Summer Internship Report

Tyler Jones

Engineering Intern

Supervised By: **Kyle Schneider**

Custom Equipment Design

Manufacturing

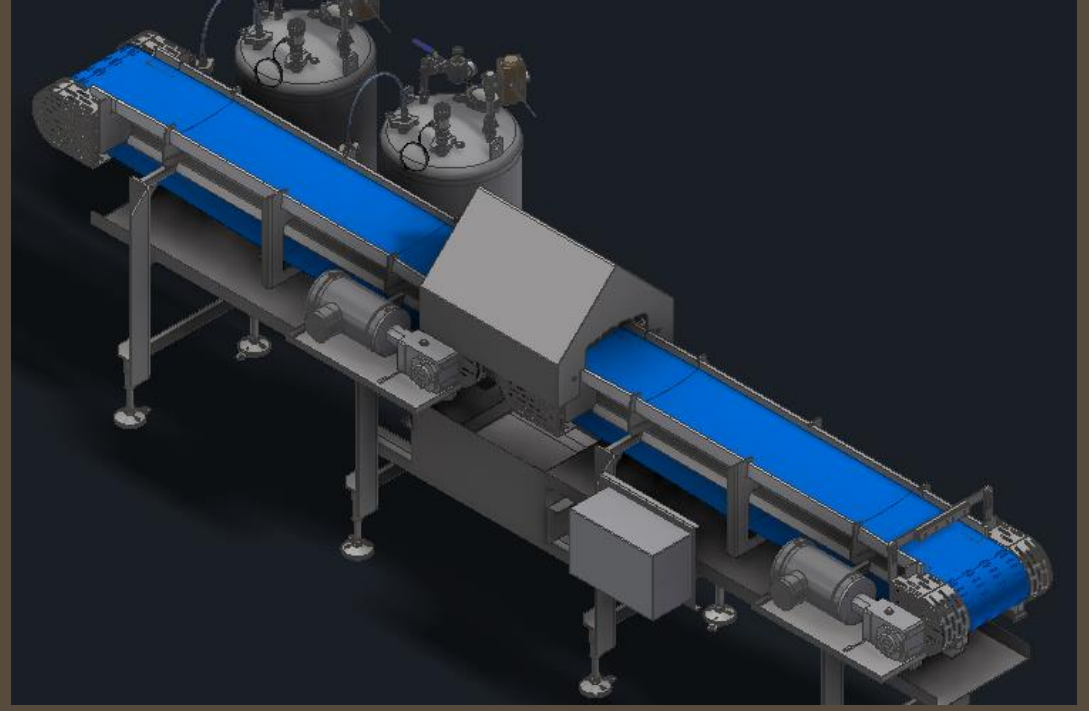
Presented To: **Executive Team**

Tweet/Garot Mechanical Inc.

Summer 2024

Manufacturing Overview

- Process Improvement
  - Reduce programming lead time
  - Improve tracking of shop inventory
  - Increase estimating accuracy



Manufacturing Process Improvement

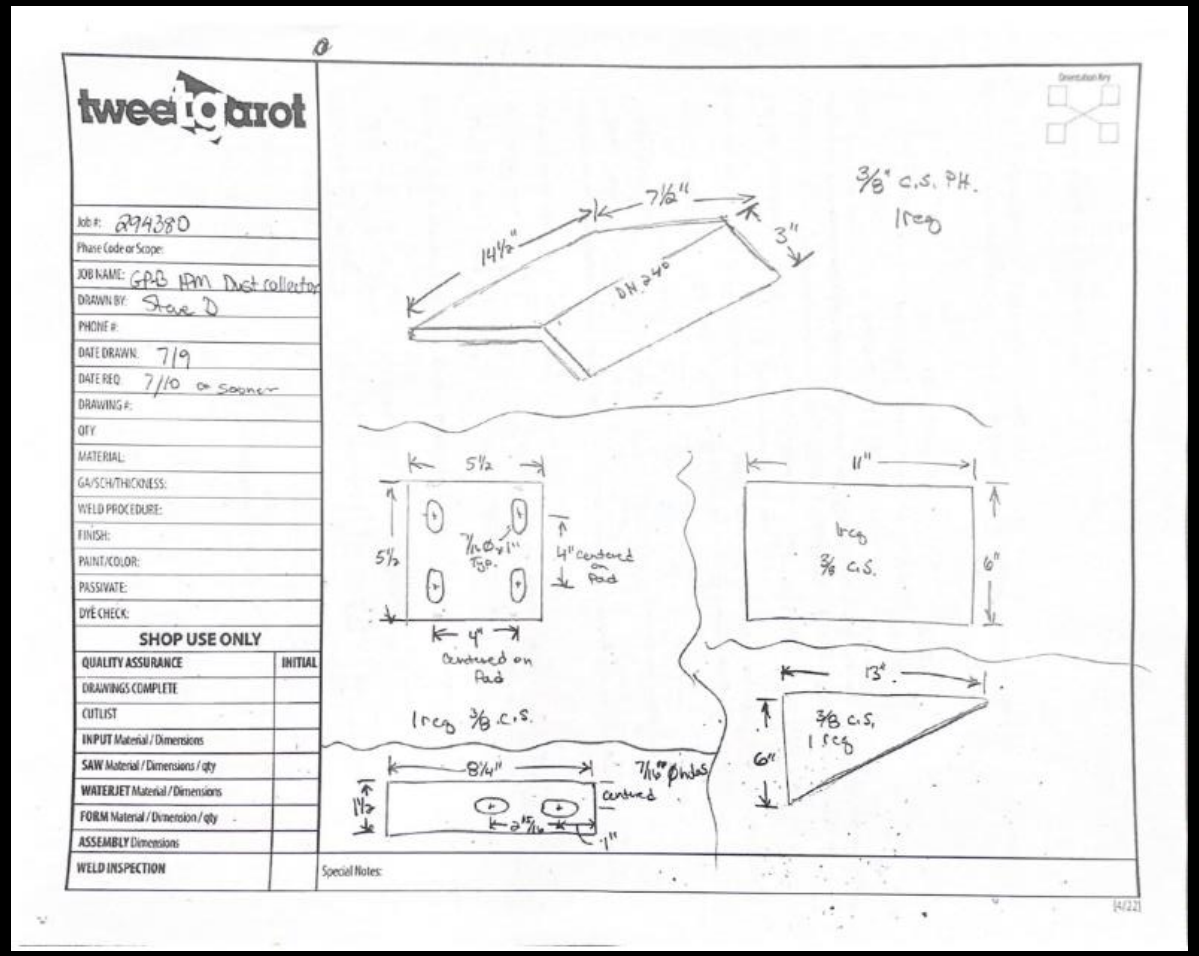
Goal

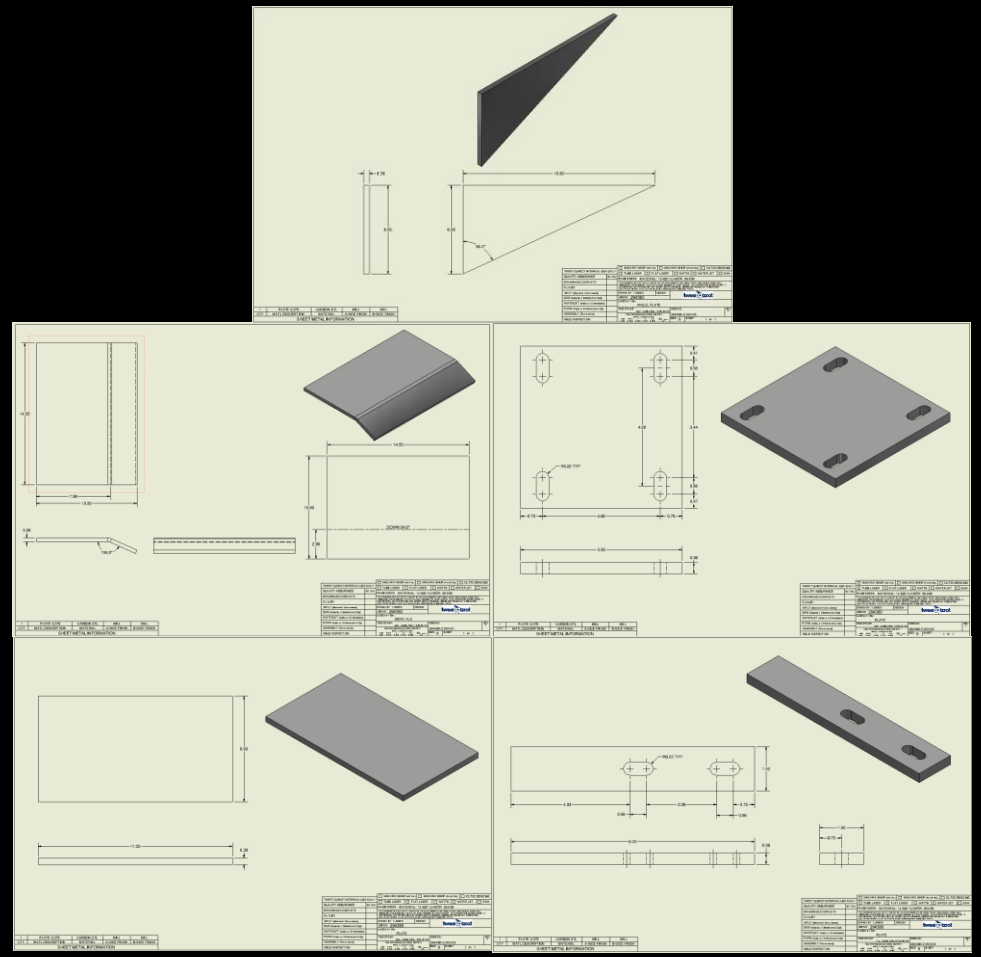
- Bridge the gap between field employees and shop programmers to reduce programming lead time
  - Hand Drawings → Engineering Drawings
  - Improve tracking of inventory, Bills of Materials (BOMs), and Bills of Operations (BOOs), and increase estimating accuracy.

Workflow

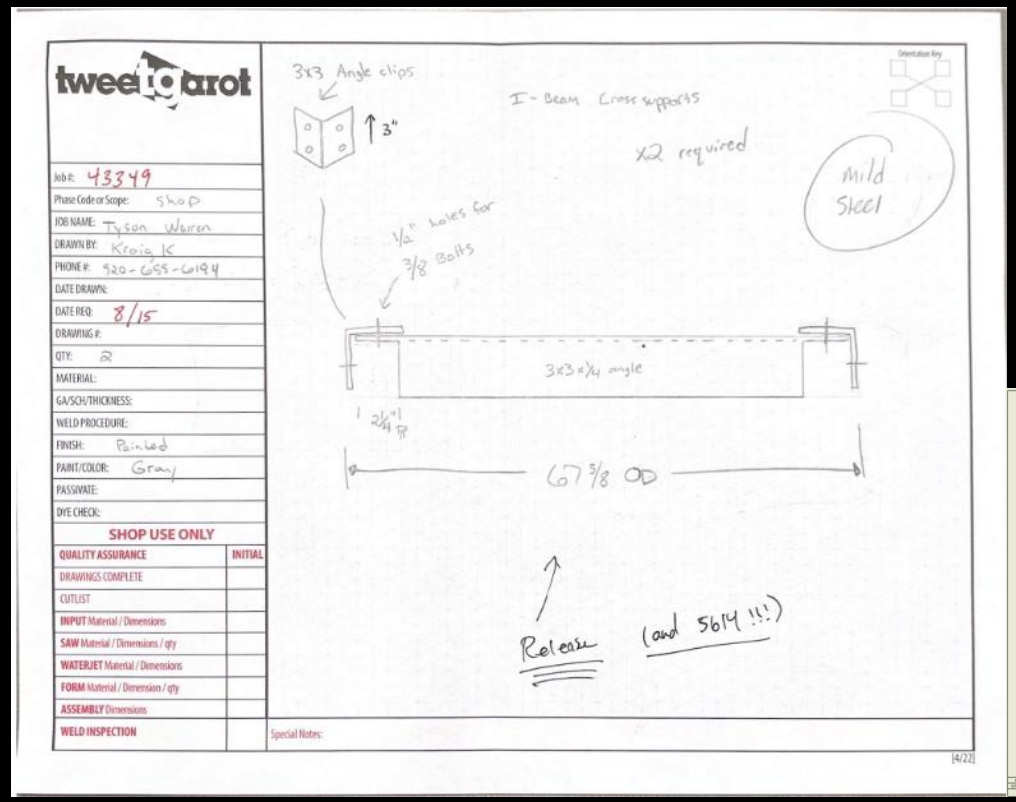
- **Receive Hand Drawings:** Design request from shop scheduler
- **Design:** Create part(s) or assembly via CAD (Autodesk Inventor)
- **Engineering Drawings:** Create engineering drawings and import files to Autodesk Vault
- **Data Integration:** Transfer metadata into manufacturing software (SAP)
- **Release Process:** Finalize and release the process for production

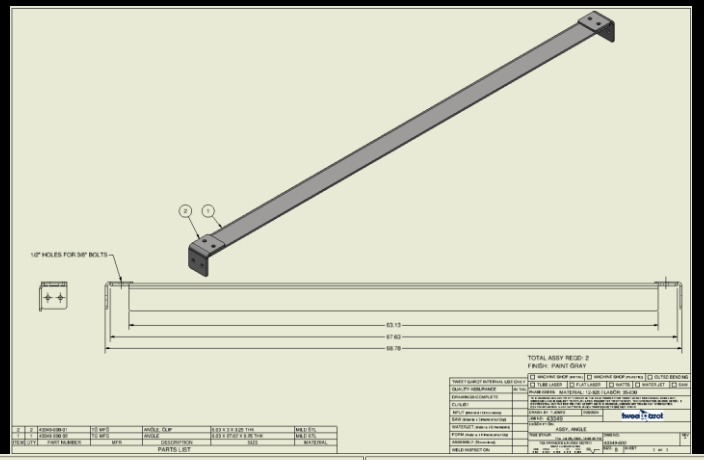
Example: Georgia Pacific – Dust Collector

