GIS & Access to the Countryside

Geographical Information Systems & Rights of Way

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COUNTRYSIDE COMMISSION

Proceedings of a workshop held at
the City Discovery Centre, Milton Keynes
on 8 June 1995

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GIS and Access to the Countryside

Geographical Information Systems and Rights of Way

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Contents

GIS AND ACCESS TO THE COUNTRYSIDE: AN INTRODUCTION TO THE ISSUES

John Hill

Countryside Access Manager, Cornwall County Council

I am here today as a Countryside Access Manager but also as a member of the County Surveyors' Society's Countryside Working Group and as the current chairman of the South West regional meeting of that group. I aim to bring a little of each of those jobs into today's discussions.

Despite the fact that I have been involved in the management of public rights of way for more years than I care to admit to, I am far from being a 'Luddite'. I welcome change and I enjoy the challenge of change, provided that it allows me to do my job more efficiently and more effectively.

Among the many other changes affecting our working lives at present, GIS is one which appears to have affected the work of public rights of way sections universally. It seems that just about every highway and surveying authority in the land is engaged in the development of a GIS system, to assist in some aspect of its public rights of way function. In Cornwall it all started some years ago.

GIS AND CORNWALL COUNTY COUNCIL

The maintenance and protection of public rights of way, in Cornwall, is divided between two managers; responsibility for the definitive map for the county rests with me. I am responsible for bringing the definitive map up to date, to record the legal events which have taken place since the map was first published in 1968 and to keep the map under continuous review.

The Council anticipated the time when the map would be subject to regular and frequent change and we realised that the plastic transparencies, from which copies of our map were produced, would not cope well with the constant erasures and additions which we foresaw. We decided, therefore, to explore the digitisation technology which we had heard about and which, we understood, would allow us to make changes to the map more easily.

With a computer engineer and a legal assistant I visited the offices of Somerset County Council, where a start had been made on the digitisation of definitive maps. We were soon satisfied that the future of our definitive map lay in the use of this new technology. When the Transportation Committee was persuaded to invest in a digitising table and to appoint two new members of staff

to digitise the existing map, we did not foresee the problems which lay ahead. I believe that Somerset abandoned its early attempts at digitisation and made a fresh start, some years later, using different technology.

We digitised our rights of way network directly from the original definitive map transparencies, fixing the position of each map, on the digitising table, by setting the Ordnance Survey grid co-ordinates of the corners of each sheet and then painstakingly tracing the line of each path with the digitising mouse.

Programmes were written to allow the paths to be labelled with their appropriate numbers, to instruct the electronic plotter to use the prescribed symbols and even to calculate the total lengths of paths by parish and by district. For the first time, in my experience, we had reliable figures of the lengths of the various parts of our public rights of way network. It seemed that the 21st century had arrived -- about twelve years early!

At that time the idea of readily available digitised Ordnance Survey data was something for the future. We planned to produce our definitive maps by plotting the digitised public rights of way data onto paper prints of 1:10,000 Ordnance Survey sheets, which we would feed through the plotter. The terms 'paper stretch' and 'localised distortion' became commonplace in the office at that time (together with a few non-technical expressions) as our computer engineer struggled with programs to spread the distortion proportionately over the entire sheet of the print, in an effort to achieve an acceptable degree of accuracy and also to persuade the equipment that it must use the prescribed symbols.

Through all of this we were finding that the accuracy of the original digitised data was suspect, and we were constantly seeking ways of electronically comparing the data with the original information, to avoid the need for painstaking visual comparison of the digitised map with the original maps.

But the GIS technology revolution was now well under way and our digitisation table was far from being state of the art technology. The talk now was of digital base maps, first raster scanned and then vector. Many counties, it seemed, were now scanning definitive map data directly into processors and developing GIS maps purely as management tools.

Were we, in Cornwall, too early into the field of GIS? Did we perhaps spend a lot of time using relatively early technology when we would have been wiser to have waited a few years for technology and techniques to develop? Did anyone realise just how quickly the technology would develop and, perhaps more importantly, how quickly other agencies, such as Ordnance Survey, would embrace the new technology? The widespread and rapid availability of digitised Ordnance Survey map data was really one of the keys to the map based IT revolution.

I feel that we were right to enter the arena when we did. The early work which we carried out in digitising our rights of way network was not wasted. When raster (and later vector) maps were installed onto our GIS system, the digitised data was relatively easily added and we were then able to edit the data, on screen, to ensure an accurate marriage with the digital base maps.

The question as to whether we were right to launch into the digitisation of our definitive map is a more complex one. We had always intended to use digitisation to update our definitive maps. Indeed, it was the need to bring the map up to date and keep it up to date which first led us towards digitisation and eventually to GIS. We had not been troubled, in Cornwall, by boundary changes since our map was first published and our update of the definitive map is, therefore, quite straightforward, at least in the legal sense.

The problem is, of course, that any map which is published as a definitive map must be entirely accurate in all respects. Not just in terms of the public rights of way data superimposed onto the Ordnance Survey map base but also in respect of such features as county, district and local council boundaries. Although the boundary of Cornwall has remained unchanged, since the publication of the original map, there have been a number of changes to parish and town council boundaries within Cornwall over the past few years and the determination of the precise line of the new boundaries proved to be extremely difficult. I was amazed that it proved so difficult to obtain accurate, reliable information relating to local authority boundaries, particularly where there had been changes. Even the digitised data provided by Ordnance Survey proved to be inaccurate in this respect and for technical reasons, sometimes extremely difficult to install.

The use of the symbols prescribed in the regulations revealed shortcomings in the software package which were eventually referred back to the suppliers, to be dealt with in a future update of the software.

We are publishing our updated maps district by district and many times during the last two years we have been held up by minor inaccuracies in the digitised data. Sometimes so minor as to appear immaterial but nevertheless sufficient to require further work, simply because of the over-riding need for a high degree of accuracy in the definitive map.

We have also been held up by the need to ensure that all the legal events which we propose to include on the new maps have been properly made and, where necessary, certified. The need for total accuracy in both the technicalities of the mapping and the legalities of the procedures has made progress extremely slow.

Meanwhile, my department has been forging ahead with a map based highways information system, recording road centre-lines, road inventories and traffic accident and traffic flow data, using separate layers, superimposed on digital base maps.

This in itself has caused problems. Whilst, so far as the road data is concerned, it is acceptable and indeed desirable to update the digital base maps as soon as revised Ordnance Survey data is available, public rights of way data which has been carefully edited to one base map can appear quite inaccurate on an updated base map, to which it has not been carefully 'married'.

Other counties, who are using their GIS maps simply as tools in the management of their public rights of way networks can tolerate a relatively high degree of inaccuracy and can, over the years, correct the errors and discrepancies until they reach the stage where they can be satisfied that their computer based public rights of way maps are sufficiently accurate to be printed and published as their definitive map of public rights of way.

Who is right? It's difficult to say at this stage but, within two years we will have published, in Cornwall, an updated definitive map for the whole of the County, on the latest available Ordnance Survey base and capable of being continually updated and re-published on the latest base maps.

Incidentally, we have not ignored the question as to whether a map comprised of data processed electronically, in a computer, can be acceptable as a definitive map. So far as we are concerned in Cornwall, the paper copy, plotted from the computer, is the definitive map, that is the map which will be stored in the strong room and that is the map which will be produced at court hearings and public inquiries. The computer and the plotter and the electronically stored and processed data are simply ways of producing the map – methods which have succeeded the springbow pen and the bottle of ink as the tools of the map-makers trade.

As I have said, in Cornwall we have, so far, concentrated our efforts, in public rights of way GIS, into the updating of our definitive map and I have also questioned whether that was the right thing to do. Whether or not we have taken the right course, there is no doubt that, within a very short time, GIS will be capable of playing a much greater part in our day-to-day work and in many other aspects of the management of our public path networks.

WHAT DO I WANT FROM GIS?

I suppose that the first question I must ask is "do I need (or indeed want) a GIS system?" But before attempting to answer that question, I will try, as a layman, to define what I mean by a public rights of way digital database. I see it as a computerised system which will accept, process and store data and allow for its retrieval in a form which allows the information to be used to best effect, in the management of public rights of way; the entry and retrieval of the data being related to Ordnance Survey digital map data, rather than to a text based system.

My answer to the question "do I need a GIS system?" is the same as it would be in relation to any other proposal for change, a qualified "yes; provided that I can be satisfied that it will enable me to be more efficient and more cost-effective in the delivery of the service which the County Council provides". However, in our deliberations in the South West, we reached the conclusion (and it was a conclusion based on experience rather than demonstrable facts) that it is virtually impossible to measure, with any degree of accuracy, the cost effectiveness of developing a public rights of way GIS system but we agreed that a well developed system, used to its full potential, must inevitably improve the efficiency of our work.

The management of the public rights of way network embraces the preparation and maintenance of a definitive map and statement, the continuous review of the map and statement by the making of modification orders, changes to the network by means of public path orders and agreements, and the maintenance, protection and development of the public path network. In the development category, I include such initiatives as P3 and adopt-a-path.

My ideal system would link all the data generated in these areas of work, into one interrelated and interacting database, with the capability of generating reports, either on screen or in hard copy, which would give all the relevant information relating to any particular path or grouping of paths. It would also be linked, as part of a corporate system, to other local authority databases so that decisions, relating to the public path network, could take account of other factors which might be affected.

In addition to the maintenance of the definitive map, a map-based, computerised database could contain details ranging from progress chasing on fault reports to the details of a library of photographs of sites and subjects.

PUBLIC RIGHTS OF WAY PRACTITIONERS NEED MAPS TO SUIT ALL OCCASIONS

There are times when we need the detail provided by a 1:2,500 scale map, to allow us to fix the route of a public right of way in relation to field boundaries or other small features. At other times we need a small map which covers a large area but without the need for detailed background information.

We want the base map to be as up-to-date as possible to show buildings and other features as they exist today but sometimes we would like the base maps to be the early edition of the 1:25,000 Ordnance Survey maps, showing the tracks and paths which were shown on the 1:10,000 scale maps and which were the basis for the original submissions by town and parish councils, when the definitive map was being prepared.

We need the clarity which comes from showing the public rights of way network in distinctive colours, the colours prescribed in the regulations, but sometimes we want to photocopy maps for reasons of speed or economy. At such times we would like black and white maps showing the network by the prescribed symbols.

I said earlier that I want an interrelated and interacting map, from which I can manage all aspects of public rights of way definition and management but, on occasions, I want to separate the various layers of information into their constituent parts, for all kinds of reasons.

