Advanced Construction Robotics

Company Analysis

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Team I
Carnegie Mellon University

Advanced Construction ROBOTICS

Robotic Automation: Autonomous robots that streamline construction processes, boosting productivity and reducing labor shortages

Enhanced Safety: Automation of hazardous tasks, significantly improving worker safety and reducing risks on-site

Innovative Technology: Designed to reduce delays, prevent cost overruns, and enhance accuracy and reliability in construction operations

Founders and Leadership Team

Stephen Muck
Co-founder &
Executive Chairman

- MBA at Penn State University
- Over 30 years leadership experience in construction innovation and management
- Founder and former CEO of Brayman Construction, a leading infrastructure firm

Analysis: Strong visionary providing strategic direction and industry leadership

Danielle Proctor
President & CEO

- BS in Industrial Management at CMU
- Over 25 years of experience in construction, technology, and product development
- Founded and operated DBE structural steel construction company
- Proven leader with expertise in scaling tech-driven businesses

Analysis: Ideal for operational leadership and accelerating company growth

Jeremy Searock
Co-founder, Former
President & Former CTO

- MS in Robotics at CMU
- Expertise in robotics, automation, and construction technology
- Crucial role in development and deployment of ACR's robotic systems
- Left ACR in early 2023

Analysis: Key technical expert driving innovation and technology development at ACR

Management Team

Patrick Weber
Vice President

- **BS in Computer Engineering at Penn State University**
- **Joined ACR in 2017, oversee engineering and intellectual property management**
- **Extensive expertise in construction robotics systems and product engineering**

Analysis: Critical for driving product development, protecting IP assets, and overseeing engineering operations at ACR

Edward Buddy Baca
Director of Operations

- **Associate's degree at Pittsburgh Institute of Aeronautics**
- **Extensive experience in operations management and robotics deployment**
- **Oversees robot fleet operations, facilities management, and production**

Analysis: Essential leader in operational efficiency, fleet management, and ensuring smooth deployment of ACR's robotic solutions

ACR Engineering Team Robotic Experience

90+ Autonomous & Semi-Autonomous Projects

Self-Driving Car
(1st Ever)

Advanced Military Robots

Agricultural Robots

Self-Driving UAV/UGV Team

Mining Robots

Self-guided Naval Vessel

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ADVANCED Construction ROBOTICS

Carnegie Mellon University

Ministry of Defence

Australian Government
Department of Defence

New Zealand
MINISTRY OF DEFENCE
Manatū Kaupapa Waonga

Funders and Partners

100% privately funded

$40M

Supporting efforts:

GROUSE RIDGE CAPITAL, LLC

Grouse Ridge Capital: Private equity and VC firm founded by Stephen Muck

HOLCIM

Holcim Accelerator

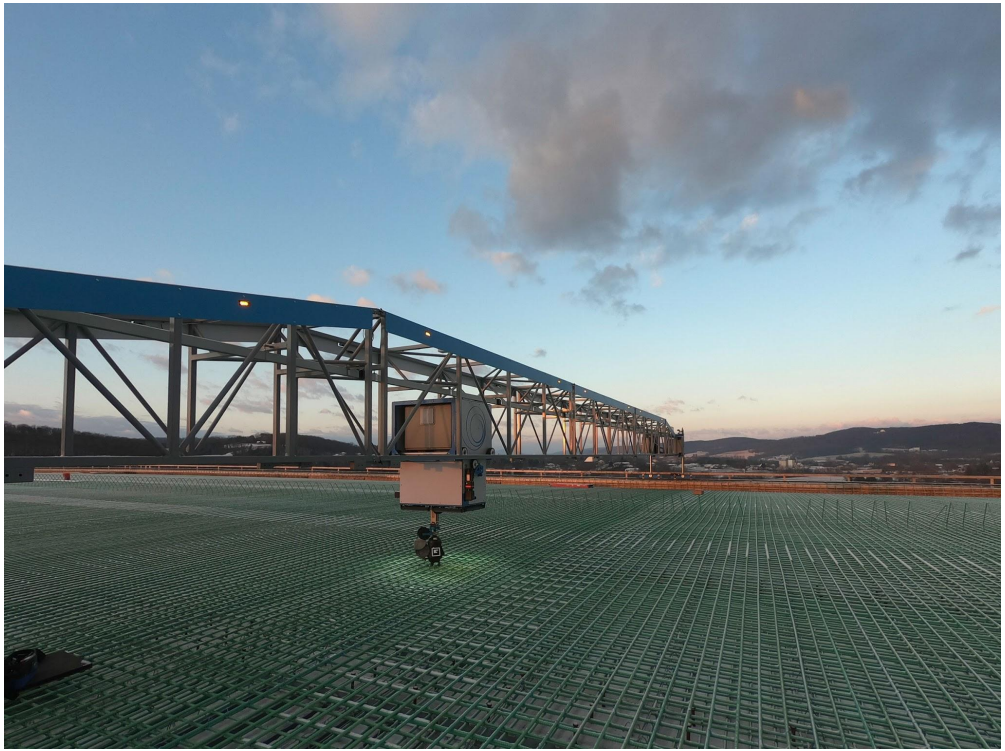
Partner:

NUCOR® REBAR FABRICATION

Integrate TyBot with its crew for rebar installation projects [Source]

Technology

Technology Solutions



TyBOT (Autonomous Rebar Tying Robot)

- Self-locates, self-positions, and ties rebar without pre-mapping or programming
- Ties **1,200+** rebar intersections per hour
- Used in **40+** major infrastructure projects, including large bridges
- **25%** Minimum Schedule / MH Savings
- [Source]

Technology Solutions

IronBOT (Autonomous Rebar Placing Robot)

- Lifts, carries, and self-places horizontal and longitudinal rebar, without pre-mapping or programming
- Can place **5,000+** lbs of rebar per hour
- Works alongside TyBOT for end-to-end rebar installation automation
- **35%** Minimum Man-Hour Savings
- [Source]

TyBOT® REBAR TYING ROBOT + IronBOT® REBAR PLACING ROBOT

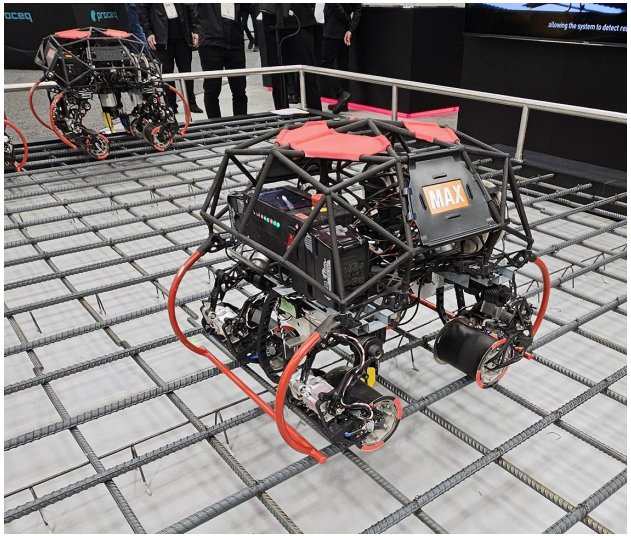
50% Minimum Man-Hour Savings When Working Together

Competitive Landscape

Feature	Advanced Construction Robotics (ACR)	Toggle Robotics	Built Robotics	Construction Robotics
Key Technology	Autonomous rebar tying & placement	Automated rebar fabrication	Autonomous excavation & pile driving	Semi-automated masonry system
Main Product(s)	TyBOT (Rebar-tying) & IronBOT (Rebar placement)	Robotic rebar fabrication system	Exosystem (Retrofit kit for excavators), RPD 35 (Autonomous pile driver)	SAM (Semi-automated mason)
Use Cases	Bridge & infrastructure rebar work	Prefabricated reinforced structures	Excavation, earthmoving, solar piling	Bricklaying for buildings

Has no direct competition (right now), except manual labor

Emerging Competitors



Autonomous Rebar Tying Robot by MAX

TOMOROBO by Ken Robotech

- Offer solutions supporting simultaneous multi-robot deployment – enhance speed and efficiency
- May challenge ACR's market position by offering comparable or superior productivity, speed, and operational flexibility

Intellectual Property and Competitive Advantage

What is Protectable?

- Semi-autonomous system for carrying and placing elongate objects (Patent No: 10597264, 2020)
- Autonomous apparatus and system for repetitive tasks in construction (Patent No: 10061323, 2018)
- Autonomous system for repetitive construction tasks (Publication No: 20180181134, 2018)

Trade Secrets (Proprietary Tech): Computer Vision algorithms, Motion Planning, Autonomy, Custom Hardware-Software Integration

Does the "Secret Sauce" Matter?

