Mapping children's places and activities:
Analysis of the local area around a primary school

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1. Introduction

Children's needs cut across a variety of topical concerns of national government, local authorities and the wider public: the provision of education; the congestion of the 'school run'; obesity and exercise; and social problems associated with 'youths on the street' on the one hand, and 'stranger danger' on the other. The planning and design of the built environment can play a role in addressing these concerns to some extent, in supplying places that encourage outdoor play, exercise, walking as a means of transport, sociable (as opposed to anti-social) spaces, and even assisting with the psychological development of the children themselves.

Successful design of the built environment requires appreciation of the users for whom it is to be designed. This includes appreciation of the user's physical characteristics and capabilities (size, weight, speed, range and so on); the user's motivations and aversions; and usually an appreciation of how users actually behave, in terms of where they typically go, when, and what they do there.

A successful built environment is difficult to achieve if not much is known about the users for whom it is to be designed – or if some users are not considered in the first place. When it comes to children, there are potentially gaps in provision. For example:

- There are 'in-between places' – the environment around and between the dedicated facilities (such as schools or play areas) [1]: the general urban environment of tarmac, car parks, verges, landscaped areas, and so on. How these are designed and configured could have a significant impact on children's activity.

- There are 'in-between activities' connected with children 'roaming around' and 'hanging around' that are neither directly identified with 'travel purpose' (journey to/from school) nor 'destination activity' (e.g. education, sports, formal play, etc).

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[1] Town planning has often specifically provided for children. This is seen in the provision of dedicated spaces and places for children, such as play areas, 'tot lots', recreation areas and informal open spaces. With respect to wider urban layout, there has a long tradition in town planning of designing settlements around neighbourhood units that are themselves based around the catchment areas for the local primary school.

- Much of the conventional planning theorising to do with schools and neighbourhoods was premised on the assumption that children normally go to their nearest school. However, this does not necessarily apply nowadays.

- Much of conventional planning theorising to do with schools and neighbourhoods was premised on traditional activities of children – for example when outdoor play was taken for granted, and almost any kind of space (streets, yards, alleys, vacant ground) might be used for play, whereas nowadays children may be more limited to programmed recreational or sporting activities, many of which now take place indoors.

In short, there is a need to better understand children as users of the built environment today. Accordingly, a programme of research has been undertaken as part of the CAPABLE project[2] to establish children's activities, travel and use of the local environment, though a combination of surveys and mapping exercises. This paper reports preliminary findings on research addressing the kinds of outdoor / public spaces used by children, whether for travel, play, or other recreational or 'place-related' activities. It is part of a component of the CAPABLE project relating to the analysis of areas and child-friendliness of neighbourhoods.

The overall research programme draws from an analysis of various locations in London and Hertfordshire. This paper reports on preliminary findings from one primary school[3] in Flamstead End in Hertfordshire. The work reported is part of a wider programme of surveys of school children's travel and outdoor activities, captured using Global Positioning Satellite (GPS), travel diaries and other surveys.

This paper first gives an overview of the study area and its various features of relevance to the study. Data on children's activities (obtained from GPS surveys) is then analysed, and is matched up with the study area locations and features. The main analyses reported here concern which children use which places ('where-who' analysis) and which areas are used when ('where-when' analysis). Subsequent research and analysis will cover other combinations of 'who', 'where', 'when' and 'what', and also questions of 'how long' and 'how far', and ultimately 'why'.

2. The study area

Flamstead End is located near Cheshunt in Hertfordshire, just outside Greater London and just outside the M25. The specific study area to be considered for analysis is a 1km square area centred on the school gate of Flamstead End Primary School, as shown in Figure 1. The size of area chosen had to be a balance: it has to be large enough to offer a reasonable range of types of area (in terms of built form land use, associated activities) to be meaningful and worthwhile to analyse, but small enough that the coverage by local children (in terms of density of use) would be sufficient to allow meaningful inferences to be made about the kinds of places visited and those not visited.
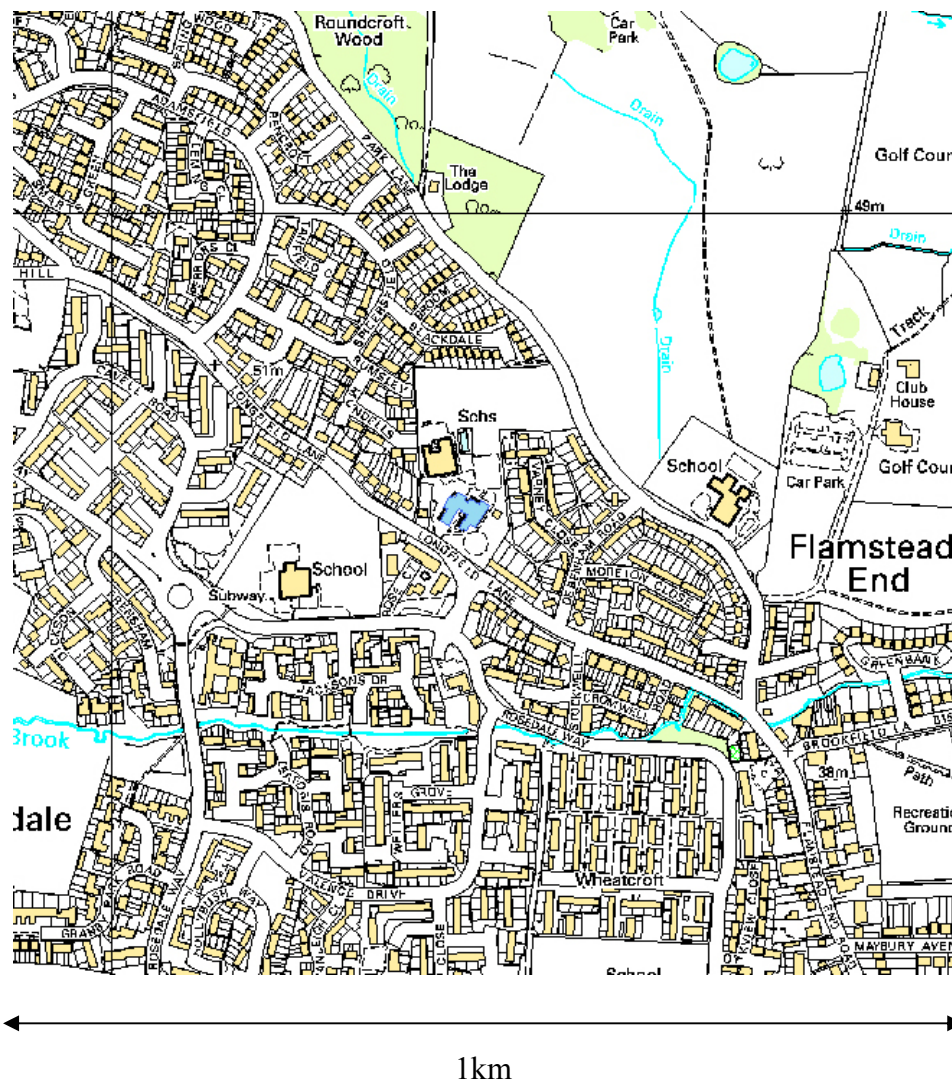