We want one seamless map but we also want individual maps; large maps and small maps; coloured maps and black and white maps; detailed maps and uncluttered maps; new maps, old maps, large scale maps, small scale maps and all of them quickly and unfailingly available.

These are some of the things that a GIS system can provide to make the work more efficient and more effective. You may, having heard my list, have reached the opinion that I am a supreme optimist. However, I would settle for something less comprehensive, provided that the following criteria are satisfied:

- **Accuracy** Accuracy will be foremost in my requirements and by that I mean the public rights of way officer's accuracy -- a true representation of the public rights of way network -- a map legally acceptable as the definitive map of public rights of way in the County of Cornwall. Incidentally, it should be linked, through the database, to the definitive statement.

  The computer engineer's version of accuracy is not always good enough. How many of us have listened to the argument that any map can only be an indication of what exists on the ground and that we cannot expect a greater degree of accuracy than the scale of the map allows. So far so good; but then of course we are told that if the footpath shown on the definitive map, on one side of the hedge has, by the magic of digitisation, converted into a by-way and transferred itself to the other side of the hedge, all can be corrected, by a knowledgeable explanation to a landowner who is looking for any opportunity to discredit the definitive map and to cast doubts on the existence of any rights of way on his land.

- **Accessibility** Under the heading of accessibility, I include not only the siting of the computer but also the speed of the computer when loading map data onto the VDU screen and when printing hard copies. If a computerised mapping system is to prove attractive enough to woo us away from our dog-eared, tea stained, definitive map sheets it must be at least as accessible as the competition. We simply do not have the time or the patience to spend minutes waiting for maps to assemble on the VDU screen or to issue from the printer.

We need support in respect of the hardware and software. Quick response to problems is essential. Our direct involvement with the public does not allow for long waits whilst computer problems are sorted out.

So far, in our discussions in the South West and in preparing for today, I have identified my list of key issues in the digitisation of definitive maps:

- **Cost** As I have said earlier, it is extremely difficult to measure the cost effectiveness of the introduction of GIS into public rights of way management. Is the question "can we afford to introduce GIS into our work?" or is it, perhaps "can we afford not to introduce a system?".

- **Accuracy** Absolutely vital if the definitive map is to form part of the system, perhaps less important if the system is to be used purely as a management tool.

- **Accessibility** GIS systems will only be used by public rights of way practitioners if they find them to be easier to use, in all respects, than conventional information management systems.

- **Support** Support of the computer engineers' services, to ensure that the system is working properly and to deal with any problems which arise relating to either hardware or software. A reasonably quick response to requests for help is needed.

- **Legality** I am convinced that hard copies of computerised maps are as valid as maps produced by any other means but the question of the legality of maps, stored electronically within computers, remains an issue.

- **A British Standard?** This is perhaps, potentially, the biggest issue. Many highway authorities have invested very large sums of money in either developing their own systems or in installing systems bought off the shelf; it is highly unlikely that they will be prepared to write off their investment and install new hardware and software to comply with a national standard. I look forward to hearing Mandy Smith's contribution to this debate, later this morning, when she will speak on the subject of a "Draft British Standard for GIS".

GLOUCESTERSHIRE'S EXPERIENCES WITH GEOGRAPHICAL INFORMATION SYSTEMS

Mike Gibbons

Gloucestershire County Council, Public Rights of Way Unit

INTRODUCTION

All that I will relate is personal experience and all of it is true. (Some of it painfully so!) I am speaking from a point of view that is not located quite at the 'sharp end' because I am essentially involved with maintenance of the Definitive Map. Really it is the enforcement officers who have to take the flack; with loaded guns being pointed at them and their copies of the Definitive Map being torn up in front of their eyes. However, we are the people who are providing that (supposedly accurate) map for them to use.

A quote from a leader article in 'Byway and Bridleway' magazine: "We can't cope with the Definitive Map as it stands, let alone how it should be!"

I think that encapsulates how many rights of way sections feel, be they in countryside sections, planning departments, legal sections or a surveyor's department, as we in Gloucestershire are.

In rights of way terms Gloucestershire has (and I don't mind admitting this) been a group of fiddlers and meddlers. Unfortunately, by giving the impression that we could cope and by doing a bit of everything (and all of this is probably a great deal to do with the willingness of the staff in the section) it meant that we have dug ourselves a bit of a hole.

Under a very charismatic leader we adapted the old sapper's attitude of "Keep the traffic moving." This has led us to a situation where we have reached what one of my colleagues calls "The Critical Mass". A good proportion of the network is open and available. This then tempts users to explore further off the beaten and publicised track. Then Pareto's Principle takes over and we find that 20% of the network causes 80% of the problems.

A CHRONOLOGICAL STORY

The history of Information Technology and Geographical Information Systems within Gloucestershire's Public Rights of Way Unit has a number of elements.

1) The Definitive Statement
2) The Devolved GIS
3) The Corporate GIS
4) The Condition Survey Methodology
5) Management Information

Going back in time we need to examine a bit of the history. I am reminded of a Monty Python sketch that was a skit of the old steam radio panel game "Does The Team Think?" Some little while after being asked what they would do if they were Hitler, one of the panellists expressed the opinion that he believed that "All wrong thinking people in this country are right".

Unfortunately, the system chosen for the display of Gloucestershire's Definitive Map was as wrongly thought out as it could be made. The actual Definitive Map is the one that the public can get their grubby hands on. The changes by Order are shown on a series of tracing paper overlays.

The first thing that was done was to set up a database system for the Definitive Statement. We are fortunate in that the Statement is in a tabular form and is easily amenable to being translated into the fields and records of a database application.

However, one of the key elements is that a separation between what is considered 'Legal' and 'Working Data' has to be made. Our base point was to make a set of text files that are an electronic facsimile of the Definitive Statement as it was on the original relevant date. This involved proof-reading the whole of the Definitive Statement so that the final files represented the Statement, 'Warts and All!'

A PROTOTYPE GEOGRAPHICAL INFORMATION SYSTEM

The next thing to arrive was the 'Devolved GIS'. The decision to purchase this 'Windows' based software was made independently by the Public Rights of Way Unit. (It is this system that I have brought with me.)

At the outset of any GIS project one of the fundamental prerequisites is that there be a map of some kind of the working area in the system. This aspect raises the questions of contracts with the Ordnance Survey and copyright implications.

I would hope that, by the time those of you who are considering moving into GIS, your authority will have a contract with the Ordnance Survey that provides digital mapping. When we first had a go, Gloucestershire County Council didn't have such a contract, so we were in the position of having to make our own map base.

MAKING YOUR OWN MAP BASE

The first thing that we discovered is that you can't scan translucent maps! The light scatter within the plastic causes all sorts of problems. So you have to get hold of a blank paper set of maps that

have not been too 'dog eared' over the years. You next find that the red contour lines have a life of their own; no matter how you set the density of the scan, sometimes the contours appear and at other times they don't get picked up at all!

However, you do have more source material that is amenable to being scanned into the system. Consider how useful it would be to have readily available information right there on your desk rather than having to lug heavy map books around! For example:

- The Draft and Provisional Maps
- The County Series 1:2,500 maps
- Coloured working copies
- Combined record sets (i.e. roads and paths on the same sheet)
- Aerial photographs.

Placing a County wide set of 1:2,500 scale maps into a system is a massive task; particularly as the County Series maps are not based on the National Grid. So, after you have assembled a base by whatever means, what are you going to do with it?

ADDING THE OVERLAYS

Getting some paths into the system would be nice; but just how are you going to do that? You may be lucky in that you might have a consolidated Definitive Map on 1:10,000 scale that you can simply copy. But even so, this is not a 'five minute job'. Wiltshire Public Rights of Way Unit were in that happy position, and are only using the GIS as a management tool. However, it took them nine months to place all the public rights of way lines into the system.

You may be fortunate and find that the digitising table can be used. However, you may find that the 'Assisted Digitising Module' that you scrimped and saved for produces some very odd results.

You may be lucky and any 'X'—'Y' offsets that are produced may not be big enough to concern you, or are amenable to being corrected by some form of mathematical algorithm.

You may find that the offset is too large or is variable in character and that everything requires editing 'point by point' to make it fit; or you may be on a tight budget and cannot afford to spend money on extra software.

This leaves us with another option of drawing on the screen with the mouse. Certain Geographical Information Systems are good for such a use whereas others are nowhere near as easy or intuitive.

Also there is the aspect of how much control you as a user can exercise over the system. Even within the same system some users' views of the system are all that you would expect given the level of the technology. Other views are unfortunately much less usable and operate far too slowly to be of much practical use.

And as you all realise, most people will take the line of least resistance no matter how much money has been spent. So unless the GIS can deliver what the users require you may have a devil of a job weaning them off the 'Paper Map', 'Magic Tape' and 'Tippex' regime.

THE CORPORATE GIS

In Gloucestershire a decision was made to adopt a Corporate GIS. This was done after we had done a significant amount of work using the devolved system. This Corporate System is a different regime to the devolved system in that it currently only features the Ordnance Survey Vector mapping.

This is an 'intelligent' map that is both accurate and up-to-date. However, even this Utopian situation poses a number of problems. Different work stations have different views of the system. The average view is extremely tedious to use because it is so slow and its vertex to vertex drawing system is inferior to the ropey old 'Windows' Application System. So now we are in the position that we are one of the few authorities who are attempting to place their rights of way information against the detailed and infinitely scaleable Vector mapping.

PLACING LINES INTO A VECTOR GIS

The Digitising Table

Although we could set up 1:10,560 scale acetates on the table with apparent 'X'—'Y' offsets in relation to the National Grid of less than 1.0 metre, when the vector information was brought onto view against lines that had been digitised into the system it was apparent that the background map was a long way out of line. It appears that the vector information is simply not in the same place in relation to the National Grid as the detail on the 1:10,560 scale map. In addition, the vector map detail also contains a very strange paradox. The details of the buildings and other ground features is placed extremely accurately; but the representation of the paths and tracks is very stylised, probably more so than the information shown on the modern paper 1:2500 scale maps.

This again leads us to the position where the Definitive Map lines have to be added to the system vertex by vertex. In many instances the definitive line does not follow any map detail. This is a trying situation that sometimes has to be rectified by drawing temporary construction lines on the screen. But in any event, all of this additional work slows the progress down to about 40 lines a day added to the system. Subsequently, the lines that the digitiser places into the system have to be verified by somebody else who, broadly and colloquially, 'knows what the crack is'. This means that the Area Officer or somebody who has walked the area for Condition Survey purposes has to verify the lines by checking against other source material.

