



# **Steel Founders' Society of America**

## **2022 Industry Market Forecast**



# Marketing Committee Role as defined by SFSA Board

The function of the Marketing Committee is to **broaden the market for and promote the use of steel castings** by investigating and developing new markets, developing and implementing an effective marketing program, and communicating the advantages of steel castings to present and prospective consumers in an effective manner.

To carry out its mission, the committee maintains liaison with other committees of the Society through the staff, identifies technical, business and market topics of interest to customers and SFSA members, directs development of the material and delivery of the information. The committee develops the deliverables for the marketing program such as messaging, competitive input, target market, and specific planning, The committee also performs related market research to help guide the work of the Society and **prepares each year for the Society an annual forecast of steel casting demand.....**



# Customer Education Resources

- Member Directory
- Free SFSA Publications
- Online Specs./Stds. Tool
- Customer Webinars
- White Papers
- Foundry Glossary
- Other buyers/designer resources

Casting Inspection

## Casting Inspection

### Standards and Specifications for Steel Castings

Choose one of the search tabs below, enter the desired search criteria and click "Search" to find matching alloy grades in our database.

**Notice:** This facility is in its beta test stage, and is provided for convenience. Search results provided are subject to both human and machine errors and you should not rely on the information provided here without confirming it against the applicable standards and specifications.

Properties/Chemistry By Standard By Alloy Family By Microstructure By UNS By Wrought Equivalent

**Mechanical**

- Standards specify either a minimum or a range of mechanical properties. Your entered value(s) must be equal to or higher than the minimum or within the range of mechanical properties specified for a grade in a standard to have a match result.
- You can search tensile strength (UTS), yield strength (YS), impact toughness, and rupture strength in Metric (SI) or Imperial System. You only need to input value using one unit and your entered value will automatically be converted to the other unit.

Hardness BHN  HBW  HRC   
Tensile strength ksi  or MPa   
Yield strength ksi  or MPa   
Elongation%   
Reduction in area%   
Impact Foot-pounds  or Joules   
Impact test temperature in °F  or °C   
Stress rupture test ksi  or MPa   
100 hour rupture test MPa  at temperature in °C

**Chemistry**

- All values are in weight percent (wt%)
- Standards specify either a maximum or a range of wt% for various elements. Your entered value(s) must be equal to or lower than the maximum or within the range of wt% of elements specified for a grade in a standard to have a match result.
- Elements that are specified as "Others" in a standard are not included in the search algorithm. To see these "Other" elements of a certain grade, click the page for that specific grade (either shown in the search results or by going to the other tabs e.g. By Standard)

Al%  As%  Ba%  Bi%  B%  C%  Co%  Cr%  Cu%  Mn%  Mo%   
N%  Nb%  Ni%  P%  S%  Sb%  Se%  Si%  Sn%  Ta%  Ti%   
V%  W%  Zr%

Search  Clear form fields

**STEEL FOUNDERS' SOCIETY OF AMERICA**  
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### Free publications

Casteel Reporter - SFSA's newsletter

Other free SFSA publications:

- Supplements to the Steel Castings Handbook
- Research Reports 94 A&B on Fatigue and Fracture Toughness of Five Carbon or Low Alloy Cast Steels at Room or Low Climate Temperature
- SFSA Project A95 on Corrosion, Toughness, Weldability and Metallurgical Evaluation of Cast Duplex Stainless Steels
- Test Coupons and Casting Properties - Information gathered from several publications on the relationship between the properties of test coupons and the properties of castings
- Fracture Toughness in Relation to Steel Castings Design and Application
- Ultrasonic Testing of Steel Castings
- Cast to Shape. A history of the steel castings industry in the United States
- Raw Materials Specifications
- Sub-size Charpy specimens

### Understanding Steel Casting Failures

All parts, regardless of their product form, be they castings, forgings or fabrications will fail if the service load exceeds the design limits. The load bearing capacity of a casting depends on the geometry, material properties (strength) and quality. Selecting these requirements is the responsibility of the design engineer. The casting producer must meet the requirements specified.

Routine part failures generally indicates either one or a combination of inadequate geometric design, incorrect material selection or failure to select the quality requirements which might include NDE

requirements, the net result is that a redesign is required. A sporadic part failure indicates the part was not capable of meeting the load required, which may be due to an unplanned use or a quality issue that may or may not have been identified as a requirement for the part.

It is common for a failed part to be sent to a laboratory for inspection and analysis. The fracture surface is examined and the initiation feature and crack path are determined. Pictures are taken and a report is written. Unfortunately, this does not address the main issues: did the casting meet the specification requirements, did it meet or exceed the design loads, was the design adequate for the service conditions, or did the part experience abuse with loads that exceeded the design?

Steel casting are used to make complex shapes. As the design becomes more complex in shape, the load is highest at and is constrained to the smallest cross section subjected to that load. When a part is loaded in excess of its capacity, it can fail in a brittle manner in the heavily loaded section without obvious deformation as the failure path is determined by the complex part shape and the load, Figure 1. Often the fracture surface at the microscopic level shows ductility but the crack path will be flat without any macro deformation due to the geometric constraint. The initiation of failure will be at the weakest, most heavily loaded feature and will propagate through the weakest material Figure 2. A test laboratory that examines the failure path is expected to find an initiation point and areas of weakness that limited the capacity of the part, Figure 3.

All parts can be loaded beyond capacity and fail. The failure will occur at the weakest area of the heavily loaded section of the part. The weakest area will have a feature that initiates the failure. Common practice is to identify this initiation feature as a defect and attribute the failure to its existence. This is often incorrect since the part load may have exceeded the design intent due to an inadequate design or product abuse. Labeling the initiation of failure to a defect incorrectly and prematurely assigns responsibility of failure to part quality and fails to correctly identify the root cause or commercial responsibility.

All real materials have features that limit the capability of the part. In the ASTM nondestructive testing standard E1316, the definition of a defect is, "one or more flaws whose aggregate size, shape, orientation, location, or properties do not meet the specified acceptance criteria and are rejectable." In this definition the correct commercial and technical use of the term, defect, is a condition that violates the purchase requirement at the transfer of ownership from the producer to purchaser. A flaw in the part that





