

Great Designs in

# STEEL



## Optimization Process for Agricultural and Commercial Vehicles Steel Wheels

**Pedro Gabriel Santos**

**Maxion Wheels**

- Business
- Development Cycle
- Input
- Validation
- FEA x Test
- Finite Element Optimization
- Results



Largest Manufacturer of Original Equipment Passenger Car, Commercial Vehicle and Off-Road Wheels in the World



Passenger Car  
Steel and Aluminum Wheels

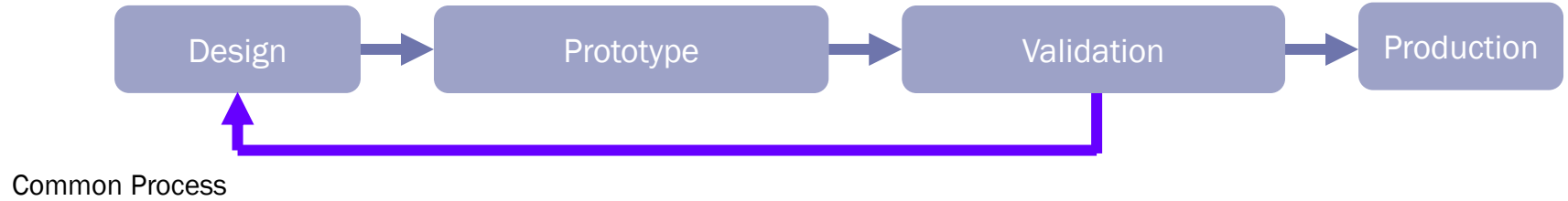


Commercial Vehicle  
Steel and Aluminum Wheels

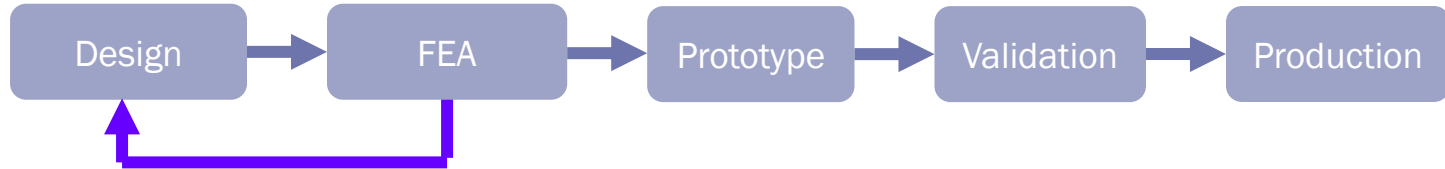
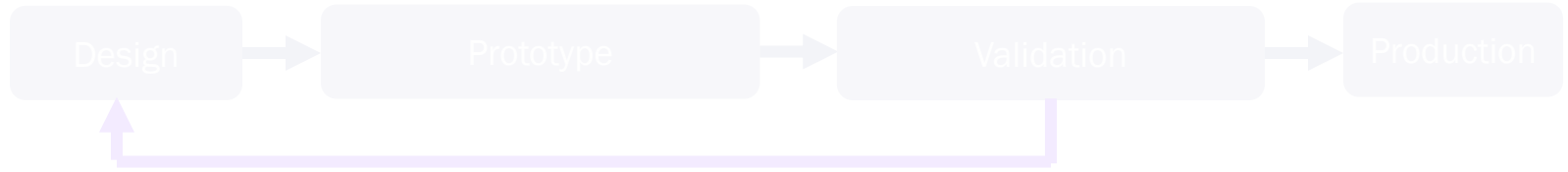