All of this argument is taking us down a different avenue to the usual 'Electronic Argument' about what constitutes the Definitive Map. In my view, this question is easily resolved by having different overlay definitions for different purposes.

A 'SUPREME' DEFINITIVE MAP

In Gloucestershire, we are of the view that we should attempt to use the modern technology to give us an accurate picture. My personal view is that a modern Definitive Map could contain three documents.

• **The Definitive Statement.** (I believe that one should bear in mind the implicit ramifications in the 1949 Act that gives the Highway Authority the opportunity to make the Definitive Statement an accurate and comprehensive document.)

• **The 1:10,000 Scale Network Map.** This would probably be provided in the traditional sheet division. In essence, a Definitive Map at this scale is more of a document than a map 'per se'. It shows a series of lines that indicate where the public may exercise certain rights. It is this part of the documentary system that would be distributed and sold.

• **The Detailed Map.** Essentially the GIS could be used to provide a County-wide 'blow up' situation. This could become pertinent if it was accepted that a record held within a computer could count as 'definitive' without the necessity for anything to be produced on paper. Essentially, any part of the vector 1:2,500 mapping could be produced as a 'seamless' map and be accepted as conclusive evidence. Mapping at detail level (suggested scale 1:2,500) would be used to resolve issues where the actual position of the way is under challenge rather than any question of the existence of a right.

HISTORICAL CONTINUITY IS REQUIRED

We feel that there is actually a problem in that, despite all the influx of technology, we are losing touch with the accurate Ordnance Survey material that formed the basis of the Original Submissions and the subsequent stages right through to the Definitive Map. In Gloucestershire we may be in a unique position in that there is heavy reliance on the County Series 1:2,500 scale maps. Indeed, the parcel numbers on these maps that public rights of way pass through are quoted in the Definitive Statement.

Some people are of the opinion that the stylised 1/10,000 scale map with great thick lines on it is the way to go. This may be acceptable to give people a clear picture of the network. That is to say, a user's map to be given to parishes and user groups.

However, if this is all you have as a Definitive Map then such a map creates a problem. People will actually challenge what is contained in the map; and this is despite whatever may be said about the map being conclusive evidence of what it shows. In real terms it is more like 'it's conclusive of what it shows until somebody can prove that something else pertains.' In many instances, because of the limitations of scale (the representation of the path appears to be 8-10

metres wide on the ground when scaled), the self-same line on the map may be used with equal validity for both sides to argue their case.

People will accept the 'de-minimis' situation of a few inches or a couple of feet. If, however, you give them four or five metres to play with, there is almost certain to be a fuss. And almost invariably the worst arguments are over distances of a few feet! If the map is accurate and has historical continuity we would be prepared to defend that in court. We feel that this is infinitely better than having to tout around for user evidence that a certain path has been used in one position or another; particularly in tricky and potentially very expensive cases of encroachment or erosion.

Having an accurate map also gives the practitioner an element of choice and having the historical continuity is extremely useful; but of course there is always the exceptional case that proves the rule. Take, for example, the path that on successive editions of a map is partly enclosed, wholly enclosed, then unenclosed and now enclosed again. What price now is the tenet that the highway extends from boundary to boundary?

RESOLUTION OF PROBLEMS BY FIELD SURVEYS

The conclusion that may be drawn from the above preamble is that on most occasions there is no substitute for the pragmatic approach of 'going and looking'.

I can assure you that if you have actually walked all the paths in a parish it really does make it much simpler to add those lines to a Geographical Information System. If you have actually experienced the site it makes what is shown on the screen that more real. Very often, even detail that has become stylised on the 1:10,000 scale map becomes fairly easy to interpret. So, what might have involved a lengthy 'head-scratching-session' and a trip to examine the draft map, can be resolved easily within seconds if you have been there. In my view, although some might dispute this, having visited the site can speed up the digitising process by three or four times.

CONDITION SURVEYS—HOW TO CREATE HUGE DATA SETS!

The next stage in the information technology route that we took was a condition survey.

There have been numerous rights of way surveys and we examined the methodology of a number of them before embarking on our own. We felt that very often the most limiting feature of the survey was the survey form itself. Very often the compilers of the form fell into the trap of believing that only certain features, and moreover only a limited number of those features would occur along a path. We felt that the survey form should be designed to be flexible in its layout so that virtually any eventuality could be dealt with. We decided also that we would mirror the Countryside Commission's sample condition survey and break the rights of way network into links.

Broadly speaking a link is a section of one classification of right of way that runs between two nodal points. These nodes occur where paths join 'county roads', where public rights of way intersect each other, and, in Gloucestershire's case, also at parish boundaries. Incidentally, this type of sub-division of paths pre-empts the requirements of the National Standard. Breaking the network down in this way is also a help in a condition survey in a number of ways; for example, a journey along a particular path may be interrupted by an insurmountable obstruction. However, it may well be possible to regain the 'county road' (which is usually the objective on a recreational walk) by returning to the previous node and continuing along another link.

It has to be admitted that if you have a piece of paper for every link in the County it does make an appreciable sized pile! I would estimate that there would be twice as many links in a network as there are individual paths.

THE SURVEY METHODOLOGY

Our survey methodology was based on coding features in a sequence rather than having areas on the form to describe things. After all, one walks or rides along the way meeting one feature after another, so why not code it that way?

The front page of the form contains information which enables the link to be identified on a map. Also the identity of the surveyor and the date of survey is recorded. In addition, there are a couple of 'overall concept' questions about the quality of the waymarking and whether the link has any Definitive Map anomaly. (An error or omission that would require a modification order to fix it.)

The back of the form contains the survey matrix. This is simply a grid of boxes into which code letters may be placed. The columns are the 'elements' of the 'features' and the lines represent particular nominated points along the link. The columns have no specific heading (apart from the element number); the notes section was deliberately kept small so that people could not write 'War and Peace' on the form!

The heart of the survey methodology is the key-sheet. This gives the appropriate codes for twelve different features, not every feature has twelve coded elements; most need far fewer.

The questions asked do reflect some of our special needs. For example, we concentrate on whether boundaries are shown or not shown on the County Series 1:2,500 map. This can give clues as to whether structures found at those boundaries were original limitations on the use of the way or have appeared subsequently. Also we have universally adopted the concept of whether a structure is convenient for those people who may lawfully use it.

In use the system has worked well and has been used by rights of way staff and practitioners and by volunteer workers. In practice, one soon becomes used to the fact that not every feature requires all the element columns to be filled. Eventually, you can memorise most of the regularly used codes and can reel off lines of accurate code without needing to refer to a key-sheet.

The other point to be borne in mind is that there can be more than one feature at any nominated point along the link. Obviously, features that have a length element to them can lie between nominated points. Such points don't have to be coincident with another feature; just so long as each point nominated on the survey sheet is shown on the survey map all will be well. The map used for the link survey is the County Series 1/2,500 scale map which is marked up using the information on the 1:10,560 scale Definitive Map. Remarkably in most instances the conditions on the ground are found to be that which is represented on this survey of the 1920s.

THE DATABASE APPLICATION

The next stage in the operation is to enter the coded data into a database application. This system is flexible enough to cope with the fact that more than one code letter may occur in a box. (This is designed to happen; it is apparent that a boundary may consist of both a hedge and barbed wire and that a surface may have the attributes of being both rutted and eroded.) The application is designed to expand the code into a form of language so that a short narrative describing the structure is available.

For example, if I focus on a stile that is coded:

'W—W—S—S—X—C'

The expansion will read along the lines of:

'Wooden Wortley Stile with sound frame and sound step. Required for purpose of preventing unlawful user. Convenient for average user.'

At the entry stage we have the option to make modifications to rectify any small bugs that have become apparent. For example, if the feature 'Other' is used many times to describe the same thing, then such a new feature could be added to the key-sheet.

THE AMALGAMATION TRAP

One change that we expect to make to the method is to separate the items 'Growth' and 'Surface' that appear together under keyword seven. This is the one area of the coding that we felt did not work as well as it might. We unintentionally created what we referred to as an 'Amalgamation Trap'. If you think about it, the problems caused by excess growth or deficient surfaces really are quite different and should be separated. We thought we had been rigorous in eliminating the 'Amalgamation Trap'; but this time we fell right in! We feel that the trap is easy to fall into because 'lumping' is altogether an easier exercise than 'splitting'. It took us a number of small 'lateral moves' and 'quantum leaps' to devise the system as it stands!

RETURNING TO GIS VIA DATA MANAGEMENT

Talking about the condition survey seems to have taken us away from Geographical Information Systems into the realms of data management. In my view this is a pertinent question to address because, even though we work with a document called the Definitive Map and despite the fact that 60 - 70% of correspondence received by a County Council refers to a geographical location, there is still a great deal of information in rights of way work that is text based. I refer here to things such as research and evidence required for Orders and the amount of correspondence related to enforcement matters and the serving of notices. In my view there is still much work to be done in the management of rights of way that could be more efficiently done by means of database applications that don't necessarily need the 'umbrella' of a Geographical Information System. Indeed, at Gloucestershire County Council's Development Control Unit an extensive application is used to progress Section 38 Agreements. This software operates outside the Corporate GIS. We envisage that certain elements of rights of way management will be added to this system because some of the same routines can be used.

GEOGRAPHICAL INFORMATION SYSTEMS ARE NOT 'MAGIC'

In conclusion, I would say that there is a danger that Geographical Information Systems can come to be regarded as some form of panacea for the ills of rights of way management. It has to be admitted that many demonstrations of systems look very impressive and at times almost magical.

However, in Gloucestershire we have had experience in dealing with different types of system and have also had different types of software developers working for us. All of them pose different problems that need to be solved.

Another thing that I would caution you about is to keep a very close check on your own prejudices. Sometimes it is very hard to make the fresh start that is required when you work day to day with a traditional 'pen and ink' approach that creaks along but does at least provide the public with some form of service that is tangible and understandable.

