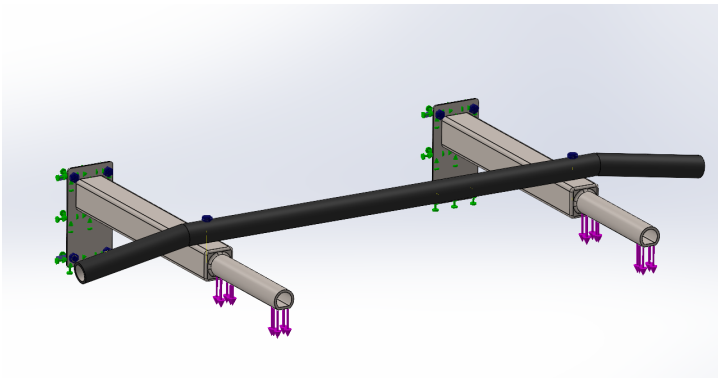
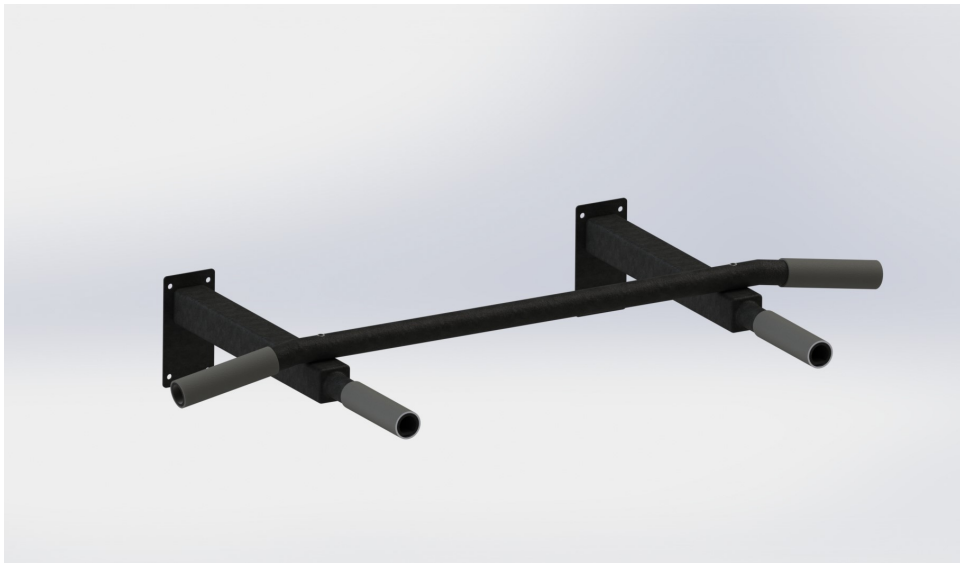


