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Tracing the path of cycling initiatives: Revisiting Lancaster's CDT program and unravelling current policies

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ABSTRACT

Introduction: Active modes of transportation have gained significant prominence in many cities, with governments and public health organizations increasingly advocating for cycling. While policy and planning decisions are actively aimed at boosting cycling rates, their long-term impact remains somewhat uncertain. This study seeks to shed light on the enduring effects of policy and planning decisions on cycling and outlines potential steps for sustainable progress.

Methods: To achieve this, we have chosen Lancaster, UK, as our case study, with a specific focus on the UK Government-funded Cycling Demonstration Towns (CDTs) program that operated from 2005 to 2011. Our approach involves revisiting this program and the changes in the city through a multi-pronged methodology: conducting surveys with cyclists ($n = 65$), engaging in interviews with personnel from Lancaster City and Lancashire County Council ($n = 3$), and analyzing cyclist numbers at specific locations ($n = 5$).

Results: The findings of our study reveal the positive influence of the CDTs program on cycling rates and the perspectives of cyclists in Lancaster. However, after the program's completion, progress has been somewhat gradual, drawing attention to specific areas in need of improvement, particularly infrastructure and safety measures.

Conclusions: In conclusion, we delve into potential strategies for implementation, not only within Lancaster but also for other CDTs and cities aspiring to promote cycling initiatives. This underscores the effectiveness of such programs and decisions in the short-term while emphasizing the critical importance of sustained investments in infrastructure and maintenance for long-term impact.

1. Introduction

Cycling serves as a significant mode of transportation for daily commutes, a source of leisure and recreation, and contributes positively to the environment and individual health (Pucher and Buehler, 2012). Encouraging cycling and increasing the number of cyclists can be highly effective in urban settings, creating a “safety in numbers” effect (Pucher et al., 2010; Robinson, 2005). This phenomenon enhances safety by reducing bicycle injury rates, improving cyclist visibility to motorists, and even inspiring a shift in travel mode among motorists who become cyclists themselves.

However, it is essential to note that people are more likely to embrace cycling regularly when optimal conditions are in place. These conditions encompass a range of factors, including favourable weather (Meng et al., 2016), the approach to addressing safety concerns (Mullan, 2013; Yesiltepe and Conroy Dalton, 2022), and the general promotion of cycling culture. For example, countries with strong cycling culture, such as the Netherlands and Sweden, encourage cycling more effectively compared to countries with low-emerging cycling culture, such as Italy or the UK (Fraboni et al., 2022). Researchers have classified factors affecting bicycle use into several categories, including individual factors, socio-cultural factors, cost of bicycling, local authority initiatives and policy variables

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(Rietveld and Daniel, 2004) or analyzed them using a socio-ecological perspective (Yesiltepe et al., 2021).

Many governments and public health organizations are dedicated to promoting cycling in cities and employ diverse approaches to increase cycling. These approaches encompass policy and legal interventions, marketing campaigns, infrastructure development, and effective communication strategies, all geared toward making cycling an attractive and accessible choice for urban residents (Wang, 2018). Individually and collectively, they are perceived to be helpful in increasing cycling, especially in cities where a wide range of infrastructure and programs are implemented, including expanding and improving bike lanes, traffic calming, bike sharing, training programs and promotional events (Pucher et al., 2011). These findings are supported by other review papers that show how community-level promotional activities and improving infrastructure for cycling have the potential to increase cycling (Yang et al., 2010).

1.1. Cycling policy

While cycling policies globally aim to encourage more cycling, their specific focus and outcomes often adapt to local or national challenges. These challenges include geographical factors like altitude differences and city size, as well as practical considerations such as travel time and the quality and quantity of cycling infrastructure (Braun et al., 2016; Harms et al., 2016; Rietveld and Daniel, 2004). The urban form, such as compact city models, can also positively impact cycling behaviour by making destinations more accessible and reducing travel distances (Adam et al., 2020). Additionally, effective policies often involve managing alternative modes of transport. This includes reducing the attractiveness of car use and enhancing public transport options, which have been shown to significantly promote cycling (Braun et al., 2016; Harms et al., 2016). Moreover, socio-demographic factors such as ethnicity, education, and cycling habits (e.g., regular cyclists) influence perceptions and acceptance of cycling provisions (Jahanshahi et al., 2022). Thus, increasing cycling rates requires a holistic approach that addresses infrastructure, alternative transport, and socio-demographic considerations.

Recently, cycling infrastructure and policies have gained even greater significance, particularly after the COVID-19 pandemic. Studies have found that temporary cycle lanes are not only implementable but also economically feasible, and that traffic calming measures and road safety enhancement initiatives are essential for cities (Rérat et al., 2022). Furthermore, it is stated that providing adequate cycling parking and bike storage is crucial to support cycling. Policymakers should be decisive and take immediate actions, exploring the possibility of expanding local schemes to invest more in cycling. Additionally, research has explored what should be prioritized in cycling investments. An effective approach is to focus on connectivity-driven prioritization strategies to consolidate the bicycle network and improve connectivity (Zhao and Manaugh, 2023). By prioritizing well-connected bike networks, the promotion of cycling can be maximized, thereby enhancing the benefits of cycling investment.

Policy outcomes have been measured through research in various ways previously. The most widely applied policy outcome is the change in the number of cycling or an increase in bicycle mode share (Pucher et al., 2010). Another key indicator is the perception of cycling conditions and changes in these perceptions over time (Klinger et al., 2013). Additionally, the percentage of trips that shift from motorized modes to cycling serves as a valuable measure to gauge short-term outcomes or long-term effects on health and the local economy (Harms et al., 2016).