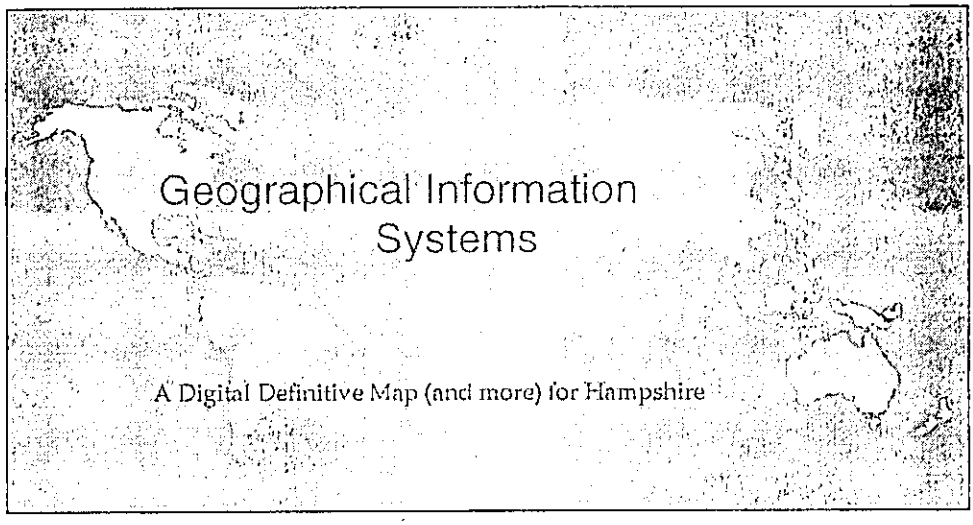
I believe that you should bear in mind that there is still much that could be done by using computer applications that are not linked to a Geographical Information System. I estimate that Gloucestershire's Condition Survey will generate upwards of half a million data items. Devising methods to deal with that amount of data and keep it up to date is another question over and above concepts of a '1:2,500 Scale Vector Definitive Map'.

To those of you contemplating taking the road towards Geographical Information Systems:
"Be wary how you tread and have a firm idea of where you wish to go."

GIS AND RIGHTS OF WAY: THE SYSTEM IN USE AT HAMPSHIRE COUNTY COUNCIL

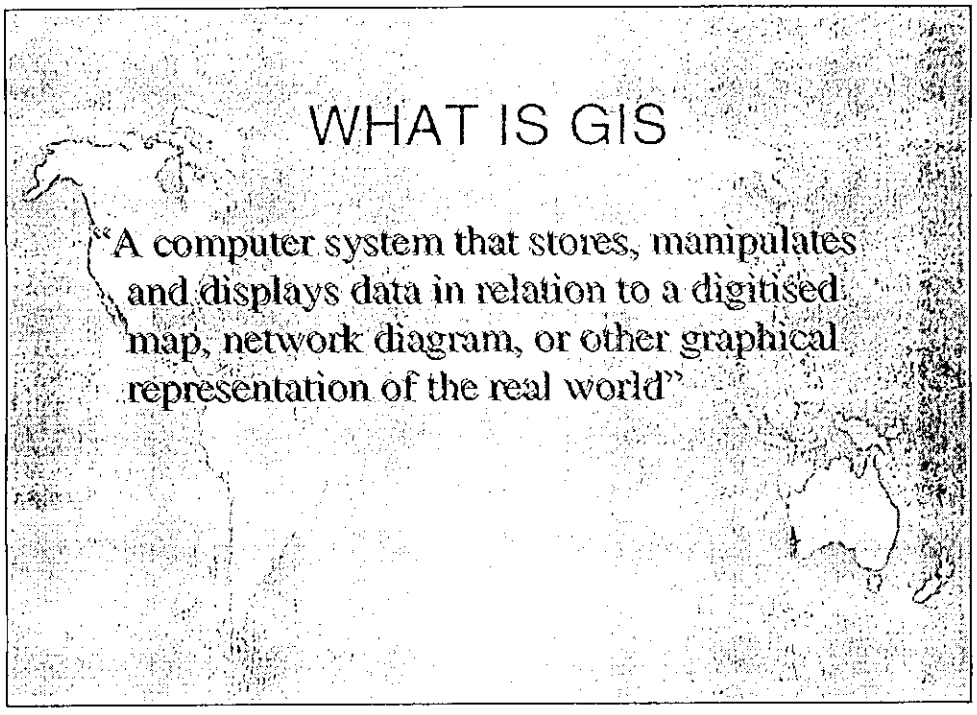
Harvey Davies

Rights of Way Manager, Hampshire County Council



Hampshire County Council has been involved in the development of GIS systems since 1990. The County Surveyors Department has developed the ROMANSE project, a fully automated traffic control system for Southampton, the County Planning Department has developed a GIS system to cover strategic planning and habitat survey county wide. Most recently the county has developed a GIS based fire and rescue system.

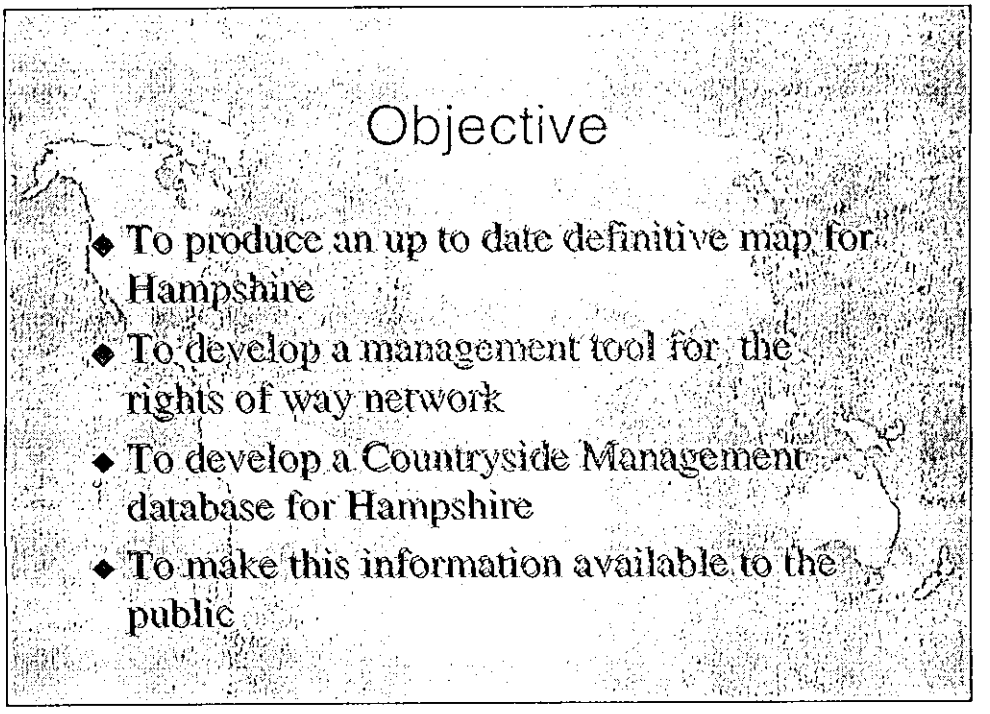
The Countryside and Community Department are responsible for the public rights of way network and for country parks, nature reserves and a range of historical sites across the county. As part of the production of a Public Rights of Way strategy, and as part of the milestones initiative, HCC has identified the pressing need to publish a new definitive map for Hampshire. GIS provides the vehicle to produce a digital definitive map, a management database for rights of way and a wider countryside information system.



There are many definitions of GIS and many different systems. HCC has developed ARC based software with ESRI but this is only one of many systems and companies working in the GIS field. Different systems have their merits but most importantly the secret of success is to identify what you want to achieve and to build a GIS accordingly.

Enthusiasm is no substitute for careful planning. There are many stories of failed systems and of money wasted on computer hardware and software. These problems are often as a result of the technology obscuring the data.

The development of a GIS system for rights of way has been set up with clear objectives and a clear project management and support mechanism. All operational requirements have been set by the customer (rights of way staff) and the project has been managed by the rights of way manager. Specialist IT support has been provided by IT services and by technical staff with GIS experience in other Departments. The rights of way data has been the most important element of the project and the software has been developed to fit the data rather than a compromise.

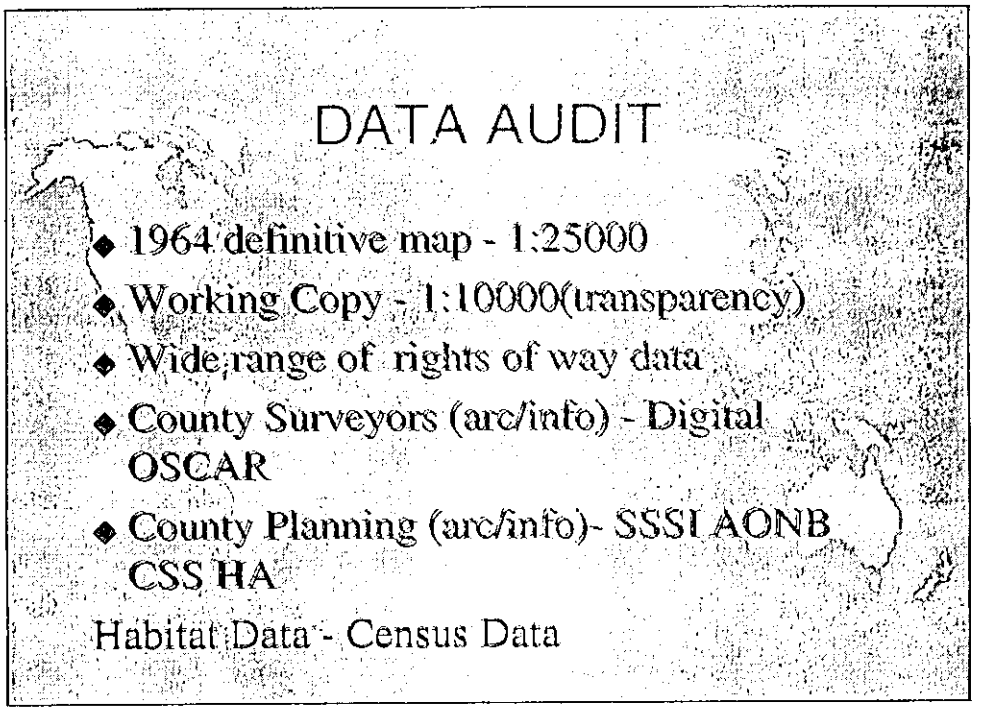


• The most important objective is to produce an up to date definitive map for Hampshire. In paper or digital format this is a huge task, particularly as the current 1:25000 map base was surveyed between 1955 and 1961. The objective is to consolidate at 1:10,000 in digital format.

• The second objective is to develop a comprehensive rights of way management system. Separate datasets will be developed for a range of information from structures to claims to management requirements - the list is limited only by the information required, the data capture and to a lesser degree by the computer system.

