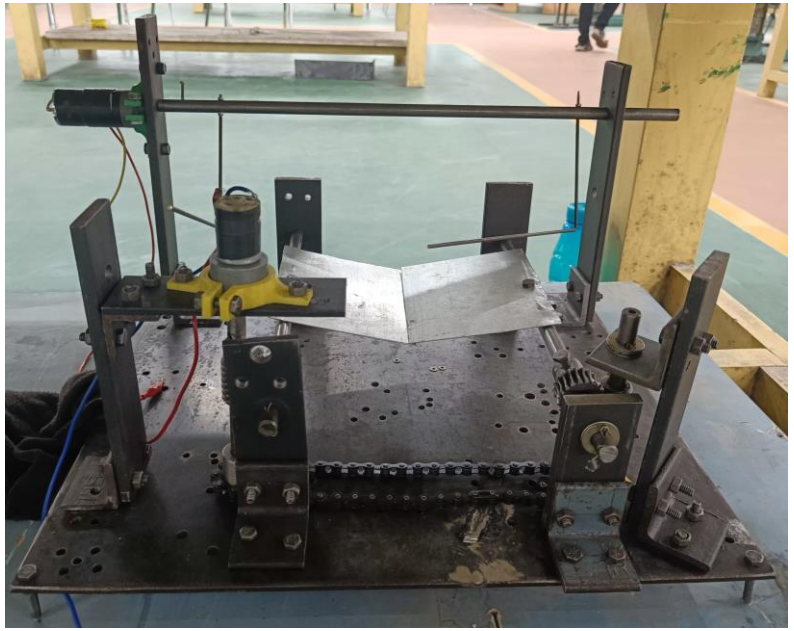
Manufacturing process 2
TA212 LAB

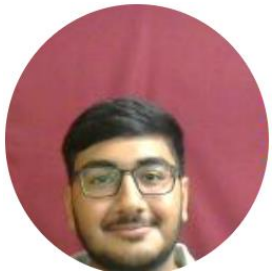


Group No : 05
Year 2023-24
Semester – 2
Lab Day - Tuesday

Tutor : Dr. Niraj Sinha
Course I/C : Dr. Niraj Sinha

Guide Name:
Mr.Kishan Babu Prajapati

Dhananjay Dixit
220351



Dhruv Budhedeo
220360

Dhruv Bansal
220359

Divya Choudhary
220374

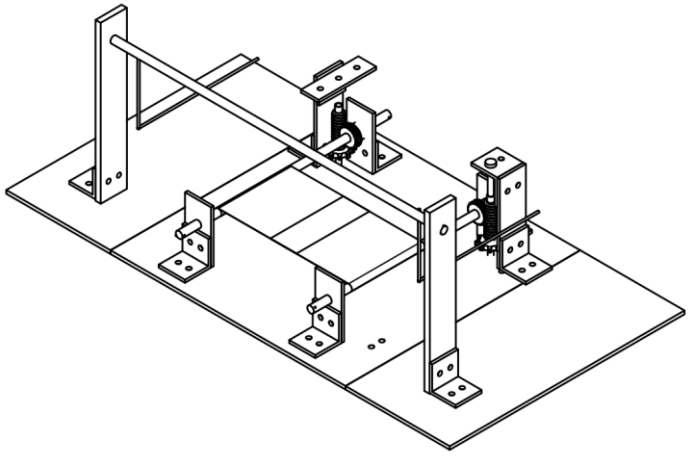
Gopika Sivani K S
220411

Gorre Karthik
220412

TA212A:

Manufacturing Process II

Project Title: Automatic Opening Bridge and Vehicle Barrier System



Group Number: 5 (Tuesday)

Dhruv Bansal (220359)

Divya Choudhary (220374)

Gopika Sivani K S(220411)

Gorre Karthik (220412)

Dhruv Budhedeo (220360)

Dhananjay Dixit (220351)

Project Guide :

Mr. Kishan Babu Prajapati

Instructor :

Prof. Niraj Sinha

Introduction

The objective of the project is to build a split bridge, which would be perfectly coordinated with a pair of barriers which open simultaneously as the bridge is closed and falls back to the original position as the bridge swings open, all the movements occur at a steady pace. The set-up senses the upcoming ship andperform the set of actions described.

We use several gear mechanisms to achieve the coordination of barrier and split bridge, while the IR sensor senses the upcoming ship and gives off a signalfor the bridge to open and barriers to close.

Motivation

Our group is motivated by the opportunity to improve safety,efficiency, and sustainability in maritime transportation. By developing a system that coordinates the movement of a splitbridge and barriers, we aim to enhance safety for ships passing through the area while improving operational efficiency by combining gear mechanisms with sensor technology to automate bridge operations. We recognize theenvironmental impact of efficient transportation and strive tocontribute to reducing traffic congestion and emissions.
Moreover, this project offers valuable learning opportunities and skill development for our team members, allowing them to learn the in depth working of several gear mechanisms andwork with Arduino.

Materials List

Part No :	Part Name	Page No	Material used	Machine process used	Quantity
1	Base Plate	9	Mild steel	Drilling	1
2	Angle	10	Mild steel	Drilling	10
3	Flat Type 2	11	Mild steel	Drilling	4
4	Bridge Rod	12	Mild steel	Cutting	2
5	Flat Type 1	13	Mild steel	Drilling	2
6	Bridge	14	GI Sheet	Cutting	2
7	Motor Support	15	Mild steel	Drilling	1
8	Worm	16	Mild steel	Lathe & Milling	2
9	Worm Gear	17	Mild steel	Lathe & Milling	2
10	Sprocket	18	Mild steel	Lathe & Milling	2
11	Barrier Support Column	19	Mild steel	Drilling	2
12	Barrier Support Rod	20	Mild steel	Cutting	1
13	Barrier	21	Mild Steel	Drilling	2
14	Side Column Rod Mount	22	Mild Steel	Drilling	1
15	Side Column Rod	23	Mild Steel	Cutting	2
16	Chain	-	Mild Steel	-	1
17	Motors	-	-	-	2

Calculation (Worm/Worm Gear Assembly)

No.	Item	Symbol	Formula
1	Normal Module	m_n	1.5
2	Normal Pressure Angle	(α_n)	20°
3	No. of threads, No. of teeth	Z	1 20
4	Pitch Diameter of worm	d_1	18
5	Pitch Diameter of worm gear	d_2	30.105
6	Reference cylinder lead Angle	Y	4.78
7	Centre Distance	a	23.84
8	Addendum	h_{a1} h_{a2}	1.5 1.287
9	whole Depth	h	3.375
10	outside Diameter	d_{a1} d_{a2}	21 34.178
11	Throat Diameter	d_t	32.679
12	Throat Surface Radius	r_1	7.5
13	Root Diameter	d_{f1} d_{f2}	14.25 25.929

