PAI (Positional Accuracy Improvement) Programme

Stratford-on-Avon District Council Case Study

OS PAI release November 2001

"Did the Earth Move for You 2"

a candid insight into the world of PAI

PAI was never going to be fun. This was Stratford-on-Avon District Council's (SDC) approach to the very first PAI data release, some of the 'why's' and lessons learnt. Since this first exercise much still holds true but we have gained further experience. In due course this initial case study will include a supplement on how the procedures and processes have evolved.

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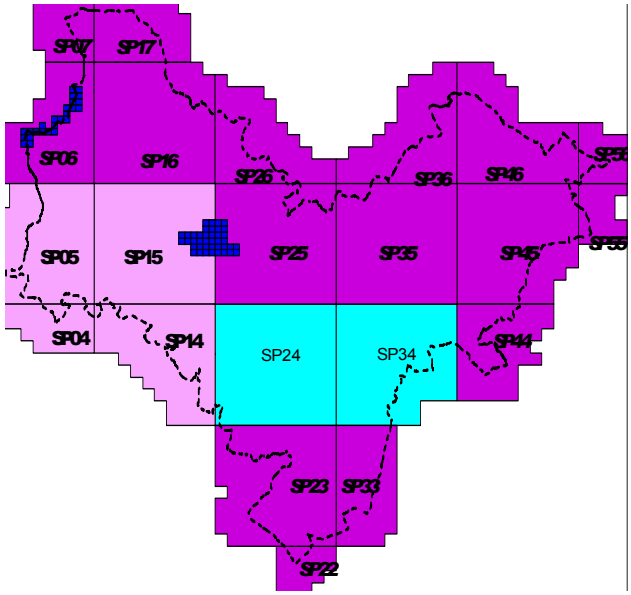


SDC Map Base facts:

1:1250 map tiles ■ 65

1:2500 map tiles 1104

PAI :

Nov 2001

1:2500 map tiles in first PAI release 178

2004

2006

Introduction

Stratford District Council (SDC) have always had a corporate approach to GIS. (We have been a GIS site since 1995.) The data is channelled through the GIS Project Manager to avoid duplication of datasets and all potential users of the dataset are lobbied to determine requirements. The data is captured to the standard of the highest detail user requirement (spatially and attributes).

For polygon/area data that means copying/tracing OS Land-Line. Datasets that share identical polygon boundaries (or have the majority in common, as a starting point) can be copied across to one another reducing duplication of effort.

This requires a deep understanding of the Authority's business use for the data, a foot in every service provision team and gaining the corporate vision. All datasets have a protocol, procedure, owner and set standards: most of this metadata is in an Access database (a read-only version is available across the intranet for users).

Datasets have a default viewing legend assigned to them based on historical paper colours and other datasets that will be viewed at the same time (so you do not end up with users looking at three different datasets in the same colour/patterns).

SDC have over 100 datasets in use, some of which are project based. Around 25 are Land-Line based, many for key business use such as the Local Plan, Tree Preservation Orders TPOs, Conservation Areas, English Heritage dataset [Listed Buildings, Registered Parks and Gardens and Scheduled Ancient Monuments] and around 30 small datasets have to be data captured soon, to Land-Line accuracy.

November 2001

SDC knew PAI was coming and we knew we would be affected. What we did not know was by how much (how many metres changes, how consistent) or that the

solutions we needed were not available off the shelf (in fact hardly on the drawing board).

Further Disappointments and Discoveries in process (aka Challenges)

- Rubber sheeting was never an option with Land-Line traced/copied data, so no solutions available were fit-for-purpose.
- No complete Pre-PAI OS MasterMap version is available for UK (about 5000 km^2 in the initial OS MasterMap supply were already PAIed).
- Real world change and PAI arrive together, and ADDRESS-POINT is PAI dependant; have to make decision to load both or neither for PAI affected areas.
- Tired of companies/consultants ignoring the QA (quality assurance) issues, especially given real world and PAI changes are delivered simultaneously.
- Do nothing is not an option for long, as maps get out-of-date. Users expect real world change to appear and be data captured to the same accuracy as other data.
- Second PAI delivery not to timetable, could be over 6 months later than expected.
- Small teams on small budgets, high work-load and in cash strapped authorities are dealing with LLPG, NLIS, other e-government initiatives and timetable - probably migrating to upgraded or new software with associated data, as well as PAI – which delivers the last tranche in 2006, after the 2005 e-government target.
- PAI requires a cocktail of solutions.
- LLPG grid references will change, particular care with terraced housing required, overall could be 10-20% change required.