• A further objective is the development of a wider Countryside information system. This is valuable not only to countryside managers but also to the public. Much data is already available and much more will become available.

• The final objective is to develop a system which makes GIS data available within local government to public and private agencies and most importantly to the public. A pilot access point is due to become available to the public in the autumn and it is envisaged that long term access will be available in libraries and information centres.

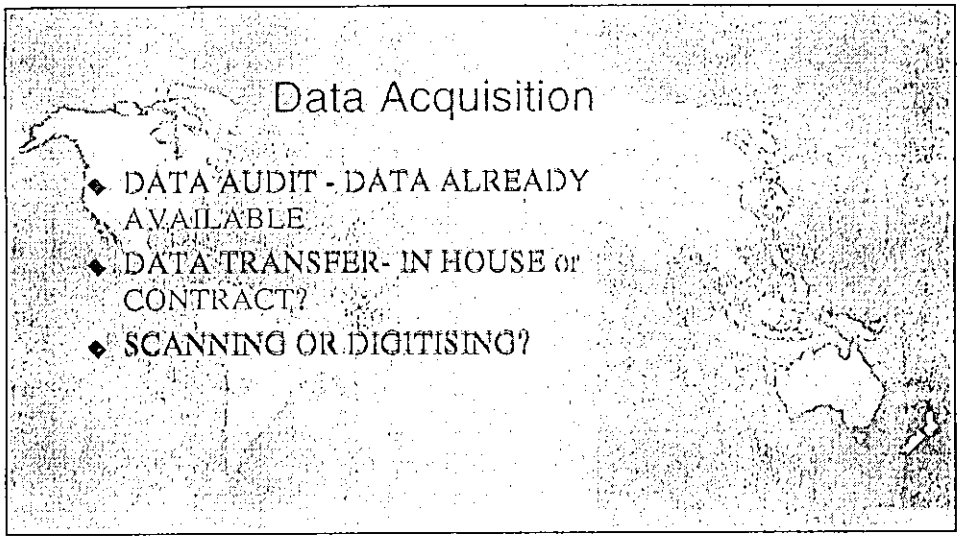


Any GIS system relies on data. Data capture is a key element in developing any GIS and is a major factor in the success or failure of any system. A GIS system can have all the analytical functions in the world but no data means no analysis. Second to hardware and software purchase data capture will be the biggest expense of developing any GIS system. Data can be captured in many different ways and it is vital to assess what data is required and how accurate this data needs to be before deciding on capture techniques. It is also important to identify what other data may be available in analogue (will require digitising) or digital format.

Analogue or paper data is available for public rights of way (1964 definitive map) at 1:25000 scale and working copy on transparency at 1:10,000 and 1:10560. A wide range of order plans is available for changes to the network since 1964.

A wide range of paper based data for rights of way and county estates data is available at 1:2500.

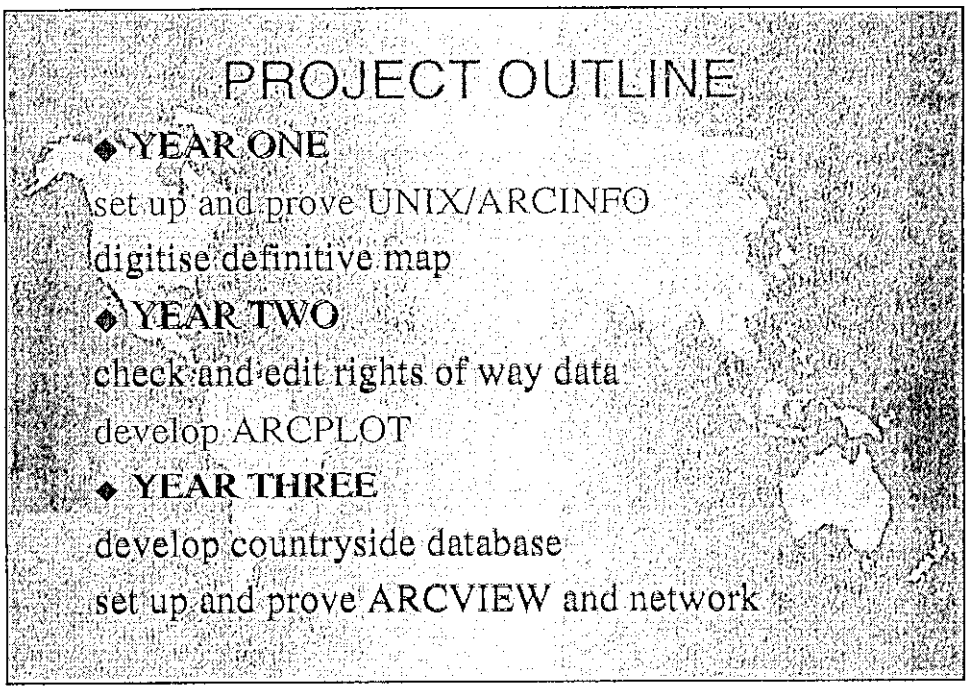
County Planning data is available (1:10,000) and includes habitat analysis, parish and electoral boundaries.



There are two principal conversion techniques: scanning and vectorisation. Scanning offers ease and speed, but the resulting raster images lack the 'intelligence' needed and creates large image files. Vectorisation can be achieved using a digitising table and is a straight forward process which produces high quality results. It is, however time consuming and therefore costly.

The Rights of Way Section was not able to re-deploy staff solely to undertake the digitising of rights of way data. A decision was taken to employ an extra member of staff and to develop a dedicated team to undertake the digitising process. With a Countryside Commission grant aid a digitising officer was employed on a year's contract. Thus the staff undertaking the digitising already had an understanding of rights of way and particularly of the definitive map. The estimated cost of contracting out was £10,000 to £15,000. In-house digitising has cost in the region of £12,000. A combination of these techniques could have been the basic digitising going to contract and editing being undertaken by in house staff.

Digitising has been a two stage process. Data has been vectored using a digitising table to transfer from 1:10,000 transparency data to overlay a vector coverage on the 1:10,000 up-to-date OS raster maps. The second stage is to edit the data and in the process consolidate the map. The editing process is vital and involves a check that the digital line is accurate, that where anomalies have been thrown up that they are resolved with the help of the map review team, or can be shown to be as a result of a legal event order having been made.



The goal for the first year of the project was to purchase both hardware and software and to digitise the definitive map.

•An IBM UNIX work station, a single X terminal and calcomp digitiser purchased;

•ARC/INFO software was purchased and developed to create a rights of way dataset;

•OS 1:10,000 digital maps were imported to the system;

•The system manager and a member of staff were given UNIX/ARC INFO training;

•System development and project support given;

•Digitising was started and two further staff were trained (in-house).

Year Two

•Digitsing completed mid way through year two, editing work commences.

•Second terminal purchased giving ability for two staff to edit at once

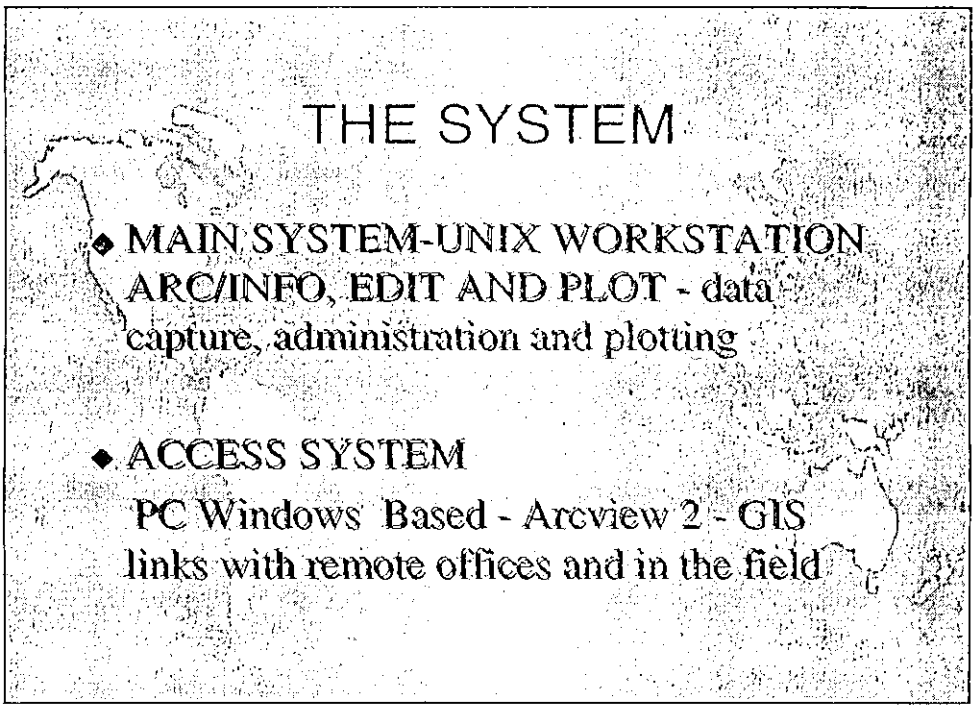
•Planning Data imported

•ARCPLOT developed to allow plotting of data to give paper output.

•ARCVIEW 2 tested for PC and local network created giving PC access to all data

Year Three

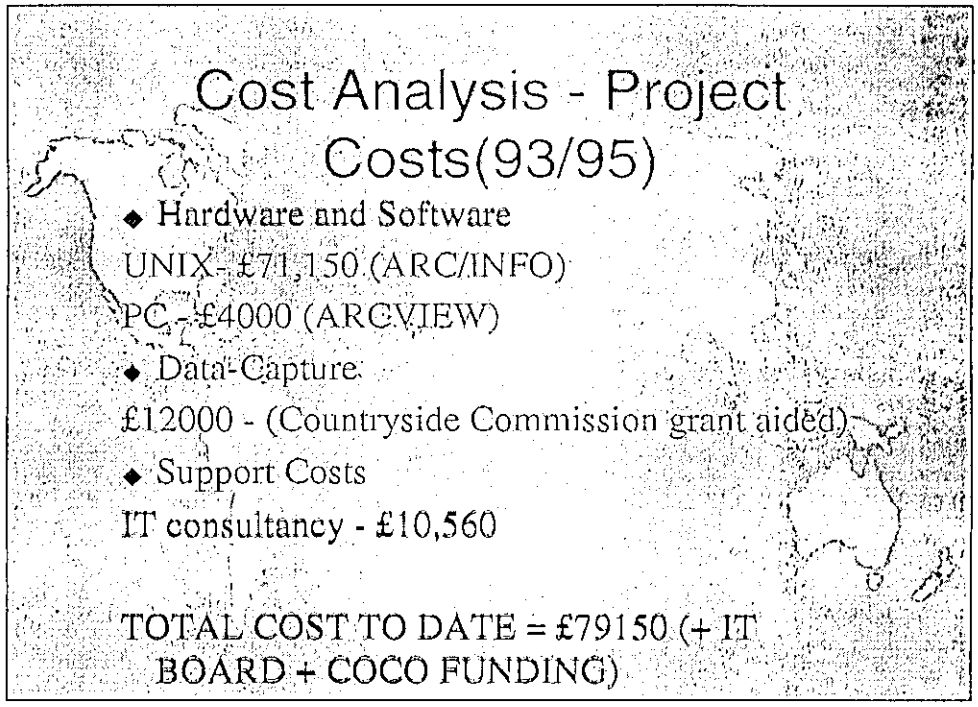
•Complete Digitising, complete network - Arcview and develop Countryside Database



The main system is an IBM UNIX workstation linked to two terminals and a digitising table. Also linked to an IBM postscript printer A3 / A4 size. This system uses a variety of ESRI ARC software packages and is secure, there being no external access to data. Data is currently backed up on 8mm tape on a daily basis. Map info is imported and updated as OS make new map tiles available. Updated data is supplied by other Departments.

