

SAFE, SHARED, SUSTAINABLE

Bicycles have their own distinctive way of moving and turning, posing unique challenges for **road design**. To address this, Transoft Solutions collaborated with Sustrans on the development of an innovative bicycle turning simulation tool that empowers transport planners and engineers to create safe and inclusive road designs.

With the April 2024 signing of the [European Declaration on Cycling](#), the European Union reinforced its commitment to promoting cycling as a sustainable, healthy, and affordable mode of transport. Yet, while some metropolitan areas have long encouraged cycling through policies and planning, others are grappling with how to safely accommodate an influx of cyclists. Growing diversity in bicycle shapes and sizes and increasing numbers of e-bikes and e-scooters further complicate the process of safely integrating cycling into transportation networks.

As the European Cycling Declaration acknowledges, accommodating cyclists

requires more than just implementing ipolicies. Properly designed streets and cycling facilities are crucial to ensuring the safe passage of cyclists alongside motor vehicles and vulnerable road users such as pedestrians and those with mobility challenges. Bicycles have their own way of manoeuvring, distinct from motorised vehicles like cars, and creating infrastructure that supports cycling goes beyond simply painting road lines to add a bike path.

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Cyclists in Copenhagen, Denmark

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According to Andres Velez, P. Eng., Senior Product Manager, Civil and Transportation at Transoft, 'providing a tool to allow transportation professionals to create designs that facilitate the cyclists' safe passage involved the developing of new algorithms capable of modelling bicycles' distinct manoeuvrability.' Long a leader in developing innovative transportation software, Transoft has included the bicycle simulation tool in its flagship swept path analysis application [AutoTURN Pro](#).

Creating road designs that bikes can safely navigate

Swept path analysis is the act of calculating a vehicle's space requirements, by considering the movement and path of the different parts of the vehicle as it undertakes a turning manoeuvre. For example, a truck towing a trailer requires more room to turn and therefore has a greater swept path, than a compact car.

Since 1991, transport engineers have used Transoft's AutoTURN software to conduct swept path analysis of motorised vehicles, including cars, buses, and trucks with trailers, and ensure these types of vehicles can safely manoeuvre road infrastructure.

But as David Homola, Business Development Manager, Transportation Safety at Transoft, notes, bicycles have different turning characteristics. 'Many bicycles, along with their riders, lean when they turn. So, it is not a straightforward analysis. We must account for how that lean impacts the space requirements of the turn. The angle of lean will also vary depending on the speed.'

Additionally, a cyclist's body becomes an extension of the bicycle, meaning analysis must account for clearance of a rider's head, arms, and legs – what Transoft calls the 'rider box.' AutoTURN Pro's bicycle simulation tool factors in that rider box, the wheelbase, tyre size and number, and the length and height of the bike, the pedals, and handlebars.

Cyclists on a bike path in Paris, France

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Transoft also wanted to account for a range of cycles turning at sustainable speeds, so the tool automatically calculates swept paths of different bicycle types, including those with trailers, cargo bikes, tandem bikes, recumbent bikes, mopeds, and scooters.

Assessing the space requirements of different bikes is especially important in multiple design scenarios such as chicanes, S-shaped curves, or other speed reduction measures being considered.

‘A standard bicycle might be able to navigate a zigzag barrier, but when you add a trailer or have a longer bike, it might not make the turns’, says Homola.

AutoTURN Pro users can also have access to a wide variety of cycles as per established bicycle guidelines developed in different countries.

‘This tool is helpful for those starting who maybe haven’t yet established guidelines’, says Homola. ‘It can give them peace of mind, knowing how a bicycle would

navigate, whether it be on a dedicated bike route or alongside vehicles and pedestrians on a marked path. For cities expanding their network, will help them create designs for different neighbourhoods and accommodate the diverse range of cycles we are seeing today. For instance, many cities are looking at ways to facilitate deliveries by cargo bike.’

