

# Road safety factsheet: Electric bikes

May 2023

## What is an electric bike?

An electric bike, sometimes known as an e-bike, is a bicycle fitted with an electric motor that provides assistance when pedalling. The motor draws its power from a rechargeable battery attached to the bike. For a bike to be considered an e-bike, the motor must only aid in pedalling and not propel the bike on its own. The amount of assistance is determined by how hard you pedal and the selected level of support.

The motor will provide assistance up to a maximum speed of 15.5mph, after which it will cut out. You can still cycle faster than 15.5mph, but without the motor's assistance.

## The law<sup>1</sup>

Individuals aged 14 and above may legally ride an electric bike, referred to as an 'electrically assisted pedal cycle' (EAPC), provided that the bike fulfils specific criteria. No licence is required to operate an EAPC, and it does not need to be registered, taxed, or insured. If an e-bike meets the EAPC requirements, it is considered a standard pedal bicycle. However, if it fails to meet these criteria, it will be classified as a motorcycle or moped and will be subject to the corresponding regulations. You can find out more about motorcycle rules [here](#).

### EAPC requirements:

An EAPC must have pedals that can be used to propel it.

It must show either:

- the power output
- the manufacturer of the motor

It must also show either:

- the battery's voltage
- the maximum speed of the bike

Its electric motor:

- must have a maximum power output of 250 watts
- should not be able to propel the bike when it's travelling more than 15.5mph

An EAPC can have more than 2 wheels (for example, a tricycle).

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<sup>1</sup> GOV UK Electric bikes: licensing, tax and insurance: <https://www.gov.uk/electric-bike-rules> Accessed 12 May 2023

## How do electric bikes work?

Electric bikes operate by providing assistance to the rider when pedalling. The motor is activated when the rider starts to pedal. There are two types of motors:

1. Hub or wheel motor - located at the centre of the bicycle wheel, either in the front or rear. Generally associated with single-speed systems
2. Centre drive/mid-drive system – located near the bike's centre, with power transmitted via the chain drive.

All e-bikes have a sensor that monitors the speed and instructs the motor to turn pedal assist on or off. Pedal assist deactivates automatically when the bike's speed exceeds 15.5mph. All e-bikes have a battery and this powers the motor. While battery technology has improved, resulting in smaller batteries, they remain a heavy component of the bike. Therefore, they are often positioned near the bike's centre. Battery life between charges depends on several factors.

## Benefits

E-bike use in Europe and the UK has been increasing for several years and is set to continue to grow. The growth has been driven by people buying e-bikes for leisure use as well as a growing preference for e-bikes as an eco-friendly vehicle<sup>2</sup>. A review of e-bikes on travel behaviour<sup>3</sup> concluded that the uptake in e-cycling was primarily attributable to people substituting traditional cycling or private car journeys. This shift could potentially lead to a reduction in motorised vehicle use, offering environmental and health benefits.

The results of a North American e-bike user survey<sup>4</sup> suggested that e-bikes could enable people to cycle who would tend to cycle conventional bike less, including; women, older adults, people with mobility problems and those who need to travel longer distances. The study found that e-bikes facilitated users to cycle more frequently, travel to more distant locations, and carry more luggage and equipment with them.

Various research has shown that replacing car trips and reducing effort during cycling are common motivations for buying e-bikes. In Australia, 60% of the respondents in an online survey reported that replacing car trips was their primary motivation for buying an electric bike, followed by 49% who were motivated by reduced the physical effort required to ride an electric bike<sup>5</sup>. A Norwegian study found that providing individuals with an electric bike increased the proportion of trips completed by bike from 28% to 48% of all trips<sup>6</sup>. Similarly, a comparative study involving 66 individuals who were given an electric bike found that their cycling trips increased from 0.9 to 1.4 per day, and distances increased from 4.8km to 10.5km. The study also revealed that

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<sup>2</sup> Precedence Research, E-bike market – Global industry analysis, outlook and forecast;  
<https://www.precedenceresearch.com/e-bike-market> - Accessed 12 May 2023