Agricultural / Off-Road  
Steel Wheels

# Development Cycle

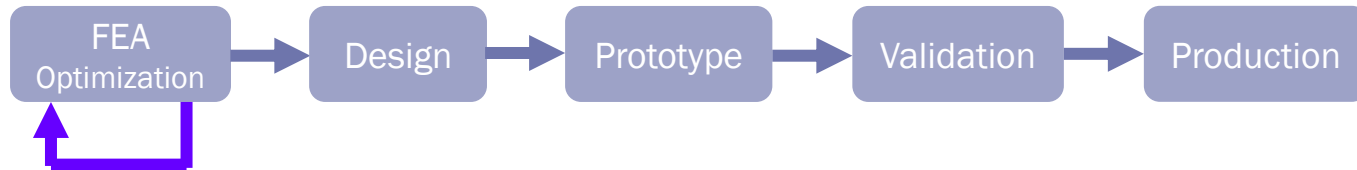
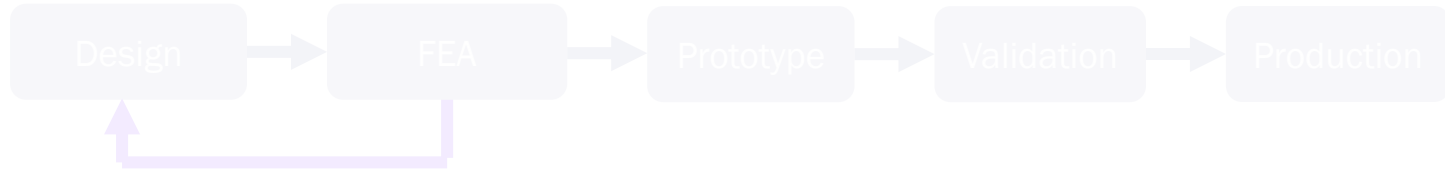
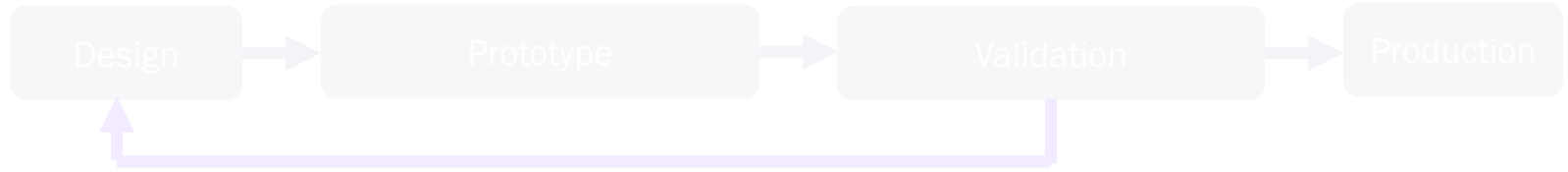