1km

Figure 1 Survey area: 1km square around the primary school (shown in light blue)

A site observation – referred to as the 'area survey' to distinguish it from other surveys – was carried out to identify the general lie of the land, and specific points of interest that might have a bearing on children's activities and behaviour. An overview is now given.

Overview

The area is a predominantly residential suburb with a large park and a golf course in the North East part. Longfield Lane could be said to be the main 'axis' locally (at least in terms of the 1km square under scrutiny). It has a variety of housing types and ages along it, and appears to form a kind of original or vestigial 'ribbon development' that was subsequently surrounded by newer development. This newer development, which forms the majority of the housing, is mainly formed by two storey terraces, mainly in 'Radburn' style with culs-de-sac often linked by footpaths.

In addition to Flamstead End Primary School itself, there are two other primary schools within a 300m radius. There are not many shops or facilities in the area; these are mainly concentrated in the south-east corner, on Flamstead End Road. The whole area is studded with trees and green patches (whether verges or larger areas); those areas bounding the open fields or parkland are perhaps particularly attractive and tranquil.

Routes

The main routes of interest are picked out in Figure 2, and are discussed below.
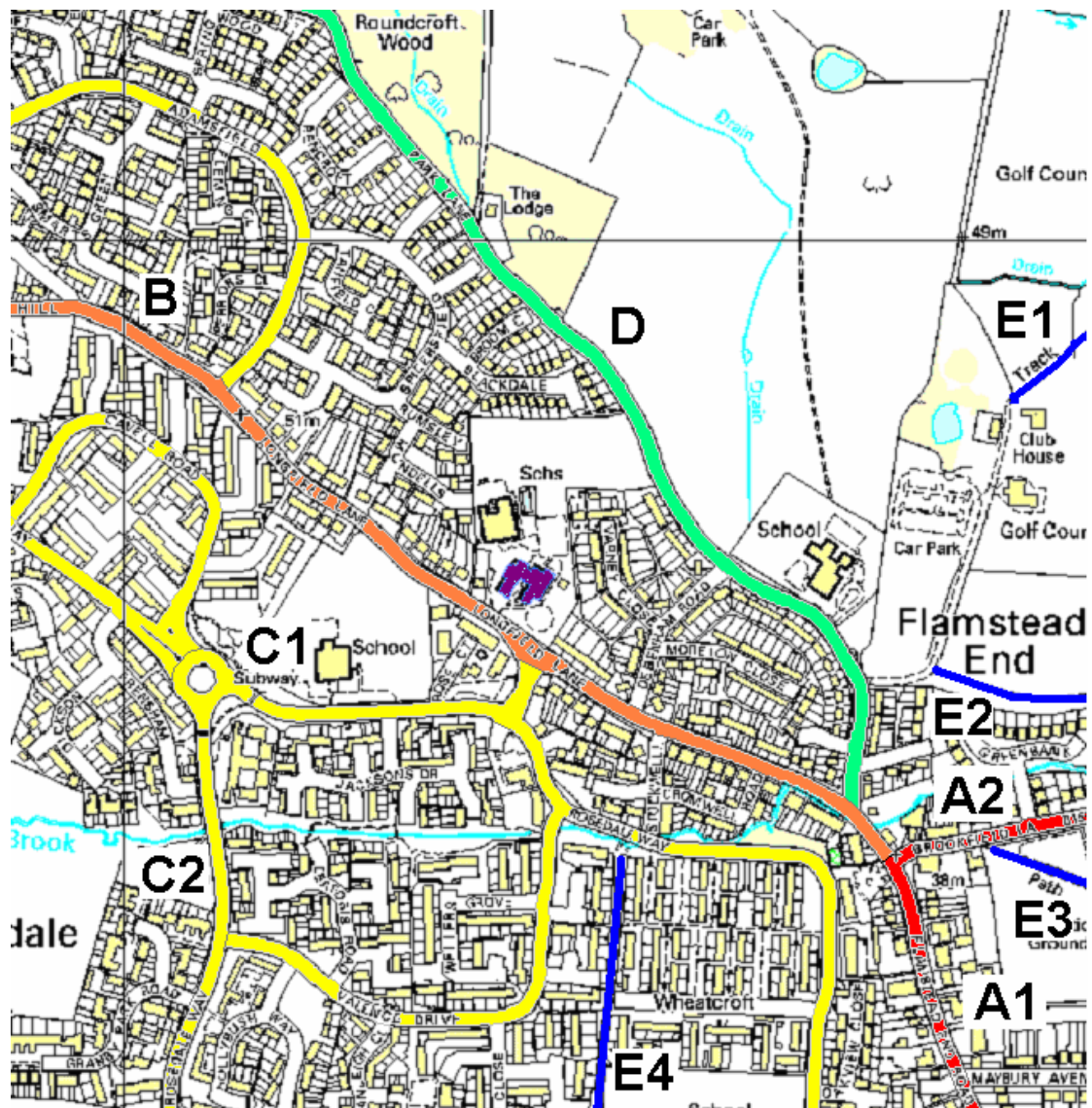

Figure 2. Interpretation of notable routes. See text for explanation.