<sup>3</sup> Bourne JE, Cooper AR, Kelly P, Kinnear FJ, England C, Leary S, Page A. The impact of e-cycling on travel behaviour: A scoping review. *J Transp Health*. 2020 Dec;19:100910. doi: 10.1016/j.jth.2020.100910. Epub 2020 Aug 29;  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7456196/> - Accessed 12 May 2023

<sup>4</sup> Heinen et al (2010) cited in MacArthur et al (2014) 'E-bikes in the North America: Results from an online survey' [https://ppms.trec.pdx.edu/media/project\\_files/E-bikes\\_in\\_North\\_America.pdf](https://ppms.trec.pdx.edu/media/project_files/E-bikes_in_North_America.pdf) Accessed 12 May 2023

<sup>5</sup> Johnson and Rose (2013) cited in Fishman, E. and Cherry, C. (2015) 'E-bikes in the Mainstream: Reviewing a Decade of Research' *Transport Reviews*, 36(1): 72-91.

<sup>6</sup> Fyhri, A., and Fearnley, N. (2015) cited in Fishman, E. and Cherry, C. (2015) 'E-bikes in the Mainstream: Reviewing a Decade of Research' *Transport Reviews*, 36(1): 72-91

women experienced the greatest increase in cycling trips, while the control group did not show any increase in the number of cycling trips or distance travelled by bike.

Much of the current research has focused on the positive impact e-biking can have on mental health and physical wellbeing<sup>7</sup>. This implies that the widespread adoption would potentially benefit the overall health of the wider community. However, whilst e-biking has the potential to improve health and physical activity, there are few longitudinal studies which investigate the health effects of this over a longer time period<sup>8</sup>.

## Risks

The rising number of electric bike users involved in collisions internationally has raised some concerns about their safety in comparison to conventional bikes<sup>9</sup>.

Rider behaviour will have an effect on the safety of users of e-bikes. One study suggested that factors such as weather, temperature and road infrastructure were closely related to e-bike riding behaviour<sup>10</sup>. The same study found that young and middle-aged male riders were also more likely to exhibit risky behaviours.

A report into e-bike injuries in the USA by Reuters<sup>11</sup> suggested that e-bike users were more likely to suffer internal injuries and three times more likely to be involved in a collision with a pedestrian than conventional cyclists. Both reports suggest that these outcomes are due to lack of cycling infrastructure and slow policy changes and regulations in the market.

On the other hand, a study conducted in the Netherlands concluded that most e-bike users were not more likely to than conventional bike users to be involved in a collision. However, the study did find that older female e-bike riders were more susceptible to crashes that require treatment at A&E and suffer more severe injuries than their conventional cycling counterparts<sup>12</sup>. This could be because elderly cyclists tend to ride faster on e-bikes than on conventional bikes, and since bicycles do not offer much protection to cyclists, the injuries sustained in the case of a fall or collision could be more severe<sup>13</sup>.

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<sup>7</sup> Anderson CC, Clarkson DE, Howie VA, Withyman CJ, Vandelanotte C. Health and well-being benefits of e-bike commuting for inactive, overweight people living in regional Australia. *Health Promot J Austr.* 2022 Oct;33 Suppl 1(Suppl 1):349-357. doi: 10.1002/hpja.590. Epub 2022 Mar 17; <https://pubmed.ncbi.nlm.nih.gov/35263497/> - Accessed 12 May 2023

<sup>8</sup> Riiser Amund, Bere Elling, Andersen Lars Bo, Nordengen Solveig. E-cycling and health benefits: A systematic literature review with meta-analyses. *Frontiers in Sports and Active Living* V4, 2022; <https://www.frontiersin.org/articles/10.3389/fspor.2022.1031004/full> - Accessed 12 May 2023

<sup>9</sup> Schepers et al. (2018) 'The Safety of E-Bikes In The Netherlands', Discussion Paper, International Transport Forum, Paris.

