9 categories, all unchecked]

Note the proper waypoint description and suitable symbol!

Categories – Use of and Descriptions

Currently, the Waypoint Categories are not stored inside the .GDB file in any way. These are stored on the local user's computer in the registry, and are meaningless if not communicated through to T4A Data Management.

Should you decide to use categories at this point in time, they are for your own edification and clarification only. As not all users submit data using MapSource®, it is not possible to make this part of the submitting dataset.

The waypoint language policy.

T4A waypoints must be in the English language and it must be free of spelling errors.

T4A Data Management does not always have the time or the skills to properly edit waypoint descriptions - it is a simple 'copy and paste' operation from data submissions. Consequently, the T4A waypoint data set is riddled with spelling mistakes. If you spot such errors, please report them by creating a waypoint at the same location and providing the correct spelling or description.

Waypoints must be in mapping software data format.

T4A prefers waypoint data in mapping software files such as MapSource®, Oziexplorer®, GPSTM®, Fugawi®, TTQV® and others. Waypoint data processed and submitted in spreadsheet or text editor formats will not be taken up in the T4A Data Warehouse, but it will be kept for reference and validation purposes.

Waypoint Coordinate Standard.

The GPS unit can be set to display position data in various formats, the most common ones being "degrees, minutes, seconds" format (hddd mm ss.s), "degrees, decimal minutes" format (hddd mm.mmm) or "decimal degrees" format (hddd.ddddd). The setting on the GPS has no effect on the track logs or waypoints you collect.

Typically, it would make sense to set the GPS to hddd mm ss.s, if you need to plot your position on a 1:50,000 or 1:250,000 Surveyor General Map. The T4A data warehouse, however, maintains waypoint data in the **hddd.ddddd** standard, which is the GIS standard.

If waypoints data (and coordinates) are communicated in text on emails and Overland trip reports, it is best to publish this data in the hddd.ddddd data format as well. The two main reasons for this recommendation are to avoid the possible confusion associated with the hddd mm ss.s and hddd mm.mmm formats, and to maintain accuracy.

To illustrate accuracy calculations, let us convert minute and second coordinate systems to **hddd.ddddd**:

- $00^{\circ} 00' 00,1'' = 0.000028^{\circ}$ ie 2.8 times more than 0.00001°
- $00^{\circ} 00.001' = 0.000017^{\circ}$ ie 1.7 times more than 0.00001°

Further, let's consider the Earth as being a perfect sphere. By using the following great circle formula for distances ($\text{distance} = \text{acos}(\sin(\text{lat1}) \times \sin(\text{lat2}) + \cos(\text{lat1}) \times \cos(\text{lat2}) \times \cos(\text{lon1} - \text{lon2}))$), and remembering that 1 nautical mile is equivalent to one minute along the 0° latitude and along all longitudes, and that 1 nautical mile = 1,852km, we find that 0.00001° is equal to:

- 1.11m along the equator, and along all lines of longitudes,
- 0.94m along the 30° latitude,
- 0.67m along the 52° latitude

(In reality, these distances are slightly different, as the earth is not a perfect sphere)

Recommended settings:

- Set GPS to whatever coordinate format is preferred.
- Set your mapping software to **hddd.ddddd**
- Use at least 5 decimal places when entering waypoint data, or doing calculations.

T4A Classification of WAYPOINTS.

T4A waypoints are classified in the following five categories, with different waypoint TYPES in each category.

- ROAD MARKERS (RM's);
- PLACE MARKERS (PM's)
- LAND MARKERS (LM's)
- WATER MAKERS (WM's)
- QUALITY CORRECTIONS (or Recordings) (QR's)

The waypoint TYPE is used primarily to know what waypoint SYMBOL to use on T4A maps.