# Steel Casting Design Webinars

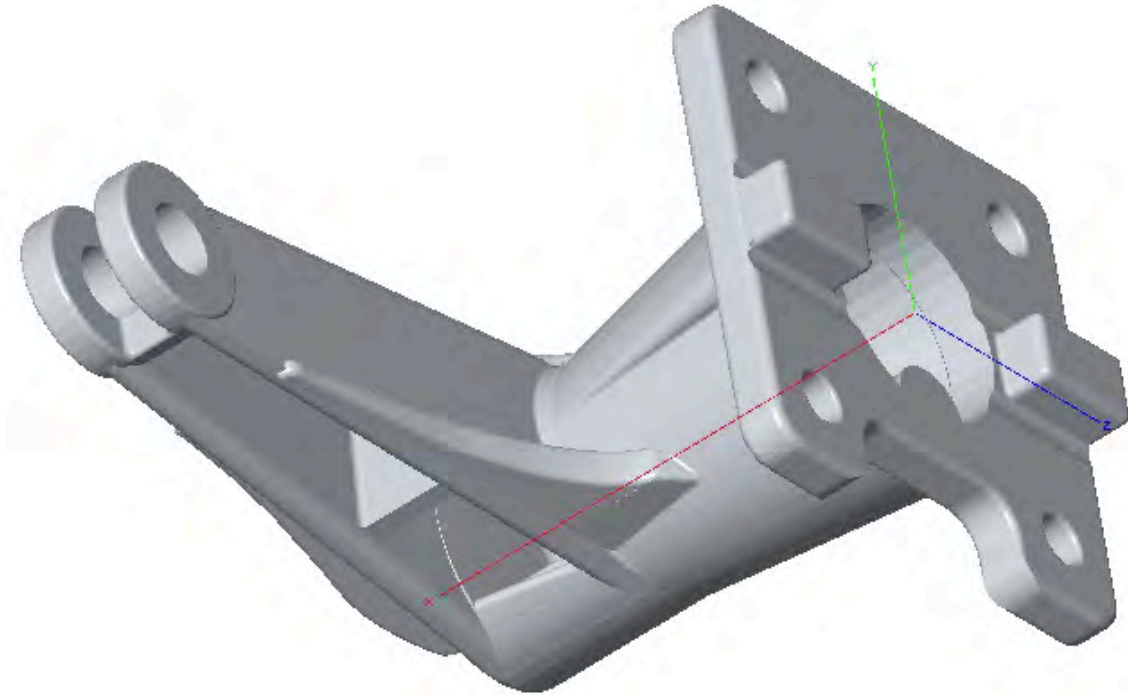


Mike Gwyn

- Enable dramatically better steel casting designs for lower mass, assured design life, easier producibility, and lower final assembled total cost.
- Disseminate via the SFSA Website to casting buyers and industry - steel casting producers' foundry engineering teams, and OEM concept-to-production teams.

## Topics

- Castability Geometry
- Structural Geometry Overlay on Castability Geometry
- Manufacturing Engineering
  - Improve mold-filling temperature distributions
  - Mitigation of re-oxidation inclusions
  - Dimensional capability
- Innovative application of GD&T

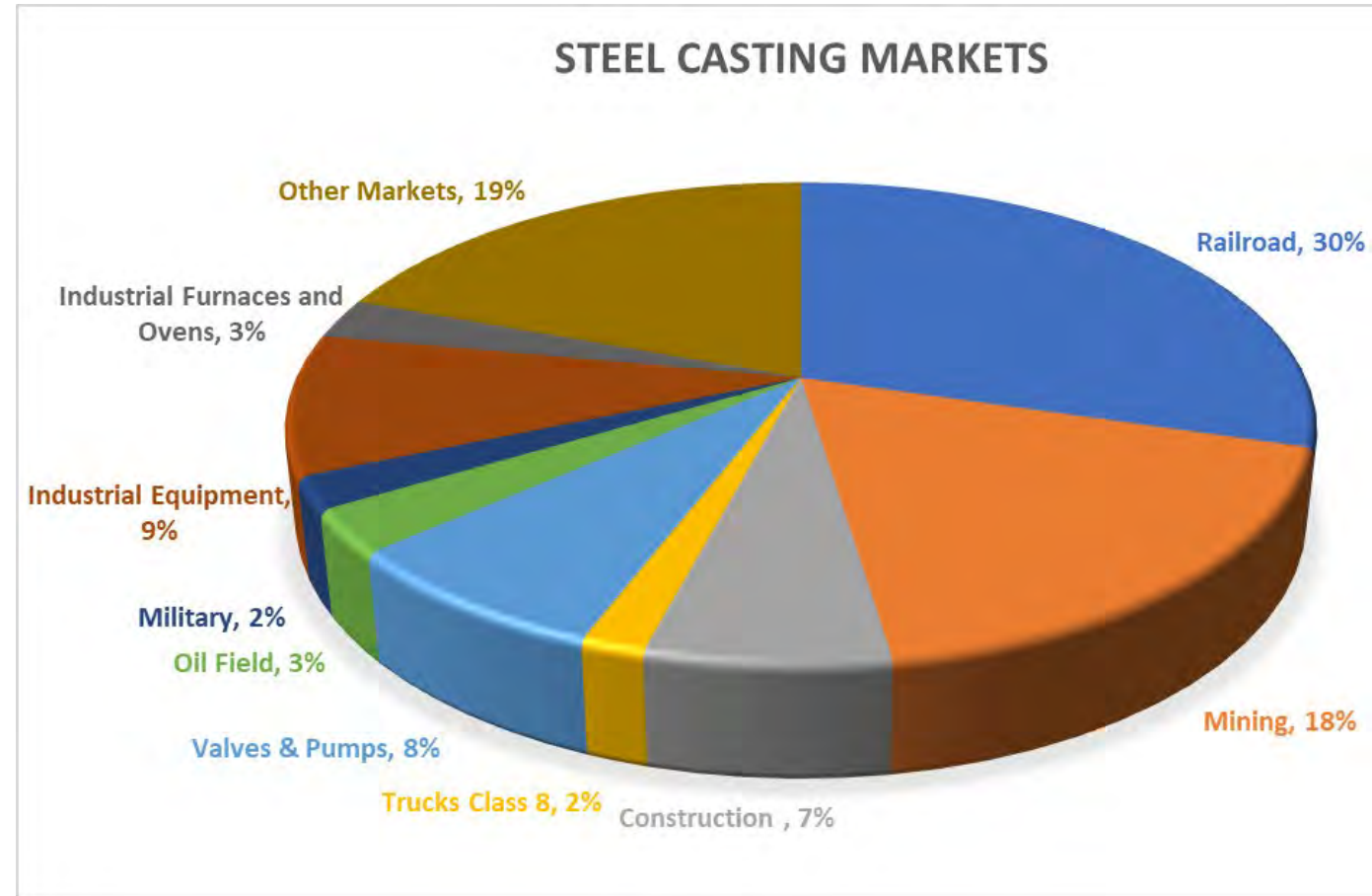






# Forecast Process

- Segmented primary markets
- Identified key customers and users in each market
- Analyze customer top line sales
- Market survey to members
- Leverage customer associations
  - Pumps, Valves, Rail, Equip. Mfg.
- Review analyst reports





# Steel Markets Survey

SFSA Markets	Steel Casting Examples
<b>Rail/Transit</b>	frames, couplings, bolsters, track components
<b>Mining - Equipment</b>	axle housing, frame components, suspension, gear case
<b>Mining - Consumables</b>	G.E.T., liners, hammers, grate plates, cement and aggregate components
<b>Construction Equipment</b>	axle components, sprocket, end caps, transmission housing
<b>Truck - Class 8</b>	suspension brackets, brake components, axle spindles, fifth wheels
<b>Pump</b>	housing, impeller, covers, bowls
<b>Valve</b>	strainer bodies, bonnets, butterfly valves
<b>Oil &amp; Gas</b>	port adapters, brackets, levers, slip linkages
<b>Military</b>	ground vehicle and maritime components
<b>Industrial Furnace and Oven Mfg.</b>	Furnace, heat treat, steel mill components - rollers, links, baskets
<b>Industrial Machinery</b>	Industrial equipment parts - pulp & paper, food, shotblast - plates, wheels, sprockets, flanges
<b>OTHER MARKETS</b>	
<b>Agricultural Implement Manufacturing</b>	Agricultural Products - Hitch Links, Sprockets
<b>Electric Power Generation</b>	Power Generation - Coreforms, deflector blocks
<b>Aerospace Product and Parts Manufacturing</b>	Aerospace bearing supports, combustor cases, compressor cases, exhaust diffusers, stationary inlet guides, swirlers
<b>Engine, Turbine, and Power Transmission Equipment</b>	Turbine engine - compressor cases, combustor basket
<b>Special Die and Tool Manufacturing</b>	Dies, Tooling, fixtures

