Bucks Cycling Infrastructure Evaluation (BCIE)

Aylesbury
This project was commissioned and run in collaboration with Oxfordshire County Council (iHub) as part of the Open Data Institute’s Innovation programme funded by Innovate UK.
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1. Introduction

About this document

The Bucks Cycle Infrastructure Evaluation (BCIE) ran for 5 months between November 2019 and March 2020. It was conducted by Buckinghamshire Council’s Business Improvement Team and commissioned by Oxfordshire County Council (iHUB) as part of the Open Data Institute Local Government Open Geospatial Stimulus Fund funded by Innovate UK.

The project aimed to demonstrate the potential to use a crowdsourcing platform to collect geospatial data in an approach which can be replicated by another organisation through a process of project scaling and knowledge transfer between Local Authorities.

This report documents the methods and processes used within the BCIE project and aims to provide a comprehensive assessment of challenges, benefits and potential use of the tool in the future.

1.1 Project Overview

Buckinghamshire Council (BC) was approached by Oxfordshire County Council (OCC) to take part in phase 2 of The Open Oxfordshire: Cycle Infrastructure Evaluation (CIE). The CIE project has demonstrated the Council’s capacity to develop a tool to lever community knowledge and experience to map cycle infrastructure from the perspective of a local user.

CIE phase 2 aims to demonstrate the potential for the application to be replicated by other Local Authorities, by comparing the quality and quantity of the data collected against phase 1 data. In order to test the hypothesis, OCC will be sharing knowledge acquired in phase 1, which includes tools, project management documents, GIS and OSM expertise.

1.2 Objectives

The BCIE project comprises three main objectives:

1. Knowledge Transfer.
   Identify and analyse the benefits of adopting a knowledge sharing approach between Local Authorities when implementing similar solutions.
2. Tool Development
   Define and implement the development of GIS infrastructure to host geospatial survey tools and publishing open data
3. Route Data Collection
   Collect and analyse data of existing and aspirational cycle routes infrastructure in Aylesbury using a crowdsourcing Digital Cycle Route Audit Tool (DCRAT)

The primary objective focuses on evaluating the benefits of adopting a knowledge sharing approach to optimise time and costs in the implementation of a common solution between different Local Authorities (in this case Buckinghamshire Council and Oxfordshire County Council).
The Secondary objective was the development of a Digital Cycle Route Audit Tool (DCRAT) to enable BC to collect data and evaluate the cycle infrastructure across Aylesbury.

The third objective focuses on the collection and analysis of a new digital dataset evaluating cycle infrastructure across Aylesbury. This will be made available for use by Buckinghamshire Council (BC) policymakers, and the wider community through integration of the infrastructure data into the open mapping platform OpenStreetMap (OSM).

The BCIE project would also allow us to gather information that would enable BC to make more informed decisions regarding the upkeep and expansion of its cycling infrastructure, primarily by gathering information on existing and aspirational cycle routes.

### 1.3 Project Team

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Primary Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buckinghamshire Council</td>
<td>Project management, app creation and survey framework</td>
</tr>
<tr>
<td>Oxfordshire County Council</td>
<td>Expert support (Project management, GIS, CIE tool/data sharing)</td>
</tr>
<tr>
<td>Sustrans</td>
<td>Consultancy</td>
</tr>
<tr>
<td>SystemeD</td>
<td>OpenStreetMap (Consultancy, Development and Operations)</td>
</tr>
</tbody>
</table>
2. Knowledge Transfer

2.1 Oxfordshire County Council - iHUB

OCC provided expert support throughout the project, from conception to data analysis, including the building of the digital cycle route audit tool (DCRAT) used for the cycle infrastructure evaluation.

Tapping into OCC’s previous knowledge of the project meant that BC had a very accurate roadmap and project plan from the start, which made planning of areas to audit, number of auditors, timescales, app building and GIS integration much easier and faster.

The supporting material made available to BC by OCC included:

- Open Oxfordshire: Cycle Infrastructure Evaluation Story Map and data
- App use documentation
- Audit Reference sheet
- Health & Safety form
- Auditor data reports
- Final Report
- GIS build documentation

The CIE Final Report was used to define preliminary objectives and define roles for BC’s team. A workshop was organised and an information pack containing a draft of the project plan and supporting material from OCC’s CIE was circulated beforehand. The objective was to provide relevant information about a similar project to bring all team members to the same level of information.

The information made available from OCC proved to be an invaluable resource to the team which was reflected in the speed that decisions were made during the workshop. The constant support from OCC in every step made it possible for the team to avoid known pitfalls experienced by the Oxfordshire project team in Phase 1 of the CIE project.

2.2 Collaboration with Sustrans

Sustrans were invited to join the project because of their expertise in cycling infrastructure and access to cycling groups nationally. As the project progressed their support was focused on developing the audit criteria.

The development of the audit criteria was one of the key challenges faced by the team as it is driven by the project’s Problem Statements and if not defined properly at the outset the data collected will not be of value.

Sustrans, were crucial to guide the team during the process, by asking the right questions at the right time and providing expert advice when justifying why a criteria was relevant or not.

