



Capital Advisors

CONSTRUCTION MATERIALS OUTLOOK

JANUARY 2023

www.fmicapitaladvisors.com

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WHO we are

Industry Insiders



Capital Advisors

Consulting & Research



FMI is a leading investment banking and consulting firm dedicated exclusively to the built environment. We serve as the industry's trusted advisor, providing current market insights, deep industry research, and key relationships that deliver tangible results for our clients.

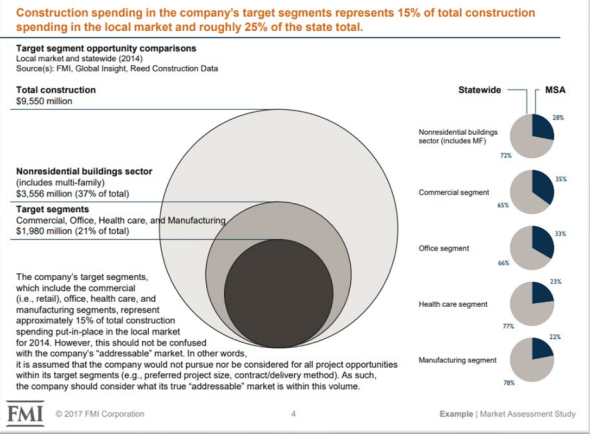
Consulting and Research

CM Focused Consulting



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Ph.D. Boston College
Experience: Construction Materials and Market Research



Management Consulting Capabilities:

- Leadership development
- Field productivity improvement
- Business strategic planning
- Acquisition integration
- Compensation analysis
- Market studies

Global Research



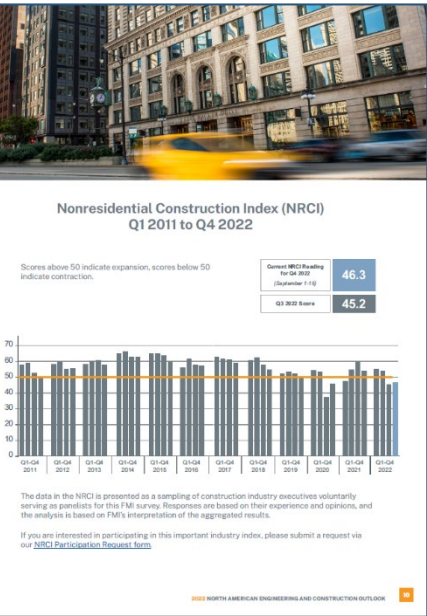
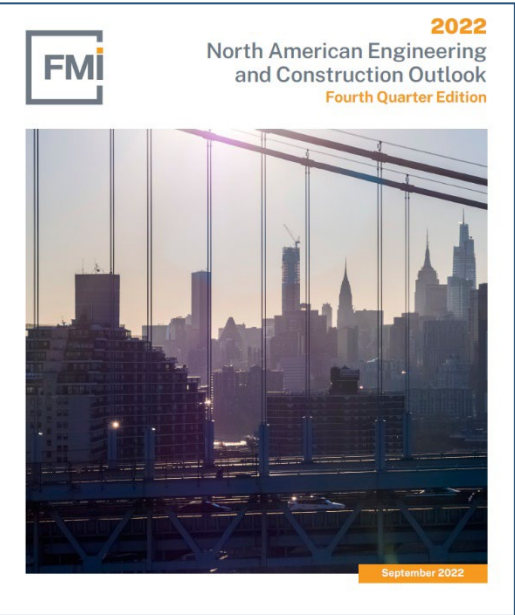
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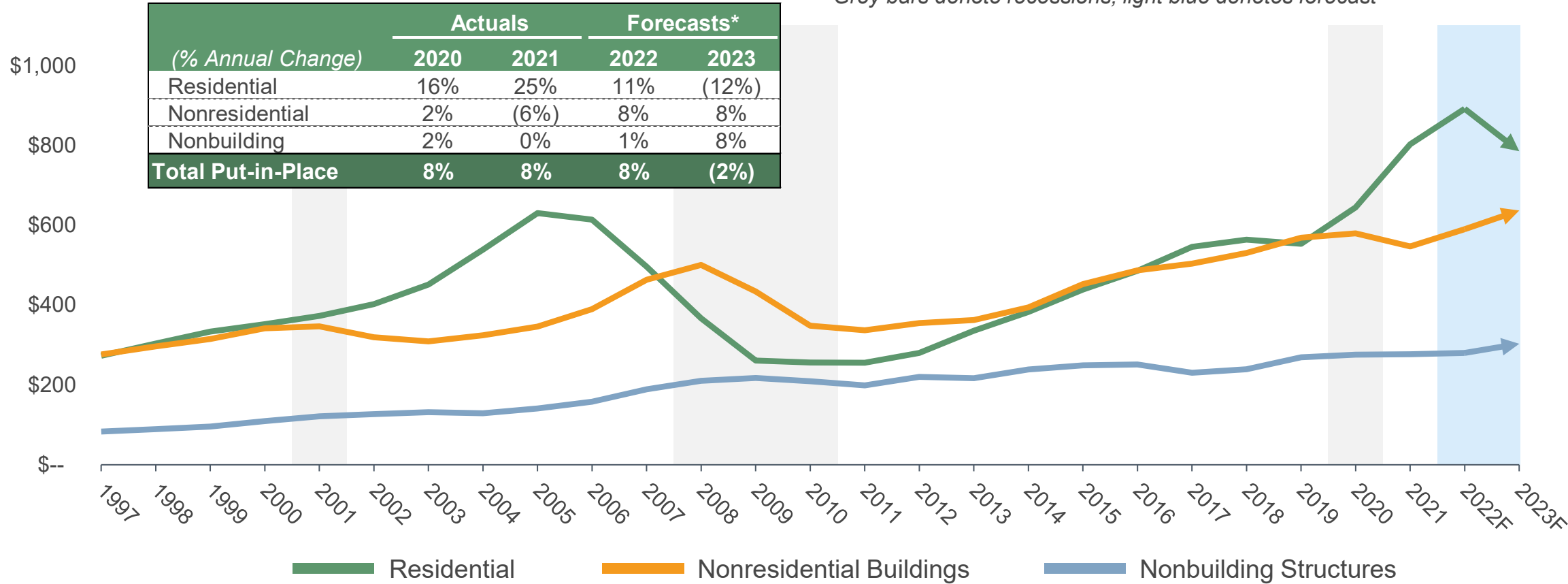
Construction Materials Drivers

Total U.S. Market – Construction Put-in-Place (CPiP)

- **Drivers** – Increased funding from the IIJA, supply-demand imbalance in Residential, and strong investment in data centers & manufacturing
 - **Public Works** starts (Nonbuilding) are projected to **increase 18%** in 2023 to \$225B *per Dodge Construction Network*
 - **Manufacturing starts are expected to triple in 2022** and are then remain at historical levels at ~\$51B in 2023 with tailwinds from the CHIPS Act
- **Headwinds** – Inflation’s impact on profitability, increasing interest rates, looming recession, labor cycles, and the Russia-Ukraine conflict

Construction Put-in-Place (1997 – 2023F)*

(\$ in billions) Grey bars denote recessions, light blue denotes forecast



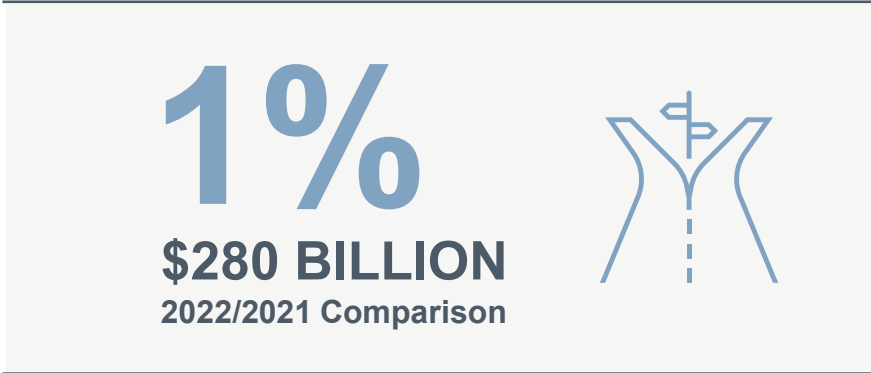
Location Matters:

While national trends are attractive, it is important to always remember **construction is a “local” business**

*Q1 2023 Forecast based on Q3 2022 Actuals and Q4 2022 Assumptions; CPiP Segments defined by U.S. Census Bureau
Source: FMI Research; Dodge Construction Network

Construction Put-in-Place Outlook by Segment (2022 / 2021 Comparison)

TOTAL NONBUILDING

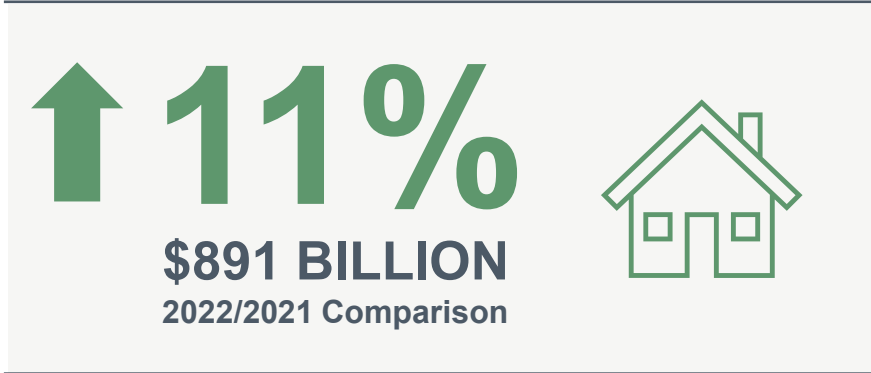


2020	STA	2%	\$276 B
2021	STA	0%	\$277 B
2022	STA	1%	\$280 B
2023	UP	8%	\$303 B

1 Nonbuilding Growth Drivers

- Highway & Street
- Power
- Sewage & Waste Disposal
- Water Supply
- Conservation & Development

TOTAL RESIDENTIAL BUILDING

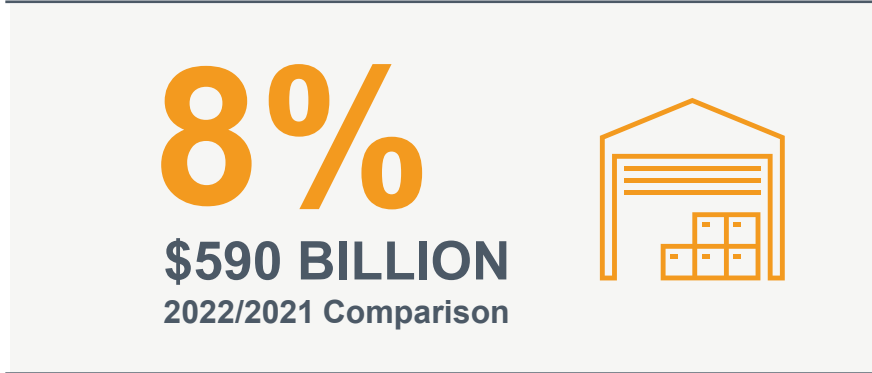


2020	UP	16%	\$644 B
2021	UP	25%	\$803 B
2022	UP	11%	\$891 B
2023	DWN	(12%)	\$785 B

2 Residential Growth Drivers

- Single-Family
- Multifamily
- Improvements

TOTAL NONRESIDENTIAL BUILDING



2020	STA	2%	\$580 B
2021	DWN	(6%)	\$547 B
2022	UP	8%	\$590 B
2023	UP	8%	\$637 B

3 Nonresidential Growth Drivers

- Commercial
- Manufacturing
- Office
- Health Care
- Educational
- Religious
- Public Safety
- Transportation
- Communication
- Lodging
- Amusement & Recreation

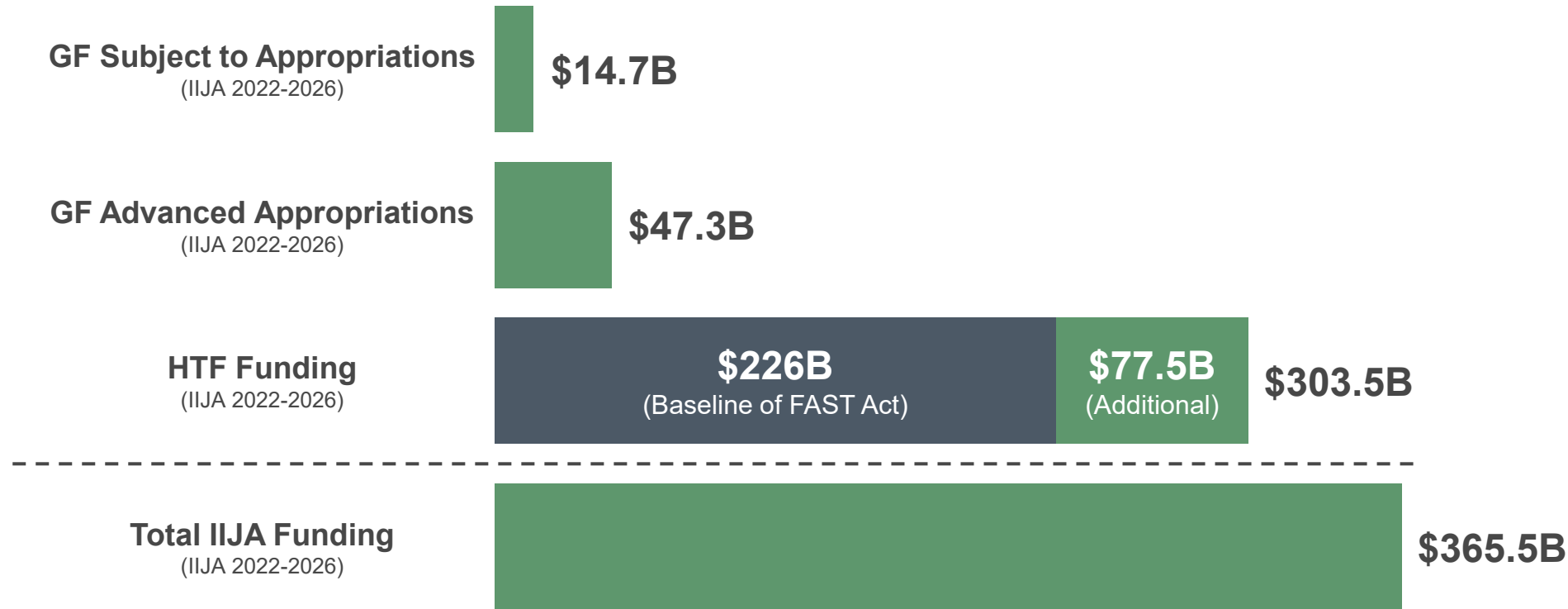
*Q1 2023 Forecast based on Q3 2022 Actuals and Q4 2022 Assumptions; CPiP Segments defined by U.S. Census Bureau
Source: FMI Research

Nonbuilding Construction – IIJA Funding



- IIJA Funding
 - \$1.2 trillion bipartisan federal infrastructure bill - \$550 billion over baseline federal funding
 - Emphasis on maintenance and repair
- Nonbuilding Construction Implications
 - Funding disbursements started slow in 2022, but saw momentum in Q4 going into 2023
 - **Nonbuilding / Infrastructure construction starts** are expected to **increase 16% in 2023** to \$281B

Federal Funding – Infrastructure Investment and Jobs Act (IIJA)



TOTAL NONBUILDING

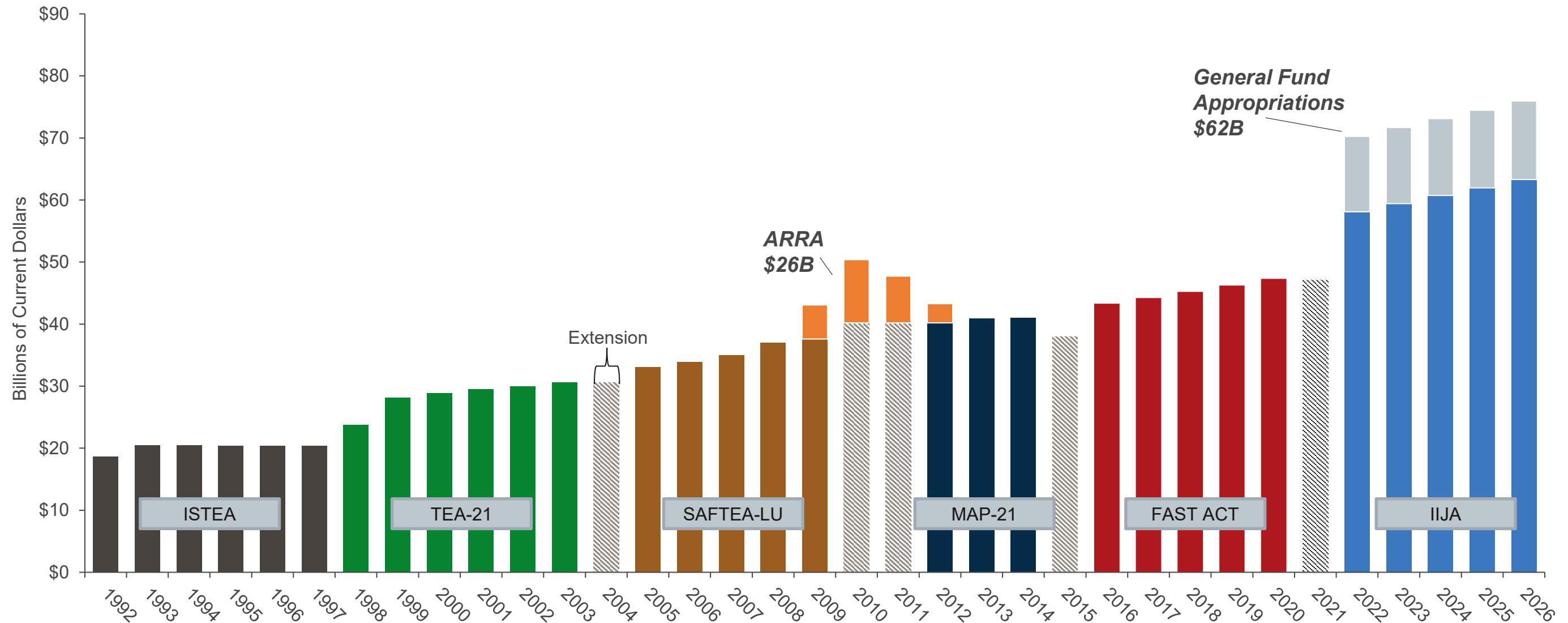
1% \$280 BILLION 2022/2021 Comparison			
2020	STA	2%	\$276 B
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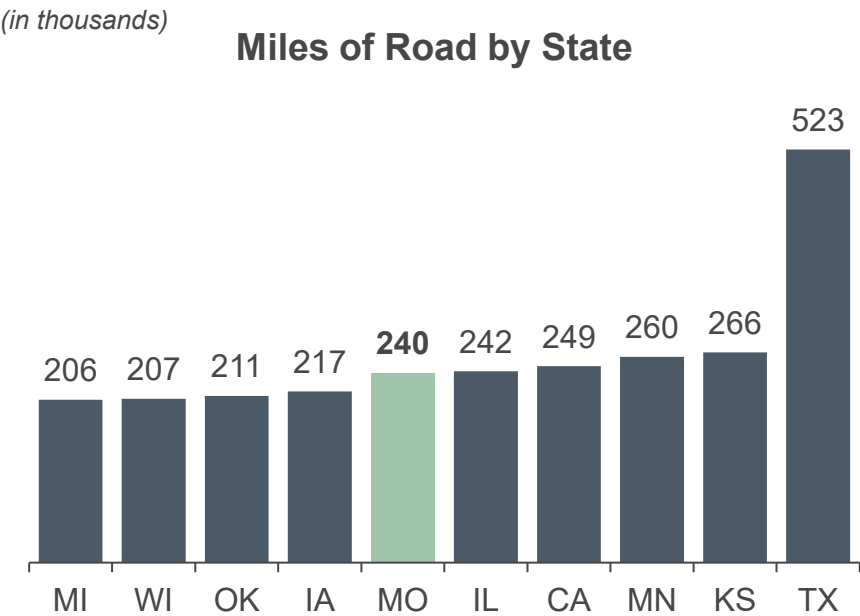
Nonbuilding Construction – Comparison of Highway Authorization Bills

The IIJA is a “once-in-a-generation” infrastructure bill with huge implications for Construction Materials

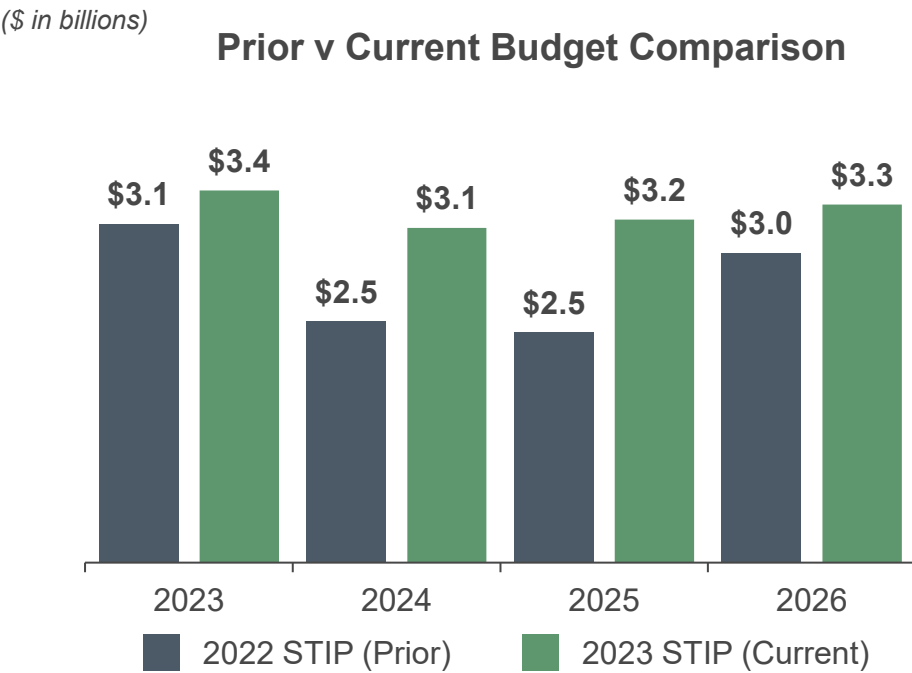
Federal Road and Bridge Funding



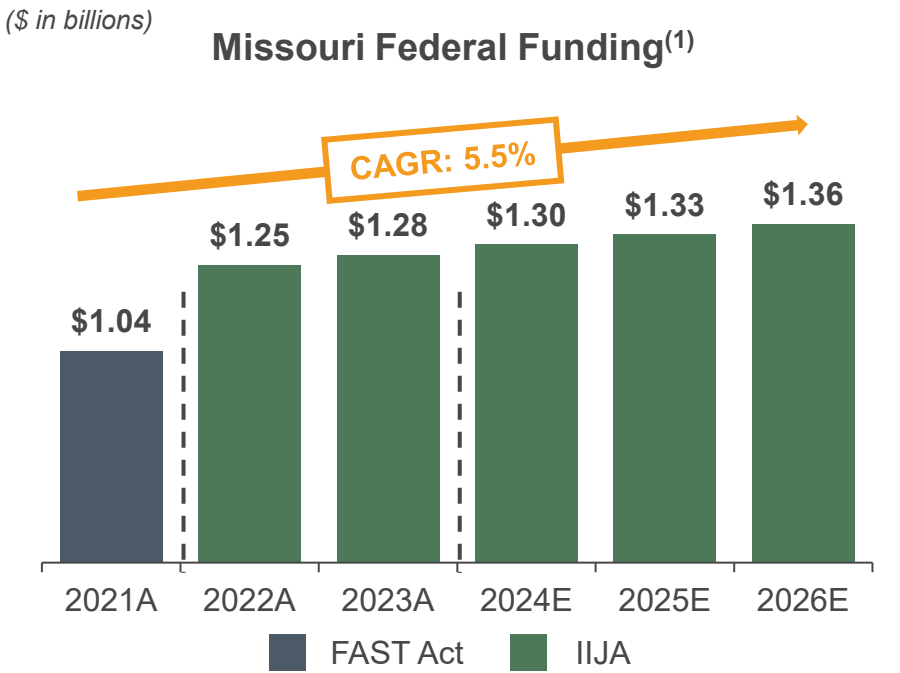
Nonbuilding Construction – Missouri Funding



- Missouri has the **6th most roadway** based on miles in the country
- MoDOT also has **~10.4K bridges**, which ranks Missouri among the highest in the nation



- **Increased federal funding**
- **\$500M** proposed state bond issuance in 2023
- **Enacted long-term gas tax increase in 2021**



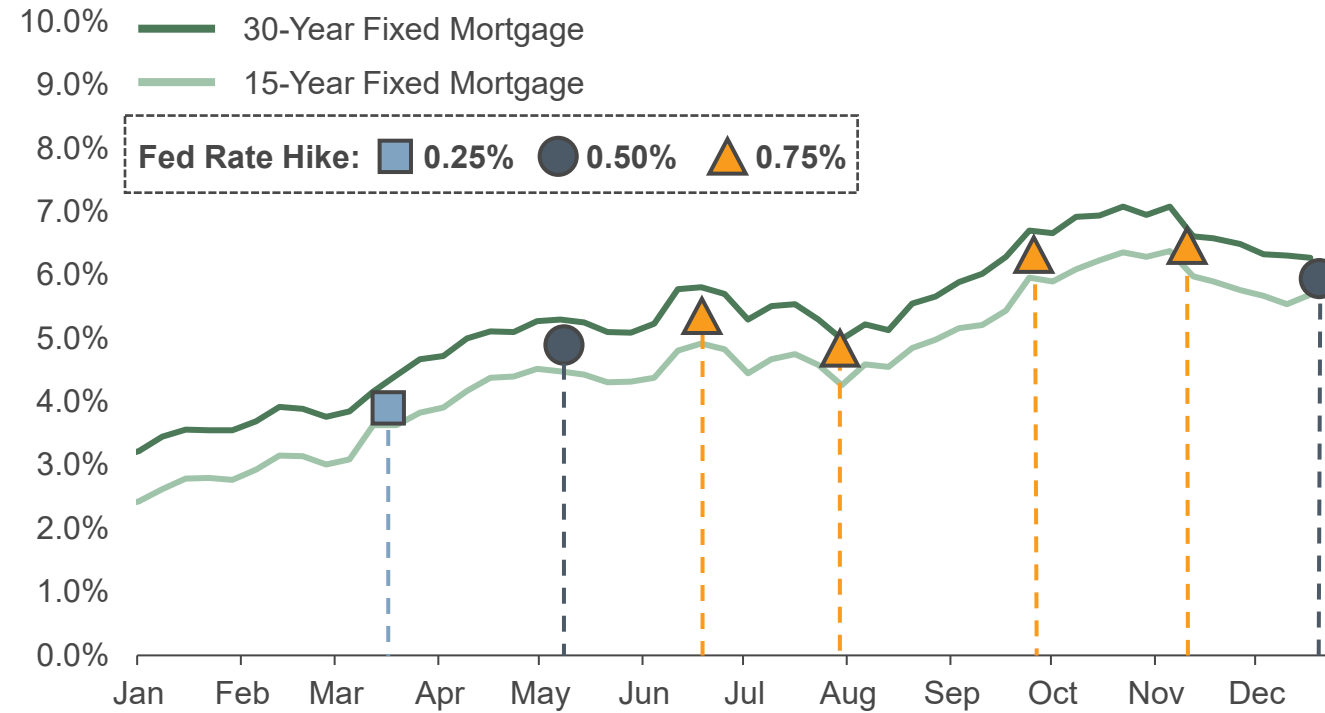
- Missouri is set to receive the **14th most** in IIJA Federal-Aid Highway Program Apportionments
- Well-positioned to receive funding from new **\$27.5B Bridge Construction & Rehabilitation** program due to infrastructure network

