

EDGE BIKES

Joe Li | ME 102B - Fall 2020



DESCRIPTION

Riding a bicycle is a convenient and environmentally conscious mode of transportation that is becoming increasingly popular in urban centers. In cities around the US, bicycles have become a central part of the local culture and are often used in place of cars or public transit to commute to work. The issue however, is that while bikes are significantly smaller than traditional vehicles, they are still large enough that carrying them indoors is unwieldy and, in some cases, inappropriate. The alternative is locking it outdoors on a rack, but spots may not be available and a large risk of theft exists.

The solution to this problem is the foldable bicycle, which allows the commuter to collapse the frame into a smaller package that can then be stowed away or carried at the person's side. There are already several designs on the market for folding bikes, however these products feature unconventional frames that are incompatible with standardized parts. Further, many use smaller diameter wheels which are harder for the consumer to source. The Edge Bike aims to solve these issues with an innovative approach to the collapsible frame.



Figure 1: The ROME Citizen 16" bike (left) and the Edge Folding Bike (right). The new approach uses four and five bar linkages to collapse the frame into a thin bar.

DESIGN

The Edge Bike uses four and five bar linkages to rotate its frame into a smaller form factor. When transitioning between each state, these links fold to fill as much open space as possible while ensuring structural rigidity of the frame. In the closed and open positions, these bars are secured by quick-release pins that lock with a push-button. To keep the head tube parallel to the seat tube, the five-bar linkage also incorporates gear teeth on its central hinge to fully constrain the assembly's motion. The Edge Bike frame was modeled in SOLIDWORKS and rendered in Keyshot 9. Peripheral components, including the pedals, sprockets, wheels, saddle, and handlebars were sourced from GrabCAD.

REFINEMENT

This current iteration of the Edge Bicycle is a prototype and will be improved in future iterations of the design. Plans include:

- Sliding links in conjunction with hinges to further decrease collapsed volume.
- Toolless locking mechanisms similar to locking carabiners.
- Sheet construction, allowing the use of lightweight composite materials.
- A collapsible saddle, pedal, and handlebar design.
- Built-in stowage for the removable wheels.

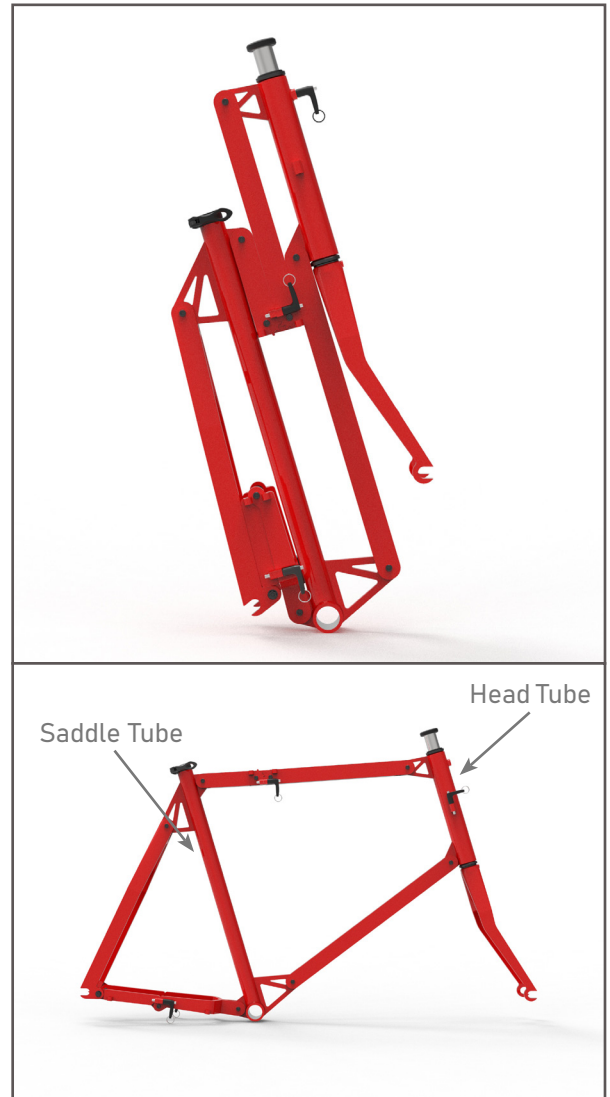


Figure 2: The Edge Bike in its closed (top) and open (bottom) states.

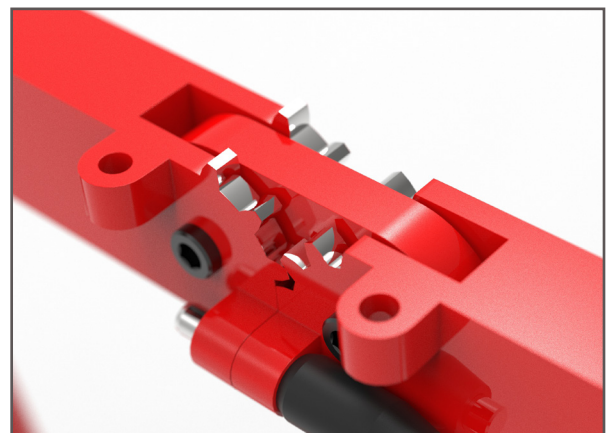


Figure 3: The gear teeth on the central hinge of Edge

PARTS LIST

PART	ITEM NO.	VENDOR	QUANTITY	PRICE
5mm Flanged Ball Bearing	57155K479	McMaster-Carr	20	\$11.18/1
1/4" L-Handle Locking Pin	90302A149	McMaster-Carr	4	\$22.922/1
M6x1x35 Socket Head Screw	91290A202	McMaster-Carr	1	\$5.08/10
M6x1x22 Socket Head Screw	91292A073	McMaster-Carr	7	\$6.37/25
M6x1x12 Socket Head Screw	91292A134	McMaster-Carr	2	\$8.15/50
M6x1x22 Flat Head Screw	92125A241	McMaster-Carr	1	\$8.78/25
M6x1x12 Low Profile Screw	92855A613	McMaster-Carr	2	\$8.39/25
M6x1 Steel Hex Nut	90591A151	McMaster-Carr	12	\$2.60/100

MANUFACTURING

- The saddle and head tubes are made from tube stock and machined bars that have been welded together.
- The frame linkages are rectangular tube stock with welded endcaps made from machined aluminum.
- The head stock is an aluminum tube with a threaded endcap that is welded to an assembly of drawn and formed rectangular tube stock.
- All 5mm flanged ball bearings are press fit into their receptacles and then reamed.
- The receptacles for brake calipers are made from machined aluminum that is welded to the frame, drilled, and then threaded with an M6x1 tap.
- The locking pin receptacles are machined from aluminum bar stock and welded to the frame.

APPENDIX I: IMAGES



APPENDIX II: SOURCES

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