Sustrans also made available access, within confidentiality restrictions and GDPR, to research information gathered in similar projects that the organisation has being engaged in before. The information helped the team to focus on different criteria used in similar previous projects and insight into the data analysis phase based on the chosen criteria (Annex C).
The final audit criteria were:

Table 1: Audit Criteria

<table>
<thead>
<tr>
<th>Category 1: COMFORT</th>
<th>Category 2: SAFETY</th>
<th>Category 3: OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria 1: Poor surface (e.g., potholes, bumps, loose gravel)</td>
<td>Criteria 1: Conflict with road traffic</td>
<td>Free text</td>
</tr>
<tr>
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<td>Criteria 2: Conflict with pedestrians</td>
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</tr>
<tr>
<td>Criteria 3: Barrier or obstruction (e.g., chicanes, parked vehicles)</td>
<td>Criteria 3: Lack of safe crossing</td>
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</tr>
<tr>
<td>*Criteria 8: Serious road defect (report to FixMyStreet)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The initial exercise of identifying the audit criteria did not include Criteria 8 under the Safety category, which had to be added after the start of the auditors’ training sessions, when one of the auditors brought to our attention the implications of not reporting serious road defects and leaving BC exposed to future insurance claims.

BC uses the FixMyStreet platform to allow residents and Local Councils to report road defects and has a 24 hour window to investigate the defect. Identifying a serous defect and not reporting it might leave BC liable for future insurance claims. Auditors were therefore instructed to report any defects in this category to FixMyStreet as well as in their audit response.

2.3 Literature Review
- OCC-CIE Final Report – Annex B
- Cambridge Audit Criteria – Annex C

2.4 Buckinghamshire Council’s Approach

The success of BCIE project is based on the use a collaborative approach from the start. This was facilitated by OCC’s ‘here to support’ attitude throughout the process. Also the project team shared their interest in the collaborative approach and investigating its benefits and challenges.

The information provided by OCC’s team was circulated within the team and the first exercise was to understand the process used, the challenges faced and the outcomes. The initial analysis allowed the team to create a better understanding of the similarities and therefore what needed to be adapted to meet BC’s needs.
A workshop was organised to identify the objectives of the project, define problem statements, establish audit area, number of auditors and deadlines. The workshop was led by BC with assistance of OCC, SUSTRANS and SystemeD, who provided assurance and guidance during the workshop.

Key decisions:

a) Sector approach:
   The team decided to use a sector area approach which divided Aylesbury into five (5) sectors (see details below). This made it easier to manage the auditors and analyse the data at the end of the process.
   - Sector 1: Quarendon, Meadcroft, Buckingham Park, Berryfields
   - Sector 2: Manor Farm, Elmhurst, Watermead, Bierton
   - Sector 3: Stocklake, Kingsbrook, Walton, Bedgrove
   - Sector 4: Shouthcourt, Elm Farm, Hawkslade, Stoke Mandeville
   - Sector 5: Town Centre, Fairford Leys, Gatehouse, Haydon Hill

b) Routes:
   The project would audit Aylesbury existing cycling routes and aspirational routes which had been developed as part of the Aylesbury Garden Town Local Cycling and Walking Infrastructure Plan.

<table>
<thead>
<tr>
<th>Route</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASP</td>
<td>Aspirational route</td>
</tr>
<tr>
<td>GMS</td>
<td>Gemstone route</td>
</tr>
<tr>
<td>ASP/GMS</td>
<td>Intersection of Aspirational and Gemstone routes</td>
</tr>
<tr>
<td>OTHER</td>
<td>Routes used by the auditors to get to the Aspirational/Gemstone route</td>
</tr>
</tbody>
</table>
c) Number of Auditors: 
In order to identify the ideal number of auditors for this exercise, the timeframe, the areas to cover and the information on the number of auditors used by OCC-CIE were used. In order to complete 100 hours of auditing, to meet the project scope and timeframe it was decided that 20 auditors were needed. Due to unforeseen circumstances, the final number of auditors was actually 16 and the table below shows their distribution per sector and the number of auditors with technical transport knowledge background.

<table>
<thead>
<tr>
<th>Sector 1</th>
<th>Sector 2</th>
<th>Sector 3</th>
<th>Sector 4</th>
<th>Sector 5</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td># Auditors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>Transport Background</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 2 – Auditors distribution per sector and technical background
Audit objectives:
- Gather information of alternative routes used by cyclists to the Town Centre
- Identify why the user DOES NOT use an existing route
- Gather information of potential relevance of the aspirational routes

3. GIS infrastructure and tool development

3.1 App Development

Our choice of application for the BCIE project was the Esri Collector for ArcGIS mobile phone application. This was chosen as we already had an established Esri licence and therefore the application offered an easy and low-cost option for us. We also already had an organisational licence to use ArcGIS Online which gave us the ability to utilise AGOL to host the data collected through the app. When setting up the project we had a number of vacant accounts on AGOL which we determined could be used by auditors to enable them to access the project content through the app and facilitate data entry.