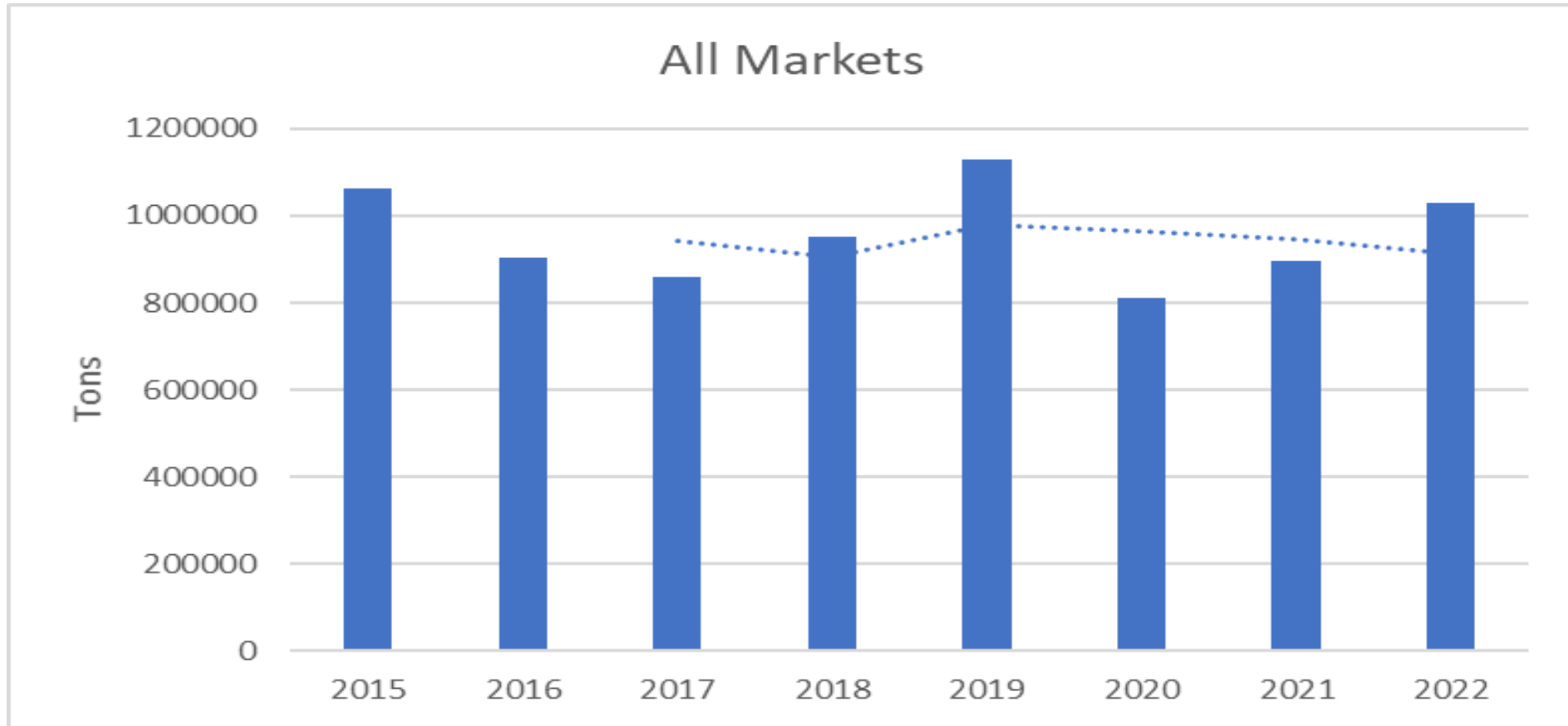


# Market Segments – Annual Production

<b>Market</b>	<b>Industry</b>	<b>% of total market prod.</b>	<b>SFSA Members</b>	<b>% of Industry Production</b>
<b>Railroad</b>	308,000	30%	55,000	18%
<b>Mining</b>	187,600	18%	115,000	61%
<b>Valve and Pump</b>	79,400	8%	52,200	59%
<b>Oil &amp; Gas</b>	30,300	3%	22,300	74%
<b>Construction</b>	67,700	7%	21,800	32%
<b>Trucks</b>	17,900	2%	4,500	25%
<b>Military</b>	22,500	2%	15,000	67%
<b>Industrial Equip.</b>	98,000	9%	27,000	28%
<b>Industrial Furn.</b>	28,000	3%	15,000	54%
<b>Other Industrial</b>	201,000	19%	133,000	66%
<b>Total</b>	1,040,400		460,800	44%



# Total Steel Castings Market

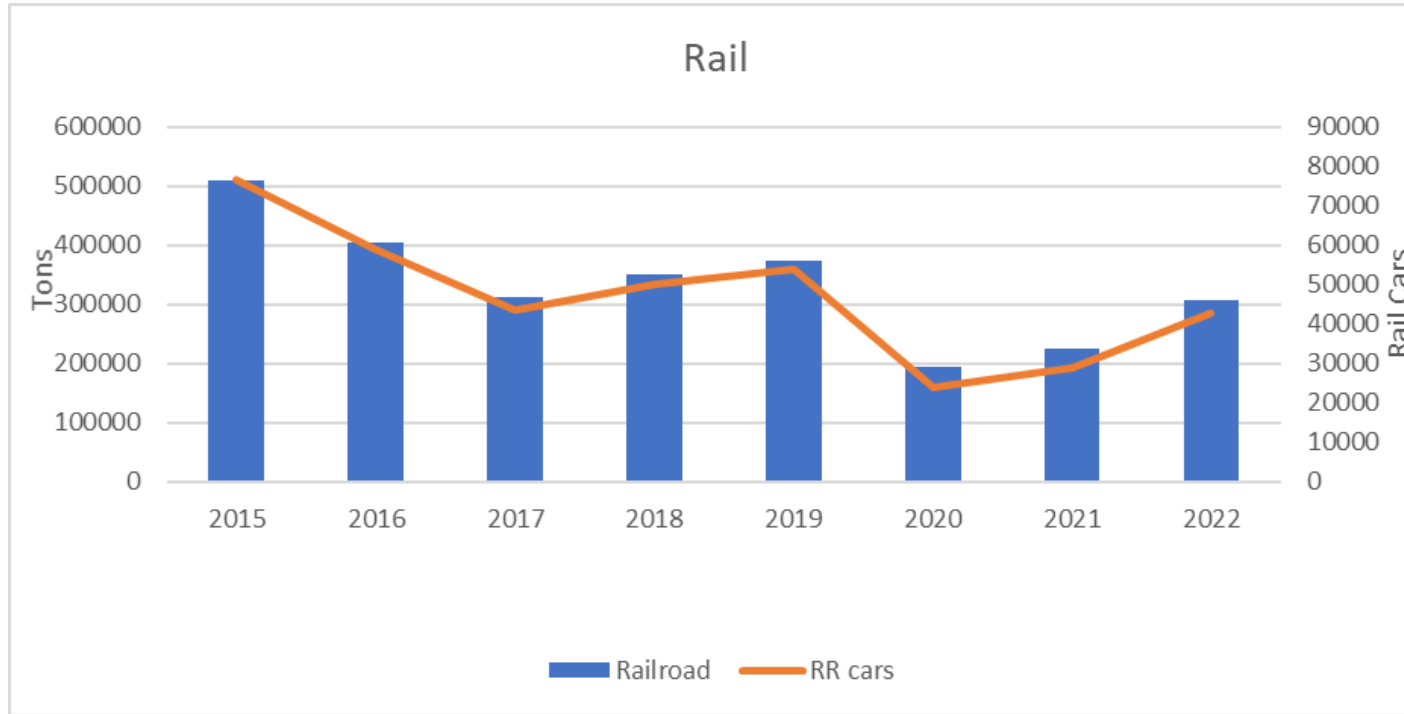


2021		2022	
Total Market	Excluding Rail	Total Market	Excluding Rail
10.5%	9%	15%	7%





# Railroad Forecast



## Projected Car Deliveries

2020 – 24,000

2021 – 29,000

2022 – 43,000

2021	2022
15%	38%

- Below-replacement production this year
- Underlying demand strength
- Freight car volume recovery



# Customer Market Sales Forecast

**% change from prior year**

<b>Railroad</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>
Railroads (sales)	1.4%	-9.2%	11.9%	7.3%
Equipment (sales)	20.1%	-21.5%	-2.8%	38.4%
SFSA Forecast (tonnage)	7%	-41%	15%	38%

Note: Customer market data is percentage change in sales,  
SFSA forecast is percentage change in tonnage.



