

Exploring Electric Bicycle Safety Performance Data & Policy Options

Dr. Kevin Fang – Sonoma State University
April 30, 2026



Outline

- 1) What's an e-bike?... Definition challenges
- 2) Safety incident data and major trends
- 3) Where to go from here?

California Senate Bill 381 (2023)

- Bill commissioned study of available information on electric bicycle safety
- Co-PI: Dr. Asha Weinstein Agrawal, San Jose State University
- Funding from the Mineta Transportation Institute at San Jose State

Project 2423 | December 2025

SJSU SAN JOSÉ STATE
UNIVERSITY



Exploring Electric Bicycle Safety Performance Data and
Policy Options for California

Asha Weinstein Agrawal, PhD
Kevin Fang, PhD



CSU TRANSPORTATION CONSORTIUM

transweb.sjsu.edu/csutc

So, you're interested in e-bike safety...
What even is an e-bike?

Which of these is an electric bicycle?

1



2



3



4



5



6



7



8



9



Which of these is an electric bicycle?

1



2



3



4



5



6



7



8



9



Differing definitions...

- What is **legally an “electric bicycle”**
- What **a consumer/user considers to be an e-bike**
- What **industry advertises as e-bike**
 - Devices clearly legal “electric bicycles”
 - Devices individual manufacturers consider to be legal “electric bicycles” but whether they are is questionable
 - Devices marketed as e-bikes where the fine print acknowledges they’re not street legal

Legal “electric bicycles”

Laws in most US states...

- A device with operable pedals
- Maximum motor power of 750 watts

	Class 1	Class 2	Class 3
Electric power is applied:	Only when rider is pedaling	When rider is pedaling or by hand throttle	Only when rider is pedaling
Speed above which power will no longer be applied	20 mph	20 mph	28 mph

Class 1-3 electric bicycles have the same rights and responsibilities as human-powered bicycles

Clearly not street-legal...

- Devices far exceed power and speed maximums
- Manufacturers state* for off-road use only

Sometimes referred
to as...
E-motos
Out of class
E-mopeds
E-motorcycles



Segway Xyber Electric Bike

\$2,899.99 ~~\$3,299.99~~ MSRP ⓘ

📦 In Stock

Notes:

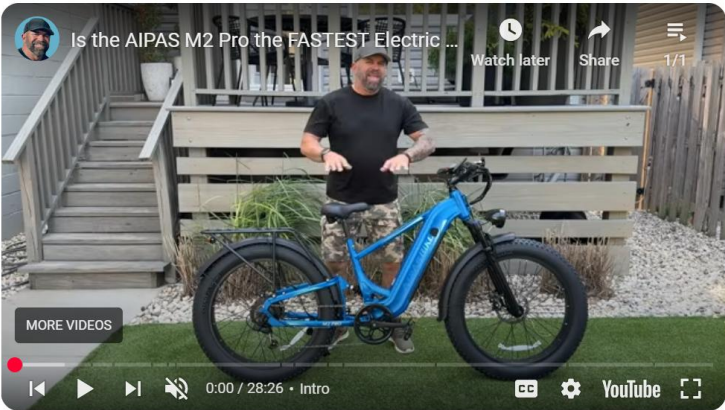
***Product recommended for riders 18 years and older, for off-road use only. Riders must follow all local, state and federal regulations.**

Power Performance	Rated Power	1 Battery = 3000 Watts, 2 Batteries= 6000 Watts
	Max. Torque	1 Battery = 120 Nm, 2 Batteries= 175 Nm
	Max. Speed	Off-road use only; 35 mph max with speed limiter available in App
	Max. Range	1 Battery = up to 56 miles, 2 Batteries=up to 112 miles

Marketed as very powerful... but also legal

- **Some manufacturers market devices as being street-legal, but also faster/more powerful than legal limits**
- Such devices are market and/or shipped as Class 2 Electric Bicycles
- But, can be unlocked to higher power/speed

Urban Commuting



Is the AIPAS M2 Pro the FASTEST Electric ...

Watch later Share 1/1

MORE VIDEOS

0:00 / 28:26 • Intro

YouTube

⚡ Aipas M2 Pro can be unlocked from class 2 (20 mph) to class 3 speeds (up to 36 mph).

🚲 Equipped with a 1,800W motor and 110 Nm torque, enabling strong hill climbing and off-road capability.