# FEA PULL UPS BAR WITH BOLT ANALYSIS

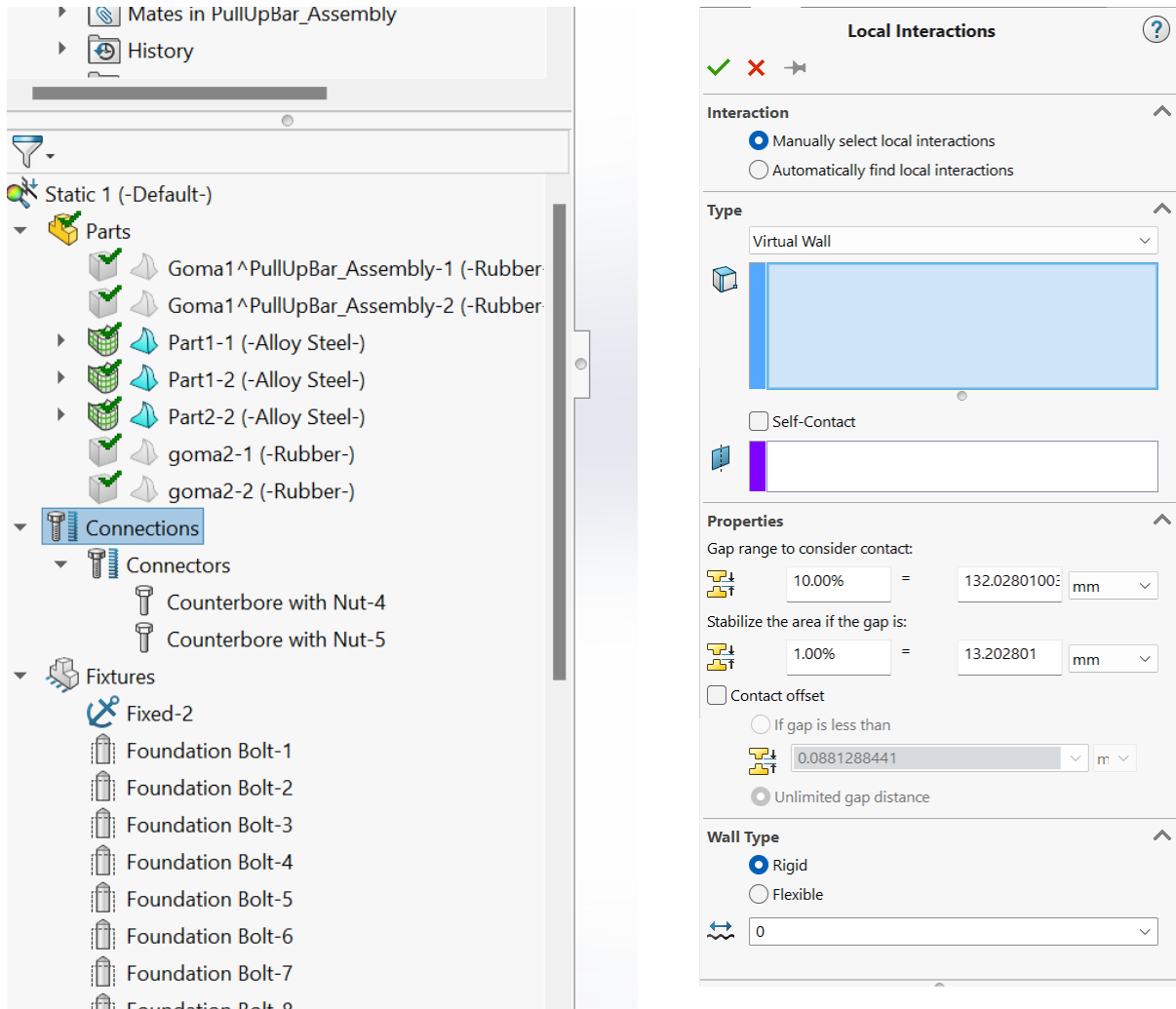
By Ramón Piquer Blancas



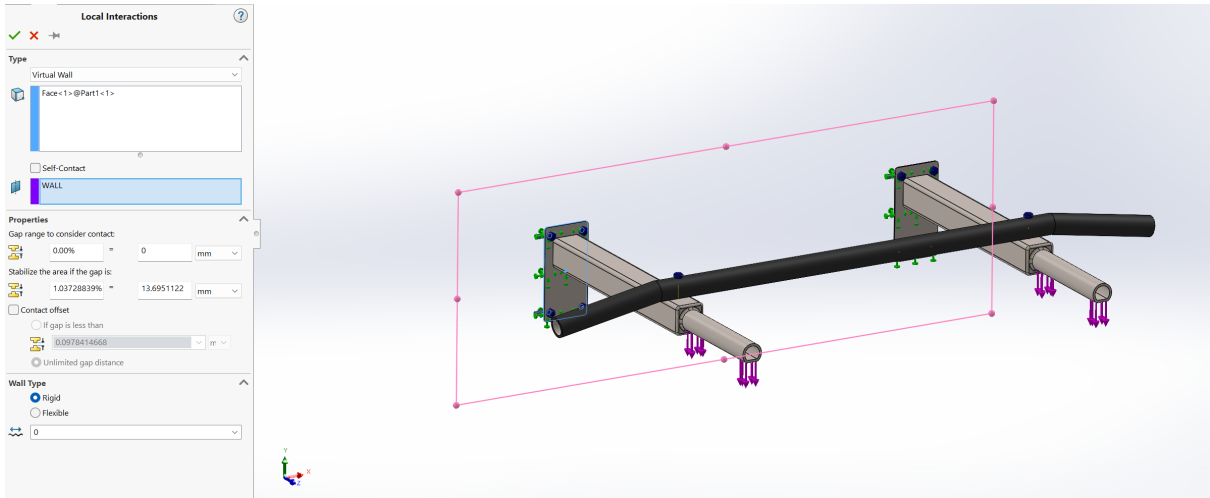
For the static study we apply the following constraints and forces:

- **FORCE:** 4900 N on each bar ( **pink arrows** )
- **FIXTURES:** Fixed geometry on each plate marked in **green**
- **BOLTS:**
  - Foundation Bolt for the 8 bolts placed on the two plates.
  - Counterbore with nut for the bolts on the long bar.

