
USDA Subsurface Banding Implement Soil Trencher Improvements

Concept Design Review

Corp 10 – Fall 2010

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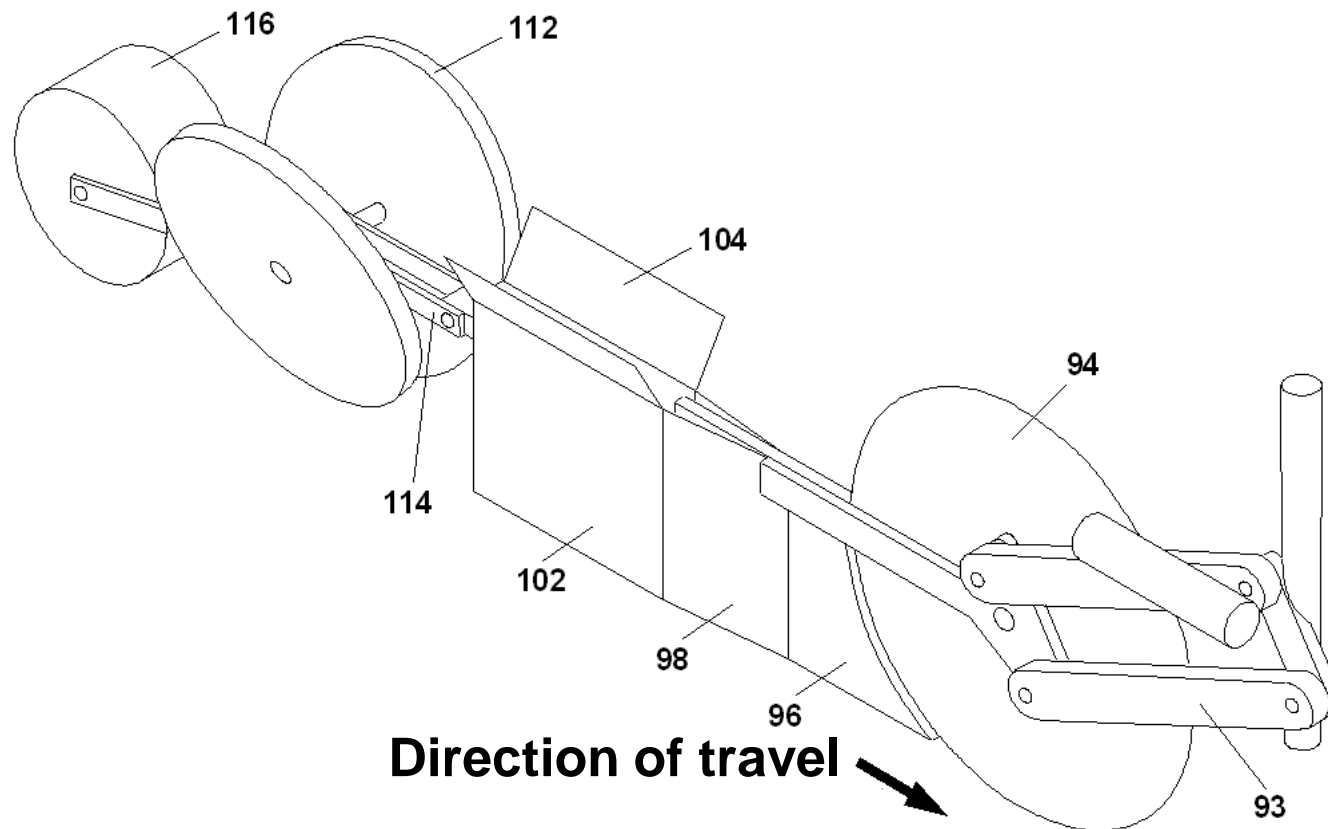
Matt Turberville



Outline

- Mission Objective
- Architectural Design
 - Feasible Alternatives
 - Final Concept
- Product Hierarchy
- Bill of Materials
- Preliminary Analysis
- Questions

“The Trencher”



Way, Thomas et al. "Applicator System and Method for the Agricultural Distribution of Biodegradable and Non-Biodegradable Materials." Patent 7,721,662 B2. 25 May 2010

Mission Objective

- Litter Application Component:

