



MEMORANDUM

Date: September 22, 2017, Updated November 15, 2017
To: Chris Pauley
Organization: Northern Virginia Regional Park Authority
From: Bill Schulteiss, P.E.
Preston Buehrer
Christina Fink, P.E.
Project: E-Bike White Paper
Re: Literature Review and Draft White Paper

INTRODUCTION





As requested by the Northern Virginia Regional Park Authority (NVRPA), Toole Design Group (TDG) has prepared this memorandum to inform NVRPA policy regarding the use of electric bicycles (E-bikes) on the NVRPA path system, in particular for application on the Washington and Old Dominion Trail (W&OD). In preparing this memorandum, TDG has conducted a literature review of existing E-bike popularity, usage, safety, policy, and legislation. The results of the literature review are presented herein, as well as phased policy approach for NVRPA shared use paths.

WHAT IS AN E-BIKE?

GENERAL DESCRIPTION

While there is no single, agreed-upon definition for what constitutes an E-bike, one is generally accepted to be any standard, pedal-powered two- or three-wheel vehicle that has an electric motor which can be used to assist the rider's pedaling efforts. Within this basic framework, there are two main types of E-bikes: pedal-assist and throttle. Pedal assist E-bikes work by providing power from the electric motor only when the rider is pedaling – if the rider is not pedaling the electric motor will not engage. Throttle E-bikes allow the motor to engage whether or not the rider is pedaling.

Both pedal-assist and throttle-type E-bikes may be sold as integrated systems on new bikes, or as retrofit systems designed to work on standard bikes. While prices vary considerably from manufacturer to manufacturer retrofit costs range in price from a couple of hundred dollars to over two-thousand dollars. Complete E-bikes generally start around one-thousand dollars and may cost up to ten-thousand dollars for top-of-the-line models.

E-BIKES	NOT E-BIKES
 <p data-bbox="326 604 805 695">Figure 1 - A Specialized Turbo Vado, sold as a complete E-bike with an integrated electric motor and battery.</p>	 <p data-bbox="846 594 1289 646">Figure 2 - An electric moped. Note specifically the lack of pedals and difference in form factor</p>
 <p data-bbox="358 1052 769 1104">Figure 3 - A standard bicycle retrofitted with a Copenhagen Wheel E-bike system</p>	 <p data-bbox="841 1062 1294 1115">Figure 4 - A standard bicycle, retrofitted with a gas-powered motor.</p>

LEGAL DESCRIPTION

Currently, federal regulation of E-bikes only applies via consumer product safety law, and limits E-bikes to “a two- or three-wheeled vehicle with fully operable pedals and an electric motor of less than 750 watts (1 h.p.), whose maximum speed on a paved level surface, when powered solely by such a motor while ridden by an operator who weighs 170 pounds, is less than 20 mph.”¹ Federal regulations do not address the use of E-bikes on streets, sidewalks, or shared use paths, and do not define what classification of vehicle they fall into. States are therefore left to regulate the use of E-bikes within the public right-of-way.

State-by-state regulation varies greatly, with about half of all states defining and regulating E-bikes similarly to bicycles. The remaining states generally do not clearly define E-bikes, and regulate them via a patchwork of bicycle, moped, and other motor vehicle laws. In Virginia, an E-bike is defined as “a vehicle that travels on not more than three wheels in contact with the ground and is equipped with (i) pedals that allow propulsion by human power and (ii) an electric motor with an input of no more than 1,000 watts that reduces the pedal effort required of the

¹ Public Law 107-319 AN ACT TO AMEND THE CONSUMER PRODUCT SAFETY ACT TO PROVIDE THAT LOW-SPEED ELECTRIC BICYCLES ARE CONSUMER PRODUCTS SUBJECT TO SUCH ACT

*rider.*² From this, and other sections of Virginia State Law, the following applies to all E-bikes in the state of Virginia:

- All E-bikes are limited to a maximum power of 1,000W, and a top speed (when the electric motor is engaged) of 25mph.
- E-bikes are subject to the same rules of the road as human-powered bicycles and are allowed on sidewalks and paths wherever human power bicycles are allowed.
- E-bikes are not subject to registration, licensing or insurance requirements, however the minimum age for an E-bike rider is 14.

PeopleForBikes and the Bicycle Product Suppliers Association (BPSA) are working with states to implement legislation that clearly defines E-bikes to help ensure the viability and safety of E-bikes into the future. Model legislation has been implemented in a number of states, including Tennessee, Utah, and California. Below is a table comparing Virginia's current E-bike regulations to the model legislation.