# Development Cycle



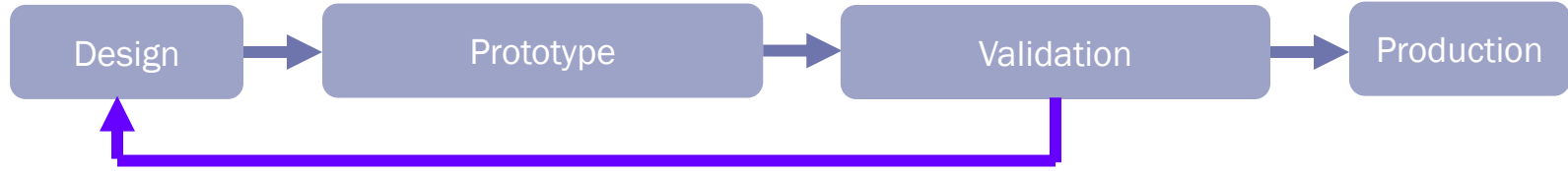
FEA Process

# Development Cycle

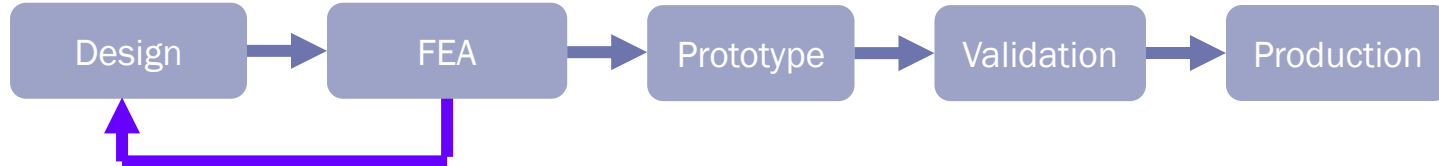


FEA Optimization Process

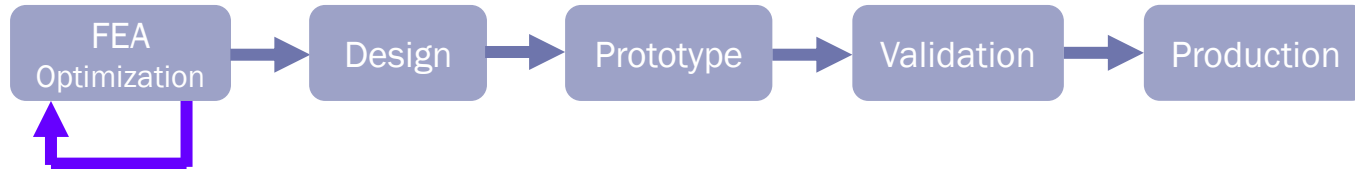
# Development Cycle



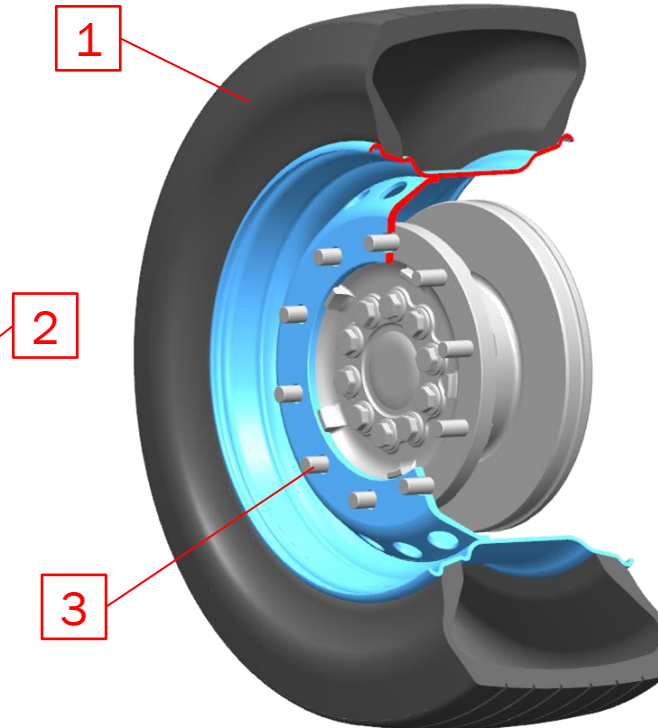
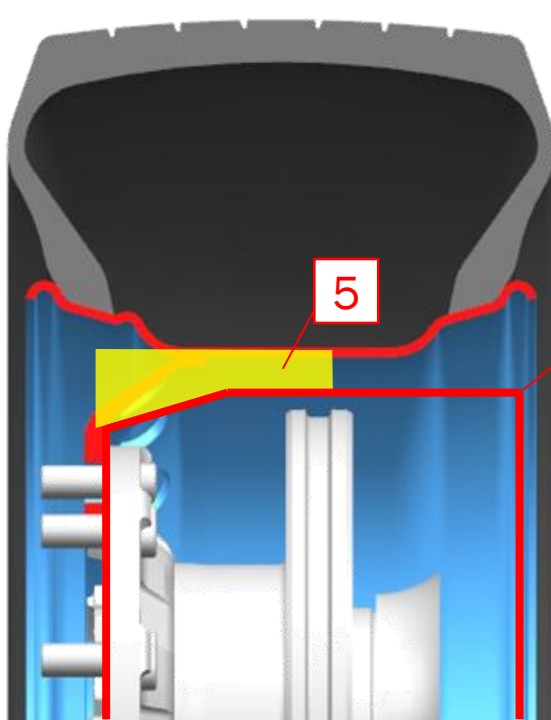
Common Process