While numerous interventions and policies are implemented and evaluated within cities as part of various programs, there remains a notable gap in research regarding the assessment of these programs' impacts on cycling rates (Pucher et al., 2010), especially over the long term. A recent study highlighted that it is still unclear which interventions effectively reduce barriers and are both feasible and acceptable (Logan et al., 2023). This discussion was supported by a further review article, which stated that there is still uncertainty about the exact effects of specific policies (Winters et al., 2017). Addressing this gap in understanding the long-term effectiveness of policies, both generally and as determined by authorities, is the primary aim of this article, by investigating a cycling program that was developed and implemented more than a decade ago, the Cycling Demonstration Town (CDT) program (see Section 3.1).

In this research, we focus on the CDT as one of the important programs promoted by the UK Government to improve cycling, as the UK has one of the lowest cycling rates in Europe (Cycling UK, 2019). Through our research, we aim to understand how the program developed, the immediate effects of the program and the current situation in the area. We aim to answer the following questions.

- How did the CDT program impact the number of cyclists during its implementation and immediately afterward?
- What decisions were made after the end of the CDTs program?
- What are cyclists' perceptions regarding the CDTs program and subsequent changes up until now?
- What is needed for a cycling initiative to be successful in the long term, based on the case study results?
- What actions can be taken in cities with similar conditions to create more impactful solutions?

2. Method

2.1. Case study

Lancaster with Morecambe (UK) was selected as a case study because it was one of six Cycling Demonstration Towns (CDTs) in the UK. Among the other CDTs, Lancaster is selected as a case study because it is considered one of the most bike-friendly cities in the UK (Everett, 2020; True Solicitors, 2020), making it an important subject of investigation. Between 2005 and 2011, the UK Government invested money to improve cycling infrastructure in CDTs. The annual expenditure per head of population was £17, considering all CDTs, and this amount was approximately £13 for Lancaster and Morecambe. Towns were selected from among those with a

medium-sized population of around 100,000, and Lancaster was selected following a competition for funding. Final reports on the impacts of the project suggested that the investment in CDT towns helped increase cycling activity (Cope et al., 2017). However, it has been more than a decade after completion of the project and currently there is no clear information about cyclists' satisfaction levels or their expectations. This is why we focused on Lancaster as a case study and investigated the situation here.

To gain a deeper understanding of the CDTs program, its effects, and current perceptions, we employed various methods, including a comprehensive review of reports, a survey of cyclists in Lancaster, cycle counting, and interviews with officials from Lancaster City and Lancashire County Councils.

In order to ensure ethical compliance throughout our study, we obtained approval from the Lancaster University Ethics Commission, specifically the FASS LUMS Research Ethics Committee, in August 2022 (Reference: FASSLUMS-2022-0968-RECR-3).

2.2. Reviewing the reports of CDTs program

Our review primarily drew upon the "Outcomes of the Cycling Demonstration Towns Programme" report authored by Cope et al. (2017). This report encompasses several sections, including an introduction, details on data collection and analytical methodologies, overall findings, and individual town results. Additionally, we consulted a summary document of the outcomes by Sloman et al. (2017) and another qualitative survey report published by Cycling England (2009). These sources were essential in providing valuable insights into the CDTs program, its objectives, decisions made concerning the participating towns, the metrics employed to gauge program impact, and the overarching results achieved.

This approach allowed us to comprehensively evaluate and understand the key aspects of the CDTs program and its implications, both in the broader context and within the Lancaster and Morecambe case study.

2.3. Interviews with council staff

A set of interviews was conducted with members from Lancaster City and Lancashire County Councils ($n = 3$) to gain insight into the specifics of the CDTs program and the perceptions of Council staff following the project's implementation. We interviewed three staff members out of the four potential staff we reached out to within the councils. This number of interviews provided a representative sample in terms of both quantity and quality, reflecting the capacity of individuals in smaller local and county authorities to effectively engage with transportation-related matters. Council staff members were contacted via email and provided with a participant information sheet. Prior to the interviews, these staff members provided their consent to participate in the study. The interviews were conducted virtually using Microsoft Teams and were recorded for transcription purposes. Subsequently, the transcriptions were meticulously reviewed and corrected. To maintain confidentiality and data security, the video recordings were deleted after a month, when the corrections of transcriptions were completed. All procedures and details were transparently communicated to the interviewees through the participant information sheet.

The interview process commenced with more general questions, such as inquiring about the interviewees' roles or their usual involvement in council developments. Following this, we delved into inquiries about the CDTs project in general, the changes that occurred in Lancaster, and the Councils' perspectives on the program's success. Finally, we asked questions about the alterations following the program and recent decisions. Interviews were conducted in September 2022 by the first author of the paper.

In analyzing the interview data, our approach aligned with the principles of qualitative descriptive analysis, as we aimed to present findings that reflected the participants' thoughts and insights. Following data collection, each interview transcript was reviewed to identify responses that directly addressed the research questions asked. This method was specifically chosen to ensure that the descriptions and opinions extracted from the interviews were presented with clarity and remained faithful to the participants' perspectives, providing straightforward answers.

This approach is supported by Sandelowski (2000), who advocates for qualitative descriptive studies when the goal is to capture direct accounts of participants' experiences without the infusion of interpretation. Our focus was on extracting significant statements that provided clear and substantial contributions to the research questions, thereby ensuring that our findings were accurate and informative.

