Customization of Composite Speedboard

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Abstract

Downhill longboarding is the control and orientation of a rider down a constant decline, aiming to increase speed while maintaining safety. This sport has advanced with the manufacturing technologies of the decks, in the form of composite speedboards - A high strength to low weight board utilizing properties of multiple different structural materials and fabrics.

The process of applying fabrics to boards require specialized materials and presses, mainly Carbon fiber and a Ribbed press, to ensure complete structural integrity and strength. The combination of materials with a highly accurate press will create a uniform bond between stratum; This will create a higher resilience to compression and damage, leading to better endurance in an entirely damaging sport. The finished product will be a high strength board that has a lower weight than a maple wood replica, with the addition of being highly variable to suit the rider's needs.

Introduction

Downhill skateboarding is a sport that is based around the natural geocentric force of gravity, and utilizing the slope of an open road and the aerodynamics of the specific stance the rider takes to reach near terminal velocity, while lacking any protective structure surrounding you, as safely as possible. Downhill skateboarding is limited by the riders comfort and the reference/contact points of the board. This function of the board is only accessible through the method of creation - or when the plies of material are pressed together to form a specific shape. Presses are a method of applying a constant force to separate segments of material, around a specific shape (Cebulski, 05/05/10). Once pressing is complete, and the bonding agent is cured and properly adhering the plies of material together, the final shape of the board is demonstrated. There is currently no way of creating a new reference/contact point directly into the board without expensive aftermarket applications. With the addition of open customization through the removal and reinstallation of separate pieces contributes to make this a difficult task, both to research and implement, as this is the first of its kind. The process of building a downhill speedboard requires building materials, board design, and a board press or mold (Roarrocket, 03/16/15).

The strength and rigidity of any and all compositions or structures is the choice of material, The majority of applications tend to attempt maximum strength to minimum weight, most commonly using aluminum alloys or specific fabrics (Consortium, 2006). In the production of a Downhill skateboard, the most versatile materials are carbon fiber and fiberglass(Yan Poirier, 11/18/13). Both are fabric materials, that are adhered to wood or another support structure with high strength resin (jestah, 12/06/06). When adhering to wood, it is most often applied during the pressing process between plies of wood (TeacherOfTheWays, 01/04/09), or atop the top or bottom of the board. Customization of the board allows each individual rider to utilize their own preference, due to every aspect that is able to be changed in a board. There are differences in the concave - the 'U' shaped bend in the wood parallel to the direction of the board, this simple shaping gives the rider leverage and traction to properly control the board. Wheel flares exist above the location of the wheel, to allow for extended clearance, to prevent 'wheel bite' or contact between the rotating wheels and stationary (in relation to the wheels) deck. This allows the rider to run larger wheels, and has an increase of concave in that area. 'W' is another board shape term that describes the uncanny resemblance to a letter, the shape is an extended hump along the middle of the board. Drops are the lowering of the foot platform from the trucks, lowering the center of gravity from a rider, and enabling pockets to fit your foot into. Bringing this all together with the process of 3d printing will enable the production of a completely customizable board, with the benefits of weight saving fabric materials, and a large palette of concave additions to choose from.

Methods

Phase one:

- Press construction
  - Cut 1 in. x 2 in. x 8 ft. into 8 1 foot segments
  - Mark shape of concave onto 36 wood pieces
    - Different shape for each - different concave
  - Cut each shape with tablesaw along lines
  - Apply glue on both long sides of 34 segments, and glue on the innermost side of the outermost segments
  - Re adjust to ensure each segment is even
  - Using clamps, press together segments
  - Once dry, remove from clamps, sand excess glue
  - Repeat for upper portion of press, the exact opposite dimensions (convex instead of concave)
  - Screw 2" x 4" x 36" beams atop and the top face of press, and below the bottom face.
    - Attach parallel to direction of board if it were in the press
    - Drill 1 screw each foot on each beam

Phase two:

- Building board
  - Fit 9 plies of maple into press
    - Apply liberal amount of wood glue evenly along each side of ply, except the outermost sides. (top and bottom)
  - Attach clamps to both sides of press, 1 foot from edge
    - Clamp down until wood glue begins to drip from between plies
    - Allow time to cure ~12-36 hours
  - Take out pressed board from press, ensure it is correct shape
  - Input 3D model file into CNC machine, place uncut board into CNC machine, and run. Cut away excess wood, and cut out mounting area for 3D printed segments
    - Sand rough edges
- Cut out mounting holes
- 3D printed segments
  - Create 3D models of concave segments
- Upload file to Markforged printer, print
  - Sand excess material

Results

A composite speedboard would most readily have similar traits to that of an entirely fabric board (i.e kevlar, carbon fiber, or fiberglass), but at a fraction of the cost. The involved time of labor is reduced, as well as the cost involved in the creation of a ribbed press (Rsnider, Solid Wood Press). Using this specific style and design of a press will create a nearly flawless bond between the strata of wood, allowing the plies to better adhere to one another - creating a more unified board. he process of inlaying composite segments allows the board to be made with any concave, and supports the overall structure from torsional and perpendicular flex. An increase in flex leads the rider to be less sure of themselves when maneuvering and does not transition the riders force directly to the trucks in turns, meaning that when weight is transferred left or right, the board will flex with the rider and apply a force to the trucks. This precipitates outward to the board going straight momentarily while the riders weight is well over the centerline of the deck.