Sprocket Calculations

ITEMS	CALCULATIONS
PITCH	12.7
NO OF TEETHS	9
PITCH DIAMETER	37.13
OUTSIDE DIAMETER	42.51

TORQUE CALCULATION

For 2Nm Motor :

Step 1: Determine the load inertia (JL) of the arm as:

$JL = Jx$ = (1 /12) ρABC [(A^2 + B^2) + 12r^2]

Step 2: Determine the torque:

T_a = ($JL \times V$)/ (9.55 × t_a)

V – speed in rpm, ta - acceleration/deceleration time

T_a = {(392 .457 x 10^{-6}) x (373/60) } /(9.55 * 1) = 0.00255 N-m

With Safey Factor (X = 2) = (T_a *2) = 0.05 N-m

(As torque required is less than the rated torque of Motor it is safe to use)

For 1Nm Motor :

$T_a = T_1$(worm shaft & sprocket) + T_2(Bridge + worm gear)

T_1 = (0.017x30)/(9.55 x 0.5) = 0.106 N-m

With safety factor = 2 T1 = 0.212 N-m

T_2 = (0.0255 * 30*2/20)/(9.55 x 0.5) = 0.016 N-m

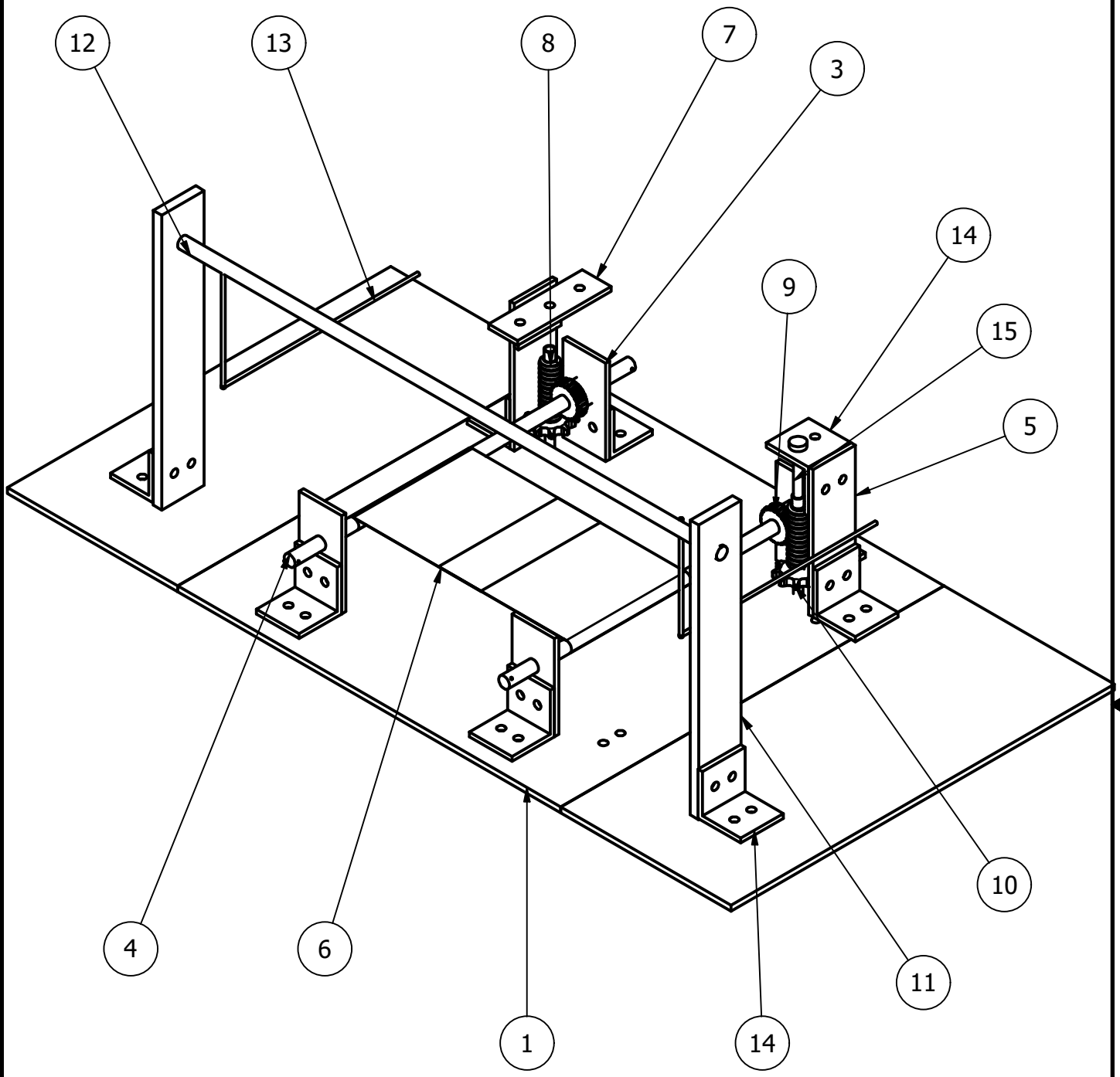
Total Torque = T1 + T2 = 0.123 N-m

T_a safe = 2 * 0.123 = 0.246 N-m (which is less than the rated torque = 1 N-m)

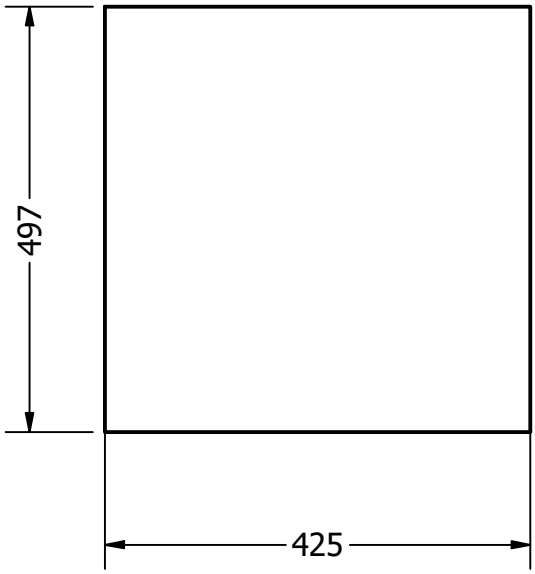
COST CALCULATION

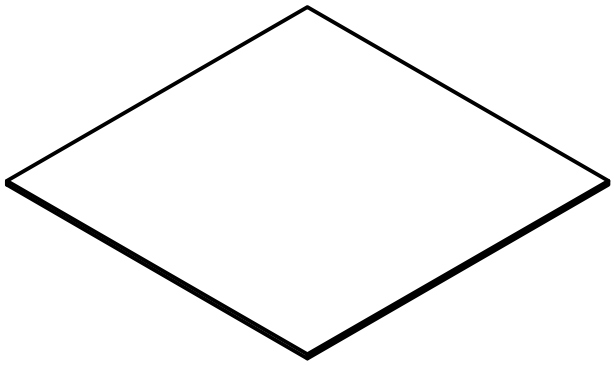
MATERIAL /MACHINE NAME	Time/ Amount used	Cost	Total Cost
Mild Steel	20.97 Kg	90 Rs/kg	Rs 1887.3/-
Lathe Machine	7Hrs	350Rs/hr	Rs 2450/-
3D Printer	1.5Hrs	300Rs/hr	Rs 450/-
Milling	3Hrs	450Rs/hr	Rs 1350/-
Drilling	2Hrs	100Rs/hr	Rs 200/-