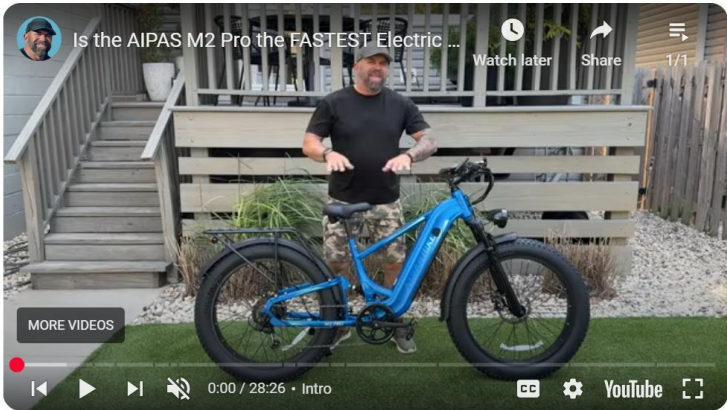
📺 Full-color, sunlight-readable display with intuitive controls and detailed ride info (speed, battery, trip).

🔋 Equipped 48V 17.5Ah battery with 840Wh power.

☔ IP65 water resistance, puncture-resistant tires, and robust suspension enhance durability and comfort.

Marketed as very powerful... but also legal

- **The unlocking of devices highlight issue of hardware vs. software**
- The way that many (most?) legal electric bicycles comply with power and speed maximums is via software... the hardware is capable of higher speeds/power
- Some manufacturers allow additional power/speed to be unlocked



Urban Commuting

⚡ Aipas M2 Pro can be unlocked from class 2 (20 mph) to class 3 speeds (up to 36 mph).

🚲 Equipped with a 1,800W motor and 110 Nm torque, enabling strong hill climbing and off-road capability.

📺 Full-color, sunlight-readable display with intuitive controls and detailed ride info (speed, battery, trip).

🔋 Equipped 48V 17.5Ah battery with 840Wh power.

☔ IP65 water resistance, puncture-resistant tires, and robust suspension enhance durability and comfort.

California SB 1271 (2024)

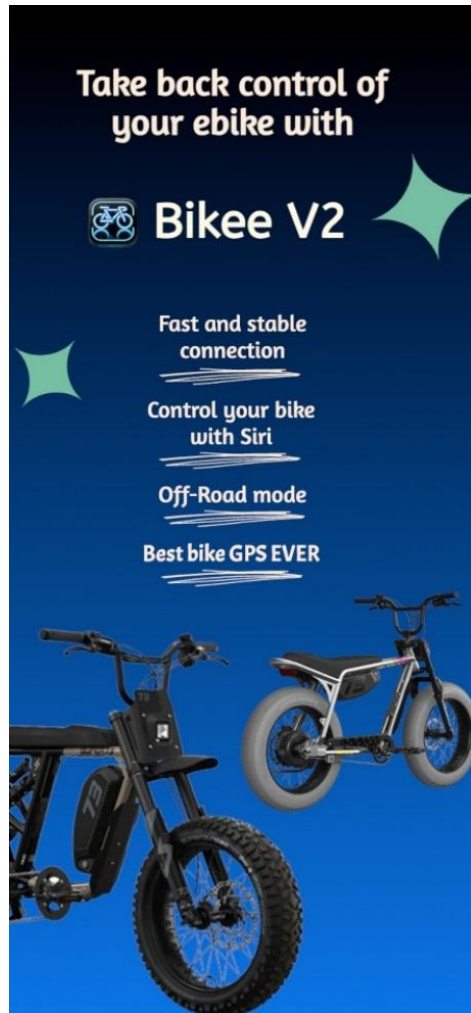
Banned officially-sanctioned unlocking...

- Devices where manufacturers *intend* for operators to be able to unlock higher power and higher speed settings do not qualify as “electric bicycles”
- Cannot be sold, marketed, or labeled as such

**Unlockable devices cannot be sold as “electric bicycles”,
but can they be sold as “e-bikes” or “bikes”?**

***The term “bike” also used colloquially to refer to motorcycles**

Third-party unlocking apps



- SB 1271 banned manufacturer sanctioned unlocking, but third-party control apps easy to find



Gejdngxjd, 02/23/2025

Best app ever!

I have had a super 73 for 2 years now. One of the reasons I got a super 73 was because it could go faster than 20mph. When I saw you could not switch it to off road mode anymore I call my local shop to ask them. That is how I ended up here. This is the best \$8.99 that I have ever spent! I also noticed that it is a little bit faster. I would highly recommend it if you have a super 73.