Category: ROAD MARKERS

RM BORDER CONTROL	Border control gates
RM CATTLE GRID	Also known as "motor grids". See S26.33590 E16.54393
RM GATE ENTR CONTROL	Entrance gates to National Parks, Natural Reserves, and Destinations - where you pay to enter ...
RM GATE LOCKED	Locked gate, with chain and lock, for which a key must be arranged for unlocking
RM GATE UNMANNED	Farm gates (irrelevant whether they are open or closed). Also 'Donkey Gates' or 'Bekslaners'
RM R/CROSS /BRIDGE	Bridge / Low level river crossings / ferries
RM RAIL CROSSING	Railway crossings
RM ROAD BLOCK	Police/Military/Road Safety or Vet control/check points
RM ROAD JUNCTION	General road marker. Jct W=Nelspruit E=Komatipoort
RM TRACK MARKER	Specific track markers e.g. 4x4 trails etc.
RM SPEED TRAP	No comment
RM TOLL GATE	Toll gates/pay points on major roads/highways
RM TRAIL START/END	Trail starts/end Hiking trails, 4x4 trails, Routes

The following waypoint notation for RM ROAD JUNCTIONS is important:



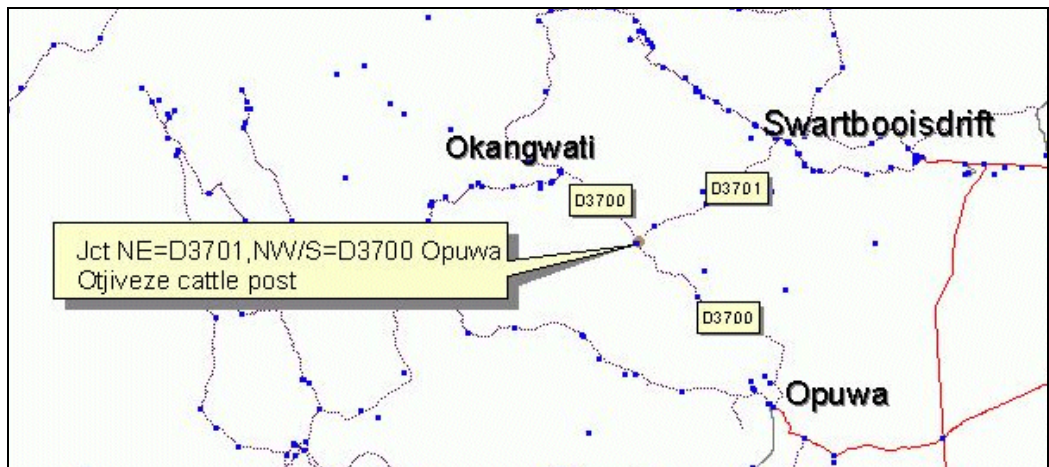
Waypoint **“Jct NW/SE=C39,NE/SW=Huab river bed”** indicates the swing of the roads. When stopping at this junction, the C39 road runs from North-East to South-West, whilst the Huab river bed track runs from North-East to South-West.

Waypoint **“Jct W=Desolation valley, S=Ugab camp, N=Huab river”** indicates the direction of tracks/roads to specific places.

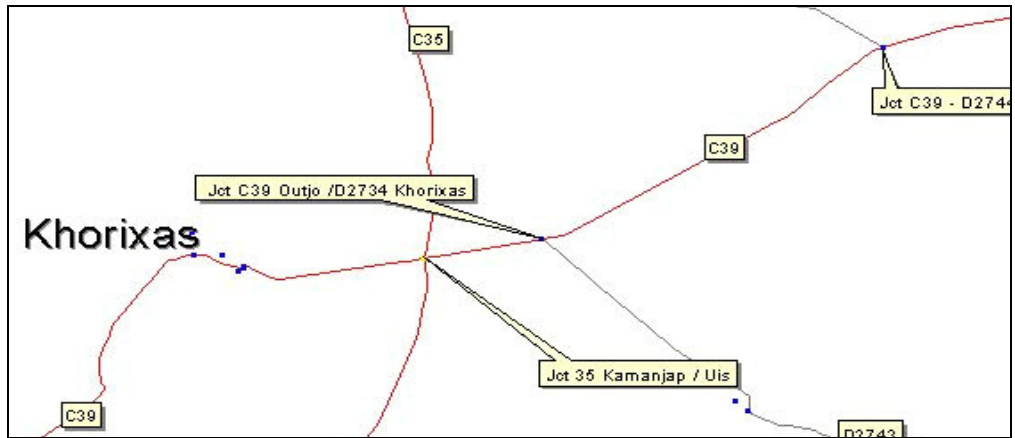
In both cases, these waypoint notations provide an accurate description of where the user would be heading if taking any of the available directions from the junction.