FEA Process



FEA Optimization Process

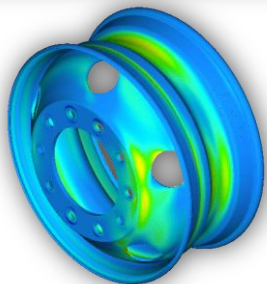


## Definitions:

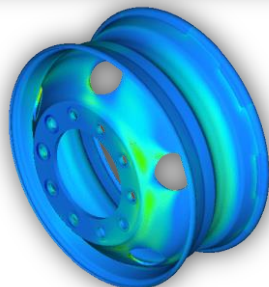
- 1- Tire
- 2- Hub Contour (Caliper)
- 3- Assembly Dimensions
- 4- Load Capacity
- 5- Optimizable Domain

# Validation

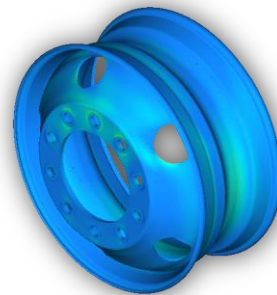
## Radial



## Cornering

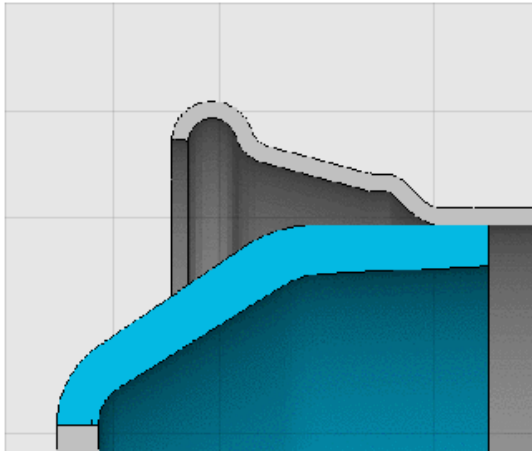


## Biaxial

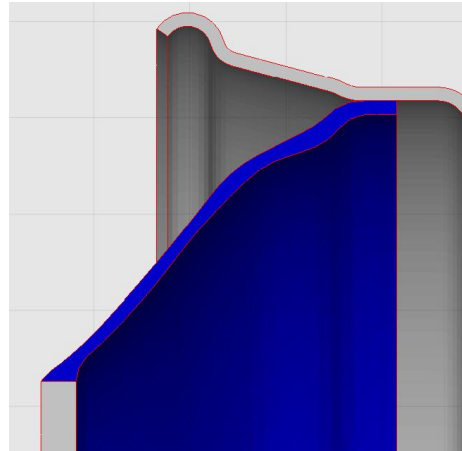


# Finite Element Optimization

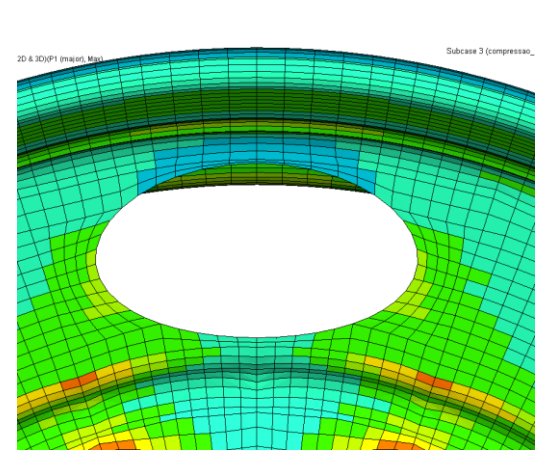
Topology



Shape (Profile)