2.4. Survey

A survey was crafted using Google Forms to collect data on the socio-demographics of cyclists and their perspectives on the CDTs project, as this is viewed as an effective way of measuring policy and planning outcomes (Klinger et al., 2013). The survey was distributed between July and September 2022 through various social platforms, including the Lancaster Institute for the Contemporary Arts (LICA) Twitter account, the Lancaster Guardian webpage, and local cycling groups such as the Lancaster Women's Cycling Group on Facebook. Hence, we adopted a convenience sampling approach, in which participants were selected, based on their availability and willingness to participate (Farrokhi and Mahmoudi-Hamidabad, 2012; Stratton, 2021). The response rate for the survey study was approximately 1%, considering the number of members of these platforms.

Before participating, potential respondents were furnished with a participant information sheet outlining the project's objectives and the survey's process. They were required to provide consent before proceeding to answer the survey questions. It was also made clear that they could withdraw from the study at any time. Additionally, participants were asked whether they resided in Lancaster and, if not, whether they were familiar with the city's cycling infrastructure. This step ensured that respondents could provide fair and informed responses regarding the cycling infrastructure or CDTs project.

Descriptive analyzes were used to investigate the survey data, and population characteristics were precisely analyzed for each question (Lehtonen and Pahkinen, 2004). This method is widely used when researchers aim to collect data from a sample with the goal of providing detailed and accurate results. Thematic analysis is utilized for open-ended questions, categorizing factors influencing participants' cycling behaviour based on recurring responses (Popping, 2015).

2.5. Cycle counters

As our objective was to comprehensively assess the impact of the CDTs program, we concentrated on cycling counters that were used both during and after the implementation of the CDTs program. This was defined as another effective way of measuring policy outcomes by Pucher et al. (2010).

The locations of the cycle counters were obtained from the Council staff. However, it should be noted that the results from these individual counters were only available for five of them as the counter data was collected by Sustrans, a cycling charity, and the data for the rest of the counters was not available. This data was recorded hourly, and the available years varied among the counters. The counters were active from 2009 and were deactivated in different years following the completion of the project, with the last counter being deactivated in 2017.

Following the data we received from the council, we conducted another count at the same five locations to observe the change in numbers after 2017. We conducted cyclist counts on both weekdays and weekends in October 2022, with a specific focus on morning (08:00–09:00), afternoon (12:00–13:00), and evening (16:00–17:00) time intervals. During both the weekday and weekend observations, the weather conditions were sunny and dry, with temperatures ranging between 15 and 20 °C, and the wind speed remained below 15 kph, classified as light wind (Ahmed et al., 2010). Counts were conducted for 15 min and then multiplied by 4 to align with the dataset recorded by automated counters. For a fair comparison, we retrieved data from the Lancaster City or Lancashire County Council dataset, selecting a date from the same season and month for the new field study (from the October dataset for each year). We matched weekend and weekday dates with weather conditions as close as possible to those recorded in 2022 (dry and sunny with light wind) using a dedicated webpage¹ to ensure the new dataset was reliable. The counting was completed by the first author of the paper (Fig. 1).

3. Analysis and results

3.1. CDTs program

3.1.1. Overall decisions and initial impacts (2005–2011)

Drawing from prior reports compiled by Sustrans (Cope et al., 2017), the Cycling Demonstration Towns (CDTs) initiative centred on the objective of providing funding to support medium-sized English cities with populations of approximately 100,000, with the aim of promoting cycling. Local authorities had the opportunity to submit applications for this funding, and from the thirty-one applications received, six towns were selected. These towns included Aylesbury, Brighton and Hove, Darlington, Derby, Exeter, and Lancaster, together with Morecambe. The program spanned two phases, operating from 2005 to 2011. The first phase, from 2005 to 2008, received support from Cycling England, an independent body financed by the Department for Transport (DfT), to advance cycling. During this phase, local authorities received strategic guidance regarding their cycling initiatives and received technical advice on cycling infrastructure. Additionally, the towns collaborated and had opportunities for the exchange of ideas.

In the second phase, the program expanded to encompass additional cities, including Greater Bristol, Leighton Linlade, and an additional ten towns. During this phase, the CDTs shared their experiences with other Cycling Cities and Towns (CCTs), leading to the introduction of additional initiatives, such as bike hire schemes and school-based cycling programs. Across all 18 towns and cities involved, the primary focus remained on promoting cycling for everyday urban journeys (Sloman et al., 2017). Various methods were employed to measure the impact of the project, including automated and manual cycle counting, household-level surveys on physical activity, and cycle hire scheme monitoring data.

Overall, an average increase of 29% in cycling trips was observed across all towns in 2011 when compared to data from 2005. This increase varied from 6% to 59% in individual cities. Additionally, there was an increase in the overall number of trips based on cycling counts. Household surveys also indicated a rise, with the proportion of adults engaging in cycling weekly increasing from 24.3% to 27.2%, while the proportion of “inactive” adults decreased from 26.2% to 24.3% (Cope et al., 2017). As a result, the reports emphasized the positive impact of the program.

3.1.2. Lancaster and Morecambe CDT (2005–2011)

During the initial phase, from 2005 to 2008, the primary objective of the Lancaster with Morecambe CDT was to address gaps in the cycle network. This involved permitting cycling on Morecambe Promenade and implementing route signage for this specific area. Additionally, improvements were considered for the Lancaster Canal towpath routes, and measures were taken to enhance safety at collision hotspots for cyclists (Cycling England, 2009).

In the second phase, spanning from 2008 to 2011, the primary focus was to encourage more individuals to cycle to work or school.

¹ Weather dataset is received from <https://www.timeanddate.com/weather/uk/london/historic>.

