

# The Electric Bike: A Potential Car Replacement

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# Why build an E-bike?

Needed a form of transportation for:

- Travel to work
- Grocery shopping
- Emergencies: disaster preparedness

# Is riding e-bike feasible?

Factors to consider:

1. Distance: how far is the destination?
2. Time: are you constrained by a quick arrival time?
3. Security: facility to lock or store bicycle safely at destination?
4. Visibility: riding at night?
5. Route: Is your riding path safe for bicycles?
6. Weather: raining or excessively hot day?
7. Air quality: is this a dangerously low air quality day?

# My e-bike requirements

- Must be able to carry at least 50lbs of cargo (not including batteries)
- Must be able to traverse narrow trails or pathways
- Must have dual-power redundancy: human and electric power
- Must have effective braking (heavily loaded e-bikes result in increased stopping distance)
- Must be low maintenance
- Must have high visibility
- Must be quiet

# E-bike Specifications

- Front wheel can easily hold 70 lbs. loads
- Rear wheel can easily hold 70 lbs. loads
- Bicycle trailer (when attached) can hold 75 lbs. loads
- Bicycle weighs approximately 55 lbs. (includes batteries)
- Bicycle range without pedaling (motor only): approximately 30 miles
- Top speed (flat-level ground): 16 mph.
- Redundant power: Front wheel is electric powered. Rear wheel is human powered.
- Redundant braking: front and rear wheels contain disc brakes. Front wheel also has electric regenerative braking.
- Electric lights (night riding) 4200 lumens (front). Lights last minimally for 1.5 hours on rechargeable battery under maximum output. I have two batteries for 3 hours run time.
- Low maintenance Sturmey Archer 3-speed internal geared hub.
- Quiet operation.

# Designing an E-bike: tips

## **Front-wheel electric e-bike:**

- No aluminum or carbon-fiber front forks.
- Yes: cro-moly steel front fork.
- Be sure to install torque arm on front axle!

## **Mid-drive electric e-bike:**

- Make sure rear-drive of bicycle can handle force from electric motor. Specifically, Sturmey-Archer 3-speed internal gear hubs or 14-speed Rohloff speed hub.

## **Rear-drive electric e-bike**

# Factors to consider using E-bike

1. Is there a safe, secure place to store e-bike at destination?

- Do you have tough bicycle locks?

2. Will you be travelling at night?

- How long will lights last?

3. What is the maximum distance e-bike can travel?

- Using both human and electric power?
- Using only human power (no electric motor)?
- Using only motor (no human power)?

4. Prepared for emergency?

- Tools to change flat tire,
- Air pump
- Emergency lights
- Water
- Food
- Extra clothing

5. Prepared for weather?

- Dangerously hot day?
- Unhealthy outdoor air (particulate from smoke and pollution)?
- Extremely wet/rainy day?



## E-bike: daytime view





## E-bike: night time view





# Charging Infrastructure: Solar carts





# Charging Infrastructure: Solar carts





# E-bikes that look even more like cars!



Source: <https://electrek.co/wp-content/uploads/sites/3/2018/06/pebl2.jpg>



# E-bikes that look even more like cars!



Source: <https://organictransit.com/wp-content/uploads/2014/03/ELF-on-Grassy-Hill-Optimized.jpg>

# Resources

Endless Sphere (a forum dedicated to electrically powered vehicles) at <https://endless-sphere.com/forums/>

Luke Workman racing his homemade e-bike at Laguna Seca Speedway at <https://www.youtube.com/watch?v=KX-ki3pP8YU>

Doctor Bass drag racing his homemade e-bike at [https://www.youtube.com/watch?v=xhBz0\\_BNXkY](https://www.youtube.com/watch?v=xhBz0_BNXkY)



# Thank you!

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