SDC's 'keep it simple and straightforward' approach has been:

1 Assess the 'damage'
2 Corporate-wide warning flags to service plan timetables
3 SDC Data Audit

Solution for SDC 2001 PAI data

4 Market Place solution investigation and data assessment
5 'Red Flag' Challenges identify [Dataset that require action]
6 Feedback to OS of issues with our data and theirs
7 Prepare representative samples of data: before PAI with Land-Line, and by data capturing again, how we would wish to see our data after PAI change on new base.
8 Distribute samples to non-rubber-sheeting potential suppliers that may provide an algorithmic solution. Data samples to and from OS, and others. Receive feedback and continue the information/solution loop. Market Place update.
9 Manage the change. Develop programme, protocols, datasheets, QA mechanisms, work up timetable and identify resources.

What prompted SDC to Take On the Challenges (the way we did)?

- Out-of-date maps
- Local Plan Review, release date 24.01.2003
- Ground Maintenance and Grass Cutting Contract renewal Q1/2 2003

- More solutions likely to be available for second PAI delivery, and more likely to be designed for Pre- and Post- MasterMap availability.

1 Assessing the 'Damage'

SDC have always used the /Data/Report.txt file as supplied on the OS Land-Line CDs. So it was apparent that when 178 adjacent tiles arrived with dates in the last quarter that PAI had arrived (the famous gold disc).

SDC store Land-Line archives on an annual basis anyway, We simply archived our holding pre-this new CD (labelled 'Pre-PAI 2001'). We store current Land-Line in 2 formats, for different system delivery, so we update one of them with the new CD and do a comparison on a map tile grid. We view the old Land-Line in the normal colour display and add the layer of new Land-Line in red. By viewing each tile resupplied on that CD we could evaluate the changes. There were real world changes on many tiles all over the District which had a PAI impact too.

The main PAI tiles showed between 0m and 4m generally, enough to move a terraced house next door! This meant that constraints against a property were severely compromised or just wrong and would have to be realigned. ADDRESS-POINT would move on its next release where the dot/building seed no longer fell within the building footprint, and any data derived from Address Point would also have to be moved. [LLPG Administrators be warned].

We loaded only the tiles for the main users Land-Line format that were not affected by PAI and kept back the PAI tiles ready for when we had a method and timetable for change worked out. Subsequent quarterly updates within the PAI areas were also kept back.

The Shambles, Shipston-on-Stour

2 Corporate-wide warning flags to service plan timetables

The Chief Executive, all Directors and Heads of Service were informed of PAI immediately after Stage 1 as described above. Whatever means were going to be necessary to adjust data to PAI changes – it would not happen overnight!

An Address group was set up around this time for LLPG and all services likely to be affected were represented at a working level. PAI changes were also introduced to this group. Although they would not be making the XY corrections to the LLPG, it was another dimension to be added to the timetable.

Although the map base would become more and more out-of-date address data had to match this base.

3 Data Audit

SDC trace/copy Land-Line for their area/polygon data, ready for NLIS Level 3 and it was always better for collecting "data within polygon" enquiries on the GIS. This meant that rubber sheeting was never an option for our datasets captured to this accuracy.

The following tables illustrates the different types of data sets held by SDC and the specific PAI action for each.

