E-BIKES ADVANCE

TYPES & TRENDS IN TODAY'S MARKET

- **Ken Bradford**, ken@kensbikeski.com
- Principal owner of **Ken's Bike-Ski-Board** in Davis
- **Types of e-bikes** (CVC 312.5):
- **Type I** – assist up to 20 MPH, no throttle
- **Type II** – assist up to 20 MPH, with throttle
- **Type III** – assist up to 28MPH, no throttle
- above that (or above 750W), it's an **Electric Motorcycle** (different laws apply)

CALIFORNIA ELECTRIC BICYCLE POLICY

CA

VEHICLE TYPE	VEHICLE		USER				BIKEWAY ACCESS			
	PEDAL OPERATED	MAXIMUM MOTOR-ASSISTED SPEED (MPH)	MINIMUM AGE (YEARS)	DRIVER'S LICENSE	LICENSE PLATE	HELMET	CLASS I BIKE PATH	CLASS II BIKE LANE	CLASS III BIKE ROUTE	CLASS IV PROTECTED LANE
BICYCLE	YES	N/A	N/A	NO	NO	17 AND UNDER	YES	YES	YES	YES
TYPE 1 E-BIKE*	YES	20	N/A	NO	NO	17 AND UNDER	YES	YES	YES	YES
TYPE 2 E-BIKE*	NO	20	N/A	NO	NO	17 AND UNDER	YES	YES	YES	YES
TYPE 3 E-BIKE*	YES	28	16	NO	NO	YES	NO	YES	YES	YES
MOPED	NO	N/A	16	YES	YES	YES	NO	YES	YES	NO

STYLES OF E-BIKES:

- **Performance Road Bike** – for recreational riding or inter-city commutes
- **Performance Hybrid** – for fitness riding and fast intra-city commutes
- **Comfort Bike** – for casual riding and relaxed commuting (most approachable)
- **Cargo Bike** – for hauling families or business cargo (assist is most needed!)
- **3-Wheeler** – for those who can’t balance a two-wheeled bike, or don’t want to
- (Mountain Bike – mostly for recreational use)

TYPES OF PEDAL ASSIST:

- Throttle Only
- Pedaling Sensor*
- Cadence Sensor*
- Torque Sensor*
- *with or without Throttle Assist

THROTTLE ONLY

- +
- Simple, inexpensive to build
- Makes it possible for those who couldn’t otherwise (because of part-time or full-time disability) to still enjoy bike riding, participate in micromobility revolution
- Far lower GHG footprint than a car!

- -
- Not as much fun as the other types
- Encourages “lazy” operation w/o pedaling (no exercise, like an electric scooter or skateboard)

PEDALING SENSOR

- Switch turns motor on when rider pedals
- +
- Simple & inexpensive to build
- Makes e-bikes accessible to lower budgets
- With many such bikes, rider can choose from multiple assist levels

- -
- A bit disconcerting, if not dangerous, when all the power engages at once

CADENCE SENSOR

- Measures rider's cadence (RPM) and adjusts motor output proportionally
- The faster you pedal, the more power
- +
- Eliminates big surge of power when starting out
- Encourages higher cadences

- -
- When do you need the most power?
- Climbing hills
- What's your cadence like when climbing?
- LOW (but torque is high)

TORQUE SENSOR

- Measures rider’s torque (power output) and adjusts motor output proportionally
- The *harder* you pedal, the more assist
- +
- Most power when you need it most!
- Multiplies rider’s own output, and that “natural” feeling is much more fun
- “I feel like Superman!”
- The “Turbo Smile”

- -
- Most difficult to engineer
- Most expensive
- Some “torque sensors” are better than others

HUB DRIVE

- +
- Usually less expensive
- Easier to install on existing bike
- Less wear on drivetrain
- -
- Inferior weight balance
- Less torque, for hill climbing
- &#*(^%@! to change a tire

MID DRIVE

- +
- Better torque, for hill climbing or heavy load
- Better weight balance: lower, centered
- More integrated wiring
- Changing a tire is as easy as any other bike
- -
- Hard to add on, usually designed in
- More wear on drivetrain

THE BEST E-BIKES HAVE:

- The heart of a great bicycle: good frame design & construction
- Quality bicycle components: wheels & tires, brakes, saddles & so much more
- An integrated mid-drive system, controlled by
- A sophisticated torque sensor
- Great support:
- Established company with broad, well-trained dealer network
- Readily available updates to hardware, firmware & software
- Parts & service will be available at least ten years into the future

NEW DEVELOPMENTS:

- Battery technology: smaller, lighter, higher capacity
- Motor technology: smaller, lighter, more efficient; quieter, smoother, more reliable
- Frame design: beefier where needed, lighter where “beef” isn’t needed
- These three have made new “SL” bikes **10 to 16 pounds** lighter than “Std” e-bikes
- Controller/App sophistication: measure and control power, range, navigation & more
- More durable parts: chains, cassettes, tires… designed & rated for e-bike stress

- Ken’s picks:

E-TRIKE: SUN SEEKER E-ECO TAD

E-CARGO BIKE: YUBA ELECTRIC MUNDO

COMFORT E-BIKE: SPECIALIZED TURBO COMO 4.0 LOW ENTRY

PERFORMANCE HYBRID E-BIKE: SPECIALIZED TURBO VADO SL 4.0 EQ

PERFORMANCE E-ROAD BIKE: SPECIALIZED TURBO CREO SL E5 COMP