TOTAL AMOUNT = Rs 6337.3/-

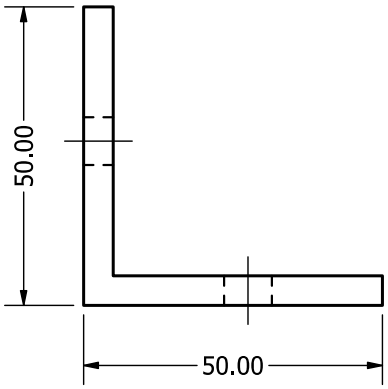


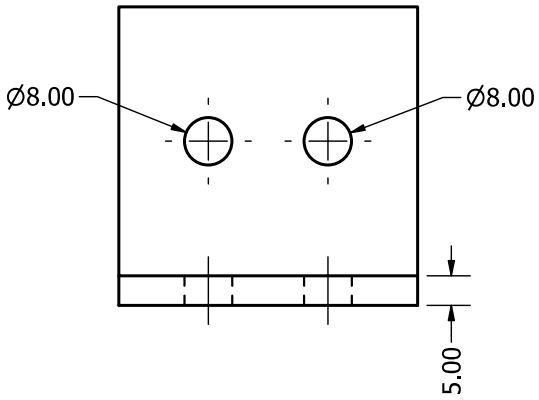
Drawn By Dhruv Budhedeo	Part Name Assembly	
Guide Kishan Babu Prajapati		
Not for dimensioning	Not to Scale	Part No.

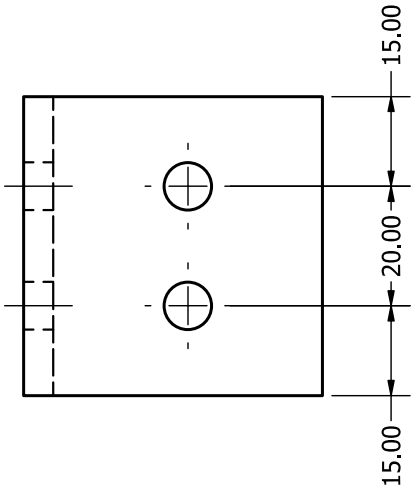


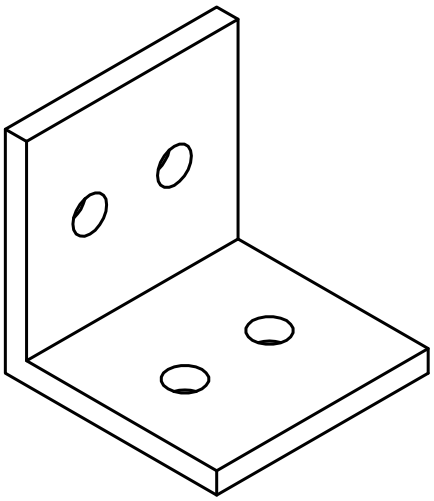


Drawn By Dhruv Budhedeo	Part Name Base Plate	
Guide Kishan Babu Prajapati	Material Used Mild Steel	
All Dimensions are in mm	Scale 1:1	Part No. 2