Type	Category	PAI Action
a	Those captured at 10K to 50K : 3rd party data, most utilities, Environment Agency, English Nature data, some OS datasets (Boundary-Line)	Visual check; for falling wrong side of obvious landmarks (buildings, water, roads). Communicate viewing scale accuracy (eg on GIS legend)
b ~	In-house Land-Line data captured datasets (including recapture of some 10K supplied datasets).	Identify datasets Prioritise 'Business Critical' datasets Identify numbers of features in PAI area for each dataset*
c ~	As **b** but with freeform lines not associated with Land-Line or a measured distance from Land-Line. (same for MasterMap)	Identify datasets Prioritise 'Business Critical' datasets Identify numbers of features in PAI area for each dataset*
d ~	MS Access etc databases viewed in/ linked to GIS	Identify datasets Prioritise 'Business Critical' datasets Identify numbers of features in PAI area for each dataset*
e	Datasets about to be data captured	Areas OK to do (1:1250 and PAI areas). Deadline?
f	"Don't start" – datasets	Assess if pilot will do for now, see **e**
g	Base data – OS, Aerials	Still needs PAI management

h	Project files – date stamp eg Summer Leisure schemes, landscape assessments	Question still relevant, access scales for a,b,c; store as archive against archived Land-Line for year
j	Datasets that you provide to other organisations/authorities (ie we are the third party)	What have they done with PAI? When do they need PAI datasets to match their base map holdings? Do you need to keep 2 parallel versions?
k	Datestamp/Vintage of National Initiative maps eg. NLIS hub, NLPG grid references	Has anyone got an answer on this yet?

* Draw PAI tiles as a dataset, perform GIS analysis for any part of selected dataset features falling within PAI tiles = number of features requiring attention.

~ Large polygon/areas and those overlapping PAI area are not likely to fit solutions

Metadata is never fun to collect, but is invaluable in informing you about your dataset holdings, and as we already held this metadata it proved to be a fast starting point in identifying datasets and priorities. Examples of metadata we hold are given below.

Dataset	View name	View Scale	Status	Quantity	km/m	Type
Addresses (see OS AddressPoint and UPRN) ©2						
Advanced Payment ©SDC						
Advert Control (see Area of Special Control for Advertisements)						
Aerodrome Safeguarding ©2	AirSafe Consultation	>10000	A	18		7
Agricultural land high grade 1,2,3a ©2	Agric Grade 2 &	>10000	PF	112		2
Agricultural Occupancy ©SDC	N/A		1			
Alcester Roman Town ©SDC						
Alcester Town Preservation Order ©SDC						
all 6 acre standard ©SDC		any	Pilot			
Ancient woodland (English Nature) ©	SSSI+LNR+AW		All @ .01.2002	(245)		2
Anti-Poverty mapping (see Deprivation mapping)						
AONB (see CAONB - Local Plan)						
Appeals (see Planning Appeals)						
Archived Conservation Areas (see Conservation Areas - archived)						
Area of Special Control for Advertisements ©SDC	ADVERT Area of Spec	>1250	A	1		1
Areas of Restraint in Local Plan ©SDC	Local Plan ADOPTED/l		A	6		1
Areas of Special Restriction in Local Plan ©SDC	Local Plan ADOPTED/l		A	3		1
Article 4 Directions ©SDC	article4	>5000	C	4		1
Battlefield ©2	Battlefield	any		1		1
Breach of Condition ©SDC						
Bridleways (see Footpaths)						
British Waterways Consultation Areas (BW) ©						
Building Preservation Orders ©SDC						

Contact	Phone	Updated by	xt	Update Frequency	Capt'd	Dept to view	Land Charges	Filename	Add
							y		
							y		
S.Bromley	2336	GIS PM	2338	NE	I/E	P		Airsafe	R
D.Jones	2334	J.Naylor/GISPM	2741	NE	E	P		agri	G
L.Cureton-Taylor	2214					L	y		
							y		
							y		
C.Wood	2640					TP			Y
R.Rose/A.Hillman	2329	GIS PM	2338		I	All		engnat03cn	
P.Harris	2314	J.Naylor/GISPM	2741	NE	I/E	PT		asc02cn	R
D.Jones	2334	J.Naylor/GISPM	2741	NE	I	C		lp2000/lpdep01	W
C.Staves	2333	J.Naylor/GISPM	2741	NE	I	C		lp2000/lpdep01	W
L.Greenwood	2120				E	P	y	article4	R
S.Bromley	2336	J.Naylor/GISPM	2741	NE	I	C		battfld	R
Planning DC							y	En4boc	R
British Waterways		GIS PM	2338	NE	S/I	C		bw	R
L.Cureton-Taylor	2214					L	y		