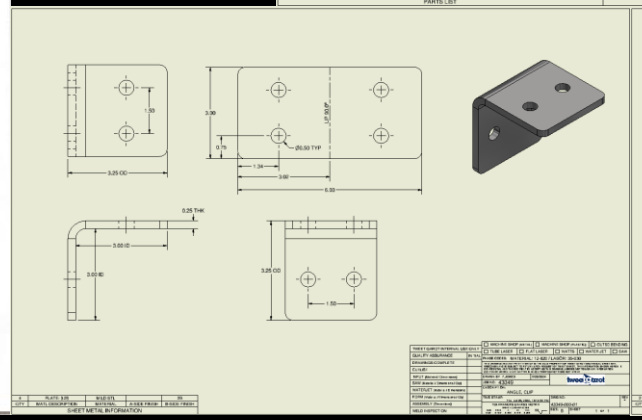


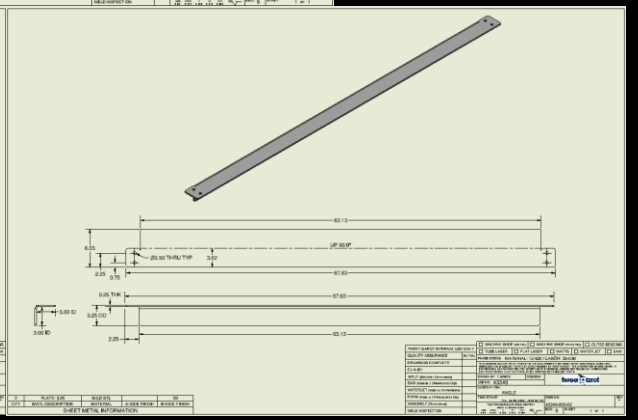


Example: Tyson Warren – I-Beam Cross Supports



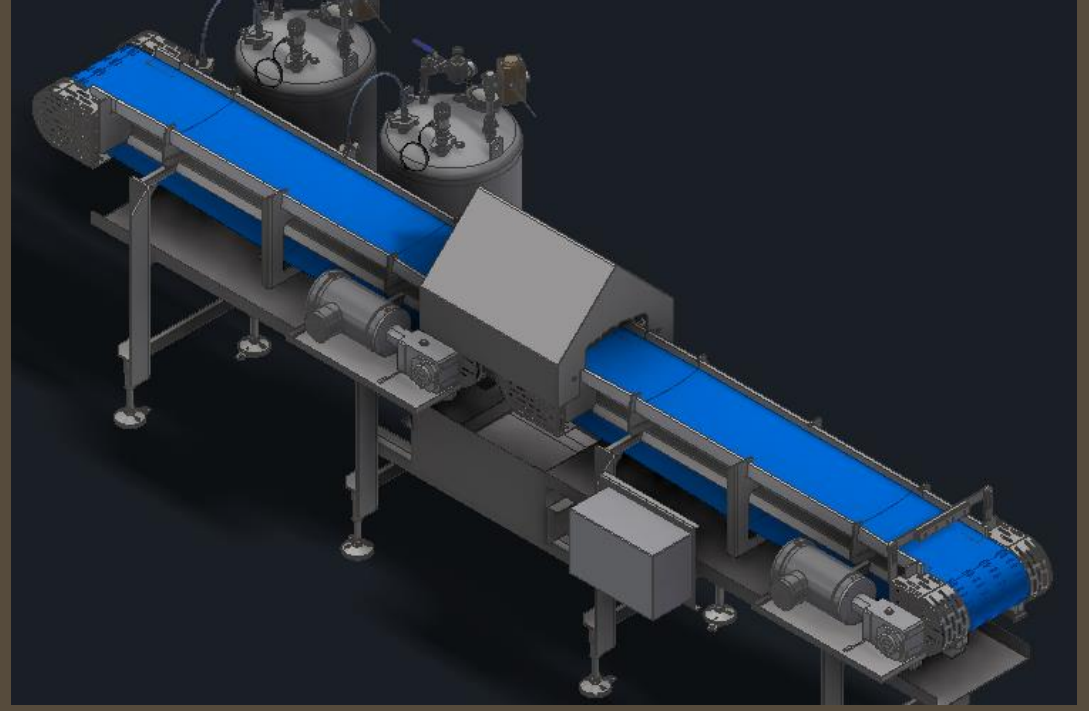




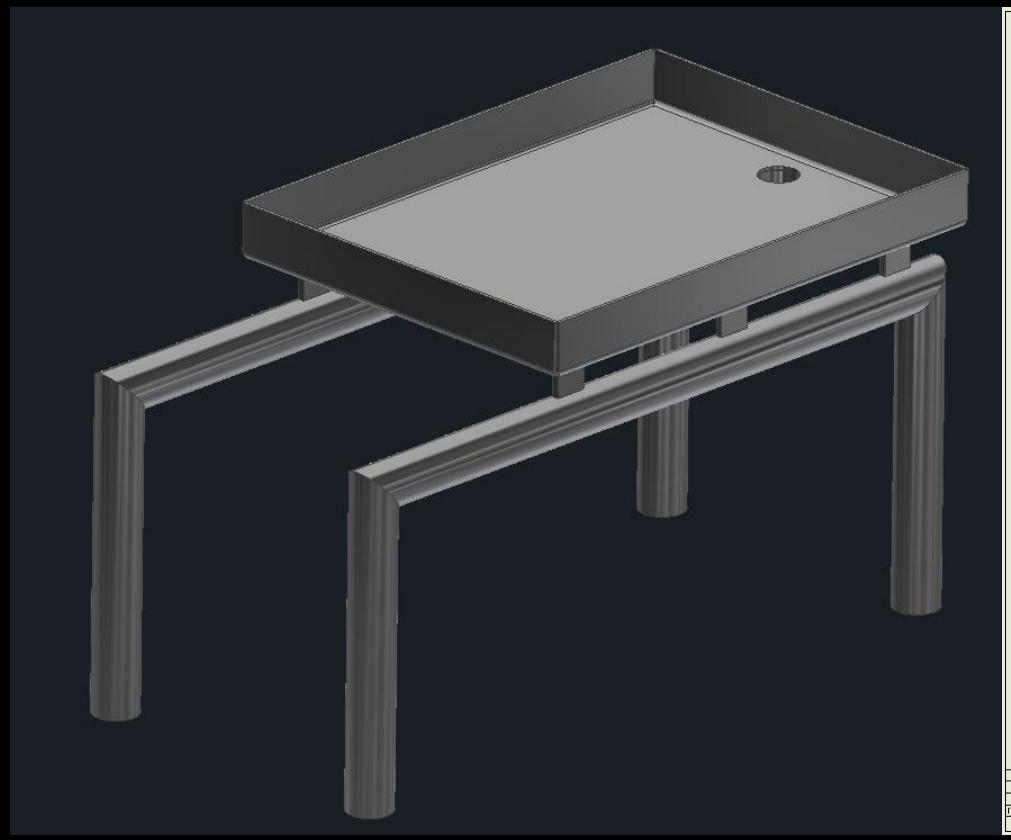


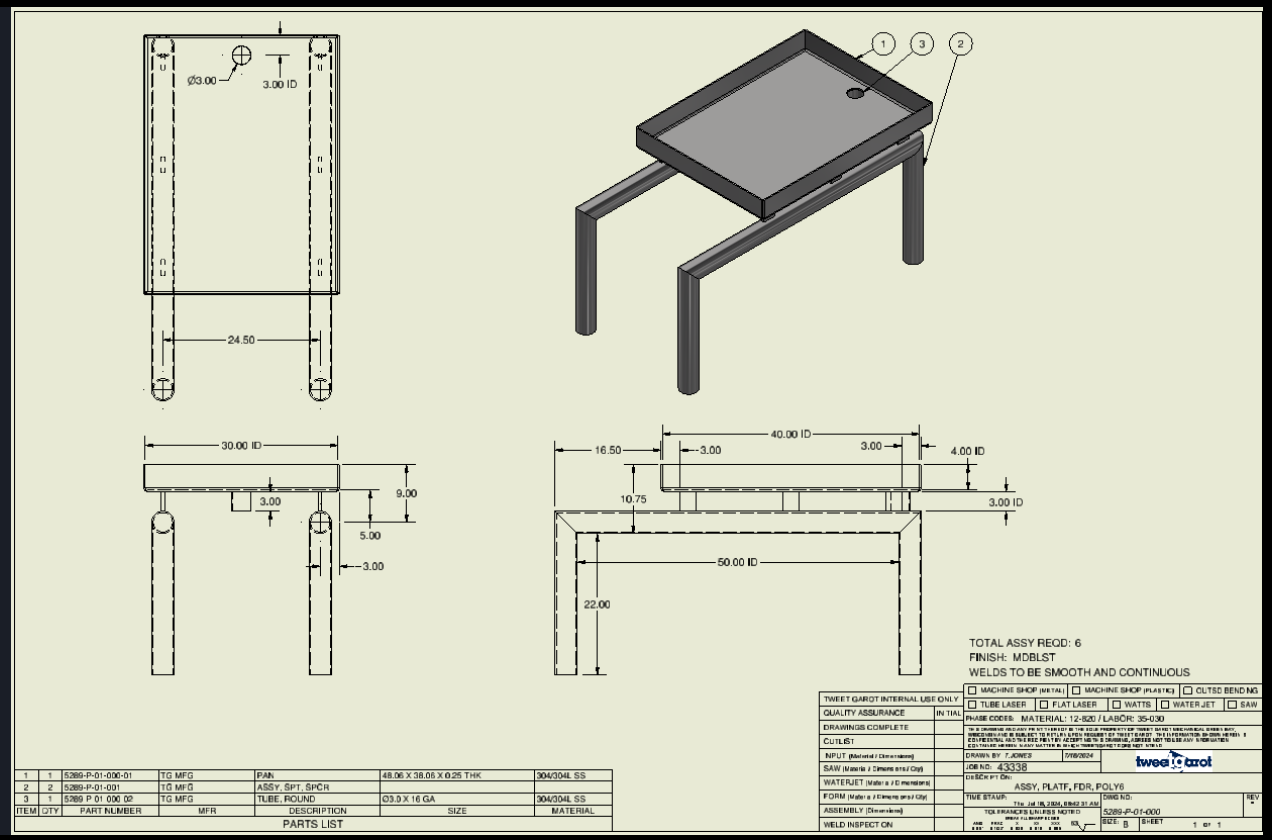
Custom Equipment Design Overview

- Conagra Foods
  - Feeder Platforms
  - Access Platforms
  - Conveyor Lid Counterweight
- Tyson Foods
  - Peeler Table
- Great Lakes Cheese
  - Blender Platform