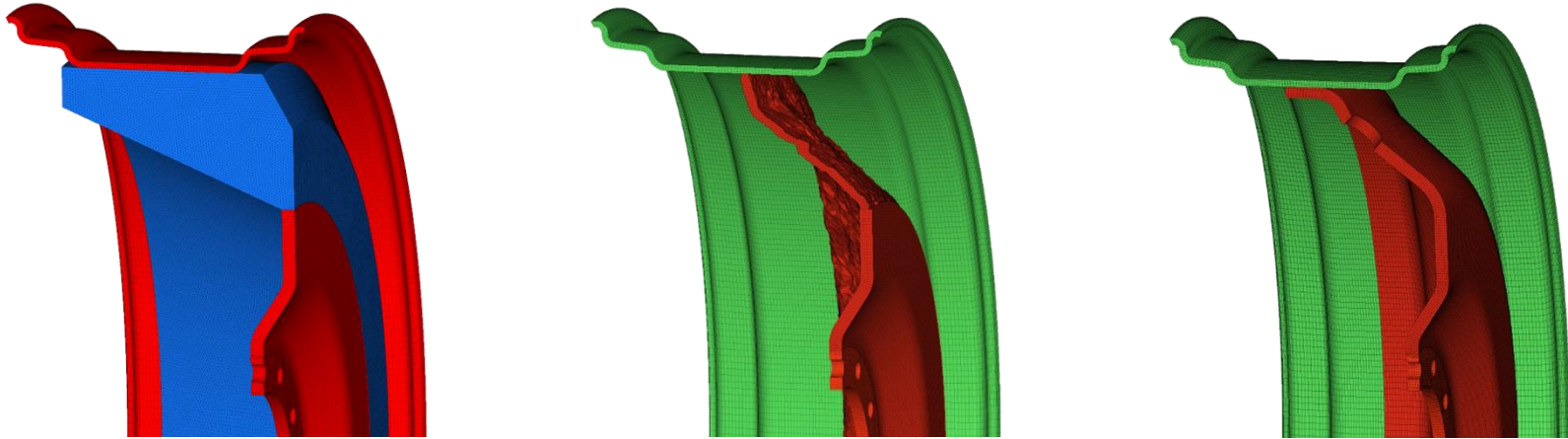
Shape (Ventilation)



# Finite Element Optimization

## TOPOLOGY

46 x W13B

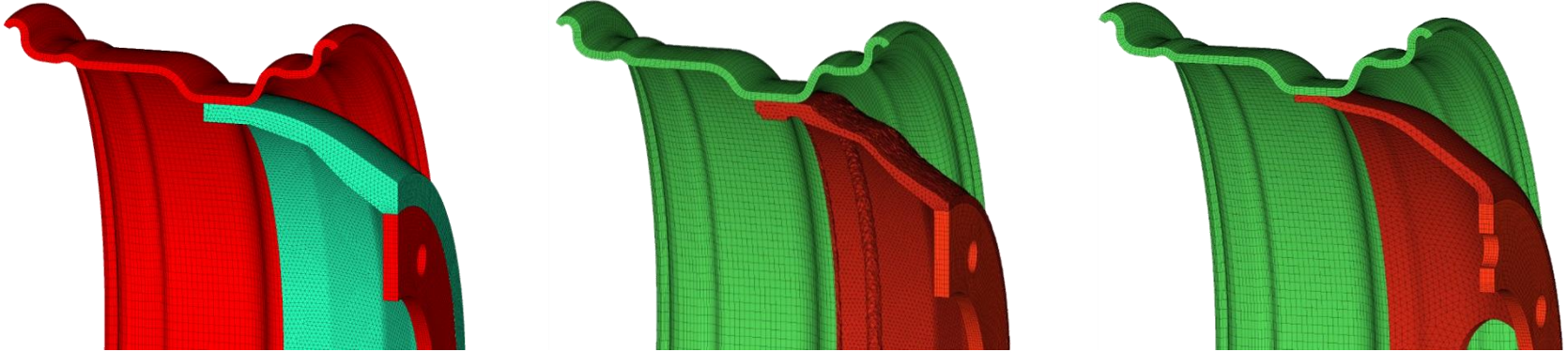


- ✓ There was a reduction of **-27%** at stress level.
- ✓ There was an increase of **+20%** at the wheel load capacity.

# Finite Element Optimization

## TOPOLOGY

16H2 x 6J



- ✓ There was a reduction of **-12%** at stress level.
- ✓ There was an increase of **+50%** at the wheel load capacity.