4 Market Place solution investigation and data assessment

SDC needed a solution that dealt with types **c** and **b**. A non rubbersheeting, intelligent solution, moving Land-Line referenced polygons with lots of freeform lines, and that could handle real world change, with no degradation of data. (See **7**)
The other types were dealt with as follows:

Type **a** needed visual sign off, but not captured at sufficient accuracy to cause PAI concern.

Type **d** would need either an XY coordinate input link to database, manual input or combination; polygon/area linked databases would be unaffected as long as join reference(s) maintained. LLPG grid references will change, especially from those sourced from ADDRESS-POINT

Types **e** and **f** limit new (large) datasets/pilots to PAI changed areas and 1:1250 maps where possible and roll out with next PAI release etc.

Type **g** know your supplier's criteria. Aerials and raster maps unchanged, unless tied to or sourced from 1:2500 or its grid references; OSCAR-Asset not changing short term unless falls outside carriage width, ADDRESS-POINT moved when falls outside building footprint. Boundary-Line as supplied is from 10K source so not accurate enough for us to use anyway.

Types **h**, **j** and **k** see table under **3 Data Audit**

In 2001 there were no solutions available that fitted our criteria for types **c** and **b**. During 2002 there were still no solutions available that fitted our criteria for types **c** and **b**. (See **8**)

5 'Red Flag' datasets identified

Business Critical datasets in types **b**, **c** and **d** identified and prioritised. See **9** for more detail.

6 Feedback to OS of data issues

SDC communicated the following points to the OS:

Jan 2002	Convey to OS dismay at amount of PAI change and lack of link file points. Also lack of solutions. Provided examples.
April 2002	OS Bath conference – see OS PAI staff re concerns and flaunt our "Did the Earth Move for you?" catchphrase and PAI signature map (see plot of The Shambles above). At this time a lot of LA's were in denial as to whether PAI would affect them.
During 2002	PAI programme paused. Samples and test data provided by/to both parties.
Oct/Dec 2002	More link points supplied with PAI data
Q4 2002	Work with possible solution providers
Dec 02/Jan 03	PAI programme implemented at SDC
During 2003	Work with OS PAI consultant on issues

7 Prepare representative samples of data:

SDC prepared:

PAI Sample of PAI-Land-Line to form new map base, including real world change area

Pre-PAI Sample of Pre-PAI-Land-Line to form original map base

Pre-PAI A 100 feature sample of a typical type **C** dataset before PAI, to sit on prepared pre PAI map base

PAI Recaptured the 100 features as we would wish to see them on PAI map base, including real world change interpretations

The key question for us was 'How close can any solution get to the 100 PAI dataset features?'

8 Distribute samples and Marketplace Update

Samples were distributed to potential suppliers of non rubbersheet transformation software with the blessing of OS, who also had samples and have done their own distribution.

Q2 2003 possible solutions emerging (3 months after SDC Local Plan published on latest maps, data PAI changed). Solutions on offer still require time in understanding the data, preparation, the solution required. There are costs associated with the post transformation QA and manual intervention/interpretation. On top of this it is essential to spend time on documenting your implementation and archiving copies of data and base maps.

The search of a solution, or cocktail of solutions is still ongoing. There seems to be three main types of solution available;

1. Those with a rubber sheet algorithm or similar

2. Those that require reformatting of the data to get it into and out of the transformation and back into our system

3. Advanced systems that require knowledge of coding and SQL – only for the advanced user.

9 Manage the change

The main activities here are:

- **Develop programme, protocols and datasheets,**
- **QA mechanisms,**
- **Work up timetable**
- **Identify resources.**

A year on from the PAI November 2001 release SDC hit crunch time. The Local Plan Draft Review was timetabled for release on 24.01.2003, so we either bit the bullet or

delayed the Local Plan. Furthermore our maps were getting out of date and the Ground Maintenance and Grass Cutting Contract was due for renewal Q1/2 2003.