# Mining Forecast



## Equipment

- Increase in order activity
- Accelerated growth in mining production forecasted through second quarter of next year

## Consumables

- Trending values of copper and nickel
- Increased mineral demand for shift to electric

2021	2022
8%	6%



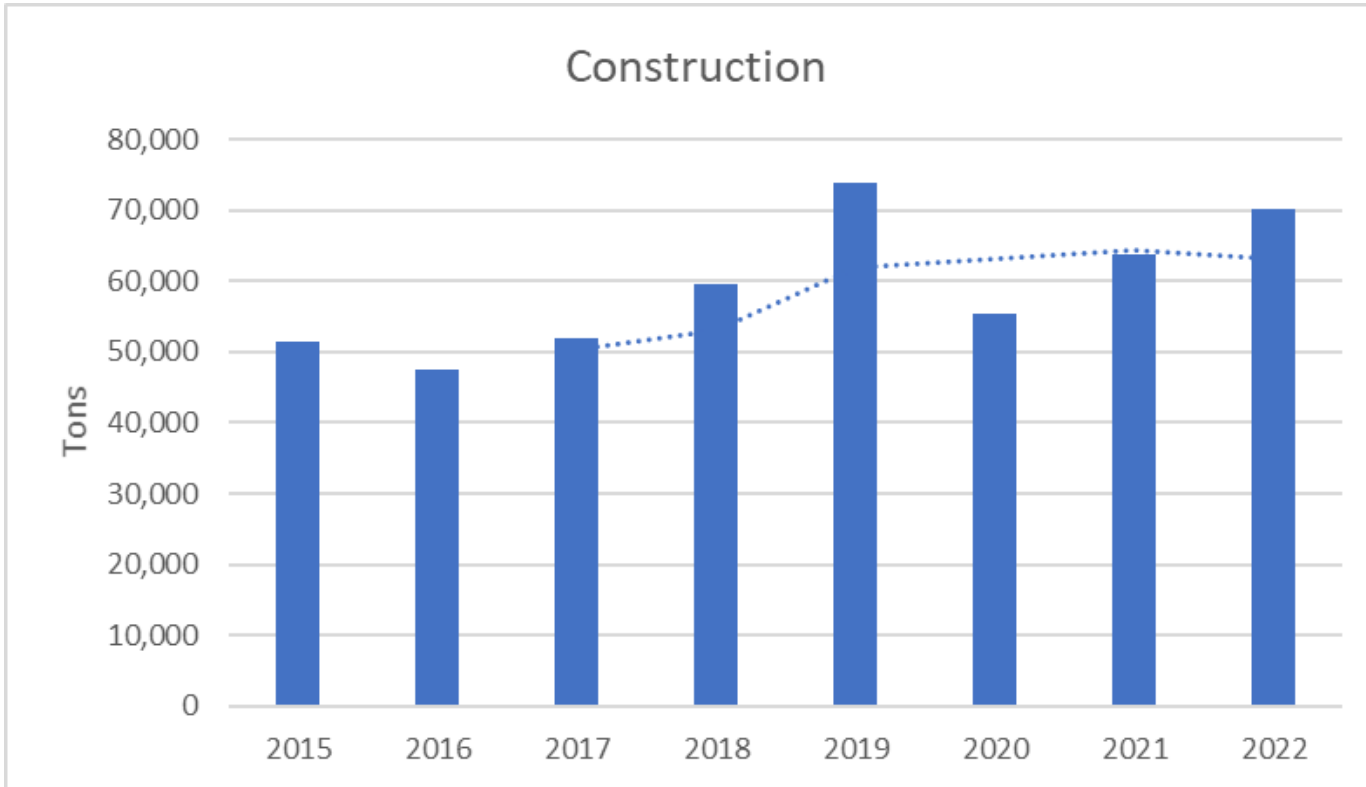
# Customer Market Sales Forecast

**% change from prior year**

<b>Mining</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>
Mines (sales)	4.6%	3.4%	38%	-3.4%
Equipment (sales)	6%	-13.1%	8.9%	13%
SFSA Consumables (tonnage)	0%	-15%	6%	5%
SFSA Equipment (tonnage)	5%	-30%	10%	10%



# Construction Forecast



- Post Covid rebound
- Residential construction leading demand – slowing growth forecasted for early 2022
- Infrastructure investment

2021	2022
15%	10%





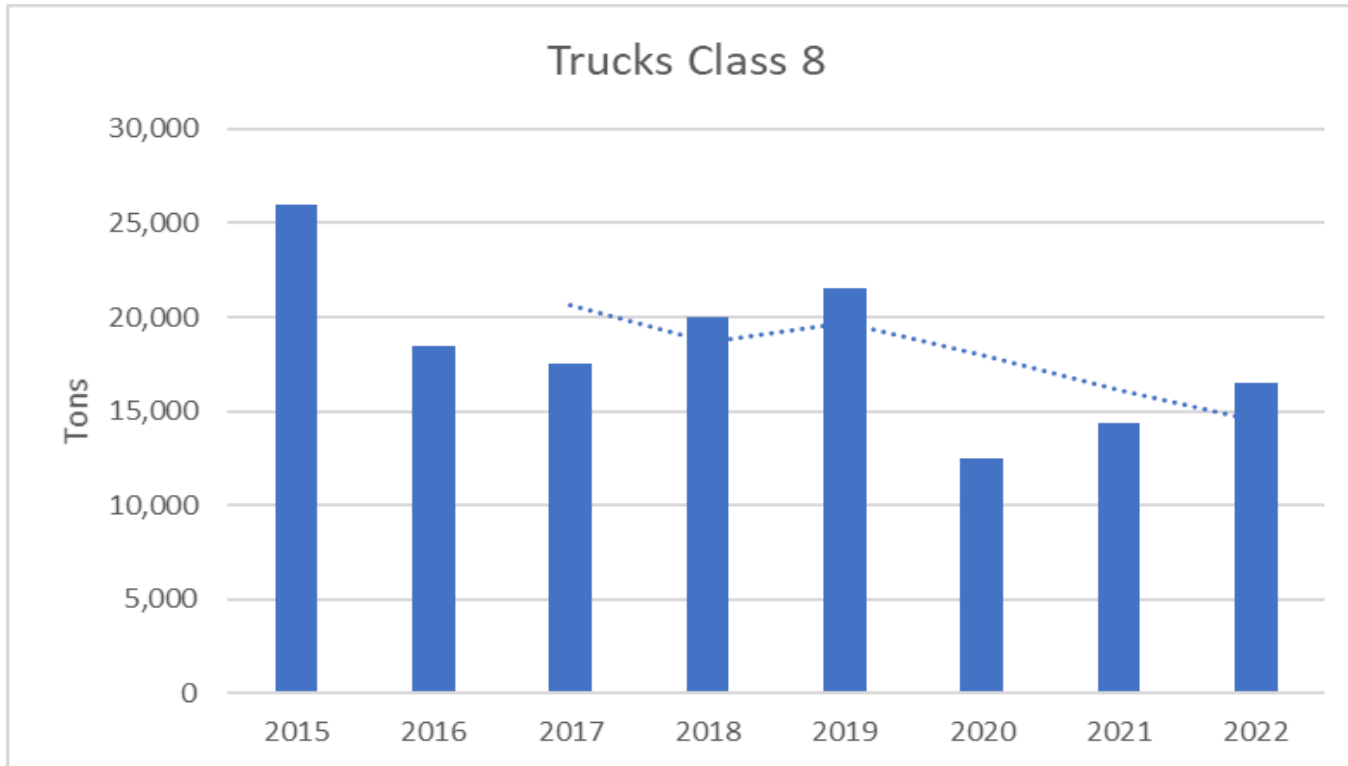
# Customer Market Sales Forecast

**% change from prior year**

<b>Construction</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>
Equipment (sales)	2.6%	-13.1%	16%	13%
SFSA Forecast (tonnage)	6%	-25%	15%	6%