“To improve or redesign the walls of the poultry litter implement so that litter can be more effectively distributed to the soil, mitigating the clogging that currently occurs during normal operation”
- Dirt Recovery Component

“To improve or replace the current press-wheel system used on the implement for dirt recovery so that the extricated soil is more effectively replaced over the deposited litter band”

Architectural Design

- **Feasible Alternatives**

- **Dirt Recovery**

- John Deere
 - Trapezoidal
 - Self Adjusting
 - Two Bar Collector
 - Two Hinge Scoop

- **Trencher Wall**

- Straight Wall
 - Circular Bend
 - Angled Bend
 - Front Flared
 - Angled Wall

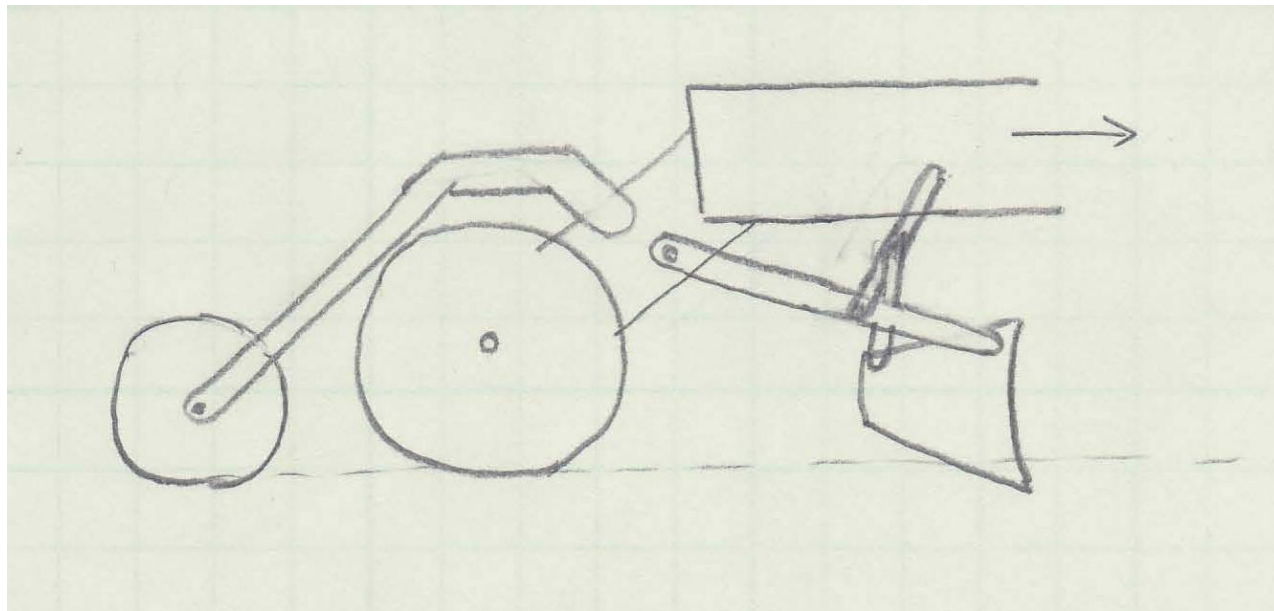
Dirt Recovery Alternatives

- John Deere Model



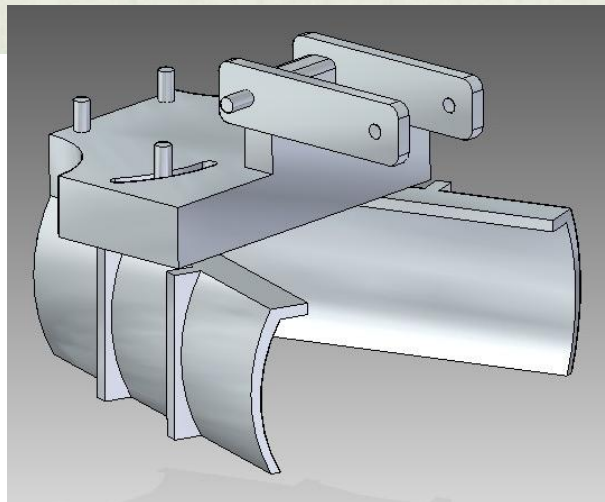
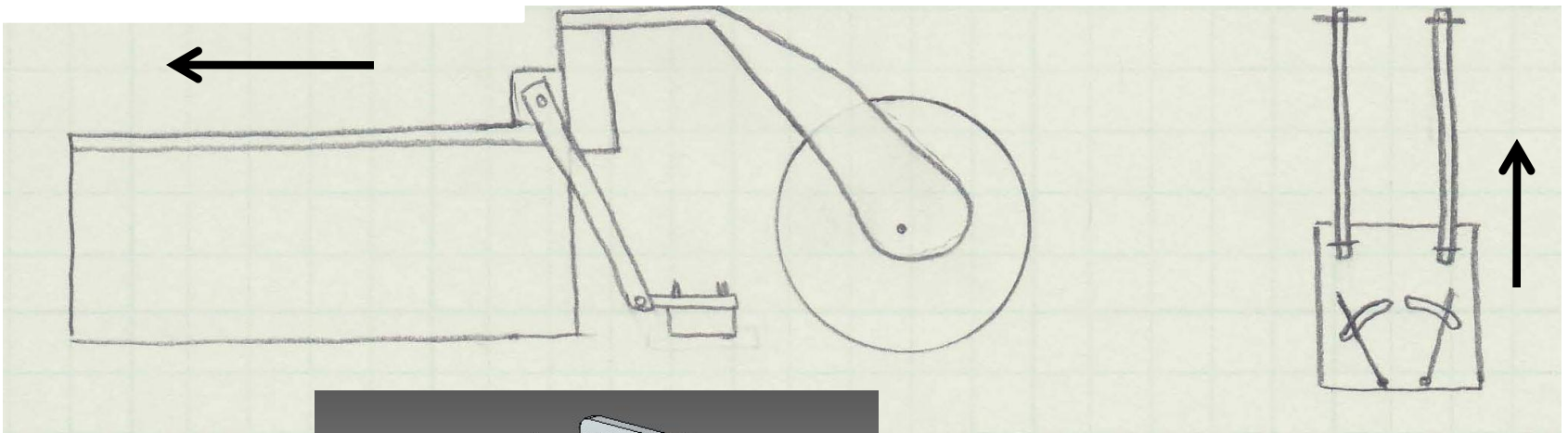
Dirt Recovery Alternatives

