NORCO® Slopestyle Bicycle Redesign

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Abstract

This paper outlines the design of a slopestyle mountain bicycle for **Norco Performance Bikes®**. The design intent was a full-suspension, single speed, chain and belt drive (**Gates Carbon Drive®**) compatible bike using the preferred frame geometry of **Norco®** Team Rider Sam Dueck. Our final design was a Faux bar layout with a concentric bottom bracket and 4" of rear wheel travel. We also designed 4 separate rockerarms to link the rear shock to the seat stay, each with a unique leverage ratio curve. Through analytical (MATLAB) and physical testing, we concluded that the Regressive 18% rockerarms would provide the ideal suspension characteristics for our design.

Introduction

Slopestyle mountain biking involves riding primarily downhill over large jumps. The purpose of this project was to design a bike that would consistently perform well under these conditions. A single speed bike eliminates the chance of gears skipping as the rider pedals between jumps and the full-suspension allows the bike to absorb the impact of landing from a large jump. Our design was to be compatible with belt drive, which requires less maintenance than chain drive systems. We also analyzed the rear suspension leverage ratio to minimize the energy lost on jump takeoff.

Design Overview

The final design of the **Norco®** slopestyle mountain bicycle frame can be seen in Figure 1 with the dropout, the rockerarms, and the bottom bracket highlighted.

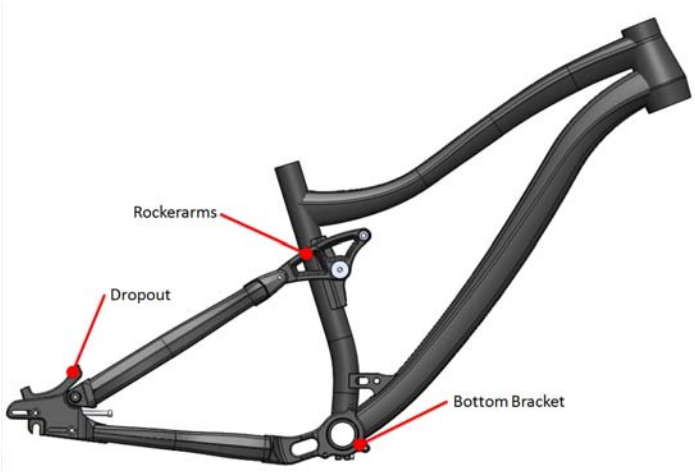

Figure 1: Final Layout of the Norco Slopestyle Mountain Bicycle Frame

A Faux Bar rear suspension layout was chosen because it was simple, highly tuneable, and has similar aesthetics to the rest of the **Norco®** lineup. The rockerarms of the rear suspension were designed such that they could be swapped for different suspension characteristics ranging from regressive to progressive while providing 4" of travel. Tension adjustment of the single speed

drivetrain is provided by the sliding dropouts, which have a 30mm range. The main pivot is located at the bottom bracket to ensure concentricity throughout the rear suspension's axle path. Rear suspension pivots utilize **Norglide®** composite bearings for improved life in oscillatory conditions as opposed to cartridge ball bearings.

Technical Analysis and Testing

The final design was to be manufactured overseas, and thus we were unable to perform physical tests on the complete bike. However, we manufactured several rockerarms that would mimic our design and could be mounted on a similar bike with Faux Bar rear suspension.

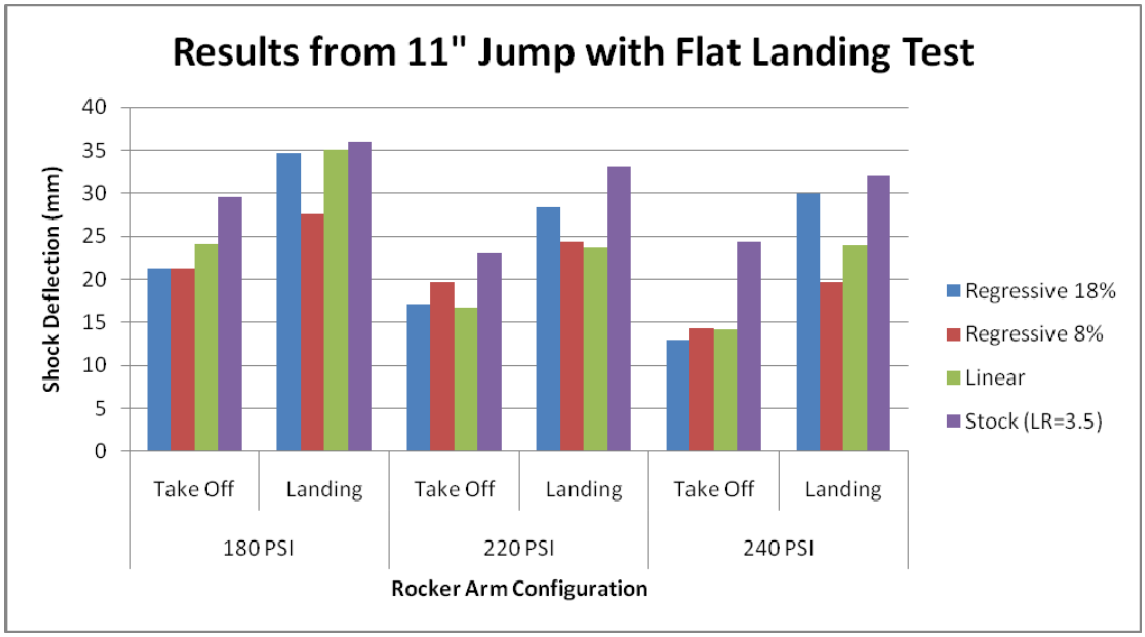

Figure 2: Physical Test Results

Through both analytical and physical testing, we determined takeoff and landing shock deflection under various conditions, and found that the Regressive 18% rockerarms had the least takeoff deflection, and thus more energy transfer as seen in Figure 2.

Discussion and Conclusions

We believe that our design has satisfied the project requirements. With the option of interchangeable rockerarms, the rider can select the suspension characteristics that best suit their riding style. After both analytical and physical testing, we found that the Regressive 18% rockerarms will deflect the least on takeoff and will conserve the most energy during a jump.

Recommendations

Although we feel that the Regressive 18% rockerarms will provide the ideal suspension characteristics for slopestyle mountain biking, further analysis by the **Norco®** team riders and personnel would be beneficial. In order to obtain the most gear ratios possible, we chose a 420mm chainstay length that can use both a 46T and 50T front sprocket. It may be possible to reduce the length to 410 - 415 mm with reduced gear combinations (using a 46T sprocket), although the reduction would also affect the clearance between the seatstay yoke and frame under full shock compression.