# Finite Element Optimization

SHAPE

19.5 x 6.0

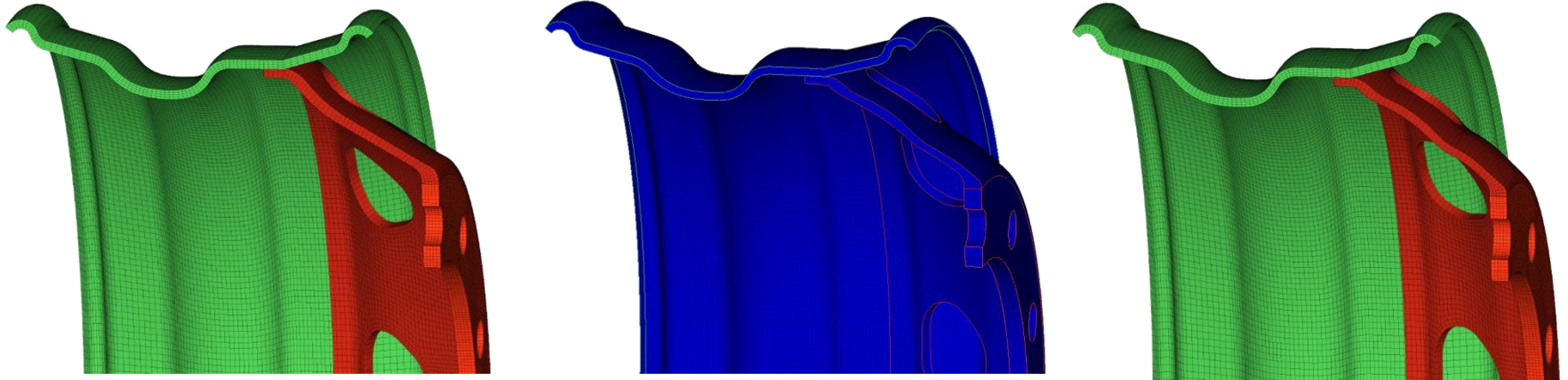


- ✓ There was a reduction of **-10%** at stress level.
- ✓ There was a reduction of **-7% (2.6lbs)** per wheel.