The routes may be described as follows:

- Red: B156. This is a relatively busy road – the busiest in the locality. It has the feel of a traditional road that has had development grow up around it. Flamstead End Road has shops, pubs, petrol stations, restaurants at various points along it (A1). On Brookfield Lane (A2) the traffic seems to be travelling at relatively high speeds, and is unpleasant to walk along.

- Orange. Longfield Lane. This also has a traditional feel to it. The traffic is less heavy and at lower speed. The section running north-west from the Primary School (becomes Dig Dag Hill) has a footway only on the north side (B).

- Yellow. This consists of a series of district distributor or local distributor type roads, associated with the post-war (perhaps 1970s) housing development. These generally have footways alongside, although often separated by a verge, and sometimes taking a slightly different alignment, such that there are sections of road with no adjacent footway. They also have subways at certain locations, as if these roads are not meant to be crossed by pedestrians (C1). Further hierarchical distinctions may be made between the busier sections of road, that are also served by buses – for example, the western part of Rosedale Way (C1, C2) – which might be regarded as district distributors; and those that are of a more intimate local character. These generally do not have houses directly accessing them, and often have landscaped verges bordered by the back fences of gardens.

- Green. Park Lane is singled out here as a separate category (D). For the most part (except for at the south-eastern end) it has a feel of a traditional country lane, which development now abuts, but without direct vehicular access. This road has no footways for much of its length, which makes it not entirely suitable for pedestrians. However, it makes for a good route to cycle along, as it is relatively lightly trafficked.

- White / uncoloured. The remaining roads are mainly residential access roads, lined with houses.

- Blue. Four notable pedestrian footpaths are highlighted. (E1) Track across golf course, that is available as a public route. (E2) Tarmac footpath to lake. (E3) Footpath across recreation ground. (E4) Public footpath that has the form of an old lane running between hedges.

- There are numerous other footpaths running between the housing blocks. Also, some footpaths run under some of the distributor roads (marked in yellow) by way of subways. On the day of the area survey no one was observed using any of these subways, or the routes immediately leading to them.

Open spaces

The main open spaces of interest, plus those that exemplify particular kinds of open space, are picked out in Figure 3.
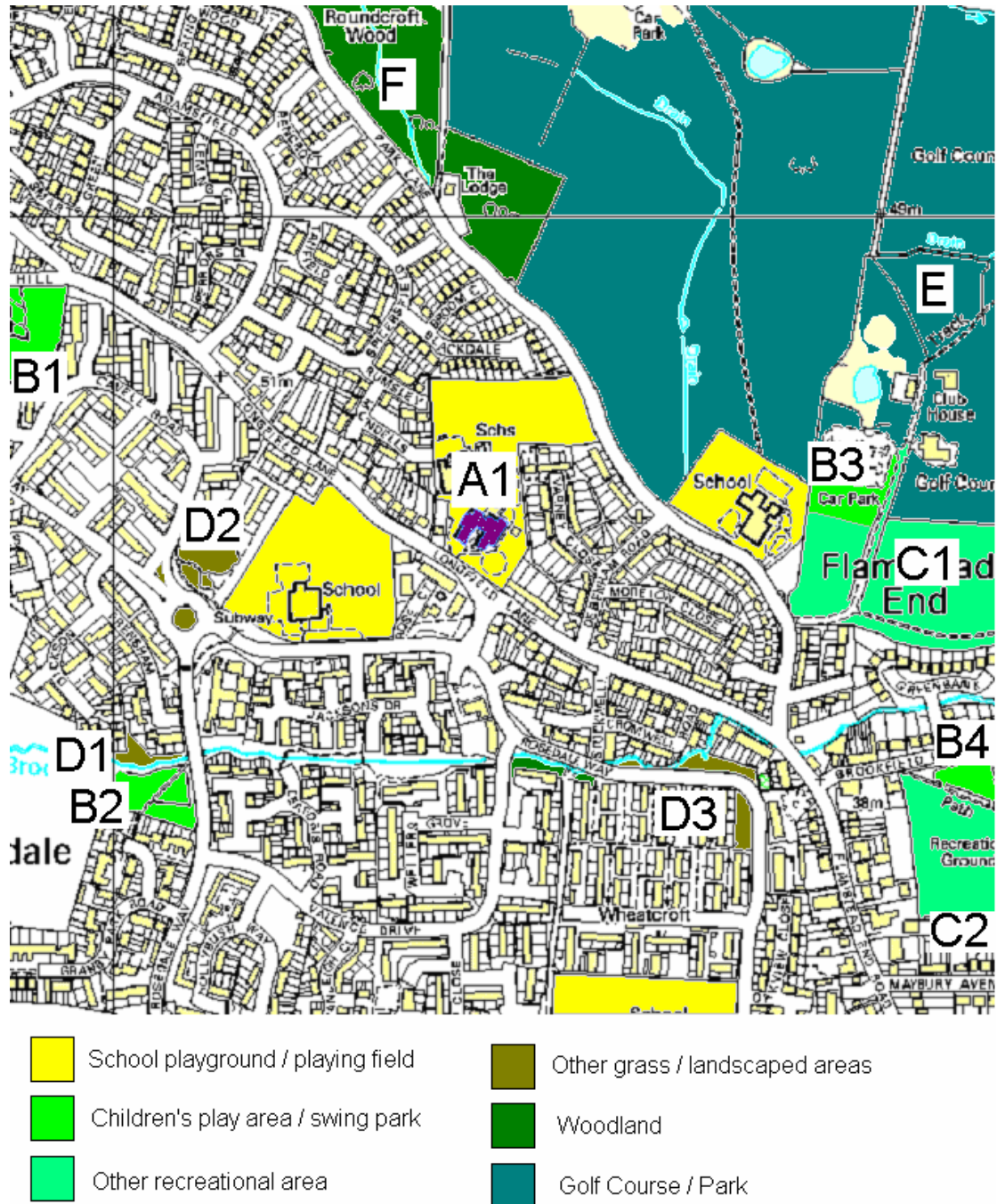

Figure 3. Open spaces.

The open spaces are now discussed below:

- A. These are school playgrounds and playing fields. Flamstead End Primary School (the subject of this study) is shown as A1. The northern portion of this is a large grass playing field.