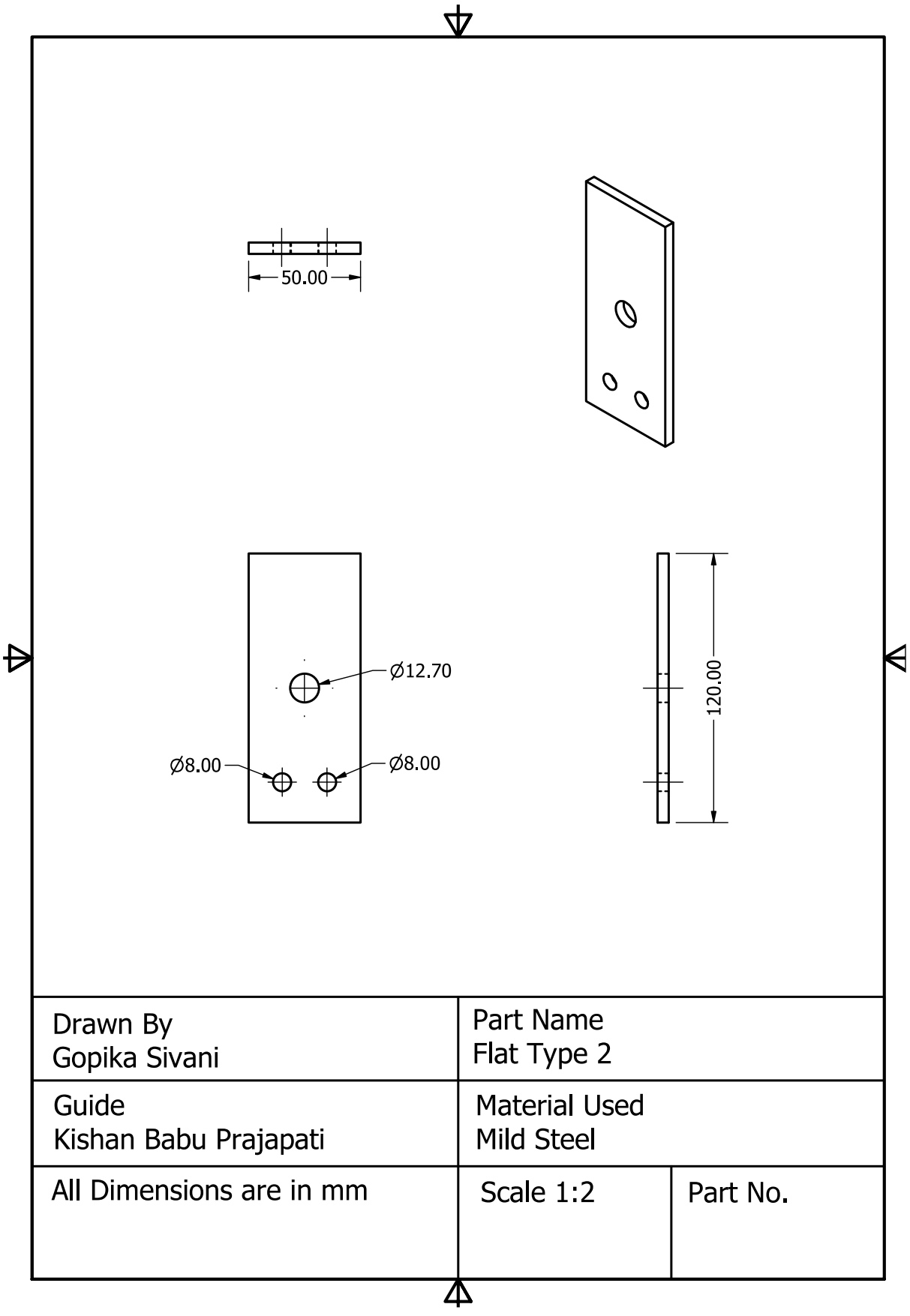








Drawn By Gopika Sivani	Part Name Angle	
Guide Kishan Babu Prajapati	Material Used Mild Steel	
All Dimensions are in mm	Scale 1:1	Part No.



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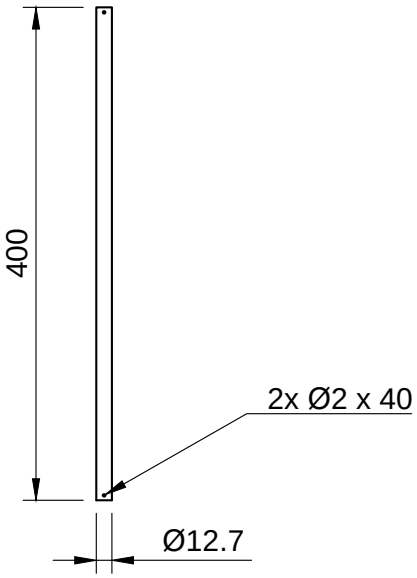
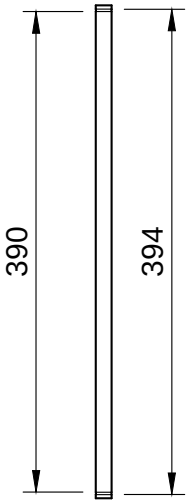
Guide Kishan Babu Prajapati	Material Used Mild Steel	
All Dimensions are in mm	Scale 1:2	Part No.





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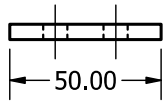
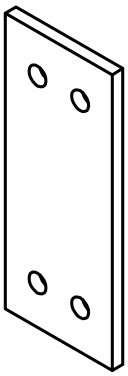
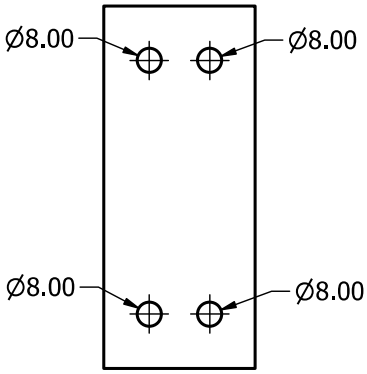
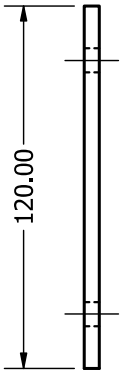
		Title Bridge Rod	DWG No.		
			Rev.	Date of issue	Sheet 1/1