Consequently, alongside the continued efforts to fill gaps in the cycling network and enhance signage, new routes to schools and employment centres were explored. Furthermore, investments were made in cycle parking facilities (Cope et al., 2017).

In total, the Lancaster cycle network expanded by 30 km, reaching a total of 79 km. This network encompassed non-road, shared-use, and segregated cycle paths, complete with crossing points and stop lines to ensure seamless connectivity between cycling routes. Additionally, the local authorities collaborated with 23 schools to promote cycling activities, engaging nearly 10,000 pupils. Schools were also provided with free Bikeability training², resulting in 620 pupils being trained by late 2008. Furthermore, new cycle parking facilities were installed at 18 schools, resulting in 620 pupils being trained by late 2008 (Cycling England, 2009).

While engaging with the public, additional issues were identified, including barriers related to cycling skills, low cycling confidence, and a lack of information. To address these concerns, initiatives such as cycle training and maintenance sessions were organized, and a “Bike Buddy” service, where new cyclists could ride with experienced cyclists, was introduced. Additionally, 60,000 copies of a local cycle map were distributed. Cycling events, including Cycling Film Festivals, were held to promote awareness. Moreover, local media was utilized, with radio advertisements, regular columns, and features dedicated to cycling (Cycling England, 2009).

To assess the impact of these efforts, various metrics were employed, including cycle counters (26 automated counters and 12-h manual counts at four locations in Lancaster and four locations in Morecambe since 2006, and an additional eight locations from 2009 to 2011), behaviour and survey data, household surveys, and workplace/school travel data. An increase of 29% in the number of cyclists was observed through automated counters in Lancaster and Morecambe from 2005 to 2011. Manual counts at four locations in Lancaster and four in Morecambe also revealed an annual average increase of 7% in the number of cyclists from 2006 to 2011. Additionally, physical activity surveys and studies on cycling to school indicated an increase in physical activity levels and the number of children cycling to school (Cope et al., 2017).

Overall, the CDTs program included various aspects mentioned in the literature, such as changes in cycling infrastructure, cycle parking, cycling promotions (especially at schools) and educational initiatives through various events.

3.2. Changes since 2011

3.2.1. Interviews with council staff

Three interviews were conducted with staff members from Lancaster City and Lancashire County Council. Their role in the councils varied: one worked as a planning officer, one worked as a senior public health practitioner and one worked as an active travel manager. All participants were aware of the CDTs program, with one actively participating in the process. When discussing the implications, both in general and in Lancaster, they cited points from the reports and shared their observations:

“A lot of big projects and the Millennium Bridge were already there when CDTs started ... what CDT was about, it was trying to fit in the missing links and there was also a lot about, sort of, promotion and signage, awareness raising, training. Say, like from an infrastructure point of view, trying to fit in, you know, we have got this really good infrastructure. But obviously, they don't connect everywhere, and it was always about trying to fit in those particular missing links ... So if you do go around Lancaster, you are aware there are a lot of blue signs. A lot of you know, little connections and routes that they put in” (Council Staff-1, September 2022).

“We worked with a small number of the big employers. So the university, the hospital, et cetera, and we also we did a number of things. So we worked with schools. We had a Sustrans officer in, so we started doing Bikeability training through that. We also started to do adult cycle training. We brought in instructors and set up that whole scheme. We did lots of events so lead rides, and film festivals and fairs to just sort of get people interested and sort of thinking about it ... So, I mean there weren't any major schemes because obviously things like the Promenade and the Greenway (some of the projects in and around Lancaster) already existed. But there was definitely some, bits of infrastructure” (Council Staff-3, September 2022).

Both staff members pointed out that Lancaster already had existing cycling infrastructure, as one would expect. However, during the CDTs program, the primary goal was to enhance it by establishing connections, raising awareness, and collaborating with stakeholders to promote cycling, as indicated in the program reports.

Our interviews with the Councils also revealed that there was no direct monitoring by either of the Councils after the project's completion. Instead, monitoring was primarily conducted by Sustrans, a cycling charity.

“Well, we didn't [do the monitoring], but there was a monitoring partner, so Sustrans was part of the project. So they had quite a comprehensive data collection plan and then, and then monitoring. So we probably left most of the monitoring up to them to be honest, because that was funded. We're separately funded for that part of the project” (Council Staff-3, September 2022).

We also inquired about the personal observations of Council staff about the change in the number of cyclists in Lancaster and Morecambe after the project's completion:

“I think in general, we had the feeling [of an increase in the numbers of cyclists], and I think this was backed up by the data. 'Cause the data definitely did show an increase in number of journeys ... I think generally myself and the team really thought

² Bikeability is the UK Government's cycle training program: <https://www.bikeability.org.uk/>.

that we were starting to make a difference. We definitely were seeing more people cycling and are interested in cycling” (Council Staff-3, September 2022).

This change was observed by one of the Council staff. The council staff mentioned not only the changes in the numbers of cyclists, but also how awareness increased through the events organized and that more people got involved in training and events. However, another staff member pointed to the idea that this change was not only about the project; it was closely related to the population in the case area:

“I think it [the numbers] did increase. I think we got quite high levels. Uh, my view, my personal view as an individual is that in Lancaster numbers rose despite of the CDT project, not because of it. I think some of the infrastructure was good, but essentially, I think cycling levels are high in Lancaster because of the demographics. Because you have a lot of students who live in the city centre and it’s a nicer way for them to get to the uni” (Council Staff-2, September 2022).

Here, the staff member suggests that the presence of two universities in the city and the population’s inclination towards cycling have contributed to the number of cyclists independently of the CDTs program. This is an important point, as the universities play an important role in Lancaster. However, it should be noted that the counting used in this study started in 2009, when the universities were already established and thus contributing to cycling numbers from the start.