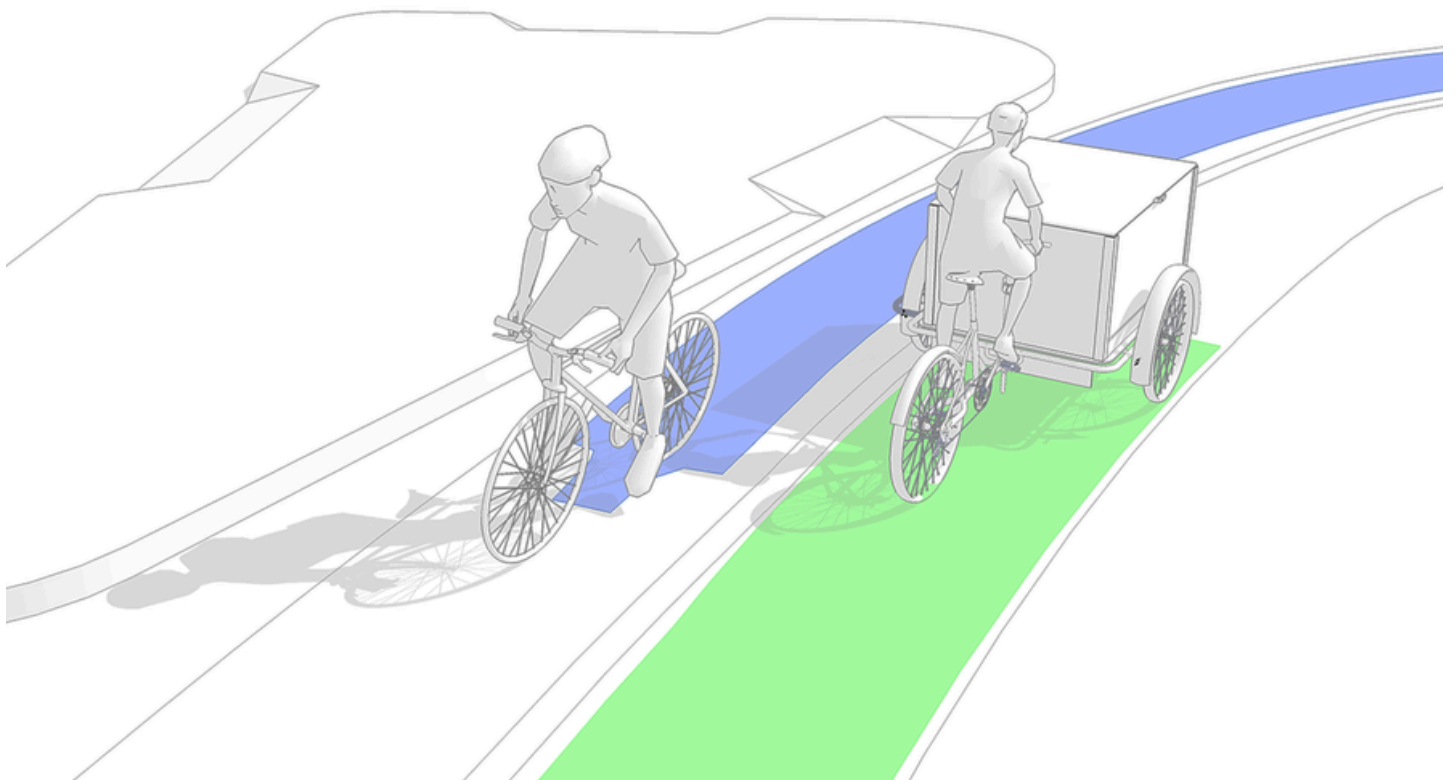
Collaboration with Sustrans sparked tool development