- B. These are children's play areas (swing parks etc.). On the day of the area survey, B1-B3 were observed with children using them. B4 is for under 12's only. On the day of the area survey, B3 was clearly the busiest site, with several parents and children observed. It is possible that this site is attractive due to the presence of other people (adults) and the fact there is a large car park close by. These points perhaps being correlated: this is the only site of the four that has parking next to it, and the presence of parking may therefore attract adults, making it a popular spot that in turn invites further use).

- C. Other recreation areas. These are large areas of mown grass, suitable for playing team games such as football. On the day of the area survey, area C1 had several people kicking a ball around, while C2 was empty at the time of visiting. Area C1 is slightly more peripheral than C2, but has a more 'sylvan' or 'lush' character, like part of a country park, whereas C2 is perhaps more mundane and 'municipal' character.

- D. There are numerous other grass / landscaped areas, distributed throughout the area. These tend to be smaller, irregular shapes, undulating, often studded with trees and shrubs (i.e. not so suitable for ball games). These may be 'left over' spaces – lying between pieces of land parcelled off for other reasons – although the examples here are all mown, and are not the wildest imaginable landscapes. Some examples are picked out in Figure 3:
  - D1, to the north of the Brook, which is a pleasant informal space (with trees and views of greenery) of a size that could be used for some activities. A footpath runs by here;
  - D2, next to and including a roundabout, which is undulating landscaped area, that looks as if it is more meant to be landscape to be looked at, rather than an area to be actively used;
  - D3, further verge areas that are next to footways and hence easily accessible to pedestrians, although not in shapes or sizes particularly 'useful' for activities.

- E. Woodland. The interior is apparently accessible by means of tracks or trails, although this interior area not surveyed.
- F. Golf Course / Park. This area has a semi-public or semi-private feel: there are notices advising to follow the footpath and not get in the way of golfers.

Local facilities / features

As it happens there are not many facilities directly within this locality. However, Figure 4 shows the location of some of these.
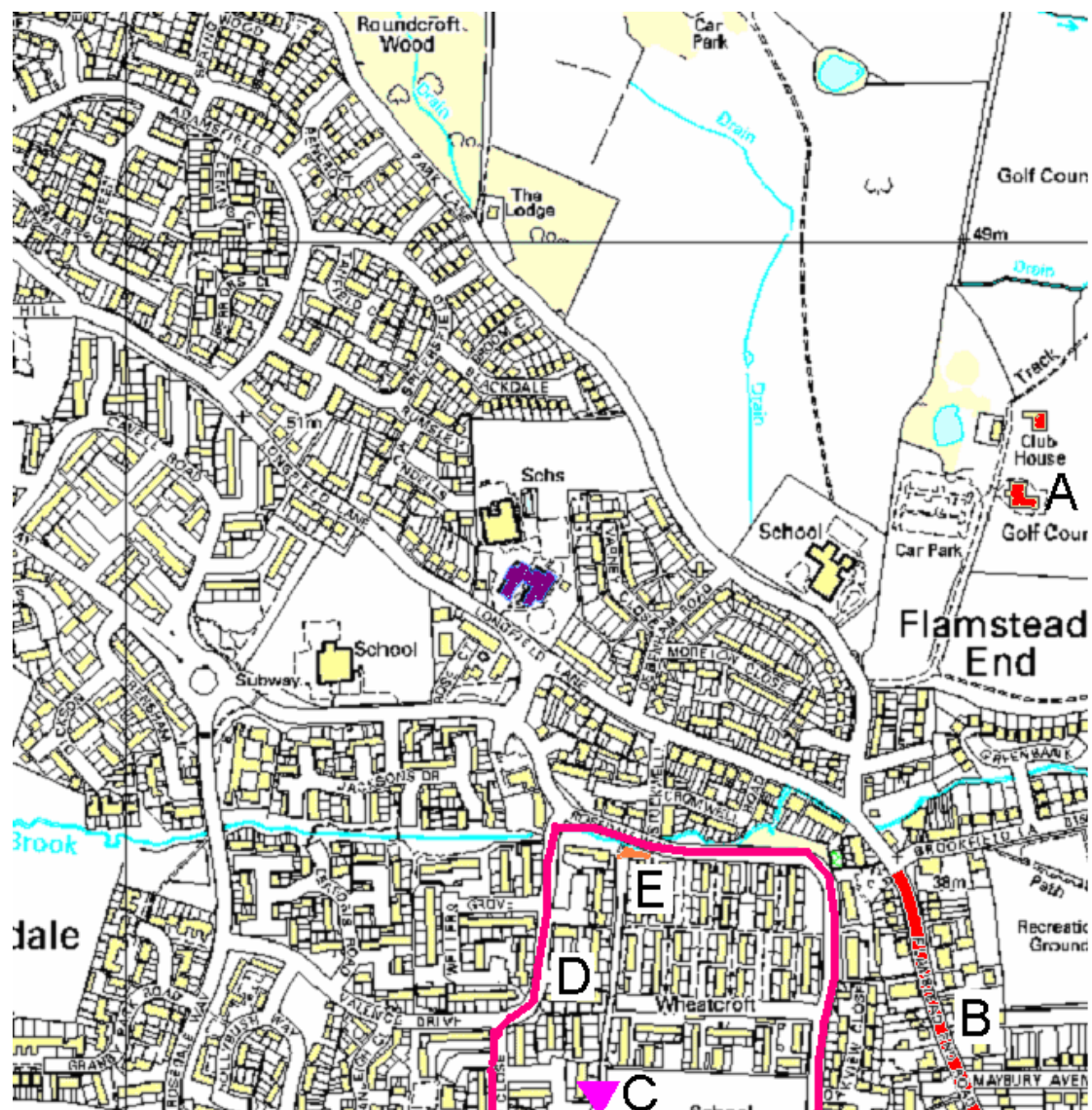

Figure 4. Local facilities and features.

The local facilities and features may be summarised as follows:

  A. Golf Course – the club house has a café.

  B. Flamstead End Road. Small shops, pubs, petrol stations and a restaurant along this road (not individually marked).

  C. Directly to the south of this area, off Andrews Lane, there is a local newsagent shop and a Chinese take-away / chip shop. On the area survey visit, there were one or two adults using these, but no children present. Nevertheless, the likelihood of these being a focus of livelier activity – possibly including children or youths, out of school hours – was hinted at by the presence of notices in the windows of these premises referring to ASBOs (Anti Social Behaviour Orders, the Act of 2003) by the Hertfordhsire Constabulary, and a less formal notice about the use of 'Go-Peds'.

