

Cool K-PAC Competition



Mauro Marconcin






Darryl Yarbrough



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Cool **K-PACs**

-  **Background**
-  **How Does it Work?**
-  **4th Annual**

Cool K-PAC: Shim Retention Design Rule

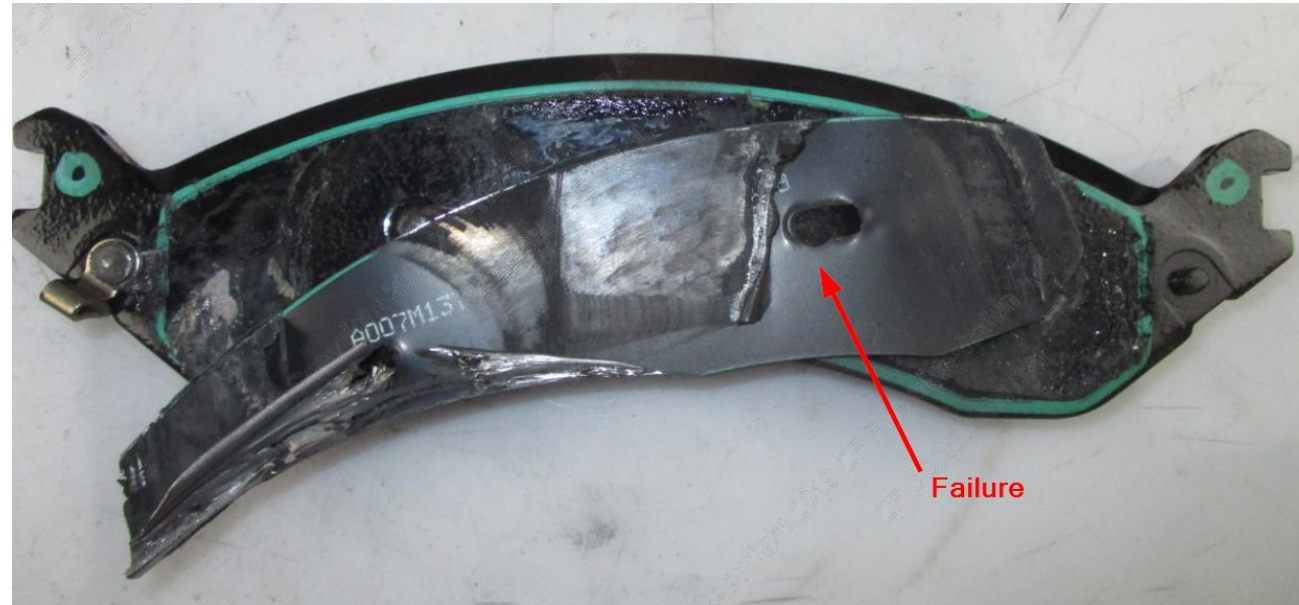


Mauro Marconcin



Problem Overview