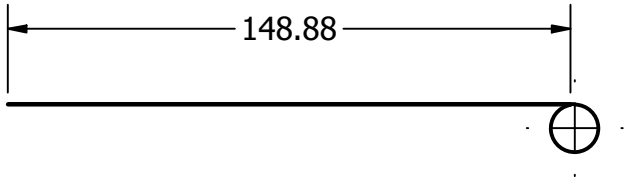


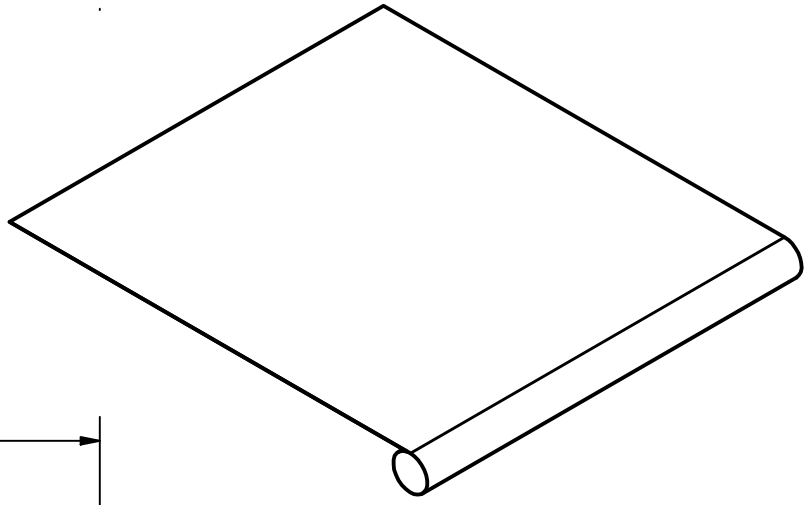


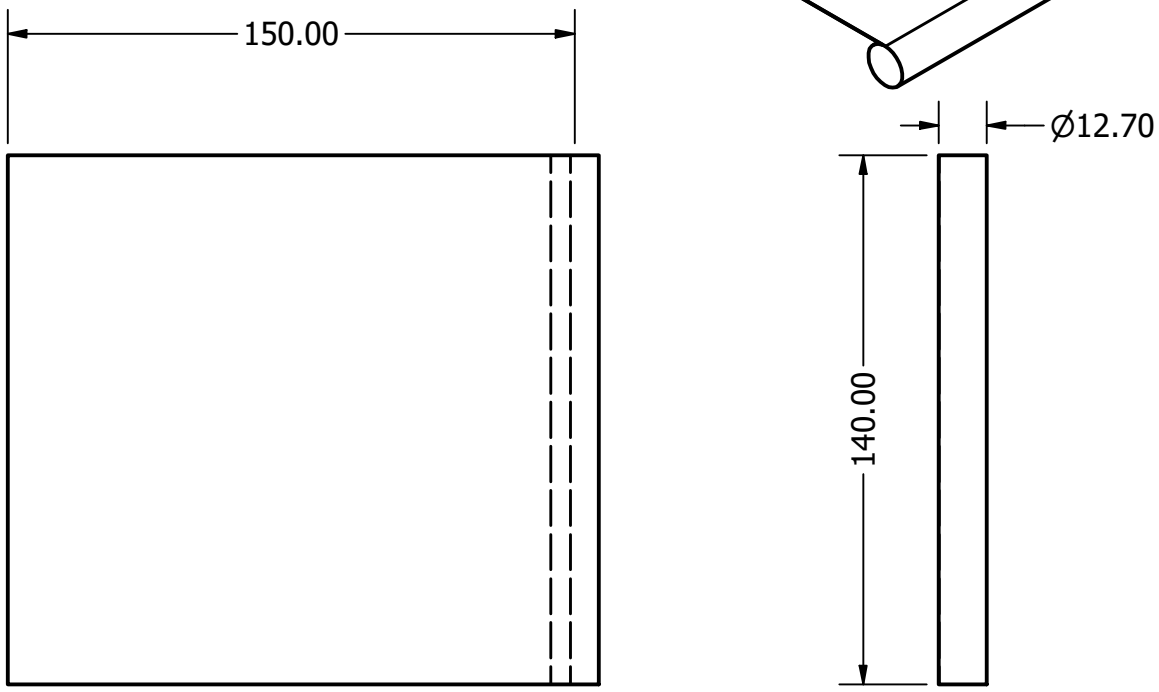




Drawn By Gopika Sivani	Part Name Flat Type	
Guide Kishan Babu Prajapati	Material Used Mild Steel	
All Dimensions are in mm	Scale 1:2	Part No.







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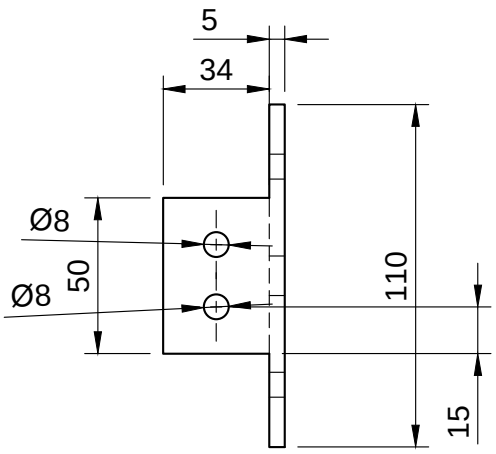
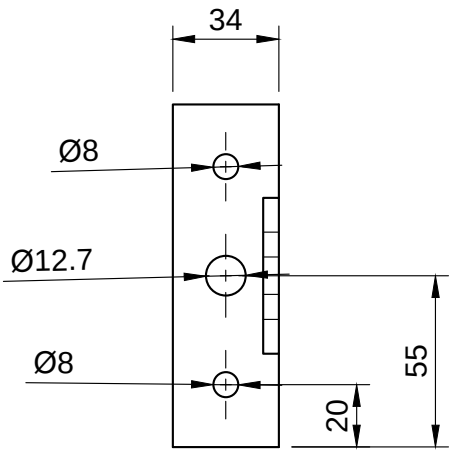
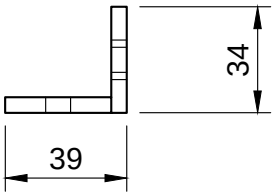
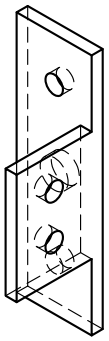
Guide Kishan Babu Prajapati	Material Used Mild Steel	
All Dimensions are in mm	Scale 1:2	Part No.









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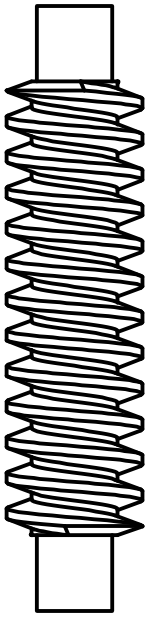
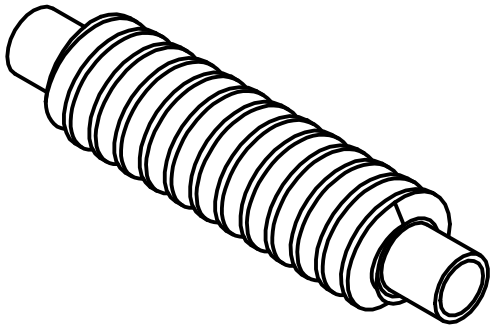
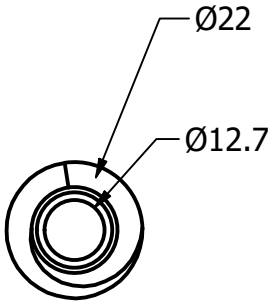
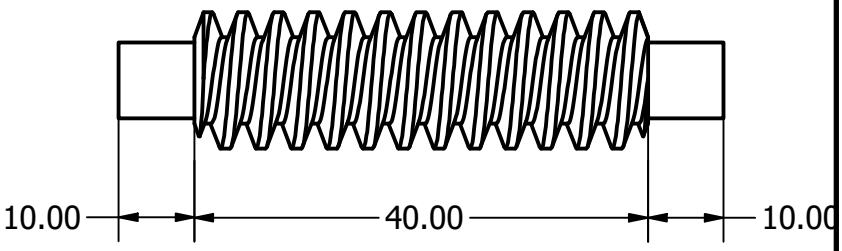
Material:Mild Steel Quantity: 1		Document type	Document status	
		Title Motor Support	DWG No.	
			Rev. / Date of issue	Sheet 1/1