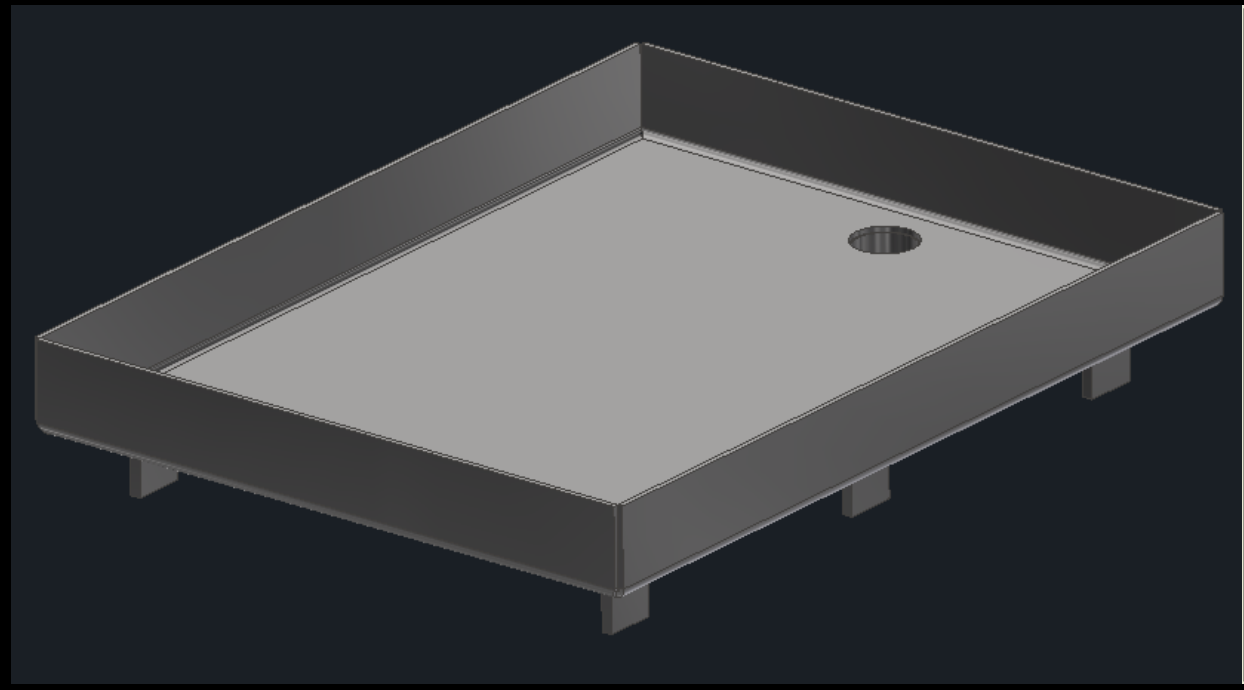


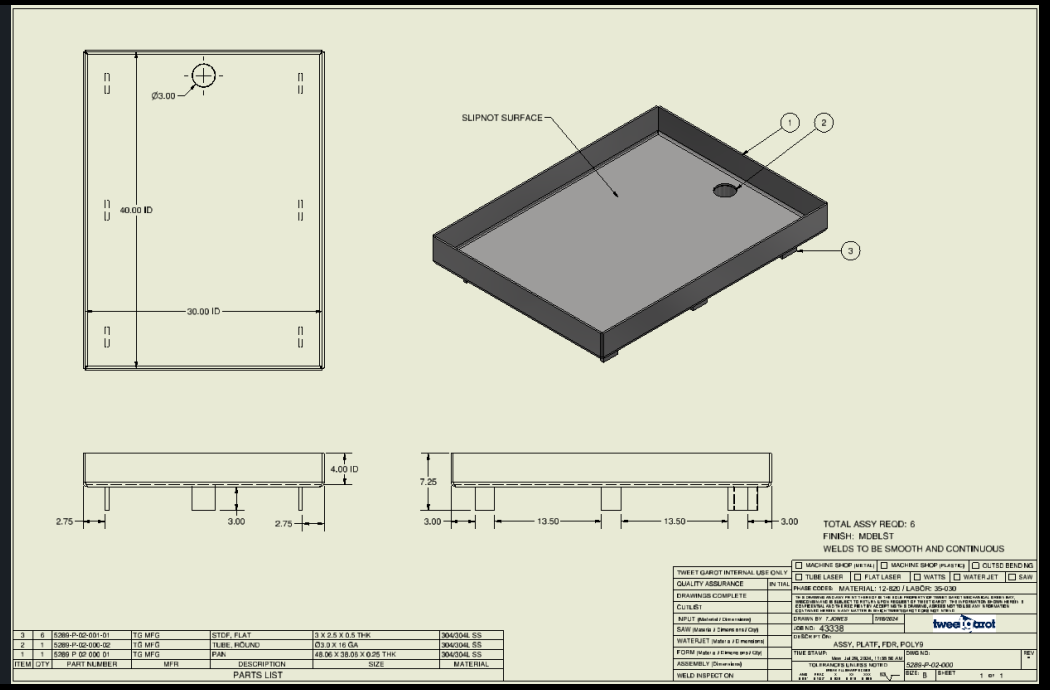
Feeder Platforms: Poly 6



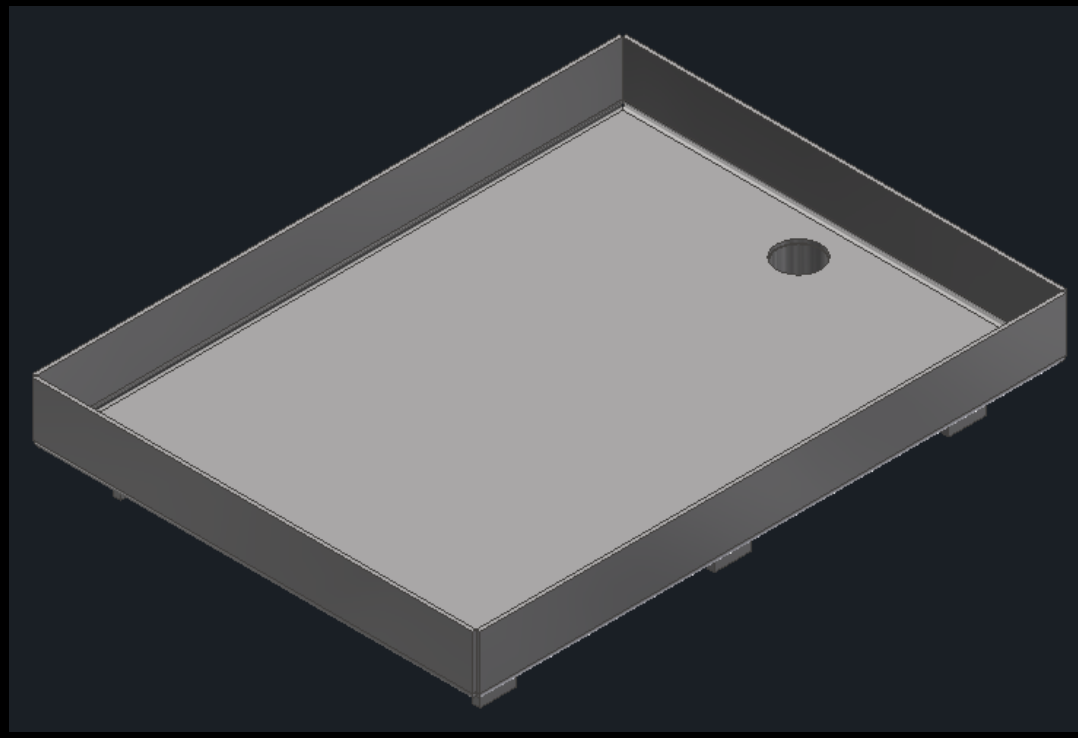


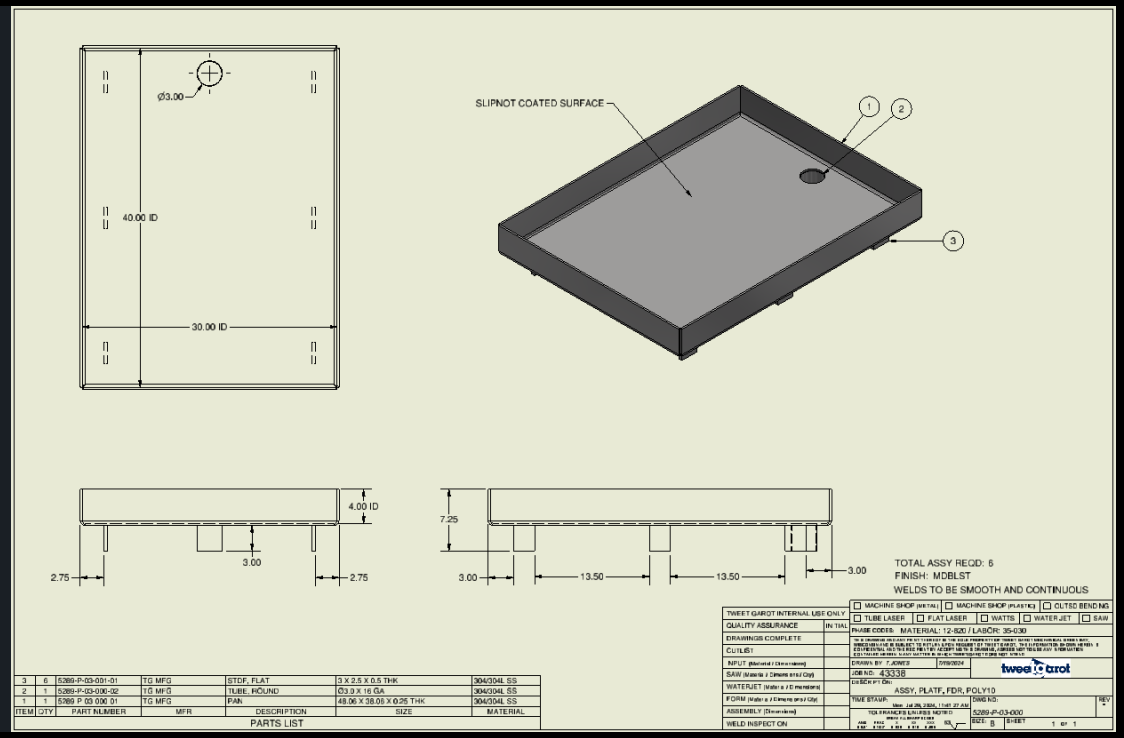
Feeder Platforms: Poly 9



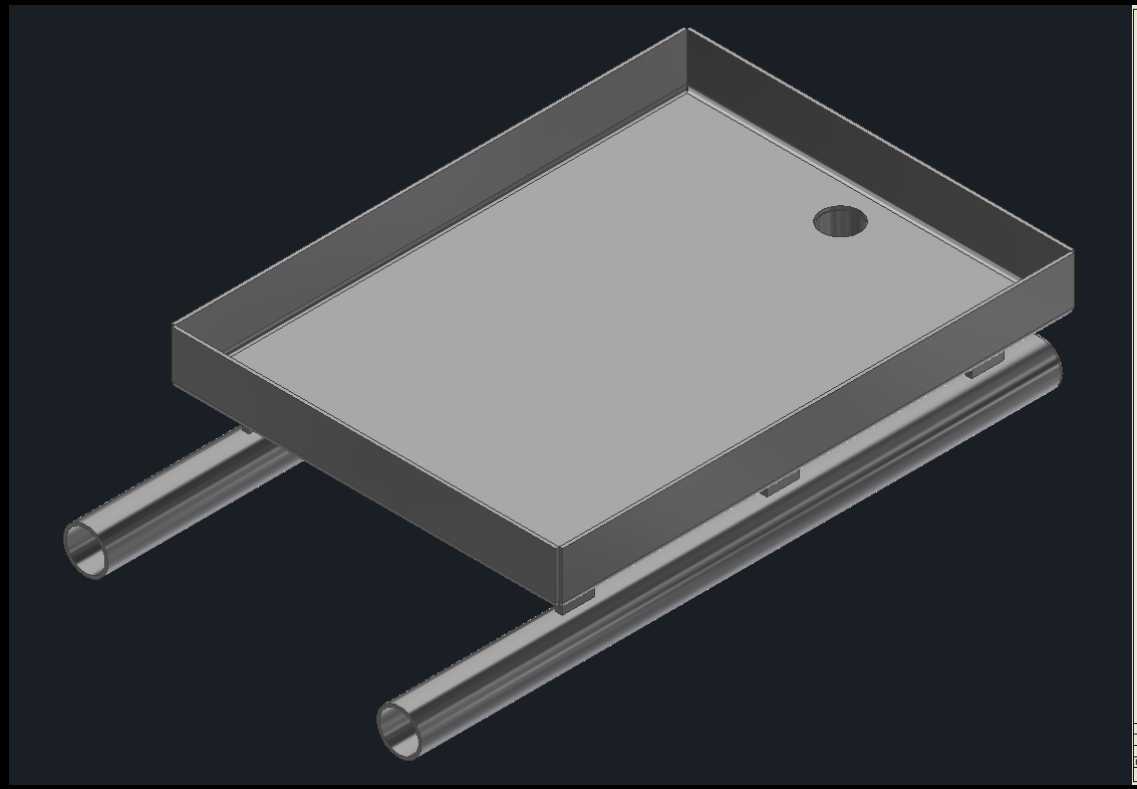


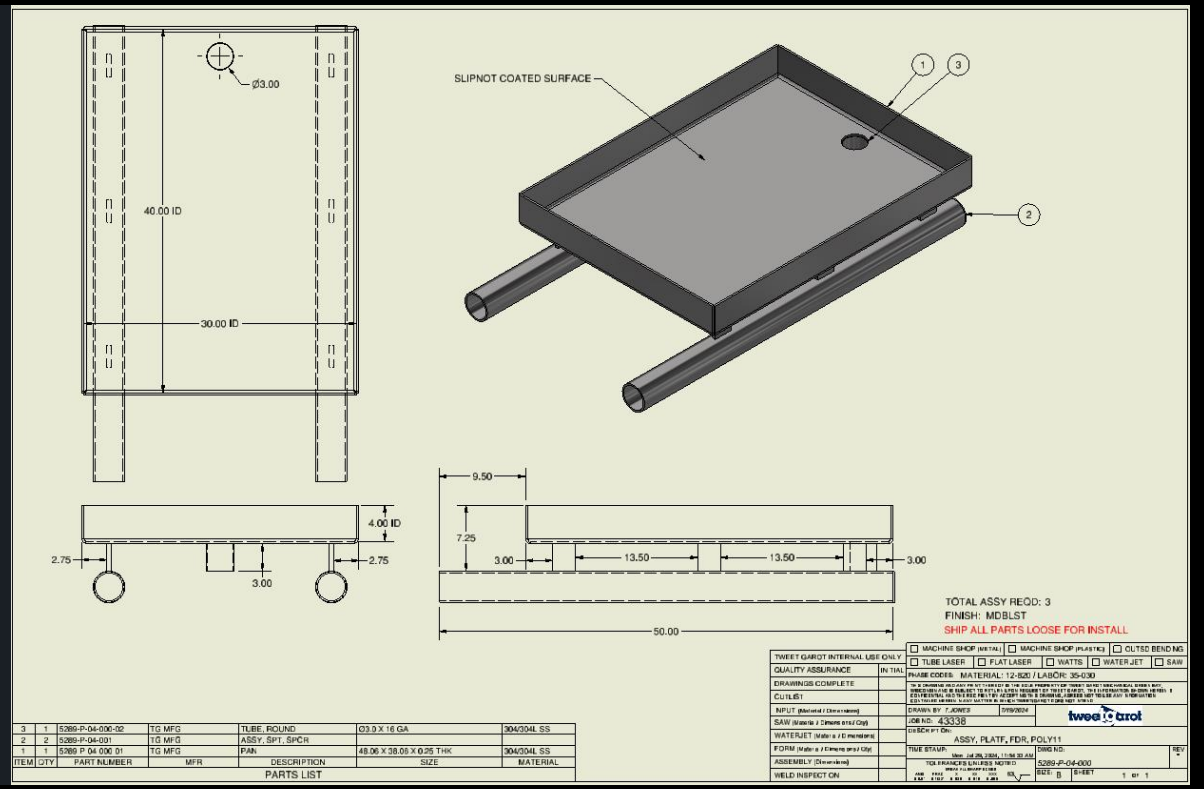
Feeder Platforms: Poly 10



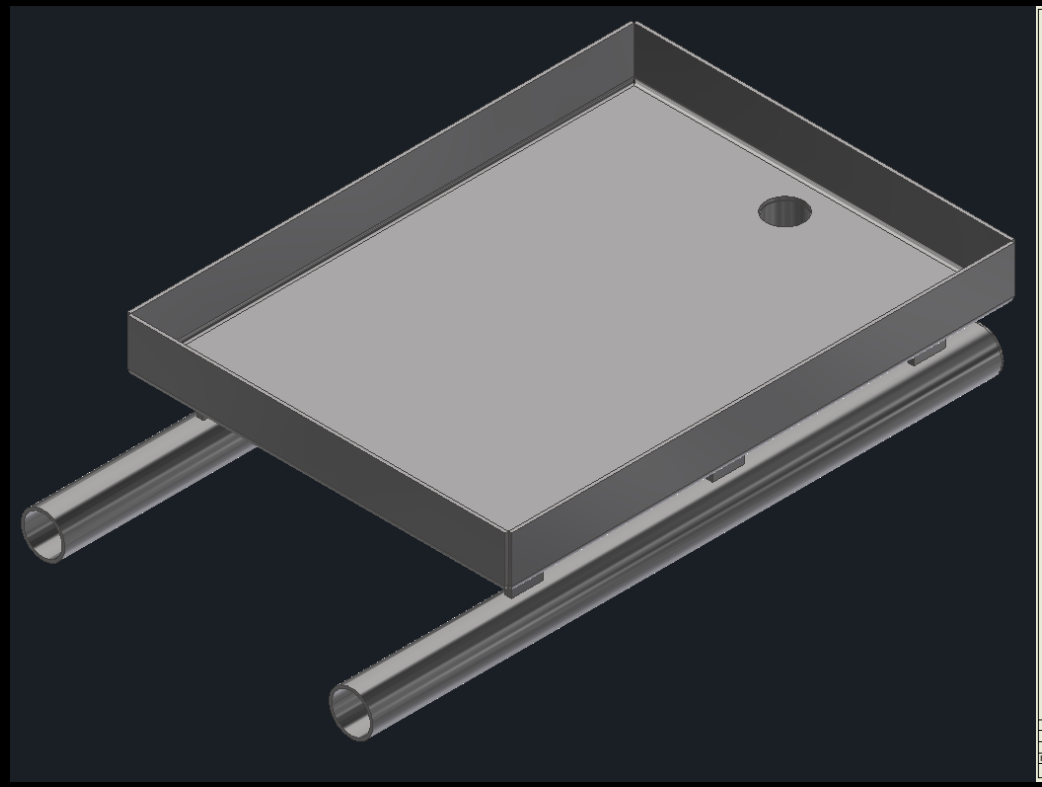


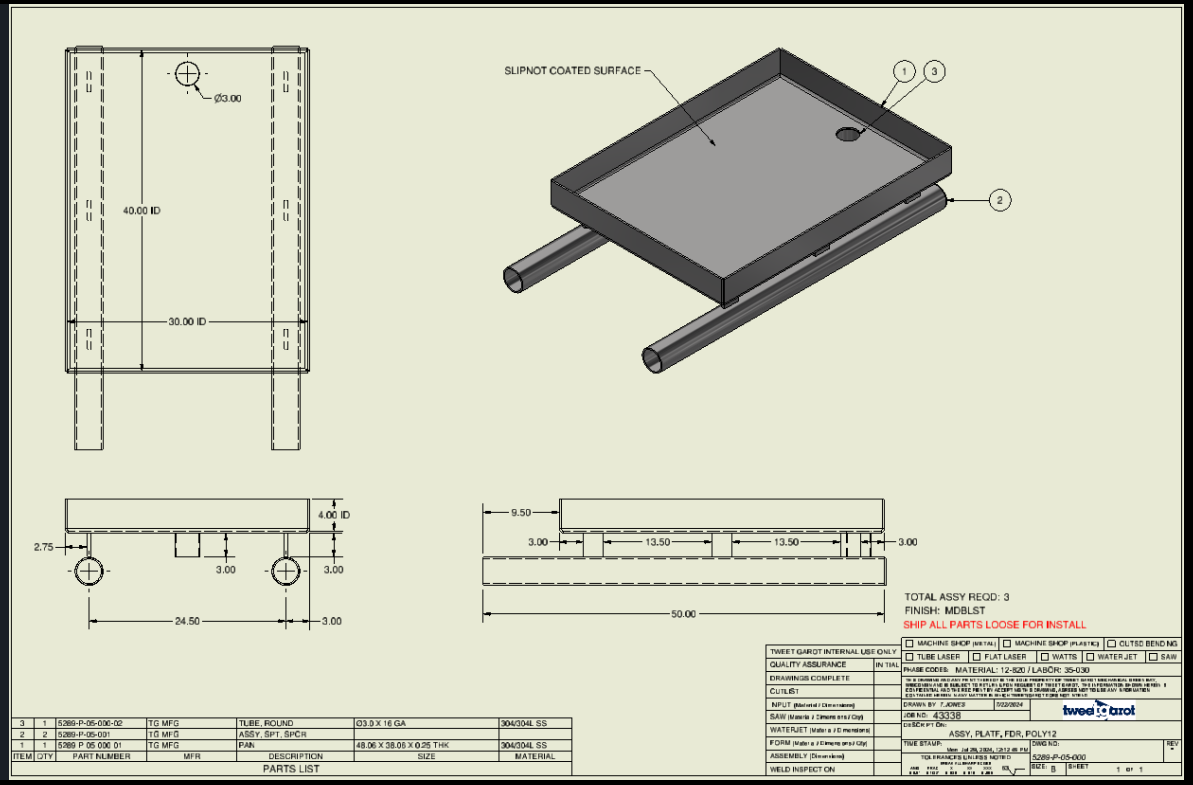
Feeder Platforms: Poly 11



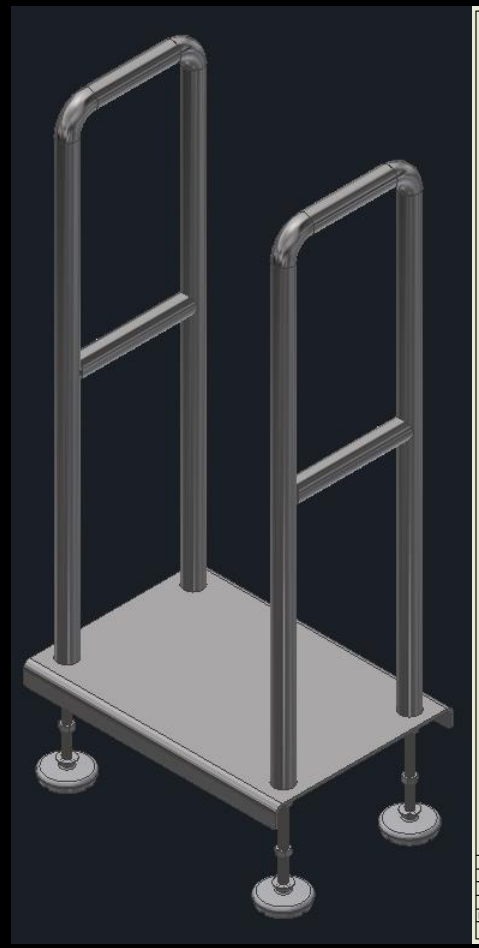


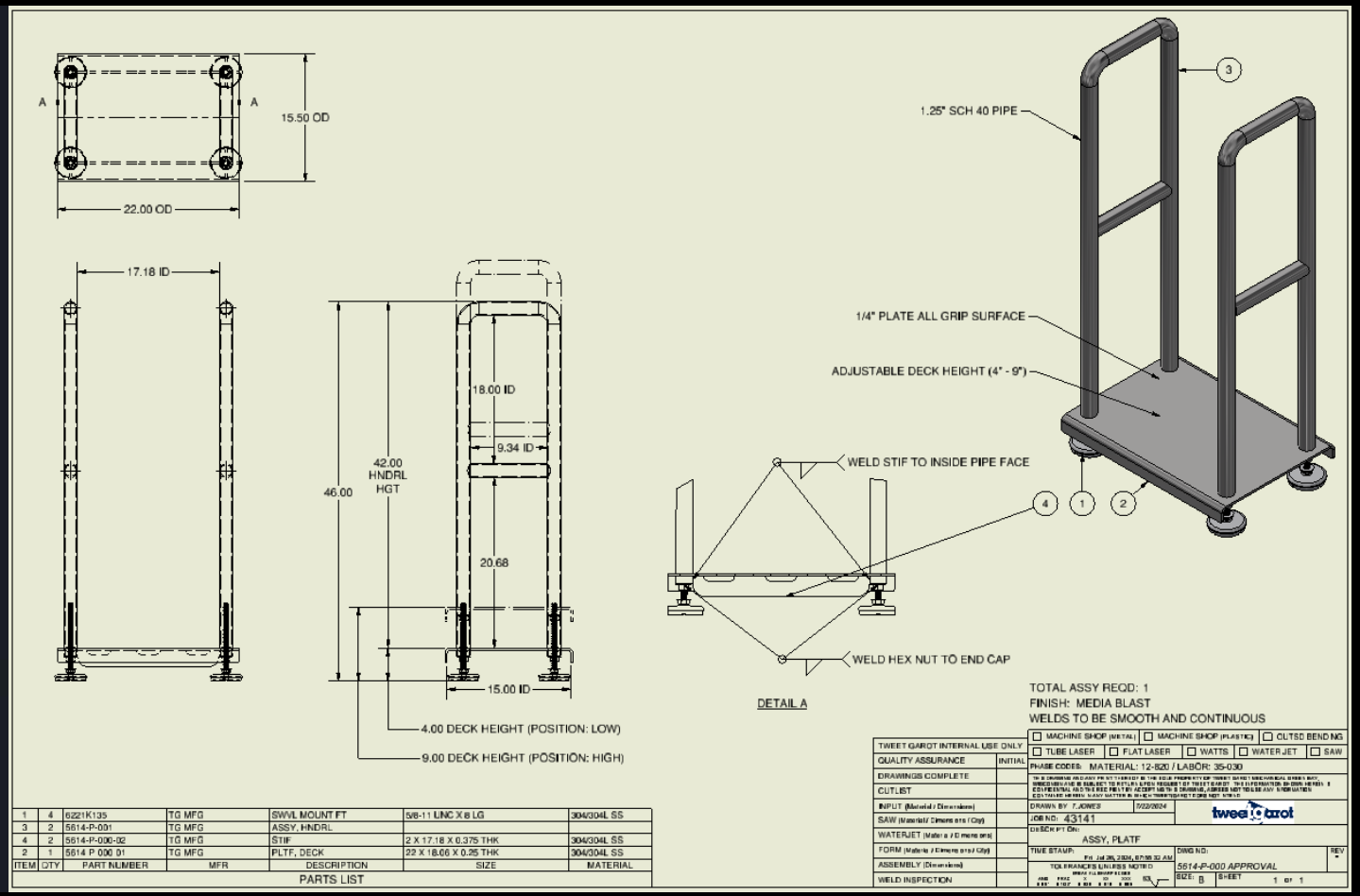
Feeder Platforms: Poly 12





Access Platform: A





ITEM	QTY	PART NUMBER	MFR	DESCRIPTION	SIZE	MATERIAL
1	4	6221K135	TG MFG	SWVL MOUNT FT	5/8-11 LINC X 8 LG	304/304L SS
3	2	5614-P-001	TG MFG	ASSY, HNDRL		
4	2	5614-P-000-02	TG MFG	STIF	2 X 17.18 X 0.375 THK	304/304L SS
2	1	5614 P 000 01	TG MFG	PLTF, DECK	22 X 18.06 X 0.25 THK	304/304L SS

PARTS LIST

TOTAL ASSY REQD: 1
FINISH: MEDIA BLAST
WELDS TO BE SMOOTH AND CONTINUOUS

TWEET GAROT INTERNAL USE ONLY	INITIAL
QUALITY ASSURANCE	
DRAWINGS COMPLETE	
CUTLIST	
INPUT (Material / Dimensions)	
SAW (Material / Dimensions / Qty)	
WATERJET (Material / Dimensions)	
FORM (Material / Dimensions / Qty)	
ASSEMBLY (Dimensions)	
WELD INSPECTION	