<sup>10</sup> Ma C, Yang D, Zhou J, Feng Z, Yuan Q. Risk Riding Behaviors of Urban E-Bikes: A Literature Review. *Int J Environ Res Public Health.* 2019 Jun 28;16(13):2308; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6651001/> - Accessed 12 May 2023

<sup>11</sup> Chander V, E-bikes show a distinct pattern of severe injuries, Reuters, Dec 25 2019, <https://www.reuters.com/article/us-health-ebike-injuries-idUSKBN1YTOMV> - Accessed 12 May 2023

<sup>12</sup> Paul Schepers, Karin Klein Wolt, Marco Helbich, Elliot Fishman, Safety of e-bikes compared to conventional bicycles: What role does cyclists' health condition play?, *Journal of Transport & Health*, Volume 19, 2020, <https://www.sciencedirect.com/science/article/pii/S2214140520301651> - Accessed 12 May 2023

<sup>13</sup> Aarts, L. and Van Schagen, I. (2006) cited in Vlakveld et al (2015) 'Speed choice and mental workload of elderly cyclists on e-bikes in simple and complex traffic situations: A field experiment', *Accident Analysis and Prevention*, 74: 97-106.

Additionally, elderly people who ride e-bikes may have poorer physical health compared to those who ride conventional bikes. For example, those who have stopped cycling on conventional bikes may start cycling again on e-bikes as it is less physically demanding. As a result, comorbidity between declining physical strength and cognitive functions cannot be ruled out. McGough et al. (2011) found that mild cognitive impairment was associated with reduced physical performance in the older population (over 69 years of age)<sup>14</sup>.

Some researchers also suggest that the health enhancing benefits of e-bikes have been overstated due to the various factors needed to establish if that are health enhancing. Whilst it is acknowledged that they can increase physical activity, they also have a lower probability on users to achieve moderate to vigorous physical activity due to reduced cardiovascular effort during riding<sup>15</sup>.

The net volume of physical activity almost certainly depends entirely on the transport mode it replaces. However, this study concludes that the increased physical activity accumulated through cycling is generally considered to be more significant than the risk of injuries<sup>16</sup>.

## RoSPA's position

Cycling in Great Britain is increasing because it is an excellent way to get about and provides a wide range of health and environmental benefits. RoSPA encourages cycling, whether on a conventional or electric bike. However, cyclists must remain aware of the different handling characteristics of electric bikes in comparison to conventional bikes, along with the added weight of the motor and battery.

Cyclists must also follow all normal road rules and laws - these laws apply no matter what kind of bicycle they are riding. RoSPA recommends that all road users regularly read the Highway Code to refresh their knowledge of the rules of the road. All cyclists should also be looking out for other road users such as pedestrians and giving them time and room. As riders can accelerate quicker when riding an electric bike, pedestrians may miscalculate their speed.

RoSPA recommends that any cyclist who is returning to riding after a long period of not riding or cyclists switching from a conventional bike to an electric bike should consider taking a cycle training course. For more information about cycle training, visit the Bikeability [website](#).

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<sup>14</sup> McGough (2011) cited in Vlakveld et al (2015) 'Speed choice and mental workload of elderly cyclists on ebikes in simple and complex traffic situations: A field experiment', Accident Analysis and Prevention, 74: 97-106.

<sup>15</sup> Haute, S et al, Impact of electrically assisted bicycles on physical activity and traffic accidents risk: a prospective observational study, BMJ Open Sport & Exercise Medicine, Volume 8, issue 4, 2022  
<https://bmjopenem.bmj.com/content/8/4/e001275> - Accessed 12 May 2023

<sup>16</sup> Sundfør, Hanne & Fyhri, Aslak & Bjørnarå, Helga. (2020). E-bikes—good for public health?. 10.1016/B978-0-12-819136-1.00011-5; [https://www.researchgate.net/publication/340563740\\_E-bikes-good\\_for\\_public\\_health](https://www.researchgate.net/publication/340563740_E-bikes-good_for_public_health) - Accessed 12 May 2023