- Self Adjusting Concept

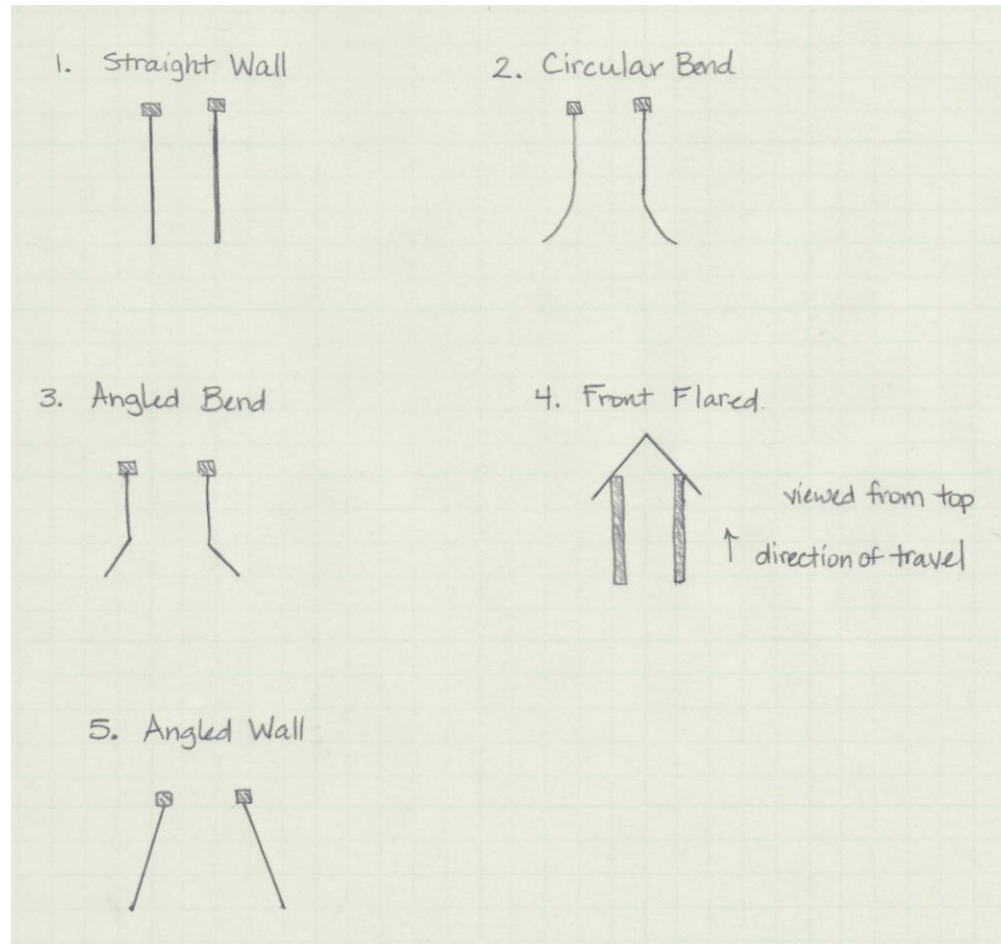


Dirt Recovery Alternatives

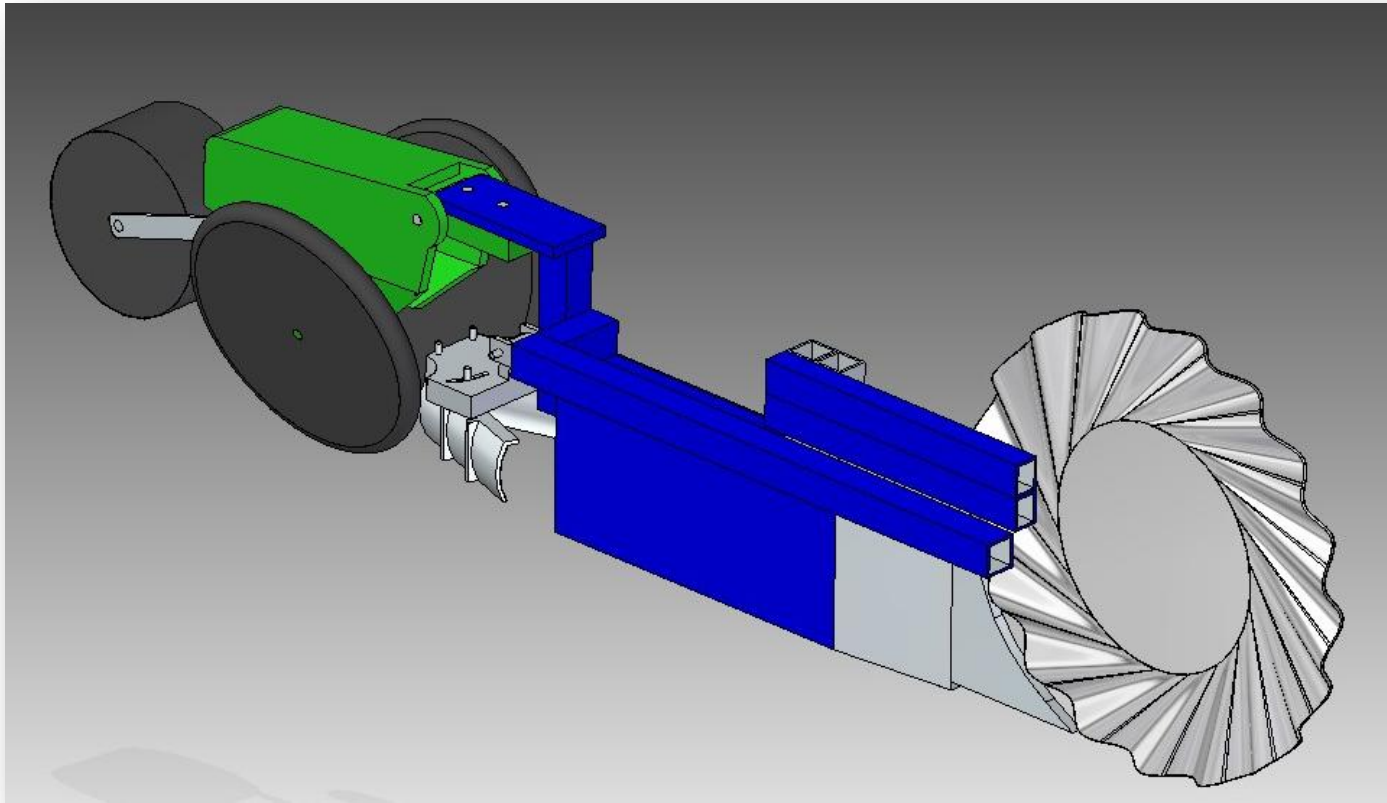
- Two Bar Concept