☐ MACHINE SHOP (METAL) ☐ MACHINE SHOP (PLASTIC) ☐ CLTSD BEND NG
☐ TUBE LASER ☐ FLAT LASER ☐ WATTS ☐ WATER JET ☐ SAW

PHASE CODES: MATERIAL: 12-820 / LABOR: 35-030

DRAWN BY: T JONES 5/22/2024

JOB NO: 4341

DESCRIPT ON: ASSY, PLATF

TIME STAMP: Fri Jul 26, 2024, 07:56:32 AM

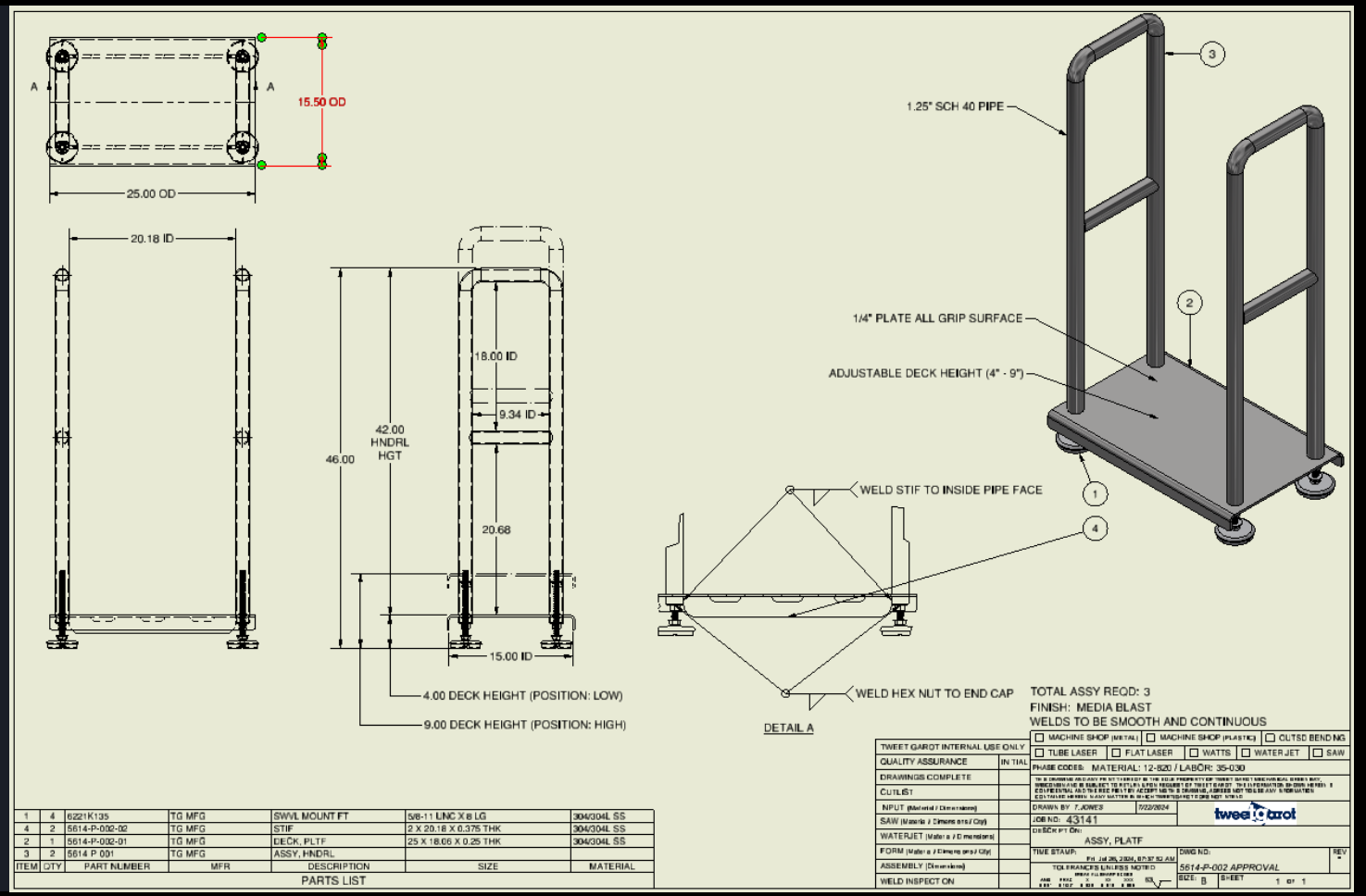
DWG NO: 5614-P-000 APPROVAL

REV: *

TOLERANCES UNLESS NOTED

SIZE: B SHEET 1 OF 1

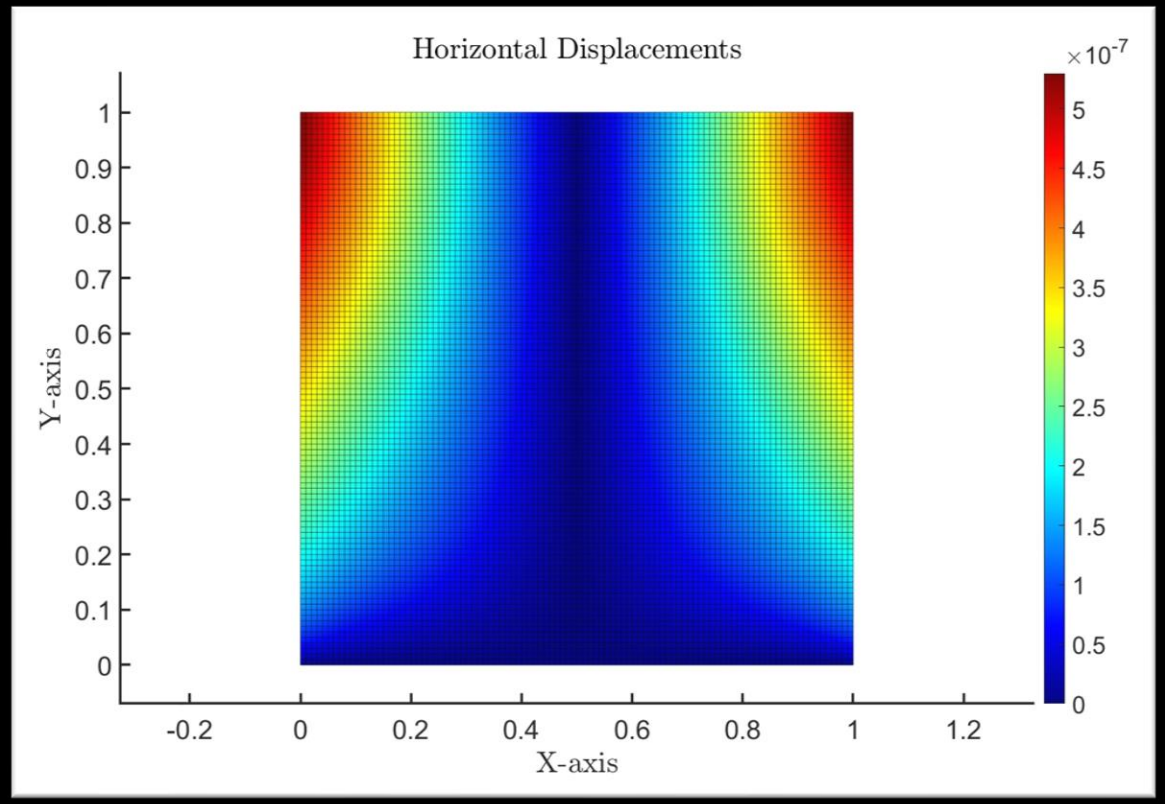
Access Platform: B



Access Platforms

Assess Design Safety

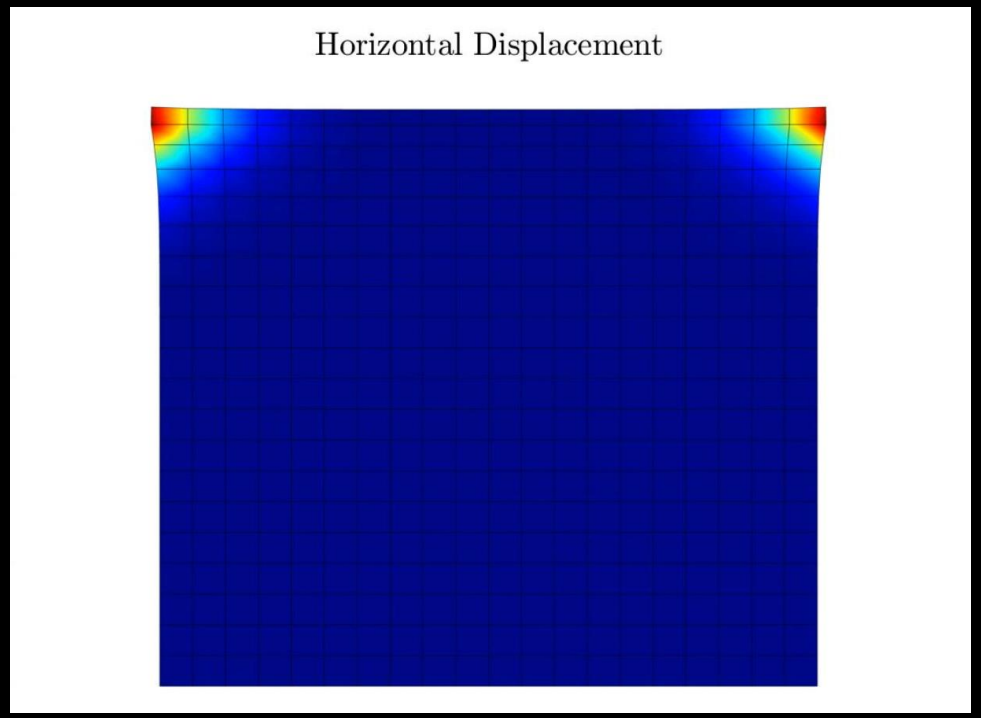
- Enhance Structural Integrity: Add stiffeners between legs
- Finite Element Analysis (FEA)
- Validate NASTRAN Results: Compare with benchmark case
- Perform Detailed FEA
- Analyze Results



Horizontal displacement of benchmark case (~5.2E-07 in)

Access Platforms

- Benchmark Test Case on 2D Plate
  - Uniformly distributed compressive load along top edge
  - Max Error (infinity norm) ~ 3.2E-07 in ✓