# Truck Forecast



- Pent-up demand
- Large backlog
- Production constraints due to availability and cost of materials

## FTR Forecast

- '21 – 260,500
- '22 – 300,000
- '23 – 360,000

2021	2022
15%	15%



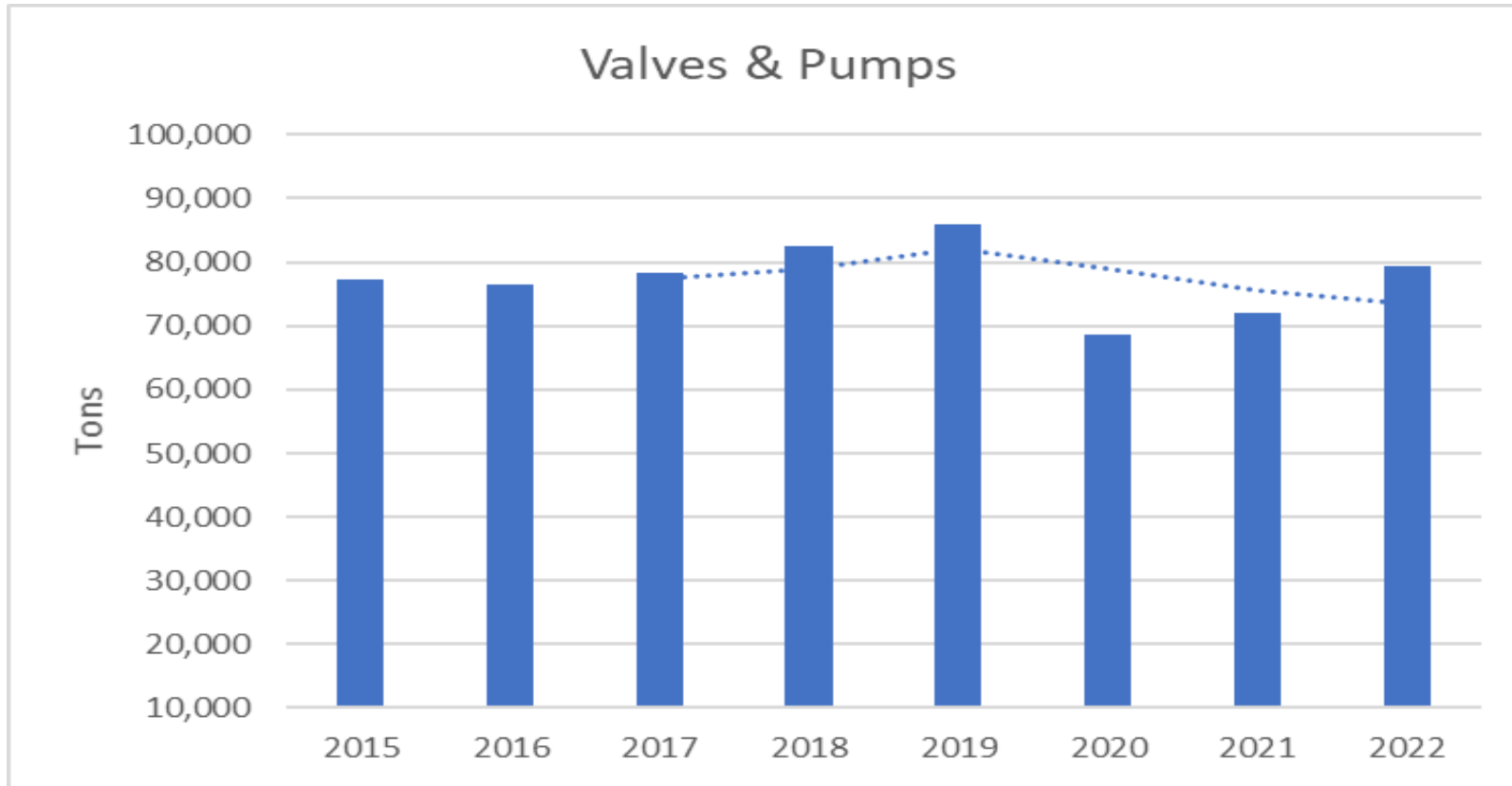
# Customer Market Sales Forecast

**% change from prior year**

<b>Trucks</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>
Manufacturers (sales)	8.9%	-22%	13%	10%
SFSA Forecast (tonnage)	7.5%	-42%	30%	10%



# Pump and Valve Forecast



- Oil prices
- Infrastructure
- Low Casting Inventories
- Long lead-times from Asia