Reviewer praises app for allowing them to unlock their bike after the manufacturer app no longer unlocked higher speeds

Prevalence of out of class devices

- Observations of 19 middle/high schools in Bay Area by Safe Routes to Schools groups
- Only 12% of devices observed were clearly legal electric bicycles
- 2025 Global Market Insights Report: Fastest growing segment of market is devices with motors above 750 watts (e.g., not legal EBs)



Challenge: analyzing “e-bike” incidents

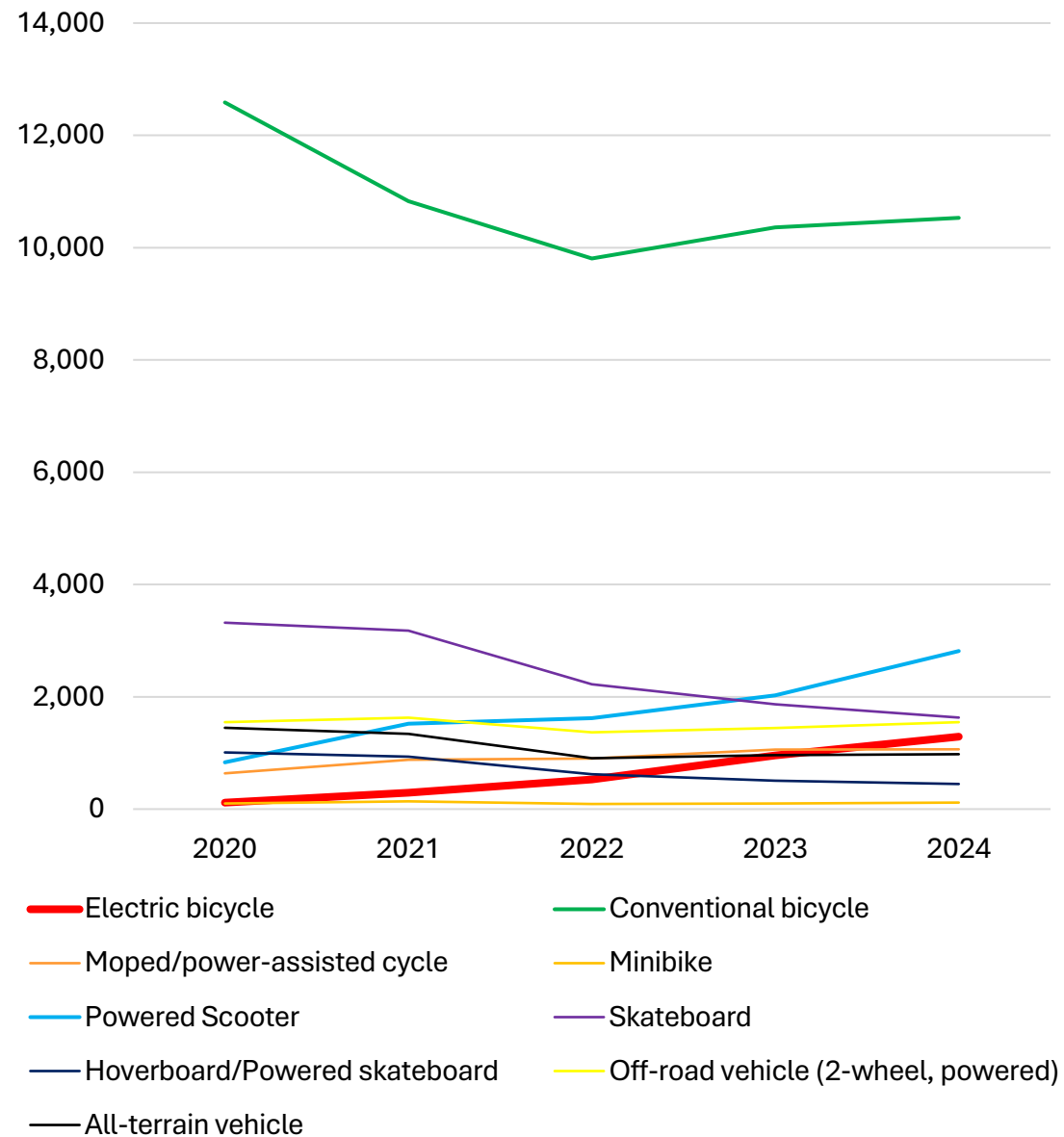
- Data on e-bike crashes/injuries typically rely on device identification by the public (e.g. patient, bystander, first responder)
- If public considers street legal and non-street legal devices to be e-bikes, both will get captured in the data
- **Stats on e-bike incidents include some share (large share?) of non-street legal devices**