All of the project data accessible in Collector was built in the ArcMap desktop application and saved on to a map document on our external GIS server. This consisted of the following feature classes:

- Five feature classes for the purpose of auditor data collection, one for each of the sectors.
- A sector boundary feature class for the 5 zones to enable the auditors to visualise where their assigned sector lies
- Feature class containing the existing Gemstone routes in Aylesbury
- Feature class containing the proposed Buckinghamshire Local Cycle and Walking Infrastructure Plan (LCWIP) cycle routes in Aylesbury, categorised into local, orbital and radial routes
- Feature class containing two additional routes in the Aylesbury area, Stoke Mandeville Way and the Waddesdon Greenway, also used as part of the audit

The auditor data collection and sector boundary feature classes were created specifically for the purpose of the project. The existing Gemstone routes and two additional routes were pre-existing datasets on our corporate GIS database. The proposed LCWIP routes were supplied to us by Ringway Jacobs who created the LCWIP.

Most of the configuration of the app for the auditors took place on our external server via the Desktop application. This included creating domains to enable the criteria to be set for the data entry files. Three domains were created, one for each of the categories of the criteria: Comfort, Safety and ‘Other’ (Table 1). Then the agreed criteria from each category were applied to each of the five data collection datasets.

The Comfort category included 5 criteria, Safety included 7, which was later amended to 8 with the implementation of FixMyStreet (Table 1), and ‘Other’ was set up as a free text comments box. Once these were applied this was reflected in the back-end app as a list of drop down options for the auditors to select the appropriate issue when auditing, as well as a text box in the ‘Other’ category for the auditors to expand on their observations. The auditors were also given the option to attach an image to their observations. This capability was added through AGOL rather than on the GIS server itself.
The Symbology for the mapping was also configured from the GIS server, with a colour scheme assigned to each sector of audit for the boundary and collection data, and appropriate colours assigned to the proposed and existing routes.

Once the map was configured it was published from the desktop application on the server to AGOL as a hosted feature layer. This meant that data collected through the Collector app by the auditors was able to be hosted on AGOL itself rather than on the GIS server, unlike the project content.

This methodology differed from OCC’s approach to the project and was the chosen option because BC does not currently have access to ArcGIS Enterprise, which meant a project group with the necessary security could not be added on to the external server. However we were able to utilise AGOL for this as it has this capability.

Within AGOL a web map was created from the hosted feature layer, which enabled interoperability with the Collector app. Then a designated project group was created for the BCIE project, which included the hosted feature layer and web map. Auditors not currently set up to use AGOL were invited to sign-up and subsequently added to the project group, enabling access to the project content. The group had the necessary security measures in place meaning that non-members could not access or edit the project content.

After a period of testing to ensure the functionality of the App, we informed the auditors of the App’s availability and asked them to download Collector on to their smartphones and test prior to their audit training presentations.

### 3.2 Data Collections & Processing

**Auditor recruitment:** 21st October 2019 – 9th December 2019

**Training presentations:** 10th – 18th December 2019

**Data collection deadline:** 19th January 2020

Before data collection began, presentations were arranged with each auditor to give them a formal introduction to the project and walk them through their input. Some auditors pulled out of the project, owing to the time constraints involved in the data collection as the audit was to take place over the busy Christmas period. Cover was arranged to compensate for this where possible, using our reserve contacts. However in some circumstances, auditors were asked to take on additional work.

The presentations were mostly delivered in small groups, arranged according to availability. The first half of the presentation consisted of a few slides on Health & Safety and Data Protection, for which disclaimers had to be signed for each auditor (Section 4). The 2nd half was focused on the usability of the app, getting the auditor familiarised with the different tools and functionality available to them whilst they undertook the audit. The step-by-step process for data collection was covered in detail, with the auditors having the ability to follow along on their personal devices.

The final section of the presentation focused on the specific areas that the auditors would be surveying. This was done on the basis that we had 20 auditors and 5 sectors, therefore ideally
having 4 auditors per sector. Where possible, auditors were assigned areas based on their home address. However, owing to the uneven geographical spread of our auditors over the town and certain auditors pulling out of the project, this was not always possible. In some cases, auditors were surveying areas in multiple sectors and covering large swathes of the town.

Whilst assigning each auditor a sector to focus on, we left it up to the auditors themselves to narrow down which sub-area within each sector they would be focussing on. We provided visual aids in the form of sector maps to assist the auditors in their discussions on audit areas. As the presentations took place in several groups, it was necessary to keep a record of which auditor was responsible for each area as we went along, and any clashes were communicated and cleared up with the auditors to ensure that everyone was clear which area they were auditing.

Sector maps, such as the one above for Sector 1, were distributed to auditors to aid their discussions on which areas they would be auditing.

As well as general areas to audit, auditors were also assigned designated cycle routes to survey. These consisted of both the existing Aylesbury Gemstone network, and the provisional LCWIP routes located in the town. Again where possible the routes were assigned to auditors based on their home address, or alternatively the general area(s) they were auditing, however inevitably this was not always the case.
The group presentations were all delivered in the 2nd and 3rd weeks of December, with the auditors free to begin their data collection at any point after attending their presentations, on the proviso that they had signed their disclaimers and picked up their health and safety kits. Due to auditors dropping out, there were two individual presentation sessions in the first week of January for the replacement auditors. Although the final number of auditors was 16 agreed additional auditing meant that the data collection was achieved.