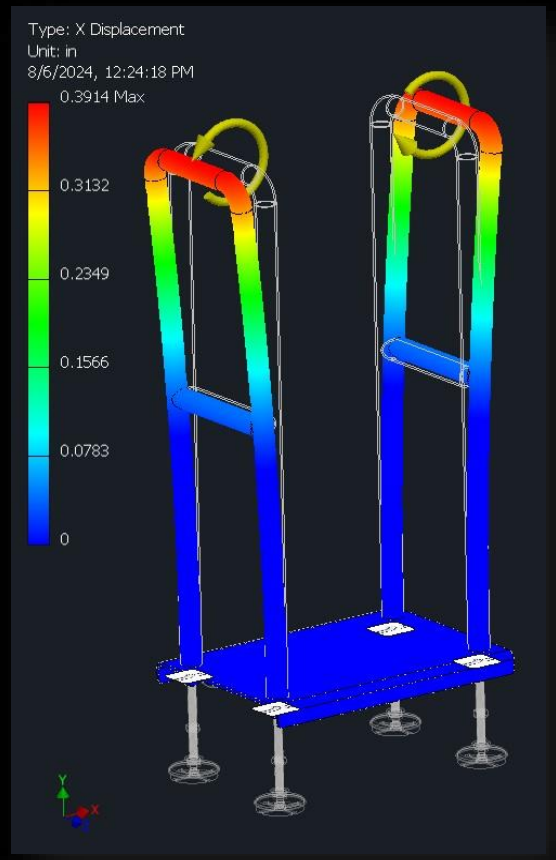


My Programmed Analysis via MATLAB

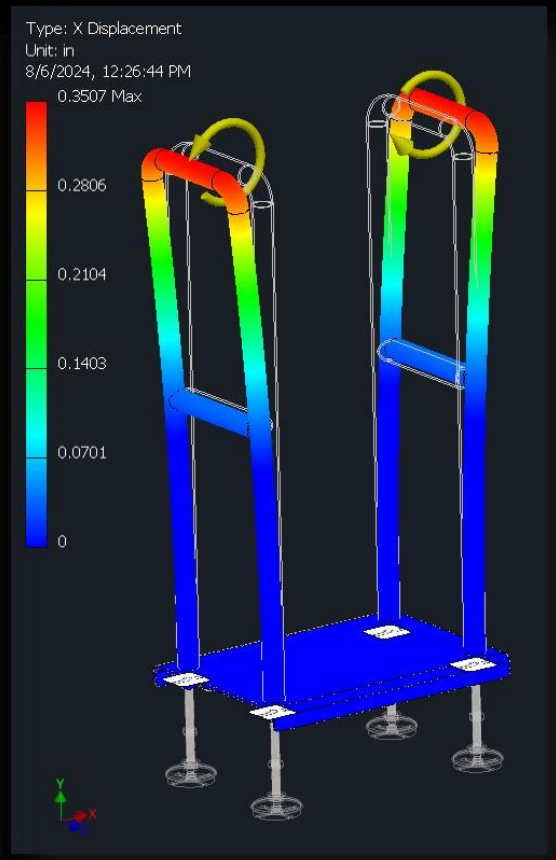
Inventor: Stress Analysis

Access Platforms

Displacement Results

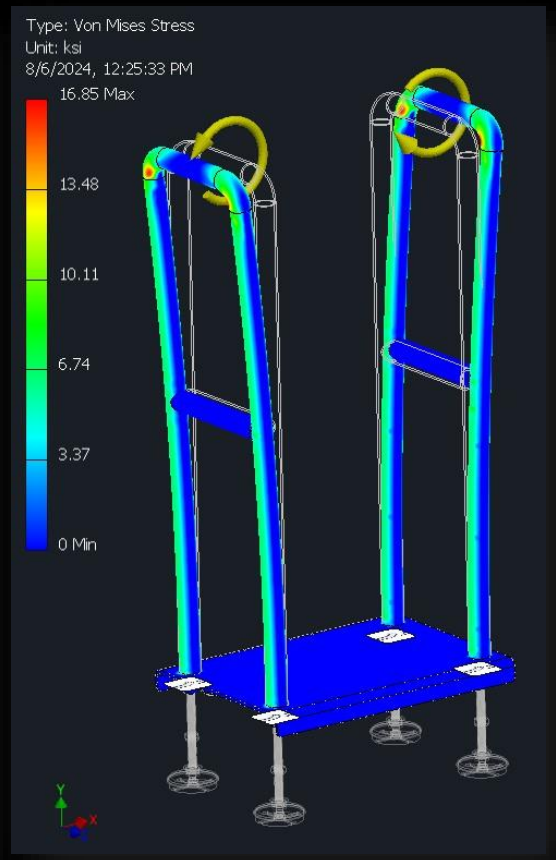


Without Stiffeners

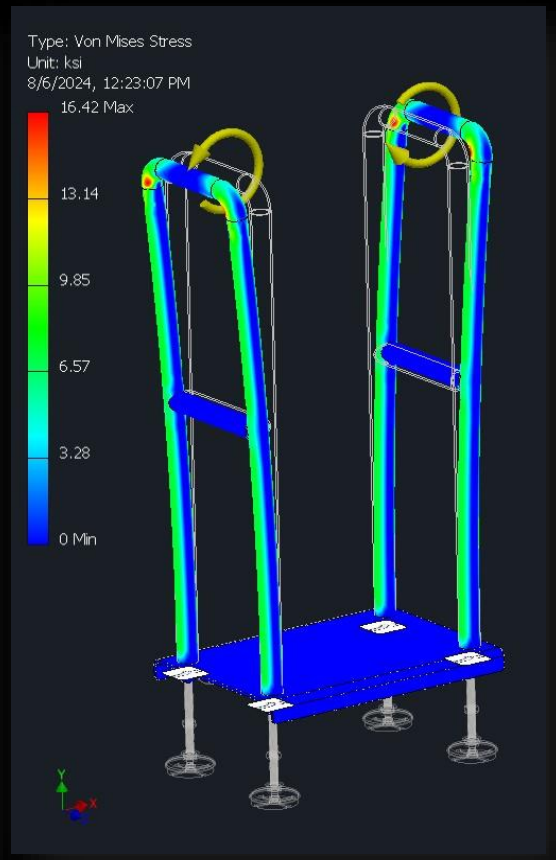


With Stiffeners

Stress Results



Without Stiffeners

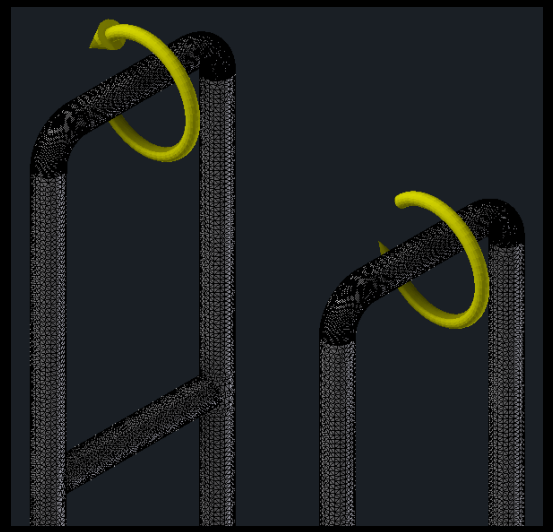


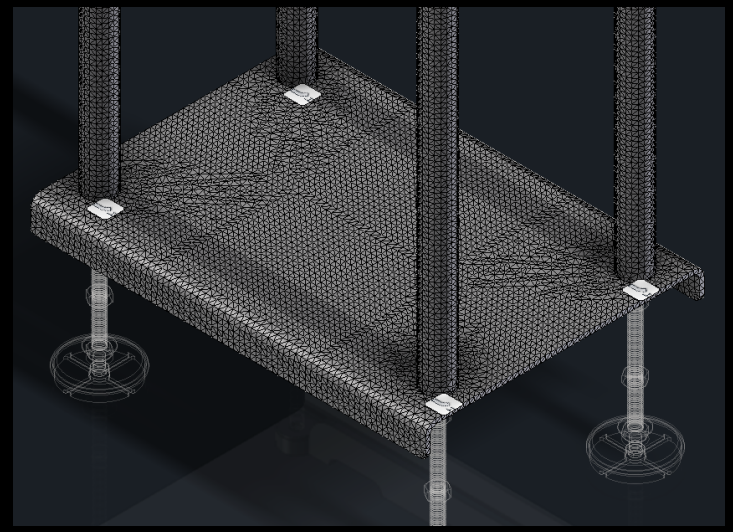
With Stiffeners

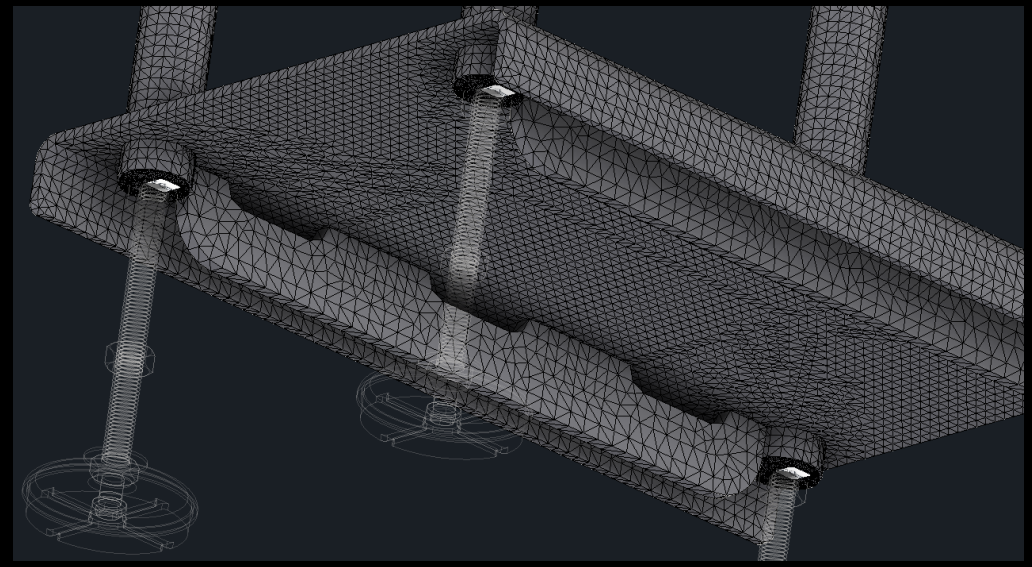
Access Platforms

FEA Results

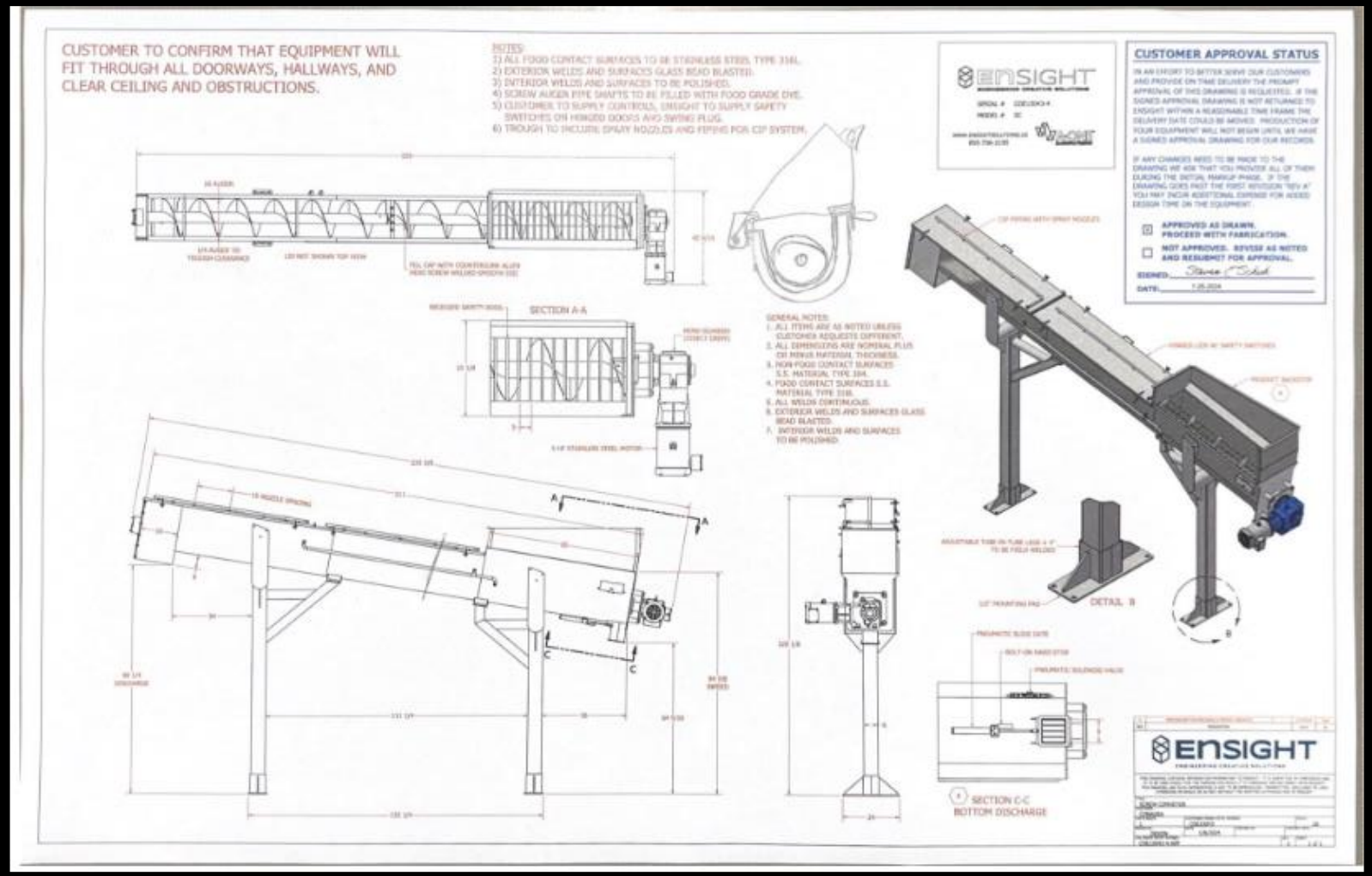
- Horizontal Load Displacement
  - 11.61% reduction
- Von Mises Stress
  - 2.62% reduction
  - Max Stress w/stiffeners: 16.42 ksi
  - Yield Strength of 303/304 SS: 30 ksi
- Conclusion
  - Rigid body remains in linear elastic regime
  - Yes, this design is safe, and the stiffeners reduce deformation/stress. More importantly, welders have more contact edges