However, a waypoint describing a junction as **“JCT R59 R21”** is almost useless.

RM ROAD JUNCTION waypoint is very important for off-road trails in remote areas, because there are often no sign posts at these junctions.



However, RM ROAD JUNCTION is not important for established well maintained main arterial roads and highways which usually have proper road signs. Besides, the GPS



will display road names anyway. The following RM ROAD MARKERS waypoints can in fact be dropped.

Category: PLACE MARKERS.

There will always be ambiguity between PLACE MARKERS and LAND MARKERS. The basic difference is as follows:

A PLACE MARKER (PM) is where one could expect to find a willing and able human being providing services and products. The Savuti Airstrip is a LM, whilst JHB International Airport is a PM.

PM AIRPORT	Johannesburg International Airport
PM BANK ATM	ABSA bank Oudtshoorn
PM CAPITAL CITY	Cape Town / Windhoek / Mbabane / Pretoria
PM CHURCH	The old church in Graaff-Reinett circle
PM FUEL STOP	Fuel stations
PM GOLF COURSE	The parking area of Golf courses
PM LODGE/HOTEL	Hotels / Lodges / Guest houses
PM MEDICAL	Medical facilities / Hospital / Clinic / Doctor
PM PERSONAL MARK	Personal waypoints, e.g. Home of mother in law
PM PLACE MARK	A place where you will find a willing and able human being
PM POLICE/RESCUE	Police station /SOS phones / Security services
PM POST OFFICE	Post Office
PM RESIDENCE	Farm residences
PM REST CAMP	Formal rest camps with shower and other facilities.
PM RESTAURANT	The Steers restaurant in Oudtshoorn / Swartruggens bar
PM SHOPS/SERVICES	Shops and Services
PM TOURIST ATTRACT	The Cango caves in Oudtshoorn / Table mountain cable car
PM TOWN/CITY	George / Grootfontein / Kang / Graskop

Category: LAND MARKERS.

LM AIRSTRIP	The air strip near Savuti
LM ANIMAL WATERHOLE	Leeupan waterhole in the Kaudom, Namibia
LM LAND MARK	Vingerklip near Xhorikas Namibia
LM PICNIC / REST	Picnic spot / Overnight bush camp / Unmanned 4x4 rest camps
LM VIEWPOINT	Scenic lookout points
LM WATERING POINT	Water well / Hand pumps / Wind pumps

Category: QUALITY CORRECTIONS (or Recordings).

QC WAYPOINT	The corrected position for a particular PLACE
QC ROAD	A road has deviated from a previous recording. For example, the A1 in Botswana is now more to the west. A QR was taken where the old road is closed, and where the new road has an intersection joining the old road.

Waypoint NAME and waypoint DESCRIPTION

Mapping software provide for NAME, DESCRIPTION/COMMENT and SYMBOL.

Because different mapping software systems employ different symbol sets, T4A cannot standardize on any of these. It is therefore advised that members devise their own waypoint 'symbol' system, but then use this consistently.

Waypoint 'symbol' is not used by T4A data administrators to identify waypoint type, the administrator must be able to read the type from your waypoint description.

Waypoint DESCRIPTION/COMMENT is the most important information provided for a waypoint. It must describe the waypoint COMPLETELY. For example, do not assume because you assigned a lodge symbol to your waypoint that the data administrator will read this type in conjunction with your description.

Waypoint 'name' is your personal waypoint 'name' and it is kept in the Data Warehouse as member waypoint reference number.

It is advised to use some sort of standard in naming waypoints.