We still had no short-cut solutions for types **b**, **c** and **d** …

SDC made the decision that we would recapture all the features affected by PAI, and get our Local Plan out on time with the latest map base.

This gave us our deadline and therefore we had to make a programme that delivered.

Having identified the datasets in types **b**, **c** (and **d)** we built up a table based on the priority of the Business Critical datasets we were going to recapture.

Examples of some type **c** Business Critical datasets details:

Features affected	**Dataset**	**File (updated)**	**Completed Before Local Plan**	**Completed for Local Plan release**	**Completed After Local Plan**
32	English Nature [SSSIs, LNRs and Ancient Woodland]	LIVE file		Y	
580	English Heritage [Listed Buildings, Registered Parks and Gardens and SAMs]	/pai/paicons/engh03		Y	
22	Local Plan ADOPTED	/pai/pailp/lp2000p1		Jan 03	
11	Local Plan Draft Review 2003	/pai/pailp/lprev03	Y	Dec 03	
1697	Site Histories (DC Application polygons)	/pai/paisites/p1xsites		Y	
?	UPRNs	LIVE file (type **d**)		Y	
803	Grounds Maintenance	LIVE file			Y

Protocol sheets were developed to produce a work flow and check list for completing the manual transformation of the data. An example is given on the following page.

Example of Protocol Sheet

PAI Type **b**, **c** and **d** Protocol Sheet Date: November 2002

Datalayer: lpdep01 [Local Plan Review 2001]
Notes: use completed file as basis for lprev03 [Local Plan Draft Review 2003]
Original file; /plancons/lps/lpdep01
Assets affected: 11
Data type: Adjacent polygon; many to one relationship; dougnuts; Land-Line traced with freeform lines.
Print attribute table of original dataset for 'assets affected by PAI': ✔ (attached)
Spatial print out of dataset for PAI area: ✔ (attached)
Decide if original dataset still allow edits/additions: NO
If 'yes' – must be done to /pai/ … files also [AUDIT!]
If 'no' change original data dictionary edit mode file to lock down (read only)

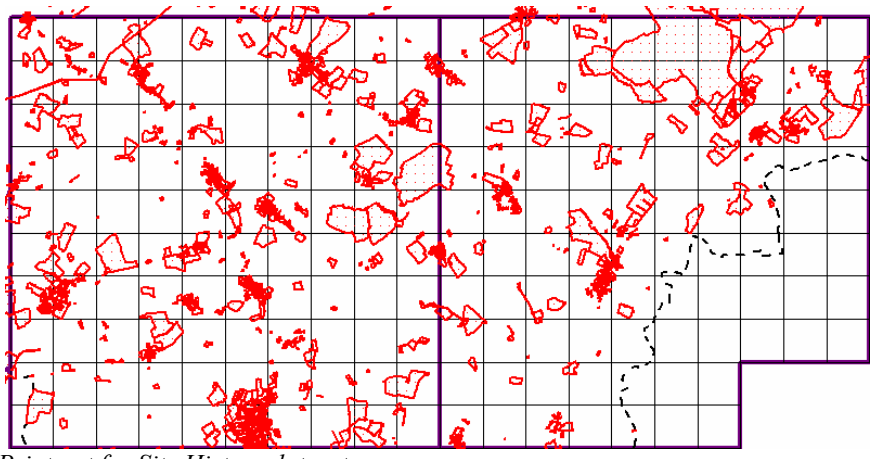
Classification: Redo / ~~Redo LIVE file / convert~~
Category: Business Critical / before/~~at same time/after~~ Local Plan 2003~~/ Later / 3rd party~~
Working files: /pai/pailp/lpdep01
Complete: 11.12.02
Finished files:
lpdep01 = /pai/pailp/lpdep01
lprev03 = pai/pailp/lprev03
sdc_id = /plancons/lpdep01/lpdep01_id
Key = /live/data/jon/lpdeposit/lpdep01.avl
/live/data/jon/lpdeposit/lprev03.avl
Data redo -
Save/copy original dataset: /prepai/lp/lpdep01 Date: 11.12.02
Save/copy associated files: /prepai/lp/lpdep01.avl Date: 11.12.02
New directory in /pai /pailp/
Data dictionary entry for new data: pailpdep01
QA: ✔ PH -Local Plans