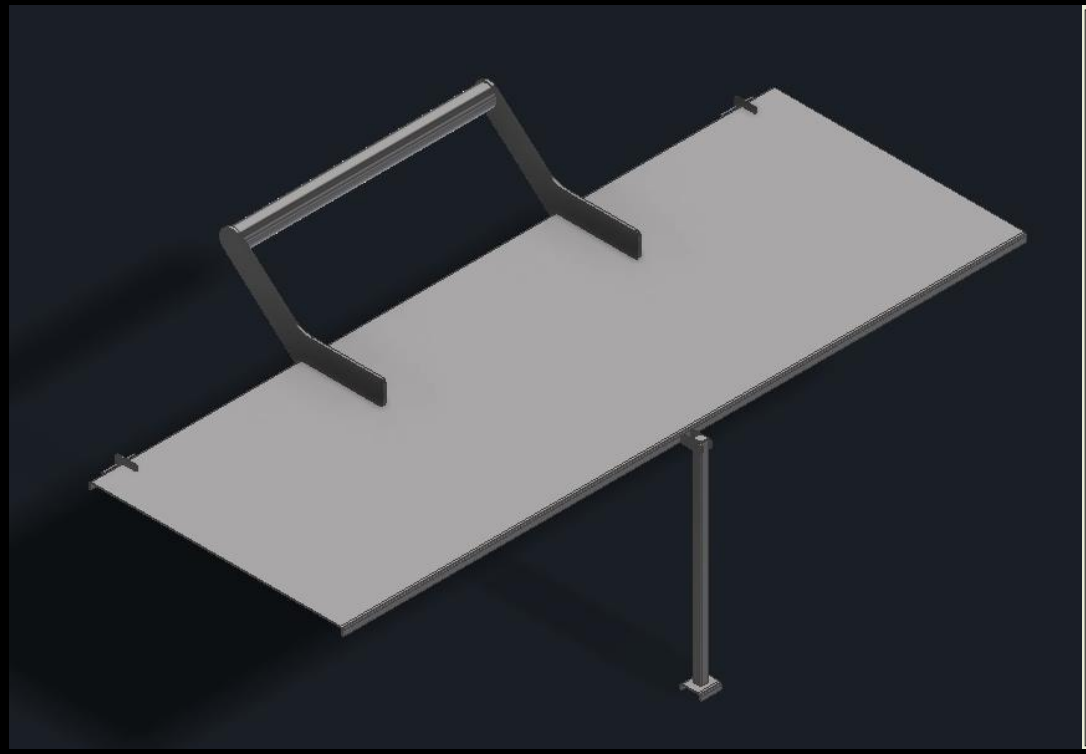


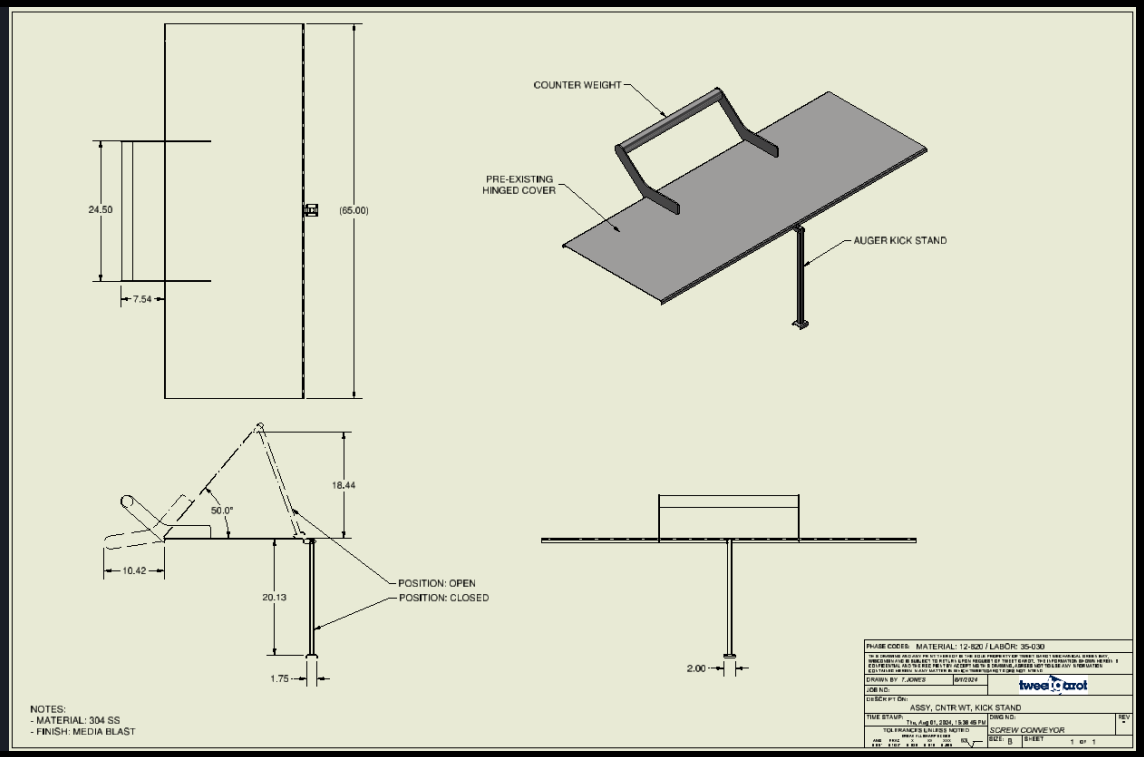


Conveyor Lid Counterweight



Conveyor Lid Counterweight

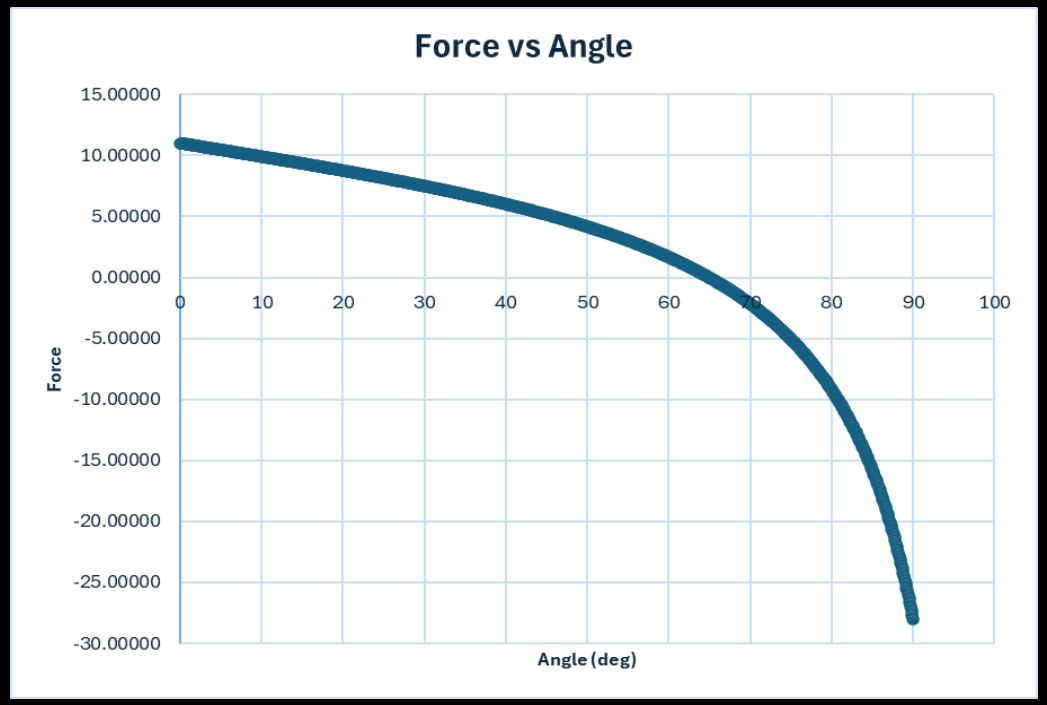




Conveyor Lid Counterweight

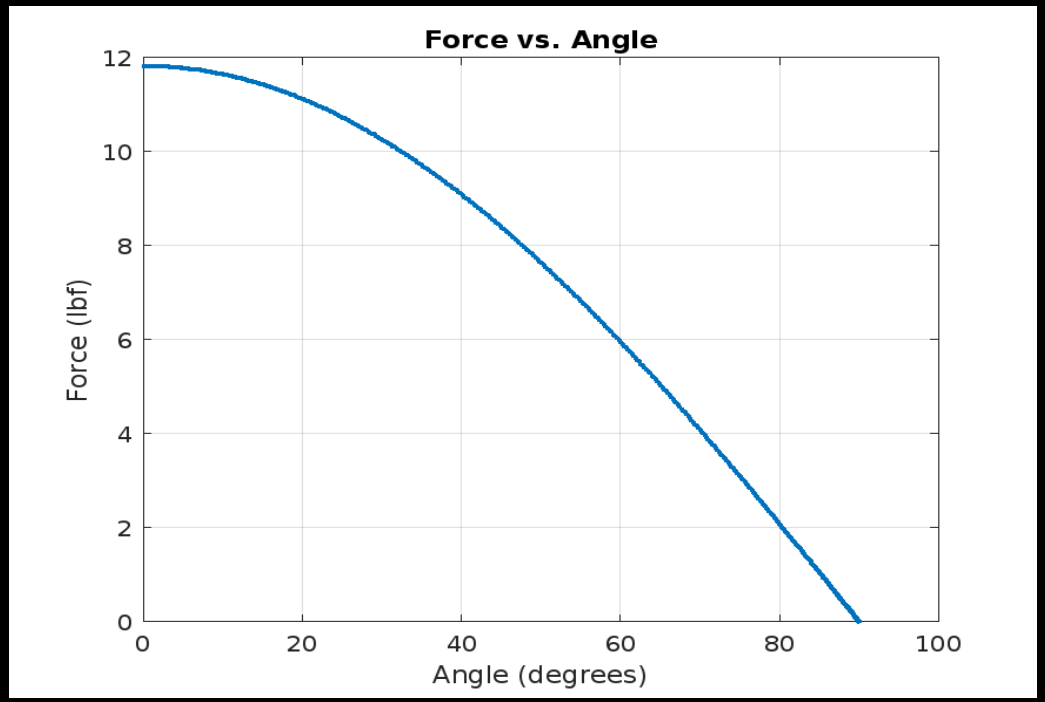
- Force required by operator to lift cover – Two different approaches
  - Target required force: ~25 lbf
  - Calculated required force: ~11 lbf ✔

Inventor: Dynamic Simulation



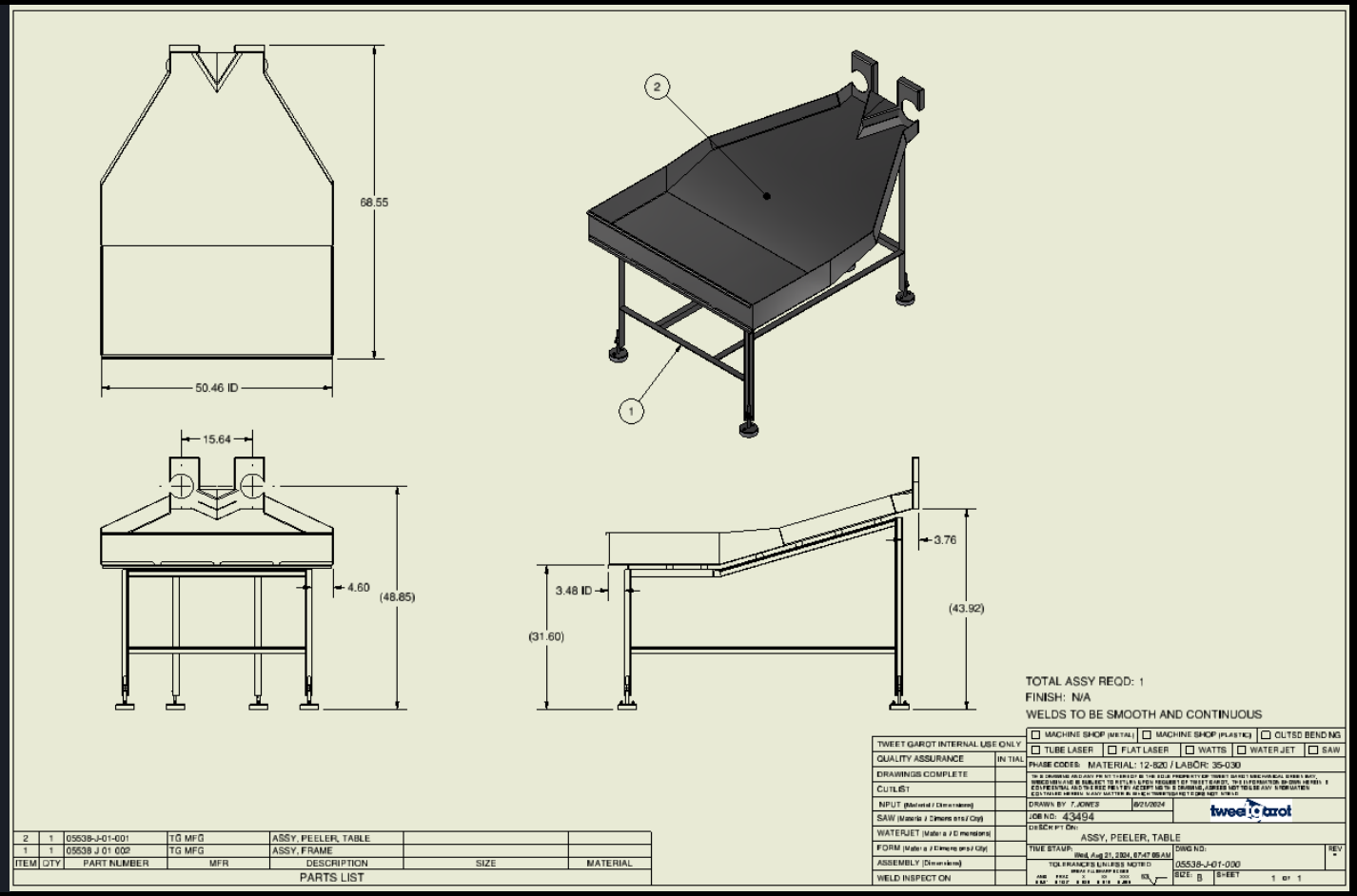
Autodesk Inventor using Lagrangian and Hamiltonian mechanics

My Programmed Solution via Fortran

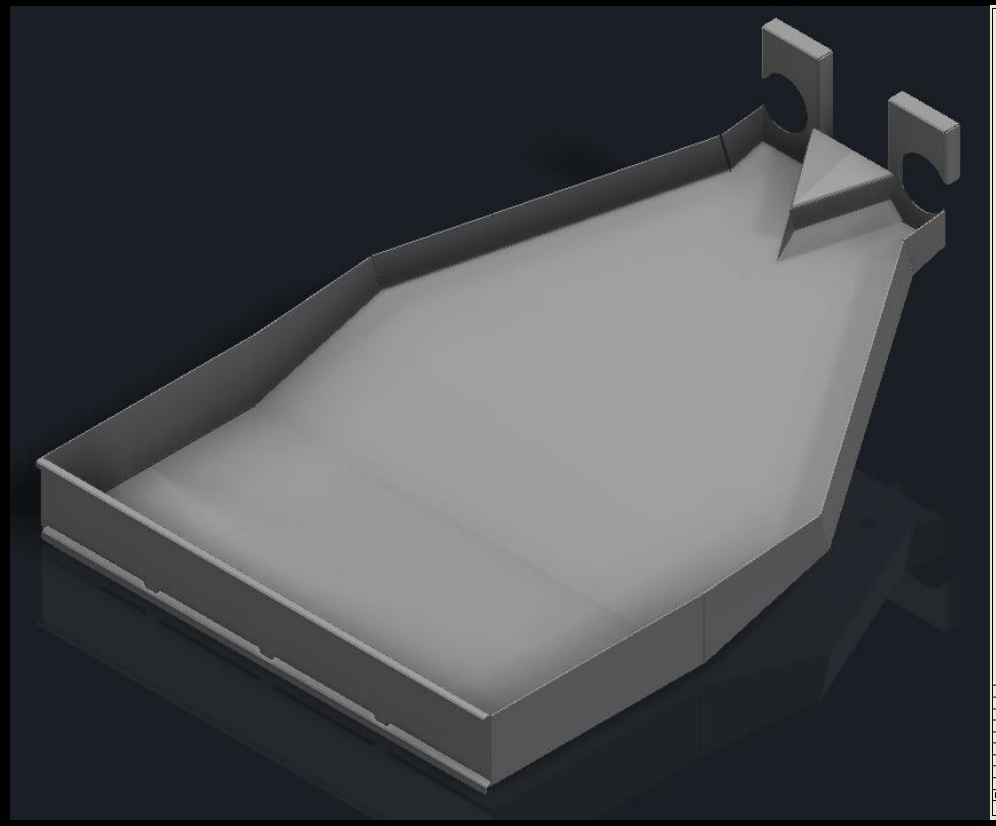


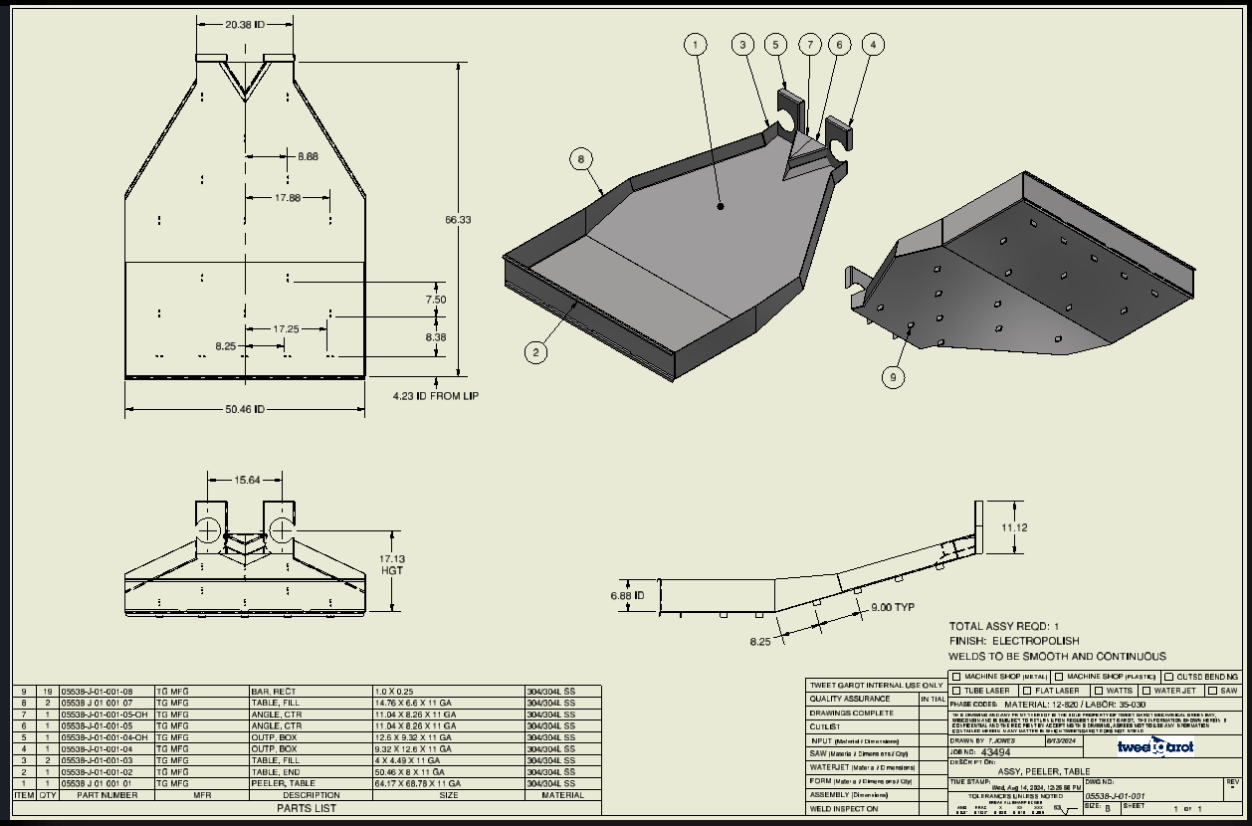
Iteratively solving static equilibrium equations Source Code

