

HOW TO DESIGN A WEST COAST STYLE DRIVETRAIN IN CAD

6328

**MECHANICAL
ADVANTAGE**

LITTLETON, MA

Presented by FRC 6328 in partnership with FRC 8604

8604



ALPHA CENTAURI

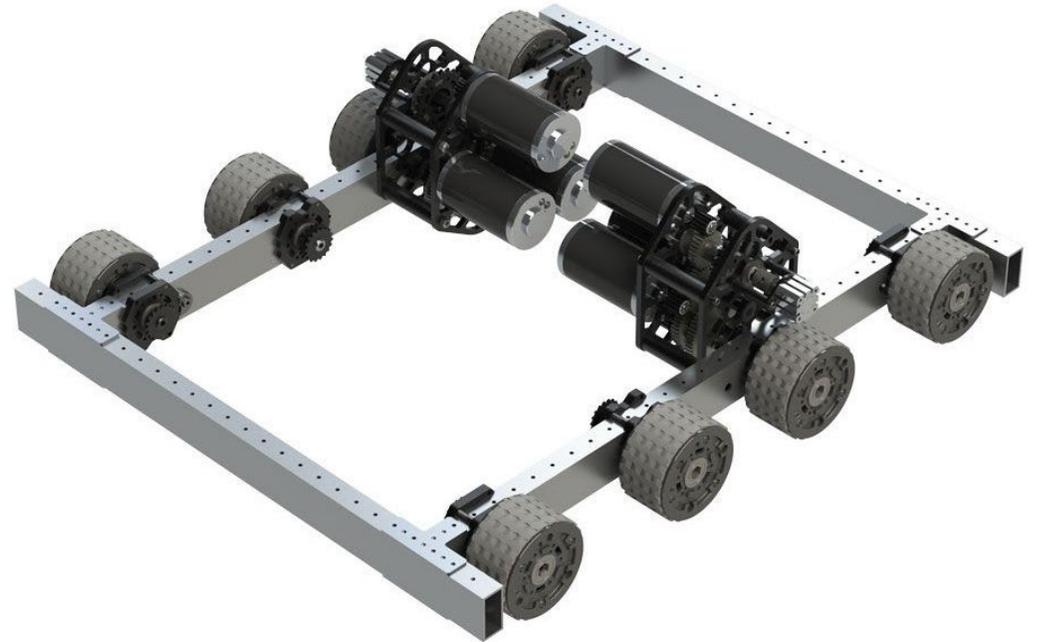


PROJECT OVERVIEW

For this project, you will be designing an FRC-style west coast drivetrain, applying your knowledge of simple machines, gears, pulleys/sprockets and chain/sprocket. You will be creating a CAD model of your drivetrain using VexPro parts.

DESIGN CONSTRAINTS

- ❖ The frame perimeter of your drivetrain shall not exceed 120in
 - ❖ You may configure your drivetrain any length and width that meets the frame perimeter criteria
- ❖ Use a belt and pulley system
- ❖ Your drivetrain should be 6 or 8 wheels
 - ❖ Drop center 1/8"
 - ❖ If using pneumatic wheels 1/4" drop center
- ❖ Construct the chassis of your drivetrain with VersaPro tubing & VexPro brackets
- ❖ Use belts and pulleys from VexPro
- ❖ Use the West Coast Products single speed gearbox with 3 CIM configuration to complete design calculations



STEP 1: PICK LENGTH AND WIDTH

❖ Based on a maximum frame perimeter of 120", choose a length and width for your drivetrain

Selected Width (in)	Selected Length (in)