Signed off: PH 11.12.02

Check works in GIS- Date: 12.12.02
Copy original prepai datasets to archive area: /prepai1/…. /lp/lpdep01 ✔
Make directory to allow replacement with paicoverage (if nec) /pailp/
Copy pai file : ~~to give same path as original~~/Map path to new file
Test it works in GIS and pulls in legend/display ✔
Final QA ✔
Live date: 24.01.2003

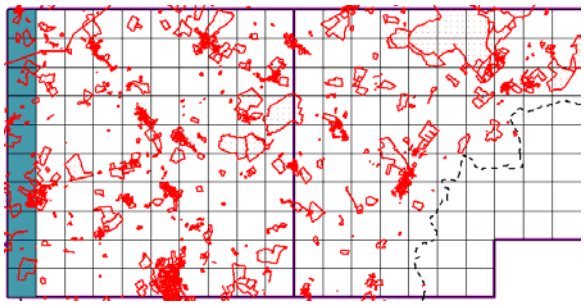
Complete:
✔

The diagram below shows a spatial print out of dataset for PAI area to be recaptured, on 1km^2 PAI tiles. This was used to mark off completed work.



Print out for Site History dataset

Each member of staff doing the recapture was given a print out as above for each of their dataset(s). We co-ordinated columns and allocated a day for each column for the work to take place simultaneously.



- Select data to be recaptured
- The GIS software we use means that the number of feature changes in = the number of feature changes out
- View pre-PAI data and maps, and PAI maps and selected data on screen simultaneously (2 windows)
- Data loaded late in the afternoon for maps and overnight for data, especially if LIVE file
- QA sign off, data owners to be on tap/call during process
- Continuous documentation

Good Practice

SDC established the following points as being "good practice" for managing your PAI implementation

- Keep an annual edition of Land-Line/MasterMap as archive
- Keep a 'before PAI' copy of datasets being moved for PAI (it only needs to be the area in each release and any overlap into adjacent tiles) – clearly labelled.
- Always compare Land-Line/Mastermap updates before issuing to your GIS users (don't update their base maps until the data corresponds)
- Make a list of all the datasets needing PAI change – even if not affected in your first delivery.

- Don’t forget ADDRESS-POINT is also affected by PAI
- LLPG ditto above
- Don’t forget quarterly updates, once PAI affected need selective treatment whilst your correction programme is rolling.
- Decide how datasets are to be updated, if copies are made and worked on for PAI they need to be updated at the same time as the datasets in use until the swap is made.
- Keep management and Service Delivery teams informed
- Service Delivery teams inform you of important deadlines to their service (what’s in their Business Plan/Service delivery Plan?). You may need to indicate PAI implications.
- Collect useful metadata on your data
- View before and after simultaneously
- Why store data:
  Quality of data capture (not always £ for £ value but accuracy = results, on searches/analysis)
- Prioritise if in crisis
- Limit new (large) datasets/pilots to PAI changed areas and 1:1250 maps where possible and roll out with next PAI release etc.
- Data Audit – Quantity and Quality
- Archive data
- Document data changes
- Document file locations

References:

No useful references at this point of time

SDC recommend :

Finally we recommend;

- you know/understand your data
- read up on OS PAI literature
- attend OS PAI seminars
- talk to your GIS suppliers
- get a PAI budget
- do QA – loads of it, especially in real world change areas
- don’t underestimate time and resources
- keep your sense of humour and perspective at all times!