CAPSTONE EXPERIENCE 2015

Integrated Transport System, John Deere 640FD

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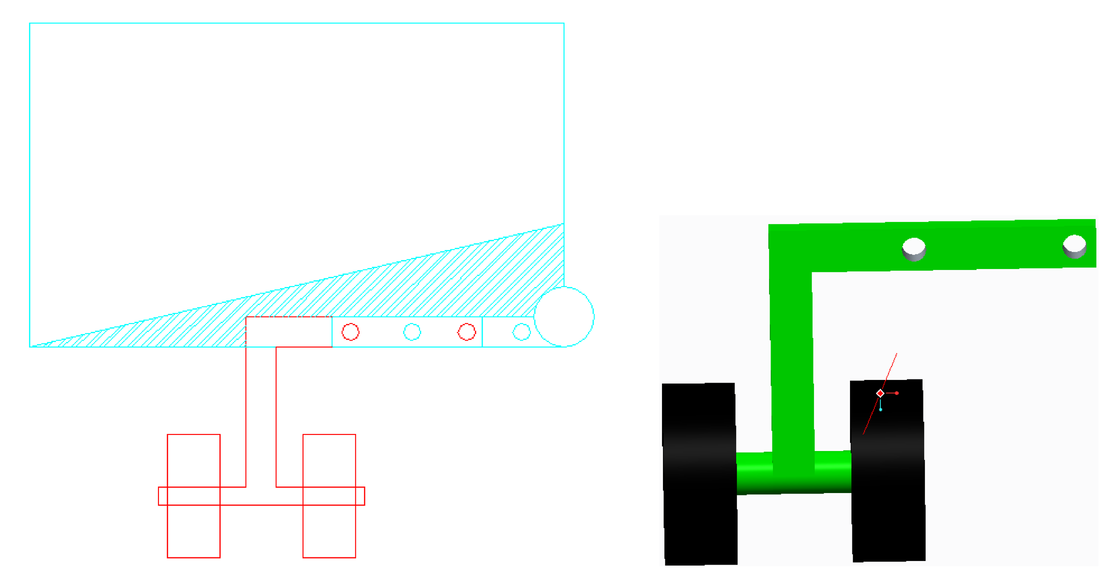
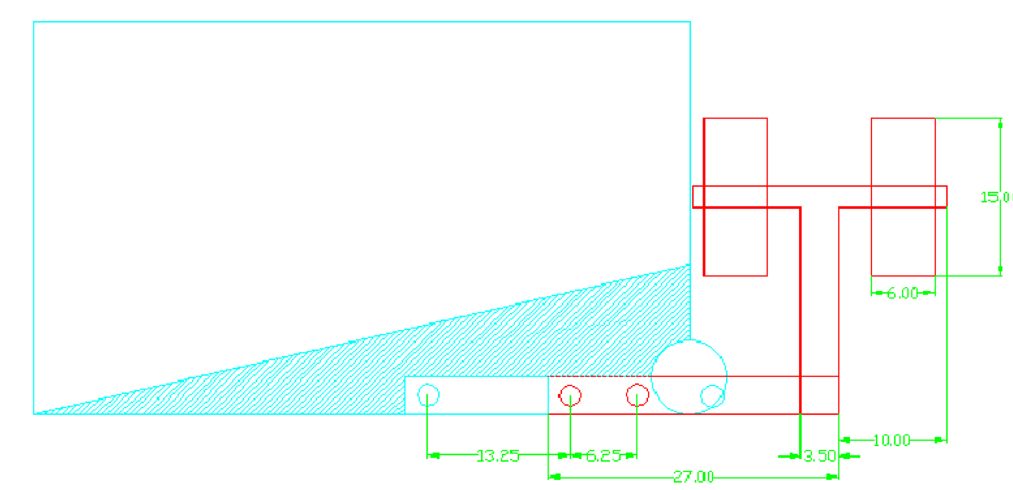
Problem Statement & Background