This permits you to quickly find a point again in the future in your own collection of information (amongst the hundreds you will collect 😊), and also ensures that you don't accidentally overwrite a waypoint at some time in the future.

It also allows quick and easy grouping of waypoints using just the names.

The COMMENT or DESCRIPTION field must be used to correctly and accurately describe the point of interest.

The following are just suggestions. (When you submit your data and you use different ones than these, please explain your naming and selection of Waypoint Symbol or icon.)

(The xx or xxx is replaced by 01 – 99 and 001 to 999)

Name	Description	Symbol
JCTxxx	A junction of two or more roads	Trailhead or Waypoint
FUELxx	A Fuel station – please indicate in the description the types of fuel available (e.g. Leaded, Unleaded petrol, Diesel) as well as fuel quality and the petroleum company (e.g. Shell, Mobil, Engen, etc).	Gas Station
FOODxx	A place to buy food and supplies. Indicate in the description field as to range, selection and quality.	Convenience Store Fast Food Restaurant Etc.
TOWNxx	A town, village, settlement. PLEASE ensure the spelling of the name is correct. Please take waypoints of the outskirts when entering and leaving, if the boundaries are obvious, i.e. two waypoints per town. This gives an accurate size of the town, village or settlement. If this is not possible and if the town is centered on an intersection take the waypoint AT this intersection. Alternatively, ‘guestimate’ the geographic centre and mark the waypoint there. Include in description whether Settlement, Village, Town, etc.	Depending on size City – Small City – Medium City – Large
MECHxx	A place where mechanical repairs can be made to a vehicle or trailer. Please describe the abilities of this shop such as: Full Capability, Average, Minor, Limited.	Car Repair
QRxxxx	A correction of data currently on the T4A map. Please describe the correction fully, and indicate which version of T4A you are comparing it to.	Circle with X or a symbol that has an ‘x’ in it.

The above are just some examples. From these you should have a good idea of how to name your waypoints. Remember, the name will not be used in the T4A Data Warehouse, but it serves as an easy link back to your data should the T4A Data Administrators have a question.

Do not submit your data, and then CHANGE your descriptions, names or symbols afterwards. This will create a ‘misunderstanding’ should a discussion need to take place about a particular waypoint.

Do not submit your data twice, once raw, and once edited. This creates extra work for the administrators who already have a massive load of work to do.

Special note on Wild or Bush Camping:

En route over night stops or wild/bush camping is often unavoidable. T4A does not recommend this form of overnight for reasons of safety and possible harm to Environment.

Where ‘wild camping’ is done in close distance away from formal PM REST CAMPS please do not submit waypoints for them. Where such wild camping is done next to T4A roads/tracks we request that the waypoint be submitted as LM PICNIC/REST.

T4A Track Log Data

There are only three criteria for T4A track log data.

- Accuracy and resolution quality
- Accuracy and resolution quality
- ACCURACY and RESOLUTION QUALITY

It must be possible to navigate a T4A track in the dark of night, in the middle of the African bush, using only headlights.

Track navigation is the only safe and environmentally conscious way to navigate the bushes and deserts of Africa.

The Quality Culprits of Track Log Data.

There are a number of culprits which cause poor, bad or useless data being recorded:

- **Incorrect GPS settings**, and specifically playing with different “Track-log-recording” settings. Set the record method to ‘Resolution’ with interval ‘Most Often’. The naming convention may vary on different models.
 - Newer GPS’s have a setting which is “Automatic”, and within that one can usually select the level of accuracy. The preferred setting for this is “Most Often” or “More Points”.
 - Older GPS’s (such as the Garmin III+) do not have this setting. In this case, use “RESOLUTION”, “FILL” (not wrap or overwrite), and set the RESOLUTION to 20 to 50 Meters.
 - It must be noted here, that having a high quality setting, such as those shown above, will not result in using up all your track point capacity on a straight road. The GPS will remove those points that are in line with each other (and in the case of the older units, have not wandered more than xx meters from a straight line).
- **Map setting “LOCK ON ROAD” is the most common quality culprit.** It must be switched OFF at all times. On some of the newer GPS models this function is switched on automatically when using the ‘GO-TO Point navigation’, so please check this setting on your GPS and determine when it turns on and off. If it turns on in certain situations, recognize these and switch it back off.
- **“WAAS Enabled”** must be switched OFF at all times. WAAS is not available in Africa.