The following images show the Collector App configured for the use of the auditors in the BCIE project:
The auditors had until Sunday 19th January to complete their surveys. A weekly check of each auditor was carried out to monitor progress but overall there were no major issues in the data collection part of the project. Every auditor carried out their full audit of the areas agreed beforehand.

Most of the auditors began their surveys after the Christmas break, and due to the fact that the work had to take place out of work hours, and during daylight, this essentially gave them 3 weekends to complete the work. Despite the tight timeframe, many auditors went over their allocated allowance of 5 hours, some doing as much as 10-11 hours of work. However this varied significantly, depending on the number of areas and routes an auditor had assigned to them, the number of issues present in a particular area, and the amount of detail the auditor went to in their observations. It was generally noted that the auditors with a background in Transport picked up more issues and went into far more detail in their observations than others. It could be estimated that if we had had the required number of 20 auditors for the study (instead of 16) 5 hours per auditor would probably have been sufficient to obtain a successful and comprehensive audit of all areas.

3.3 App feedback
In terms of feedback, for the most part we received positive comments regarding the usability of the app. The Collector app was said to be easy to use and contained most of the functionality required to complete the audit effectively. However, a small number of comments were received regarding limitations of the configuration of the app. This included the fact that the auditors could only plot points for their surveys with no option of lines/polygons. This was a decision that was made in the survey design, and differed to the approach Oxfordshire took, which incorporated both lines and polygons. This was disadvantageous when auditing a location where there was a large area of concern or a repetitive issue over a large section of route. For example, an auditor wanted to flag up a large area which was rough and not a safe area for cycling, but this could only be picked up on the app by a series of points. This tended to convey that the area had several separate issues and not a large area where one particular issue was prevalent.
Also, we received a few comments that the app could be improved if it had contained a tracker to monitor the movements of the auditors whilst conducting the survey. This would mean the auditors would have a greater understanding of which locations had already been surveyed before doing their work. The app was limited to only showing areas where particular issues had been flagged, and not showing locations which had been audited but concerns had not been raised. It was discovered after the data collection phase that the app did in fact have a tracking capability, but this was not easy to use and there would have been a risk that this would have added confusion to the process and not everyone would have implemented this functionality correctly. However, it could be argued that in terms of having a comprehensive survey of the study area, this isn’t such an issue as having several pairs of eyes monitoring a particular area should enrich the data gathered.

4. Auditor Recruitment and Training

4.1 Auditors selection

BC has a large number of employees that regularly cycle to work and a decision was made to reach out to them first. Also, as the auditors’ management would be done by the project team, it would be easier to arrange training and answer any queries using BC’s internal communication systems (Skype for business and email).

Over 40 employees expressed interest in taking part of the project and to narrow down the candidates a survey containing key questions was produced and circulated within candidates. The aim was to find 4 cyclists for each sector, therefore home postcode and years of experience as a cyclist were the most important criteria.

The candidates were scored on the following criteria (see Annex D):

- Own bicycle
- Postcode
- Availability during the audit period
- Years of experience in cycling
- Own safety gear
- Bike serviced recently
- Type of mobile phone (android/iPhone)

After the survey analysis 20 auditors (4 local residents per sector) were contacted and training arranged.

4.2 Training process & Materials

A training session was provided to the auditors covering Health & Safety, Use of the Collector App and a Q&A. A copy of the presentation was made available to the auditors after the training session for revision (see Annex E & F).

The training session proved to be valuable as the auditor had the chance to raise questions about the App and the audit process itself. The training session was conducted over 2 hours, which provided enough time to go through the theory and practical aspects.
4.3 Challenges
Two key issues arose that were not anticipated during the planning phase.

1. GDPR:
   It became evident in the middle of the recruitment process that in order to identify the auditors some personal data had to be collected. To overcome the issue a disclaimer was created where the auditor granted the consent to collect the personal data.

2. Insurance:
The fact that auditors were also BC’s employees raised concerns from the Insurance Team at BC in case of an accident. To overcome the issue the Insurer requested additional information about the project and the auditors to make a decision. To meet insurance requirements, it was ensured that auditors had a minimum of 4 years of experience as cyclists, Health & Safety training was carried out and additional safety gear provided so that the Insurer was sufficiently satisfied to cover the employees under the current policy without any additions (see Annex G).

5. Data Collection
5.1 Choice of locations
In order to address the objectives of the project a decision was made to use the existing Aylesbury cycle routes, known as the Gemstone routes. The audit of these cycle routes would provide information to understand why users DO NOT use the existing cycle routes to get to the Town Centre and what are the alternative routes used to do so.
Also, it would provide additional information on aspirational routes, by matching the alternative routes with the aspirational routes proposed by Aylesbury Garden Town LCWIP (annex A).

5.2 Choice of data collection
The data collected, when combined with additional datasets, should provide enough information to answer the objectives set out in the beginning of the project.

The data collected was split in two main categories and a catch-all with ‘other’, mainly derived from other projects managed by Sustrans and tailored to BC’s objectives. The categories were Comfort, Safety and Other. The last would allow auditors to report issues not present in the first two categories.