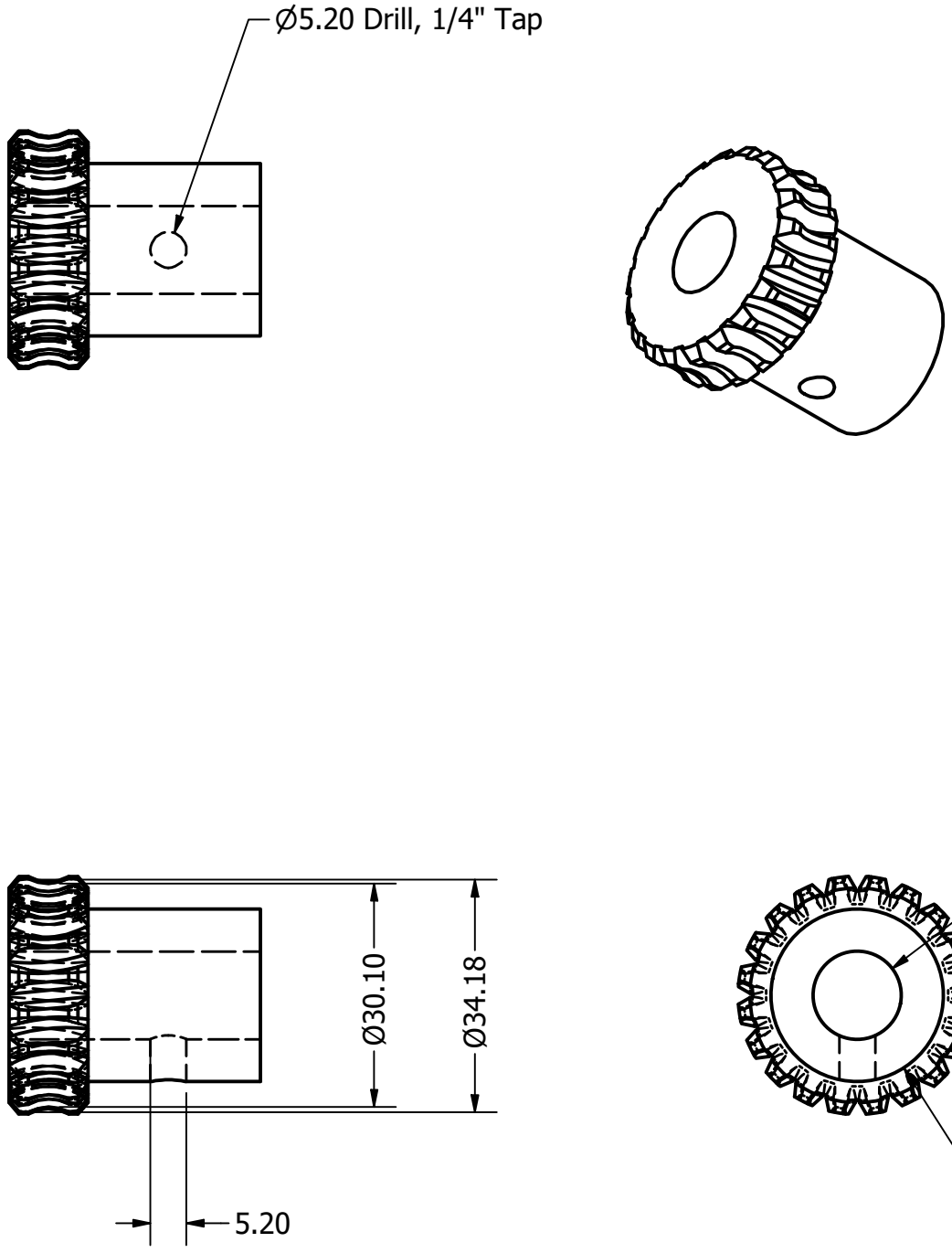




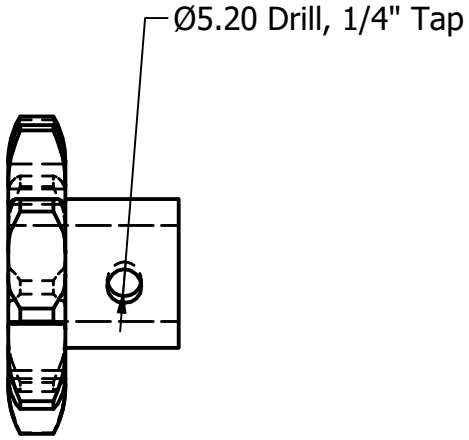


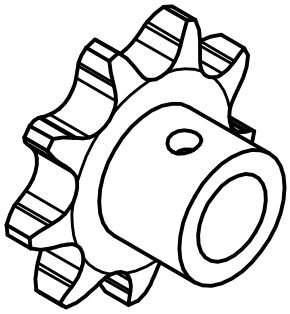


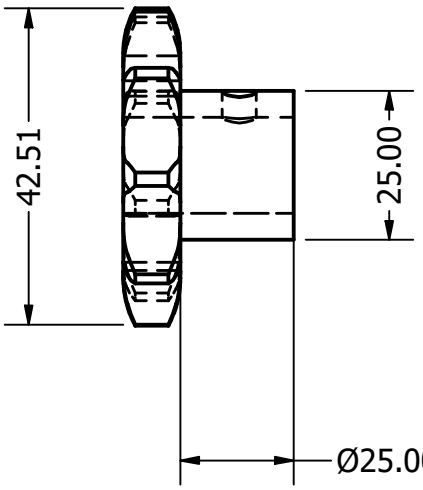
Drawn By Dhruv Budhedeo	Part Name Worm	
Guide Kishan Babu Prajapati	Material Used Mild Steel	
All Dimensions are in mm	Scale 1:1	Part No. 8

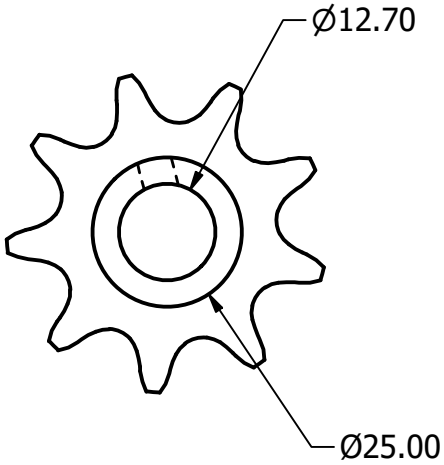


Drawn By Dhruv Budhedeo	Part Name Worm Gear	
Guide Kishan Babu Prajapati	Material Used Mild Steel	
All Dimensions are in mm	Scale 1:1	Part No. 9 -