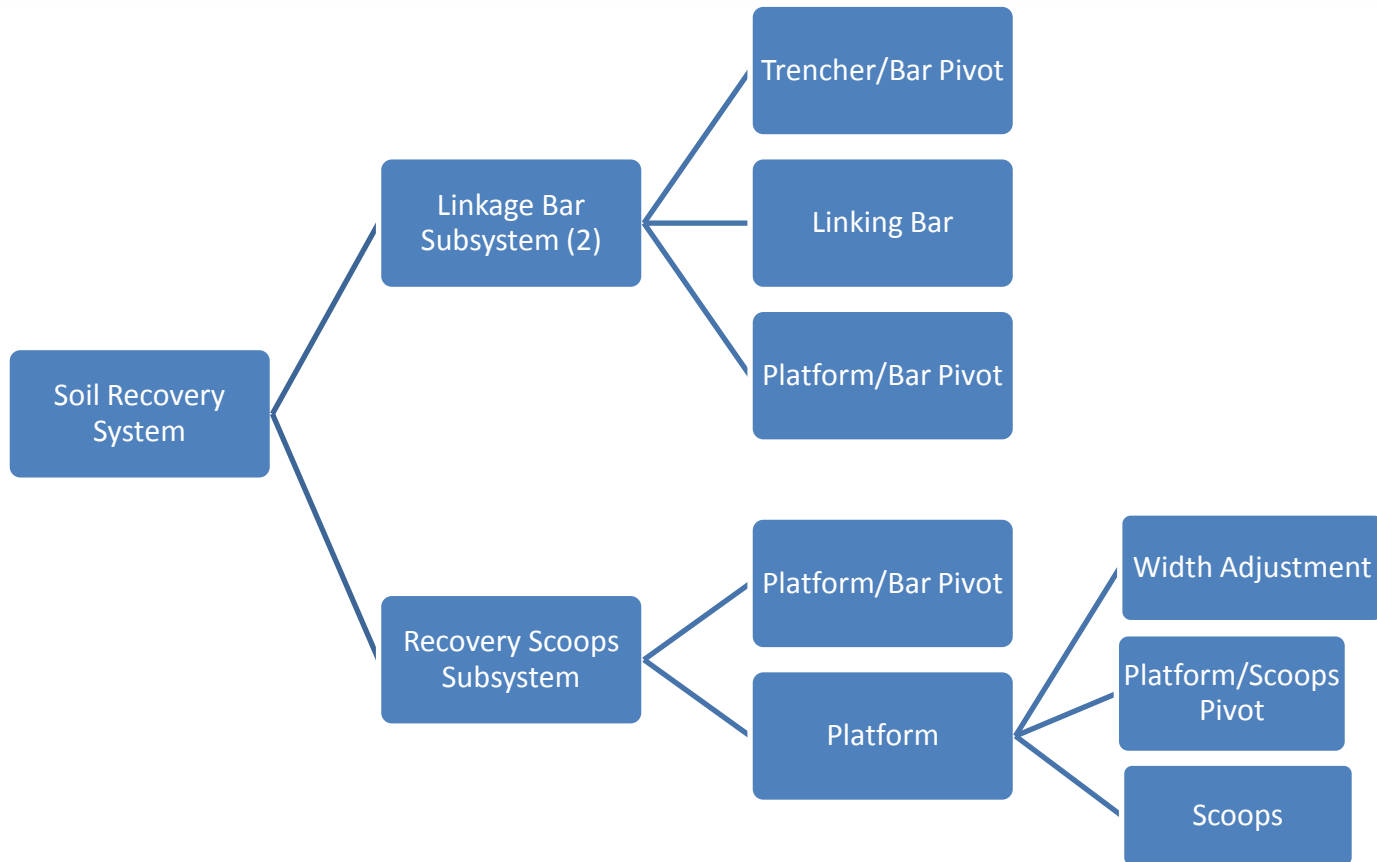
Trencher Wall Alternatives



Final Concept



Dirt Recovery Product Hierarchy

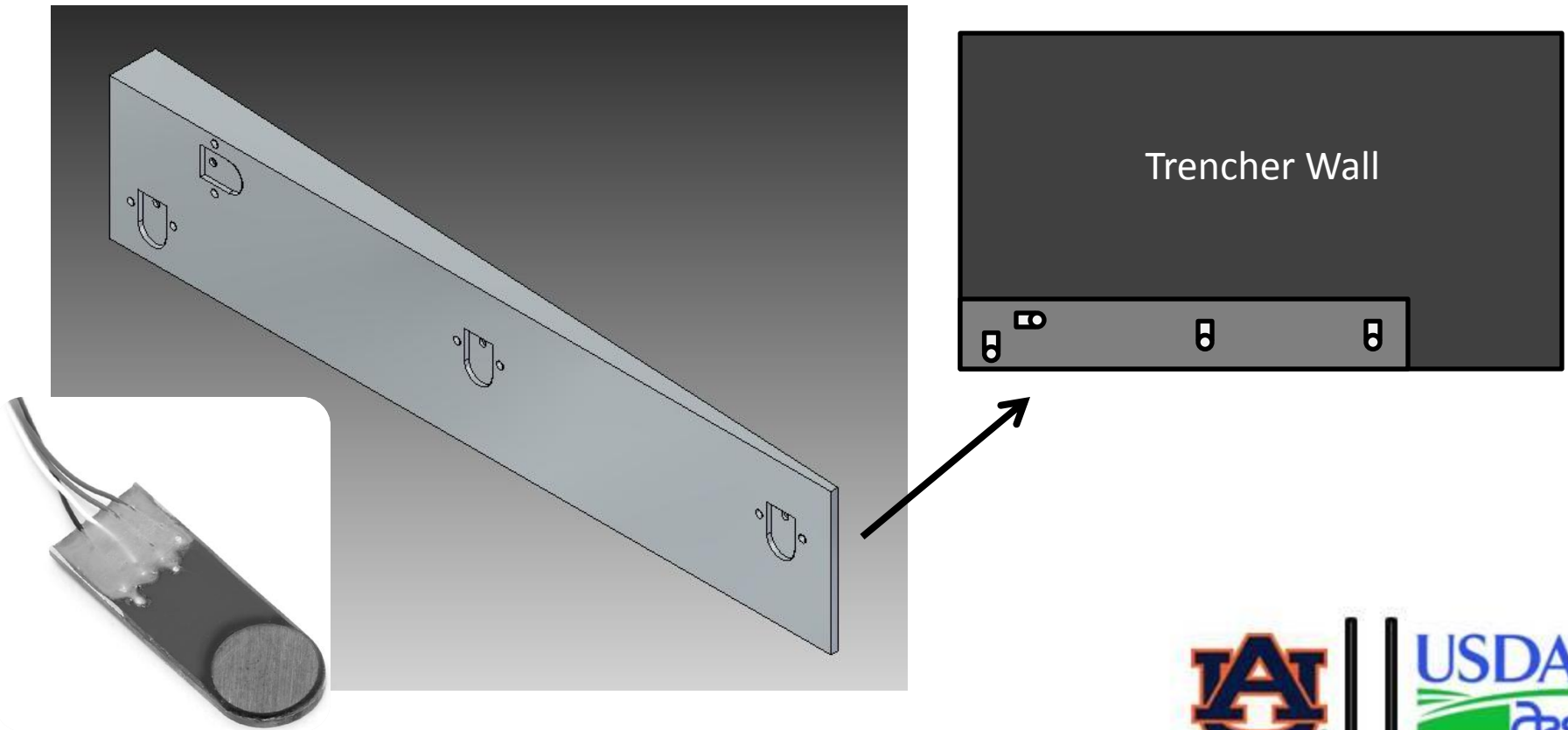


Bill of Materials

Material	Size	Quantity	Retailer	Cost
Steel Flat Bar	1 x 12 x ¼"	2	McMaster-Carr	\$ 22.14
Steel Plate	6 x 6 x 1"	1	McMaster-Carr	\$ 40.31
Steel Flat Bar	5 x 18 x ¼"	1	McMaster-Carr	\$ 56.68
Bolts	¼ -20 x 1.5"	8	McMaster-Carr	\$ 0.64
Nuts	¼ - 20	6	McMaster-Carr	\$ 0.18
Wing Nuts	¼ - 20	2	McMaster-Carr	\$ 0.20
Labor		3		\$ 105.00
			TOTAL COST	\$ 225.15