The comfort category would address aspects that make a cycle route enticing for users to choose cycling/walking a first option. This category included criteria such as poor surface, lack of cycle parking and others.
The safety category would address aspects that makes a cycle route safe, and included criteria such as conflict with road traffic, conflict with pedestrians, lack of cycle lane and others.
In addition to the data collected via the Collector App we also gathered more information through a survey after the auditor completed the audit, and an aggregated version will be shared in this report. The survey focused on the user’s experience during the audit and also the main issues in the local area (see Annex H).

### 6. Data Evaluation, Outputs and Impact

#### 6.1 Overview of data collected

#### 6.1.1: Category

The final numbers are a combination of the following records:

<table>
<thead>
<tr>
<th>Category</th>
<th>Comfort</th>
<th>Safety</th>
<th>Other</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td># records</td>
<td>649</td>
<td>224</td>
<td>74</td>
<td>947</td>
</tr>
</tbody>
</table>

The way the app was designed permitted the auditors to choose multiple categories for a single record, making it harder to analyse the data collected per category, as there is double-counting included.

#### Table 3: Audit Criteria

<table>
<thead>
<tr>
<th>Category 1: COMFORT</th>
<th>Category 2: SAFETY</th>
<th>Category 3: OTHER</th>
</tr>
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<tbody>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Table 4: Number records/category

<table>
<thead>
<tr>
<th>Category</th>
<th>Comfort</th>
<th>Safety</th>
<th>Other</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td># records</td>
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<td>224</td>
<td>74</td>
<td>947</td>
</tr>
</tbody>
</table>
6.1.2: Routes

In Chart 2 the data reveals a higher number of reported issues under the ASP/GMS route followed by OTHER route and both with a high percentage (over 35%) falling into the OTHER category.

The data also shows a high percentage of issues reported under ASP/GMS route, which comprises sections of the aspirational routes merging with existing routes.
As is, the data shows a really low number of reported issues on the existing routes (GMS) which could indicate that the maintenance of the routes are good with minor issues and that the number of reports in the aspirational routes (ASP) are high as expected due to the fact that they are not ‘cycle routes’ as yet.

A recommendation will be made to investigate further the ASP/GMS data, during the planned Data Analysis Workshop, as it shows potential to provide additional insights. The understanding is that sections of the aspirational routes merge with the existing routes; therefore dissecting the data is a must to proceed with the analysis. Map 2 in this report provides a visual of the data on ArcGIS and suggests that a more in depth analysis ‘may’ allow categorising the record into ASP, GMS or OTHER and proving a more accurate data for analysis.

6.1.3: Sectors
Chart 3 shows the distribution of the data by category and sector and clearly illustrates Sector 5 with the highest number of reported issues followed by Sector 3, suggesting that the collected data might be relevant to prioritise works on cycle routes.

![Chart 3: %Records OTHER route/COMFORT](image)

Chart 3 shows the data distribution within the categories and sectors, and when cross-referenced with auditors technical background, as represented on Table 2 of this report, the data allows the inference that sectors audited by auditors with transport background (Sector 3 and 5) provided a higher number of records and more in depth information about the conditions of the route.
Charts 4, 5, 6 and 7 provide a breakdown of the data by Category, Route and Sector to illustrate the findings from the data analysis and provide the reader a more in-depth understanding of the data distribution.

It becomes evident that the highest scores on ASP, GMS and ASP/GMS routes compared to the others suggest that the collected data might be relevant to prioritise works on cycle routes.

The data also shows (Chart 7) that under OTHER route, which includes routes used by auditors to get to the Aspirational and Gemstone’s routes, Sectors 1, 2 and 5 have similar data distribution, suggesting that the NEED for new cycle routes to meet the residents’ needs.

A recommendation will be made to investigate further the OTHER route data during the planned Data Analysis Workshop, as there is an understanding that the data includes issues reported from the auditor’s residence not only to the nearest existing or aspirational route but also to other points of interest, such as shops, parks, etc. If this assumption is correct than the data will prove to be valuable when planning the aspirational routes, as it shows regular places that are not served by a current cycling route but would provide benefits to the local community.

6.1.4: Auditor Selection/Training

Based on the data analysis it is evident that depending on the expected outcome a tailored training session needs to be in place covering Health & Safety guidelines, App use and audit objectives.

The auditor selection and any necessary technical background should be part of the initial design aiming to address the expected outcome.

6.1.5: Audit Criteria

It also emphasizes the importance of well-designed audit criteria and coherent guidelines on how to record the data on the Collector App as it will dictate how valuable the outcome will be.

6.1.6: People’s Perception

The data provides an interesting insight into how the auditor perceives the issues on a cycle route. Chart 1 shows that just under 70% of the reported issues fall under the COMFORT category.
which supports the assumption that auditors are more likely to notice issues under the COMFORT category rather than the SAFETY category.

It is also noticeable that auditors from sectors 3 and 5 have the highest scores on safety compared to others, advancing the assumption that the use of auditors with a ‘technical background’ will provide a more in depth exposure for SAFETY issues (see Chart 3).

Finally, it is also possible to assume that using auditors with a technical background on sectors 1, 2 and 4 may bring to light more SAFETY issues, therefore for a fair assessment, if the decision is to include auditors with technical background in future similar projects, there should be an equal distribution throughout the sectors.