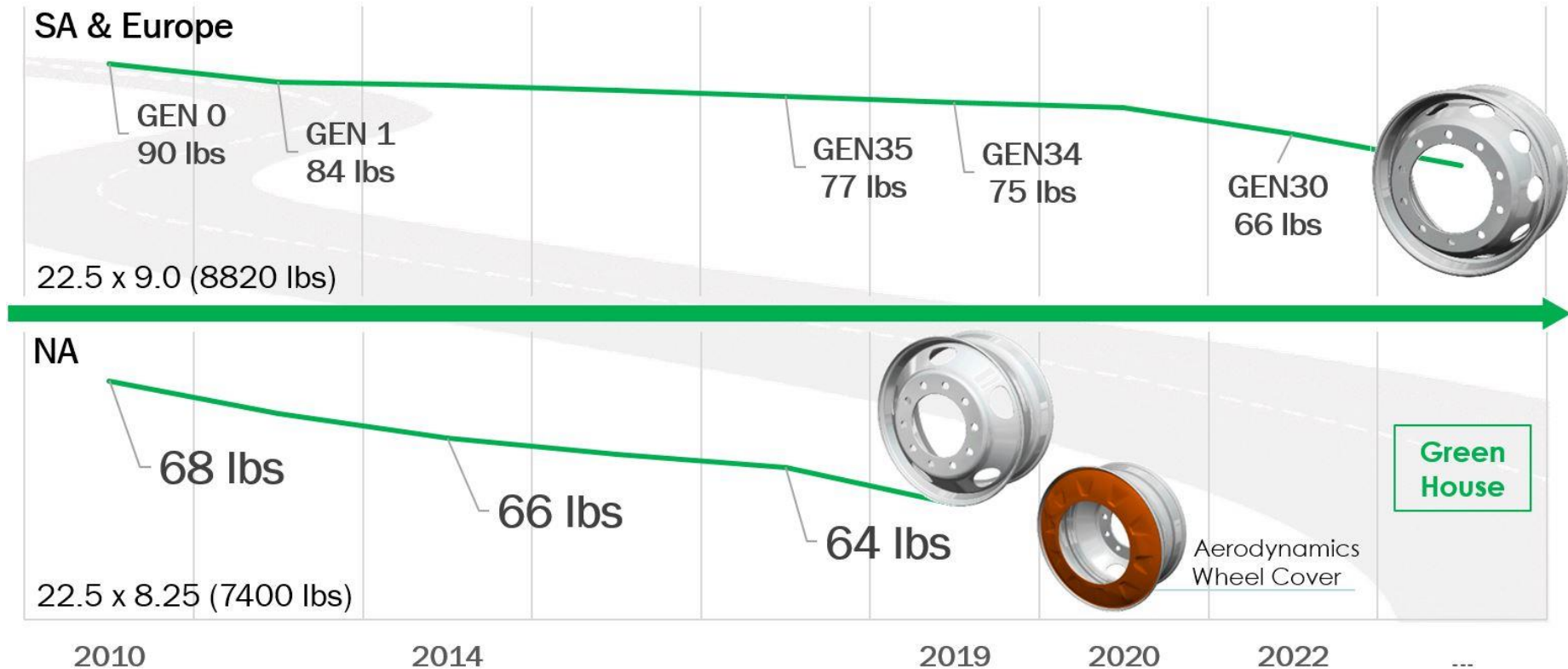
# Finite Element Optimization

SHAPE

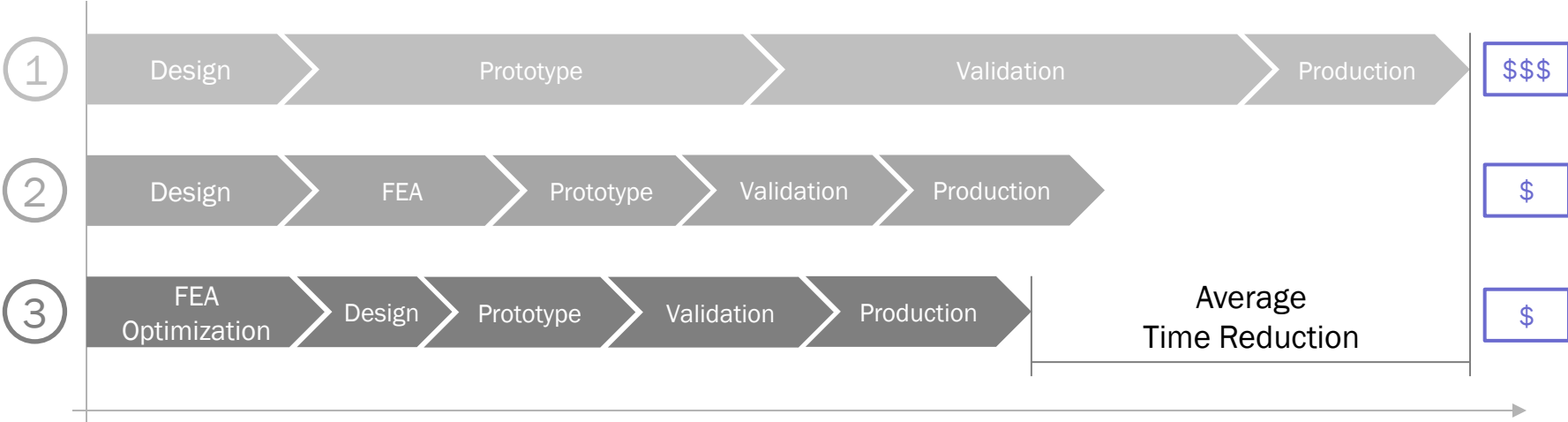
22.5 x 8.25



- ✓ There was a reduction of **-9%** at stress level.
- ✓ There was a reduction of **-5% (3.7lbs)** per wheel.



# Results



**-26%**  
**Time-to-Market**

**+30%**  
**Fatigue Life**

**-12%**  
**Weight**

Thank you!

# For More Information

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