We also inquired with the council staff about the changes that occurred after the conclusion of the CDTs program and the cycling-related projects conducted in Lancaster. Following the CDTs program, planning decisions included maintaining the infrastructure that had been developed during the CDTs project:

“From a planning policy point of view, we have the local plan to protect and enhance the existing network ... And we have a policy specifically to, kind of, protect the existing routes and encourage the development of the network. So, I think from a planning policy point of view, the CDTs program had that kind of direct input into our policies, into a cycling, walking sort of policy that we didn’t have before” (Council Staff-1, September 2022).

“It’s still used to this day, probably to the extent that you’re doing a project on it, but the CDT is, like, is still used as a justification of how great the Council did some, like, brilliant infrastructure, and how much we’ve made Lancaster a much more cyclable city and we still use that” (Council Staff-2, September 2022).

The latter quote points to the idea that implementation of cycling infrastructure has been quite limited in Lancaster since the CDT programs ended and that more is needed. This idea of the importance of ongoing development to promote cycling was mentioned as a limitation in the interviews:

“But I think, in order to be truly successful, there needed to be a continuation, there needed to be some kind of continuation of it, really. Because otherwise you do need to be building on that momentum and that really is a failing ... It’s not just a case of, you know, putting some things in and introducing a few people, it does need that constant reminder and constant improvement and addition to the network. So yes, on one hand it was successful and I’m pretty sure Lancaster probably has a better cycling rate than any town in Lancashire. But could it have been a lot more successful? Yes” (Council Staff-3, September 2022).

When we inquired about subsequent planning and policy decisions following the CDTs program, the responses from the Council staff also revealed changes in the system:

“Now, Lancaster would not have been able to bid for it (the funding). So, Lancaster managed to get that money, even though now that would go to the County Council at the time we delivered a lot on highway works because we had, sort of, a special agreement, which then changed quite soon after we started. But now, all of that money, so all of the funding opportunities at the moment ... fund all goes to the County Council” (Council Staff-3, personal communication, September 2022).

This shift in the system implies that the City Council can no longer directly apply for funding opportunities like the CDTs, as such opportunities now primarily go through the County Council first. One of the staff members addressed this point:

“Most of the funding from government on cycling infrastructure comes down, filters down through the Highways authority, which is the County Council, rather than the District Council. So that is a problem for the City Council. ... We’re not the obvious people to get the funding” (Council Staff-1, personal communication, September 2022).

As a result, after the CDTs project, Lancaster has initiated projects to maintain and further develop the cycling network, building upon the existing infrastructure. Nevertheless, the CDTs program continues to stand out as one of the most significant projects in Lancaster.

3.2.2. Survey results

A total of 66 participants aged above 16 completed our survey. One participant indicated their lack of familiarity with the city and its cycling infrastructure; therefore, their responses were excluded from the study ($n = 65$). The majority of participants were male (66.2%), with 32.3% female participants. Most were either full-time employed (64.6%) or retired (16.9%). About 78% of respondents reported living in Lancaster, while others were familiar with the cycling infrastructure despite not residing there. Additionally, more than half of the participants (54.9%) had lived in the area for more than 10 years, which allowed them to witness the changes and impacts of the CDTs program.

Participants were asked general questions about the cycling infrastructure and projects in and around Lancaster. Of those surveyed,

54.7% were aware of some of the projects in Lancaster. When asked about familiar projects, their responses included COVID-19 cycle lanes, the CDTs program, the canal path for cycling, and the Millennium Bridge. These answers demonstrate residents' awareness of various projects in Lancaster. A significant 87.5% expressed that the current cycling infrastructure in Lancaster was insufficient. This high percentage underscores the need for improvements in the cycling infrastructure, post-CDT funding, as perceived by cyclists.

Regarding the CDTs program, 62.5% of survey respondents stated that they knew about this project. However, the total number who mentioned an event or an implementation during the CDTs program was below 25%. Answers to the changes during the program included cycling training and parking, new signposted routes, improvement of cycle path to Morecambe, motivational films and free cycle repair points. Hence, the respondents could observe changes that took place in Lancaster during the CDTs project.

In a multiple-choice question, participants shared their thoughts on the CDTs program (Fig. 2). Twenty-three participants stated that the project was helpful but emphasized the need for additional projects, as CDTs was considered an older program. Another 22 participants found the project helpful but believed it fell short in providing a sufficient cycling infrastructure. On the other hand, nine participants felt that the project had played a significant role in advancing cycling infrastructure developments in Lancaster, while an equal number of participants expressed that they did not find the project particularly helpful. Overall, these responses suggest that, while most participants acknowledged the program's helpfulness to some extent, there was a consensus that the initiated developments under the CDTs program needed to either continue or undergo further enhancement for a more comprehensive cycling infrastructure.

If participants selected options such as, 'this project was not really helpful,' 'not enough,' or 'we need other projects' in response to the initial question, we proceeded to ask them to elaborate on their reasons. A total of thirty-three participants provided further explanations, which we categorized, as shown in Fig. 3. Among these, 46% listed reasons related to infrastructure, with 26% specifically emphasizing the necessity for dedicated cycle lanes. Safety concerns were the next most common category, accounting for 16%, often related to infrastructure issues like one-way systems. Additionally, some participants voiced concerns about the age of the project and the ongoing needs in Lancaster for cycling improvements. One participant succinctly stated their perception of the situation after the CDTs project:

"Looked like when they got the initial funding something was done, then nothing afterwards" (male participant, 35–44 years old).