Source: FHWA, MODOT
(1) Figures only show Federal-Aid Highway Program apportionments

Residential – 2022 Slowdown & 2023 Caution



Increasing Mortgage Rates - 2022

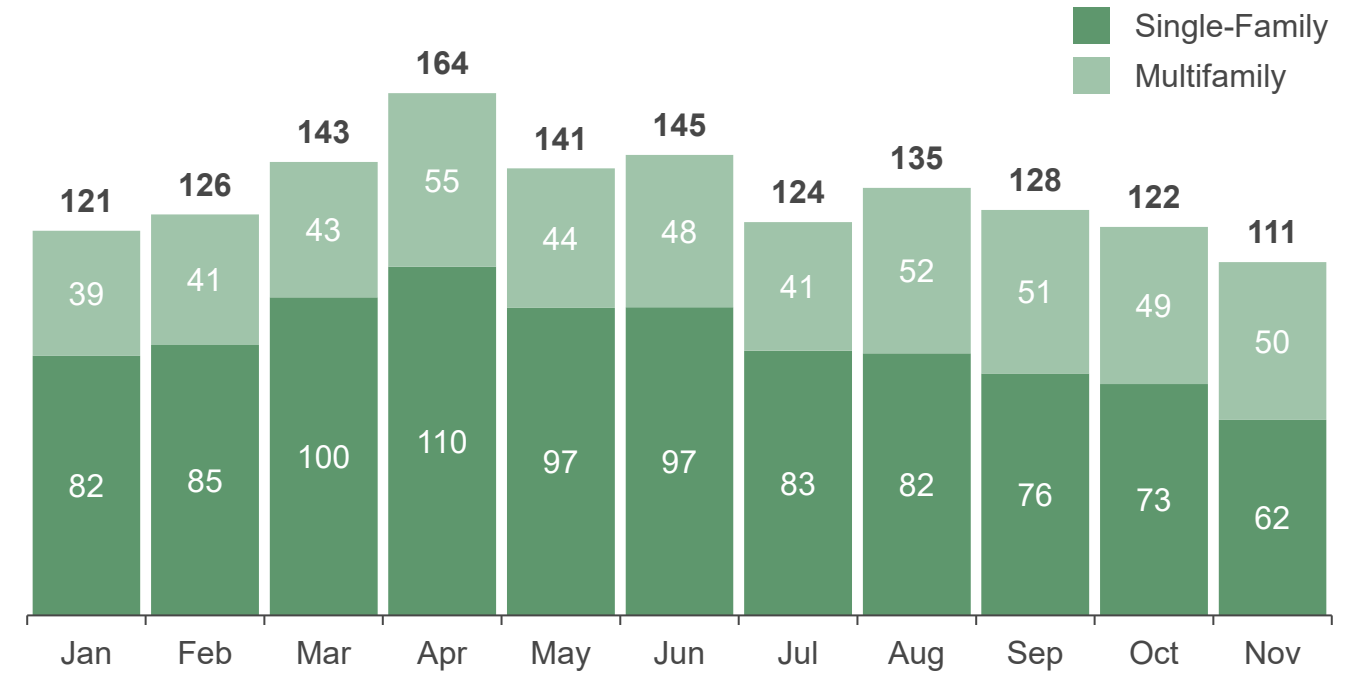


Buyer Caution: Residential

- Monthly mortgage payment on median priced U.S. home up **43%** in November compared to the start of 2022
- Median sales price of U.S. houses in Q3 2022 were at an all-time high, up **10.1% from 2021**
- Builder sentiment has dropped for **12 consecutive months** as demand for single-family declines

2022 Monthly Housing Starts

(in thousands)



YTD Single-Family v Multifamily

- YTD starts through November for **Single-Family are down 9%** while **Multifamily starts are up 18%**
- Permits, a leading indicator for starts, are **down 12% for Single-Family** and **up 11% for Multifamily** YTD through November

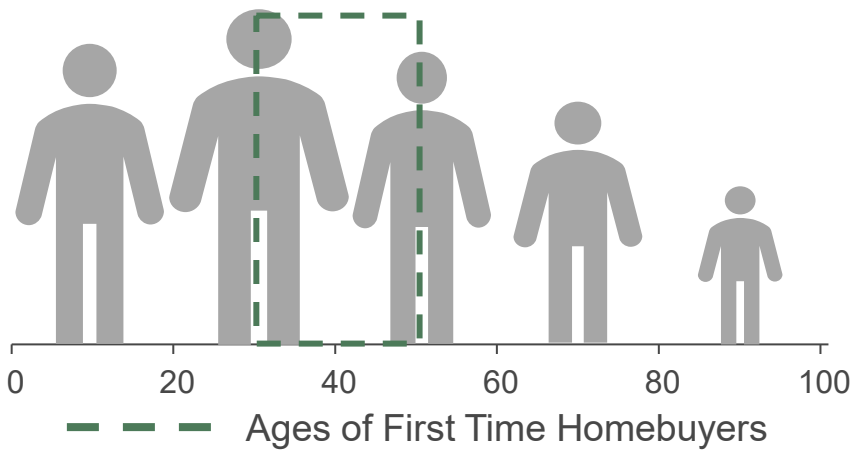
Residential – Long-Term Tailwinds



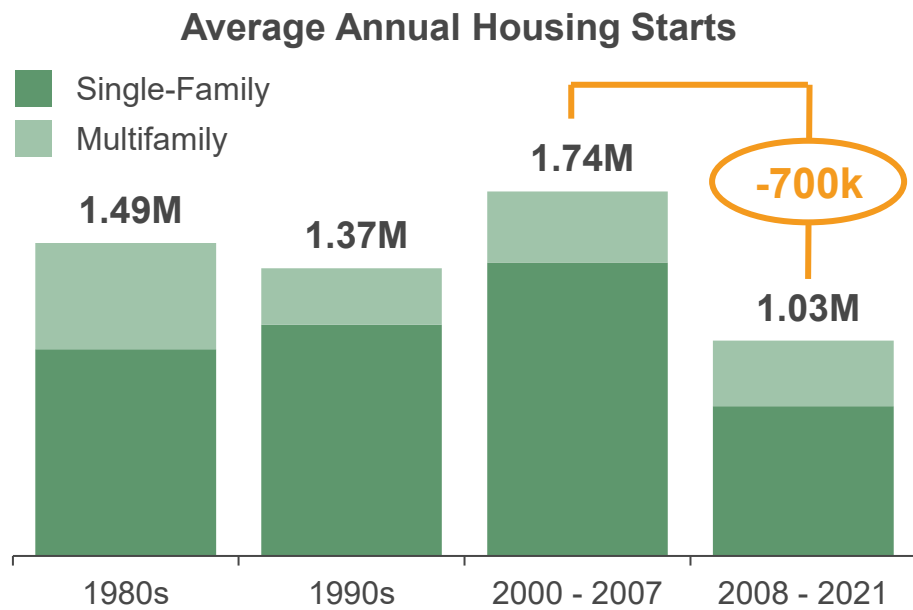
Strong Population Demographics

86.4 M 90.6 M 82.6 M 59.8 M 11.6 M

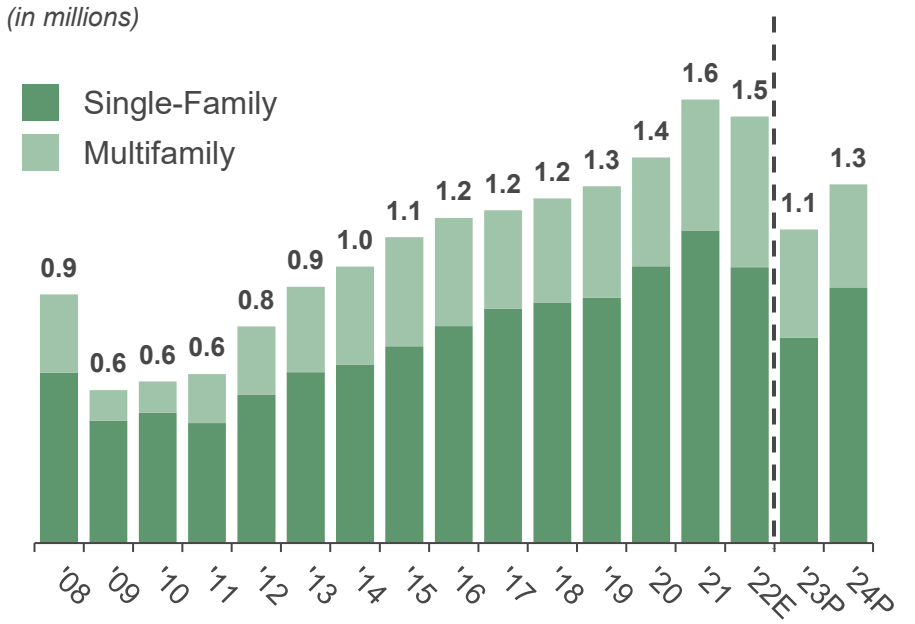
U.S. Population (1980): 227M
U.S. Population (2022): 332M



Historic Underbuilding



Total Housing Start Projections



Long-Term Housing Demand

- Medium- to long-term demand driven by generational demographics and low supply
- The National Association of Home Builders projections are optimistic:
 - Total starts are expected to rebound in 2024, increasing **15%** off 2023 projections and reaching pre-pandemic levels

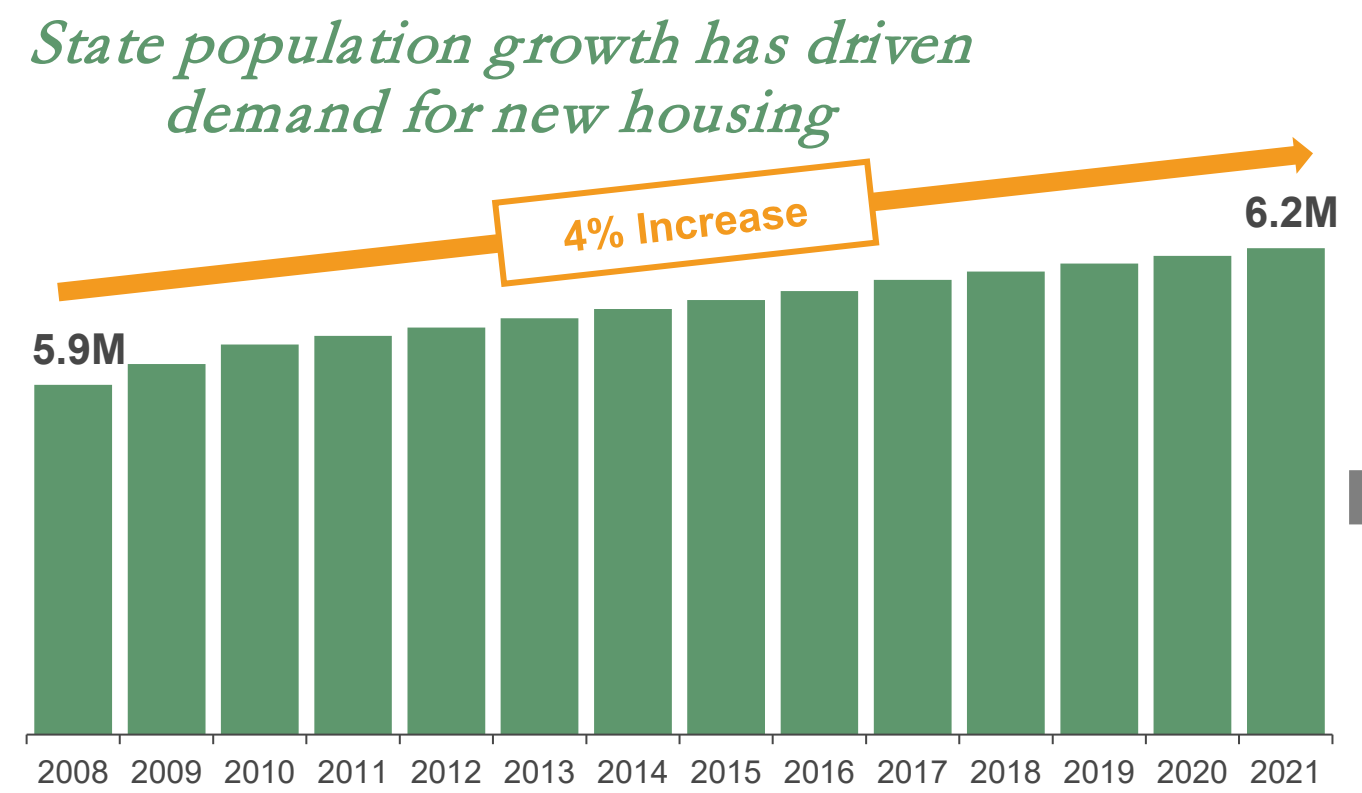
TOTAL RESIDENTIAL BUILDING			
↑ 11% \$891 BILLION 2022/2021 Comparison			
2020	UP	16%	\$644 B
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2023	DWN	(12%)	\$785 B

Residential Construction – Missouri



Population Migration

2008-2021 Missouri Population Growth

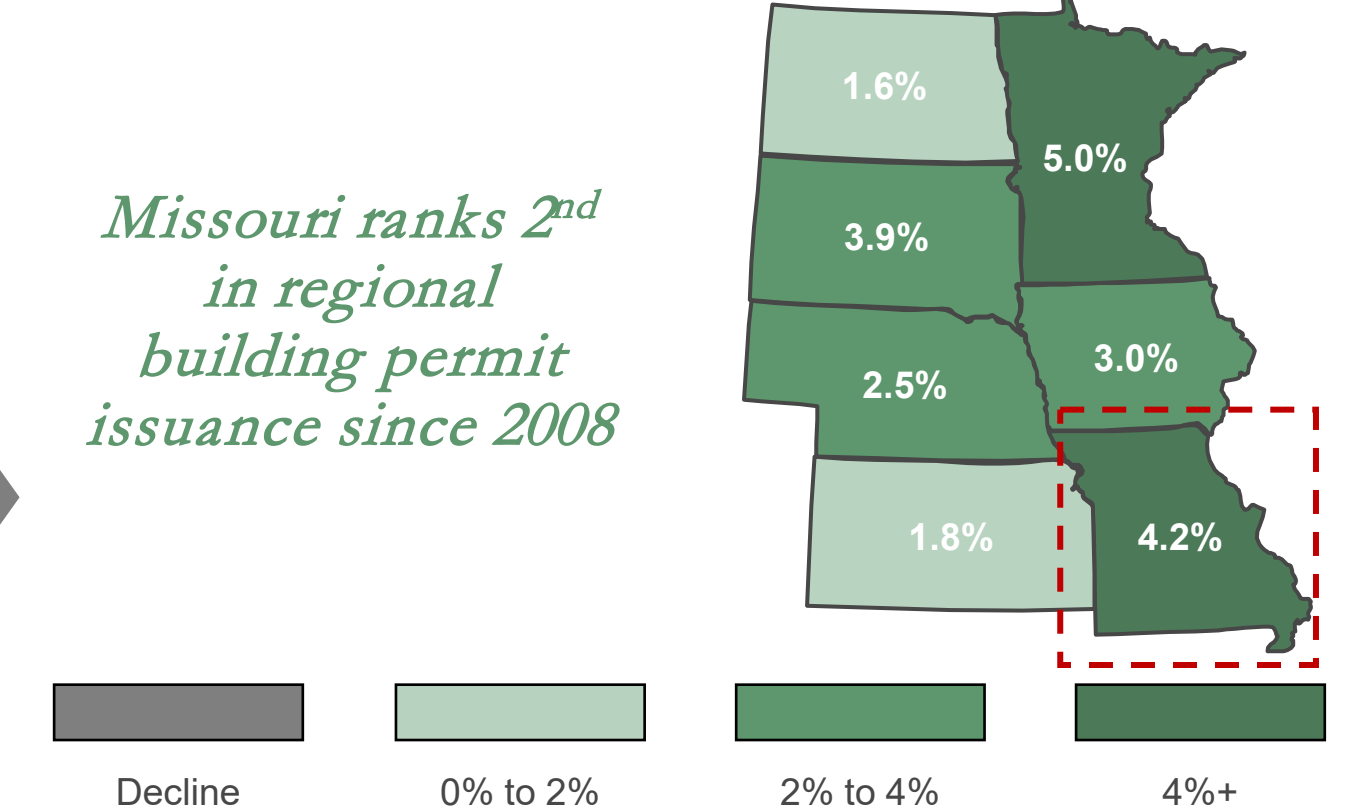


MO's building permit YTD issuance is underperforming through Nov. 2022

- Missouri building permits: -12%
- U.S. building permits: -10%

Residential Construction

West North Central Region Building Permit Issuance 2008-2021 CAGR



MO's starts show more stability compared to the total U.S. through 2024

- Missouri housing start projections 2023 & 2024: -14% and 6%
- U.S. housing start projections 2023 & 2024: -27% and 14%

Nonresidential Construction



Key Areas of Nonresidential Construction Demand

E-Commerce:

- Warehouse and distribution space investment has accelerated in recent years as e-commerce penetration remained strong and was bolstered by the pandemic
 - E-Commerce supply chains require 3x more industrial space than brick-and-mortar stores

Manufacturing & CHIPS Act:

- Consistent due to producers addressing domestic demand, supply constraints, and trade tensions
- Manufacturing construction spending rose ~**43%** in November 2022 year-over-year
- CHIPS Act calls for ~**\$53B** in funding for chip manufacturing infrastructure over the next 5 years

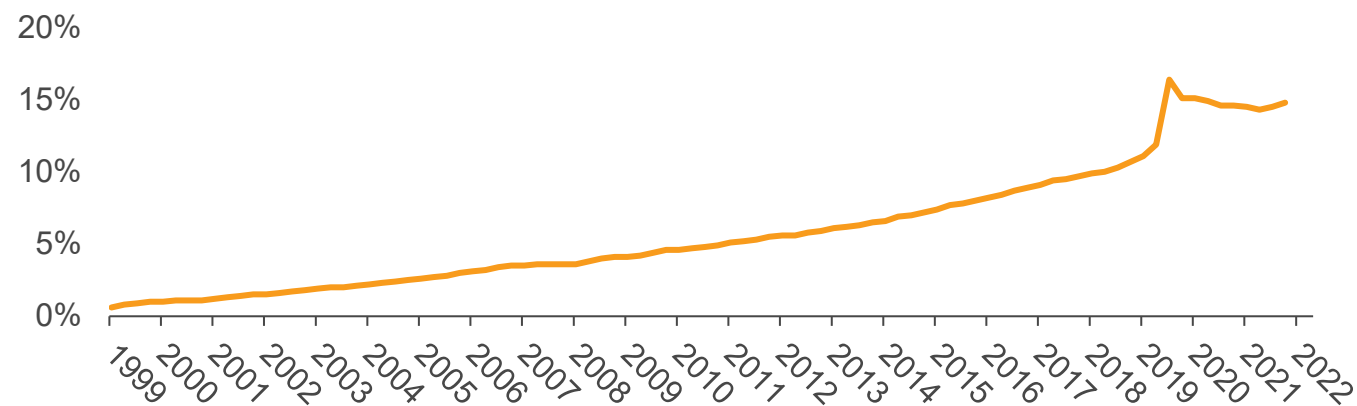
TOTAL NONRESIDENTIAL BUILDING

8%

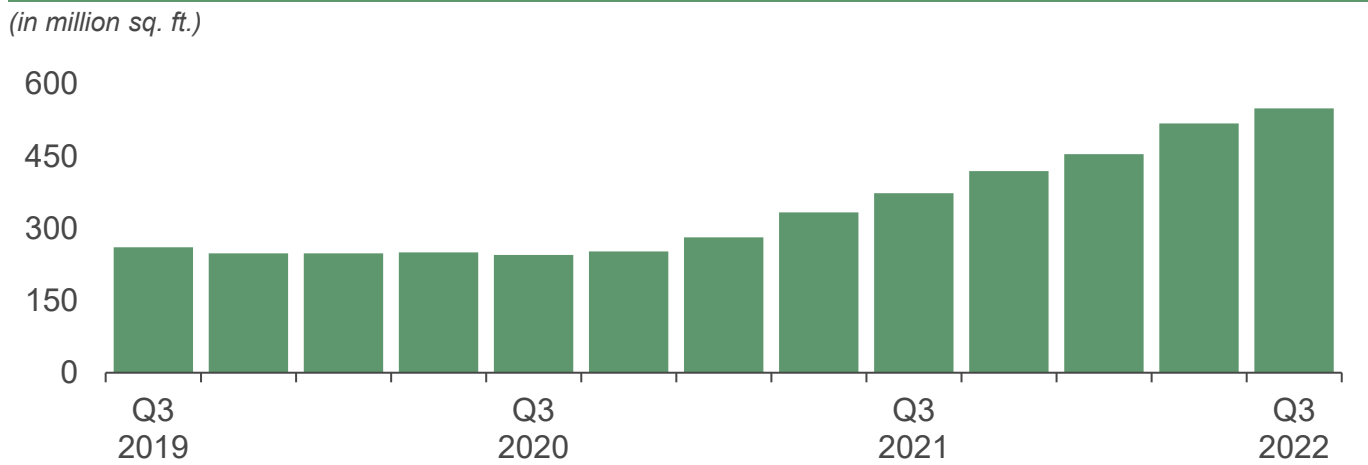
\$590 BILLION
2022/2021 Comparison

2020	STA	2%	\$580 B
2021	DWN	(6%)	\$547 B
2022	UP	8%	\$590 B
2023	UP	8%	\$637 B

E-Commerce as % of Retail Sales



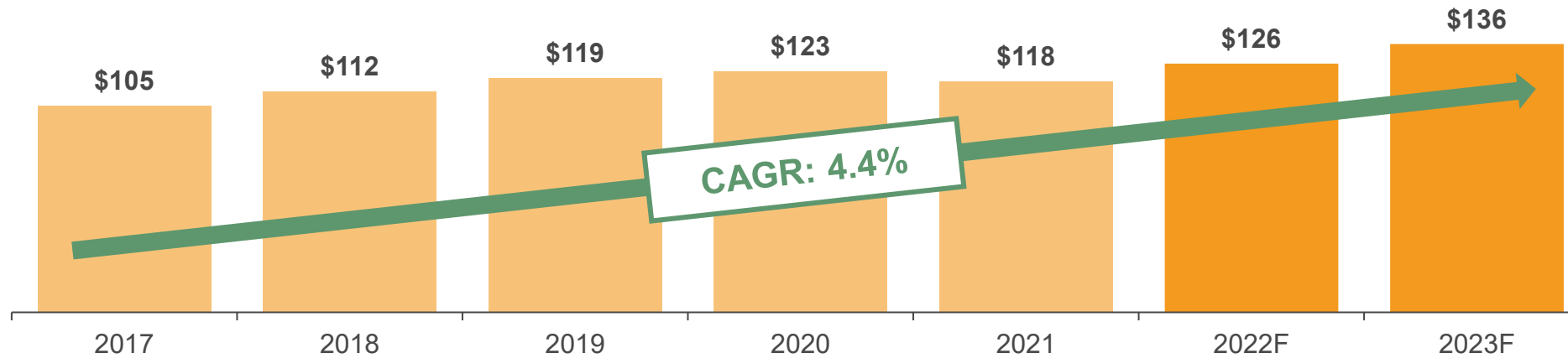
Industrial Real Estate Under Construction



Midwest Nonresidential Construction



Midwest Nonresidential Construction Put-in-Place (2017 – 2023F)*



YoY % Change	2017	2018	2019	2020	2021	2022F	2023F
Manufacturing	-13%	8%	11%	-3%	7%	30%	21%
Lodging	1%	11%	4%	-14%	-33%	3%	11%
Transportation	5%	15%	12%	7%	-1%	-3%	9%
Amusement and Recreation	10%	2%	7%	-9%	-13%	9%	6%
Communication	4%	5%	-11%	8%	3%	1%	6%
Commercial	10%	-1%	-2%	8%	5%	17%	6%
Health Care	6%	1%	6%	4%	-1%	6%	6%
Public Safety	2%	7%	25%	28%	-30%	-3%	4%
Office	-4%	16%	14%	7%	-4%	-1%	2%
Educational	3%	6%	3%	2%	-13%	-3%	2%
Religious	-7%	-4%	9%	-2%	-12%	-4%	-3%
Total Nonresidential Buildings	1%	7%	6%	3%	-4%	8%	8%

MIDWEST NONRESIDENTIAL BUILDING

8%

\$126 BILLION
2022/2021 Comparison



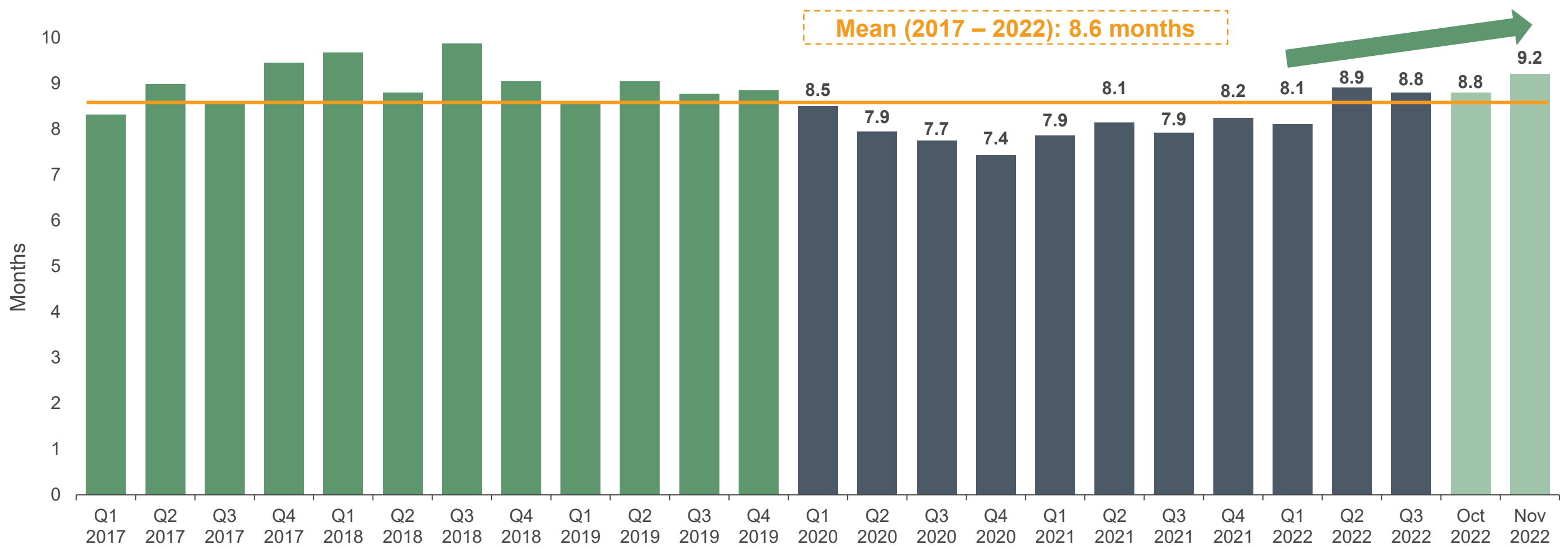
2020	STA	3%	\$123 B
2021	DWN	(4%)	\$118 B
2022	UP	8%	\$126 B
2023	UP	8%	\$136 B