The most interesting development is the extension of the system to remote offices and the public. Currently testing Arcview 2 on PCs linked to the main file server by ethernet cable. There is a limitation because of the amount of data in that there needs to be a physical link but we are looking at stand alones using CD ROM.

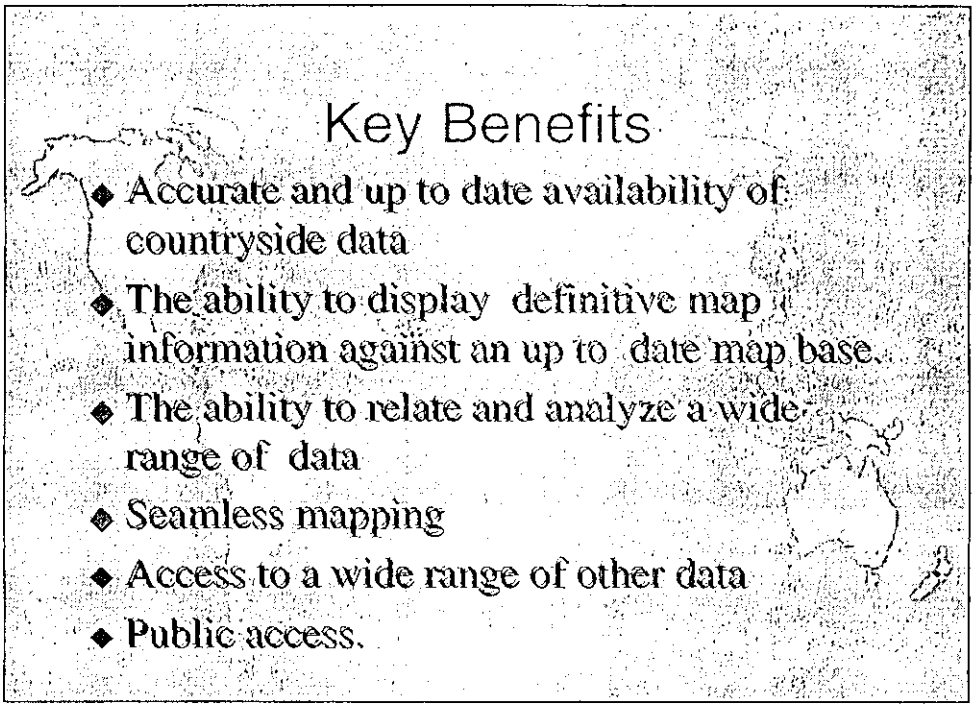
Major advantage of the systems being used is that ARC software is becoming the industry standard (used by OS) and is compatible with most other GIS software. The vision is a country wide definitive map - hence British standard.



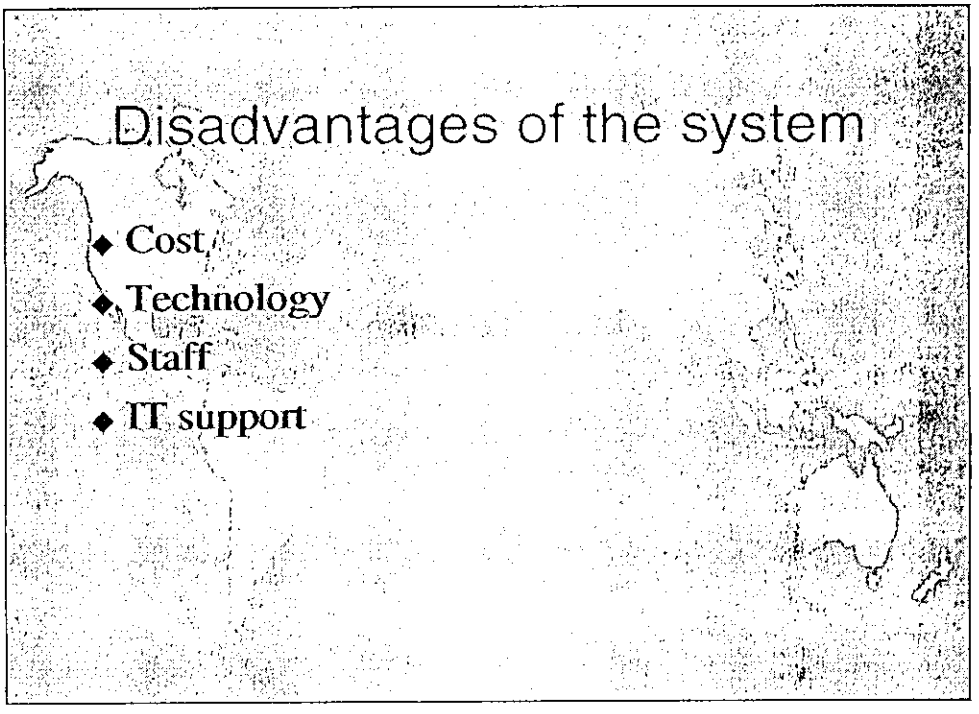
• Project funding has been secured from a variety of sources within the County and through grant aid from the Countryside Commission.

• The Countryside and Community Department has secured further funding for the rights of way section to further map review work. It was vital that a separate project budget was identified that would not impact on the limited budget already available for rights of way work. £35,000 per year was secured to fund the project for three years. A further £8,000 was secured in grant aid from Co Co to fund data capture. £10,560 was secured from IST board (IT services) to fund research and tecnical support.

• There are annual charges of approx £3000 to cover hardware maintenance and software licenses.


Key Benefits
Accurate and up to date availability of countryside data
The ability to display definitive map information against an up to date map base.
The ability to relate and analyze a wide range of data
Seamless mapping
Access to a wide range of other data
Public access.

As above

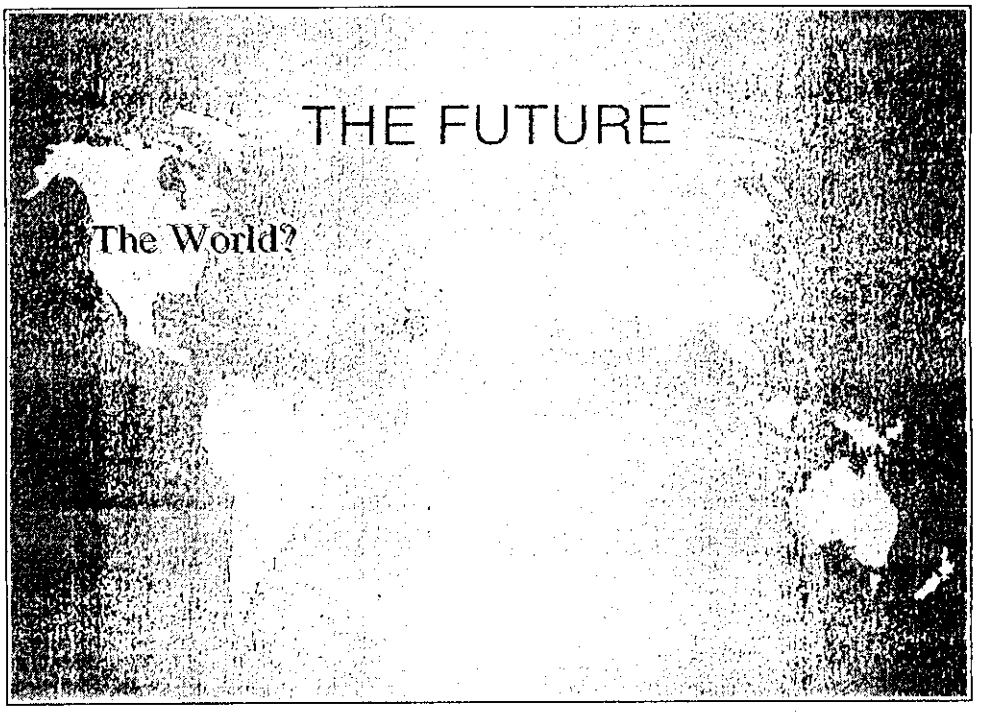


• A key disadvantage of setting up any GIS system, particularly at this time of reduced budgets, is the cost. This must be carefully set against the advantages that the system will bring. A key factor in our decision was the requirement to consolidate and publish a new definitive map.

• There is always a risk in committing to technology which may become obsolete. The decision to purchase ARC/INFO software was based on the County's experience with this particular software and with the view that this has become an industry standard.

• Any system relies on the ability of staff to input data, to maintain the system and to extract information. We have resolved this in Hampshire by taking the view that an understanding of rights of way was vital and that IT skills could be acquired through training. Through training, Hampshire staff quickly acquired an understanding of the system and saw the advantages this brought to rights of way work. UNIX/ARC training costs in the region of £1500 per person.

• Lack of IT support was a perceived problem. In reality IT expertise has always been available from other departments.



The future for the GIS project looks brighter as each development stage of the project is completed. By October 1995 the editing of the rights of way data will be complete.

The coming months will see ARCVIEW developed so that the full range of GIS data can be made available to staff and eventually to the public. The long term aim is to develop a comprehensive countryside database which will give access to a wide range of information and will be available through HANTSNET.

The development of a comprehensive rights of way management database will be developed by linking the management of the physical network to the paper (now digital) definitive map.