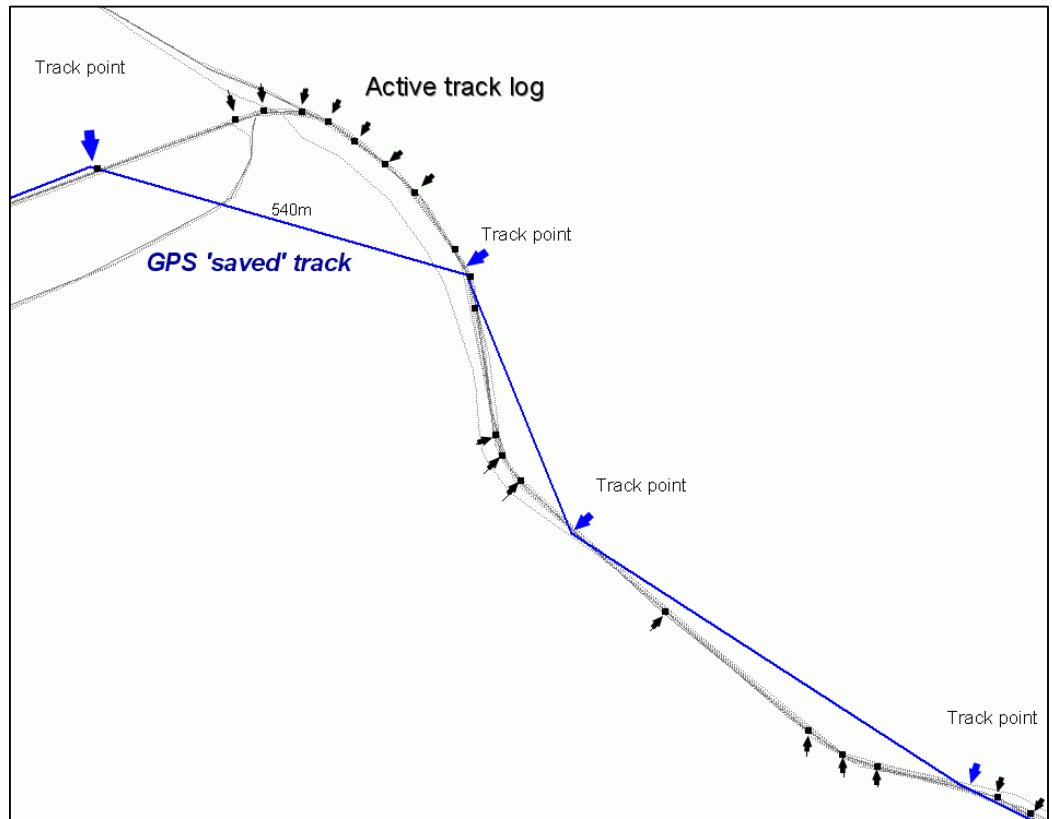
- Some GPS's need to 'wake up' in the mornings. If not, they record tracks with an off-set for the first 10km or so. It is good practice to 'Double start' your GPS in the mornings: Switch it on, let it find the satellites, switch it off and then on again.
- **Badly mounted GPS**, or held by hand. Mount it on the dash and as far to the front as possible. At best get an external antenna.
- **REDUCED track log data when saving the 'Active track log' on the GPS.** (See below). 'ACTIVE TRACK LOG' data is high quality data - 'SAVED TRACKS' is bad quality data.
- Track log spilling because of **shade trees**. A problem with older models. Switch your GPS off when stopping under a tree/shelter.
- **Forgetting about your GPS.** For security reasons you may want to hide your GPS from sight when parked in certain areas, do not forget to take it out when you resume your travels!