These results indicate that while the CDTs project was appreciated by the residents, further infrastructure-related developments are needed in the area.

3.2.3. Results of counting at specific locations

Our bicycle counting efforts in Lancaster revealed notable variations between weekday and weekend periods (please also see Table S1 for changes in numbers for each counter), as well as between morning, afternoon, and evening periods. Fig. 4 presents the results of this comparison, emphasizing that the highest number of cyclists was recorded in the evening period when considering both weekday and weekend totals ($n = 560$ during the evening period and $n = 432$ during the afternoon period). Furthermore, for weekdays, the highest number of cyclists was observed in the evening, while on weekends, it peaked in the afternoon. This discrepancy can be attributed to the different purposes of cycling: weekdays often involve transport cycling, while weekends are characterized by a greater prevalence of recreational cycling (Yang et al., 2022).

Analyzing the cyclist counts at the five locations, we observed higher numbers on two routes: from Lancaster to Morecambe and from the Millennium Bridge to Water Street, connecting the northern part of the city to the city centre.

The total number of cyclists is integrated with data obtained from the Council to analyze year-by-year changes. It is important to



Fig. 1. Location of the study area and 5 observation points shown in green circles for manual counting. Green lines represent the cycle lanes.

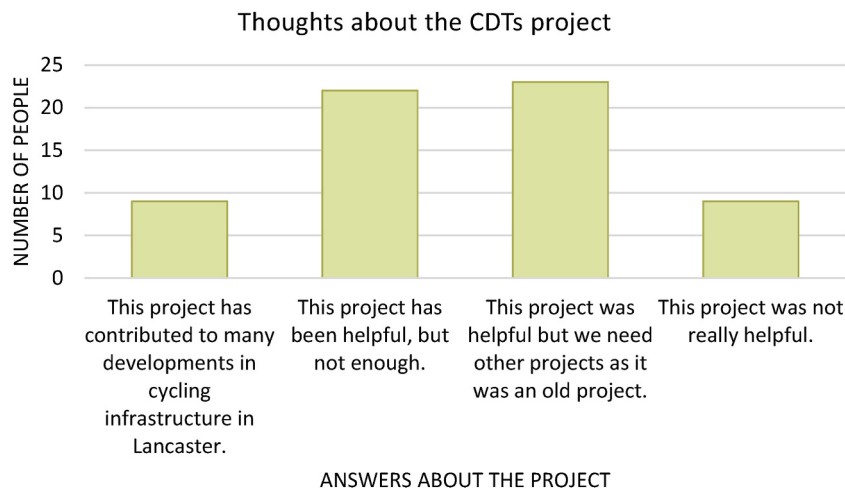


Fig. 2. Survey respondents' thoughts about the CDTs program.

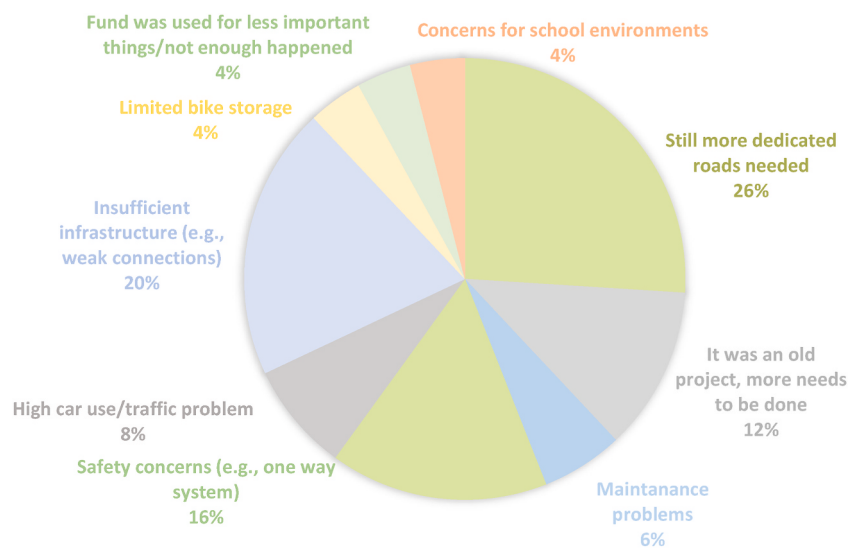


Fig. 3. Reasons listed by survey respondents who stated that more needs to be done in Lancaster.

note that the data begins in 2009, coinciding with the commencement of the second phase of the CDTs program. The recording continues through the project's active phases in 2011, including its completion that same year, and extends into the subsequent period. Fig. 5 illustrates these year-to-year variations for weekdays, while Fig. 6 does so for weekends (please also see Tables S2–S3 to see the changes in the number of cyclists over the weekday and weekend periods for each counter).

First and foremost, when considering the periods of 2009 and 2011, no significant shifts in the numbers are discernible. This indicates that, during the program's second phase, there were no noteworthy increases in cyclist numbers. However, post-program completion, some counters began registering higher cyclist counts. Notably, the counter on the Millennium Bridge, connecting with Water Street, recorded higher cyclist numbers for both weekdays and weekends during 2013–2014 and 2015. Nevertheless, our subsequent counts did not indicate further increases. A similar trend was observed for the counter on St. George's Quay during 2014 and 2015, encompassing both weekdays and weekends. This increase persisted in our weekday observations, though it did not extend to the weekends. The significance of changes in the number of cyclists was assessed using repeated measures ANOVA in SPSS, conducted separately for weekdays and weekends. This analysis excluded data from 2016 to 2017, as only one counter was active during this period. The changes in other years for each counter were tested. The results indicated that the differences in cyclist numbers by year were not statistically significant ($p > 0.05$) for both weekday and weekend counts.