As other Counties develop GIS the long term view can be of networked, compatible systems which would give a countrywide definitive map and countryside information system.

DRAFT BRITISH STANDARD FOR GIS

Mandy Smith, Senior Map Review Officer

Hampshire County Council

WAYS INTO GIS – Report of the Public Rights of Way Working Party

An informative commentary on the formulation of the draft specification for BS7666 Part 4 – Specification for Public Rights of Way

In May 1993, in response to an approach from Ordnance Survey, the local authority associations' Geographic Information Advisory Group (GIAG) set up a working party to consider the implications of creating a digital dataset of public rights of way information. The specification for this dataset needs to recognise the uniqueness of public rights of way documentation whilst taking on board recent legislation and standards affecting all highways.

The composition of the working party was drawn from members of county and metropolitan councils, the Department of the Environment, the English Countryside Commission, the Countryside Council for Wales, Ordnance Survey, the Ramblers Association and the LGMB. Within this group the expertise ranged from rights of way officers with a working knowledge of GIS, GIS experts and those with legal and user based backgrounds. Their common purpose was to establish guidelines for those with responsibilities for public rights of way in an area of technology where users in the public and private sectors are constantly encountering different applications. In order to achieve this, certain issues were identified as being central to an overall understanding of the subject.

This report presents the views, conclusions and recommendations of the working party and summarises both the advantages and the problems which the introduction of a geographical information system (GIS) can bring to recording information about public rights of way. The recommendations must be interpreted by each individual authority in the light of its own priorities and requirements.

One of the main conclusions was that an application should be made for the British

Standards Institution to approve a specification for a digital dataset for public rights of way information.

The definitive map and statement is the statutory document for public rights of way, which must be recorded on a map base to a minimum specified scale. Representation of this information in a geographical information system (GIS) provides the facility to record the data in a standard computerised form. However, there are important constraints which must be considered, due to the legal and physical nature of data. The form and modelling of definitive lines abstracted from old plans and their relationship to the opportunities afforded by a digital mapping system geared to rapid updating and scale enhancement is an important issue that requires investigation.

Embracing the GIS concept can, in the Working Party's opinion, play a pivotal role in authorities' future highway management programmes. This report seeks to address how and why public rights of way information should be included in such programmes.

The draft specification for Part 4 of BS 7666, Specification for Public Rights of Way, will be available for public consultation from July to September 1995. All the comments received will be considered before the decision is taken to submit a specification for endorsement by BSi. It is strongly recommended that those who wish to comment on the draft specification should purchase a copy of the report 'Ways into GIS' as it gives the background and context to the formulation of the draft specification and outlines the problems considered and recommendations made by the Working Party.

The report 'Ways into GIS' is published by the LGMB and is available from the Publications Department, The Local Government Management Board, Arndale House, The Arndale Centre, Luton LU1 2TS. Tel: 01582 451166.

The draft standard BS 7666 Part 4, Public Rights of Way is available from BSI, Linford Wood, Milton Keynes MK14 6LE.

For queries/clarification please contact:

Ways into GIS	David Jacobs, Dudley MBC	01384 452429
Draft Specification	Harry Pearman	0171 2650514
Report/specification	Tony Black/Rosi Somerville, LGMB	01582 451166

GIS AS A MANAGEMENT TOOL

John Clayson

Lake District National Park Authority

INTRODUCTION

Although our experience in the use of GIS for Rights Of Way (ROW) has been relatively limited, it is hoped that the ideas explored in relevant case studies in the National Park Authority (NPA), and our plans for digitising ROW, will provide several useful topic areas for discussion.

The aim of the workshop is to take a look at how GIS can help in the management of the ROW network. Examples will be given of how GIS can help improve the efficiency of routine tasks associated with ROW management, and examine how the tools which the technology has to offer can be used to analyse the network in a more innovative manner.

GIS IN THE LAKE DISTRICT NATIONAL PARK AUTHORITY

The Lake District National Park Authority (LDNPA) has been using GIS since September 1991. Most of the work has been undertaken as part of a three year development project, jointly funded by the Countryside Commission. The Lake District GIS Development Project was initiated as a follow up to the Monitoring Landscape Change in the National Parks (MLCNP) project (Countryside Commission, 1991). The MLCNP project, undertaken by Silsoe College, produced digital land cover maps for all National Park Authorities (NPAs) from air photo interpretation for the early 1970s and the late 1980s.

The Lake District GIS Development Project was based around the ready availability of the digital land cover maps. The main aim of the work was to investigate a range of NPA functions which would benefit from the specific use of this data, and more generally from the capabilities of GIS. A series of case studies were completed to allow the utility of GIS to be assessed across a wide spectrum of work. Progress has been summarised in a series of annual reports to the Countryside Commission (Clayson and Fishwick 1992; 1993; 1994). A final report will be completed shortly (Clayson and Fishwick, in press) and will bring together our experiences of the last three and a half years.

Since the initial three year GIS development project ended in September 1994, additional contract work has been completed for the Countryside Commission as part of their Parks

Inventory and Monitoring System (PIMS) pilot study (Kayes, 1994). The work aims to identify mechanisms by which National Park Authorities can produce standard performance indicators for different aspects of their work. As part of the pilot study, the LDNPA carried out an assessment of how information on a sample area of the Yorkshire Dales National Park Authority Definitive Rights Of Way (DROW) map could be entered into a GIS and utilised for routine and other work. The study also looked at how information on footpath furniture and condition surveys could be displayed and analysed in a GIS to help assess some of the performance indicators raised by the PIMS work.

A permanent GIS Officer was appointed in April 1995 and work is now concentrating on the automation of routine tasks using GIS, as well as specialist analysis in preparation for Local Plan and other inquiries.

GIS AS A TOOL IN RIGHTS OF WAY MANAGEMENT

For the purposes of the workshop, the management tasks associated with ROW are divided into three arbitrary topics:

- administrative management;
- legal management;
- management of the resource on the ground.

Whilst the tools which GIS has to offer can lead to significant improvements in the speed and efficiency of routine management tasks associated with the ROW network, users should be aware that more innovative use of the technology can also lead to potential improvements in the management of the network. The final section therefore covers analysis of the ROW network using GIS which may not have been considered when concentrating purely on the automation of existing tasks.

ADMINISTRATIVE MANAGEMENT

Transfer of the information from the Definitive Map to a digital format has the potential to lead to significant improvements in the administrative, i.e. day to day, management of the map. Several key advantages can be identified:

Storage and backup

Currently much of the DROW information stored on paper maps within local authorities is hand drawn on paper maps. As a consequence, either original maps or copies of the originals are relied upon. There is a risk that these could be damaged and the information irretrievably lost, or only able to be reproduced at substantial costs. Such losses would cause considerable disruption to the work of an authority. One of the benefits of being able to handle map based information on computer is that it is relatively easy to make backups and substantially improve the security of the information.

Greater and easier accessibility

If the digital definitive map can be distributed through an organisation, either on networked or stand-alone computers, different departments can gain access to the data without the need for multiple paper copies. Speed of access to the information can be markedly improved by having immediate access to the data on the desktop, leading to improvements in the time taken to deal with general enquiries. Such improvements should help save officer time and help improve customer care.

Flexibility in the scale at which the information can be drawn on the computer screen and output to paper eliminates the need for multiple paper copies to be held at a variety of scales. The need to manually redraw the definitive line at obscure scales, which were not accommodated by the paper version, is also bypassed. The use of a seamless dataset avoids having to tape together several maps when the area of interest lies on the corner of multiple sheets.

Single copy of the data which is up to date

If the digital definitive map is stored centrally on a computer network and appropriate read/write and update protection is implemented, there should only ever be one copy of the data. When paper maps are held at different scales, and multiple copies held by different departments, it is all too easy to have several versions of the same map all showing slightly different degrees of update. The use of digital data should help to eliminate these problems thereby improving the quality of the data and helping to avoid discrepancies within an organisation. Updating the digital definitive line is quicker and easier in comparison to paper, and archiving of the data is relatively simple.

All these improvements in the general day to day use of the data can bring cost benefits in comparison to traditional techniques, which over time can lead to significant savings.

LEGAL MANAGEMENT

Some common difficulties can be identified when using traditional methods to deal with the legal management of the DROW network. On the whole these relate to the limitations imposed by the use of paper maps.

• The need to know the number and location of modification orders which are needed to bring the definitive map up to date, ensuring it is legally defined, is a basic requirement. Using traditional paper maps it is often difficult to gain an overview of the network to visualise the distribution of this information.

• Once a modification is agreed, update of the DROW map often takes place at one scale. It is time consuming to transfer the data to a different scale or to cross reference it with information, such as constraints.

• The time taken to measure the length of a diversion/modification and the accuracy of the result can vary depending on the quality of the paper map and the scale at which it is drawn.

GIS, and the use of digital ROW data, can help solve these problems and increase the user's ability to query the data in a more versatile manner. Modifications can be quickly entered into the system at an agreed scale, either via a digitising table or on-screen tracing, and this only needs to be done once.

The modifications can then be viewed and analysed with much greater flexibility. For example, the data can be displayed at a specific scale, across the whole network or for a particular administrative area (parish, ranger or management area).

Analysis with other datasets would then allow summary statistics to be produced, or to highlight patterns in the data. For example, database information on each modification could be linked to the digital map and used to display attributes, such as the length of time the modification has been outstanding. The link with the GIS and a database would also allow map based access to textural information giving details of the modifications. Alternatively, the GIS can perform geographical analysis (as opposed to simple viewing of database attributes) allowing the data to be viewed in new ways. For example, the GIS can produce a colour shaded parish map which highlights the number of modification orders in each area.

The improvement which GIS can bring to this area of work will produce similar cost benefits to those associated with the administrative management of the DROW map.

MANAGEMENT OF THE RESOURCE ON THE GROUND

The routine tasks associated with the day to day management of the DROW network can be aided by GIS in the following ways:

Viewing ROW database/survey information

GIS can help rangers or wardens plan their work, such as the replacement of furniture along a route, by aiding the production of maps which show where the work is needed. In a system where the ROW survey information, whether in a database or stored on paper, is divorced from the Ordnance Survey (OS) map, time is wasted in even the simplest of tasks. For example, to plan the replacement of signs in a given area, the survey information has to be interrogated to identify all the relevant sites and these then have to be located and marked on an OS base map.

If the database and digital OS maps can be linked in some way, this task can be completed in a fraction of the time, and maps can be printed to any scale. If the use of technology is taken still further, the need for printouts can be avoided by using mobile (and increasingly pen based) computers, linked with Global Positioning Systems (GPS). These systems allow the necessary OS base map and data to be taken into the field, and accurate locational references to be made automatically.