	Model Legislation	Current Virginia Law
Maximum Power	750w	1,000w
Maximum Speed	20mph, Class I & II 28mph Class III	25mph
Regulated as Bicycles?	Yes	Yes
Insurance, Licensing, and Registration Requirements	None	None
Labelling/Identification	Requires Class I, II, or III labeling	None
Restrictions on Tampering and/or Modification?	Yes	No
Consumer Product Safety Commission Compliance	Yes	No
Required Motor Disengagement	Yes – Throttle disengagement required when braking	No
Allowed on Shared Use Paths?	Yes, Class I & II	Yes
Minimum Operator Age	Class III - 16	14
Helmet Requirements	No	No
Speedometer Requirement	Yes – Class III	No

² 2006 Code of Virginia § 46.2-100

Per conversations with the Virginia House Transportation Committee and the Virginia Senate Transportation Committee, there is no pending E-bike legislation in the Virginia legislature.

HOW POPULAR ARE THEY AND WHY

Despite longstanding success in other parts of the world, E-bikes are just beginning to grow in popularity in the United States. U.S. E-bike sales rose 51% between 2015 and 2016, and are up a further 40% in 2017.³ Global E-bike sales are estimated to increase from \$15.7 billion in 2016 to \$24.4 billion by 2025, with the U.S. and Western Europe accounting for increasingly large shares of the E-bike market.⁴ Increasing urbanization, congestion, improving lithium ion battery technology, and a generational shift away from car use are only expected to increase the future demand for E-bikes as people seek to find ways to replace trips that are currently made by automobile.

Research on E-bikes seems to confirm that E-bike sales are driven in large part by the desire to replace trips by car with a more active mode of transportation. Per a survey conducted by John MacArthur et. al., 65% of respondents indicated that one of their main reasons for purchasing an E-bike was to replace some car trips.⁵ From the same survey, 45% of respondents indicated that the primary use for their E-bikes was for commuting and a further 24% indicated that the primary use was for local trips, highlighting E-bikes' popularity as utilitarian vehicles. This aligns well with a survey conducted in Sacramento, in which over three quarters of respondents stated that their primary use for E-bikes was transportation, not recreation.⁶ It should also be noted that 21% of respondents in the MacArthur survey indicated that their main reason for purchasing an E-bike was that a medical condition reduced their ability to ride a standard bicycle.

DIFFERENCES FROM "NORMAL" BIKES

One of the largest concerns with the growing popularity of E-bikes in the United States is their operational and safety differences from standard bicycles. With more E-bikes being operated on roadways, shared-use paths, and other facilities, it is important to understand how E-bikes compare with standard bicycles and how they can be expected to interact with pedestrians and motorists.

Per research conducted by Langford et. al., E-bike riders exhibit nearly identical safety behaviors as standard bicycle riders.⁷ Research was conducted by tracking bicycle movements on a bikeshare program that included standard bicycles and E-bikes. Of the 4 safety statistics measured, E-bikes and traditional bicycles had similar infraction rates for wrong-way riding, stopping at STOP signs, and stopping at red lights. The last metric observed was bicycle speed. E-bikes were observed to travel slightly faster than standard bicycles when traveling on roadways (13.3kph vs. 10.4kph), however E-bike speeds were observed to be *lower* than standard bicycle speeds on shared-use paths (11.0kph vs. 12.6kph).

Similar research has also been conducted in Europe, which is also seeing a surge in the popularity of E-bikes. A study by Sander et. al. in Berlin showed an increase in on-road speeds of about 3kph for cyclists using E-bikes with

³ "In a Class All Their Own", Kimberly Kinchen, PeopleForBikes <http://www.peopleforbikes.org/blog/entry/in-a-class-all-their-own>

⁴ "Electric Bicycles", Navigant Research <https://www.navigantresearch.com/research/electric-bicycles>, retrieved November 13, 2017

⁵ "E-Bikes in North America: Results from an Online Survey", MacArthur et. al., 2013

⁶ "Experiences of Electric Bicycle Users in the Sacramento, California Area" Popovich et. al., 2013

⁷ "Risky riding: Naturalistic Methods Comparing Safety Behavior from Conventional Bicycle Riders and Electric Bike Riders" Langford, et. al., 2015

the motors engaged.⁸ Similar research in Sweden showed an increase in on-road speeds of about 4kph for cyclists riding E-bikes. However, in the same study it was also noted that E-bike users had fewer potentially threatening interactions with other vulnerable road users.⁹

REVIEW OF OTHER TRAIL SYSTEM POLICIES

Due to their relatively recent increase in popularity, many trail agencies across the United States have yet to adopt formal policies regarding the use of E-bikes on their trail networks. The lack of trail-specific policies and the patchwork of legal definitions across state and local agencies, can often lead to confusion about where E-bikes are permitted. In response to this confusion and to the rise in popularity of E-bikes, many trail agencies are beginning to adopt formal policies on the use of E-bikes on their trail networks.