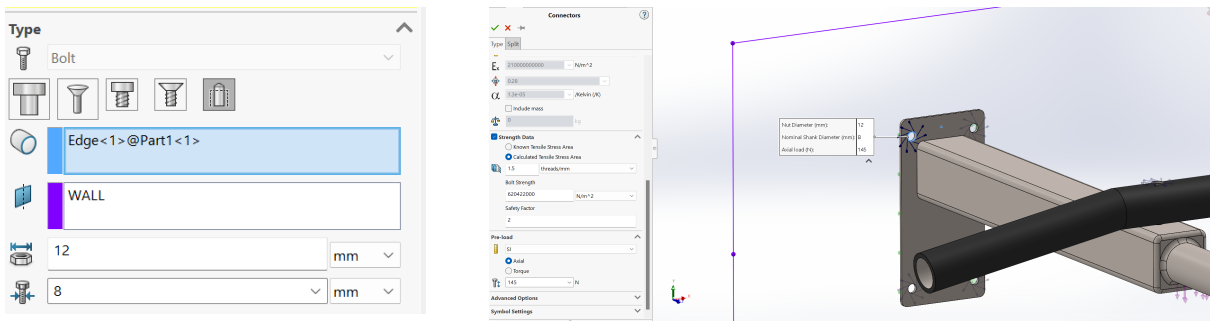
For creating the **Foundation Bolts**, we need first to create the virtual wall.



Go to *Connections* → *Local interactions* → *Select Virtual Wall* → First select the face where will be the facing the wall and below the plane you must have been created earlier in that face.

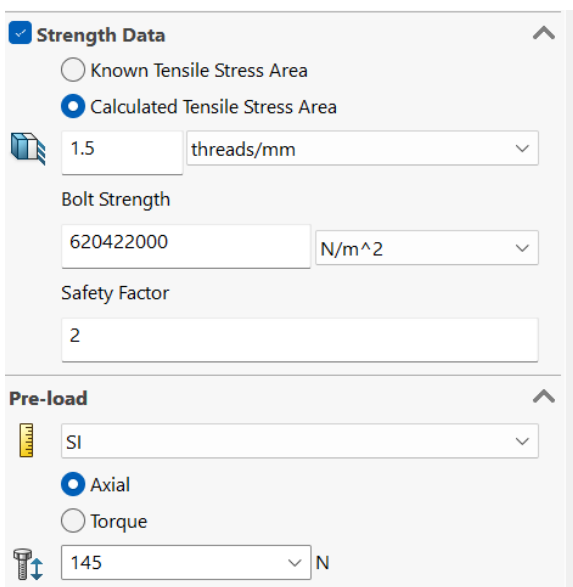


Now, we can configure the *foundation bolts*:



Select the edge where the head of the bolt will be placed in the box above.

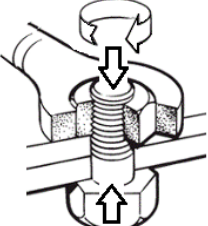
In the box below, select the plane used for the *virtual wall*.



Also, we need to set the Axial or Torque pre-load. In this case, the bolts are subjected to axial force.