6.2 Quality of data
Data quality of the generated data was good, with minor issues linking the in audit Collector App with the server, mostly due to mobile signal strength.

There are areas that could be improved to facilitate the data analysis process, such as a more granular audit criteria and clear guidance regarding the use of OTHER category.

6.3 Achieved expectations
The project was setup with three main objectives:
1. Knowledge Transfer
2. Tool Development
3. Route Data Collection

The three main objectives have been achieved throughout the project mostly due to the collaborative spirit of the different teams engaged.

There is the expectation of achieving more with the data collected in the upcoming Data Analysis Workshop, which had to be postponed due to COVID19 situation. The workshop will be the opportunity to bring together colleagues from other service areas within BC and additional datasets to examine the data further and extract more insights.

The details of this project will be shared with other service areas to drive interest in using the tool for further data collection around the County.

6.4 Added value to BC’s departments
The data analysis so far has provided some initial intelligence around the Aspirational routes, such as sectors with higher reported issues and type of issues. This data has the potential to add value to the Planning and Infrastructure team.

7. OpenStreetMap (OSM) Data Integration
Demonstration of Local Authority capability to develop a geospatial survey and integrate data generated into OpenStreetMap for the benefit of local populations and the wider mapping community was demonstrated in the original Open Oxfordshire: Cycle Infrastructure Evaluation (CIE). As part of the BCIE, the project has replicated the process, integrating data from its own geospatial survey of cycle infrastructure in Aylesbury into the OSM platform.
7.1 Integration of BCIE data into OSM

As one of the first Cycling Demonstration Towns, Aylesbury’s purpose-built Gemstone routes attracted a great deal of attention from the OSM community and, as such, are comprehensively mapped in OSM.

Map 6: BCIE data into OSM

Audit data collected for the BCIE was largely qualitative in nature, which posed a challenge for direct translation of headline data into OSM due to rules governing inclusion of empirically verifiable and permanent entities only. As a result, BCIE data was assessed to identify the observational data that could be integrated into OSM whilst avoiding subjective information which is less appropriate for direct inclusion in OSM.

Due to challenges around subjective data collection, the opportunity to deploy the open source conflation tool (https://github.com/systemed/conflation) that was developed as part of the original Oxfordshire CIE to semi-automate the process of integrating non-native datasets into OSM was limited, and as such the majority of data transfer required manual assessment and transfer.

The largest single source of information extracted from the BCIE audit, was data collected on barriers and obstructions, contained within the ‘Comfort’ category. These were brought into OSM as barrier objects, with additional detail added where photo imagery shows the type of barrier.
Digging into the dataset, the free-text nature of the ‘Other’ category also concealed a considerable amount of usable mapping information. Although the unstructured nature of the reports precluded direct conversion, reference to specific features was able to be translated for inclusion as OSM attributes. Some example of this included:

- “no lighting” is recorded as lit=no
- “railway crossing shut” is recorded by removing a crossing object and explicitly tagging as access=no
- “very small island for peds and cyclists” is recorded as crossing=island
- “chicane” is recorded as barrier=chicane

In other cases, assessment and extraction of free-text data acted as a prompt for further survey work, such as:

- “narrow lane, shared with vehicles” indicated that the width of the road was worth measuring more precisely (from aerial imagery)
- “no signpost at the entrance of underpass” indicated an underpass was present nearby

Through experience gained and challenges overcome in the audit and open data integration by the study team on both the Open Oxfordshire: Cycle Infrastructure Evaluation and the Buckinghamshire Cycle Infrastructure Evaluation, a combined document has been produced as guidance to Local Authorities looking to replicate the process of generating new data to enhance their open map data ecosystems or release existing data to the mapping community for inclusion in global open data projects such as OpenStreetMap. The guide can be found on Annex H

7.2 Secondary benefits of open dataset integrated into global mapping platform

OpenStreetMap has the most detailed mapping data for cycling and walking globally. Founded in the UK in 2004, its open, crowd-sourced nature has made it the map data provider of choice for small developers through to many of the leading technology companies including Amazon, Apple, Facebook and Microsoft (https://welcome.openstreetmap.org/about-osm-community/consumers/). With the one exception of Google Maps, almost all cycle journey-planners and similar apps are based on OSM data.
Given this, integrating new geospatial data into OSM, such as barriers and obstructions to cyclists extracted from the BCIE, improves the data from which many of the maps and journey planners local residents use are based.

This benefit to local residents was demonstrated in the Oxfordshire CIE through collection and inclusion of better cycle surface information for traffic-free routes enabled journey-planner algorithms to make more informed choices about the best route to take, so residents could enjoy a better, safer cycle to the town centre.

8. Learning and Recommendations
8.1 Overview of challenges

8.1.1 Audit
Due to the project timeline the audit was setup to happen between December 19 and January 20, which proved to be a challenge due to weather conditions and holidays. Although we had an overwhelming response of auditors, during the audit four of them drop out due to availability and health issues.

8.1.2 GDPR/Insurance
It became evident in the middle of the recruitment process that in order to identify the auditors some personal data had to be collected. To overcome the issue a disclaimer was created where the auditor granted the consent to collect the personal data.