Following the completion of a composite speedboard, there will be one product; a composite speedboard that has been sufficiently tested and prototyped. The final prototype will be something that precisely meets the aforementioned requirements. The design implementations are tested through rigorous personal activity, utilizing varying roads and hills (i.e. separate environments) to see how the board performs in standard freeride orientation (quick side-to-side turning motions, with a perpendicular sliding force) or downhill orientation (adequate stability at high speeds and is able to withstand strong perpendicular forces).This design may face implications with the strength of the board, if the segments do not interlock successfully, the wooden backbone will not offer adequate strength, and may flex severely or fracture. the designed concave may not prove to offer appropriate frictional force for the rider, causing them to slip off. Through further testing and the application of solutions to discovered problems, the board itself will improve into something able to be ridden at high speed, and remain rigid under force. Discovering designs that are likely to have structural failure would allow revisions to be made, enabling the final board to perform correctly.

Torsional, and perpendicular flex tests will be done, to measure the rigidity of the board. The more rigid the board is, the more suitable for downhill skateboarding it is. Through these tests, the physical limitations of the board will be tested, and how much strain the board can endure before structural failure. The wooden backbone will be first fracture tested, and then the frame with inserts will be tested. Previous flex tests have been done, although the build of the board is vastly different from each test, resulting in different data. The data will be define and declare the limitations of the board and build.

Figure #1

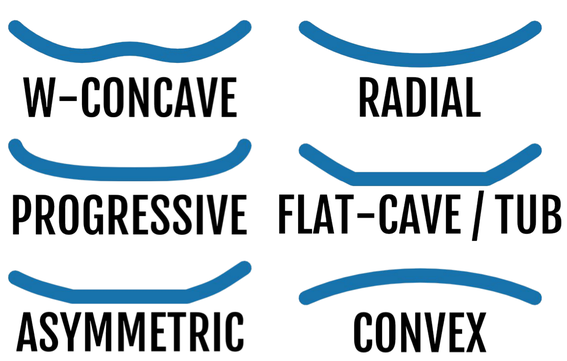
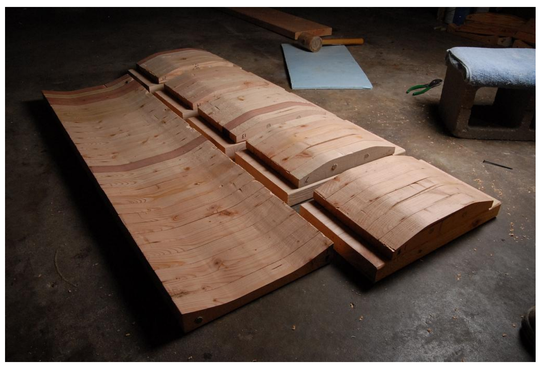


Figure #2



Composite Speedboard		Semester one															
Deliverables	W	Oct	41	42	43	44	Nov	46	47	48	Dec	50	51	52	53	Jan
Planning phase		1	2	3	4	5	6	7	8	9	10	11	12			
Develope Ideas	4	n	n	n	9/16/15-10/19/15											
Develope concept	2		n	n	n	10/6/15-10/22/15										
Design mold	3				n	n	c	10/25/15-11/15/15								
Build mold						n	c	11/1/15-11/15/15								
Press Backbone Deck								n	c	11/15/15-11/30/15						
Cnc Backbone Deck										n	n	12/1/15-12-10-15				
Print Segments											c	c	c	12/10/15-12/25/15		

Conclusions

Downhill longboarding, as a sport is mostly held back by the cost of producing quality boards, as they truly enable the rider to utilize their skills. An under defined board will not allow the rider to lock themselves into the deck, removing their concentration from riding down a hill to ensuring they remain standing on the board, controlling it. The production of a deck would have lower costs compared to a fully composite fabric board, but with similar strength and rigidity properties. This combination of a wooden backbone, or more essentially a standard wooden deck, with inlaid 3D printed composite interlocking and secured segments would achieve the required strength, rigidity, and customizability that this sport is lacking. A well produced deck, using the a uniform compression press, will hold a defined shape through more abuse, as the press creates complete adhesion between each strata. Every inch of surface area of one ply, is entirely attached to the surface area of the next - creating no cavities lat degrade the board.

Key Literatue

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4. Kdomitter. (2013, July 11). Show me your unique boards! Retrieved October 5, 2015,

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