2021	2022
5%	10%



# Customer Market Sales Forecast

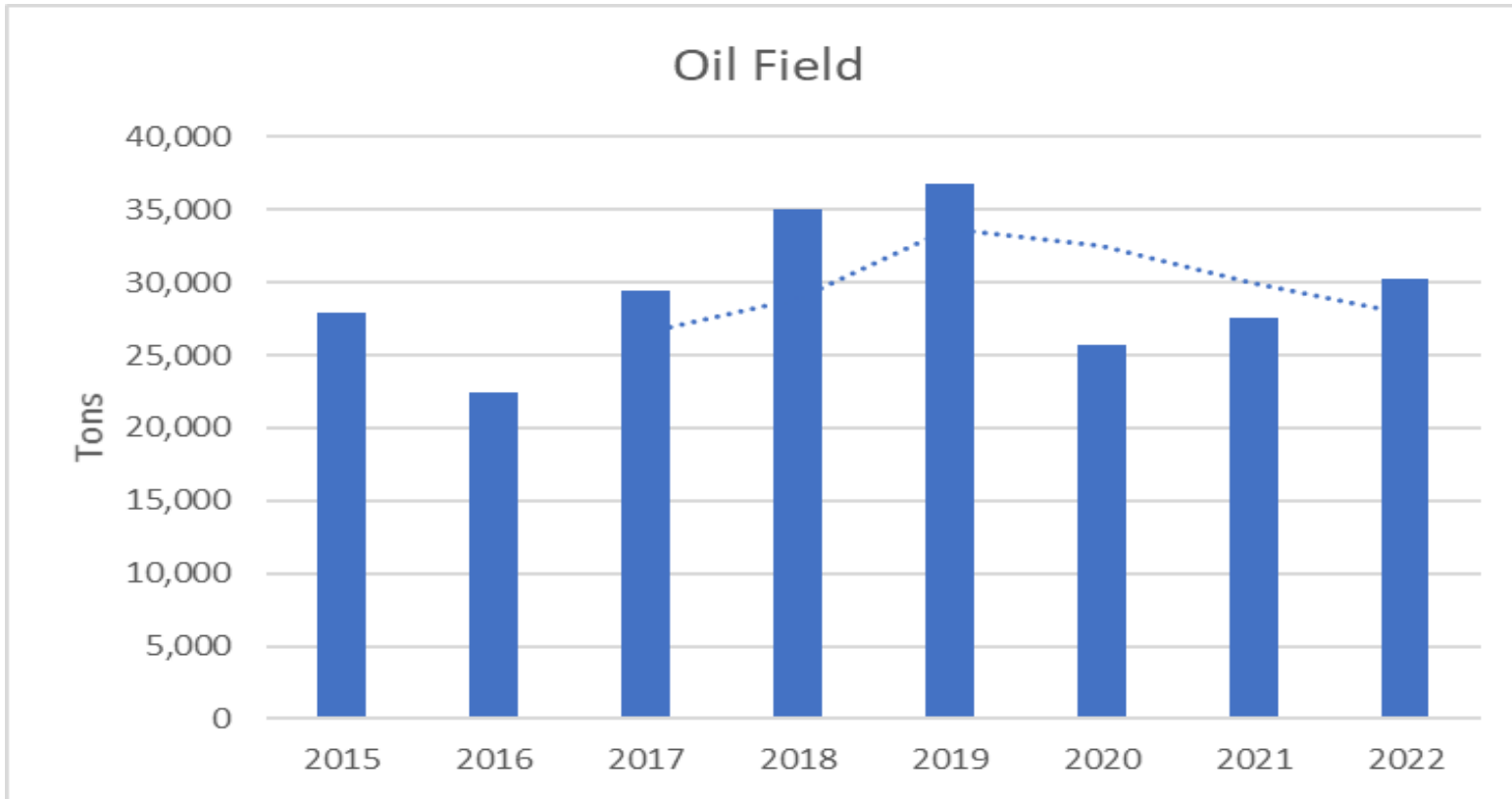
**% change from prior year**

<b>Pumps and Valves</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>
Manufacturers (sales)	3.7%	-10.2%	6.4%	7.1%
SFSA Forecast (tonnage)	4%	-20%	5%	10%





# Oil Field Forecast



2021	2022
4%	10%



- Oil price and rig count uptrend
- Demand overshadowing Covid/China concerns
- Low customer Inventory
- ITR – 12MMA production rise through 2023



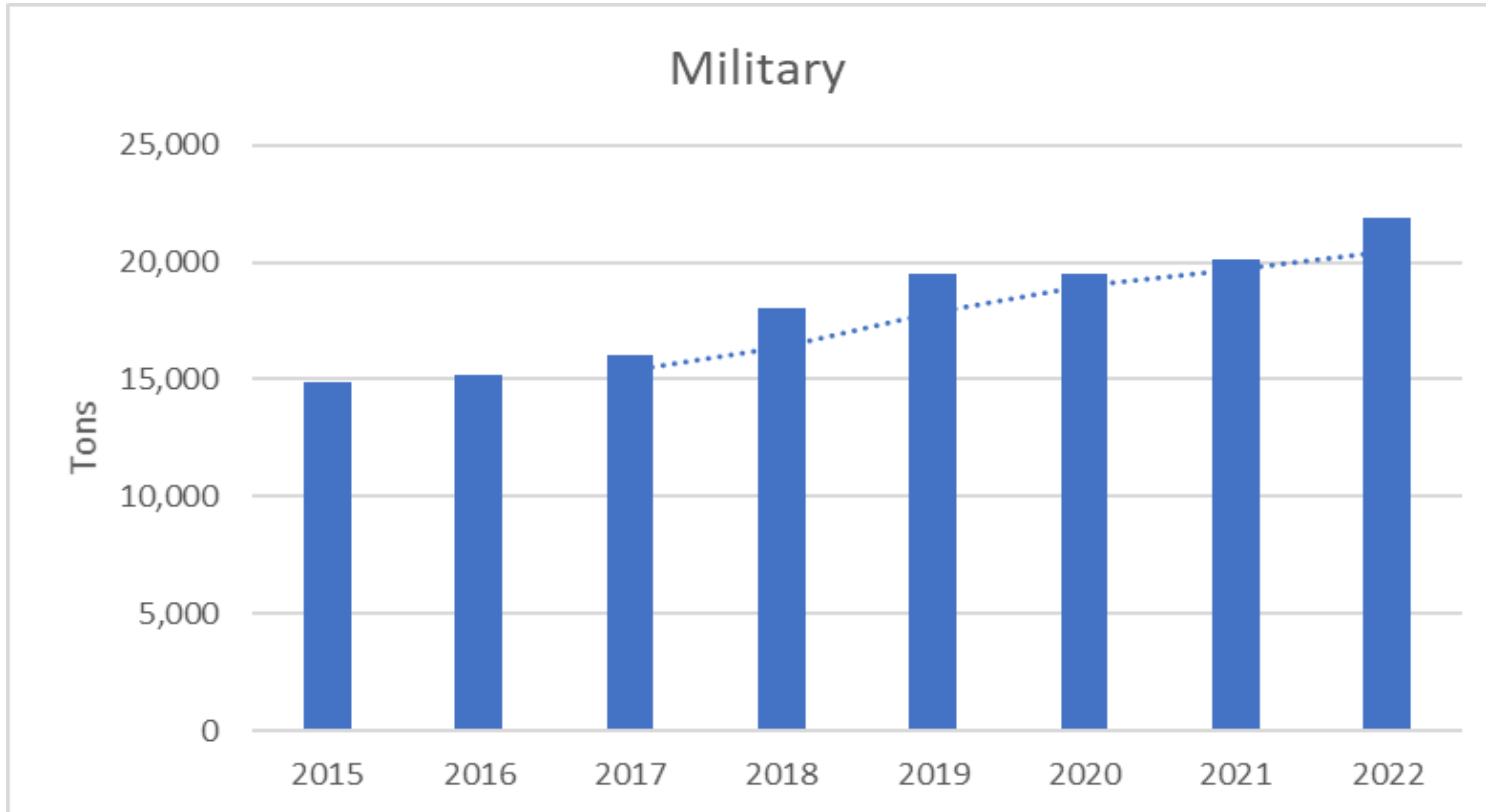
# Customer Market Sales Forecast

**% change from prior year**

<b>Oil Field</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>
Manufacturers (sales)	0.3%	-21%	-10.5%	13%
SFSA Forecast (tonnage)	5%	-30%	7%	10%



# Military Forecast



- Increase in Navy order activity
- Reallocating resources for modernization
- US Defense Capital Goods New Orders forecasted to rise into mid-2022.