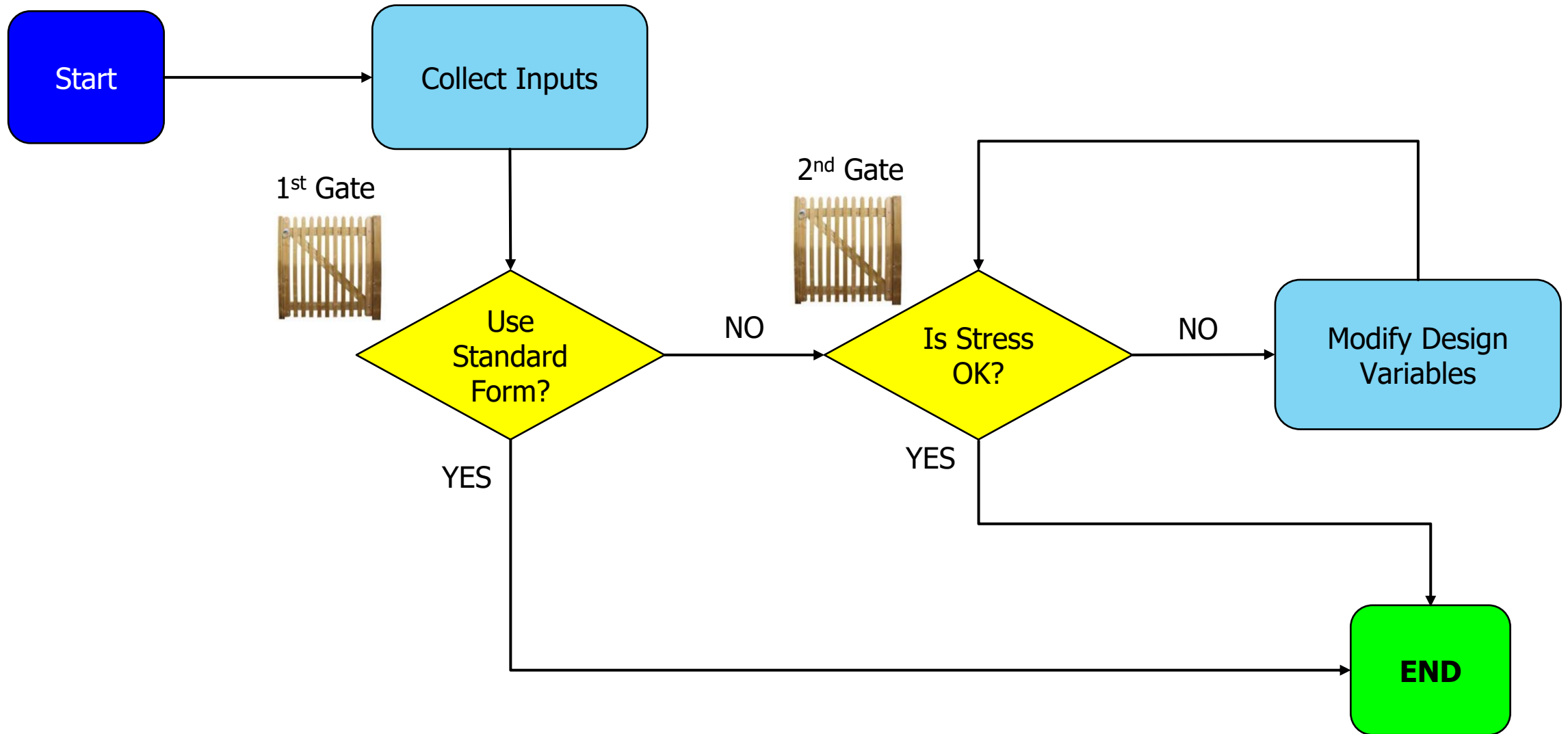
K-Pac to create a Design Rule to prevent bonded shim tearing on brake pads.



- Main Points:

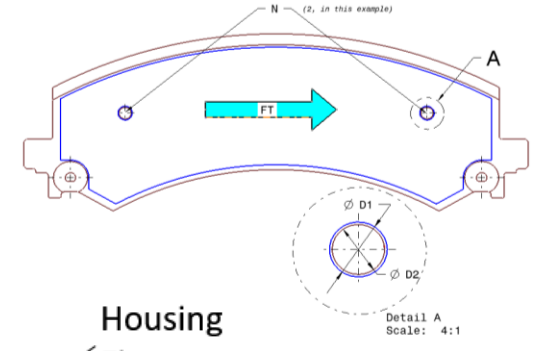
- Recommends number of posts and post diameter based on caliper size.
- Recommendation can be overwritten, as long as stress level is below limit.