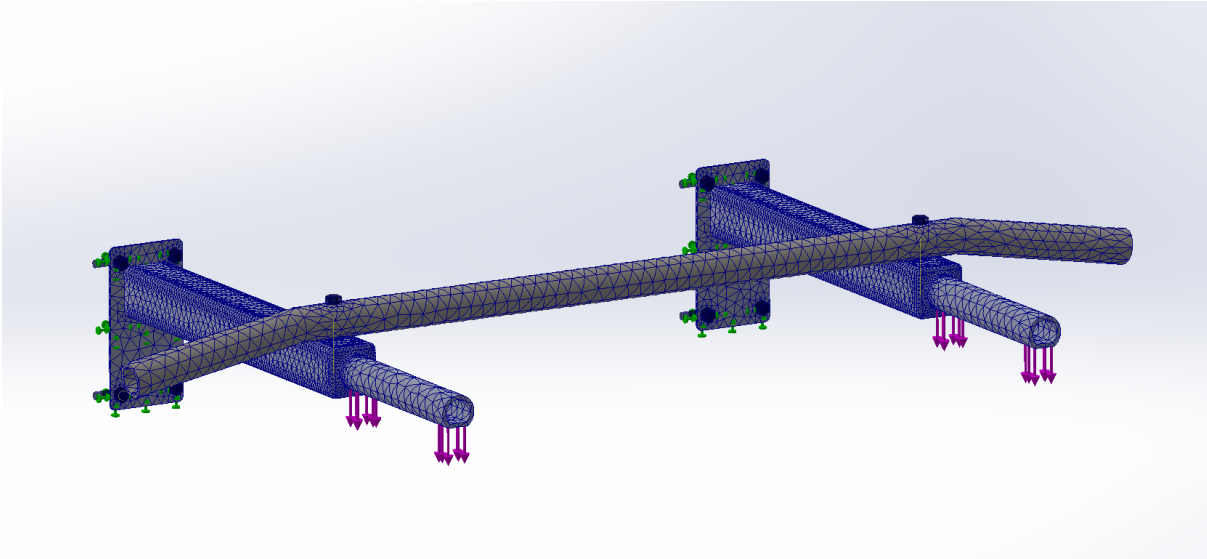
Here's a cool site where you can calculate both axial and torque force:

Bolt axial force vs torque

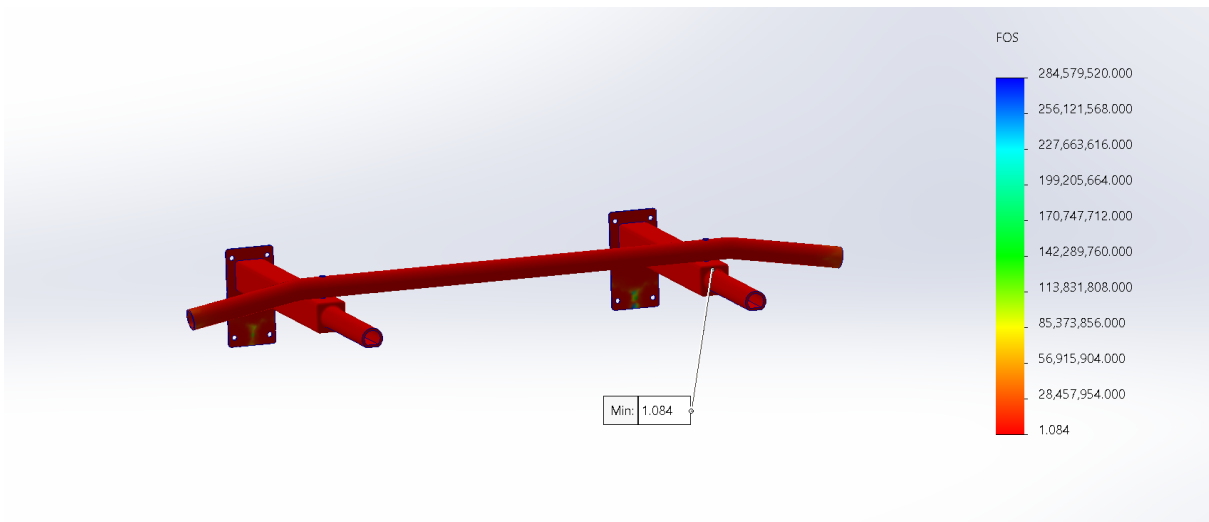
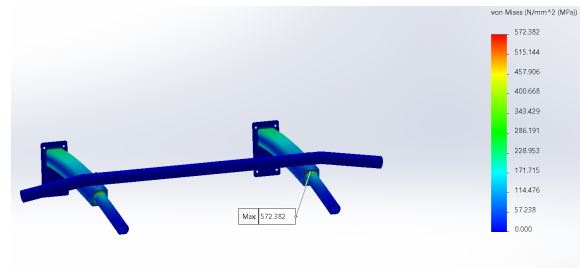
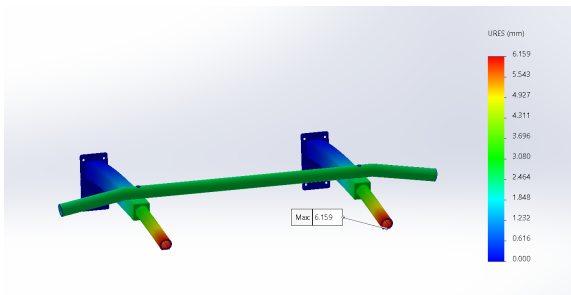