Saving your ACTIVE TRACK LOG data

Your GPS has two independent track log storage areas, i.e.

- ACTIVE LOG DATA - typically a maximum of 2,500 track points, some later units up to 10,000
- SAVED LOG DATA - typically a maximum of 10 saved tracks with a maximum of 250 points per track (it is usually 10% of the active track points). If you save a 100% full 'active track log' (say 2,500 track points) it will reduce the track to 250 track points before saving it. IT WILL THROW AWAY 1,750 HIGH QUALITY TRACK POINTS.

The QUALITY difference between 'Active track log' and 'Saved track log' is explained in the graphic shown below. The GPS 'saved' track is still accurate (i.e. the track points are



spot on) but its quality (or resolution) has been destroyed.

Active Log data

When the Track Logging feature is activated the GPS records all track data into the ACTIVE LOG memory - including the Lat/Long position and a time/date stamp for each track point.

This ACTIVE LOG DATA is the highest possible quality data (the frequency of track point recording is controlled by the "Track-log-recording" settings as discussed above.)

The Active Log storage memory typically has a capacity of 2,500 track points, but some of the new Garmin receivers have a capacity of up to 10,000 active track points.

Each time you switch of the GPS, or it loses track of the satellites because of a poor signal, it will begin recording a new Active Track. There seems to be no limit to the number of Active Tracks that can be recorded - they will be numbered ACTIVE LOG 001, ACTIVE LOG 002 etc - but the total number of points in the Active Log(s) cannot exceed the GPS Active Log capacity.

You will only see this breakup of the tracks after the information has been downloaded to mapping software, such as MapSource. This is essentially a result of the GSP putting down a 'Start' marker each time it reacquires the satellites.

Saved Log data

When you save the Active Log data it is transferred from the Active Log memory to the Saved Log memory.

When the data is transferred to the Saved Log memory, all the Active Tracks (ACTIVE LOG 001, ACTIVE LOG 002 etc) are merged and saved as one track. What is more, is that the active track log being saved will be 'compressed' or 'reduced', and the time stamp is discarded (from 2,500 to 250, from 3,000 to 300 or 10,000 to 1,000 depending on the unit).

The obvious consequence here is that the quality of the data will be severely compromised.

For instance, 90% of the track points will be discarded if the Active Log is 100% full when being saved. This will produce a track log with rather poor quality/resolution, and it will be rejected by the T4A Data Warehouse.

If the Active Log is saved when only 30% full, only 20% of the track points will be discarded - this track would probably meet T4A requirements

Acceptable Saved Log Data

The T4A Data Warehouse prefers to get Active Track Log data (best resolution plus the time stamp) but Saved Log data **MAY** be acceptable to the T4A data warehouse if :

- The Active Track log is saved when it is no more than 20 – 30% full. The GPS will not tell you how many points are in the Active Log, but it does give an indication of the percentage of available memory used. For a Garmin 76, (capacity = 10,000 points) 2,000 track points = approx 20% full. If the log is saved when it is only 10% full (10,000 x 10% = 1,000) you will not lose any track points during compression but you will lose the Time stamp - so if at all possible, your data should be kept as an Active Log.
- If you save every time the Active Log reaches 10% full you can log up to 10,000 track points without any compression loss as follows:
 - 10,000 track points of saved data (10 x 1,000) but you will lose the stamp on this data
 - 10,000 track points in the Active Log

Record only specific sections of road

Please note: Only do this if you do not have the means to download from the GPS to another device and you do not have enough track point capacity for your trip.

Using only the Active Track log, and record only specific tracks/roads which are missing from T4A Maps, or for which the quality needs improvement. This can be done by switching the 'Track record' function ON or OFF.

Note that some GPS units (like the E-map) cannot switch the track record function on or off. This unit records Log data regardless of your settings.

Solving the Quality Problem.