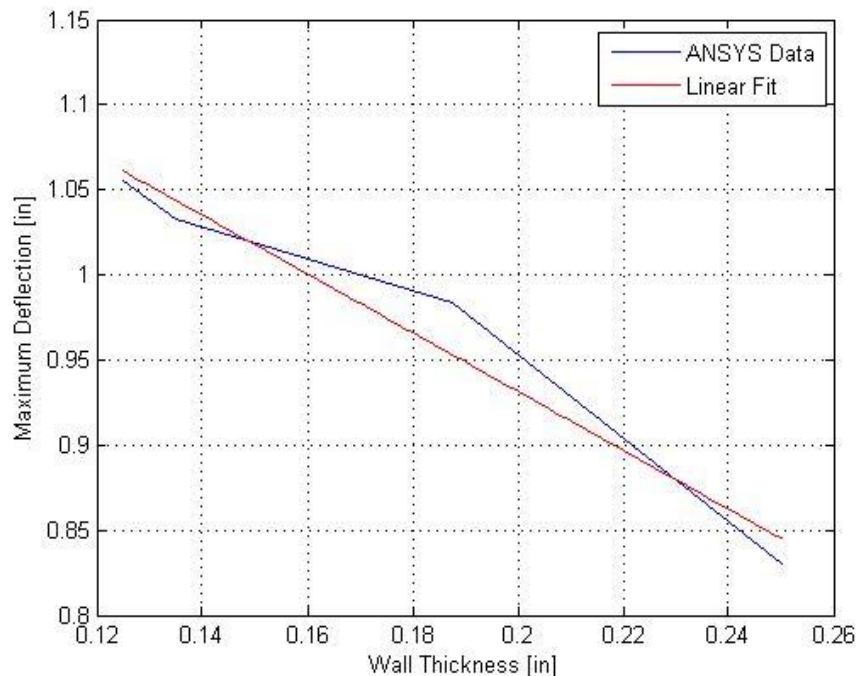
Preliminary Analysis

- Trencher Wall Pressure Analysis

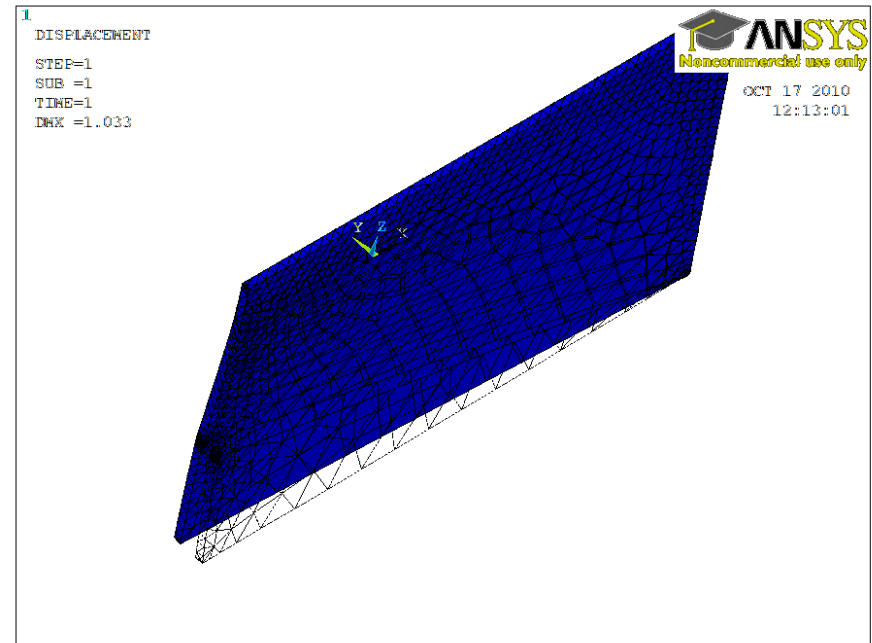


Preliminary Analysis

- Trencher Wall ANSYS Analysis

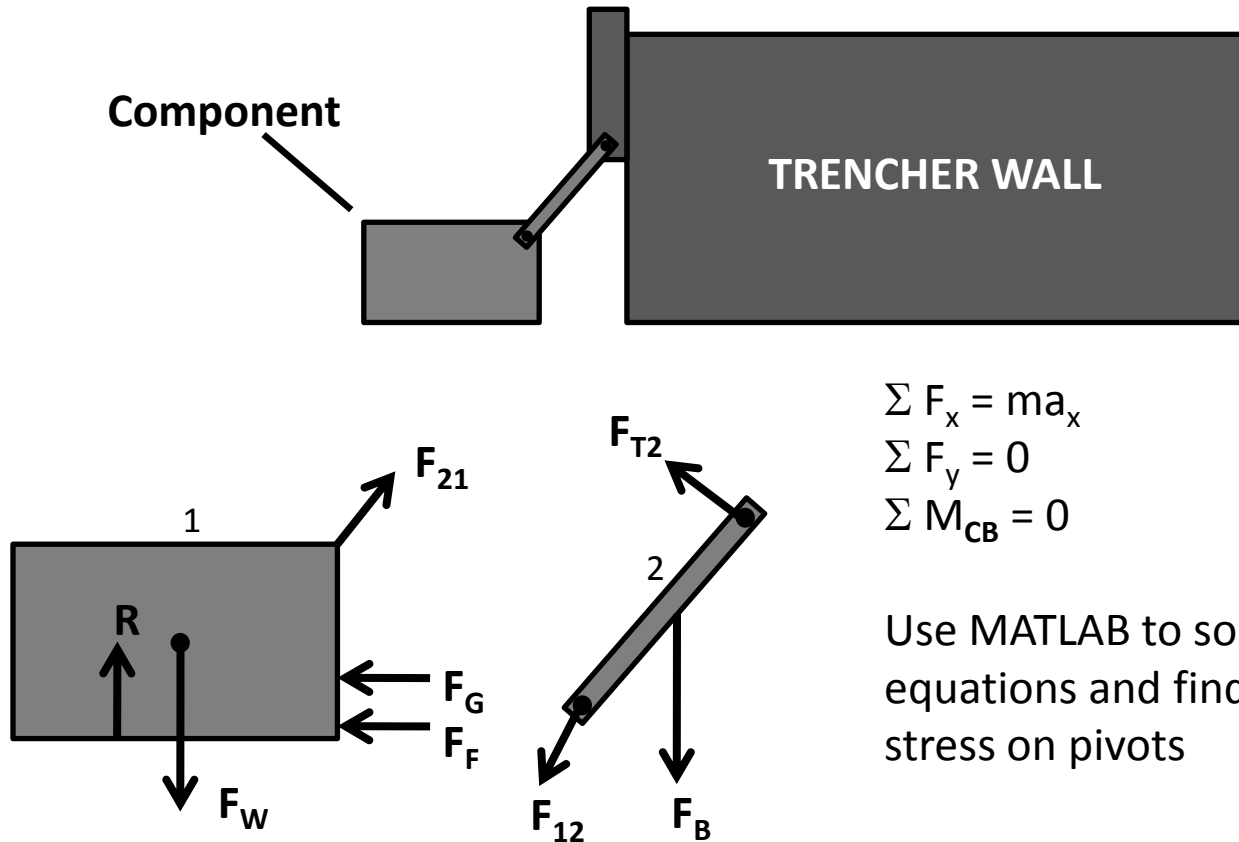


Wall Deflection vs. Wall Thickness
(40 psi Pressure)



Preliminary Analysis

- Dirt Recovery Mechanism FBD Analysis



$$\begin{aligned}\Sigma F_x &= ma_x \\ \Sigma F_y &= 0 \\ \Sigma M_{CB} &= 0\end{aligned}$$

Use MATLAB to solve force equations and find shear stress on pivots

Questions?