Some trail agencies, such as the City of Seattle, still consider E-bikes motorized vehicles and prohibit their use on trails and paths¹⁰. However, many trail agencies are adopting policies formally designating E-bikes as bicycles and allowing their use on some or all of their trail network. The Virginia Department of Transportation formally permits E-bike usage along the entirety of the Virginia Capital Trail¹¹. Toole Design conducted a brief survey of several of these agencies to gather policy details and outcomes, including specifically: (1) Town of Tiburon, CA; (2) City of San Jose, CA, (3) the Prince William County Parks and Recreation Department (PWCPRD) in Virginia, and (4) the East Bay Regional Park District (EBRPD) in California. In allowing E-bike usage on the trail networks, all four of these agencies are aligning their policies with their respective state laws (California¹² and Virginia²). In California, both state law and trail agency policy establish a classification system for E-bikes that permits most low-speed E-bikes (Class I and Class II, less than 20mph) and restricts higher-speed E-bikes (Class III and all other E-bikes). In Virginia, all classes of E-bikes are permitted.

As E-bikes often closely resemble conventional bicycles, many trail agencies avoid E-bike specific rules and instead opt for policies that apply to all trail users. For example, both the City of San Jose and the EBRPD establish a 15mph speed limit for all users on their trails. This allows them to more effectively regulate the safe operation of all potential vehicle types, even though they do not have formal policies regarding the use of all other personal mobility devices. In order to avoid sign clutter along the trail, speed limits are generally posted at trail entrances along with other rules and regulations for trail use. The Town of Tiburon occasionally uses a portable speed indicator and the City of San Jose is currently creating supplemental “15MPH Max” signs to place at various points along the trail as needed. The enforcement of speed limits and other regulations varies greatly by jurisdiction and agency, though no agency Toole Design contacted reported having issues enforcing their policies.

Given that E-bikes and in particular E-bike specific trail policies are new to the United States, there is very little user-survey information available regarding E-bikes on multi-use paths. The City of San Jose conducts an annual Trail Count, which includes a user survey. While general bicycle and pedestrian conflicts have been noted as a concern in some surveys, E-bike specific issues have not been raised as a concern in any year’s survey¹³.

⁸ “A Field Test for Comparison of E-bike and Conventional Bicycles in Traffic” Sander, et. al., 2014

⁹ “Using Naturalistic Data to Assess E-cyclist Behavior” Dozza, et. al., 2015

¹⁰ Seattle Parks and Recreation, Rules and Regulations, <http://www.seattle.gov/parks/about-us/rules-and-regulations#motorizedvehicles> retrieved Nov. 13, 2017

¹¹ Capital Rail Trail, FAQs, <https://www.virginiacapitaltrail.org/faq#faq-trail-rules>, retrieved Nov. 13, 2017

¹² California Assembly Bill Number 1096

¹³ San Jose Parks, Recreation & Neighborhood Services, <http://www.sanjoseca.gov/index.aspx?NID=5205> retrieved Nov. 13, 2017

RECOMMENDED NVRPA POLICIES

Based on a review of existing E-bike literature, TDG recommends that the NVRPA adopt short term policies to facilitate the use of E-bikes on their trail system. Specifically, TDG recommends that the NVRPA follow guidance provided in the model legislation and explicitly allow E-bikes that fall under the Class I and Class II designations, while forbidding the use of Class III E-bikes. Research indicates that E-bikes pose no significant safety concerns when compared with regular bicycles, and that E-bikes make cycling more accessible and attractive to a larger segment of the population. Specifically, E-bikes may help attract cyclists that are less able-bodied and more utilitarian in their cycling preferences, which could help explain why many studies seem to show a decrease in potentially risky behavior when E-cyclists are around other vulnerable road users.

In the long term, TDG would recommend that the NVRPA partner with the State legislature to introduce model legislation for the state of Virginia, further clarifying E-bike classifications and regulations, and aligning the state with nationally recognized best-practices regarding E-bikes.