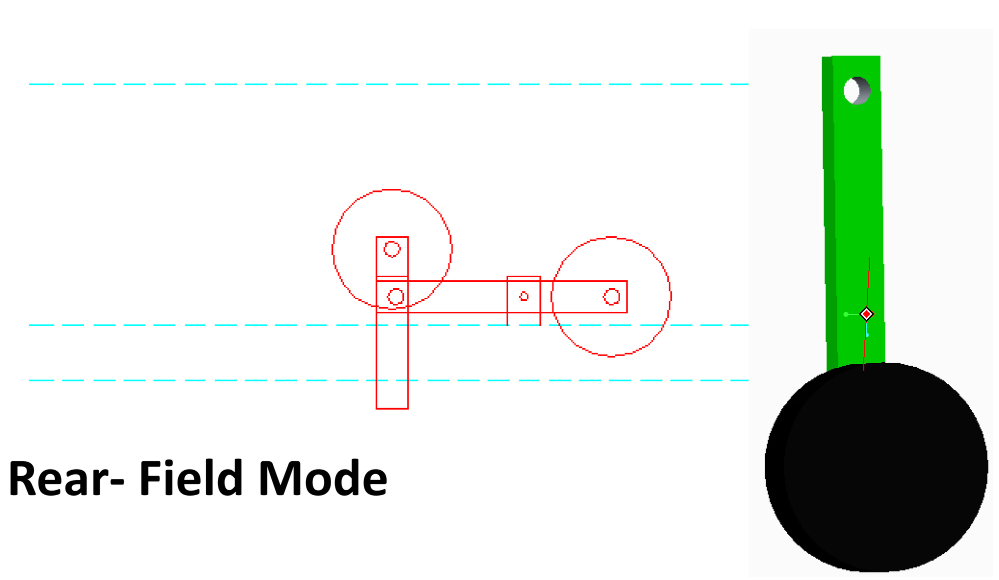
Agriculture is a very large industry, and exists over a variety of terrains. For this reason, manufacturers like John Deere design/develop equipment that produce for the industry. Harvesters are wanting more transport flexibility from their John Deere 640 Flex Draper (640FD) grain platform, which is utilized in large unleveled contour fields. These fields are located in western United States and on into Canada where harvest crews would like to utilize integrated slow-speed transport (ISST) systems to move from field to field. These new transport systems are economical for large harvest crews and are very sought after. Currently the 640FD does not have a when ISST system that can be utilized therefore an ISST design needs to come for the 640FD.