GIS can also help to view footpath condition surveys to help plan erosion control and surface maintenance.

Integrating other datasets with DROW

Additional benefits can be gained from the use of GIS by combining other 'constraints' datasets with the digital ROW network. An environmental impact assessment of proposed footpath work could be undertaken in the office by running automated constraints checking using GIS. The time savings in automating this task are obvious, and would hopefully encourage impact assessments to be undertaken more readily than they might be using paper maps. The need to seek appropriate advice from other specialist staff before starting any work on the ground could be indicated by the GIS as part of the checking procedure.

Monitoring policy objectives

At a more strategic level, database information could be viewed in a flexible manner to allow managers to monitor how well agreed policy targets are being met. GIS provides the flexibility to

view and analyse the data from field level to local authority level at the touch of a button, a task which is often impractical using paper maps. Viewing the data in this way allows problem areas to be identified on a geographical basis, and helps to target resources to those locations in most need of attention.

OTHER TYPES OF ANALYSIS

Areas of work where more innovative GIS analysis might be applied could include:

Actual DROW network versus potential network

Although footpaths are not stored as an individual layer of information in the OS digital vector base maps (Land-Line.88 to 93+) the data can be extracted via on-screen digitising. Similarly, the information can be extracted in the same way from scanned OS base maps. If the footpaths and bridleways shown on the OS maps do not form part of the definitive map the routes represent potential additions to the network. Similar information can also be gleaned from the OS OSCAR road centre line dataset which includes forest tracks which may not be included on the DROW map.

GIS allows the actual and potential network to be viewed together, and areas where extensions to the DROW could be made can be identified. Additional information such as the location of car parks, cycle hire centres or horse riding centres could also be incorporated to help assess where the greatest demand is placed on the existing network.

Alternatively, GIS can be used to quantify the differences between the actual and potential network. For example, the lengths of the two types of network can be calculated on a 1km basis and used to colour code a 1km map with the difference between the two.

If it was thought necessary to extend the definitive network in a given area, the addition of digital land ownership boundaries would help to identify those owners amenable to increased access to their land. This would help to target initial efforts at those areas where results could be achieved quickest.

Assigning scores to the network

The use of GIS for displaying database information has been highlighted on several occasions already. In this respect the GIS provides a mechanism to allow the information relating to the ROW to be viewed in a more flexible manner. Database functions initiated either in the database software itself, or via the GIS database capabilities, can be used to derive summary statistics for

each individual ROW. For example, the database might contain information on the number of obstructions along the routes. The total number of obstructions for each ROW could be calculated and used to assign a 'score' to that route on the map. Each route would therefore have its own score and this could be viewed in the GIS to help plan future policies or target work on the ground.

Any of the attributes recorded in the database could be used in this way, either individually or in combination, to derive a whole series of different types of score. For example, the total length of erosion along a route, the number of signs needing replacing, the resources already spent, or how accessible the route is for different types of users can all be used to assign scores to the network.

Predicting likely areas of erosion

Many GIS are able to process and analyse digital elevation data, in the form of contours or height points. The data is used in the GIS to form a Digital Terrain Model (DTM) of the landscape, from which an altitude map can be produced. Additional information such as slope and aspect can be derived from this, giving rise to three useful topographic datasets which can be combined with digital ROW. For example, summary statistics could be derived for the length of the network above, below or within different altitude or slope characteristics. This information could be used to pinpoint areas where paths fall on steep slopes, which, if other factors are equal, might be expected to erode more readily than paths on flatter ground.

More complex analysis might include some form of land cover analysis. Depending on the data which is available, land cover types susceptible to erosion (such as peat) could be identified. This could then be used either on its own to indicate areas where erosion on the ROW network might occur, or it could be combined with the digital elevation model to allow these factors to be incorporated.

If information on the number of walkers using the network is available, from stile counters for example, this could also be incorporated to refine the erosion model further.

Network Analysis

GIS is being increasingly used in route planning and market analysis. Processing of digital road network data calculates the quickest route between two places, or allows 'drive time' isochromes to be plotted from a given point. The same techniques can be applied to any network, and so with the DROW map it would be possible to undertake analysis to plot the time taken to walk a specific route as well as the shortest route between two points on the network. Other factors can often be included in the analysis to refine the likely speed at which it is assumed people can move along the network.

Surface modelling

Raster based GIS can handle multiple layers of information which can be incorporated into a model to produce a 'cost surface map'. The GIS utilises this information to calculate the 'least cost route' between two given points. These modelling capabilities could be used to help plan the expansion of the DROW network in sensitive areas. A cost surface map of constraints information could be produced, in which different weightings are assigned to the layers of information to reflect their relative sensitivity to increased access by walkers. The GIS would then be able to predict a route across a given area which has the least overall impact based on the underlying constraints information.

The more innovative use of GIS begins to utilise some of the many tools which are often available but never really used in the routine tasks. Care is needed, however, to avoid falling into the trap of performing the more complex types of analysis simply because GIS allows it. The use of the technology should still be driven by users' needs, but organisations should not be afraid to experiment with the tools that are available.

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LEGAL ISSUES OF DEFINITIVE MAP REVIEW AND GIS

John Trevelyan

Deputy Director, Ramblers Association

The Rambler's Association welcome the introduction of GIS as a tool for managing rights of way, particularly, as a method of improving communication between authorities about the existence of rights of way where they may be threatened by development. Many of the problems which presently exist have been caused by poor communication or the use of out of date information, GIS could help to avoid repetition of these in the future.

Bringing a GIS into use with an existing Definitive Map and a rights of way database will point up some legal issues which must be addressed, some of these issues are matters which may, in time, arise in a paper system.

BOUNDARIES OF THE AREA COVERED BY THE DEFINITIVE MAP

There is a power in Section 57 of the Wildlife and Countryside Act, 1981 to prepare a new copy of the Definitive Map and Statement, as amended by Modification Orders, with a new relevant date. This is often referred to as 'consolidating' the Definitive Map. We will return to that process later under another heading, but its relevance for this heading is that there is no power to change the area covered by the Definitive Map either under this process, or any other. The area your map(s) cover has to stay the same. This applies where the original map was done on pre 1974 RDC and UDC boundaries; it applies where a former county borough was mapped separately; it applies where you have got little bits of map acquired on an adjustment of boundaries with a neighbouring authority.

What this means in GIS terms is that you have to be able to identify each separate area of Definitive Map in your system with its original boundaries, each map has to be kept under review separately; there could be a claim arising and you have to be able to review each separate length of right of way as it crosses over on to a different map.

This is wasteful and time consuming – can a government which is committed, it claims, to cutting out waste be persuaded to do something about it? Yes and no. The Rights of Way Review Committee has persuaded the Welsh Office to produce regulations so that the new Welsh unitary authorities can compile a map for their new areas; the Department of the Environment is planning to do the same in England; though these measures may not extend to the 'rump' maps. For those

authorities which are not going to change under the reorganisation there will be no new powers to enable them to compile maps which reflect their present areas.

CHANGES MUST BE LEGAL

This point is a simple one. The Definitive Map and Statement are legal documents and the procedures which govern their initial production and review are worded so that for any change to be legally conclusive it can only be made with legal authority.

That in turn means that in order to make a change to Definitive Map information held on a GIS you must have legal authority; you probably also need to hold on the system a reference to that legal authority. This means that much of the information that is held in a rights of way database you do not want to be held as part of the Definitive Statement as it cannot be changed easily. For example, the statement might record that an owner has a right to erect a stile at a particular place, an inspection report might reveal that due to a change in farming practice the stile had been removed, and you would want to record that fact, but the right to erect a stile would still remain and would still have to be recorded.

There is another issue here too. Section 56 evidential provisions apply only to the map as modified, which means they only apply once a Modification Order to show the change has been made. Therefore, a diversion, though legally effective, does not become part of the Definitive Map until a legal event order has been made giving a new relevant date. The GIS implication of this is that the system needs to be able to record both the diversion order and the legal event order separately.

CONSOLIDATION AND RUPPS

Consolidation of the Definitive Map and Statement means incorporating all Modification Orders, legal and evidential, and producing a 'clean copy'.

The Department of the Environment have given the view that an authority should not, given the wording of Section 54 of the Wildlife and Countryside Act, consolidate if the map still shows RUPPs. This is not a universally accepted view of the law; see the article by George Laurence in the Rights of Way Law Review, and it is not at all clear what legal challenge may be mounted against an authority which does consolidate whilst its map still shows RUPPs.

The GIS implication of this is that the map should have a new relevant date, within six months prior to the date of consolidation and each path may have a separate date. It is also important to remember that there are no objection provisions for consolidation, so there must be no transcription errors.

RELEVANT DATE

Each Modification Order has its own relevant date, so for each path or part of a path there may be different relevant dates. To be able to produce a Definitive Map and Statement on a GIS you will need to record these dates.

WIDTHS

The legal width is what is recorded in the statement, it may differ from what is shown on OS data and what is shown on the Definitive Map, and what is presently available on the ground and recorded in a condition survey. There will need to be a field for a Definitive width in the GIS, in addition to any other width information that you wish to record.

GIS & ACCESS TO THE COUNTRYSIDE

THURSDAY, 8TH JUNE 1995

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Keith Wishart	Management Support Officer Forestry Authority, Scotland
Jon Young	Recreation & Access Officer Brecon Beacons National Park

GIS & Access to the Countryside Programme

Coffee and registration from 9.30am

1015	Welcome and introduction	Katharine Hope
1020	GIS and Public Rights of Way Management: An introduction to the issues	John Hill
1100	GIS and Rights of Way in action: an introduction to the system in use at Gloucestershire County Council	Mike Gibbons
1150	GIS and Rights of Way in action: An introduction to the system in use at Hampshire County Council	Mandy Smith / Harvey Davies
1240	Draft British Standard for GIS	Mandy Smith
1255	Lunch	
1400	Workshop 1	
1445	Workshop 2	

A choice of topics:

1. What use is GIS?	Mike Jenkins
2. Digitising map based information	Steve Bartley / Rod Kedge
3. Legal issues of Definitive Map Review and GIS	John Trevelyan
4. GIS as a management tool	John Clayson
5. A close-up of Hampshire County Council's system	Mandy Smith / Harvey Davies
6. A close-up of Gloucestershire County Council's system	Mike Gibbons

1500	Tea
1550	Discussion & Questions
1630	Close

Countryside Recreation Network