2021	2022
3%	9%



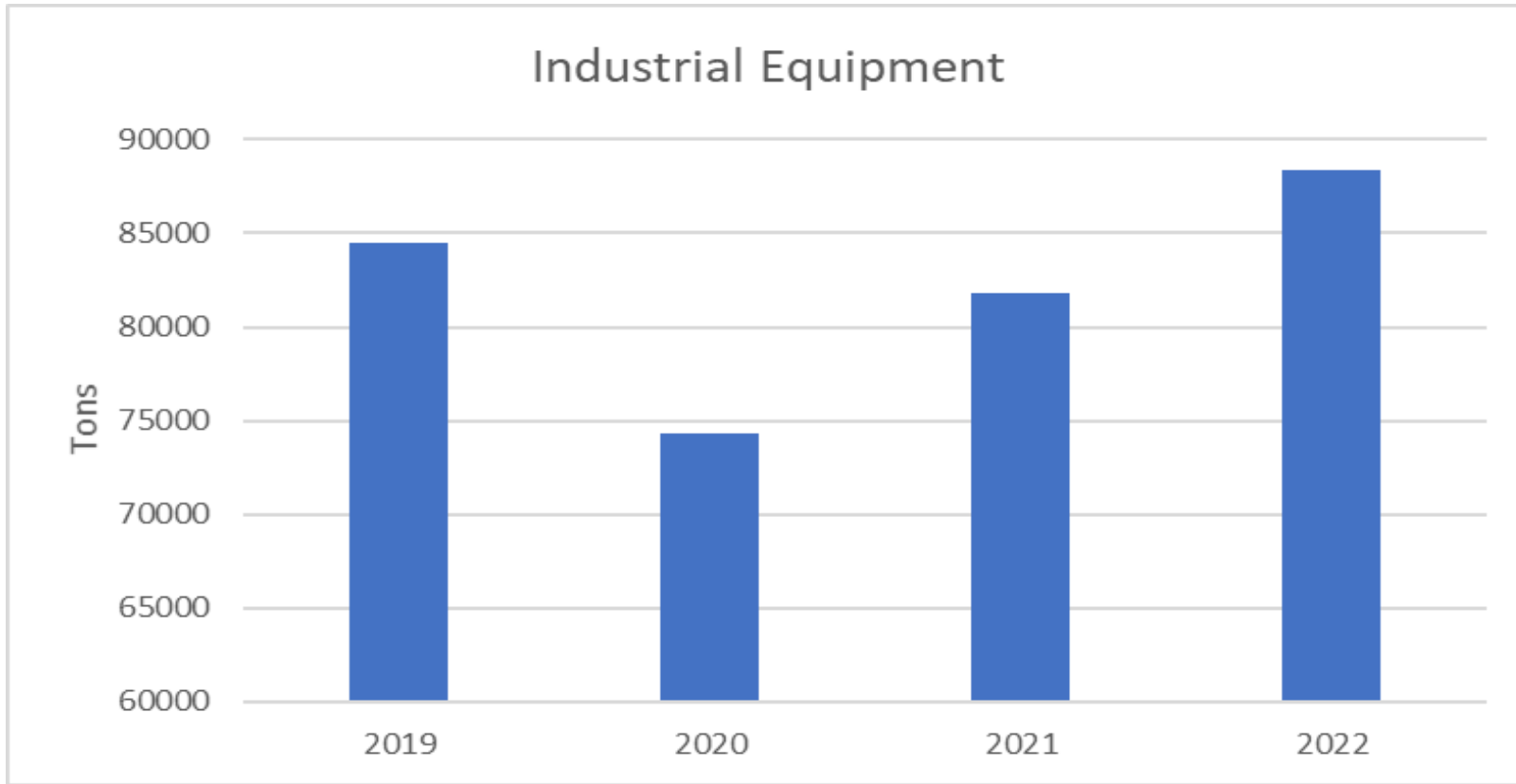
# Customer Market Sales Forecast

**% change from prior year**

<b>Military</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>
Ground Systems (sales)	8.8%	-3.6%	3%	4%
Naval Systems (sales)	8.8%	1%	2.2%	9.3%
SFSA Forecast (tonnage)	8%	0%	10%	5%



# Industrial Equipment Forecast



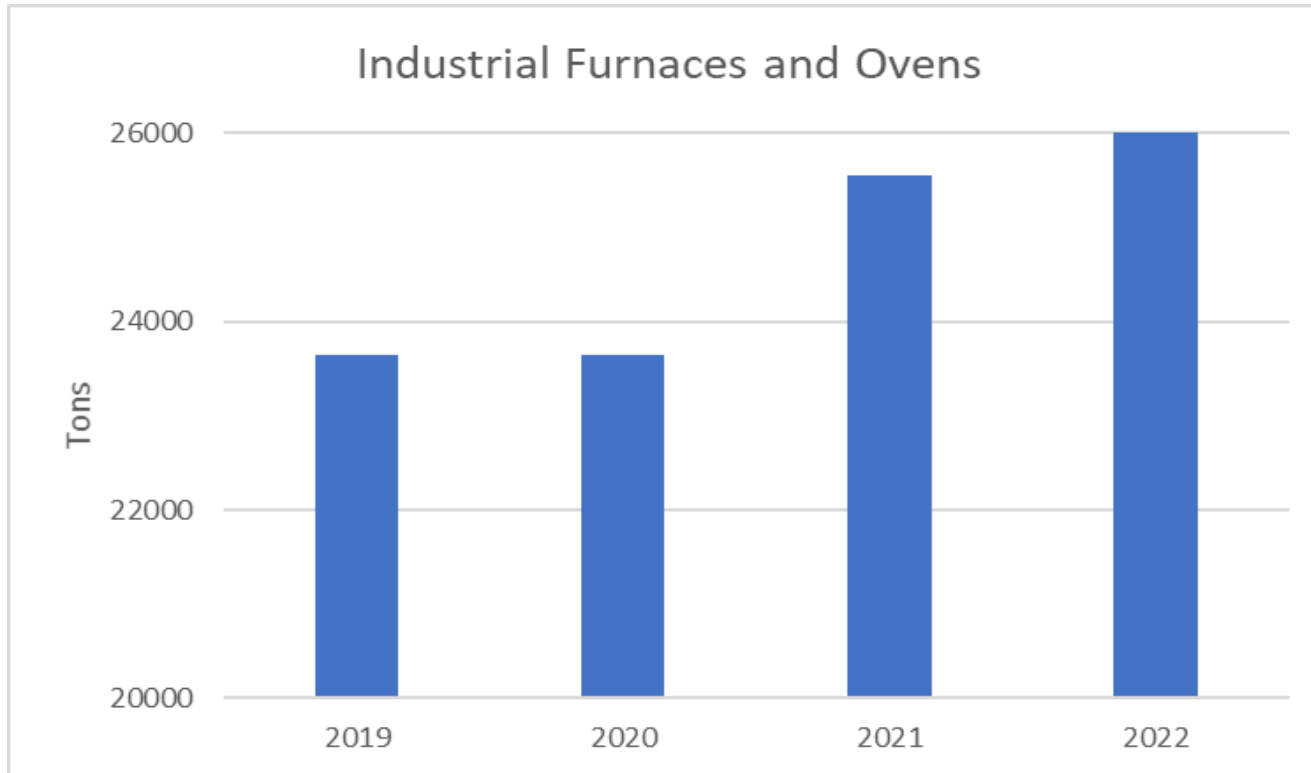
Industrial equipment parts - pulp & paper, food, shotblast - plates, wheels, sprockets, flanges

