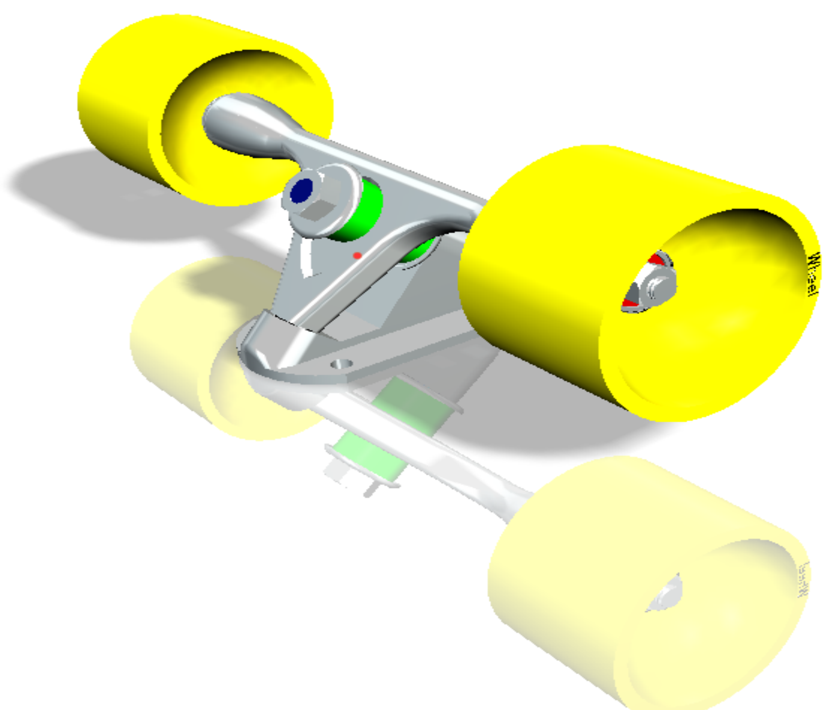
James Lakowski and Zachary Cox

Longboard Trucks

ME 170 Final Project

College of Engineering
12/9/2011



A Brief Description:

When considering the industry of longboarding trucks and wheels, we have found some room for improvement from all the other similar products currently on the market. In the design of this product we have incorporated some innovative new features. Our trucks feature a free axle that rotate on a set of precision bearings by themselves making the resistance due to friction significantly less than other similar products. Another new innovation can be found literally in the wheels. A more efficient plastic core unlike those found in other popular longboarding wheels resides in the center of our wheels. This core allows the wheel to age more slowly as well as provide for a smoother and longer ride. We chose to make the angle 50 degrees. That angle provides for dynamic turning and maneuverability at low speeds as well as control at higher speeds.

When designing the core location in our wheels we had three basic choices, side set, offset and center set. Each core orientation has its overall strengths and weakness. We ended up choosing an off set orientation because it offered a happy medium between the axle elongation provided with the side set and the gripping properties offered with the center set. Another important consideration when designing wheels is the edge cut. An acute edge cut will allow for maximum gripping abilities. A square edge cut will grip at all low speeds and finally a round edge cut will not grip nearly as well at any speed. We choose the square edge cut because yet again it offered an efficient hybrid between the two extremes. The third consideration when designing wheels is the hardness. Polyurethane hardness is measured on the 'A' Durometer scale. On that scale, 1 is the softest and 99 is the hardest; we chose 80A for our wheels. Although that number may seem high, in the world of skateboard wheels, it is relatively soft. The soft wheel in conjunction with the tapered interior of the wheels allows for a steady grip of the road.

Product Design Specification:

- Performance
  - Speeds up to 70 mph
    - 50400 rpm
  - Usually not in excess of 30 mph
    - 21600 rpm
  - Everyday use
- Service Life
  - Under normal conditions
    - 5 years
- Size
  - The current design has a 180mm axle
  - Can also be manufactured for 150mm or 210mm
  - Holes are standardized for all longboards.
- Reliability
  - MTBF: 500 miles, 5 years
- Maintenance
  - Bearings to be changed when damaged by water

  - All other parts built to last
- Competition
  - Randall trucks
    - Offer a floating axle truck
      - For streetluge
      - Only in one size
  - Paris Trucks
    - No Floating axle
- Packaging
  - To be sold fully assembled
- Safety
  - Failure could result in injury
- Testing
  - Test at what jerk the cores will break
  - Test shear strength of hanger and axle
- Intellectual Property
  - Baseplate
    - Modeled after Paris trucks
  - Reverse kingpin Geometry
    - industry standard
  - Other companies manufacture a similar product
- Disposal
  - All parts are safe to dispose of
  - Only bushings and wheels cannot be reused
- Target Costs
  - $100 Manufacturing
      - $180 Retail