  D. The approximate location of the ASBO boundary area.

  E. Where Rosedale Way crosses the brook, there is a small hard landscaped area with a low retaining wall, among bushes and trees. This spot has the feel of a place to 'hang out' next to the brook. This seems to have been the location of two benches, but with the bench planks removed leaving on the stumps. This perhaps hints at these being removed – perhaps to prevent anti-social behaviour? (Note that this is just about within the border of the ASBO area.)

Commentary

A few observations are now made about the area in terms of its potential child-friendliness, prior to looking at the actual survey results.

Firstly, the area is generally a pleasant, well-kept environment with few or no apparent candidates for 'no-go' areas. Possible exceptions could be:

  • the pedestrian subways;

  • perhaps some of the wooded areas;

  • another potential no-go area would be a genuinely 'out of bounds' location: the conduit taking the brook under Rosedale Way (by E in Figure 4) where a sign warns against unauthorised entry.

The Andrews Lane shops could either be an attractor or a deterrent: an attractor for purchasing or congregating with friends, or deterrent if anti-social behaviour occurs there. Being located in the midst of the residential area, it is both easily accessed from

a variety of directions, yet us also easily avoided, with many alternative routes around the outside.

Almost all roads are relatively lightly trafficked, and there are substantial 'precinctual' areas where one may walk around without feeling threatened by traffic. Several of the roads are traffic-calmed, or are short tortuous culs-de-sac that do not otherwise invite high speed. That said, two of the most heavily trafficked sections of road, Flamstead End Road and Brookdale Lane, form important connections to other parts of the Cheshunt area. In other words, these two are among the most useful links for getting around, and if encouraging children to walk or cycle, these would be inconvenient to avoid using. Longfield Lane (as noted earlier) forms a 'central axis' locally, which means it is an obvious candidate for use, while being inconvenient to avoid. Although the road is not as busy or fast-moving as the B156, there is a footway on only one side of the road.

3. Survey method

A general issue when we try to understand how children use their local environment is how to collect data which are detailed enough to track all of the places they actually visited and the routes they took. Most transport surveys rely on subjective accounts of survey participants by asking them to keep a diary on each activity they did during the survey period. This conventional technique is very labour intensive and thus often results in a decline in response levels over time and inaccurate entries. This is where handheld Global Positioning Satellite (GPS) equipment that has become widely available in market recently could prove to be useful tools.

GPS enables an automatic collection of pinpoint location data with relatively high (up to 15 metres) accuracy and precise time stamp. **Table 1** shows a sample of GPS data. Positioning information is provided in the form of a point of global coordinates system i.e. latitude and longitude, each of which is linked with second-scale time information as well as the altitude and travel speed at that point. Although GPS positioning is not available where signals from GPS satellites cannot reach (e.g. underground and indoors), most of the children's movement in their local environment can be reconstructed by the large amount of detailed information provided by GPS.

Table 1   Sample data of GPS

Location (Latitude, Longitude)	Date and time	Altitude	Speed
N51 42.724 W0 03.261	17/11/2005 21:00:36	198 ft	0.0 mph
N51 42.976 W0 03.338	18/11/2005 12:48:34	89 ft	5.6 mph
N51 42.953 W0 03.329	18/11/2005 12:48:37	89 ft	33.0 mph
N51 42.954 W0 03.346	18/11/2005 12:48:48	89 ft	3.9 mph
N51 42.963 W0 03.345	18/11/2005 12:48:50	89 ft	18.8 mph

In addition, the small size of the GPS equipment and simplicity of use helps reducing the amount of effort children need to make to take part in the GPS survey. For example, Garmin Foretrex 201, the handheld GPS equipment we chose for this research weighs only 2.75 oz and it is as small as a mobile phone (W: 8.38 cm, H: 4.32 cm, D: 1.52 cm). Such equipment can be easily worn by children for long time without making them feel uncomfortable. Also there are only two requests made for children during the survey regarding how to use the GPS; to recharge its battery every night; and not to forget turning the GPS on before they put it on. Therefore, GPS requires survey participants little more than a willingness to wear the equipment as opposed to quite lot of commitment required by conventional travel survey methods.

In the CAPABLE project, approximately 200 children wore wrist-watch type GPS equipment over 4 days (Figure 5). They were asked to keep the equipment on all the time except certain occasions such as while they are asleep and when GPS might get wet. On average, we collected 2000 GPS points per child, each of which shows where the child was at certain point of time over the survey period.

Figure 5   A child wearing GPS equipment on his wrist

In the following sections, we discuss the spatial patterns of children's movement by mapping these GPS points onto the local area map. Here, we look at where different children went according to age and gender – the 'who-where' analysis. Then, we look at the children's activity levels, and where they were most active or inactive.

4. 'Where–When' analysis

In this section, we are going to analyze children's spatial movement focusing on the different characteristics at different time points of a day as well as different activities on weekdays and weekend. For this analysis, simple classification of "time-band" is set in conjunction with the distinction of weekday and weekend. Each day is divided into four time bands:

1. Morning (5 a.m. – 9 a.m.)
2. School Time (9 a.m. – 3 p.m.)
3. After School (3 p.m. – 7 p.m.)
4. Evening (7 p.m. – midnight)

A selection of GPS data obtained from one of the surveys in the CAPABLE project was used for the analysis. The walking paths of 80 children were aggregated using the time-bands explained above and weekday/weekend classification and then mapped onto the 1 km square study area (Figure 1).