Design Flow



Modeling the Physics

A free body diagram of the forces was created:



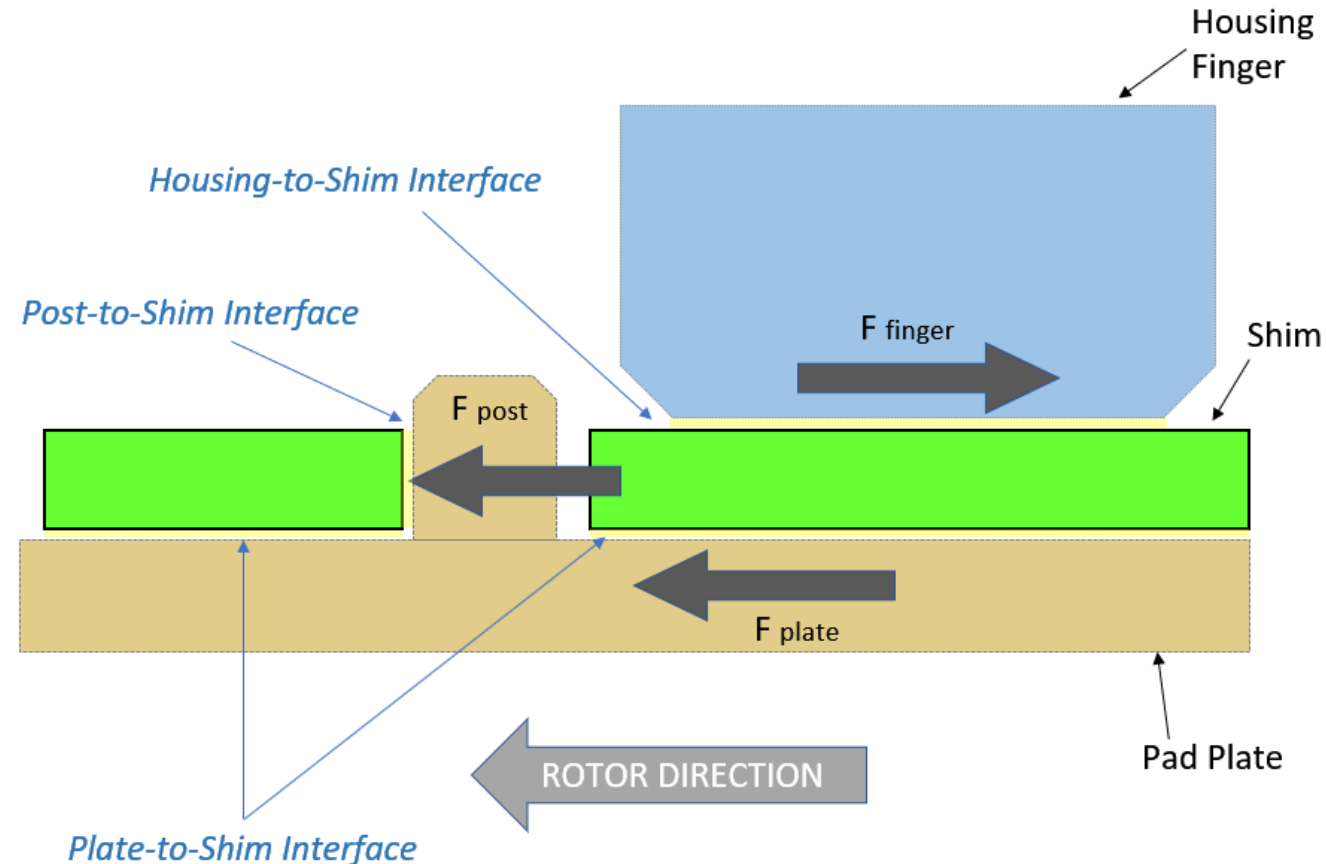
Main Points

- **F finger:** Force holding the shim by housing finger friction.
- **F post:** Force pulling the shim thru the plate post to rotate along with the rotor.
- **F plate:** Force pulling the shim by the plate friction to rotate as well.
- Balance of Forces:

$$F_{\text{finger}} = F_{\text{post}} + F_{\text{plate}}$$

or

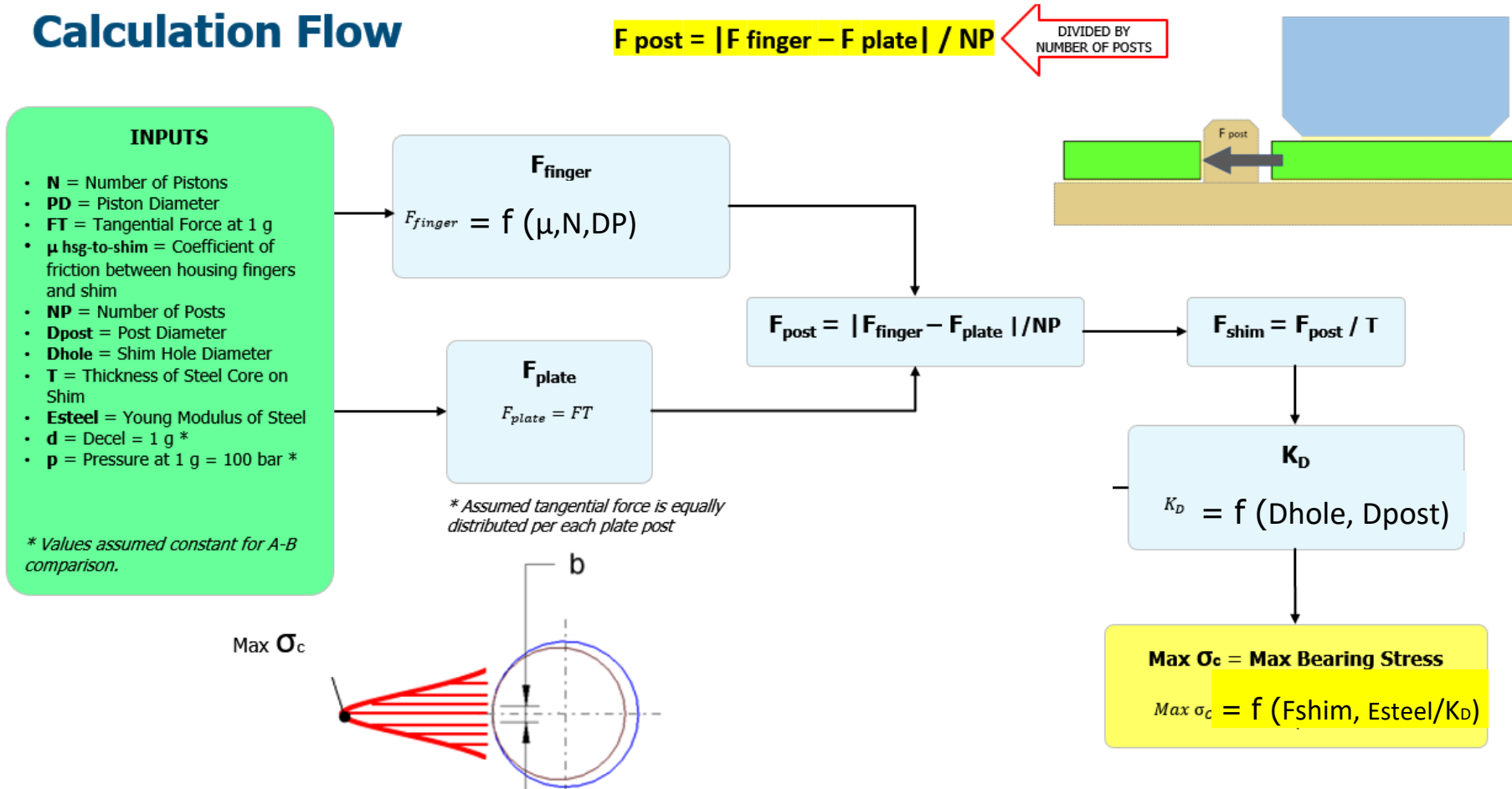
$$F_{\text{post}} = |F_{\text{finger}} - F_{\text{plate}}|$$