The fact that auditors were also BC’s employees raised concerns from the Insurance Team at BC in case of an accident. To overcome the issue the Insurer requested additional information about the project and the auditors to make a decision. To meet insurance requirements, it was ensured that auditors had a minimum of 4 years of experience as cyclists, Health & Safety training was carried out and additional safety gear provided the Insurer was satisfied to cover the employees under the current policy without any additions (see Annex G).

8.1.3 Use of OTHER criteria
During the Data Analysis phase it became clear that a further thinking of the use of the OTHER criteria was necessary. It proved to have been used not only to appoint nonexistent criteria but also to provide additional information on the reported issue. To overcome the issue a further analysis is recommended during the planned Data Analysis Workshop to explore the data in more depth.

8.1.4 Permission to record multiple criteria in a single issue
During the Data Analysis phase it became clear that a further thinking of the permission to record multiple criteria in a single issue is needed, as it allows for double counting. To overcome the issue and provide a more accurate results manual manipulation of the data was necessary to minimise the double counting.

8.2 Overview of benefits
The main benefit of this project was the proven potential to provide intelligence to service areas within BC and allow them to make more informed decision regarding upkeep and expansion of its cycling infrastructure.
The initial data analysis provided in this report provides an insight of what else can be achieved during the Data Analysis Workshop where colleagues from different Services Areas within BC will be joining forces and making their expertise available to dissect the collected data and providing additional datasets, if necessary.

8.3 Recommendations

8.3.1 Data Analysis Workshop
As part of the original plans, the recommendation is to run the Data Analysis Workshop and bring together BC’s colleagues from other Service Areas together to analyse the data in more depth.

It will beneficial to add other datasets available at BC, such as flooding, collision risk and cycling, as it will reinforce or bring to light other insights that otherwise wouldn’t be spotted.

A recommendation is made to further analyse the data on OTHER category and OTHER criteria to understand and cleanse the data, as it has potential to provide more insights.

Also, it is recommended to further analyse the data on ASP/GMS route, with assistance of the ArcGIS to be able to categorise the record into ASP, GMS or OTHER routes. Currently the data does not allow interpretation.

8.3.2 Auditors with Technical Background
If BC decides to further the data collection in this project and a decision is made to include auditors with technical background, it is recommended that there is an equal distribution throughout the sectors to minimise variations.
9. Annex

9.1 LCWIP Aspirational Routes Map
Open Oxfordshire: Cycling Infrastructure Evaluation (CIE)

Hanborough - Witney - Eynsham
## A. Cycle parking audit criteria

<table>
<thead>
<tr>
<th>Official cycle parking</th>
<th>Unofficial cycle parking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
<td>Automatically recorded</td>
</tr>
<tr>
<td><strong>Type [see images below]</strong></td>
<td></td>
</tr>
<tr>
<td>- Standard bike stand (i.e. possible to lock frame to stand, includes Sheffield, M stand)</td>
<td></td>
</tr>
<tr>
<td>- Hi-Lo stands (aka Falco Cam)</td>
<td></td>
</tr>
<tr>
<td>- Lamp post cycle hoop</td>
<td></td>
</tr>
<tr>
<td>- Two tier racks</td>
<td></td>
</tr>
<tr>
<td>- Wheel clamp (aka wheel handers)</td>
<td></td>
</tr>
<tr>
<td>- Wheel groove in ground</td>
<td></td>
</tr>
<tr>
<td>- Wall hooks / rings / bars</td>
<td></td>
</tr>
<tr>
<td>- Space for non-standard bike, e.g. cargo bike, trailer</td>
<td></td>
</tr>
<tr>
<td><strong>Length of stay / purpose</strong></td>
<td></td>
</tr>
<tr>
<td>- Definite long-stay</td>
<td></td>
</tr>
<tr>
<td>- Definite short-stay</td>
<td></td>
</tr>
<tr>
<td>- Suspended long-stay</td>
<td></td>
</tr>
<tr>
<td>- Suspended short-stay</td>
<td></td>
</tr>
<tr>
<td>- Unclear</td>
<td></td>
</tr>
<tr>
<td><strong>Signage</strong></td>
<td>Free text box. Description of signage relating to cycle parking, e.g. clarifies user group, length of stay, access restrictions</td>
</tr>
<tr>
<td><strong>Location description</strong></td>
<td>Any additional details relating the type of facility, its location and intended user group to include ease of access such as any doors, gates or steps to negotiate, narrow entrance ways etc.</td>
</tr>
<tr>
<td><strong>Number of cycle parking spaces</strong></td>
<td>Free text box</td>
</tr>
<tr>
<td><strong>Number of cycles parked</strong></td>
<td>Free text box</td>
</tr>
<tr>
<td><strong>Covered by CCTV</strong></td>
<td>Yes / No / unclear</td>
</tr>
<tr>
<td><strong>Access</strong></td>
<td>Secure compound / open access</td>
</tr>
<tr>
<td><strong>Distance between individual racks at least 1m</strong></td>
<td>Yes / No</td>
</tr>
<tr>
<td><strong>Condition</strong></td>
<td>Excellent / Good / Fair / Poor</td>
</tr>
</tbody>
</table>
9.4 Annex D: Auditor's Recruitment - Survey

Do you own a bycicle?  
Yes   No

What is your postcode?  