E-bike incident stats

*Keeping in mind some proportion of these incidents involve legal electric bicycles while others involve more powerful/non-street-legal devices

Increasing # of e-bike injuries seen at US emergency rooms

But, nationwide, fewer e-bike injuries than conventional bicycles, powered scooters

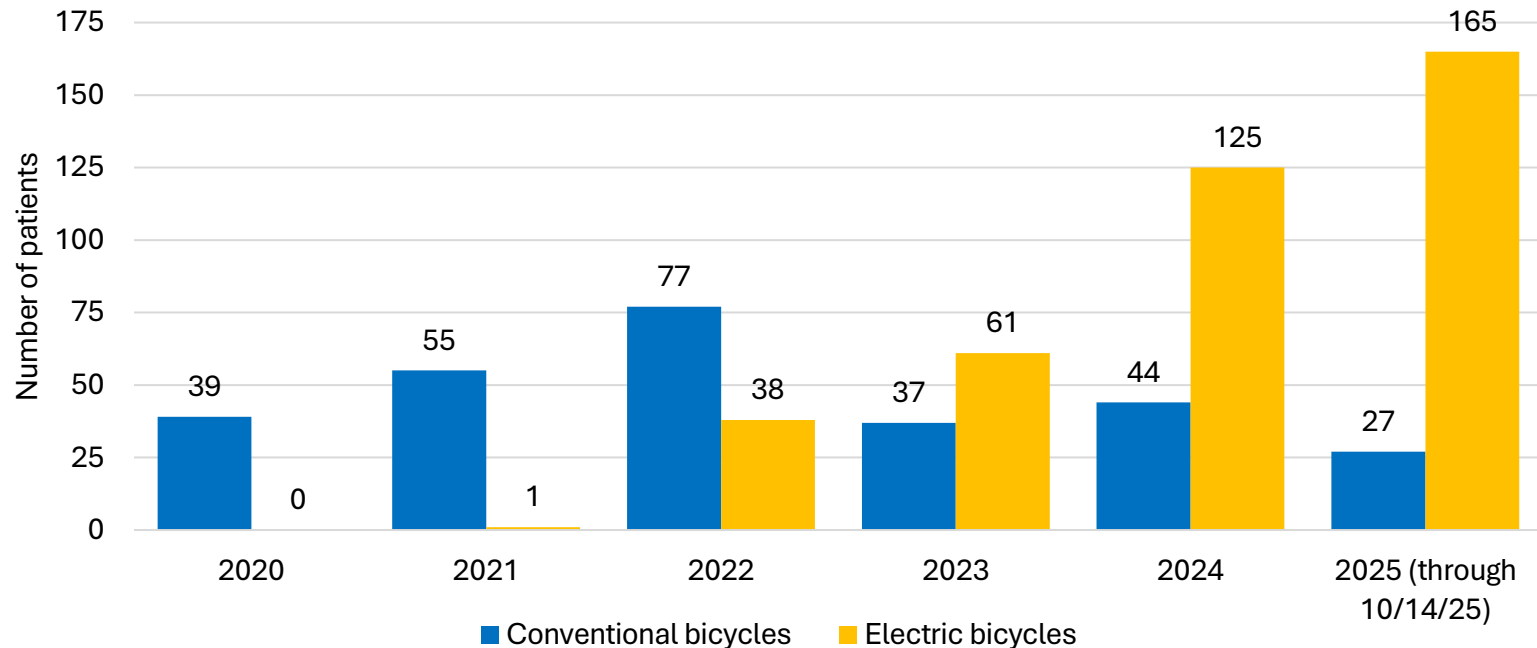


Source: Data from the National Electronic Injury Surveillance System (NEISS), produced by the US Consumer Product Safety Commission

Notes: Devices involved in incidents attributed to EBs are not necessarily legal EBs.
A lack of matching ridership data currently prevents calculation of injury rates on a per trip or per distance basis.

In some e-bike hotspots, e-bike injuries have exceeded conventional bicycle injuries

EB & bicycle trauma activation patients treated at Rady's Children's Hospital, Orange County



Source: Personal correspondence with Dr. Laura F. Goodman, Trauma Medical Director, Rady Children's Health of Orange County, November 11, 2025.