<https://caetool.com/2019/05/23/p0062/>

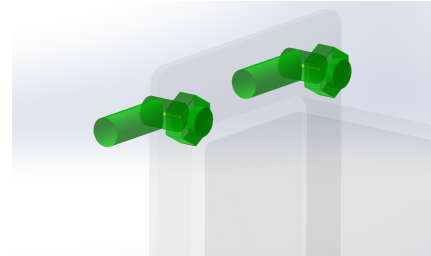
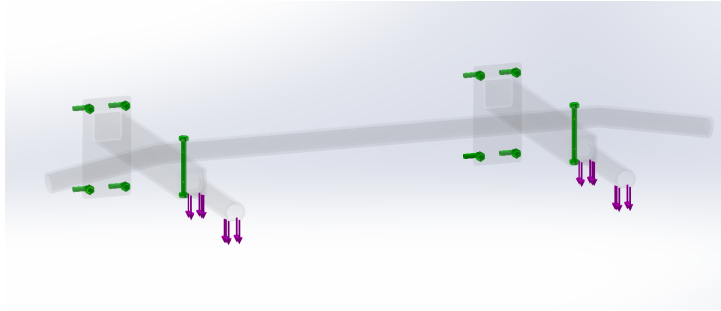
Once you have made that for all the bolts, do the mesh:



And run the study:



Green bolts mean they are correct 😊



Study name: Static 1

Connector: All bolts Units: SI

Connector type: Bolt

Type	X-Component	Y-Component	Z-Component	Resultant	Connector
Shear Force (N)	28.14	-26.803	0	38.862	Foundation Bolt-1
Axial Force (N)	0	0	145.18	145.18	Foundation Bolt-1
Bending moment (N.m)	-0.028502	-0.021895	0	0.035941	Foundation Bolt-1
Shear Force (N)	-29.453	-27.869	0	40.549	Foundation Bolt-2
Axial Force (N)	0	0	147.14	147.14	Foundation Bolt-2
Bending moment (N.m)	-0.027901	0.03338	0	0.043505	Foundation Bolt-2
Shear Force (N)	-0.49264	-0.15308	0	0.51588	Foundation Bolt-3
Axial Force (N)	0	0	937.5	937.5	Foundation Bolt-3
Bending moment (N.m)	-0.0014087	0.0050649	0	0.0052572	Foundation Bolt-3
Shear Force (N)	0.063686	-0.0030051	0	0.063757	Foundation Bolt-4
Axial Force (N)	0	0	145	145	Foundation Bolt-4
Bending moment (N.m)	-7.1676e-05	-0.00050692	0	0.00051196	Foundation Bolt-4
Shear Force (N)	28.468	-27.236	0	39.399	Foundation Bolt-5
Axial Force (N)	0	0	145.09	145.09	Foundation Bolt-5
Bending moment (N.m)	-0.028764	-0.022058	0	0.036248	Foundation Bolt-5
Shear Force (N)	-27.92	-22.344	0	35.76	Foundation Bolt-6
Axial Force (N)	0	0	136.05	136.05	Foundation Bolt-6
Bending moment (N.m)	-0.0079441	0.011318	0	0.013828	Foundation Bolt-6
Shear Force (N)	-0.096686	-0.070875	0	0.11988	Foundation Bolt-7
Axial Force (N)	0	0	145	145	Foundation Bolt-7
Bending moment (N.m)	-0.00027155	0.00082258	0	0.00086625	Foundation Bolt-7
Shear Force (N)	0.058247	-0.041722	0	0.071648	Foundation Bolt-8
Axial Force (N)	0	0	145	145	Foundation Bolt-8
Bending moment (N.m)	-0.00019671	-0.00047375	0	0.00051297	Foundation Bolt-8
Shear Force (N)	-7.828	0	-15.95	17.768	Counterbore with Nut-4
Axial Force (N)	-8.9242e-14	170.1	0	170.1	Counterbore with Nut-4
Bending moment (N.m)	2.9266	1.5354e-15	-0.69597	3.0082	Counterbore with Nut-4
Shear Force (N)	8.2361	0	-0.0030048	8.2361	Counterbore with Nut-5
Axial Force (N)	0	86.489	0	86.489	Counterbore with Nut-5
Bending moment (N.m)	1.8437	0	0.36225	1.879	Counterbore with Nut-5

You can also check all the forces of the bolts.