Manufacturing will lead Construction Put-in-Place for the Midwest in 2023

Construction Backlogs

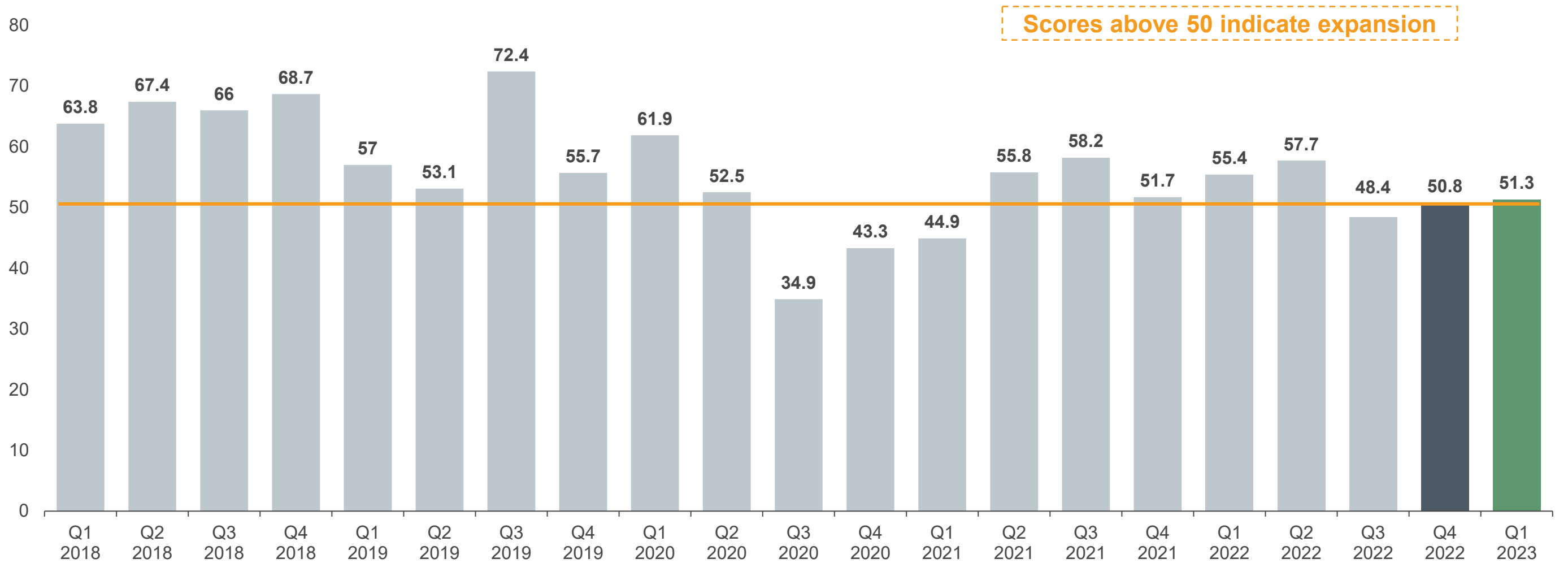
U.S. Construction Backlogs by Quarter

- Backlogs are the closest indicator of near-term revenue expectations
- The **Construction Materials** sector can respond quickly to new funding sources with “shovel-ready” projects
- Monthly backlogs reached its **highest level in November 2022** since Q3 2018



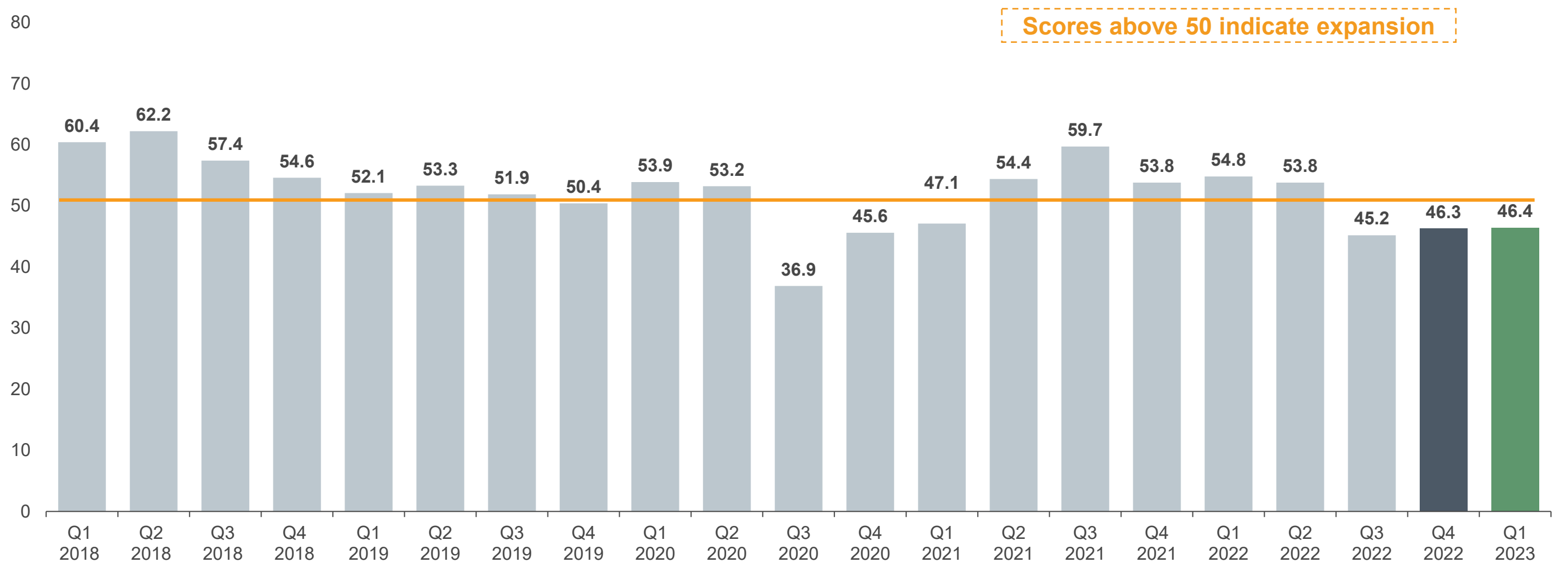
Heavy Civil Construction Index (HCCI)

- Economic sentiment has improved since Q3 2022, pushing the index above 50
- Respondents anticipate improving opportunities in most segments, apart from residential development



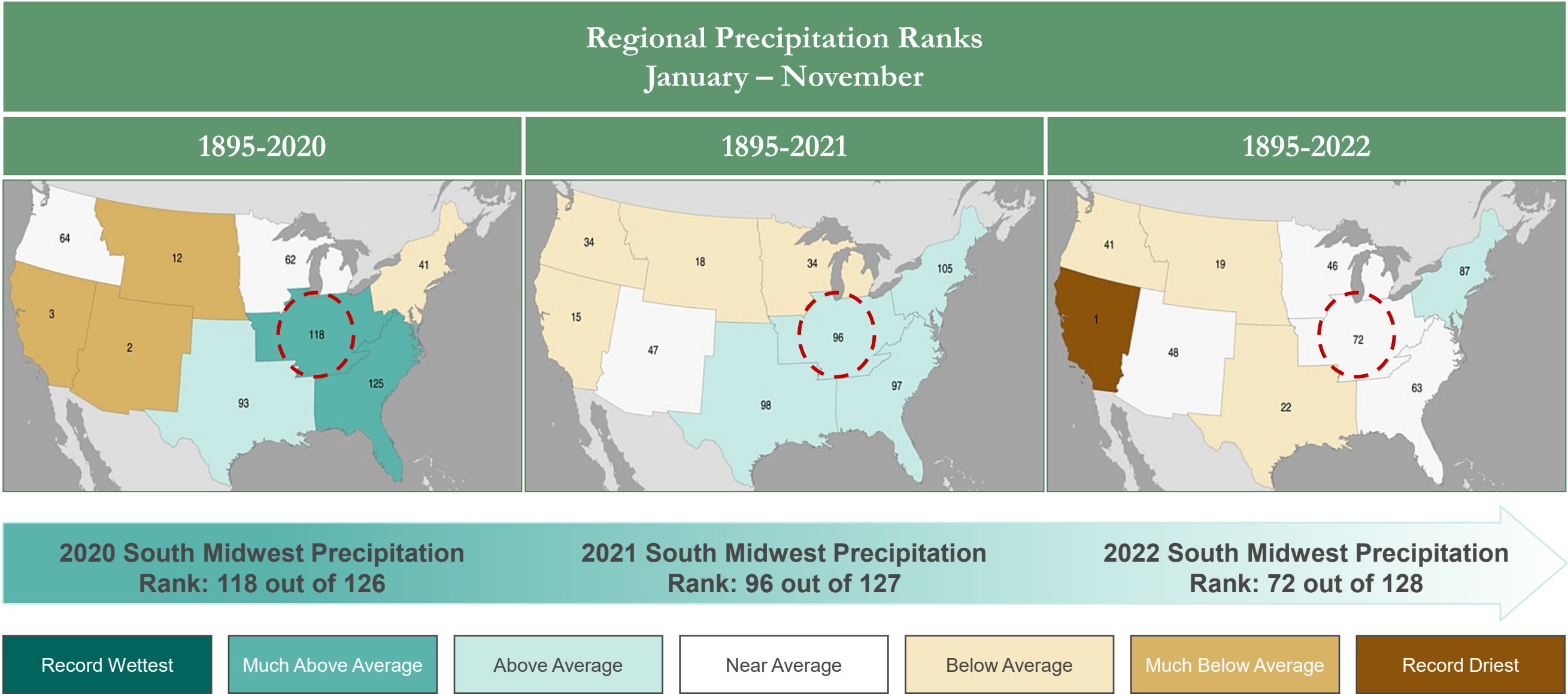
Nonresidential Construction Index (NRCI)

- NRCI suggests ongoing difficulties through the remainder of the year
- Q4 2022 and Q1 2023 sentiment was slightly improved as respondents reported material and labor costs stabilizing
- The index remains below the expansion threshold of 50, which indicates declining sentiment



Wild Card: Weather

Precipitation is always a key factor for CM – it’s the “wild card” in predicting construction volumes and performance



Industry leaders are paying closer attention to weather patterns

Source: National Oceanic and Atmospheric Administration as of November 2022

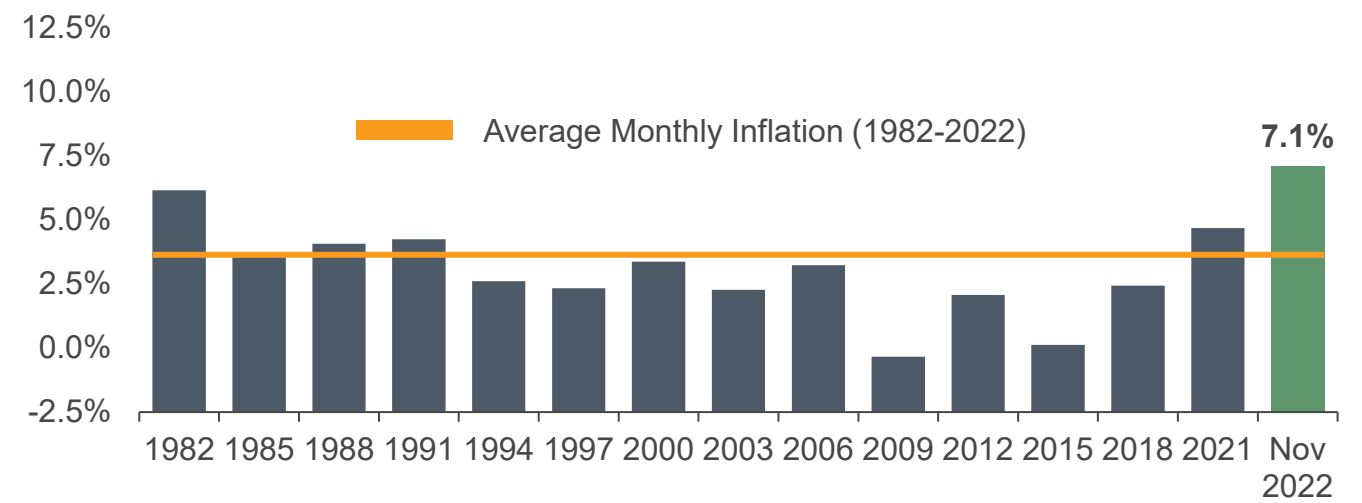


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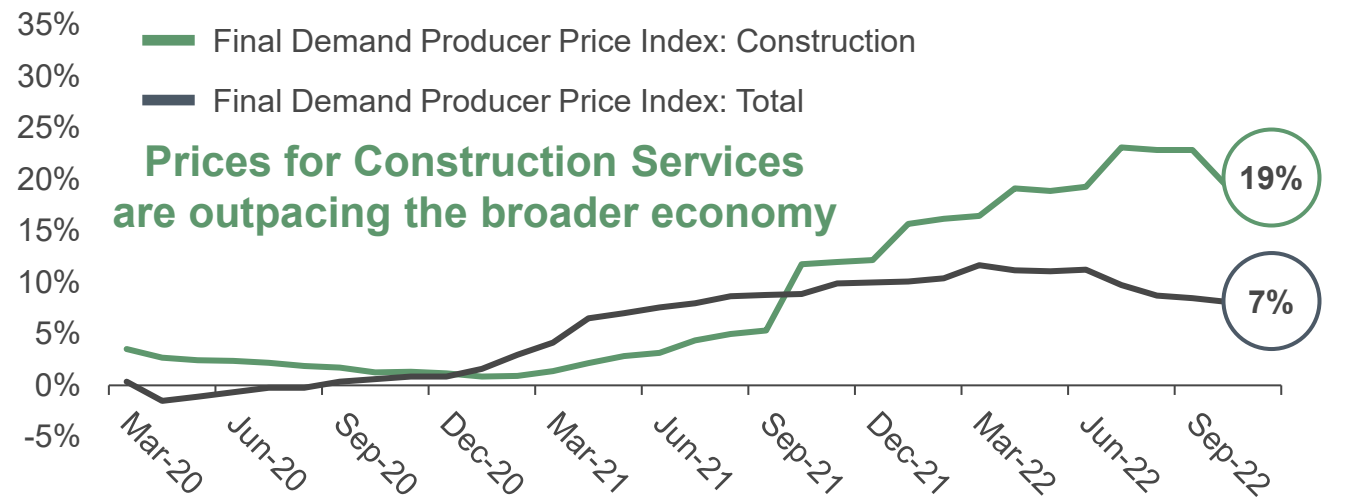
Construction Materials Headwinds, Mitigations, and Trends

Headwinds – Inflation

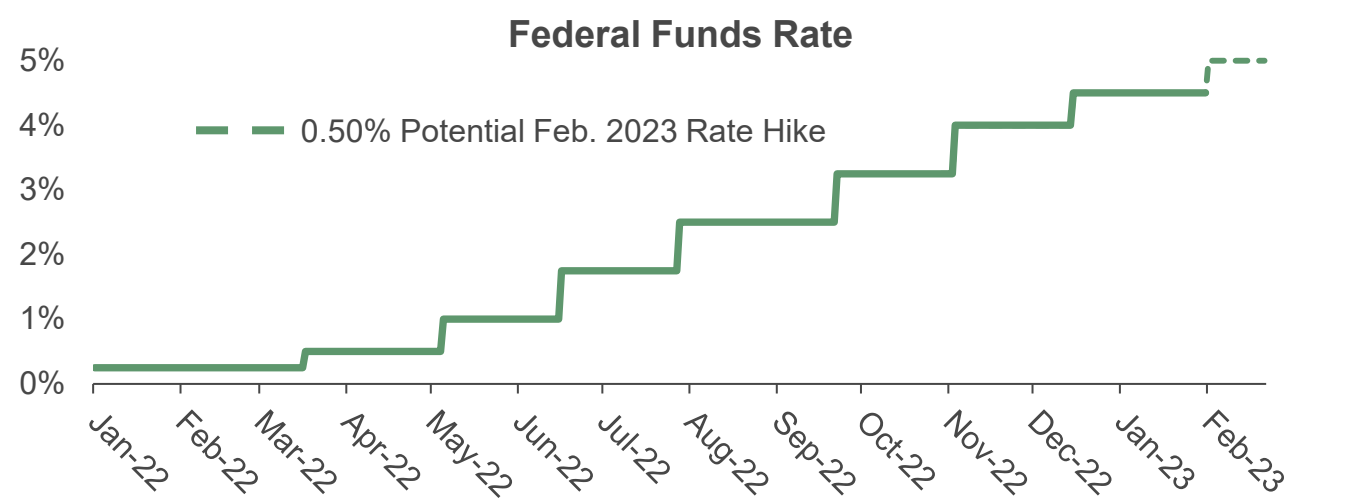
Year-over-Year Inflation (CPI)



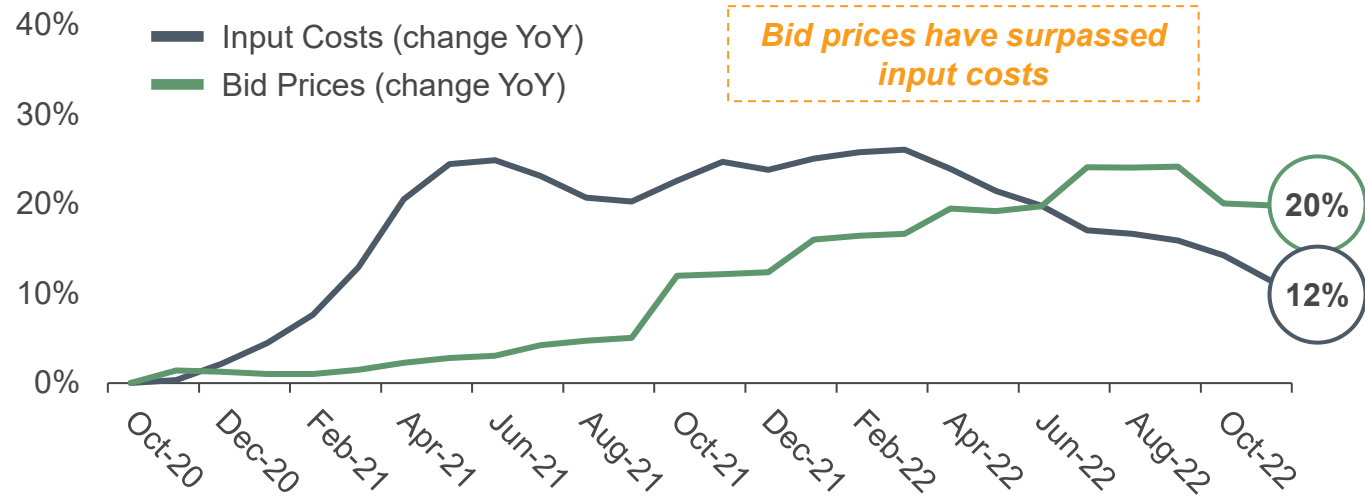
Construction Inflation – Producer Price Index (PPI)



Federal Action

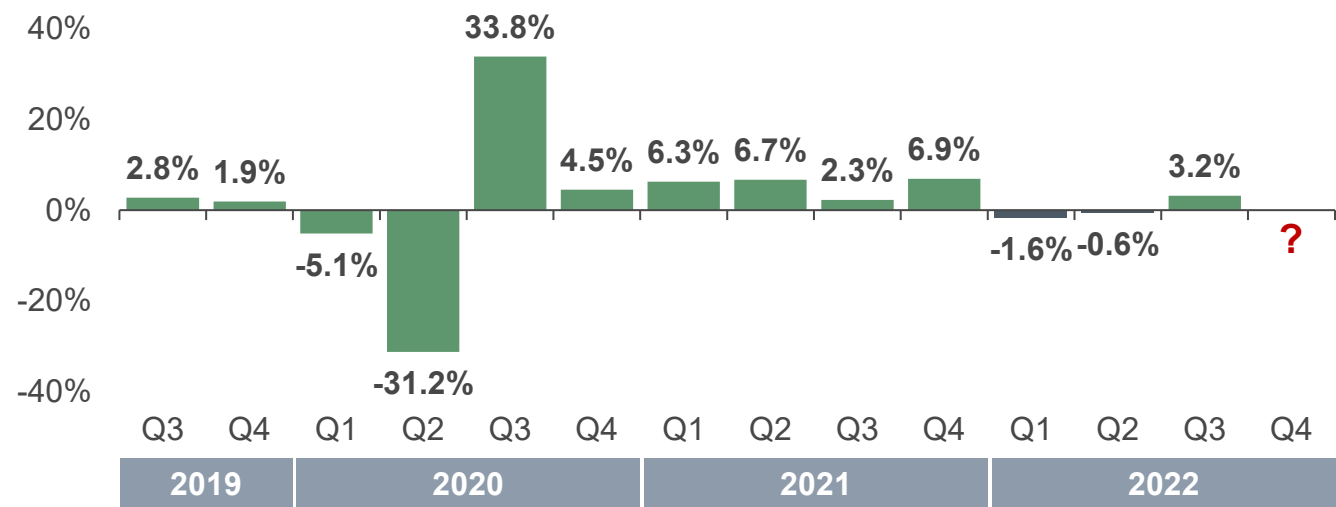


Input Costs v Bid Prices (Nonres. Construction)

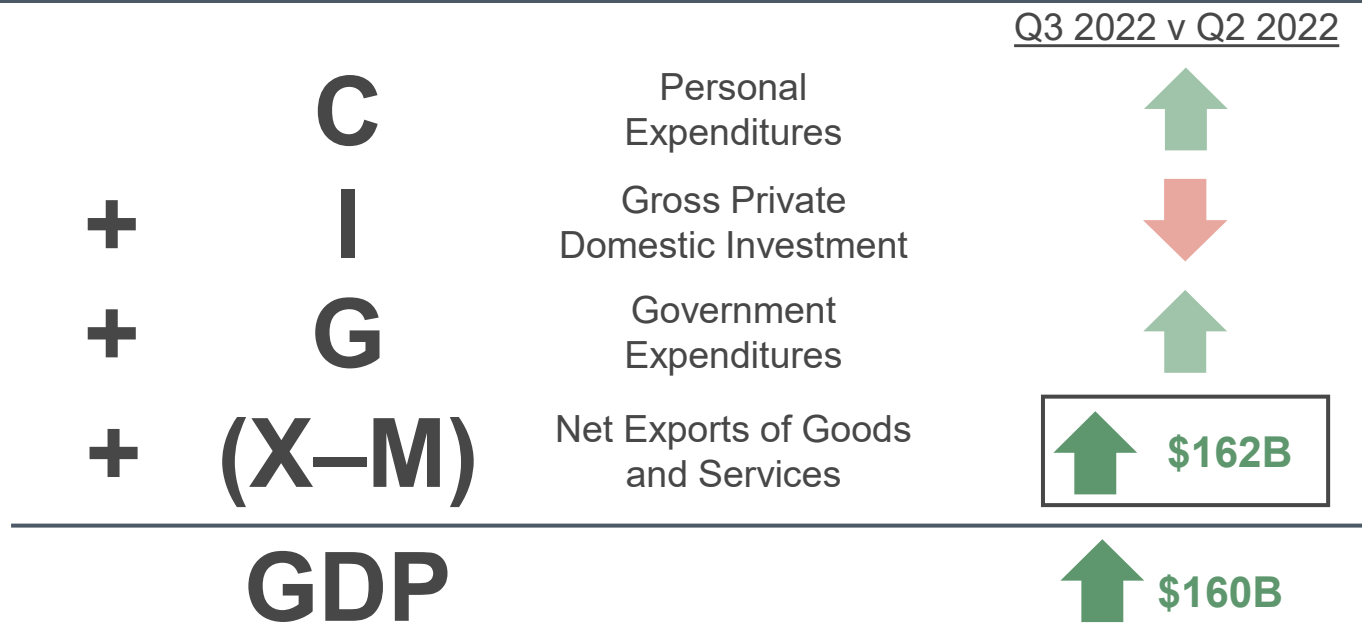


Headwinds – Potential Recession

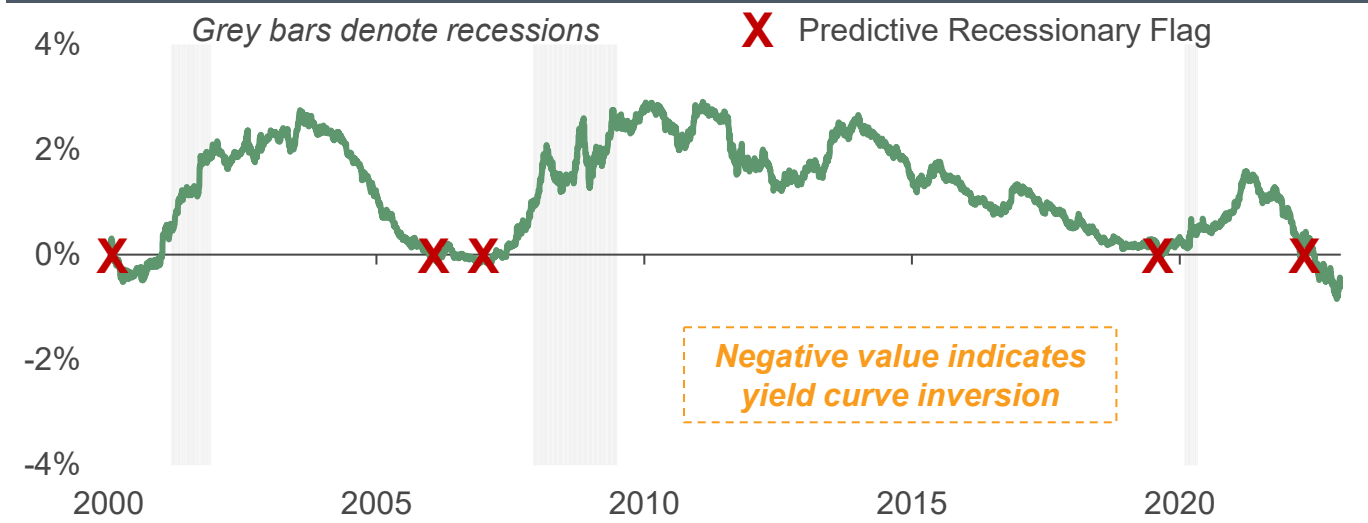
Real GDP Growth / Decline



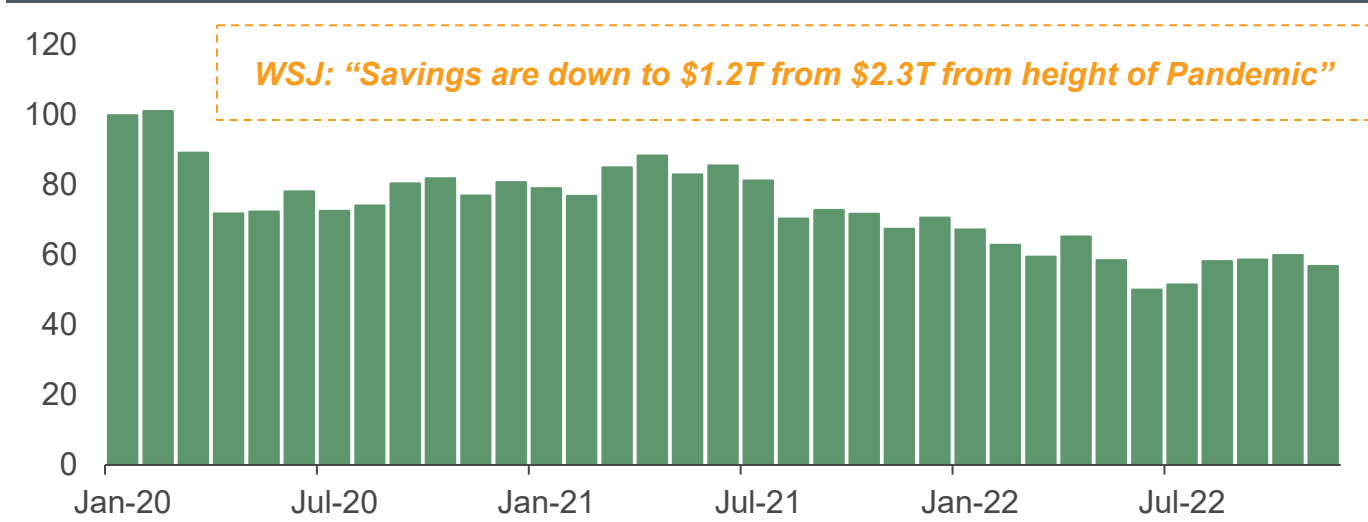
Components of GDP



Inverted Yield Curve – 10-Yr & 2-Yr Treasury Yield Diff.