The question here is whether there is any difference in children's use of the area around their school between different time points of a day as well as between weekdays and weekends. Figure 6 shows all of the children's walking paths (a) during the weekdays surveyed (Thursday and Friday); and (b) over the weekend (Saturday and Sunday). Each dot corresponds to a single GPS data point.
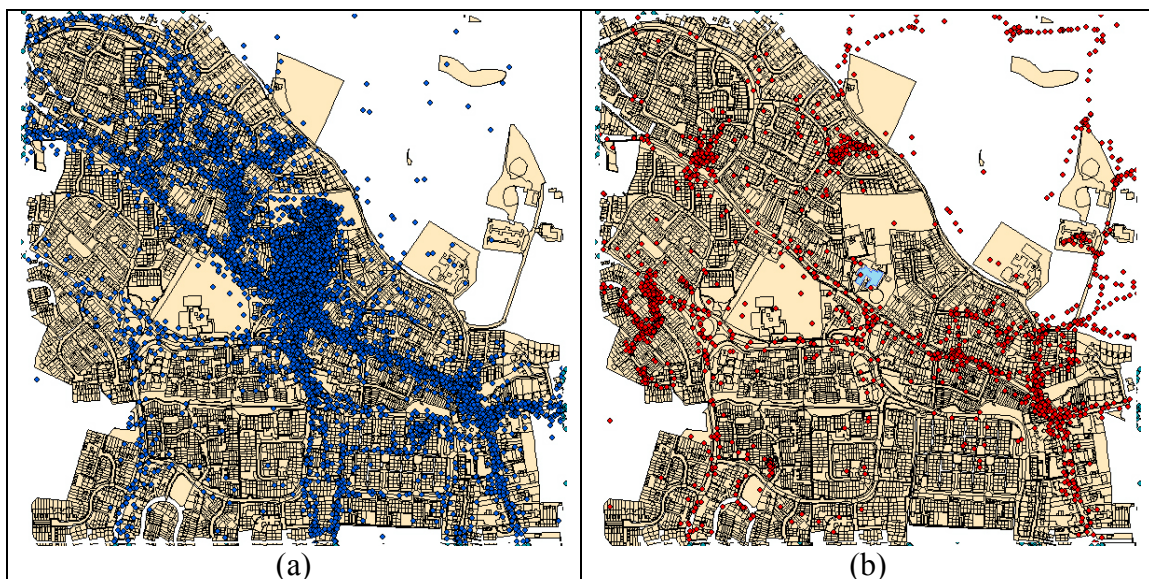

(a)   (b)

Figure 6 Children's walking paths (a) in weekdays (blue) and (b) weekend (red)

It is important to note that although the location information calculated and recorded by GPS has a relatively high accuracy (20 m on average in the survey area) it cannot avoid positioning errors that occur time to time. Amongst a number of major causes of these positioning errors, unavailability of satellite signals is the single most influential factor on the accuracy of GPS data. There are a number of places in urban areas where tall objects such as buildings and trees block the GPS users to access to the satellite signals. In such circumstances, the accuracy of GPS positioning could easily decrease up to several hundred metres. For example, although several dots can be seen in playground which is located at opposite side of the school in Figure 6, we cannot conclude that this playground was visited by the children because these points could be just error values. Although obvious outlier values have already been eliminated, GPS points need to be tagged with other information such as activity types and transport modes so that some corrections can be made based on the context in order for the location data to have better reliability.

However our main focus in this study is to understand general tendencies of children's spatial movement in their local area and it is beyond our scope to investigate where children went at micro-scale level. Thus we used original GPS data in this study and our confidence level of using it is at the range of 50 to 100 metres.

Looking at the results, there is a clear difference in use of the area around the school and school-commuting routes between the two categories:
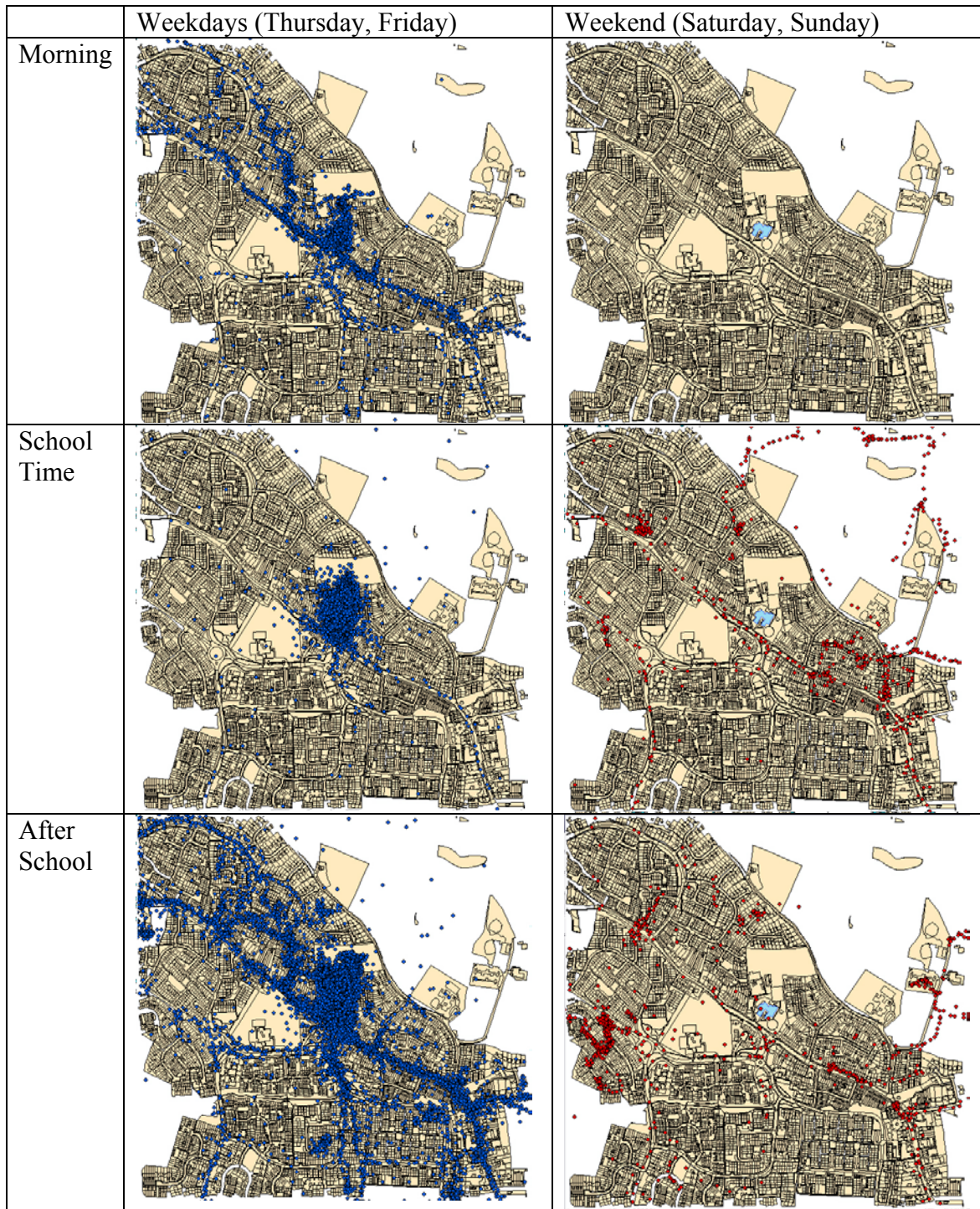
- On weekdays, the primary school itself is clearly the dominant focus and influence on the pattern of spatial distribution. Most GPS points are concentrated around the school and on several radiating routes, in particular Longfield Lane (which runs through the area from North West to South East). Note that some of these traces may be those of children travelling in cars perhaps over longer distances, as well as children walking locally.