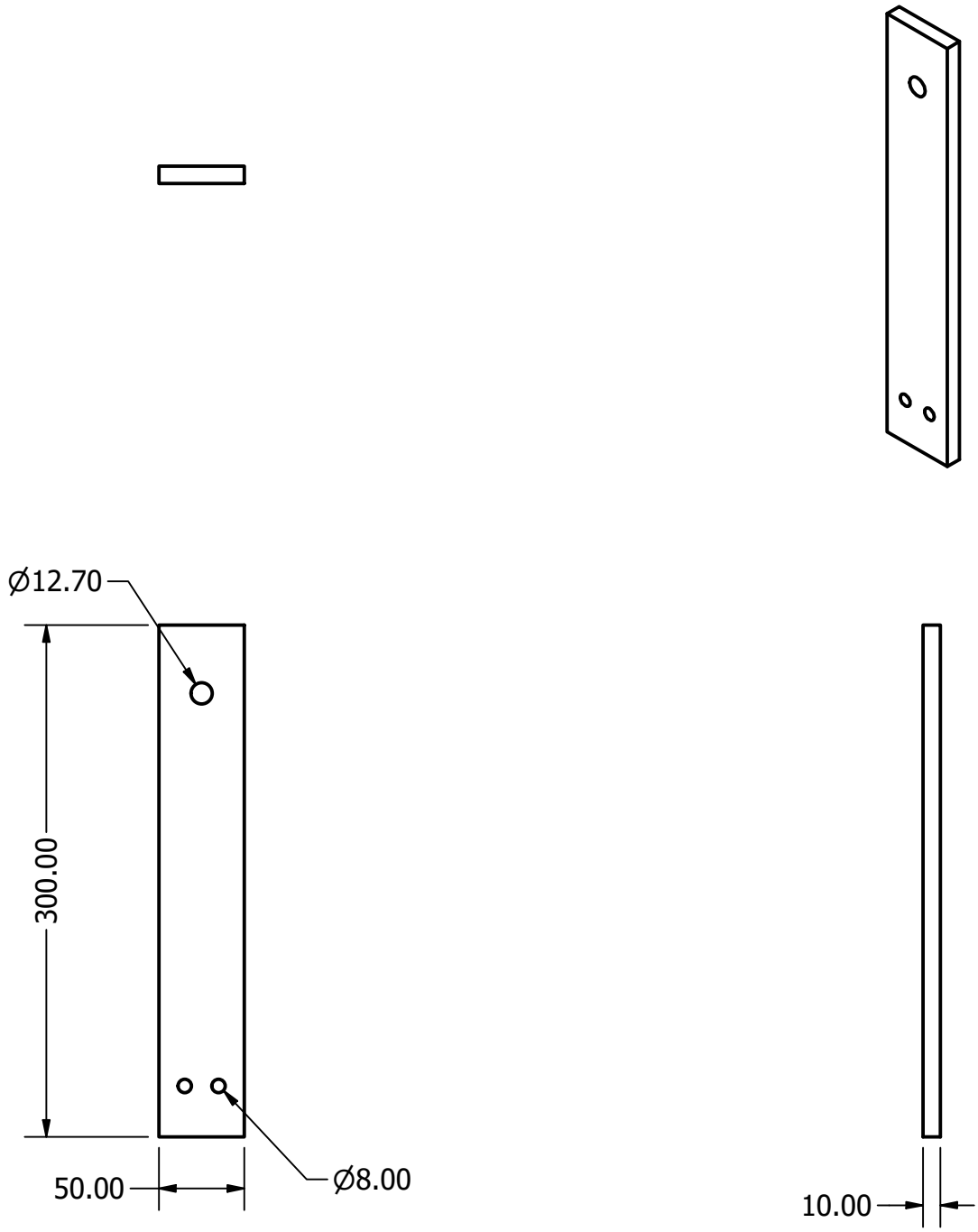




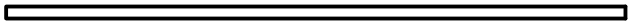


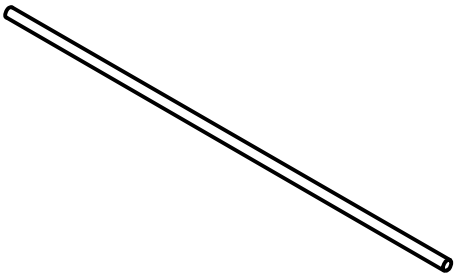


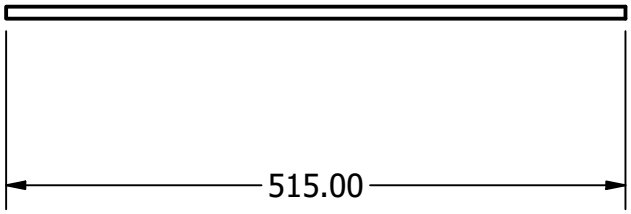
Drawn By Dhruv Budhedeo	Part Name Sprocket	
Guide Kishan Babu Prajapati	Material Used Mild Steel	
All Dimensions are in mm	Scale 1:1	Part No. 10

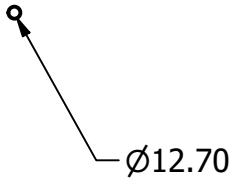


Drawn By Dhruv Budhedeo	Part Name Barrier Support Column	
Guide Kishan Babu Prajapati	Material Used Mild Steel	
All Dimensions are in mm	Scale 1:1	Part No. 11