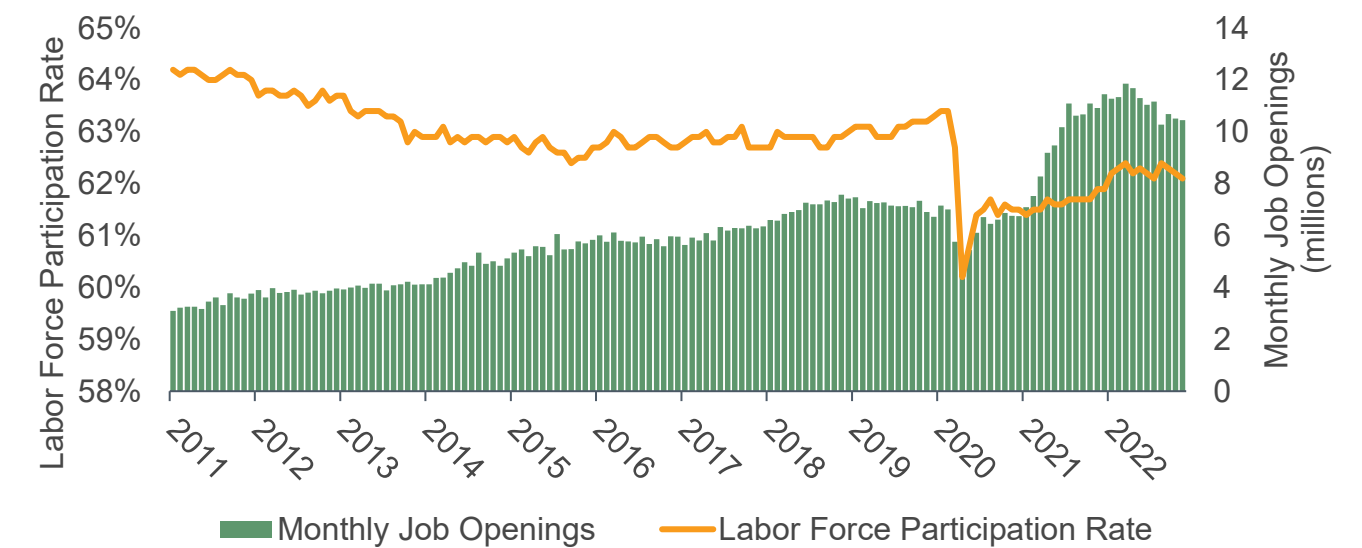


Consumer Sentiment



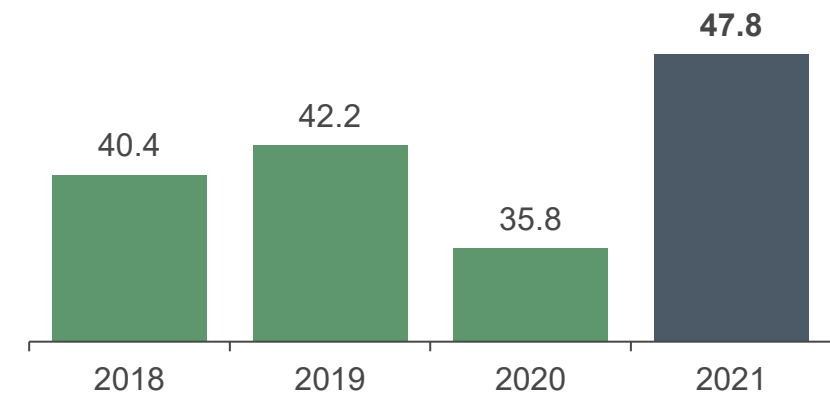
Headwinds – Labor Shortage

Leaving the Workforce – Labor Force Participation Rate



The Great Resignation of 2021 – Total Quits per Year

(in millions)



Abundance of jobs to switch to – for every unemployed worker there are **1.7 jobs available**

Mitigation Strategies

1 Investing in Technology

“We invest in our facilities, keeping them in like-new condition... Not only does this minimize cost... but it reduces labor-intensive operations... This is very helpful in the current tight labor market.”

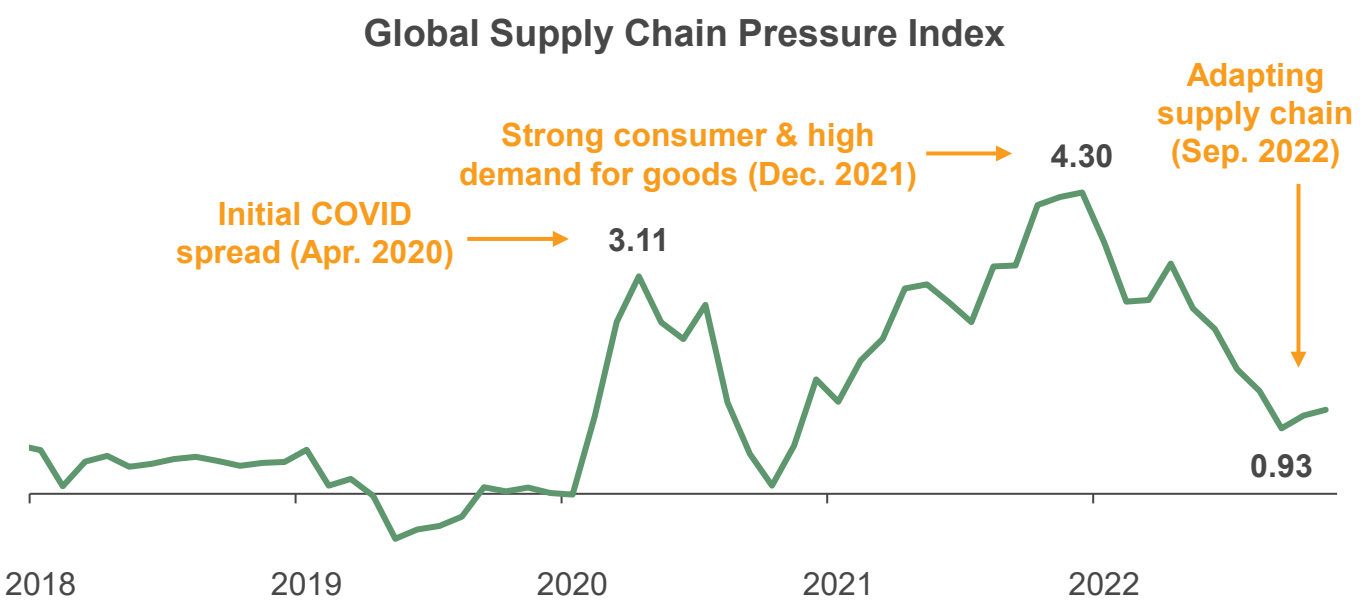
-Michael Haack, CEO, Eagle Materials

2 Investing in People – Attracting and Retaining Talent

- **Competitive benefits** packages (ex. healthcare, insurance)
- Non-traditional **work schedule** (ex. four-day work week, “work from home”)
- **Paid training** (paying employees to study for and obtain their Commercial Driver Licenses, offering college tuition)
- **Pay increases** (Bank of America, Starbucks, and Apple have all increased base salaries)

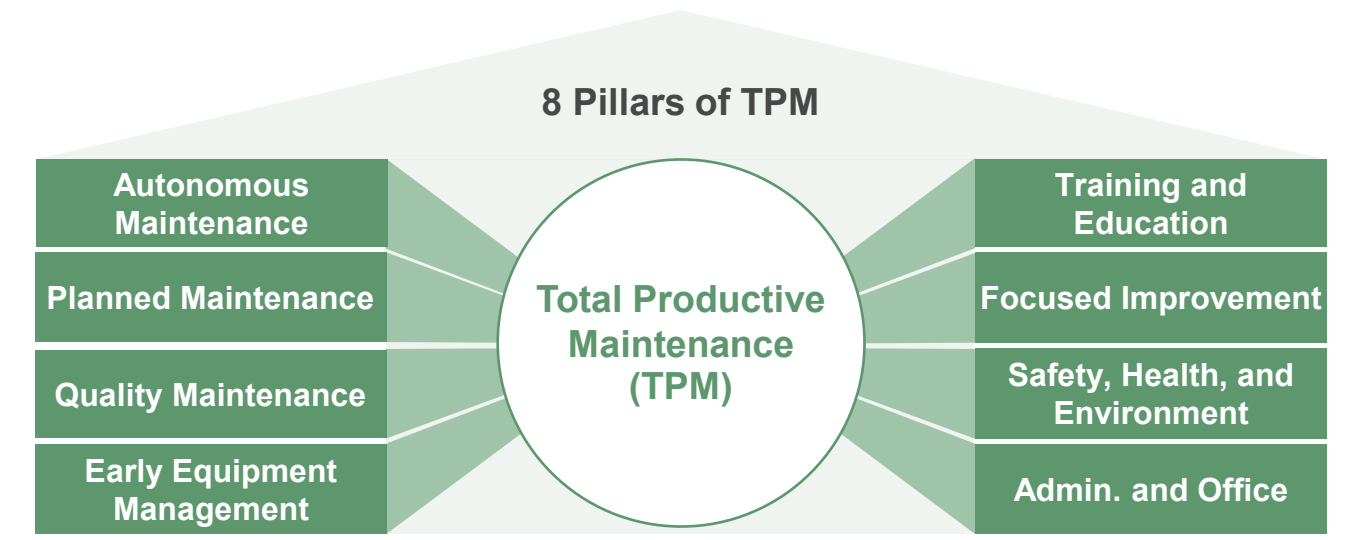
Trends – Unwinding Supply Chain Constraints

Easing Supply Chain Concerns



- **Supply chain pressures have declined in 2022 due to:**
 - Reduced backlogs at U.S. ports
 - Retailers keeping above-average inventories, reducing purchasing needs
 - Consumer demand for goods shifting towards services
- Easing constraints can help reduce inflation in the long-term
- Lockdowns in China and semiconductor shortages remain outstanding issues

CM-Specific – Total Productive Maintenance (TPM)



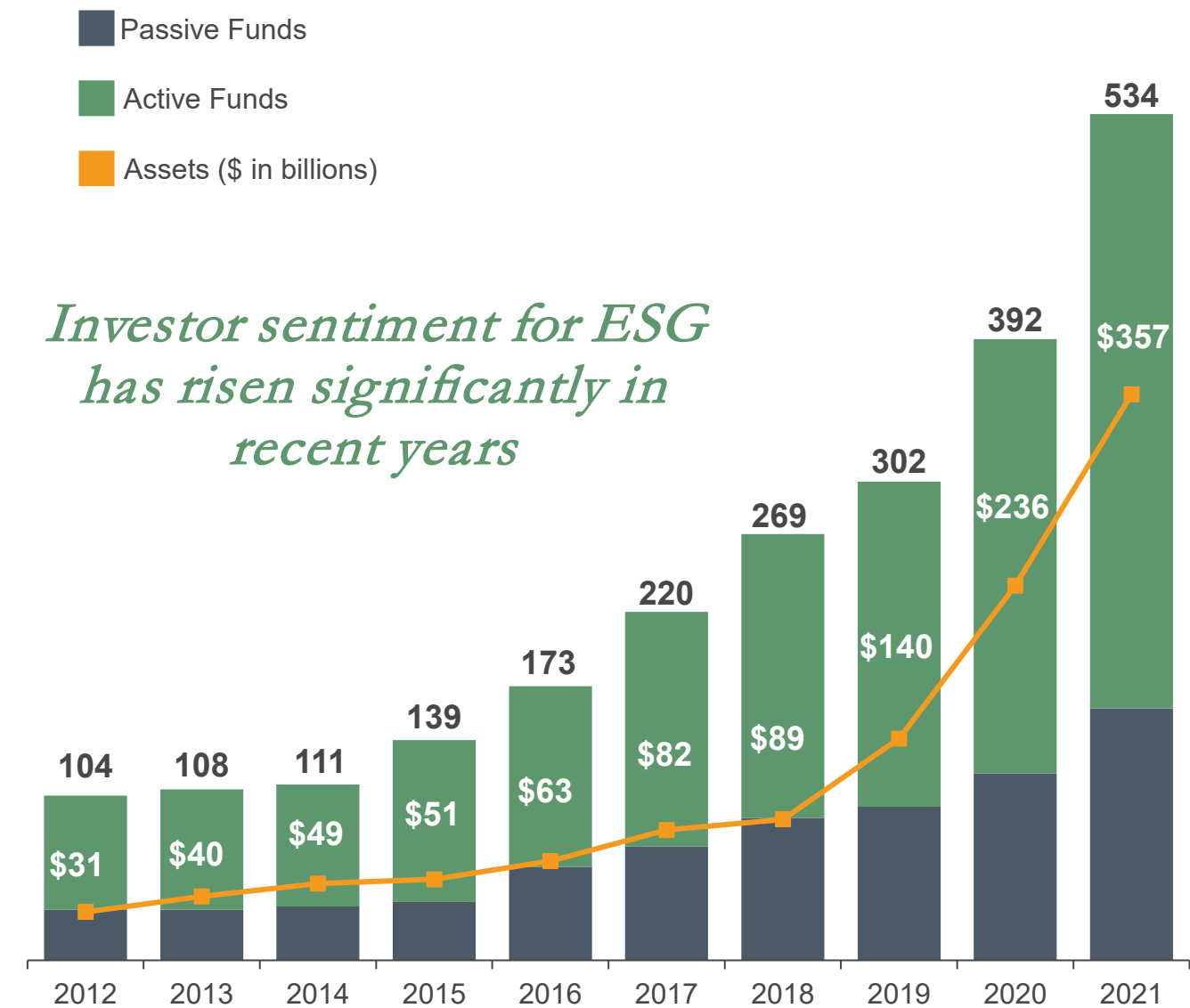
Benefits:

-  **1) Avoidance of long lead times**
-  **2) Expanded fleet capacity**
-  **3) Cost savings on repairs**
-  **4) Customer satisfaction**

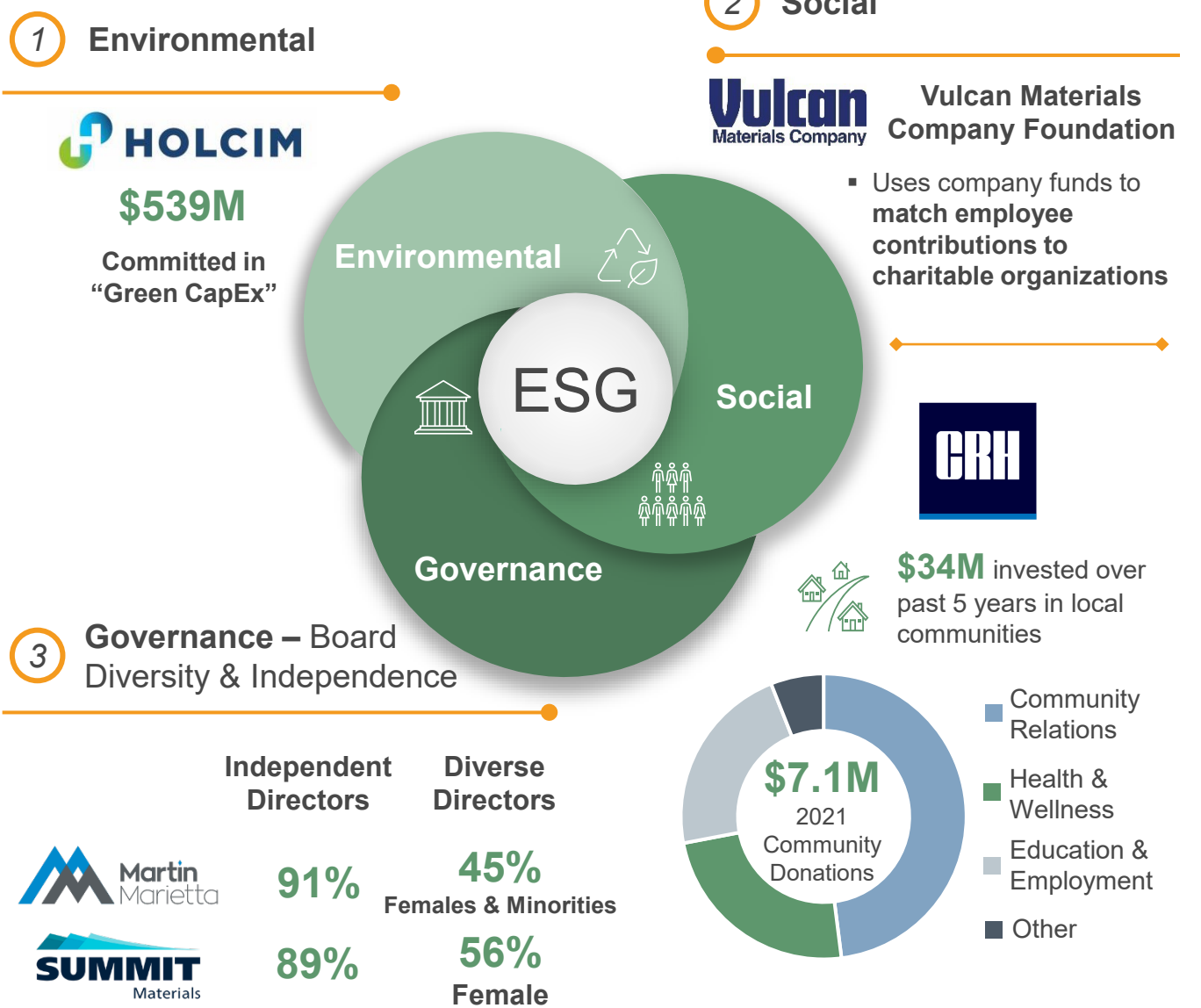
Source: Federal Reserve Bank of New York, The Wall Street Journal

Trends – Environmental, Social, and Governance (ESG): CM Specific

Growing Number of U.S. Sustainable Funds



CM-Specific Initiatives





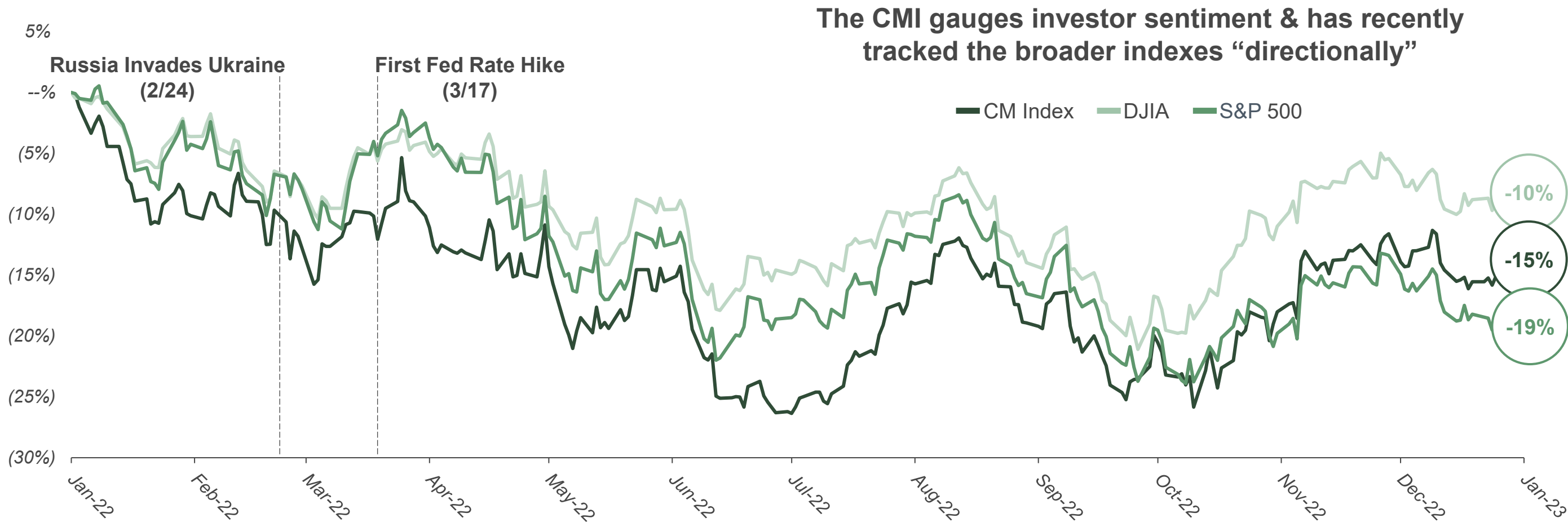
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Construction Materials Outlook & Indicators

Financial Markets – Public Company CM Performance

CMI v Major Indexes (January 2022 – January 2023)

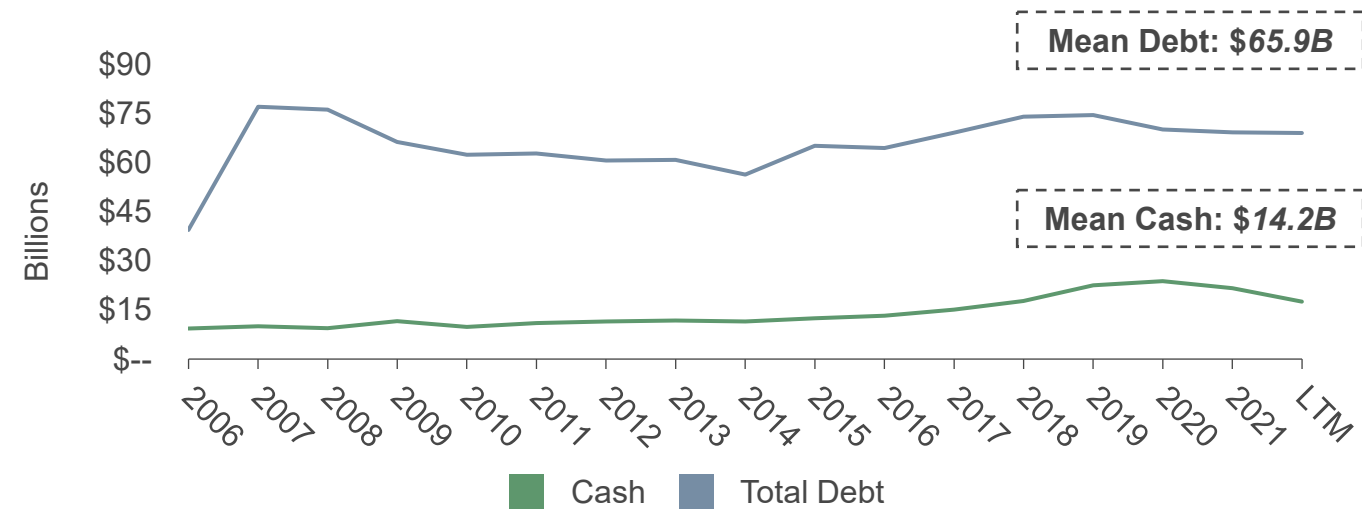
- The CM industry is perceived to be more affected by “frontpage” issues such as inflation (fuel costs), labor issues, and supply chain



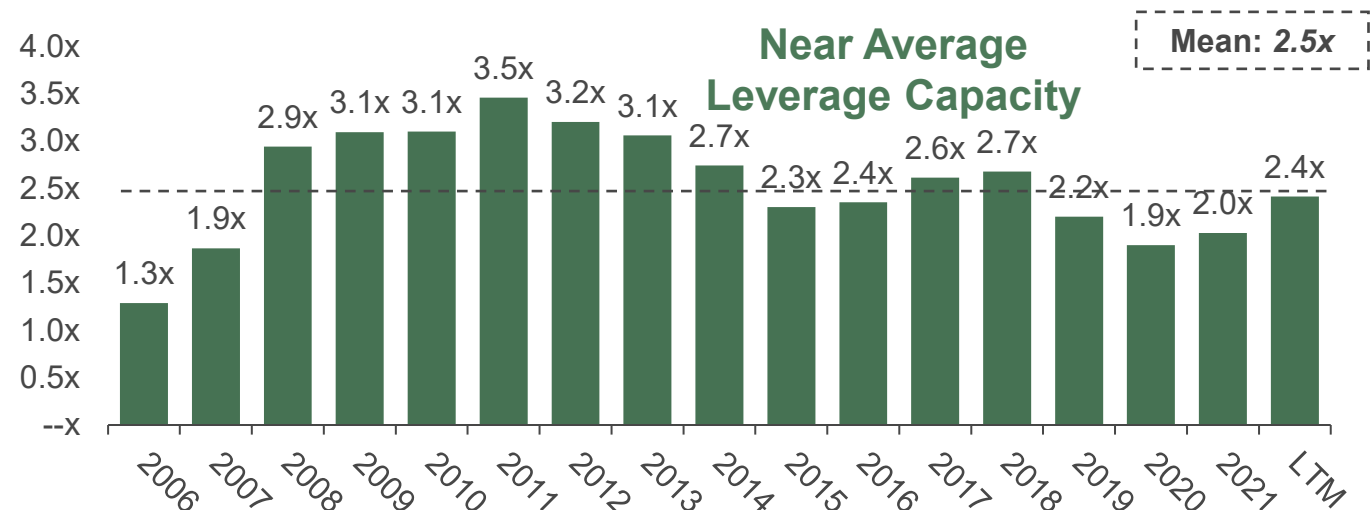
Source: S&P CapIQ as of 1/5/2023
FMI's CM Index includes: Arcosa, Inc., Buzzi Unicem S.p.A., Cementos Argos S.A., CEMEX, S.A.B. de C.V., Colas SA, Construction Partners, Inc., CRH plc, Eagle Materials, Inc., Granite Construction Incorporated, Grupo Cementos de Chihuahua, S.A.B. de C.V., HeidelbergCement AG, Holcim Ltd, Martin Marietta Materials, Inc., Summit Materials, Inc., The Monarch Cement Company, Titan Cement International S.A., Vulcan Materials Company