- For the weekend results, on the other hand, GPS points look more scattered, with several clusters of points in the north-west part of the area. These would be consistent with activities of individual children around their own homes (however this correlation has not yet been analysed). In contrast to weekdays, very few GPS points can be found around the school, with only two children passing it by over weekend. The other distinctive feature of children's movement in weekend is walking paths in the north-east part: in Cheshunt Park and the Golf Course (E in

Figure 3) (including apparently the car park, B3), and the adjacent recreation area (C1 in Figure 3). (One trail leads off to a seating area overlooking a lake, just off to east of the study area). This pattern would be consistent with recreational trips by local children (although, again, corroboration via travel diaries is yet to be established).

An interesting pattern of children's spatial movement on weekdays emerges when we look at the distribution of GPS points according to time-band classification (Figure 7). A notable contrast can be found between the children's walking paths in weekday morning and those in weekday after-school time period. While the spatial distribution of the GPS point in the former looks quite simple with most of them are concentrated on a few main roads, many more routes, especially those in the southern part of the area, seem to be used in the latter (this southern area is where the Andrews Lane shops are). In other words, the area used by children after school is different from the area around their way to school.

Although it is just an initial finding, several hypothetical explanations for this difference suggest potentially useful approaches to further our analyses. They include:

- Which transport modes were used by children (possibly different between journey to school and journey from school);
- Whether the children travel alone, with other children or adults;
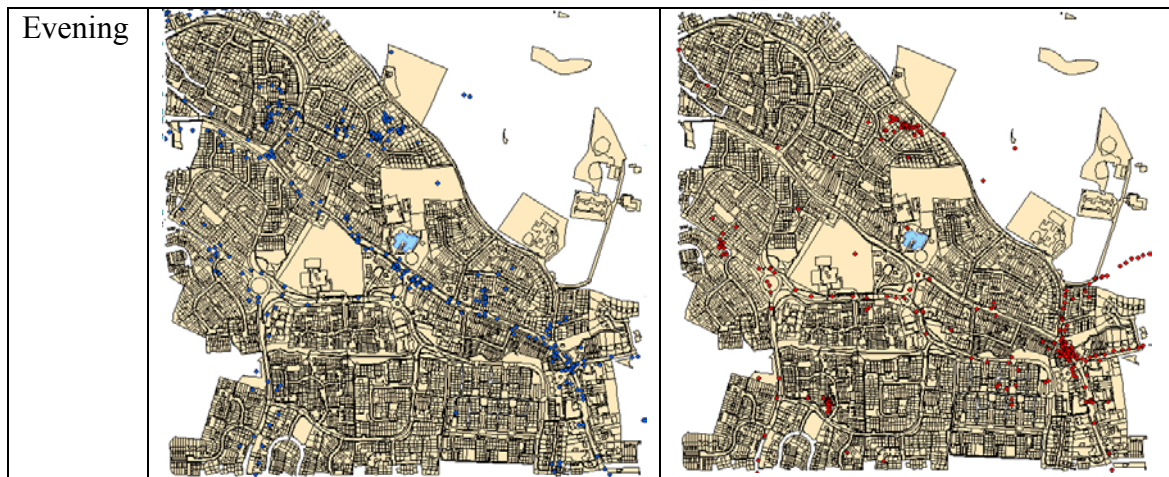- Whether or not the children joined in some after-school activities.

	Weekdays (Thursday, Friday)	Weekend (Saturday, Sunday)
Morning		
School Time		
After School		

| Evening | |

Figure 7 Classification of GPS maps by time-bands

5. Activity level analysis

The final analysis is to classify the children's walking paths according to their physical activity level calculated by RT3 monitor that calculates the amount of calorie consumed per minute. The intensity of each activity is categorized into 5 levels.

Each GPS point is linked up with the activity level at its location and each activity level is represented in a different colour in Figure 8. The dots in dark blue show where the children were inactive; light blue and yellow, moderate; orange, active; and red, very active.

From the aggregated data we used for this analysis, it is not very clear whether there are any spatial patterns in the distribution of the place where children get active. However:

- There are two large clusters of GPS points where the children became very active; one is in the school playground and the other is in the children's play area located on the north-west edge of the area (marked B1 on Figure 3).
- There seems to be some correspondence – from initial visual inspection – between some of the clusters of most inactive locations in Figure 8 and the clusters of activity recorded at the weekend (Figure 6 a). If so, this would be consistent with those being the locations of children's residences (again this is to be verified).
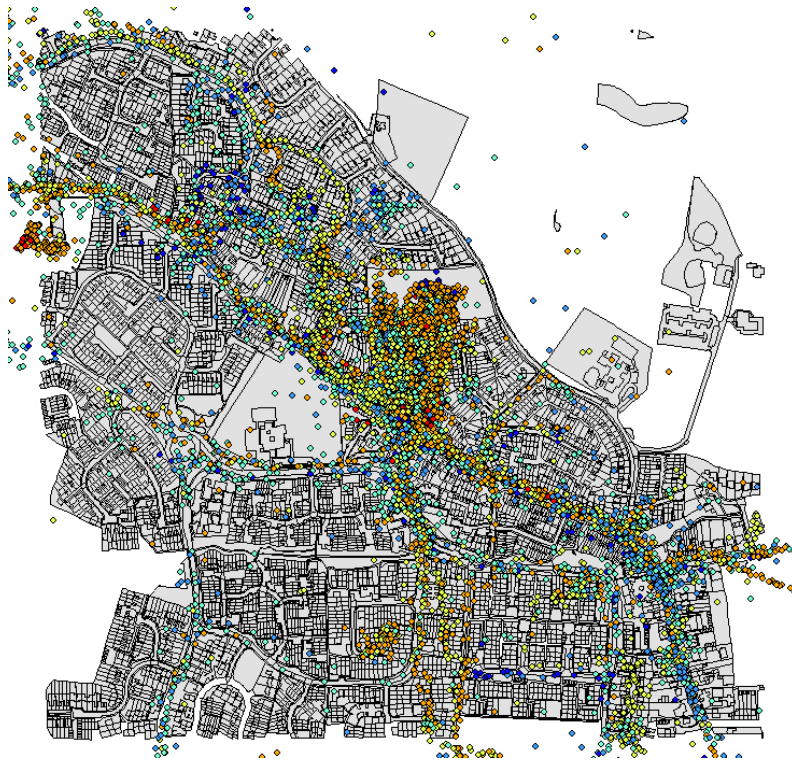
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Figure 8 Distribution of children's activity level. Weekdays, after school time (3pm-7pm)

6. Interpretation of the area and how it is used by children

From this preliminary analysis of the Flamstead End area, the following points may
be made.

Schools have often been used as a focal point for neighbourhoods, as
neighbourhoods have in turn been often used as the 'building blocks' of planned
urban development. From the surveys undertaken, the importance of the school as a
focal point is at least partly borne out. That is, on weekdays at least, the school forms
the focal point in a contiguous 'network' of radiating routes. Of course, this is a
natural result of the surveys being concerned (only) with pupils at Flamstead End
Primary School itself. If one were to include the children of the other local primary
schools (two of which are wholly within the study area, and one partly within it); and
if one were to include the children who live locally but go to school elsewhere, then
one would expect a more complex picture to present itself.

At weekends, the pattern is different, and activity seems to be more dispersed,
and if anything concentrated around particular locations (which may correspond with
local children's residences). In other words there is no clear 'children's network' of
routes or spaces, outside of the travel to/from school times of day and week.

Due to the structure of the road network, the most obvious and direct routes to and from the school involve travel along roads that are relatively speaking the busier, more major roads (Longfield Lane, on which the school itself is situated; its extension to the north-west, Dig Dag Hill; and to the south-east, Flamstead End Road and Brookfield Lane). This implies that if school-run distances were short enough to allow switching from car travel to cycling or walking, then those trips would still be likely to have to use these relatively major routes. This would tend to suggest the need to consider if traffic calming, speed reduction or pollution reduction were possible.

In terms of open spaces, two areas may be singled out. First, there is the play area (B1 in Figure 3) which seems to be a focus of great activity at least on one of the weekdays surveyed. Second, there is the Golf Course / recreation areas to the north-east of the study area (E and C1 in Figure 3), which has been used at the weekend. Some children, at least, are using the green spaces that have been provided. Within the four day period surveyed, there was no record of use of the other play areas (B2-B4) or the recreation area to the east (C2) other than as a route to/from school.

Of the 'notable' pedestrian routes (Figure 2), there is a clear distinction between the northern pair (E1 and E2) which were only used on the weekends surveyed, and those to the south (E3 and E4) that are only used on the weekdays. So it seems that route E3 (and hence recreation area C2) was not used (at least during the survey period) except for the journey to/from school. And the public footpath E4 seems to be used after school for travel between the school and the Andrews Lane area. One could infer, perhaps, that footpaths E1 and E2 could suit recreational use, while routes E3 and E4 are perhaps more used for utilitarian travel from A to B.

One may also note that Park Lane (D in Figure 2) appears not to be used at all by the children, either on weekdays or weekends. Park Lane is a semi-rural route bounded on one side by parkland and the other by housing (including backs and sides of gardens, etc). Its lack of use may be partly due to character of the road (no footway, makes for uncomfortable walking); and partly because it is not well connected to the rest of the neighbourhood, or otherwise may not be on any useful desire lines. While the reasons for this lack of use cannot be ascertained from the present surveys, the research programme as a whole should be interested in why certain kinds of routes which otherwise could make good recreational routes are underused.

No other discernible patterns of use (or lack of use) corresponding with locations flagged up in part 2 are noted.

7. Conclusions

This research has provided some preliminary insights into children's use of a local area around a primary school. Not surprisingly, this reveals information about the use of the local area by children attending the school, and the use of the area by the sub-set of those children who also live locally. A clear distinction between school day and weekend use is noted, with the former not surprisingly focused (more or less radially) on the school, and the latter more diffuse. The utility of these results is that they provide detailed empirical results recorded directly from GPS tracking of the children, and avoid some of the problems of other surveys (reliance on good memory, awareness of timing and accurate references to location – all of which may be especially vulnerable to inaccuracy or misinterpretation, when it comes to children).

That said, the real significance and value of these results will come with comparing with other areas: what are the distribution of different types of place, facilities and features, and different types of routes and patterns of movement, around different schools in different areas. Only when more locations are studied can more robust and generalised conclusions be made about the kinds of place used by children; and further surveys would be required to determine the reasons behind these patterns of use. Although data collection by GPS has proven to be very useful to identify the approximate location of where children went without requiring much effort on their side, the GPS data do not in themselves reveal any information about why children chose one particular space or route over another. In order to further our analyses, it is necessary to link these GPS points with information on the activities such as destination and purpose of the travel as well as the demographic data of the children.

A final comment made may be made here about design for the user. On first sight, the study area appeared to be a straightforward residential area with a typical arrangement of routes, precinctual housing areas and recreation areas provided for the locals to use. However, on closer inspection, the possibility suggested itself that children (or youths) might be up to other things – as hinted at by the ASBO area, the removed benches and the warning not to enter the conduit. This may remind us to ask ourselves – those who are concerned with policies and designs providing for children – if 'we' are designing for children as they actually are, or children as we would like them to be.