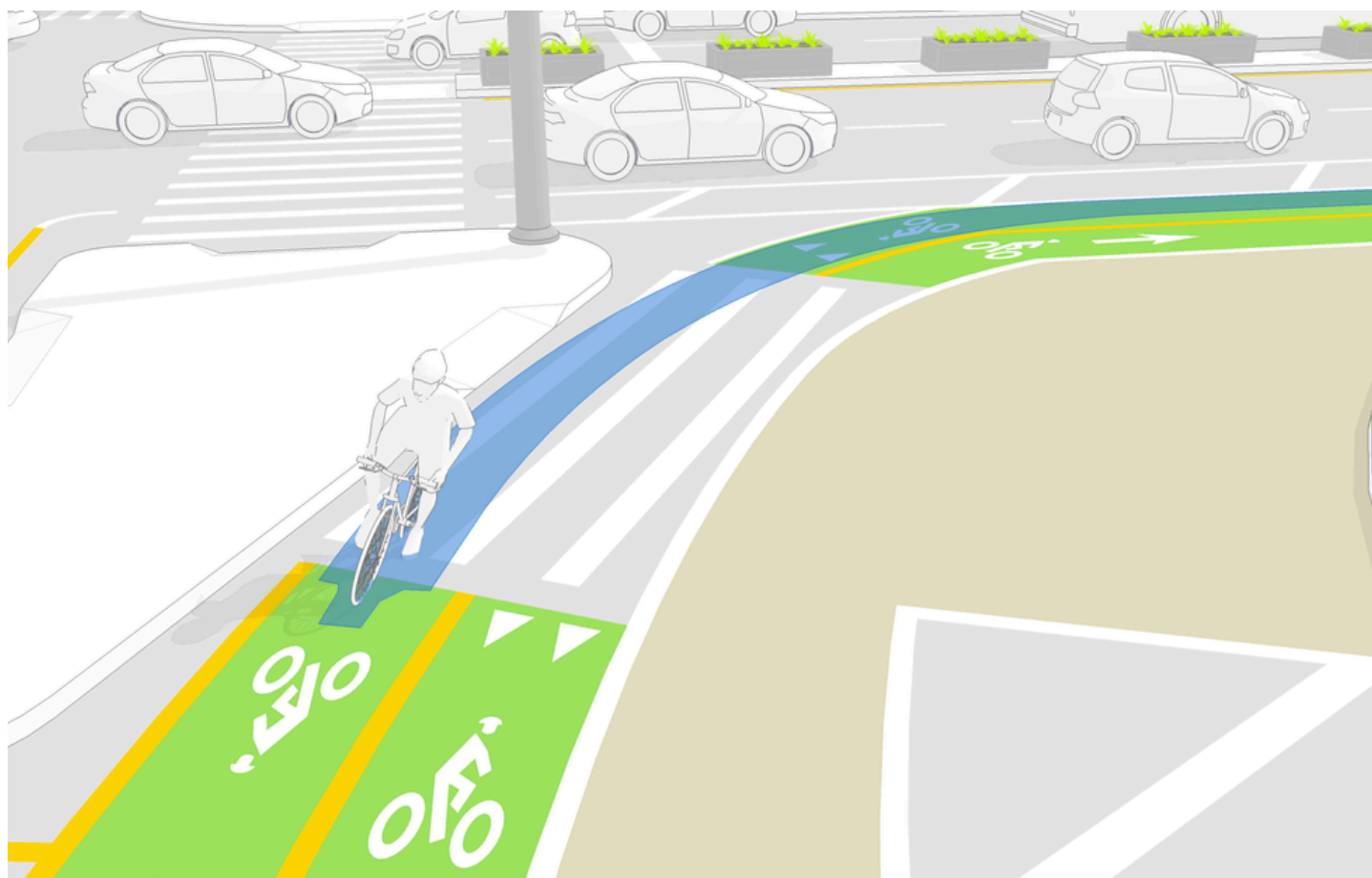
Motivated by current mobility trends emphasising inclusiveness, safety, and sustainability, Transoft embarked on developing a bike simulation tool. This initiative was sparked by a partnership with Sustrans, the custodian of the UK’s National Cycle Network. Sustrans reached out to Transoft for help with a design project for a travel route in London’s Lambeth Council Borough.

AutoTURN Pro bike simulation*

Transoft Solutions

**This image is a SketchUp rendering for illustration purposes only and does not represent the final product.*





The route runs the northern section of Brockwell Park to Gipsy Hill, connecting the historic Brockwell Park to three schools, two shopping parades, a church, and a playing field. It is alongside Rosendale Road, a wide residential road where vulnerable road users must share space daily with 10,000 vehicles, many of which exceed the 20mph speed limit. Prior to improvements, there were few safe crossing points and no protected space for cycling.

While the Sustrans engineers had UK cycle guidelines to assist with the development, calculating the swept paths was time-consuming and cumbersome. They contacted Transoft about a more efficient and accurate way to analyse the swept paths.

To assist the process, the Sustrans team conducted field tests measuring the turning radii and lean angles of bicycles travelling at different speeds. Transoft incorporated these measurements into the development of bicycle turning templates and the simulation tool.

With the tool, Sustrans could run a design simulation for projects like Lambeth Council that demonstrated how bicycles would safely move along the proposed route. The Rosendale Road is currently in progress, and Sustrans has a dedicated [page](#) sharing stories of how the segregated bike lane is helping children and adults cycle for work, school, and shopping.

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Cities are embracing safe cycling designs

Since that initial project, Sustrans has used the AutoTURN Pro bicycle simulation tool on others, including for Hitchen Road in Luton, north of London, as well as for Brockwell Park Gardens in the south London suburb of Norwood, and Leighton Road in the northeast Kentish Town area.

AutoTURN Pro's bicycle simulation tool is also being used by other European cities, including Lille, France, which will host events for both the 2024 Summer Olympics and the 2025 Tour de France.

Homola says that as cities strive to integrate better bike infrastructure, Transoft is seeing greater interest in the use of the simulation tool. 'A key benefit of using the software is that, when designing routes for bikes, one can easily visualise ahead of time where conflicts might occur, and then create a better design. Understanding how different types of bicycles move also means that cycle paths and networks can be more inclusive.'

Painted bike path

Steven Chan, Transoft Solutions