Public CM Companies – Checking the “Vital Signs” (Positioned for Growth)

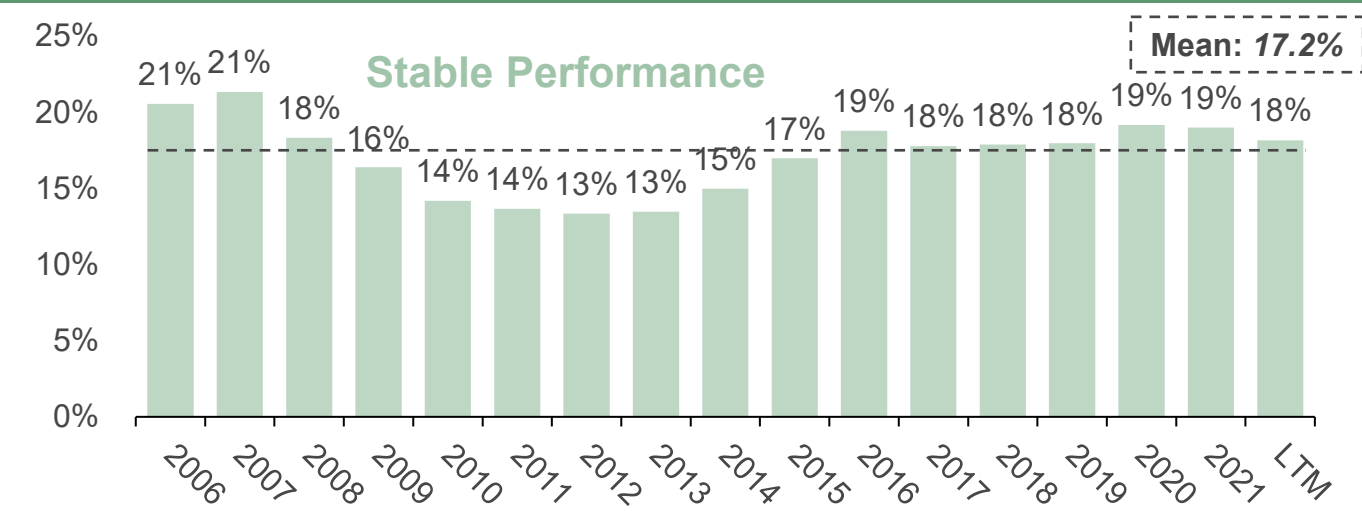
CMI Cash vs Total Debt



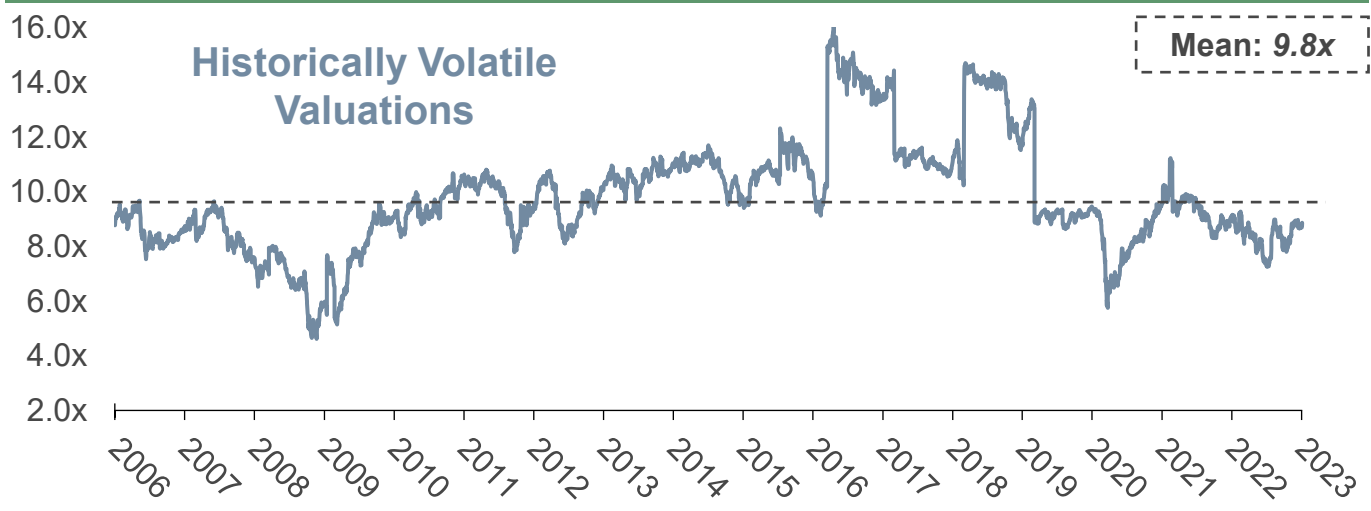
CMI Median Net Debt/EBITDA



CMI Average EBITDA Margin

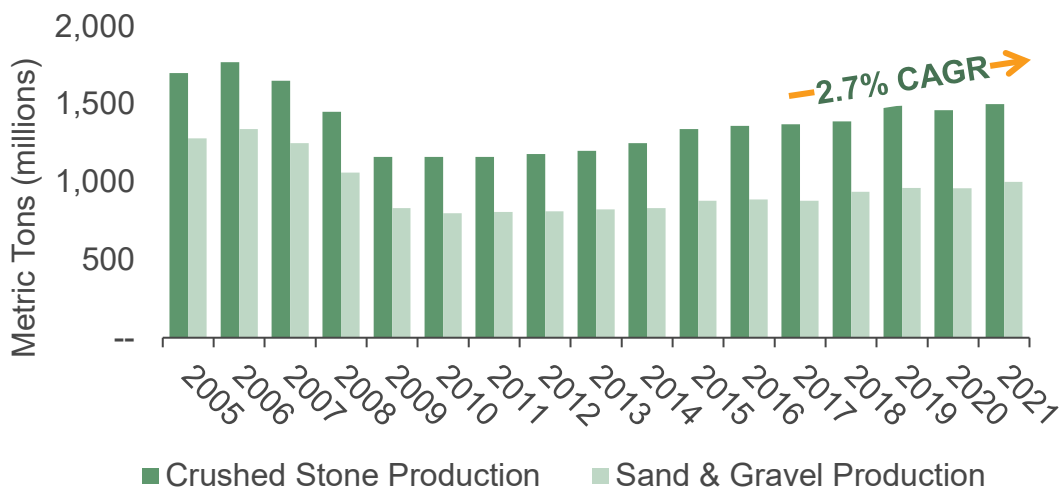


CMI TEV/EBITDA

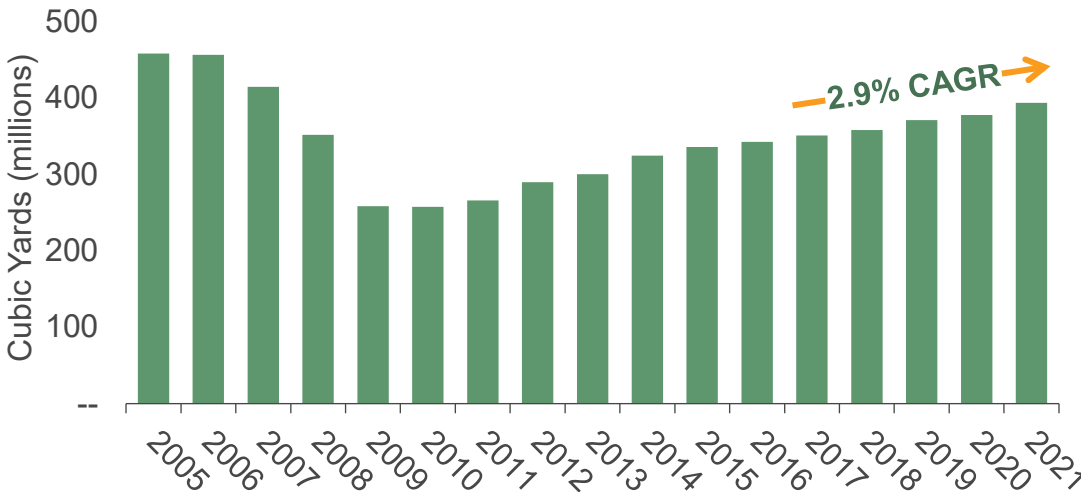


U.S. Construction Materials – Growth is Steady but Modest

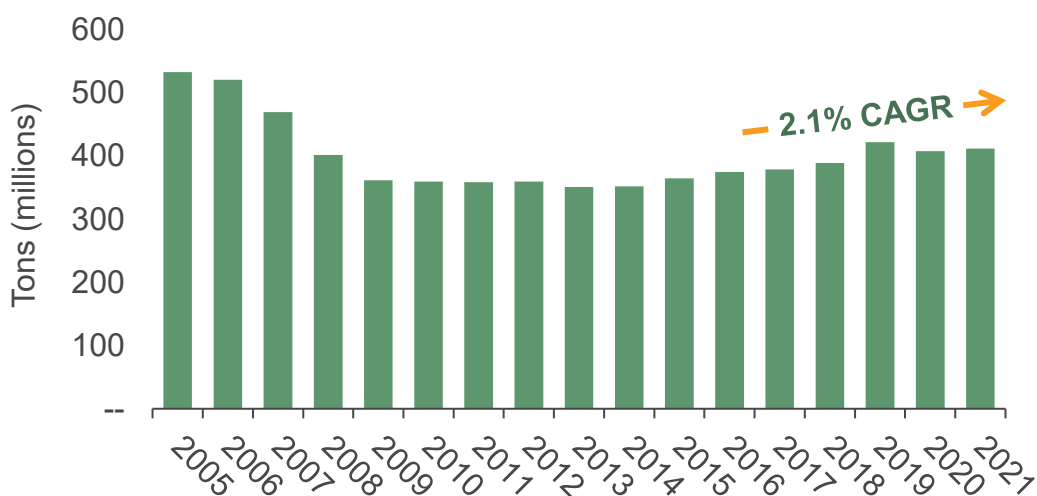
U.S. Construction Aggregates



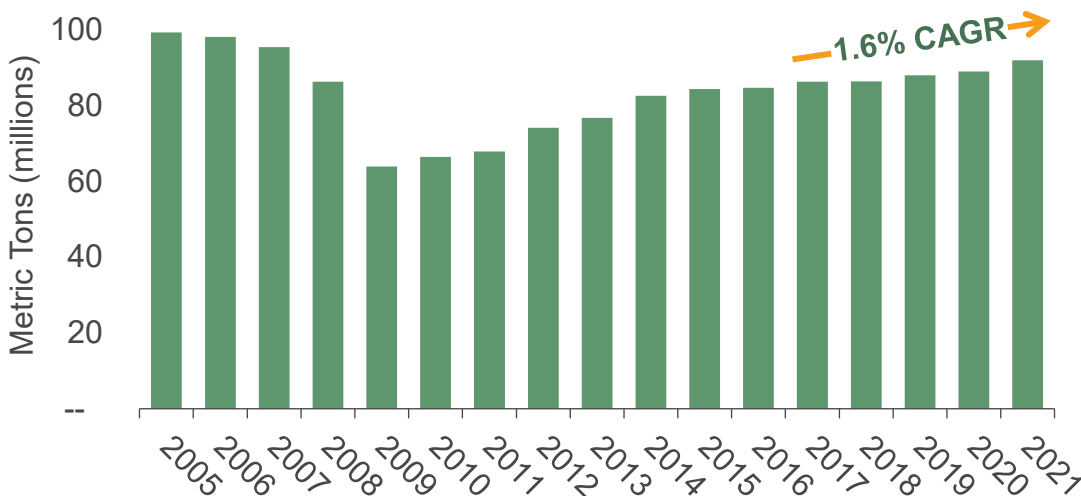
U.S. Ready-Mixed Concrete Produced



U.S. Asphalt Tons Produced



U.S. Cement Production (Domestic)

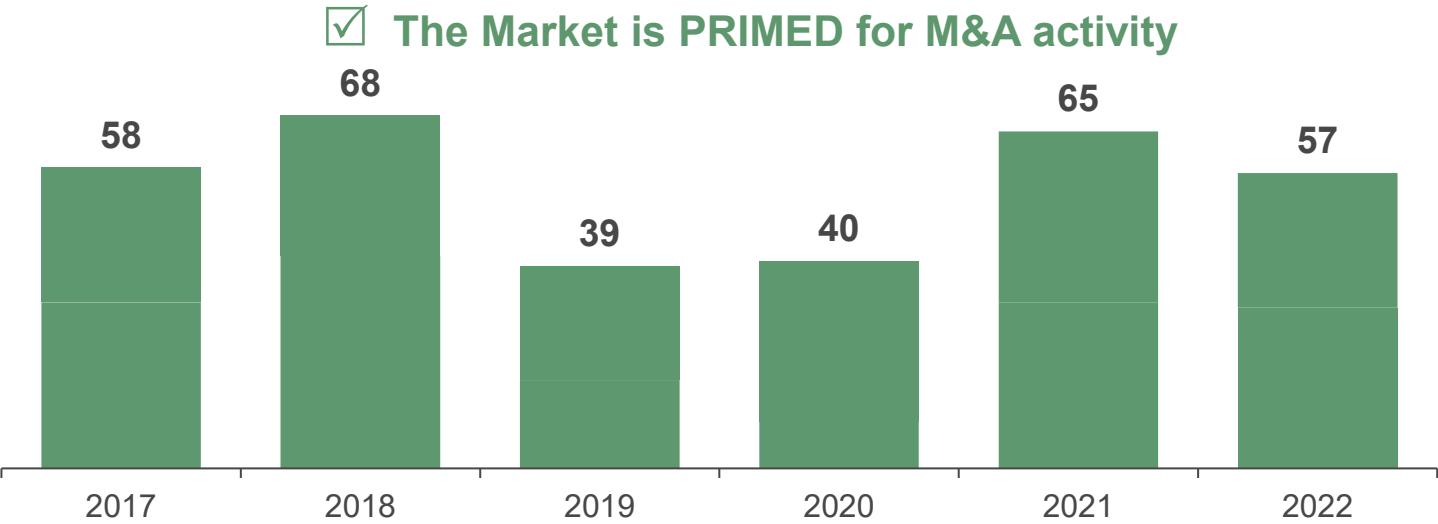


YTD aggregate production in Missouri has outpaced the national average through Q3 2022

- USGS

Mergers and Acquisitions

CM Deals 2017 – 2022



- **2017 and 2018:** M&A activity fueled by passage of FAST Act
- **2019:** CM players lost substantial market cap in late 2018 leading to uncertainty in 2019
- **H1 2020:** Sector experienced low deal volume due to COVID
- **H2 2020 - 2021:** Deals have increased due to returned optimism
- **2022:** M&A continued at a high level due to IIJA expectations

Recent activity from “Majors”

Major Buyers					
Select Acquisitions	 	 	 37 RMC plants in CO, TX, & WY 28 RMC plants in NY, NJ, & PA	 	 CA RMC and Cement Assets

Platform growth has been recently in vogue, but the pendulum is swinging back towards bolt-on opportunities

Private Equity Resurgence in the Construction Materials Space

PE has historically played a limited role in Construction Materials M&A, but has shown greater interest







Select Exited Platforms

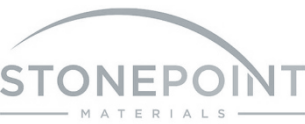
Several once-active platforms have been exited by their previous equity sponsors



Acquired by Arcosa



Acquired by Vulcan



Acquired by Arcosa



IPO



Acquired by MLM



IPO

Inflation and Pricing Trends

CM Producers were able to offset inflation in 2022 with price increases



“Pricing basically compensated all cost inflation in the quarter...[in North America] margin declined basically 0. So, the American team has been able to hold the margin” - Dominik von Achten, CEO, Q3 2022 Earnings Call



“We’ve gotten our price out ahead of cost....I don’t expect... the inflationary pressures to go down, either in Q4 or 2023.”
- Tom Hill, CEO, Q3 2022 Earnings Call



“Price realizations more than mitigated the cost of inflation pressures.” — Michael Haack, CEO, Q2 2023 Earnings Call



“In aggregates, pricing increased 10.2% and is up 6.5% over the first 9 months of 2022...Given the strong trends in pricing, we remain confident that...[we will] exit 2022 with tremendous pricing momentum” — Brian Harris, CFO, Q3 2022 Earnings Call



“Inflationary trends also impacted our...adjusted consolidated gross margin, which declined 200 basis points...As a result, we’ve advised customers of fourth quarter price increases...as well as broad based January 1, 2023 increases.”
— Ward Nye, President & CEO, Q3 2022 Earnings Call

Price increases appear likely across the board in 2023

Industry Sentiment

Strong Infrastructure Demand

Demand Drivers

- Stable funding from the IIJA through 2026
- State funding initiatives (gas tax increases, bond issuances, etc.)

“...the fundamentals for multiyear growth in highways and infrastructure are very good. You've got substantial funding, both state, county, [and] city.”

Tom Hill, CEO, Vulcan Materials – Q3 2022 Earnings Call

Strong Pricing Dynamics

Pricing Drivers

- Upstream materials (aggregates and cement) producers are better suited to pass on inflationary price gains
- Contractors facing competitive pressures will be more challenged to pass along price increases quickly

“...you'll see that we delivered solid third quarter results as evidenced by... the strongest year-on-year organic pricing growth for aggregates, cement and ready-mix in company history.”

-Anne Noonan, CEO, Summit Materials – Q3 2022 Earnings Call

Stable 2023 Forecast

Outlook Drivers

- DOT budgets drive increased volumes offsetting any potential dip in residential
- Price increases in all product lines in 2022 are seen as permanent, with additional planned increases slated for Jan. 1, 2023

“...we expect a step change in the public sector investment in 2023 to provide a stable base level of demand for years to come.”

-Ward Nye, President & CEO, Martin Marietta – Q3 2022 Earnings Call

Sustainable public sector demand and accelerating prices among the “majors” are driving stable M&A activity and strong 2023 outlook

Conclusion & Key Take-Aways



National trends and sentiment look more uncertain than at the start of 2022, but all construction is “local”



The IIJA will benefit many players in the Construction Materials industry despite inflation as funds are pushed to 2023-2026 due to disbursement delays



The short-term outlook for the residential market appears pessimistic but medium-term and long-term fundamentals remain positive



Headwinds: Inflation’s impact on profitability, increasing interest rates, looming recession, labor shortages, and the Russia-Ukraine conflict



M&A looks stable as “majors” reposition and refocus on strategic markets

The Construction Materials industry is well-positioned to weather a potential macroeconomic downturn



Scan for industry
insights, recent
transactions, and an
overview of FMI
Capital Advisors
Construction
Materials

FMI Capital Advisors

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Suite 1200
Raleigh, NC 27603

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Leading with...

G.R.I.T.

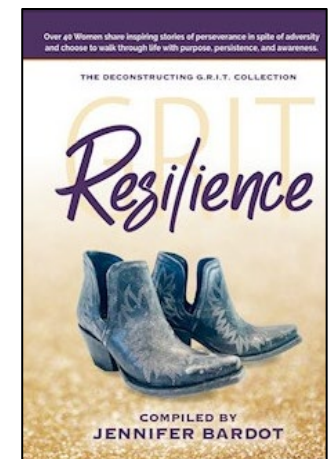
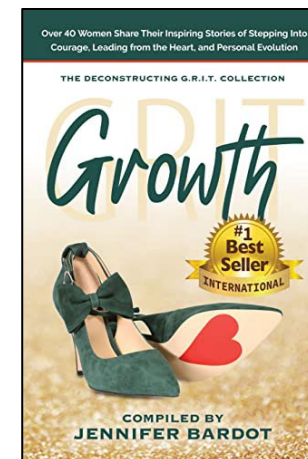
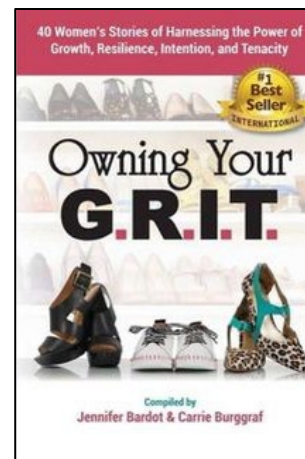
GROWTH RESILIENCE INTENTION TENACITY

Jennifer Bardot, MA, MS

International Best-Selling Author
Connector, Mentor, Community Volunteer
Director of Health & Benefits, WTW



January 10, 2023



A Little About My Background...



Supporting GROWTH For 89 Years

***George McDonnell & Sons
Tuckpointing Co., Inc.***

Family Owned Caulking Specialists Since 1933

**Traffic Coating | Tuckpointing
Waterproofing | Expansion Joint**

314-739-0468

www.georgemcdonnellandsonsinc.com

G.R.I.T.
GROWTH RESILIENCE INTENTION TENACITY

WHAT DOES IT MEAN TO HAVE

G.R.I.T.?
GROWTH RESILIENCE INTENTION TENACITY

GRIT is a positive character trait based on an individual's Passion for a particular long-term goal or end state, coupled with powerful motivation to achieve this objective.

Guts

- Courage
- Determination
- Toughness of character
- Pluck, spirit, boldness
- Fortitude/backbone
- Overcoming fear

Resiliency

- Bounce Back
- Overcoming adversity and hardship
- Recover and Reinvigorate
- Hardiness

Intensity

- Focus/concentration
- Drive
- Fierceness
- Determination
- Strength
- Ardency/passion

Tenacity

- Perseverance/Persistence
- Tireless purpose
- Resolution/Commitment
- Follow through

Did you know???

According to **Forbes Magazine**

“ **G.R.I.T.** ”

Is more important than

- **I.Q.**
- **Talent**
- **Working Hard**

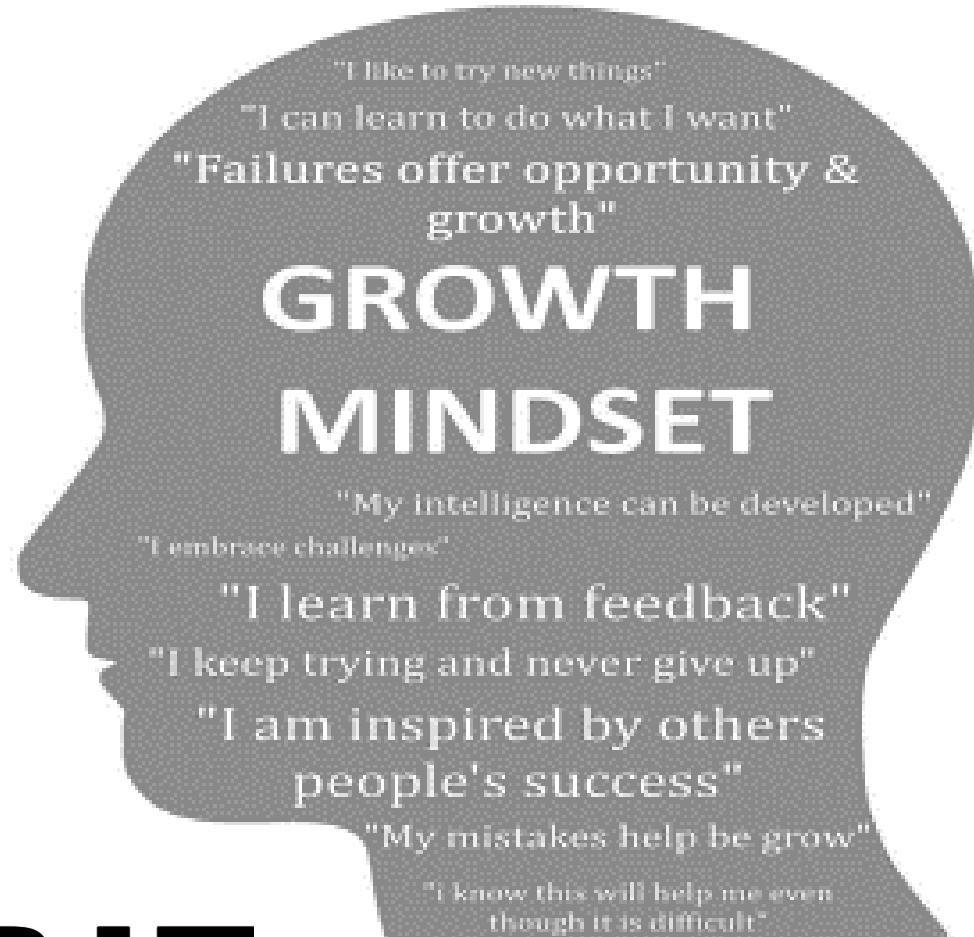
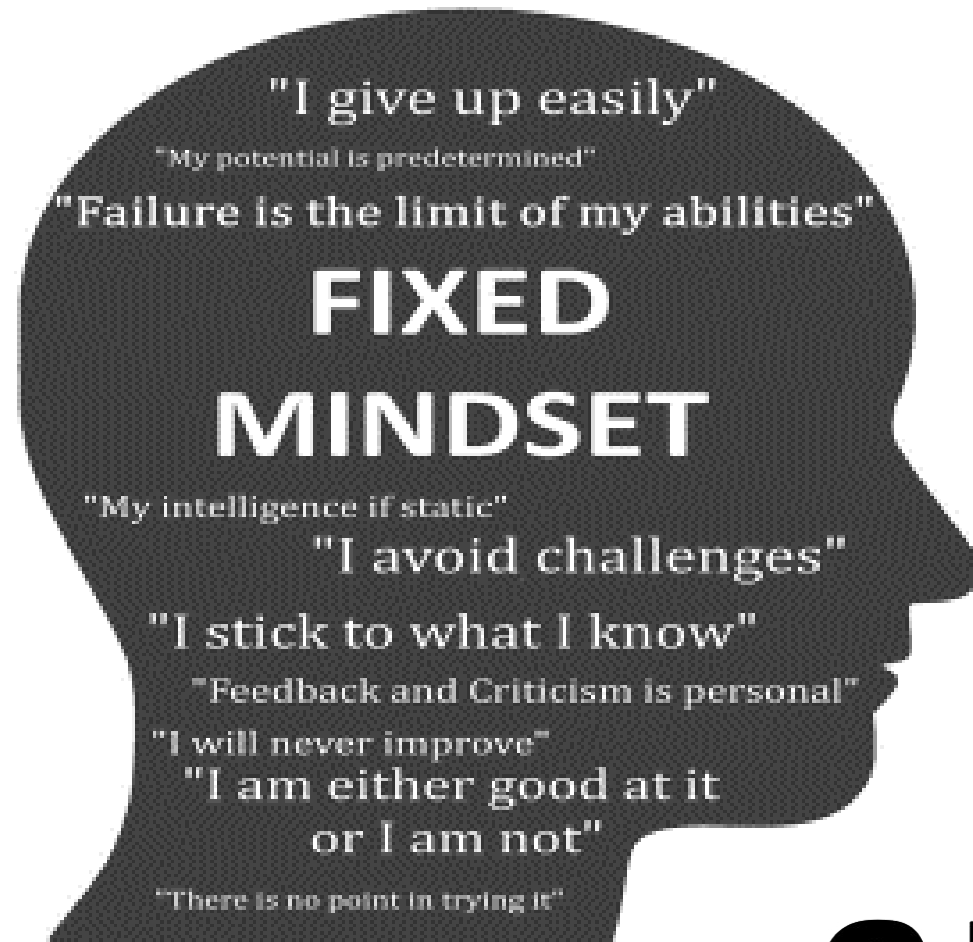
WHY

G.R.I.T.?