4. Discussion & conclusion

In this study, we aimed to understand the impacts of policy and planning decisions on cyclists' behaviour and cities (considering the

Comparison of the total number of cyclists in 2022

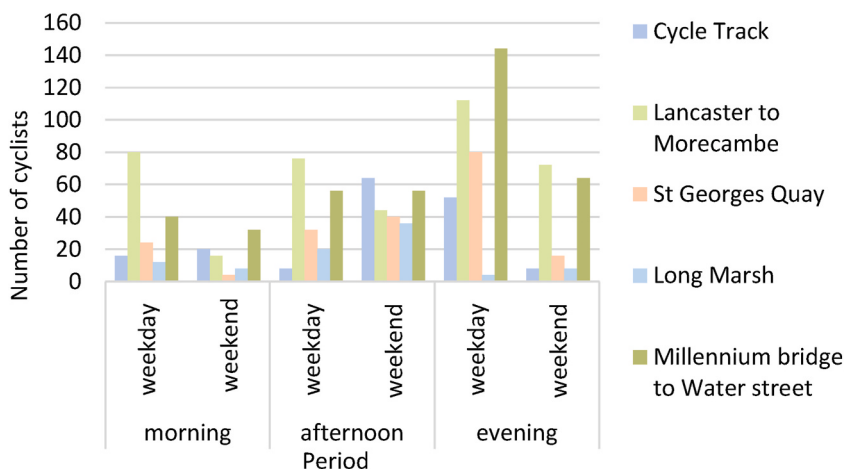


Fig. 4. Total number of cyclists at different periods in 2022.

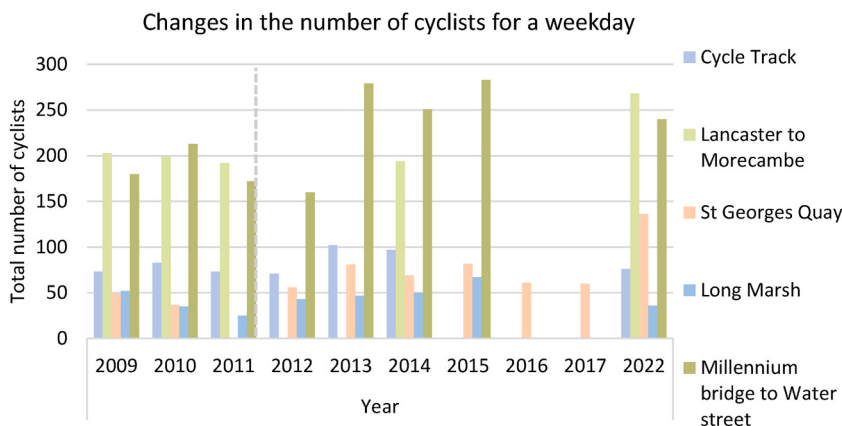


Fig. 5. Changes in the number of cyclists during & after the CDTs program for a weekday (dashed line indicating the end of the second phase, which is also the end of the CDTs program).

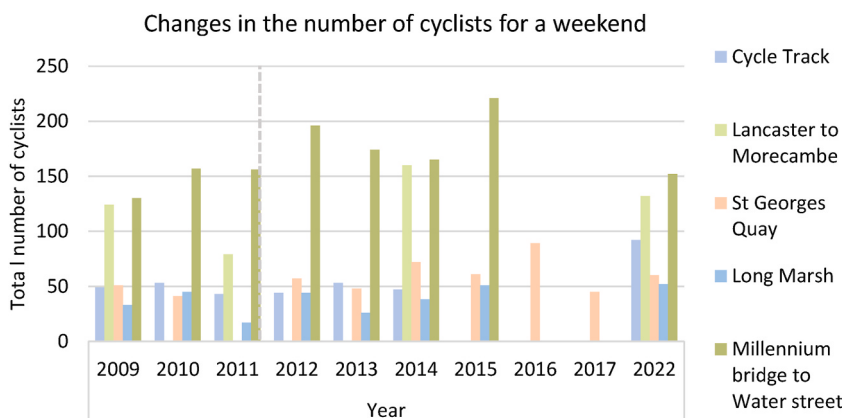


Fig. 6. Changes in the number of cyclists during & after the CDTs program for a weekend (dashed line indicating the end of the second phase, which is also the end of the CDTs program).

changes that take place in cities, including infrastructure changes or promotions). In addition, we wanted to know the long-term impact and effectiveness of different policies. We focused on a program conducted in Lancaster from 2005 to 2011 and investigated the impacts of the program, as well as the recent situation, using surveys with cyclists, reviewing the decisions from reports, conducting interviews with Councils staff, and comparing the number of cyclists in different periods using both automated and manual counts.

We discovered that the CDTs' program included infrastructure-related changes, particularly linking the cycling lanes in Lancaster, cycling promotions, and events with different groups, including adults and children. Hence, many aspects of the cycling policies were covered during the CDTs program, including infrastructure-related changes, increases in awareness levels, promotion through events, and inclusivity by working with different groups, such as children. These various approaches were also recognized by the survey respondents, who could list changes that took place in the city during the CDTs program, particularly changes in infrastructure and signage, and training and promotional events.