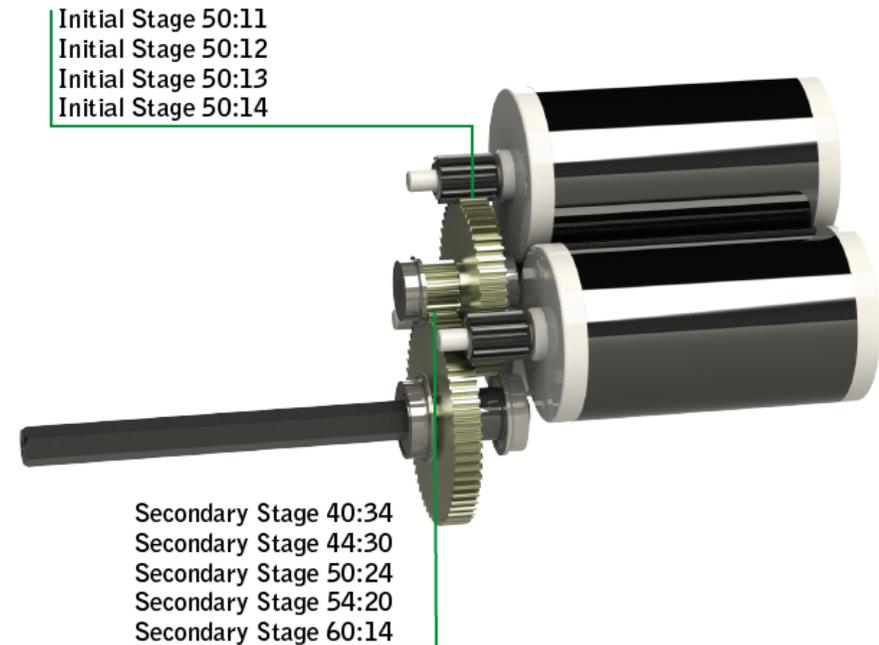
STEP 2: CREATE CHASSIS FRAME IN ONSHAPE

- ❖ Navigate to the VexPro website and look at VersaFrame stock for dimensions to guide your modeling
 - ❖ Most common drivetrain tube size is 2"x1" rectangle tube with 0.1" wall thickness and comes stock with a 0.1" diameter hole pattern spaced 1" apart
 - ❖ <https://www.vexrobotics.com/versaframestock.html>
- ❖ Select brackets needed to connect frame together
 - ❖ <https://www.vexrobotics.com/versaframegussetsandmounts.html>



STEP 3: CONFIGURE GEARBOX

- ❖ Navigate to the JVN Design Calc spreadsheet
 - ❖ <https://onshape4frc.com/calculators>
- ❖ Go to the "WCP SS" tab
- ❖ Choose "3 CIM" for motors
- ❖ Choose desired motor pinion
- ❖ Choose desired 2nd stage gearing
- ❖ Input desired wheel diameter
- ❖ Once you select these options, a free-speed and real-life speed will be calculated. Play around with gearing options until you have speeds you are happy with.
- ❖ Follow the graphic to the right for your speed options



PASTE SCREENSHOT OF JVN SPREADSHEET HERE



STEP 4: DOWNLOAD GEARBOX FROM VEXPRO

❖ Navigate to the link below and download the gearbox CAD file

❖ Note that your CAD model will not and does not need to reflect your actual gearing, they provide you with a base model to use in CAD

❖ <https://www.vexrobotics.com/wcp-ss.html#cad>



STEP 5: CONFIGURE PULLEY SPACING

- ❖ You will need to determine how far apart to space your wheels and pick belts and pulleys
- ❖ In a drawing on the side rail, place the wheel locations approximately where you want them and measure the distance from wheel to wheel
- ❖ Navigate to WCP Belt Calculator (link below) and do the following:
 - ❖ <https://www.wcproducts.com/how-to-belts>
 - ❖ Pick 5mm HTD/GT2
 - ❖ Enter desired center to center distance
 - ❖ Pulley sizes need to be the same
 - ❖ Ratio of pulley to wheel size should be no less than 6 teeth per inch, make sure you are using a pulley that exists
 - ❖ <https://www.vexrobotics.com/htdpulleys.html>
- ❖ Update CAD with calculated center to center distance based on inputs (it will give you the closest two belt sizes so pick 1)

Pulley 1		Pulley 2		Center Distance	
Number of Teeth	24	Number of Teeth	18	Desired Center	5
Outer Diameter		Outer Diameter		Center Add	0.0
Pitch Diameter		Pitch Diameter		Ratio	

Smaller Belt		Larger Belt	
# of Teeth		# of Teeth	
Center Distance		Center Distance	
P1 Teeth in Mesh		P1 Teeth in Mesh	
P2 Teeth in Mesh		P2 Teeth in Mesh	

PASTE SCREENSHOT OF BELT CALCULATOR HERE



STEP 6: DOWNLOAD PULLEYS FROM VEXPRO

- ❖ Navigate to the link below and download the selected pulley CAD files
 - ❖ <https://www.vexrobotics.com/htdpulleys.html>
- ❖ You do not need to include models of the belts you are using
- ❖ Use spacers to ensure pulleys are lined up
 - ❖ <https://www.vexrobotics.com/acetal-spacers-vexpro.html>



STEP 7: DOWNLOAD WHEELS

- ❖ Pick wheels to use from websites below:
 - ❖ <https://www.andymark.com/pages/wheels>
 - ❖ <https://www.wcproducts.com/aluminum-wheels>
- ❖ Make sure your wheel diameter lines up with what you used in the JVN calculator



STEP 8: PUT IT ALL TOGETHER!

- ❖ Now that you have everything configured, it is time to dive into CAD and assemble your drivetrain!
- ❖ If using Onshape, make sure to utilize MKCAD parts library of VexPro parts pre-loaded into Onshape
 - ❖ <https://onshape4frc.com/cad-library>