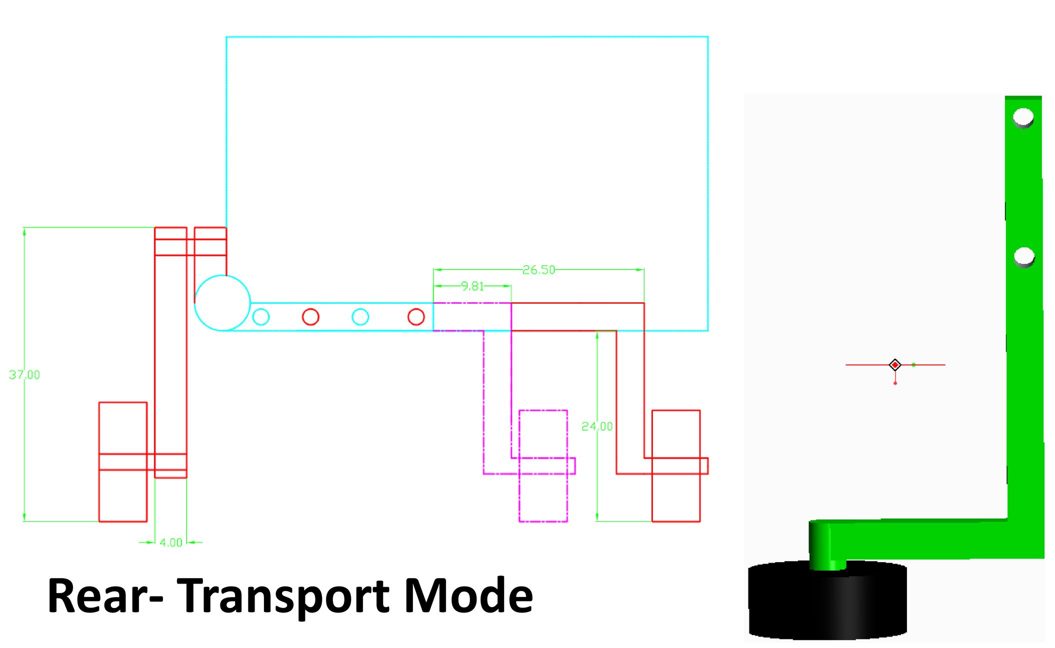
Front- Transport Mode



Front- Field Mode



Rear- Field Mode



Rear- Transport Mode

Final Solution and Conceptual Design

After taking in consideration the different constraints of weight, balance, maneuverability and possibilities in a practical and efficient design for an integrated transport system our team has come up with a conceptual design for John Deere. Our design is similar to the New Holland ISST and the John Deere ISST for the rigid draper. Our transport system acts as a tricycle. This type of design gives the 40 foot draper head balance and adequate support while maintaining a low weight. Our design is a conceptual design and requires further design to be a proto-type ready design.

- The front transport system is the front of the tricycle. It uses two 15 inch wheels that are balanced to the center of gravity of the head. The attachment acts in a pendulum motion pivoting down underneath the head for transport mode; and pivoting up to the back of the head for field mode. When in position the attachment will be locked in place by the use of pins. The tongue will be attached here when in transport mode and when in field mode the tongue will be stored in the tube on the bottom of the header.

- The rear transport system consist of two separate attachments. The left wheel is pinned up and back when in field mode. In transport mode it swings down and is pinned in place. The right rear wheel is mounted on a similar attachment to the front. The only difference is that it telescopes in and out when folding and unfolding in order to clear the ground. Our current design does not include hydraulics nor winches. These components could be included to reduce force needed from the operator.

Current 640D Integrated Transport Example

Alternative Solutions

- Using Gauge Wheels as Road Tires
- Store Attachments on the end of Header
- Wheels stored somewhere else such as on Combine
- Use a Combination of Gauge wheels and other wheels

Calculations

A sum of moments calculation was done to determine the weights at each point where a wheel is supporting the head. It was found that the sickle side wheel on the rear part of the transport would support 3106.73 lbs. It was found that the inner wheel which would be closest to the combine only supported 1923.12 lbs. The front part of the transport has just one support with two wheels on it. It was found that the support would need to hold 5029.9 lbs. which means each wheel would have to support 2514.95 lbs. The braking force calculation was done using ASABE S365.9. An assumption that was made was that the combine would not move faster than 25mph or approximately 40km/hr. It was determined that the stopping distance of the head on the integrated transport would be S-23.4m. This value was then used in the deceleration equation (Equation 1) to determine the deceleration rate. The braking force was then calculated by using F=M*A. The calculated braking force was 12kN. Using a Factor of Safety of 3 to protect the integrated transport from extreme circumstances the braking for was set at 36kN.

Economic Impact & Sustainability

Adding an integrated slow-speed transport system will have a positive impact on the economic status of the farmer. Effects of implementing the transport system will lower fuel and labor expenses for harvesting operations. Since the ISST allows harvesters the ability to have a header cart at all times, lower time and man hours is expected between field to field. Thus lower labor and fuel expenses will be noticed within operations. Such is done by removing operators, further equipment, and fuel to transport a header cart. In the end, unleveled terrain harvesters will look forward to having lower expenses and better ways to transport a 640FD header. This transport system allows John Deere to reach a part of their market without redoing their whole design.

Sponsor: Dennis Silver, John Deere
Technical Advisor: Dr. Dennis Buckmaster
Instructors: Dr. Robert Stwalley and Dr. Bernie Engel