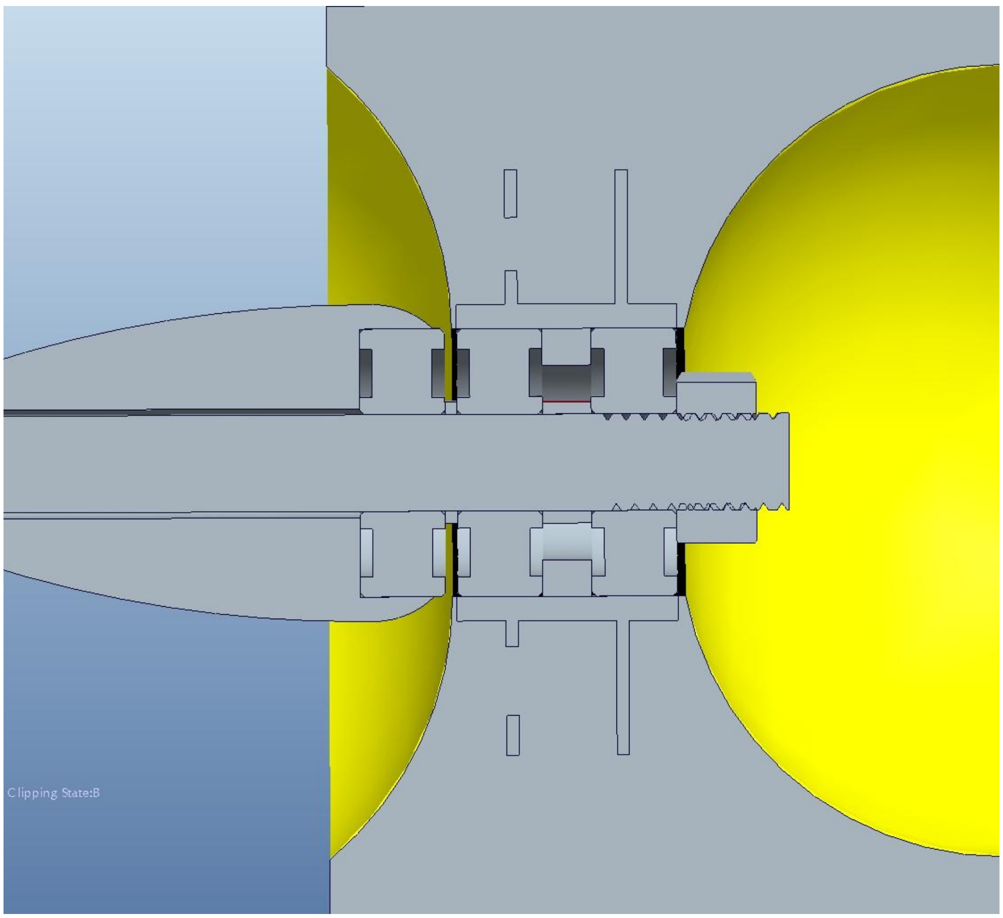
Tolerance Analysis:

Tolerancing for the truck have been minimized in order to reduce cost and maximize manufacturing efficiency. This goal has been greatly assisted by the use of flexible materials such as the polyurethane and the nature of the design. There are 4 axes of contact which required tolerance analysis on the truck design:

1) The interface between the baseplate and the hanger, which allows a small degree of rotation;
2) The bolt, contacted by the baseplate, both bushings, and the hangar;
3) The axle, contracted only by the bearings, spacers, and nuts;
4) The slots for the bearings in both the hanger and the wheel/core.

The first axis of contact needed no tolerancing. The use of a ~1 mm polyurethane spacer between the baseplate and hanger allowed significant freedom, and the standard tolerance was sufficient.
The bolt axis required freedom of assembly, but due to the use of polyurethane bushings, firmness was unnecessary. The parts were designed for a loose running fit for ease of assembly. This corresponds to an ISO fit of H11 and c11. The tolerances for the bolt at 10 mm in width was -.080 mm, -.170 mm. The

tolerances for the bushings and baseplate were each +.090 mm, 0.
The axle and bearing tolerance was entirely dependent on the type of interference desired. A push fit allows relative ease of assembly with the interference desired with a bearing to ensure stability. A push fit corresponds to an H7 hole and an N6 shaft. As the axle is 8 mm wide, this means the tolerance on the bearings and spacers are +.015 mm, 0. The tolerance on the axle, with an N6 shaft, is +.019 mm, +.010 mm.
The holes for the bearings were again selected for a push fit, for the same reasons as above. This again required H7 and N6 tolerances. However, as the size of the hole/shaft was larger at 22 mm, the tolerance was respectively, .021 mm, 0, and +.023 mm, +.015 mm.



Materials, Manufacturing and Cost Analysis:

When considering materials for this project, metal was the obvious option for most of our components. In particular, we chose stainless steel for the hanger, the baseplate and the axle mainly for the sake of longevity and durability. For the larger parts (hanger and baseplate) sand casting and machining will be used for production. To produce our plastic, polyurethane, and some of our metal parts, we are using custom molds. As a result, there will be a substantial amount of money put into tooling to create the molds for the aforementioned parts. For the kingpin and the axle, the ideal manufacturing process is machining the part out of bar stock 1045 steel.

As for cost, the prices listed when we were to buy components from McMaster-Carr are for one bag of each respective component. A likely scenario involves the price dropping when we order in bulk. This is especially evident in the bearings. When purchasing standard skateboard bearings the total cost for a set of eight is around 15 dollars. One thing that could have possibly altered our cost analysis was aPriori's lack of a polyurethane module. Four of our manufactured parts were made from polyurethane parts, so the cost of each of those is an loose estimation based on the manufacturing cost of polyethylene. This cost discrepancy is especially evident in the wheels. The market price for a set of four is between forty-five and fifty dollars. Each wheel was estimated at around forty-five dollars. This could be due to the scale at which we are producing or that we were using a polyurethane analog out of necessity. This is likely as a result of the polyethylene modeling, and is also probably raised by the scale of the order. There is little reason to believe the cost of these parts will not decline significantly when produced in high volume.