Develop the Calculation

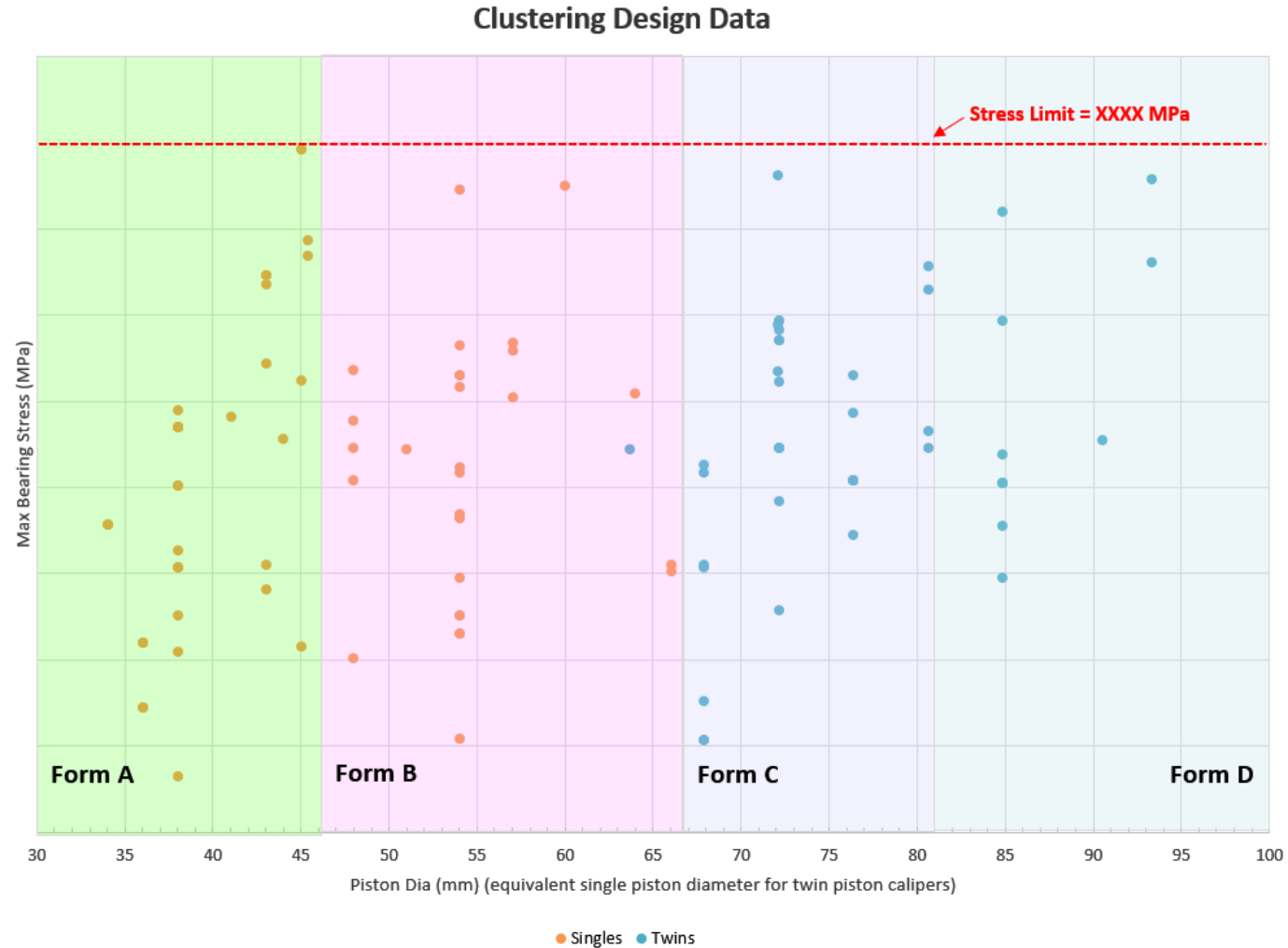
Create a rule for number of shim retention posts and their diameter based on the calculated max bearing stress at the steel core of the shim material.

Calculation Flow



Apply Calc to Existing Designs

Map out the design rule to known performance designs.



Cool K-PAC: Knowledge Based Engineering



Darryl Yarbrough

GM General Motors

Cool K-PAC: **ASTM A36 Steel**



Jim Carter



Vote Now: Cool K-PAC Competition



Darryl Yarbrough

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Cool K-PAC Champions

- 2017 – Navistar: Gary Svidron
- 2018 – BorgWarner: Matt Barron
- 2019 – Navistar: Nic Cassaday
- 2020 – ????: [Final Results](#)