Notes: "Trauma activation" patents are the most seriously injured patients.

Data for 2025 was available only through October 14, 2025.

Devices involved in incidents attributed to EBs are not necessarily legal EBs.

Some data shows somewhat similar severity between e-bikes and conventional bicycles...

Injuries in all locations

	Electric bicycles	Conventional bicycles
Hospitalization rate	16%	13%
Head injuries	23%	19%
Multiple injuries sustained	57%	41%

Injuries on streets

	Electric bicycles	Conventional bicycles
Hospitalization rate	17%	18%
Head injuries	23%	23%
Multiple injuries sustained	63%	54%

Source: Data from the National Electronic Injury Surveillance System (NEISS), produced by the US Consumer Product Safety Commission

Note: Devices involved in incidents attributed to EBs are not necessarily legal EBs.

...but, some data shows notably more severe outcomes for e-bikes vs. conventional bicycles

Injuries and fatalities, New York City (2023-25*)

	Injuries	Fatalities	Ratio of injuries per fatality
Motorcycle	4,065	112	36
Electric bicycle	2,172	44	49
Pedestrian	24,415	306	80
Moped	6,215	34	184
Stand-up scooter	3,427	17	202
Conventional bicycle	12,666	24	528
Car	52,835	95	556
SUV	34,742	43	808

Source: Authors' analysis of data from the NYPD TrafficStat Dashboard.

Notes: Data covers incidents from 1/1/23-12/22/23, 1/1/24-1/22/24, and 1/1/25-11/2/25.

Devices involved in incidents attributed to EBs are not necessarily legal EBs.

Most injuries from solo crashes, most fatalities involve motor vehicle collisions

Share of incidents involving motor vehicle collisions

	Date	Electric bicycles	Conventional bicycles
Injuries at ERs, national ¹	2024	31%	24%
Injuries at ERs, California ²	2023	20%	18%
Fatalities, national ³	2019 - 2025	70%	–

Sources: (1) Data from the National Electronic Injury Surveillance System (NEISS), produced by the US Consumer Product Safety Commission; (2) Authors' analysis of California Health & Human Services data; (3) Authors' search for news articles, 2019 to July 2025

Note: Devices involved in incidents attributed to EBs are not necessarily legal EBs.

Where to go from here?

Policy targeting

- Perception: E-bike problems
- Reaction: Tighten rules on “electric bicycles”
- However, as we saw earlier, many devices on the road are already not street legal

Need for new policy?

Enforcement of existing policy?

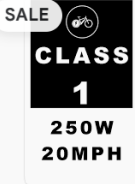
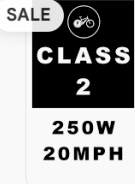
What does enforcement look like?

Can we make it easier to differentiate between legal electric bicycles and more powerful devices?

State law calls for the legal electric bicycles to be labeled with a sticker identifying class type

However, anyone can just buy a sticker...

Google Shopping results for “electric bicycle class sticker”

					
ebike Sticker Class Electric...	Ebike Class 1 250w 20 Mph...	Ebike Class Identification...	Electric Bicycle Frame (3sticker...	Ebike Class 2 250w 20 Mph...	Electric Bicycle Frame 3 Sticker...
\$7.80	\$2.62 \$3.49	\$11.99	\$4.49 \$4.99	\$2.62 \$3.49	\$23.27
Etsy	Redbubble	Walmart	eBay	Redbubble	IBSpot
★★★★★ (15)	Free returns		Free shipping	Free returns	Free returns

Considering the 3-class system...



**Historically, rules have been mostly similar
across classes**

**Some proposals for regulating the 3 classes
differently, adding more classes...**

**But does this make sense from an
enforcement standpoint?**

Our suggestion: Two sets of rules

- **Leverage existing rules for pre-existing devices**
 - Give electric two-wheeled, pedal devices the same rights and responsibilities of either conventional bicycles or (gas-powered) mopeds

**Street legal with rules
for conventional
bicycles**

**Street legal with rules
for mopeds**

Not street legal

Thank you

- Full report at:
<https://transweb.sjsu.edu/research/2423-Electric-Bicycle-Safety-Data-Policy>



SONOMA STATE
UNIVERSITY

Kevin Fang

Associate Professor of
Environmental Studies,
Geography, and Planning

fangk@sonoma.edu