Are you available to take part of the project within 16th Dec 19 to 19th Jan 20?  
Yes   No

Are you willing to dedicate a minimum of 5 hours auditing/assessing cycle routes in a allocated area?  
Yes   No

How many times a week do you currently cycle?  
0   1   2   3   4+

How many?  
0

Do you own the following safety equipment?  
Helmet  
High Visibility Jacket  
Lights  
Water Bottle  
Wheed Pump

Has your bicycle been safety checked recently?  
Yes   No

Do you own the following mobile phone  
Android (model from 2012 onwards)  
Iphone (model from 2016 onwards)  
Windows (model from 2016 onwards)  
Other
Welcome

Buckinghamshire Cycle Infrastructure Evaluation (BCIE)

Jasvinder Kaur Sidhu  
*Business Improvement Support Officer*

Luke Newman  
*GIS Analyst*
9.6 Annex F: Collector App – Handout (click in the image to access the document)

How does the App work?

There are 2 versions of the App currently available:

- Collector for ArcGIS (Classic) – for Android, Windows, older versions of iPhone
- Collector for ArcGIS 10.2.0 (newer iPhone)

1) When opening the App, find the project group, Buckinghamshire Cycling Infrastructure Evaluation. In Classic, this is located in the Main Menu and the button for this is located on the top left. In the newer version, the group should be available as soon as you open the App.

2) When you open the group, click on the Web Map for the project, BCIE_map. This presents you with a map containing all of the layers available for the project and is centred on your current location.

3) To add a new point to the map, select the Add Data button (plus sign). In Classic, this is located at the bottom of the page next to the centre button (2nd from the left). In the new version, it is located at the bottom right of the page.

4) Select the relevant dataset you are adding data to (the sector you are auditing).

5) You are presented with three menus to help give more information about the issue related to the point. You have the option to select from 2 lists of pre-defined criteria, under Comfort and Safety, along with a text box Other to give as much information about that point as possible ie which side of the road. You also have the option to attach photos to your point – select the Attach button at the bottom of the page.

6) When you are ready to plot the point, select the tick box in the top left corner in Classic, and the Add Point button for the new version. You will then be able to see your point on the Map and this will become visible to the rest of the project group.

NB: you will only be able to raise one issue per point. Please plot an additional point if you would like to record multiple issues in a particular location.

7) You have the option of turning on/off the layers in the Map as you need them. To access a list of layers in Classic, hit the More Options button in the bottom right of the Map and select Layers. There is also an option to change the Basemap. In the new version, these options are located in the top right of the Map.
9.7 Annex G: Data Protection Statement & H&S Disclaimer

Using and Sharing your Information

The personal information we collect will only be used by Buckinghamshire Council for the administration of the BCIE project. Your data will be stored in a secure location on our IT network. This information will not be shared with any other organisations in public bodies and after the project has been completed all recorded data will be managed according to our Data Protection policy and the Buckinghamshire Council Protection Schedule. Where we report on the BCIE project, all data will be anonymised. For more information on what we are doing to protect your personal data, please visit http://data-protection.gov.uk.

You may request a copy of the personal information that we hold on you, and for your personal data to be removed from our records, at any time by making a Subject Access Request to Buckinghamshire Council.

I confirm that the details on this form are correct. I have read how my information may be used and shared, and agree to this.

Yes ☐ No ☐

Name & Signature __________________________ Date ____________

Health & Safety and Safeguarding

You understand that you take part at your own risk, and will seek medical advice if appropriate.

You will submit the Highway Code at all times: https://www.gov.uk/guidance/the-highway-code

You will inform us if you are pregnant.

You accept that cycling is a public highway, off road track and trail comes to your risk and you have, on your own personal, made the choice to participate as a volunteer in the BCIE project.

You will vote responsibly at all times.

You agree to wear appropriate safety equipment must be worn at all times when cycling on the route.

You must be road worthy and mobile phone must be operational and have sufficient battery to perform the audit.

You will not feed the rabbits, be kept on or walk during the route evaluation.

You will not bring children under 15 years with you whilst auditing/crossing the cycle route.

You understand that the audit/presentation is performed in your own time.

You understand that you should stop cycling in a safe place when recording findings on the Conference form.

General

You understand and agree that you are required to use your personal mobile phones for the purpose of the cycle route assessment.

You understand and agree that the location feature on your mobile phone must be switched on for the purpose of the cycle route assessment.

You understand and agree that the WIF will access approximately 300mb of data allowance on your mobile phone plan.

You understand and agree that you are required to provide a summary of hours of data collected during your assessment in the area allocated to you and you may be required to perform up to 2 hours to complete the area assessment.

You understand and agree that in return for your collaboration you will receive a £10 Amazon Voucher.

You understand and agree to complete a feedback form providing your views on the experience.

I have read and understood the terms of the above disclaimer and take full responsibility for myself.

Name & Signature __________________________ Date ____________
Providing data to OpenStreetMap

a guide for local authorities and other data owners