The reports released after the completion of the program (Cope et al., 2017) showed an increase in the number of cyclists. However, this change could not be observed clearly using the 5 counter locations we received from the council. An important change in numbers could only be observed after the completion of the program, in the following years. However, it is not possible to relate this change with the CDTs' program, considering the timeline. More importantly, we did not observe any changes in the latest period, 2022, when we conducted a field study and repeated the counting. This was supported by the statistical analysis. This result was not very surprising, considering the answers we received from the Council staff and from the surveys.

Council staff stated that the CDTs project had some positive effects, and the reports showed a positive change considering the number of cyclists. However, the survey results and the interviews pointed out the same problem: the changes conducted during the CDTs' program were not continuous. Indeed, there have been new cycling-related decisions in Lancaster, considering the interview results; however, these do not really target the whole city, but seem more like partial solutions. Moreover, the survey results highlighted the need for further investment in Lancaster, including having dedicated cycle lanes, and better connections between cycle paths. Moreover, safety-related concerns, including having a one-way system or traffic-related issues, were also reported by residents. These results are in-line with the literature (Rietveld and Daniel, 2004), showing the significance of safety or direct and dedicated cycling routes. However, it is also important to make cycling convenient, considering different factors. For example, as Rietveld and Daniel (2004) mentioned, it is important to make cycling convenient, considering the costs. Reducing cycling-related costs or making competing modes more expensive can also be important to promote cycling in Lancaster and other cities.

For Lancaster with Morecambe, one further issue relates to who can procure additional funding. As we learned from the interviews, whereas previously both the City and County Councils were eligible to access relevant funds, now only the County Council can do so. This condition could stifle the delivery of further interventions to address local problems and result in both actual and potential cyclists turning towards other, more carbon-intense modes of transportation for their recreation and transport needs. Developing and sustaining procurement models that allow for flexibility in the types of organizations that can apply for funding might help in delivering real change in terms of active transport and cycling policy.

Moreover, the findings of this study align with prior research, underscoring the significance of individual interventions while emphasizing their effectiveness when integrated into a broader, holistic approach (Pucher et al., 2010). When cycling interventions and programs receive reinforcement through subsequent, complementary events and interventions, they have the potential to generate significant increases in bicycle usage. Therefore, it is crucial to adopt a comprehensive approach for a more substantial impact, as opposed to disjointed, individual decisions. This is highlighted by Forsyth and Krizek (2010), who state that an integrated package of different, complementary interventions, including infrastructure provision or pro-bicycle programs, is needed to increase cycling, and these have already occurred in some of the most bike-friendly cities, such as in the Netherlands or Denmark. Hence, a similar set of integrated interventions may be needed in UK towns and other similar towns to improve cycling, contributing to the long-term success of cycling initiatives.

One cycling intervention that may work particularly well is the focus on connections. Zhao and Manaugh (2023) have suggested that connections between cycling routes and important locations, including schools, can be beneficial for English cities, as these connections are currently weak (Yesiltepe et al., 2021). Considering the limitations in funding, as in the case of Lancaster, cycling investments can be prioritized based on the needs of cities. Especially in cities where the infrastructure is insufficient, the prioritization can be given to infrastructure developments, including connecting cycling lanes and creating dedicated cycling routes to increase safety. This approach can help more people to cycle. It can then be supported by reducing car dependency through various approaches (e.g., speed limits), and educational events and trainings.

Moreover, as stated by Jahanshahi et al. (2022), considering different sociodemographic groups is crucial to better understanding how to develop effective policies, since perceptions of these policies vary among and between groups. More inclusive designs and approaches could therefore be beneficial to promote cycling among all groups (e.g., regular cyclists and non-cyclists, people from diverse backgrounds). Such strategies might not only be effective in Lancaster, but also in similar cities where international students form a significant part of the community. Consequently, these more inclusive approaches could effectively promote cycling among various groups.

This study was an attempt to revisit a significant funding program to improve cycling in the UK and see the impacts of the program, shortly after it finished and in the longer term. The results give an important message to policy makers: while programs and interventions are important for cities in the short-term, it is fundamental to consider how to boost the success of such programs once they have completed to ensure a positive and sustained effect. Otherwise, these interventions and contributions may only positively impact an environment for a short period.

4.1. Limitations & future work

The analysis was conducted only in one of the CDTs, Lancaster. However, a more comprehensive analysis of the other 5 CDTs, and the Cycling Cities and Towns, could yield some interesting trends. Hence, analyzing other CDTs with a focus on cyclists' satisfaction levels and expectations, as well as cycling levels, would result in a better understanding.

The number of cyclist observation points was constrained due to the limited dataset provided by the Council. In this research we received information regarding only five counters and repeated the counting for those locations in 2022. Subsequent research endeavours should prioritize the inclusion of a larger number of observation points to facilitate more comprehensive comparisons. Moreover, considering both manual and automated bike counts, there may be some inaccuracies, including equipment failures in automated counters (National Institute for Transportation and Communities, 2019). Future research could focus on alternative approaches, such as the use of Strava data (for example Sun and Mobasheri, 2017).

In addition, in the survey study, we analyzed the results of 65 participants; however, the sample size could be expanded in future research to analyze a higher number of participants' observations and perceptions.

Finally, in this study, we used convenience sampling to collect the survey data. However, this approach may result in data being received only from specific groups (e.g., university students or staff) and might not be representative of the entire cyclist population (Farrokhi and Mahmoudi-Hamidabad, 2012). Future research may consider employing alternative methods to create survey data.

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CRediT authorship contribution statement

Demet Yesiltepe: Writing – original draft, Visualization, Methodology, Investigation, Data curation, Conceptualization. **Ruth Conroy Dalton:** Writing – original draft, Methodology, Conceptualization. **Christopher Boyko:** Writing – original draft, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jth.2024.101866>.

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