GROWTH RESILIENCE INTENTION TENACITY

THE DRIVE,
STAMINA & FORTITUDE
TO PUSH THROUGH
ANY CHALLENGE
OR OBSTACLE UNTIL
SUCCESS IS ACHIEVED.

MINDSETS



G.R.I.T.
GROWTH RESILIENCE INTENTION TENACITY

Leading with **G.R.I.T.** Boosts Employee Well-Being

Passion

G.R.I.T. leaders manifest a passion for what they do.

Work

G.R.I.T. leaders work harder than those around them.

Delayed Gratification

G.R.I.T. leaders sacrifice short-term gratification.

Focus

G.R.I.T. leaders zero in on what they want to accomplish.

Perseverance

G.R.I.T. leaders don't easily quit.



Wellbeing Shown in Five Categories

Physical

Integrated Health and Safety
Ergonomics Assistance
Onsite/near-site Services
Personalized Tools
Physical Environment
Treatment Decision-support
Navigation Support Services
Targeted Clinical Conditions

Emotional

Strategy/action Plan
Psychological Safety
Measure Stress
Redesign EAP
Programs Supporting Chronic Issues
Resilience Training
Manager Training
Parental Leave

Financial

Measure Using HR Data
Use Metrics at Pivotal Moments
One-on-one Counseling
Personalized Decision-support
Support Borrowing, Spending Decisions
Monitor Group Rates for Borrowing
Subsidize Student Loan Refinancing
Promote Family Financial Decisions

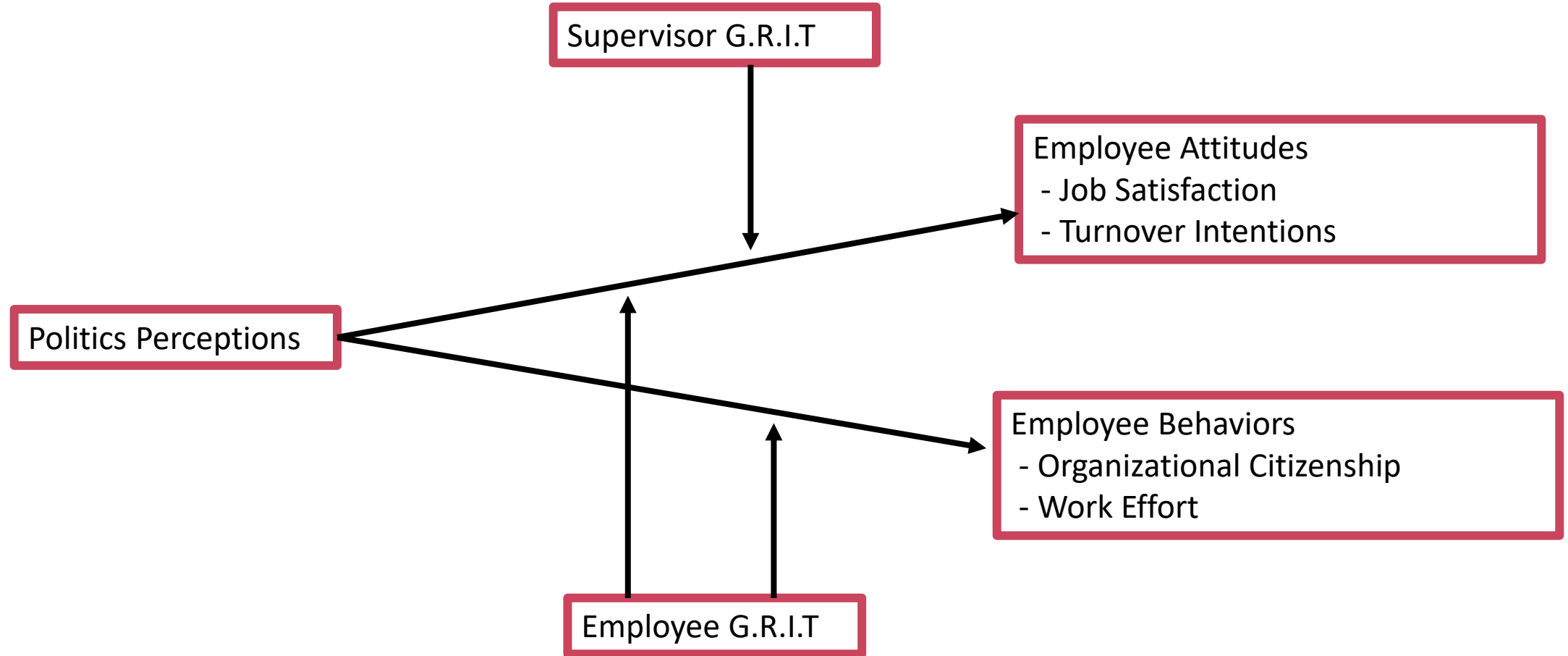
Social

Link to Corporate Social Responsibility
Incorporate I&D in Benefits Designs
Support Volunteerism
Support Compassionate Donations
Use Social Recognition
Sponsor Affinity Groups
Local Wellbeing Champions
Key Influencers to Drive Messages



Why is G.R.I.T. important at work?

G.R.I.T. determinate for our professional success and for personal happiness.



The Dimensions of G.R.I.T



G

“Growth is about how likely we are to go seek fresh ideas, perspectives, inputs, and ideas to help you succeed at that thing.”



R

“Resilience is about bouncing back from adversity and being able to use adversity.”



I

“Instinct is about going about after our goals the best way, not the hardest way.”



T

“Tenacity is that perseverance, persistence, never say die, never say quit dimension of G.R.I.T.”



G.R.I.T. predicts who will accomplish challenging goals more so than achievement test scores.”

- Research Completed by West Point

G.R.I.T. also propels people to the highest ranks of leadership in many demanding fields.”

- Harvard Business Review

GROWTH

Growth allows us to move BEYOND our personal COMFORT ZONE and become the Truest Version of Our Best Selves.

Themes of GROWTH

Awareness:

Recognizing that life happens these obstacles will always show up

Action:

The only way is through. Sooner you act the quicker you can achieve growth

Liberation:

Let go the things we can't control, resentment, pain, anger so you can achieve your goals



RESILIENCE

Resilience is the ability to recover from or adjust easily to misfortune or change and to keep going through life's hardships choosing to "DO HARD THINGS" daily, weekly, for long periods.

Themes of Resilience

Commitment: The choice to be resilient requires us to be conscious of our progress. Having a daily commitment to ourselves and our goals strengthens our ability to accept change as we overcome the next challenge. Our future is determined by a belief in ourselves, plus the actions we take, ultimately leading to the progress we make.

Persistence: Aspiring to stay on course no matter the difficult path requires patience, allows us to witness our own inner strength, and dictates our outcome. It's our persistent self-determination which leads us through struggle to success.

Purpose: Knowing our purpose in life allows us to better maneuver through the challenges when they arrive. It's the setbacks, dark times, and difficulties that strengthen our purpose and allow us to be more aware of our hidden gifts. Our purpose defines our destiny, brings us joy, and lays a path for achieving our goals.



INTENTION

Intention is thinking about the present as if it were the past

Themes of INTENTION

???

???

???

TENACITY

Strength of will, firmness of purpose,
strength of purpose, fixity of purpose

Themes of Tenacity

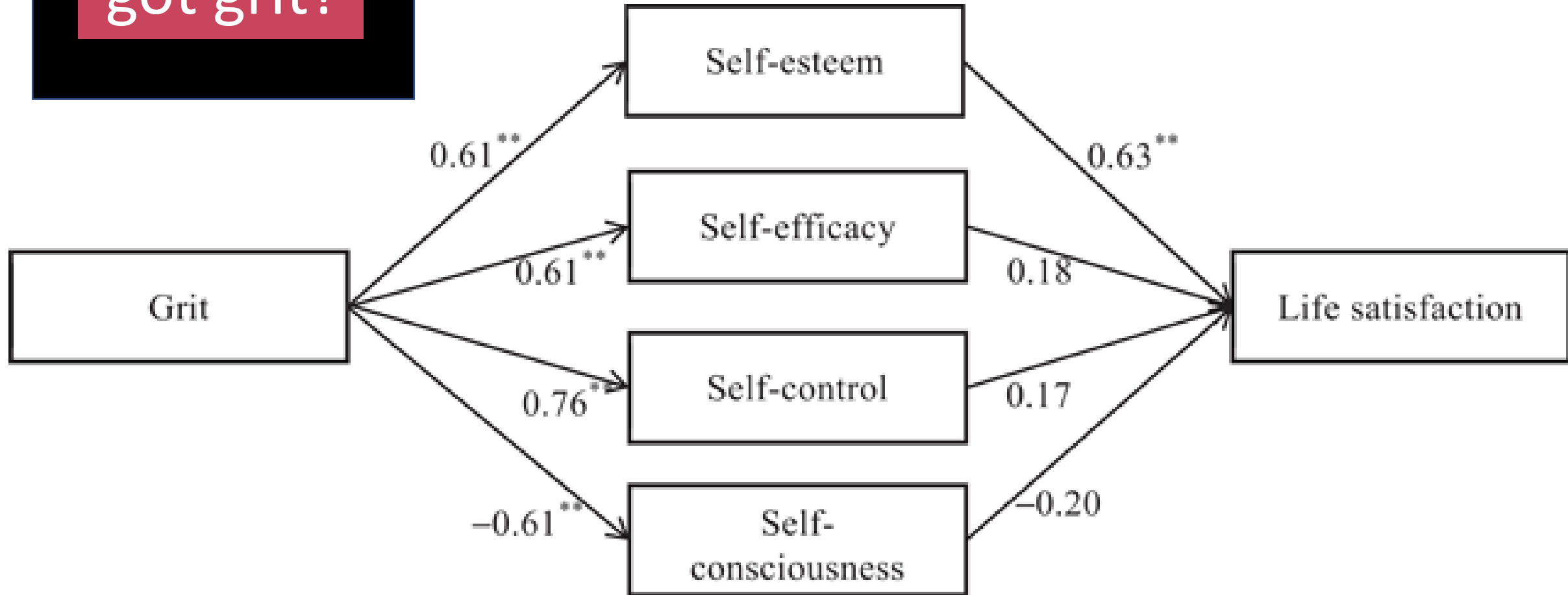
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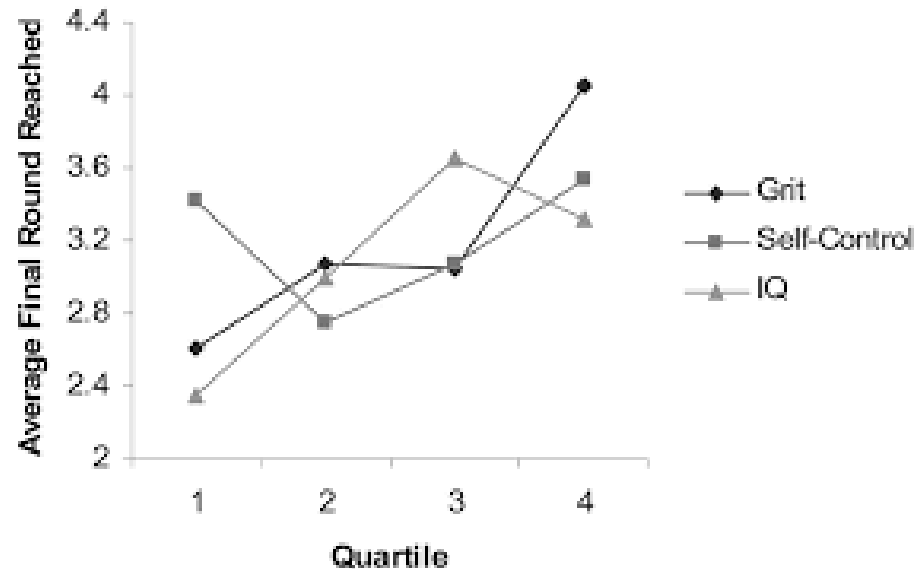
got grit?



G.R.I.T.  HELPLESSNESS

GRIT
GROWTH RESILIENCE INTENTION TENACITY

Educating Employees on their **Internal G.R.I.T.** helps with **Mental Health** and encourages **Resiliency Conversations**



Value of Understanding G.R.I.T.

- 1) Improves employee well being
- 2) Acceptance of failures & challenges
- 3) Boosts confidence
- 4) Improves culture

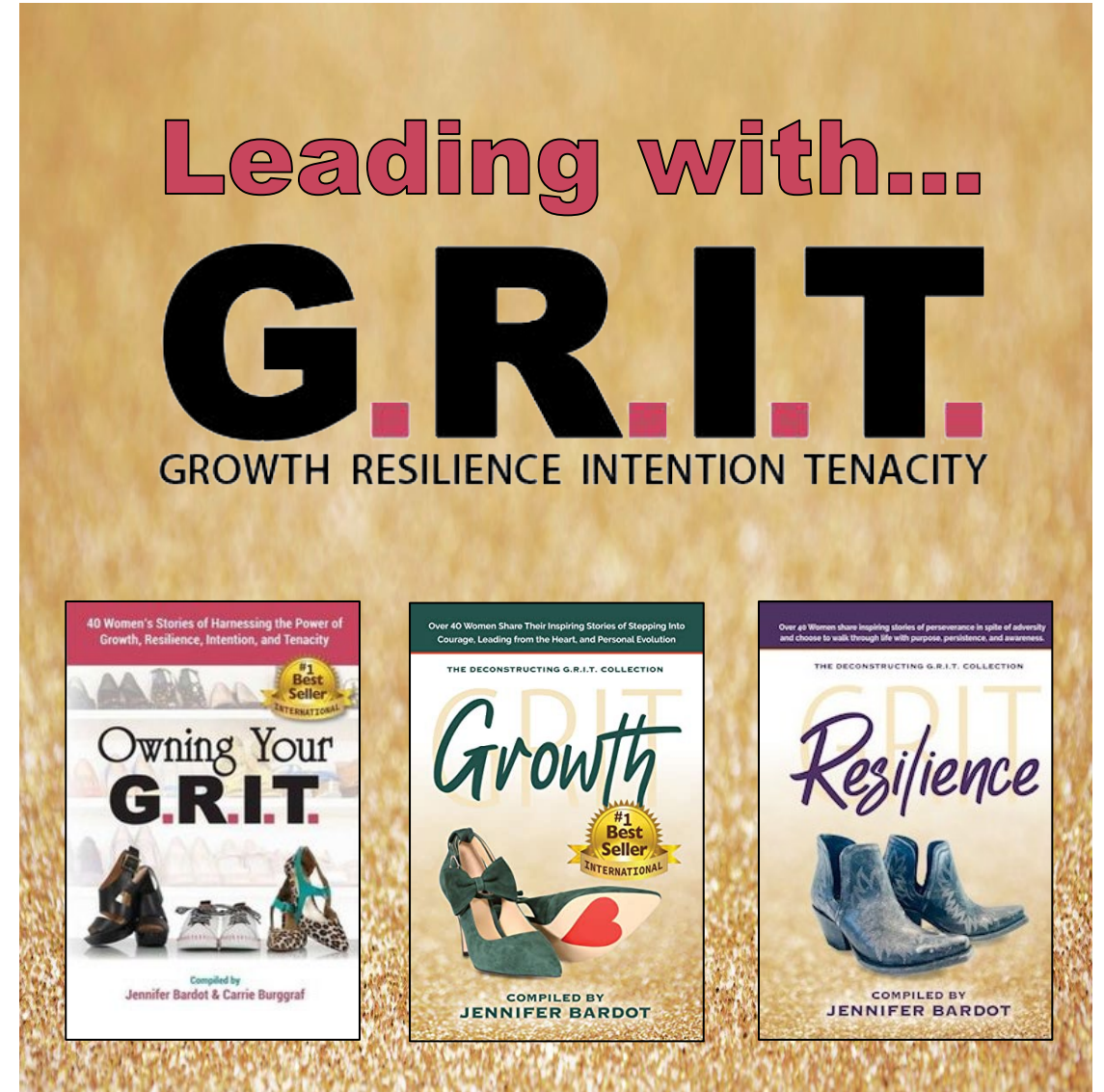
Develop a G.R.I.T. Culture as it will help with enhancing communication, wellbeing.

You can get started through a **LISTENING Program** to evaluate the resiliency of your employee culture. Through the surveys and scorecards, you can see the needs of your employees.

Why is LISTENING important? Preventing a resignation through hearing the needs to spark G.R.I.T. could make a difference within your organization!

Jennifer Bardot, MA, MS

International Best-Selling Author
Connector, Mentor,
Community Volunteer
Director of Health & Benefits, WTW



fixMOinterstates.com

Improving Missouri's Interstate System



**Missourians for
Transportation
Investment**

Who We Are

Transportation Construction Industry

- American Council of Engineering Companies of Missouri
- Associated General Contractors of Missouri
- Heavy Constructors Association of Greater Kansas City
- International Union of Operating Engineers
- Missouri Asphalt Pavement Association

Business Community

- Associated Industries of Missouri
- Greater Kansas City Chamber of Commerce
- Columbia Chamber of Commerce
- Springfield Chamber of Commerce
- Greater St. Charles County Chamber of Commerce
- Cape Girardeau Area Chamber of Commerce

Agriculture Industry

- Missouri Farm Bureau
- Missouri Corn Growers Association
- Missouri Soybean Association

Cities & Counties

- Missouri Municipal League
- Missouri Association of Counties



**Missourians for
Transportation
Investment**

Why We Exist

- Missourians for Transportation Investment (MFTI) promotes adequate and sustainable investment in, and improvement of, the transportation system for Missouri citizens.



**Missourians for
Transportation
Investment**

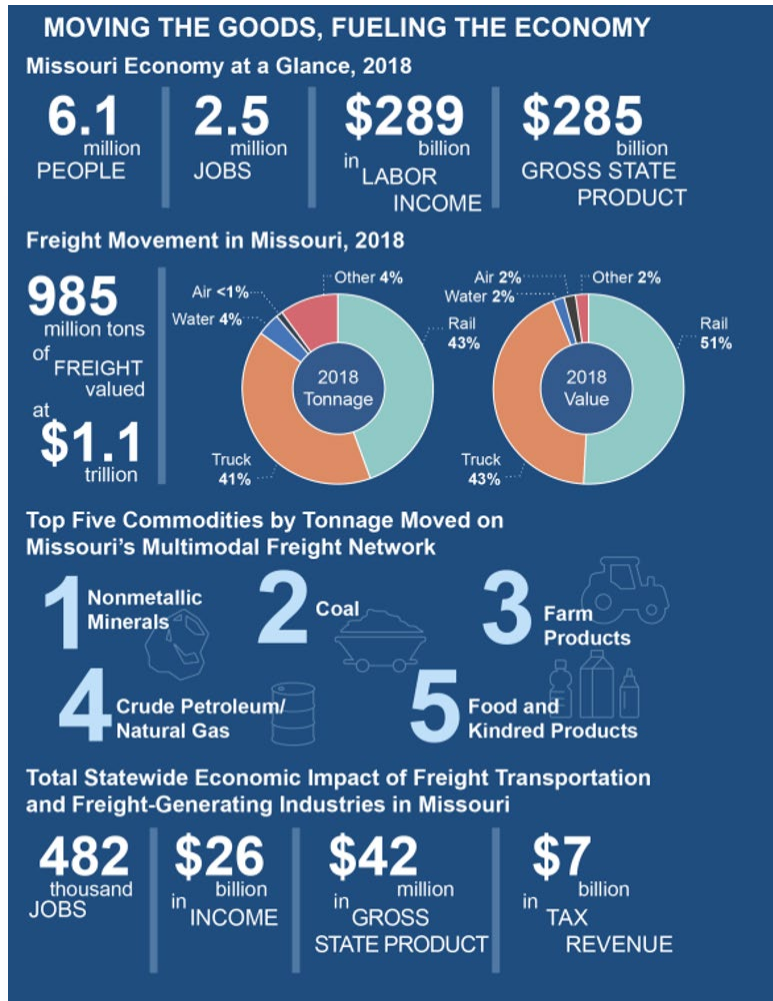
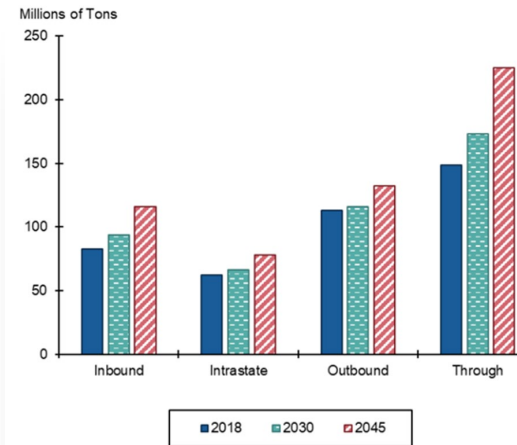


FIGURE 5. TRUCK FREIGHT TONNAGE BY DIRECTION, 2018-2045



The 400 lb. Gorilla

- Interstate 70 is Missouri's Main Street
- It's a tremendous economic asset.
- It's overcrowded.
- It's expensive!



**Missourians for
Transportation
Investment**

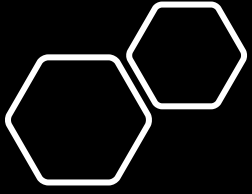
Why Not Use...

- IJA money?
- Motor fuel tax increase revenues?
- Amendment 3 bonds?



Missourians for Transportation Investment





So, how do we
fix it?

Record Surpluses



**Missourians for
Transportation
Investment**

What can we do?

Visit www.fixMOinterstates.com

As supporters, we believe...

During this time of record surpluses in federal and state revenues, Missouri should use some portion of those revenues to make significant investments in Missouri's interstates.



**Missourians for
Transportation
Investment**

What can we do?

Spread the word.

Interstate investments...

Protect	Missouri's place as the Crossroads of America.
Drive	economic activity.
Reduce	congestion.
Speed	product to market.
Free up	funding for other routes.
Fund	future investments.



What can we do?

Help us build a coalition.

Manufacturers	Trucking	Convenience Stores
Agriculture	Safety Groups	Cities & Counties
Local Chambers	Universities	Recreation & Tourism
Major League Sports Teams	Labor	Construction



What can we do?

Advocate.

Social media

Joint letters

Lobby days (January 18)

Email & phone campaigns

Talk to your legislators!

