Broadland Flood Alleviation Project

Protecting

Land Survey with use of GPS Technology

Broadland

WHAT IS GPS?

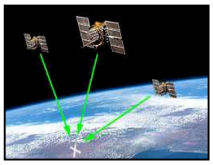
The Global Positioning System (GPS) is a world-wide radio-navigation system formed from a constellation of 24 satellites and their ground stations.

It was built in 90's by U.S. Department of Defence to provide a super precise positioning system for its military for just $12billion.

"Man-made stars" are the reference points to calculate positions accurate to within 10 millimeters.

HOW GPS WORKS?

The whole idea behind GPS is to use satellites in space as reference points for locations here on earth. By very, very accurately measuring our distance from at least three satellites we can "triangulate" our position anywhere on earth.



To "triangulate", a GPS receiver measures distance using the travel time of radio signals to satellites. To measure travel time, an accurate timing is the key.

Satellites are extremely accurate because they all have atomic clocks on board. Receiver clocks on earth do not have to be as accurate because an extra satellite range measurement can remove errors.

Along with distance, we need to know exactly where the satellites are in space. The basic orbits are constantly monitored by the U.S. Department of Defense who use precise radar to check each satellite's altitude, position and speed.

The errors are caused by gravitational pulls from the moon and sun and by the pressure of solar radiation on the satellites. These are usually very slight but if we want great accuracy they must be taken into account.

Finally a correction is made for any delays the signal experiences as it travels through the atmosphere.

DIFFERENTIAL GPS

Differential GPS involves the co-operation of two receivers, one that is stationary and another that is roving around making position measurements.

The stationary receiver is the key. It ties all the satellite measurements into a solid local reference.

Trimble Base Station at Haddiscoe Island

The satellites are so far out in space that the little distances we travel here on earth are insignificant.

So if two receivers are fairly close to each other, say within a few kilometers, the signals that reach both of them travel through virtually the same slice of atmosphere, and so have virtually the same errors.

HOW DIFFERENTIAL GPS WORKS?

The idea is simple. We have to put the reference receiver on a point that has been very accurately surveyed and keep it there.

This reference station receives the same GPS signals as the roving receiver but instead of working like a normal GPS receiver it attacks the equations backwards.

Instead of using timing signals to calculate its position, it uses its known position to calculate timing. It figures out what the travel time of the GPS signals should be, and compares it with what they actually are. The difference is an "error correction" factor.

Since the reference receiver has no way of knowing which of the many available satellites a roving receiver might be using to calculate its position, the reference receiver quickly runs through all the visible satellites and computes each of their errors.

The receiver then transmits this error information to the roving receiver so it can use it to correct its measurements.

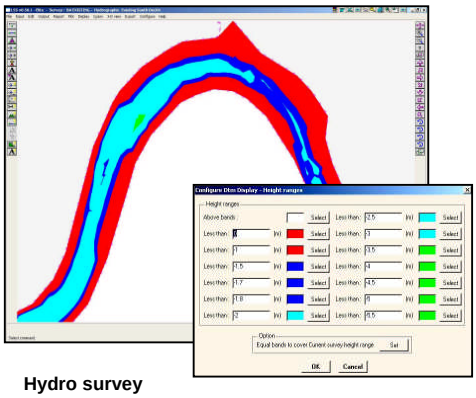
Trimble Roving Station

PRACTICAL APPLICATIONS OF GPS TECHNOLOGY - HYDROGRAPHIC SURVEY

A full hydrographic survey of the Broads Rivers has been carried out in partnership with the Broads Authority.

This information will allow monitoring sediment transfer when sheet piles are removed as part of setting back the banks.

The Broads Authority are using the information as part of their sediment management strategy to identify areas and assess quantities for river dredging.



Hydro survey

Hydro-boat

Hydro-kit

Broadland Environmental Services Limited

Working in partnership

Environment Agency

Broadland Flood Alleviation Project

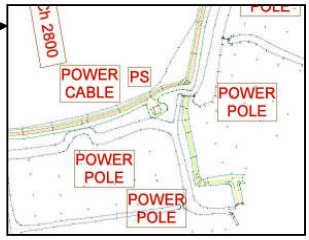
Protecting

Land Survey and Floodbank Design

Broadland

LAND SURVEY

EXISTING SURVEY
The ground level survey shows existing bank profile, folding and limits of soke dykes and ditches.

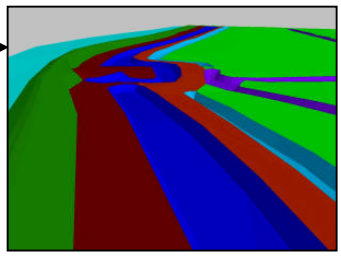


GROUND MODELING WITH LAND SURVEY SYSTEM (LSS)

LSS is a powerful complete land survey, terrain modelling, volumetric, design and visualisation package. It is developed by McCarthy Taylor Systems Ltd and is well respected amongst engineering and survey professionals as the system of choice for modelling and design.

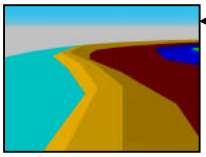
LSS is a system capable of importing a wide range of 3D data, including raw land survey information from EDM or GPS instruments, CAD systems and user-definable co-ordinate formatted data.
LSS then immediately produces a triangulated terrain model, which can then be queried, viewed, manipulated and designed through.

Provides a comparison survey to Proposed Survey for earthworks quantities. It also includes assumed invert depths of the existing soke dykes.



DESIGN CRITERIA
Crest Level
Crest Width
Slope Gradients
Folding Width
New Soke Dyke Depth

CREATE CROSS SECTIONS
Chainage identified along the length of bank. Allows to plot cross sections along desired section of floodbank

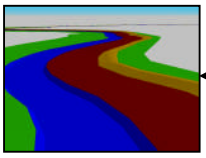


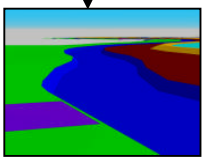
DESIGN OF NEW FLOODBANK

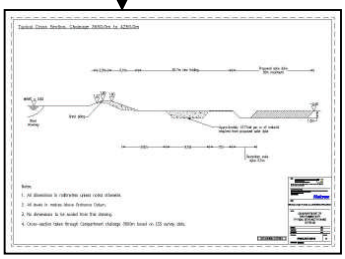
CALCULATION OF WIDTH AND DESIGN OF NEW SOKE DYKE

LSS DRAWINGS

AUTOCAD DRAWINGS







FINAL DESIGN

LANDOWNERS SURVEY
Allows to identify areas of each of the landowners and to generate cumulative area totals for use for land compensation.

ZONAL SURVEY
Enables breakdown of LSS surveys into areas by solution, i.e. Setback or Strengthening.

LAND PARCELS SURVEY
Allows to identify areas of each of the land parcel and to generate cumulative area totals for use for habitat change negotiation usually in SSSI areas.

SETTING OUT WITH USE OF LSS DATA

PROPOSED HABITAT SURVEY
Enables breakdown of Proposed LSS surveys into areas by habitat, e.g. Folding, Grazing Marsh etc. to facilitate calculation of compensation when compared with Existing Survey.

LSS REPORTS

LAND COMPENSATION

HABITAT CHANGE

EARTHWORKS QUANTITIES

Broadland Environmental Services Limited

Working in partnership

Environment Agency