Peeler Table



Peeler Table: Sheet Metal





ITEM	QTY	PART NUMBER	MFR	DESCRIPTION	SIZE	MATERIAL
9	19	05538-J-01-001-08	TG MFG	BAR, RECT	1.0 X 0.25	304/304L SS
8	2	05538 J 01 001 07	TG MFG	TABLE, FILL	14.76 X 6.6 X 11 GA	304/304L SS
7	1	05538-J-01-001-05-OH	TG MFG	ANGLE, CTR	11.04 X 8.26 X 11 GA	304/304L SS
6	1	05538-J-01-001-05	TG MFG	ANGLE, CTR	11.04 X 8.26 X 11 GA	304/304L SS
5	1	05538-J-01-001-04-OH	TG MFG	OUTP. BOX	12.6 X 9.32 X 11 GA	304/304L SS
4	1	05538-J-01-001-04	TG MFG	OUTP. BOX	9.32 X 12.6 X 11 GA	304/304L SS
3	2	05538-J-01-001-03	TG MFG	TABLE, FILL	4 X 4.49 X 11 GA	304/304L SS
2	1	05538-J-01-001-02	TG MFG	TABLE, END	50.46 X 8 X 11 GA	304/304L SS
1	1	05538 J 01 001 01	TG MFG	PEELER, TABLE	64.17 X 68.78 X 11 GA	304/304L SS

TWEET GAROT INTERNAL USE ONLY	
QUALITY ASSURANCE	IN TIAL
DRAWINGS COMPLETE	
CUTLIST	
INPUT (Material / Dimensions)	
SAW (Material / Dimensions / Qty)	
WATERJET (Material / ID mentions)	
FORM (Material / Dimensions / Qty)	
ASSEMBLY (Dimensions)	
WELD INSPECTION	

☐ MACHINE SHOP (METAL) ☐ MACHINE SHOP (PLASTIC) ☐ CUTSD BENDING
☐ TUBE LASER ☐ FLAT LASER ☐ WATTS ☐ WATER JET ☐ SAW

PHASE CODES: MATERIAL: 12-820 / LABOR: 35-030

DRAWN BY: T.JONES 8/13/2024

JOB NO: 43494

CHECKED BY: On:

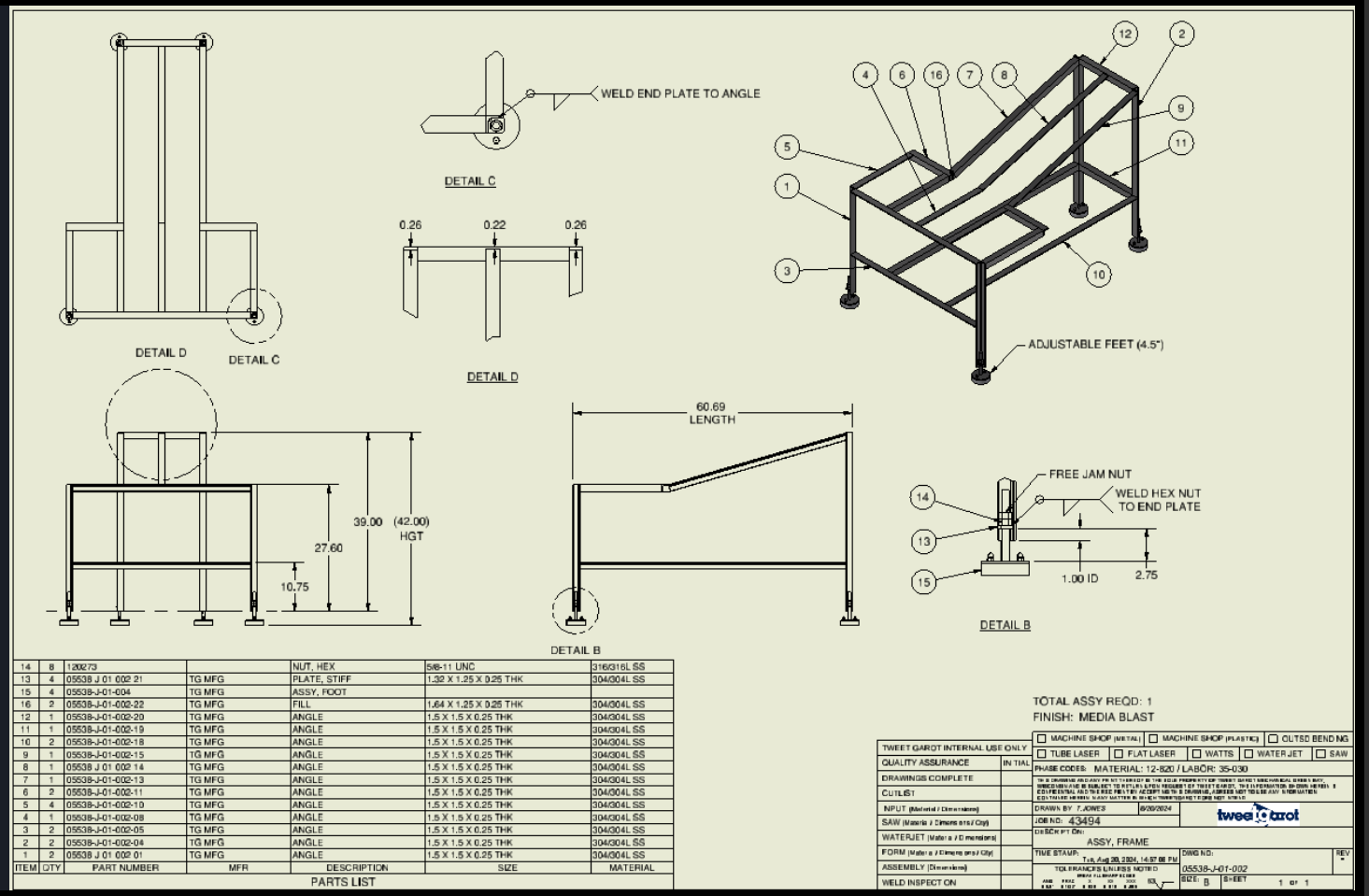
TIME STAMP: Wed, Aug 14, 2024, 12:26:58 PM

DWG NO: 05538-J-01-001

REV: *

SIZE: B SHEET 1 OF 1

Peeler Table: Frame



ITEM	QTY	PART NUMBER	MFR	DESCRIPTION	SIZE	MATERIAL
14	8	120273		NUT, HEX	5/8-11 UNC	316/316L SS
13	4	05538 J 01 002 21	TG MFG	PLATE, STIFF	1.32 X 1.25 X 0.25 THK	304/304L SS
15	4	05538-J-01-004	TG MFG	ASSY, FOOT		
16	2	05538-J-01-002-22	TG MFG	FILL	1.64 X 1.25 X 0.25 THK	304/304L SS
12	1	05538-J-01-002-20	TG MFG	ANGLE	1.5 X 1.5 X 0.25 THK	304/304L SS
11	1	05538-J-01-002-19	TG MFG	ANGLE	1.5 X 1.5 X 0.25 THK	304/304L SS
10	2	05538-J-01-002-18	TG MFG	ANGLE	1.5 X 1.5 X 0.25 THK	304/304L SS
9	1	05538-J-01-002-15	TG MFG	ANGLE	1.5 X 1.5 X 0.25 THK	304/304L SS
8	1	05538 J 01 002 14	TG MFG	ANGLE	1.5 X 1.5 X 0.25 THK	304/304L SS
7	1	05538-J-01-002-13	TG MFG	ANGLE	1.5 X 1.5 X 0.25 THK	304/304L SS
6	2	05538-J-01-002-11	TG MFG	ANGLE	1.5 X 1.5 X 0.25 THK	304/304L SS
5	4	05538-J-01-002-10	TG MFG	ANGLE	1.5 X 1.5 X 0.25 THK	304/304L SS
4	1	05538-J-01-002-08	TG MFG	ANGLE	1.5 X 1.5 X 0.25 THK	304/304L SS
3	2	05538-J-01-002-05	TG MFG	ANGLE	1.5 X 1.5 X 0.25 THK	304/304L SS
2	2	05538-J-01-002-04	TG MFG	ANGLE	1.5 X 1.5 X 0.25 THK	304/304L SS
1	2	05538 J 01 002 01	TG MFG	ANGLE	1.5 X 1.5 X 0.25 THK	304/304L SS

PARTS LIST

TOTAL ASSY REQD: 1
FINISH: MEDIA BLAST

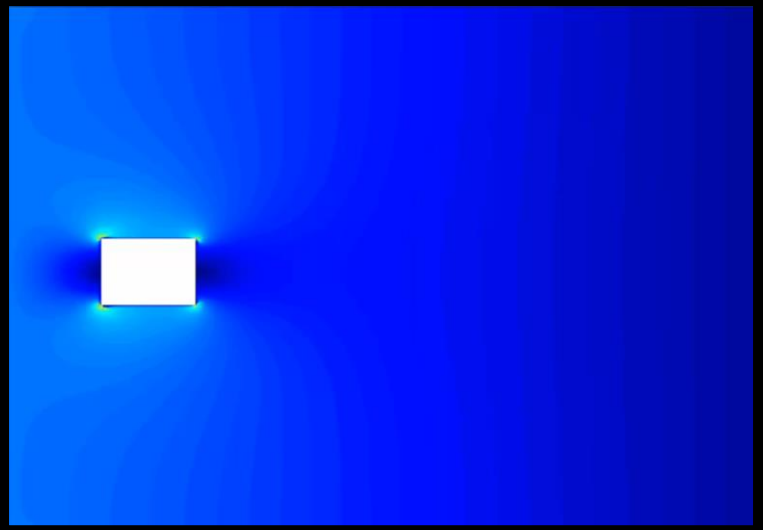
TWEET GAROT INTERNAL USE ONLY		☐ MACHINE SHOP (METAL)	☐ MACHINE SHOP (PLASTIC)	☐ CUTSD BEND NG	
QUALITY ASSURANCE	IN TIAL	☐ TUBE LASER	☐ FLAT LASER	☐ WATTS	☐ WATER JET	☐ SAW
DRAWINGS COMPLETE		PHASE CODES: MATERIAL: 12-820 / LABOR: 35-030			
CUTLIST		DRAWN BY: T. JONES	8/26/2024	tweet garot	
INPUT (Material / Dimensions)		JOB NO: 43494			
SAW (Materia / Dimensions / Qty)		DESCRIPT ON: ASSY, FRAME			
WATERJET (Materia / Dimensions)		TIME STAMP: Tue, Aug 20, 2024, 14:57:06 PM	DWG NO: 05538-J-01-002	REV	
FORM (Materia / Dimensions / Qty)		TOLERANCES UNLESS NOTED	SIZE: B	SHEET 1 OF 1	
ASSEMBLY (Dimensions)					
WELD INSPECT ON					

Blender Platform

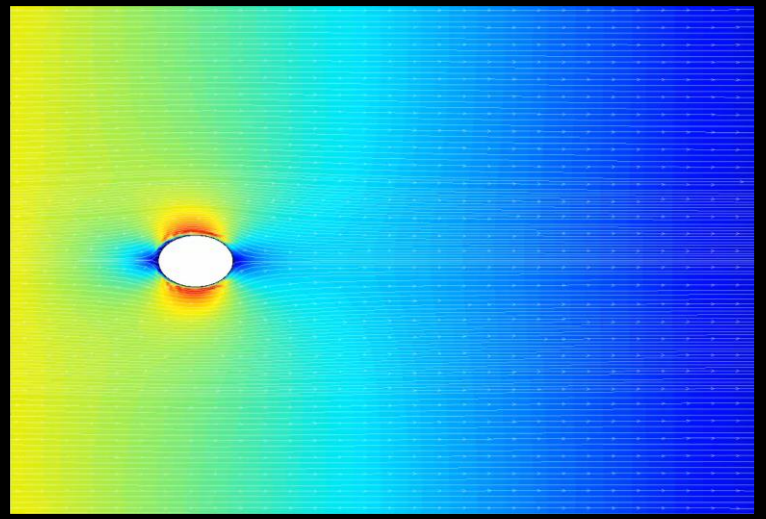
- Task
  - Design handrails for the stairs, gates, and main platform
- Tool: Frame Generator
  - Create 2D/3D sketch conforming to surrounding geometry
  - Cope members to reduce lead time in the shop
- Advantage – Process Improvement
  - Using frame generator → frame members are cut/coped on MAZAK 6-axis tube laser
  - Shop workers ‘only’ need to bend and weld instead of cope manually

Applications from Education

- Computational Engineering
  - CFD for HVAC
  - FEA for Custom Equipment Design team
  - Programming: Fortran and MATLAB
- Engineering Mechanics
  - Mechanics of Materials
  - Material Science
  - Static/Dynamic Analysis
  - Stress Analysis
- Computer Aided Design
  - Autodesk Inventor
  - Design for Manufacturing



Channel flow around a box via streamline-vorticity formulation (MATLAB)



Channel flow around a cylinder via streamline-vorticity formulation (MATLAB)

Close Support

- Manufacturing
  - Kyle Schneider – Production Manager
  - Bethany VanSickle – Manufacturing Engineer
  - Jason Waligursky – Shop Scheduler
  - All shop and field employees
- Custom Equipment Design
  - Rod Jones – CED Manager
  - Brandon Blochowiak – CED Engineer
  - Tony Vertz – Virtual Designer
  - Amber Hady – Virtual Designer
  - Leon Xiong – Virtual Designer

THANK YOU!