2021	2022
10%	8%





# Industrial Furnace and Oven Mfg. Forecast

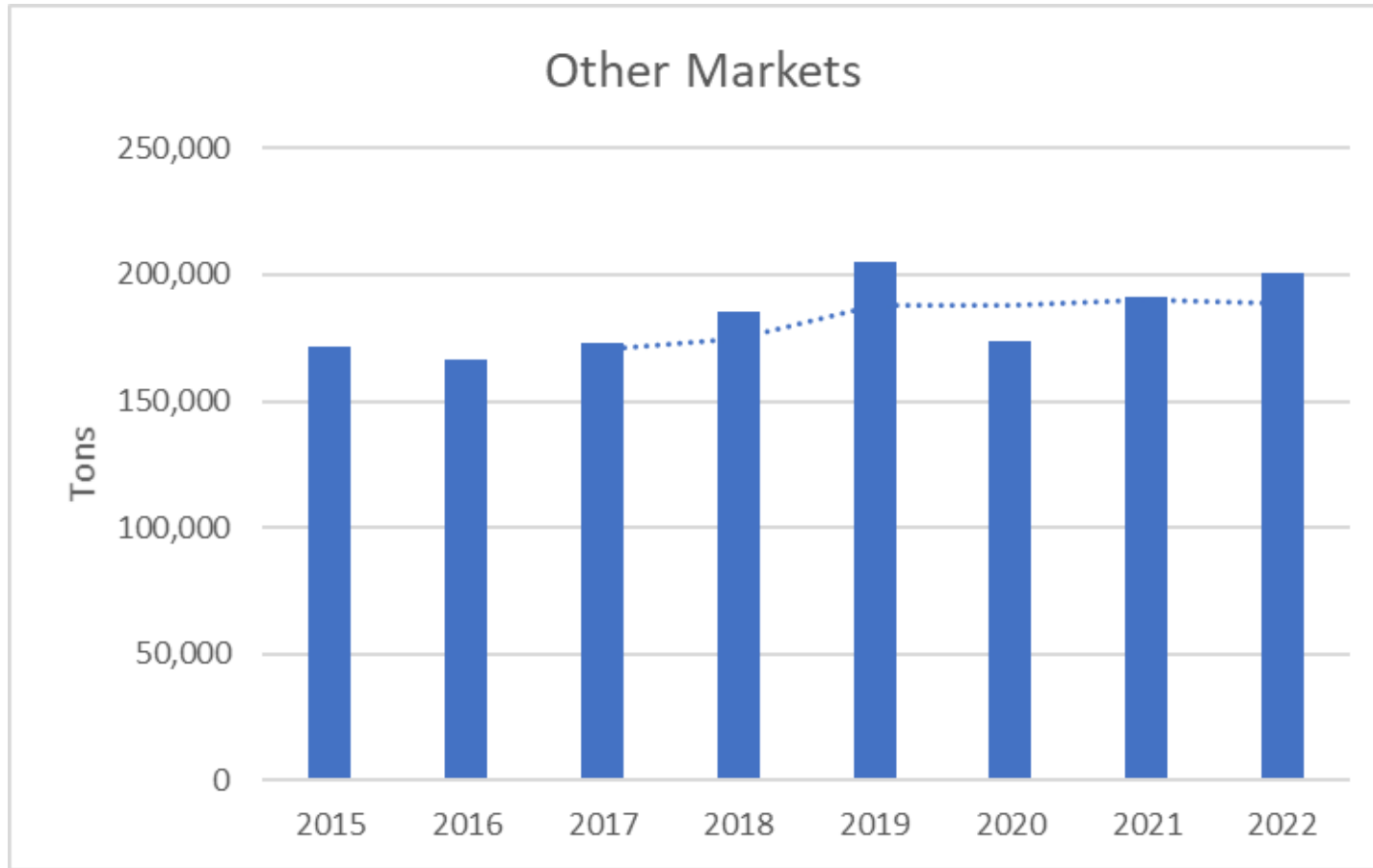


Furnace, heat treat, steel mill components - rollers, links, baskets

2021	2022
8%	10%



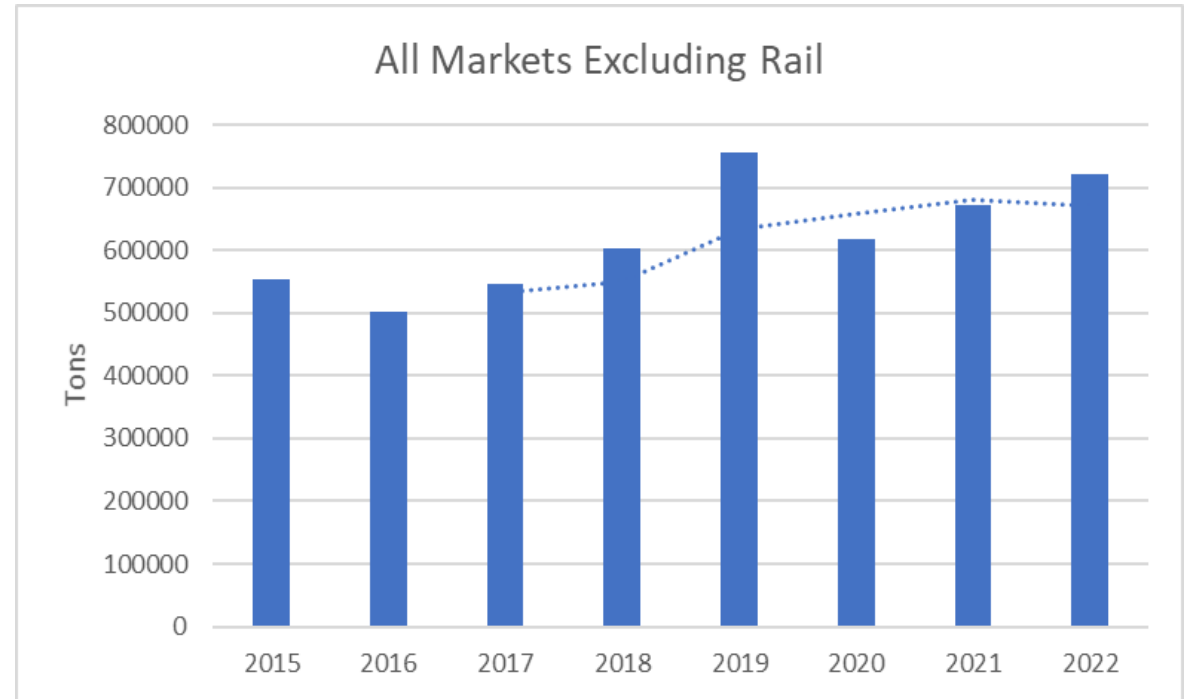
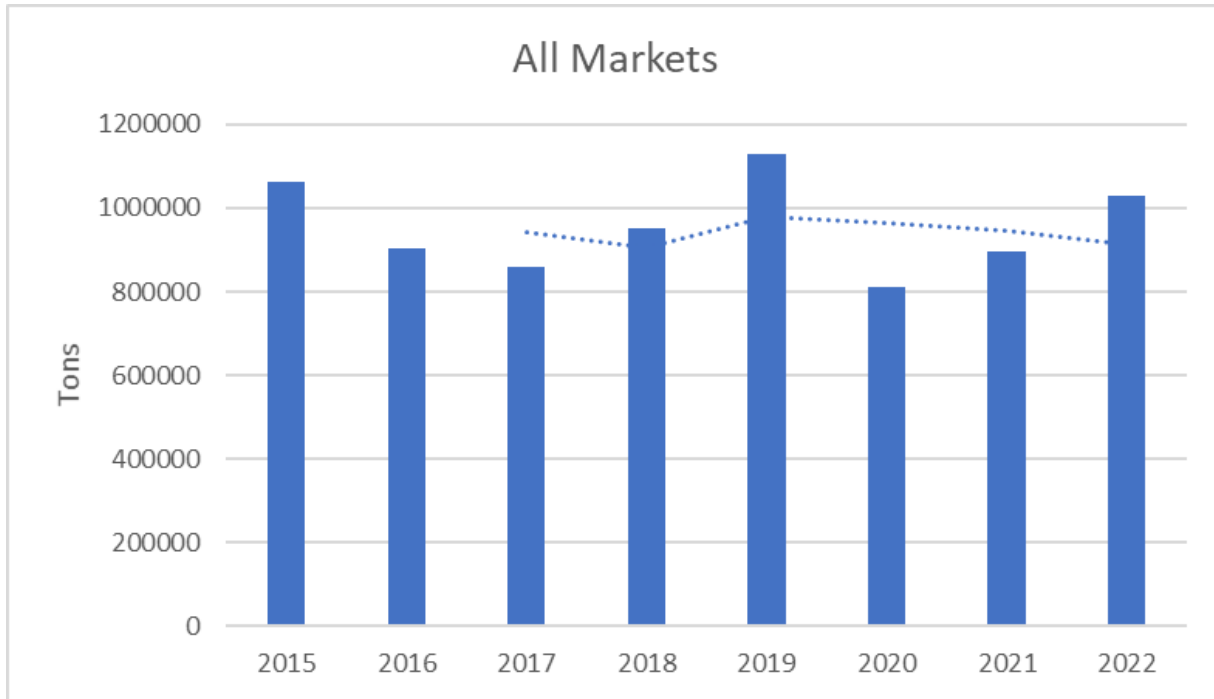
# Other Markets Forecast



2021	2022
10%	5%



# Forecast Summary



2021	2022
10.5%	15%

2021	2022
9%	7%