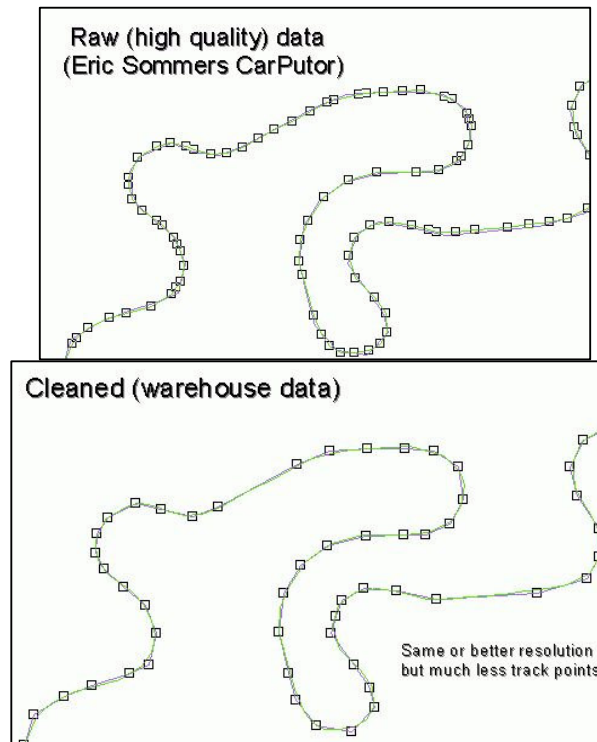
- Use a **well-mounted external antenna**. This is a MUST when travelling in tropical Africa or the mountains of Lesotho.
- Get a **DATA LOGGER** linked to your GPS if at all possible. It can record track points every second for 3 to 4 weeks.
- **Take along a laptop computer** (a major hassle) loaded with moving map software such as Garmin Mapsource, Ozi, GPSTS and Fugawi, that will act as a data logger.
- Alternatively take a "PDA (Palm PC, IPAQ) & GPS solution", or go the CarPutor route.

Data Warehouse Requirements.

The T4A data warehouse accepts only UNTOUCHED, RAW and UNEDITED track data. Editing/manipulating tracks destroys the "time-stamp", altitude and speed.

The T4A data warehouse prefers ACTIVE TRACK LOG data.

T4A will not accept or process manually prepared data. It must be recorded by the GPS and downloaded from the GPS or an alternative recording device (as in 5.4 above - data logger or laptop etc).

Data Cleaning and Warehousing of Data.

TRACK LOG DATA REDUCTION (also called TRACK FILTERING or TRACK RENDERIZING) is a quality crime that may ONLY be committed by the T4A data warehouse. The rule is simple:

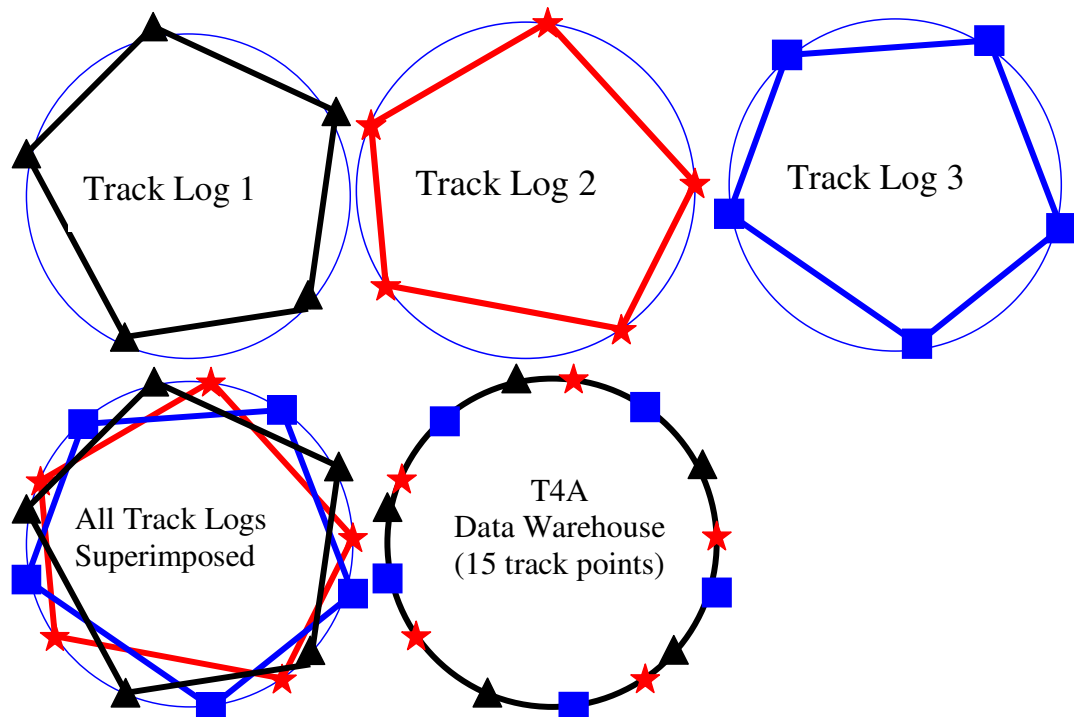
OPTIMUM TRACK ACCURACY WITH MINIMAL TRACK POINTS

Improving Track Log Resolution/Quality.

The only way to improve data quality is to compare existing data with newly recorded data. The notion of “I did not record track data on this track because T4A has it” is wrong: multiple recordings enable T4A to know where the roads/tracks go, and most importantly to improve data quality.

The principal is best explained with an example: Three high quality independent track logs are recorded with each vehicle following the same circular track. Each track log recorded five track points:

Please submit all data to T4A regardless of your perceived quality of the recording.



The T4A Data Warehouse now has 15 track points for this circle, made possible by 3 different track logs.

Your data is needed not only to improve track data quality, but also to determine the faith travellers can have in existing roads/tracks. If an off-road track on the Makgadikgadi Pans in remote Botswana is not re-recorded every 3 years, the existence of this track on T4A Maps should be questioned.

T4A Classification of ROADS/TRACKS.

T4A roads/tracks are classified according a) mode of transport and b) average traverse speed in km/hr. The following road/tracks CATEGORIES apply:

FREE WAYS	83 km/hr
ROADS	64 km/hr
STREETS	28 km/hr
OFF ROADS	13 km/hr
BIKE TRAILS	18 km/hr
HIKING/MTB TRAILS	4 km/hr
BOAT TRACKS	26 km/hr

In each CATEGORY there may be one or more road/track TYPE, used primarily to display different line styles on T4A Maps.

In addition to TYPE (to indicate suitable line styles) road/track NAME can be used to display Road names, street names, 4x4 trail grading and track conditions/legal requirements such as 'Illegal', 'not recommended', 'dangerous', 'guided' etc.

Category: FREE WAYS

01	National Freeway
02	National Road
03	Main Road

Category: ROADS

05	Other road
----	------------

Category: STREETS

04	Metro road
06	Street (main)
07	Street
08	Private road

Category: OFF ROADS

09	4x4 track (main)
10	4x4 track
11	Riverbed track

Category: BIKE TRAILS

12	Bike trail
----	------------

Category: HIKING/MBT TRAILS

14	Bike track
15	Hiking trail

Category: BOAT TRACKS

13	Boat track
----	------------

Submitting Your Data

How do I send my data to T4A?

Always send UNTOUCHED, RAW, UNEDITED track data. In other words, download from the GPS to PC or Laptop, and send in each file as you have downloaded it. Name each file according to date and roughly where you recorded it, as this will help for referencing purposes.

Editing track data destroys TIME STAMP, ALTITUDE and SPEED.

Where do I send my Data?

Send your data submissions via e-mail to newdata@tracks4africa.co.za

Verification and Confirmation of Data.

The T4A Forum http://www.tracks4africa.co.za/t4a_community.asp

This is a discussion forum designed to assist those with questions on how to use their GPS, what settings, discussions of quality issues, upcoming courses, etc.

Corrections and Updates to this document

Any errors, omissions, suggestions to this document should be sent via email to sales@tracks4africa.co.za describing in detail the error, omission or suggestion.