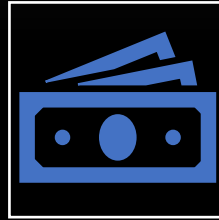


**Missourians for
Transportation
Investment**

January 18 Lobby Day



Email info@mfti.org
to register



No cost to attend



**Missourians for
Transportation
Investment**

Missouri Asphalt Pavement Association (MAPA) Endowed Professorship Update

By: Magdy Abdelrahman, Ph.D.
Missouri University of Science and Technology

2023 Annual MAPA Conference
January 11th, 2023

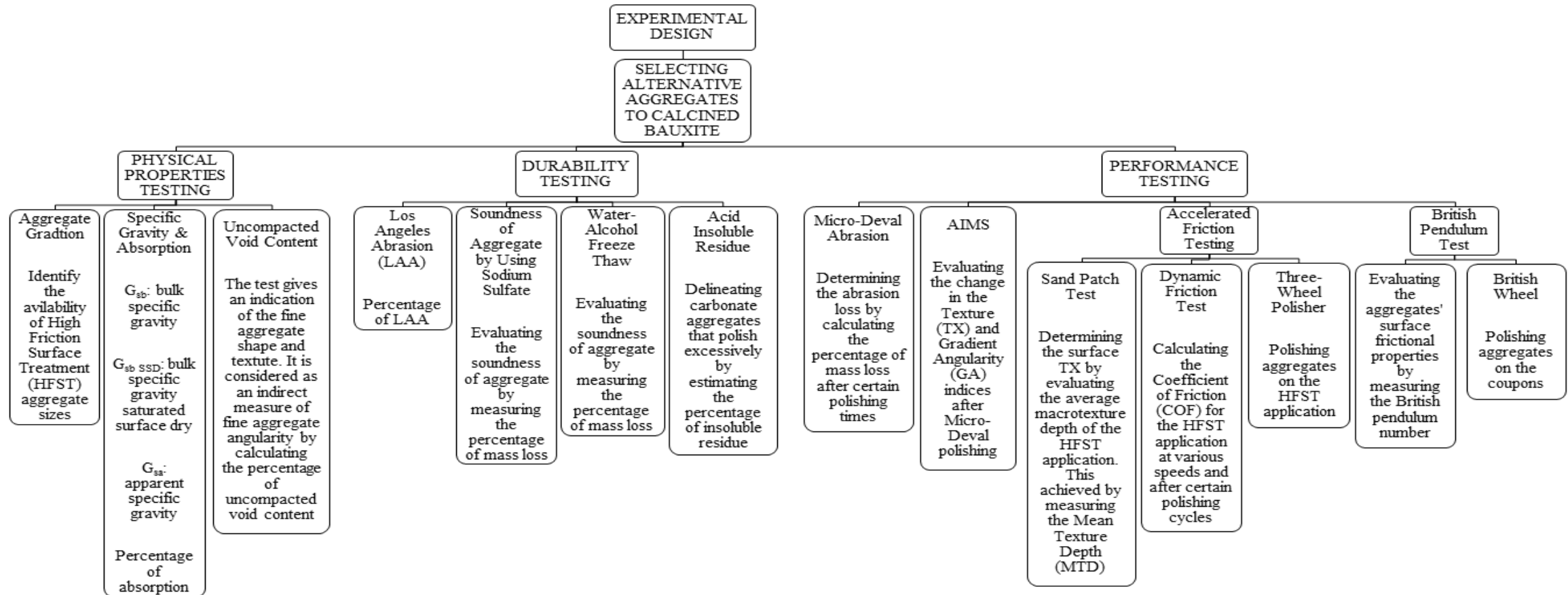
Missouri S&T Updates, Research

- Continuing
 - Evaluation of Recycled Components in Stone Matrix Asphalt Mixes. Led by the University of Missouri-Columbia, Professor W. Buttlar (MoDOT). Focus on Friction Properties (DFT)
 - Utilization of FTIR for Material Characterization and Forensic Analysis. Led by the University of Missouri-Columbia, Professor W. Buttlar (Illinois Tollway)
 - Friction Enhancements to Asphalt Pavement Surfaces. Missouri Department of Transportation, Project #00078213 (MoDOT). Focus on Alternative Binders
 - Support of CarbonCycle DoD STTR Phase-II “Furthering Circular Economy Potential of Waste-to-Value Process Through Product Development”

Missouri S&T Updates, Research₂

- New: CarbonCycle DoD STTR Phase-II “Furthering Circular Economy Potential of Waste-to-Value Process Through Product Development.” Use of Recycled Rejuvenators
- Crumb rubber optimization, adding rubber to the asphalt line to produce wet-process binder
 - Use of recycled oil, environmental concerns
- Friction Testing, [AASHTO - AASHTO Innovation Initiative - Dynamic Friction Testing with Three Wheel Polishing Device \(transportation.org\)](https://www.transportation.org/AASHTO/AASHTO-Innovation-Initiative-Dynamic-Friction-Testing-with-Three-Wheel-Polishing-Device)

Evaluation of Aggregate for use in High Friction Seal Coat (HFSC). (MoDOT)



Missouri S&T Updates, Lab Facilities*

- New asphalt testing “MAPA Asphalt Lab” Proposed, including:
 - Binder/rheology
 - Life-cycle analysis
 - Binder processing
 - Aggregate-asphalt interface
 - Update HMA testing equipment
- Asset and support for the new Missouri Center for Transportation Innovation (MCTI) *Additional 1600 ft²
- New added major equipment
 - Fourier-transform infrared spectroscopy (FTIR)
 - Dynamic Friction Tester (DFT)
 - Circular Texture Meter (CTM), Mean Texture Depth (MTD)
 - Three Wheel Polishing Device (TWPD)

CE5112 Bituminous Materials and Mixtures, Online, including Labs

Fall 2022

Properties, types, and grades of bituminous materials are presented. Emphasis is placed on usage, distress, and asphalt concrete mix properties, behavior, design, manufacture, and construction

Instruction Mode

- Classroom Based
- On-line Synchronous

Based on the NCAT Textbook

CE6123 Pavement Management, Evaluation and Rehabilitation

Spring 2023

Advanced knowledge of pavement performance; pavement evaluation; implementation of pavement management at network and project level; maintenance and rehabilitation strategies; life-cycle-cost analysis

Instruction Mode

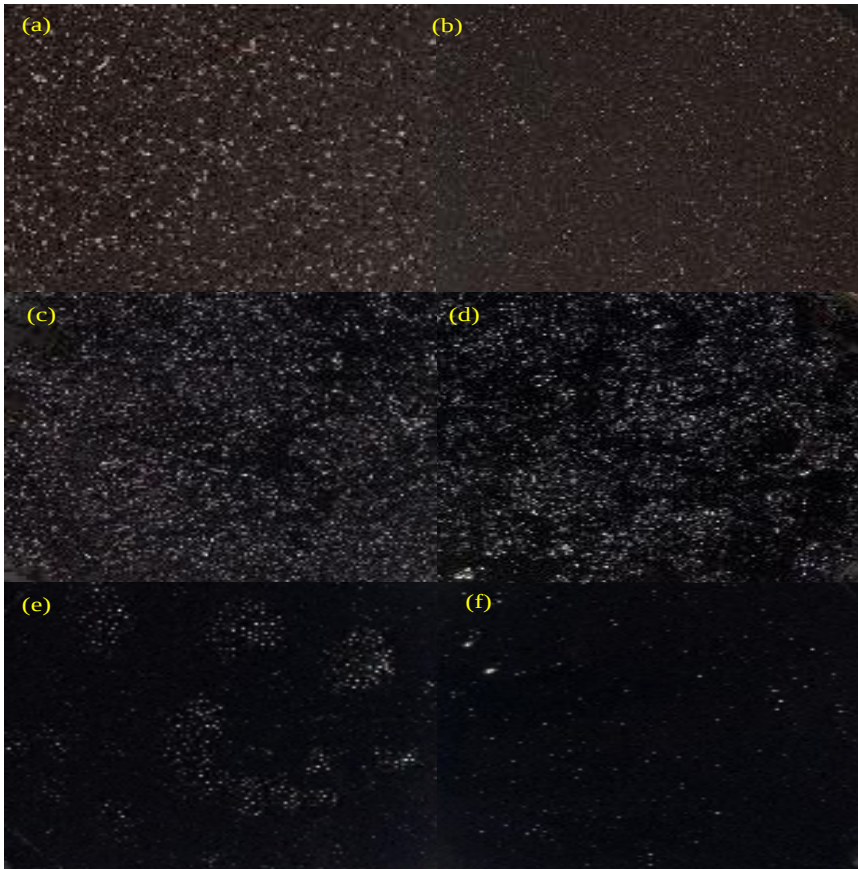
- Classroom Based
- On-line Synchronous

Based on the PAVER system and software (US Army Corps of Engineers)

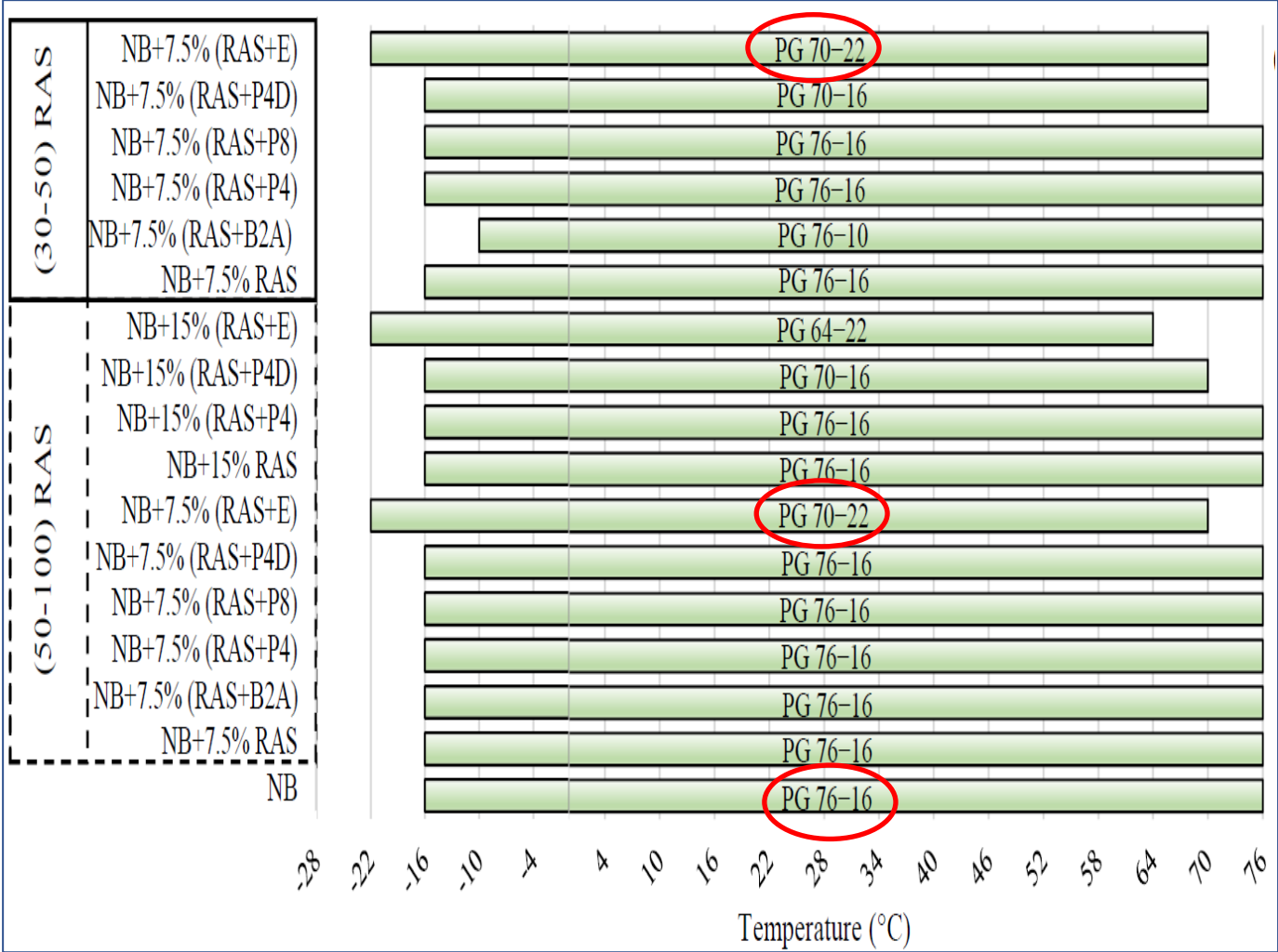
Internships and Scholarships in Flexible Pavement

- Thanks to MAPA; The NCAT text-book was provided to seniors and Graduate students enrolled in the Bituminous Materials Course
- MAPA Scholarship(s) to promote asphalt research/studying
- Organize events and connect S&T students with industry/government agencies to host internships
 - Thanks to MAPA; The NCAT text-book was provided to seniors and Graduate students enrolled in the Bituminous Materials Course
 - MAPA Scholarship(s) to promote asphalt research/studying
 - Organize events and connect S&T students with industry/government agencies to host internships

Recycled Asphalt Shingles (RAS) in Asphalt Binders Using Rejuvenators



Milled RAS with a size of (a) 30-50 and (b) 50-100, milled (c) 30-50 and (d) 50-100 RAS and rejuvenator before heating, and milled (e) 30-50 and (e) 50-100 RAS and rejuvenator after heating



Thanks to MAPA for Supporting my Work

Questions?

Contacts:

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Missouri Asphalt Pavement Association (MAPA) Endowed Professor

Civil, Architectural and Environmental Engineering

Missouri University of Science and Technology

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Rolla, MO 65409-0030

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m.abdelrahman@mst.edu



MoDOT Field Office Update

2023 ANNUAL ASPHALT CONFERENCE

***January 9-11, 2023
Columbia, MO***

A photograph of a multi-lane highway with several cars driving in both directions. The image is partially obscured by a yellow and grey curved graphic element at the bottom.

Implementing Performance Specifications

- Balanced Mix Design Performance Testing
- Paver Mounted Thermal Profiler
- Intelligent Compaction

Incorporating Balanced Mix Design Performance Tests into Specifications

CRACKING

CT-Index



DURABILITY

Tensile Strength Ratio (TSR)



RUTTING

Hamburg Wheel
Track Test (HWTT)



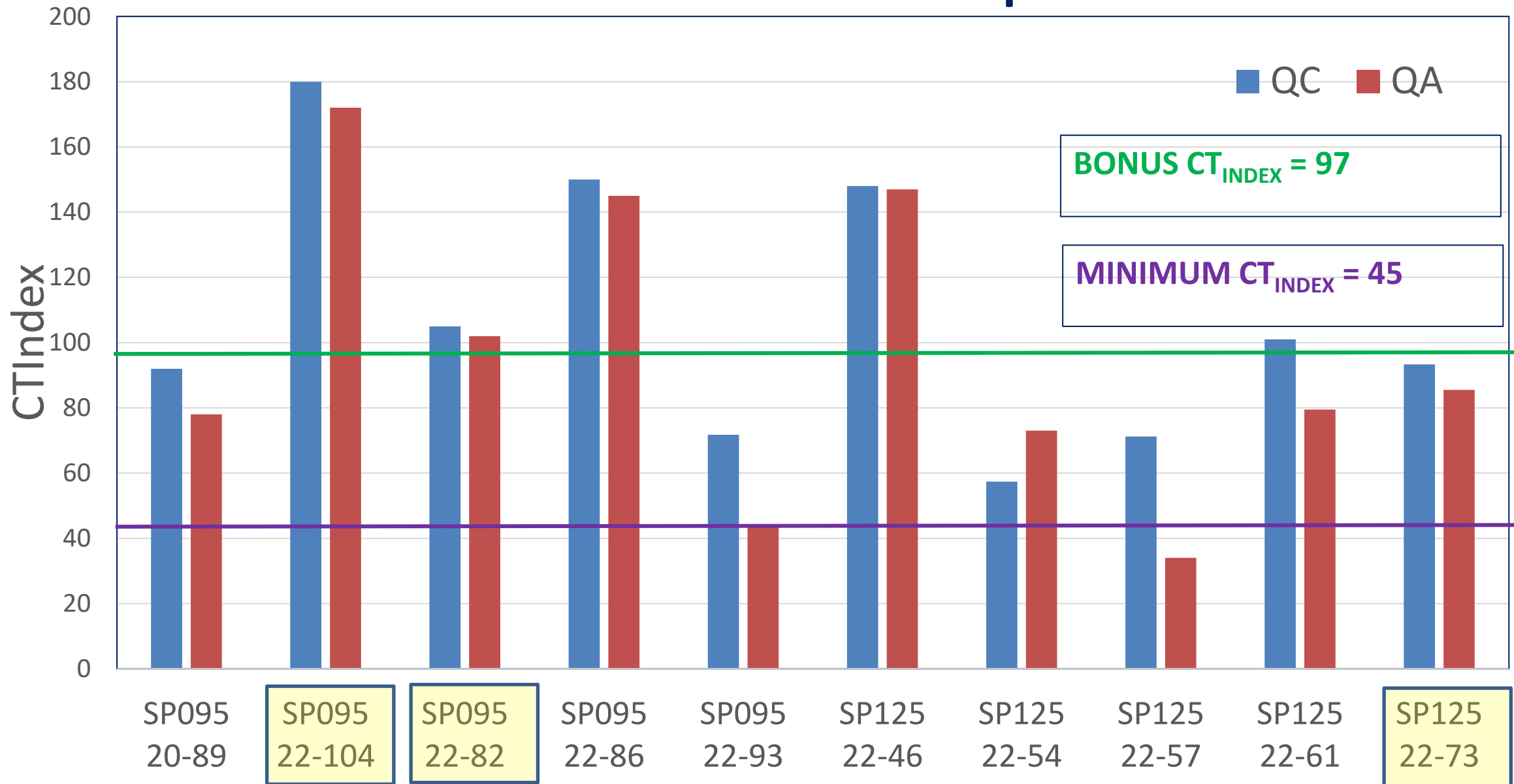
A wide-angle photograph of a multi-lane highway with many cars driving in both directions. The image is partially obscured by a yellow and grey decorative banner at the bottom.

WHY BMD Performance Testing?

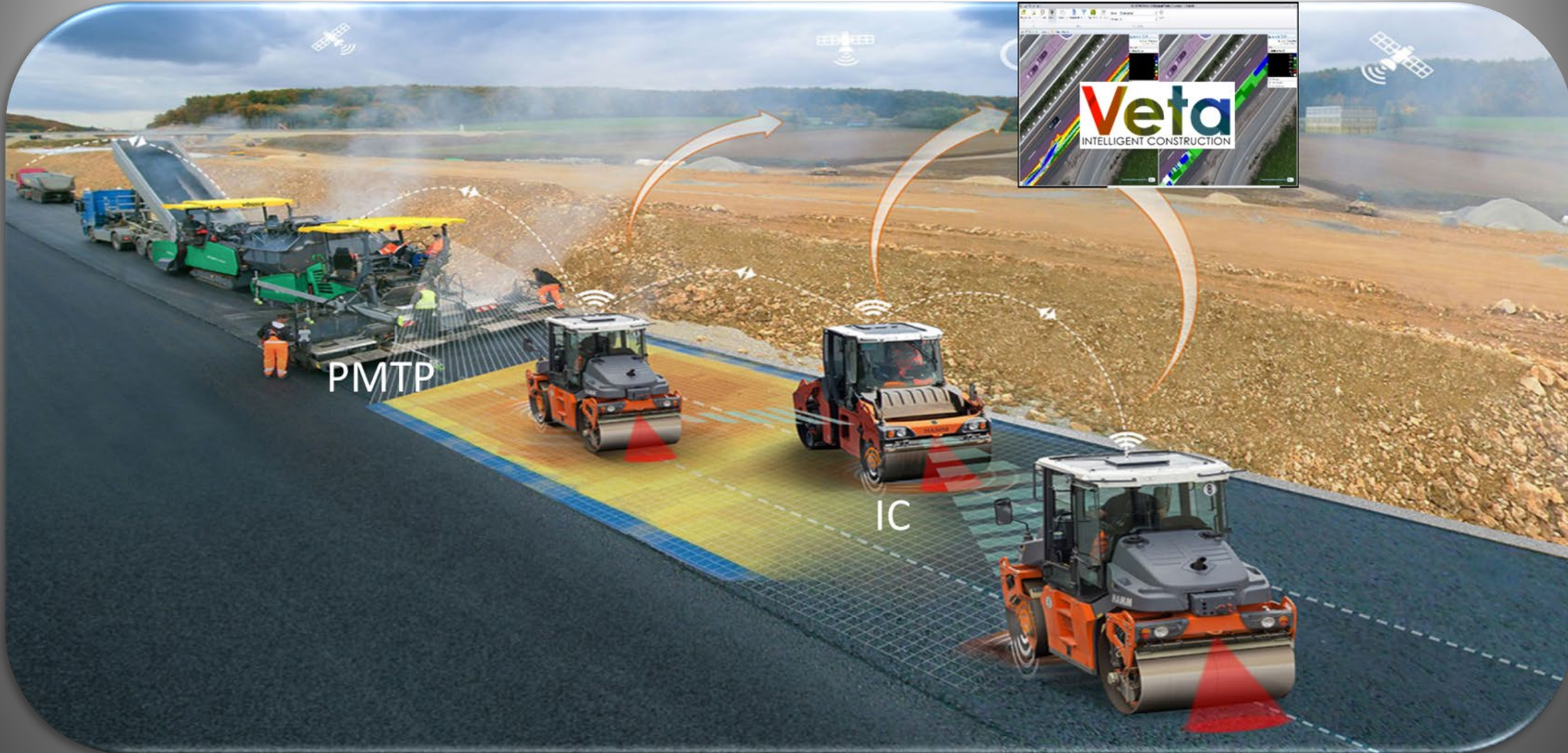


- Agency not creating specifications for mix components & additives
- Allows innovation and flexibility for contractors

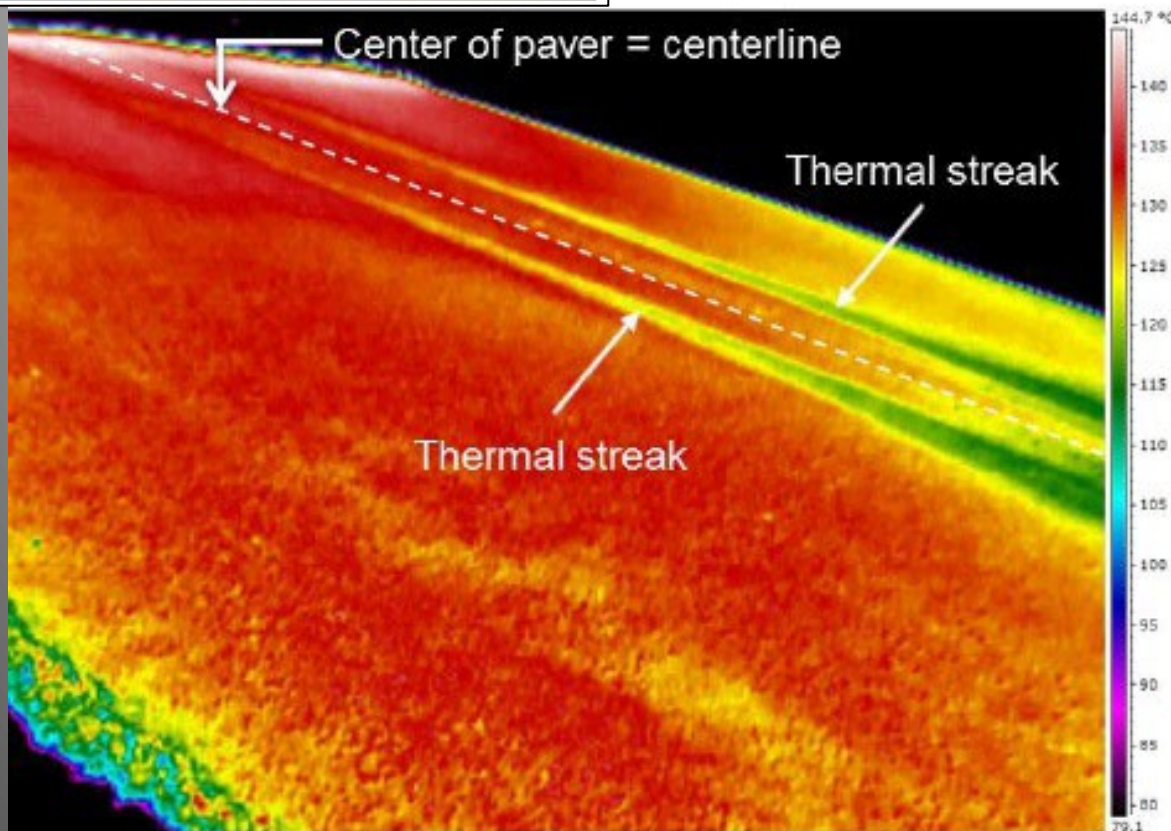
2022 CT-Index Test Results for SuperPave Mixes



PMTP and Intelligent Compaction



Why Paver Mounted Thermal Profiler?



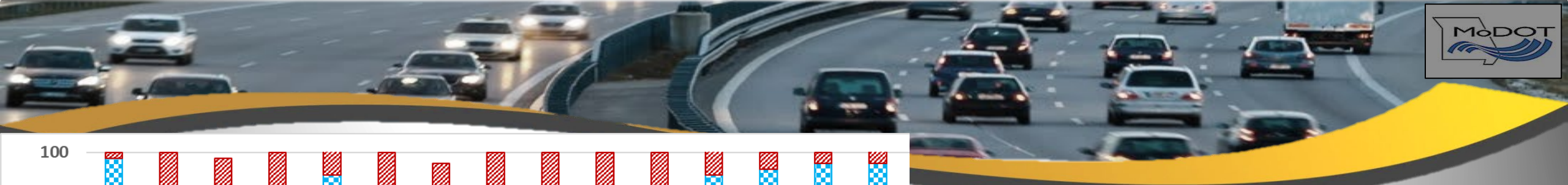
A wide-angle photograph of a multi-lane highway with many cars driving in both directions. The image is partially obscured by a yellow and grey curved graphic element at the bottom.

Why Paver Mounted Thermal Profiler?

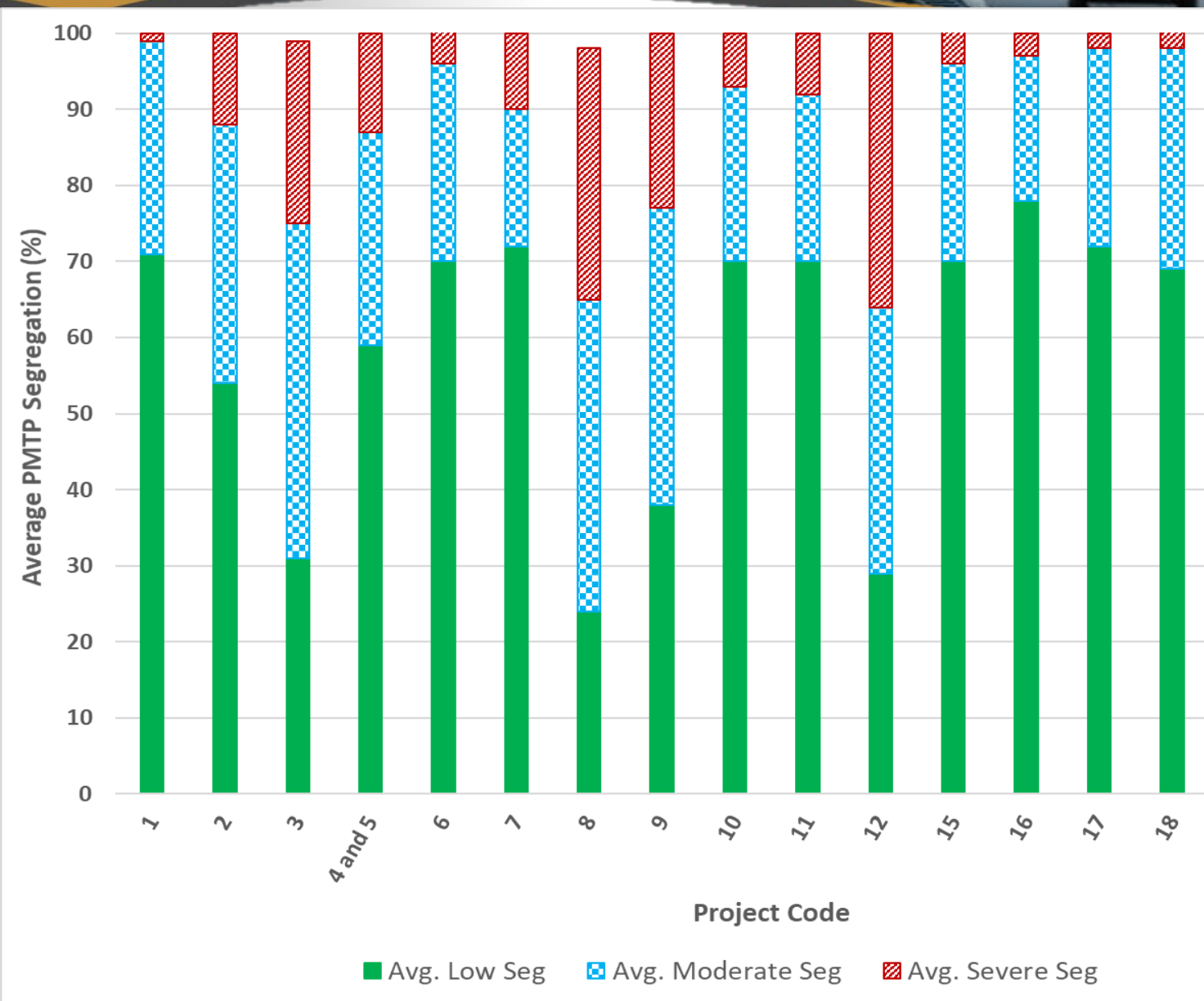


minous mixtures shall be in accordance with [Sec 404](#).