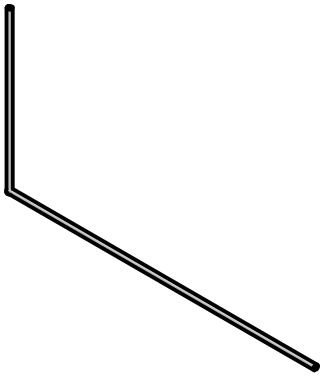


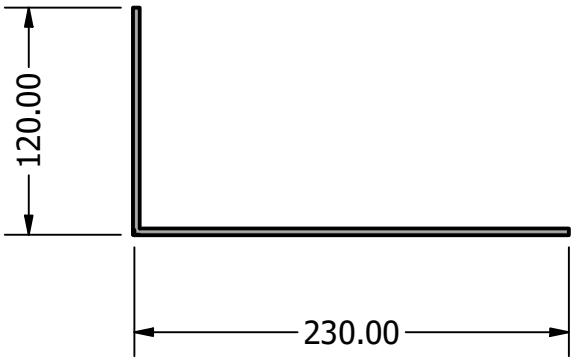




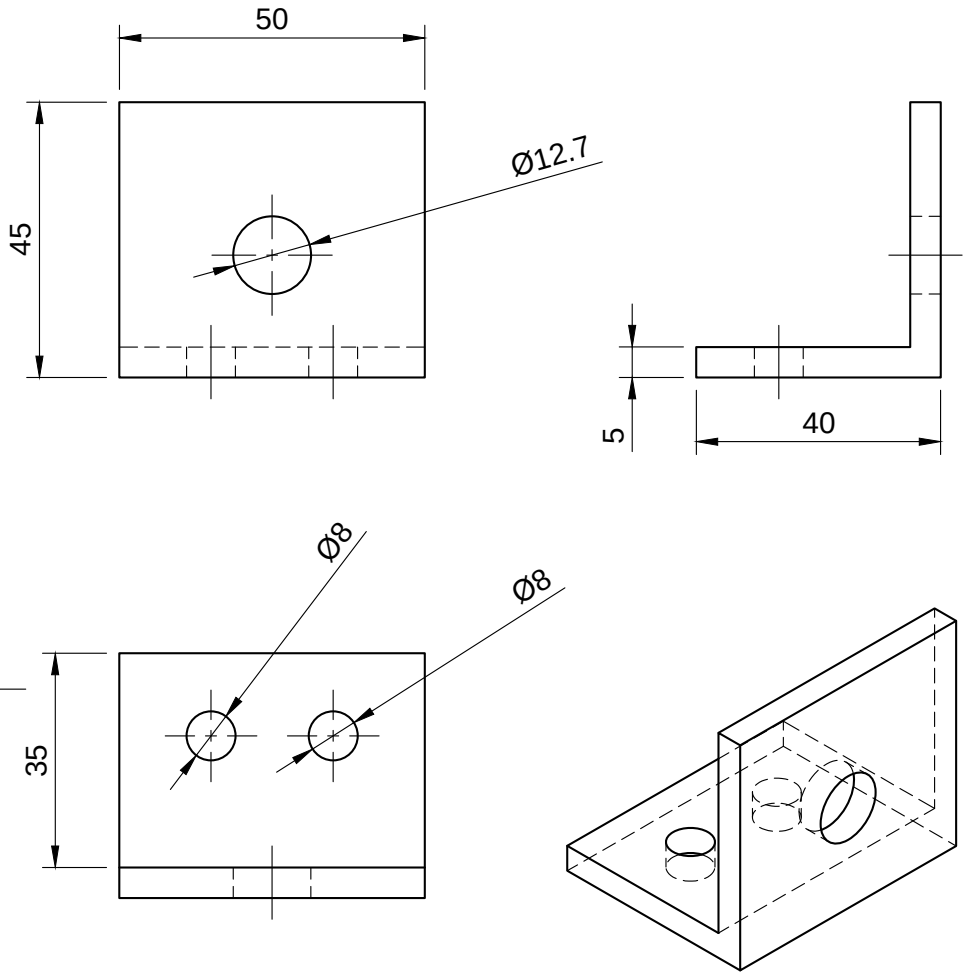


Drawn By Dhruv Budhedeo	Part Name Barrier Support Rod	
Guide Kishan Babu Prajapati	Material Used Mild Steel	
All Dimensions are in mm	Scale 1:1	Part No. 12

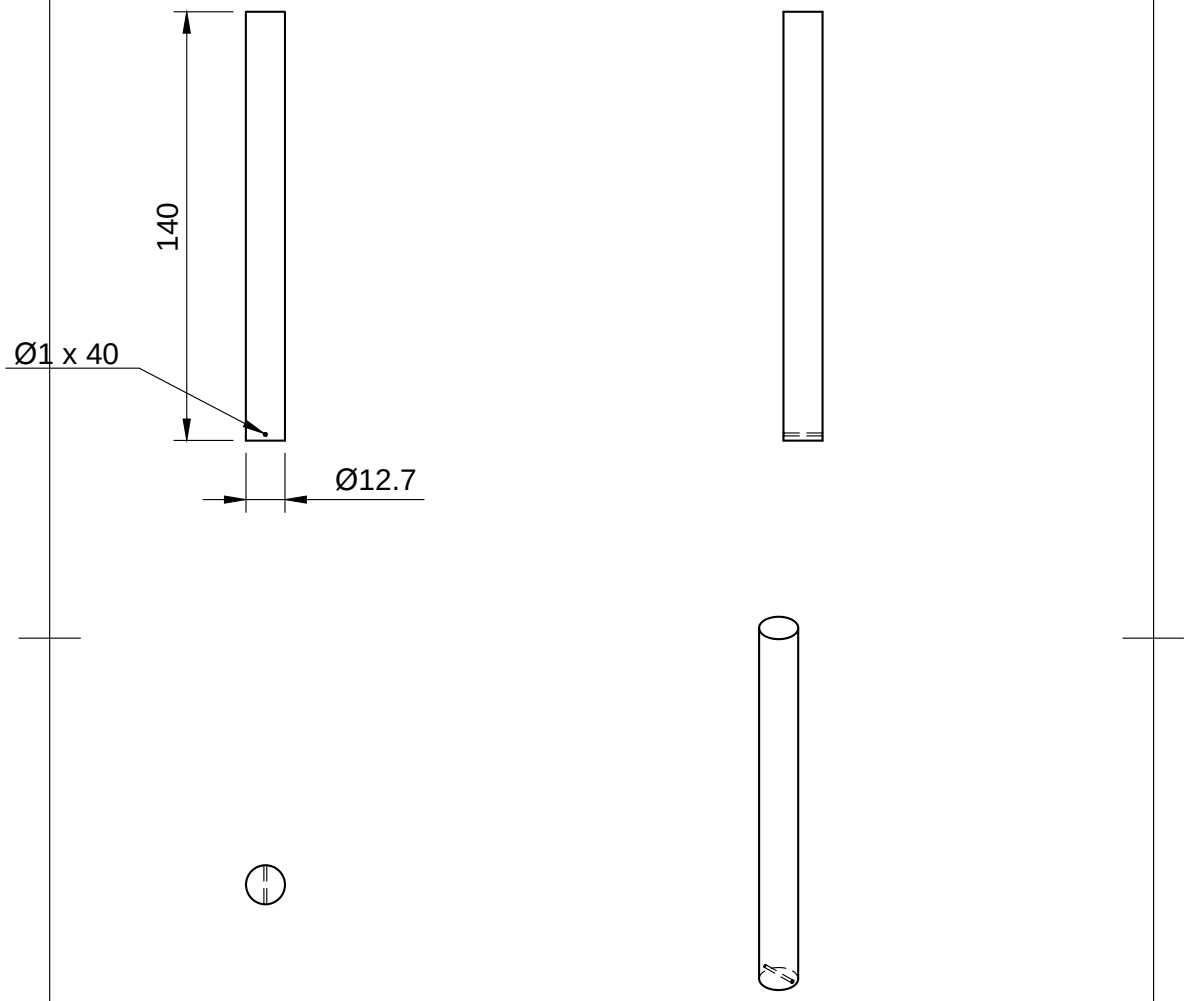




Drawn By Dhruv Budhedeo	Part Name Barrier Supporting Rod	
Guide Kishan Babu Prajapati	Material Used Mild Steel	
All Dimensions are in mm	Scale 1:1	Part No. 13



Dept.	Technical reference	Created by Divya Choudhary 13/02/24	Approved by	
		Document type	Document status	
		Title Side Column Rod Mount	DWG No.	
			Rev. / Date of issue	Sheet 1/1



Dept.	Technical reference	Created by	Approved by
		Divya Choudhary 13/02/24	
Material: Mild Steel Quantity: 1		Document type	Document status
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			Rev. / Date of issue / Sheet 1/1

Conclusion

In conclusion, the automatic opening bridge and vehicle barrier system project have demonstrated significant advancements in enhancing traffic flow management and security control. The implementation of automated mechanisms not only streamlines the process of bridge access but also fortifies security measures against unauthorized vehicular entry. Through meticulous design and integration of sensors and control systems, the project ensures operational efficiency and reliability. Furthermore, the system's adaptability to various environmental conditions underscores its versatility and practicality in real-world scenarios. Overall, this project marks a substantial milestone in modern infrastructure development, promising safer and more efficient transportation networks for communities.