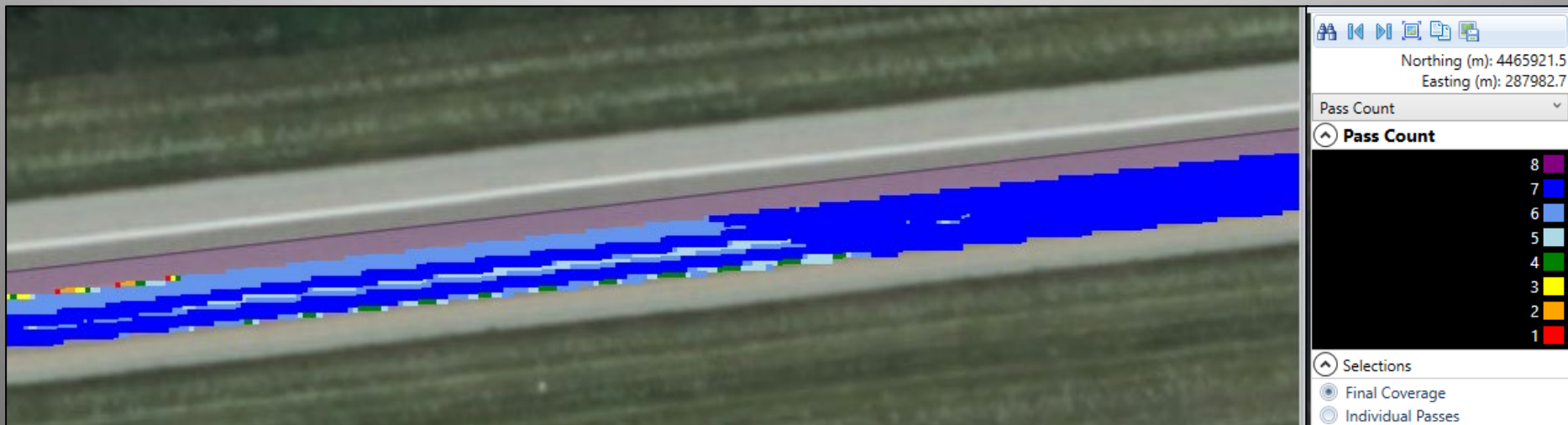
x shall have a cover of canvas or other suitable material
e cover shall be securely fastened over all sides of the
, such that the mixture will be delivered on the road at

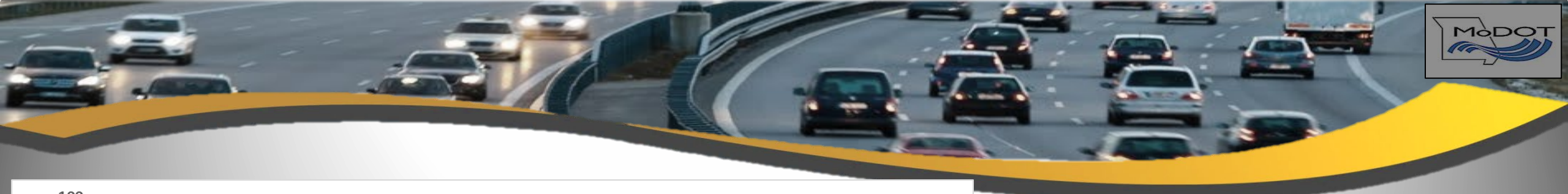


2022 Results Paver Mounted Thermal Profiler

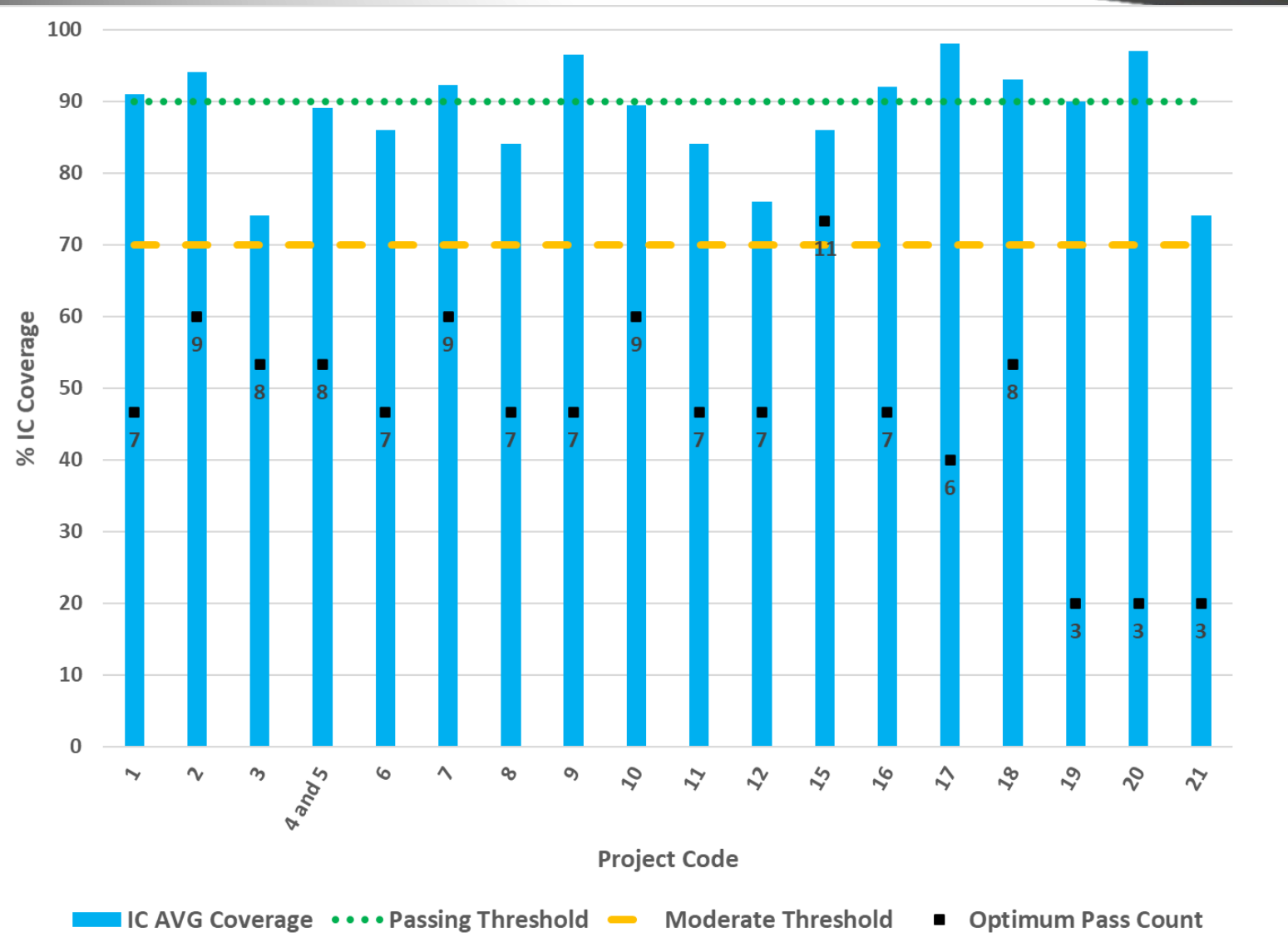


Why Intelligent Compaction?





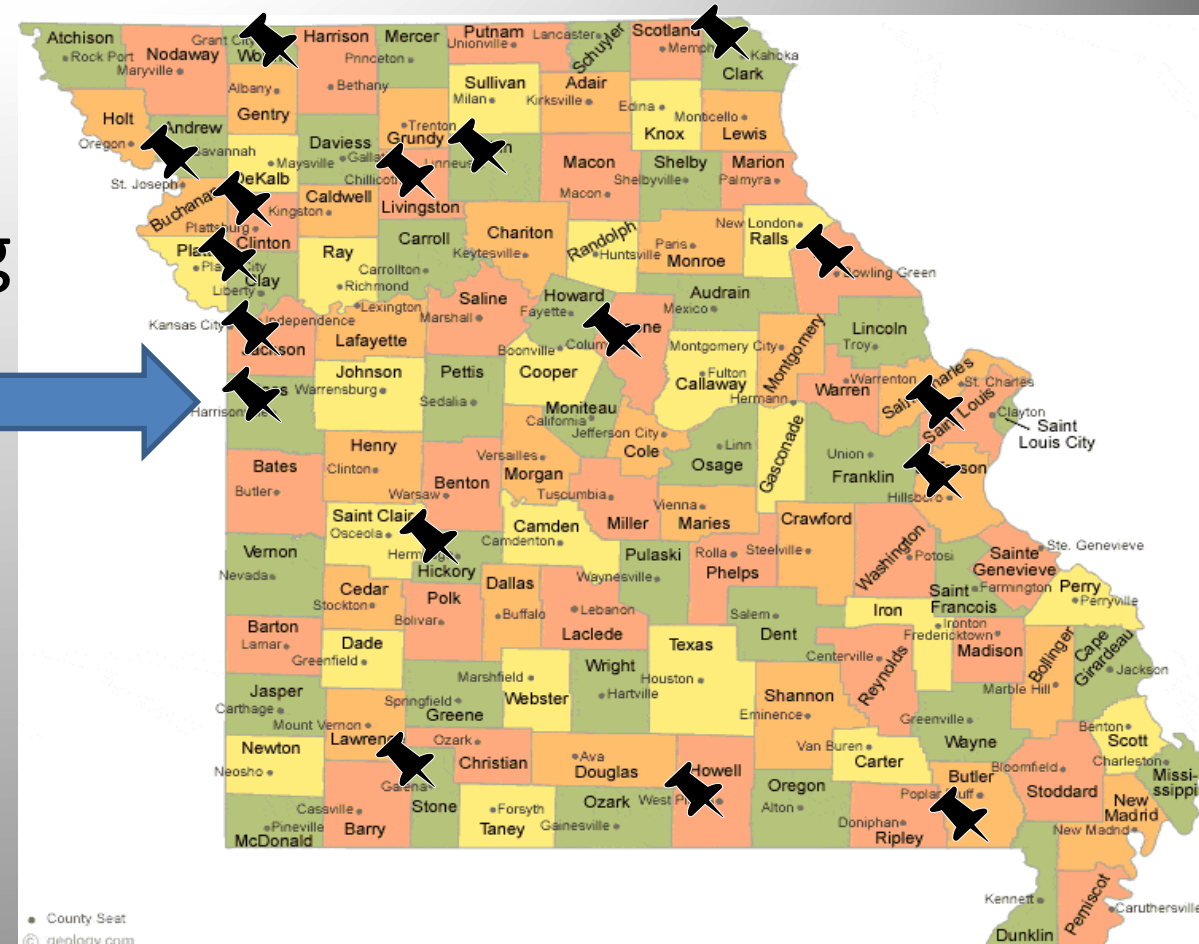
2022 Results Intelligent Compaction

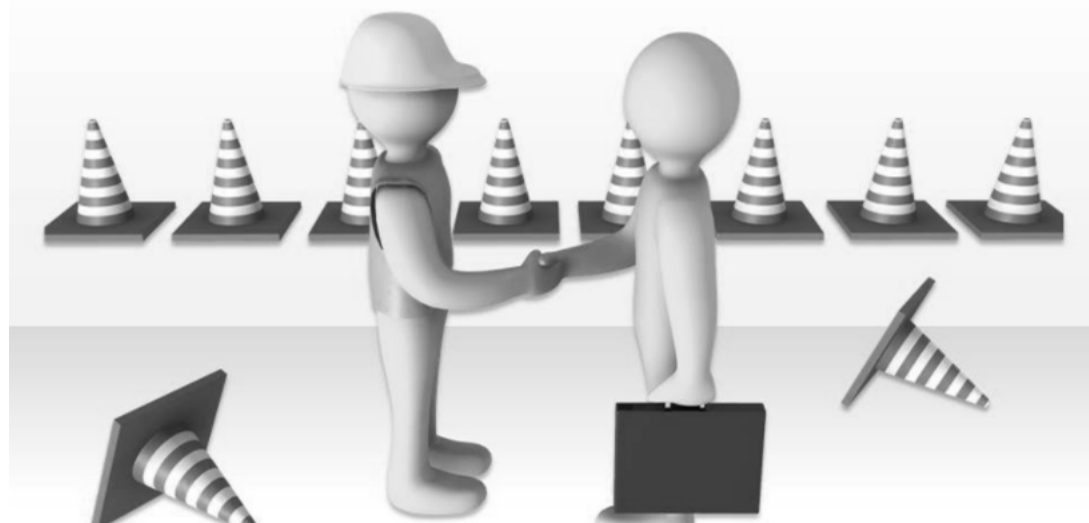


34 BMD Construction Projects in 2023

- 15 BMD with QC/QA
- 19 Projects JMF & Reporting
- 18 PMTP/IC

[Intelligent Compaction - Home \(mo.gov\)](https://www.mo.gov)





Industry/Agency/ Academia Partnership

- MAPA Quarterly Meetings
- Bituminous Technical Team Meetings
- Smaller Focus Groups

Future Implementation Goals

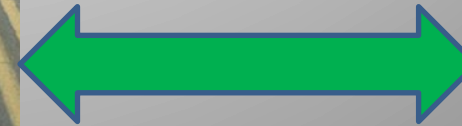
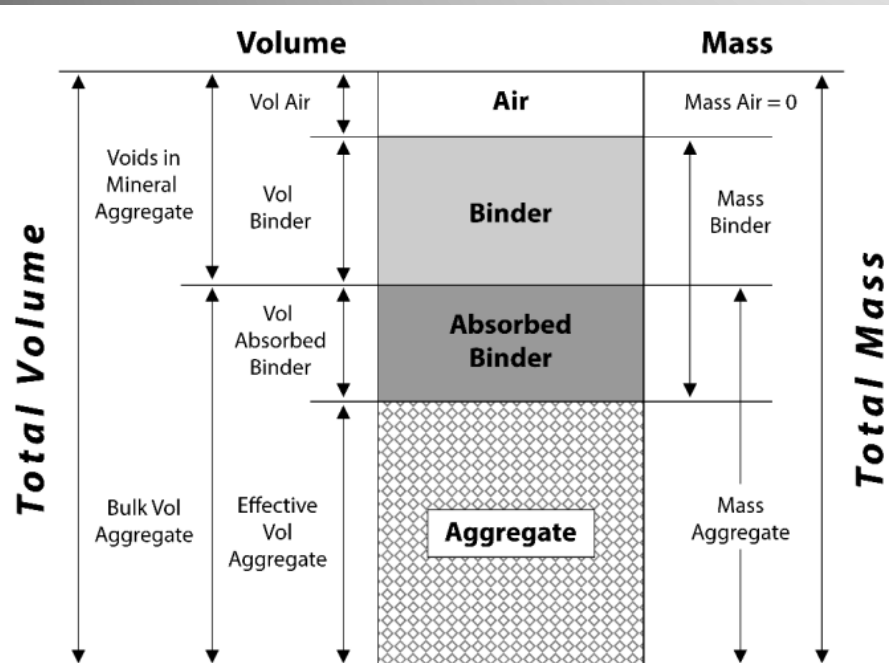
➤ Incorporating Performance tests into Specifications

Current Pay Factors

- ✓ AC Content
- ✓ Air Voids
- ✓ VMA
- ✓ Density

Performance Pay Factors

- ? CT-Index
- ? Hamburg
- ? Paver Mounted Profiler
- ? Intelligent Compaction





Continued Research

- Validation of BMD Performance Tests
- Validation of loose mix aging for BMD
- MnROAD Reflective Challenge
- MnROAD Intelligent Construction
- Improving Density of Asphalt Pavement
- Evaluation of Recycled Components in SMA mixes



Future Developments

Hamburg Wheel

Track Test (HWTT)

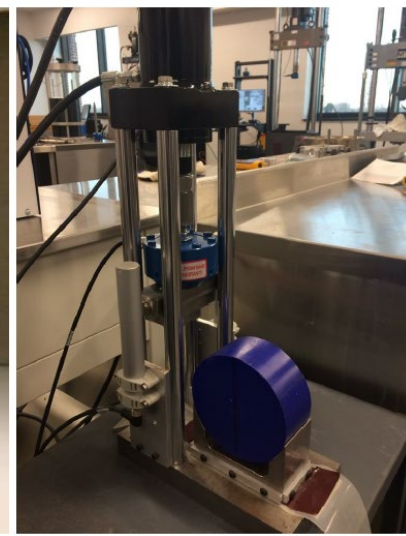
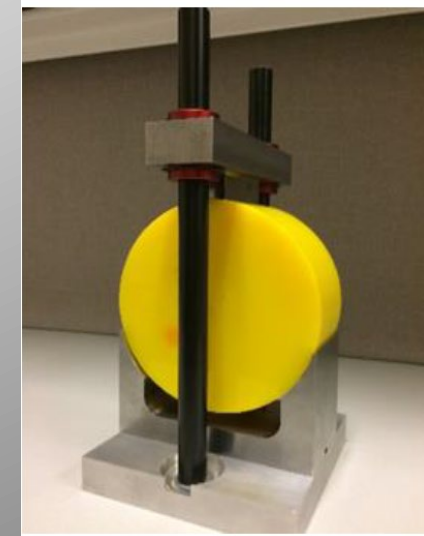


Field
Surrogate
Tests

HOT IDT



IDEAL - RT



**Looking into a BMD
specification for low
volume routes**

Future Developments

TSR Testing



Replacement Field Tests



Moisture Induced Stress Tester

Research underway on an improved stripping test for asphalt

2023 - 2024 Implementation Plan

- PMTP/Intelligent Compaction – Continuation of ~ 14 projects/yr
 - Recognize the need of on-site technical support and training.
 - Continue with annual IC/PMTP Trainings
 - Contractor's Back-To-Basics Spring Training – February 22-23, 2023
 - Contractor's IC/PMTP 101 Training – March 8, 2023
 - MoDOT IC/PMTP 101 Training – February 21, 2023



Internal MoDOT Issue

- HMA Lift Thickness need to be 4 X Nominal Max Aggregate Size

SUPERPAVE MIX TYPES	NOMININAL MAX AGGREGATE SIZE	MINIMUM THICKNESS (4 X NMAS)
SP048	4.8 mm (3/16 in)	3/4 inch
SP095	9.5 mm (3/8 in)	1 ½ inch
SP125	12.5 mm (1/2 in)	2 inch
SP190	19.0 mm (3/4 in)	3 inch
SP250	25.0 mm (1 in)	4 inch

- Entire MoDOT Asset Management/STIP Program estimates 1.75" SP125 mix
 - Moving to 2" SP125 Mixes
 - OR 1.75" SP095 Mixes



Improving Quality of Longitudinal Joints

Immediate Action Ideas

- Notched Wedge
- Required 6" Joint Trimming of unconfined edge
- Void Reducing Asphalt Membrane (VRAM)

Future Benefits to Monitor

- Effects of Balanced Mix Design
- Using 4 x NMAS Lift Thicknesses

Land Disturbance

- Storm Water Pollution Prevention Plan (SWPPP) - Ensures the design and implementation of Best Management Practices (BMP's) to comply with the Missouri Water Quality Standards
 - MoDOT ROW Area + Contractor Borrow Areas $\geq$ 1 Acre – **(Contractor's Own Permit Needed)**
 - Deficiencies must be corrected ASAP – **(No Later than 7 Days)**
 - Two trained WPCM's assigned to each project **(Highly Recommended)**

[Land Disturbance | Missouri Department of Transportation \(modot.org\)](https://www.modot.org/land-disturbance)

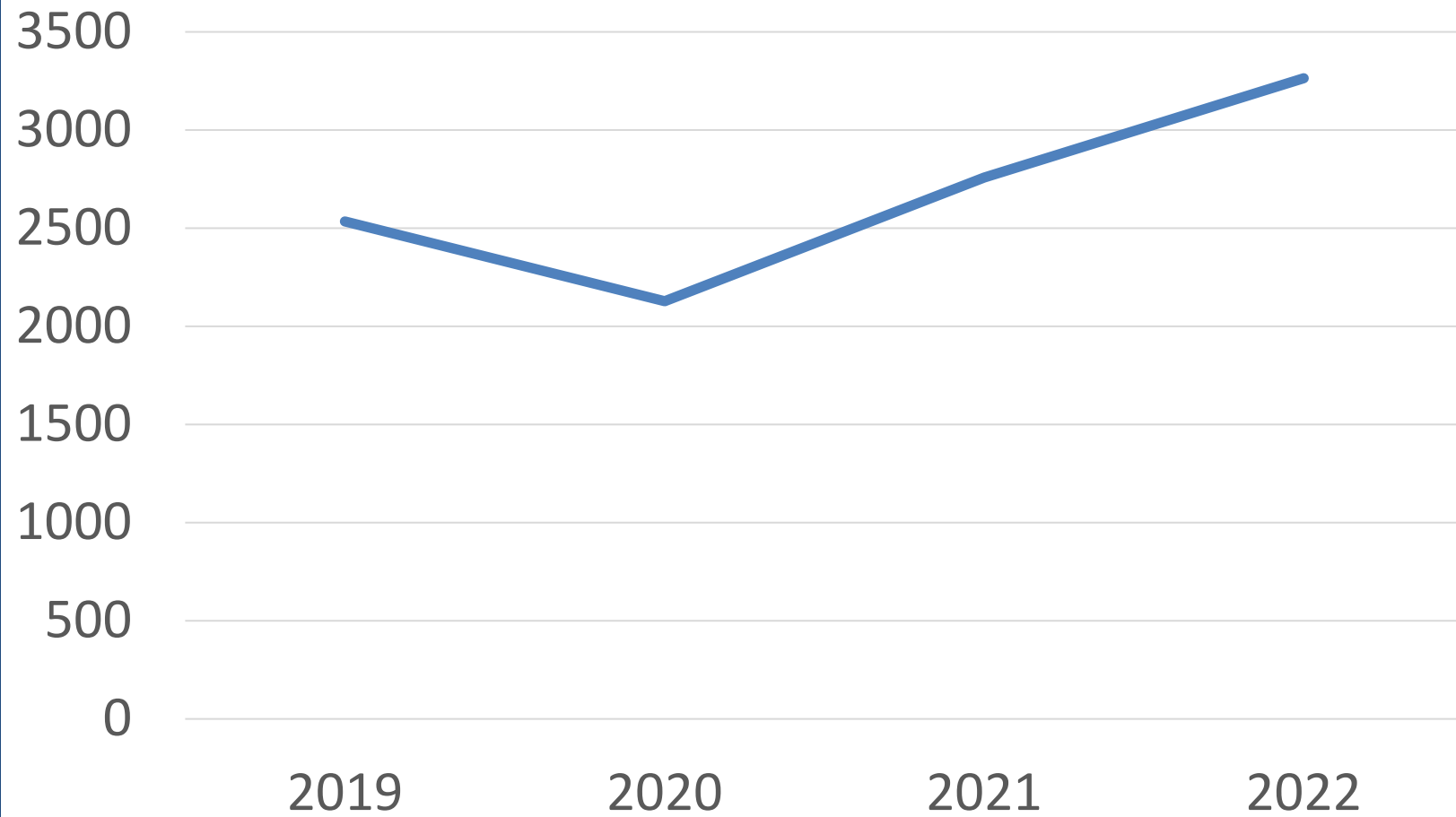
LAND DISTURBANCE FORMS AND INFORMATION

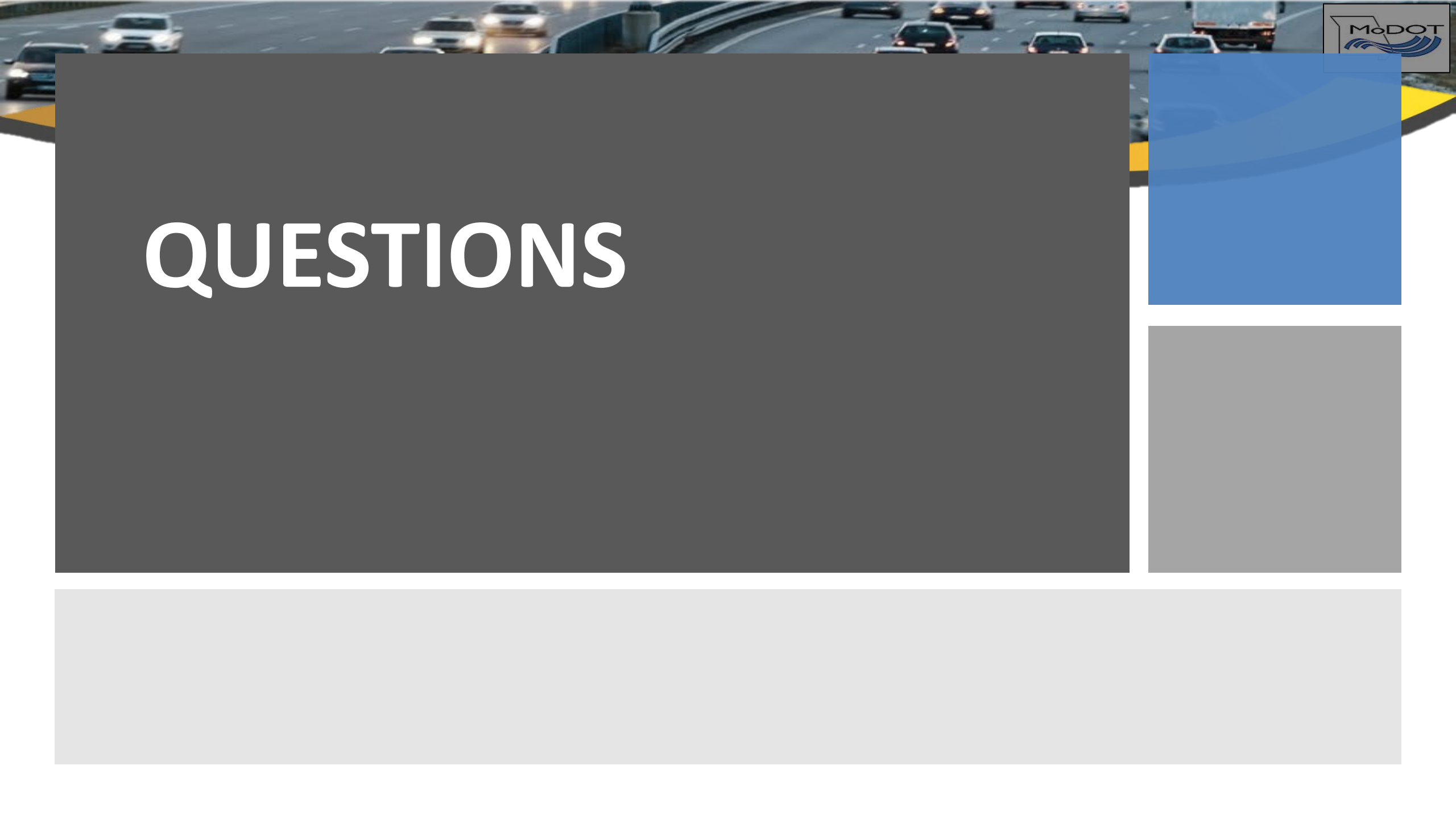
- [Project Specific SWPPP Form](#)
- [Permit Public Notification Sign](#)
- [Water Pollution Control Manager \(WPCM\) List](#)
- [N.O.A.A. Atlas 14 \(2-year, 24-Hour Storm Frequencies\)](#)

LAND DISTURBANCE RESOURCES

- [EPG Article 806.8- Storm Water Pollution Prevention Plan \(SWPPP\)](#)
- [MoDOT Statewide Operating Permit](#)
- [Missouri DNR - ePermitting for Land Disturbance Permits](#)
- [Missouri DNR – Stormwater Land Disturbance Permit Information](#)
- [EPA – SWPPP Guidance](#)
- [EPA – Construction BMP Guidance](#)

Work Zone Crashes



The background of the slide is a photograph of a multi-lane highway with several cars driving. A large, dark gray rectangular box is overlaid on the left side of the image, and a blue rectangular box is overlaid on the right side. At the bottom of the slide, there is a wide, light gray horizontal bar.

QUESTIONS