ACR's core tech is its biggest advantage!

★ Fully autonomous vs. manual & semi-automated competitors
★ No pre-mapping = faster deployment & setup
★ Cuts labor costs & improves safety
★ Expands beyond rebar to other automation areas
★ Stephen Muck's valuable connections and domain expertise

Patents + Trade Secrets = ACR's market dominance!

Markets

Market Analysis

- Market addressed is **autonomous rebar tying manual labor** in the **North American market**.
- For the entire rebar tying labor market, there is an estimated 17,400 laborers earning a mean annual income of $60,290. This equates to approximately **$1 billion dollars** of labor cost per year [1].
- Currently, automated methods only account for less than 1.5% of total labor cost, or approximately **$13 million dollars** [2].
- However, it is expected to **grow by 21.8%** compounded annually (CAGR) to an **$51 million dollar** industry by 2031 [3].

Market Size: ACR Estimate

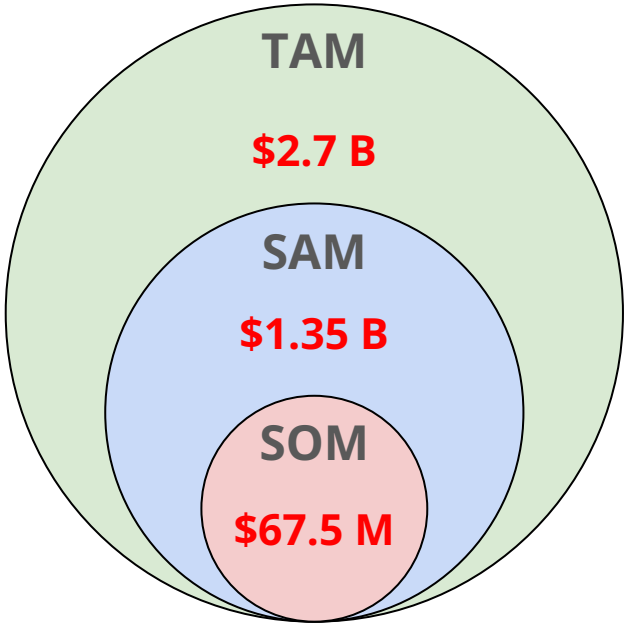
From material provided by ACR, they estimate their Domestic Total Addressable Market to be $117 B. However, we think this is misleading and unrealistic since they also incorporate the cost of all structural labor costs, which is outside their market segment of tying rebars.

Market Size: Key Assumptions

- North American rebar tying labour market size is static over next 5 years [1, 2].
- Domestically consumed rebar tools market is static at about $1.7 billion dollars [3].
- ACR is not considering expanding globally, so only considering North American market (claim from interview).
- TyBot and IronBot reduces manual workload by 50% (claim on website) [4].

Market Size: By 2031

- **Total Addressable Market (TAM):**
  - Rebar labor market ($1b) + tools market ($1.7b)
  - Total: **$2.7 Billion**
- **Serviceable Available Market (SAM):**
  - TyBot and IronBot causes manual labor and tool redundancy of 50%.
  - Total: **$1.35 Billion**
- **Serviceable Obtainable Market (SOM):**
  - Current automation adoption rate is 1.5%. At 21.8% CAGR rate the adoption rate rises to around 5% by 2031.
  - Total: **$67.5 Million**



What is Attractive to VCs (Micro)

- **Founder Track Record:** Founder (Stephen Muck) is a seasoned veteran in the construction industry. He is currently CEO at three other companies in the construction industry [1].
- **Product Validation:** Company is revenue positive. With more than 65 completed projects to date and counting [2].
- **Location-Product Match:** Pittsburgh is called the “City of Bridges” with over 446 bridges – many of them built over 70 years ago and need servicing. Company is headquartered in Pittsburgh with main product (TyBot) focusing on bridge rebar tying – a perfect match for its intended market.
- **Strong IP Portfolio:** Aggressive “IP moat” strategy, with 3 approved patents, 8 pending patents, and 4 trademarks to date [3, 4].
- **Product Differentiator:** Key product TyBot also has a companion IronBot that tags along and stores rebars. Currently only product in market that has storage feature.

What is Attractive to VCs (Macro)

- **Barrier to Entry:** Niche market with high robotic R&D costs means significant barriers for new entrants.
- **Construction Labor Shortage:** The number of rebar workers fell by 6.8% since 2020 to 17,400 workers in 2023 indicates the well-known labor shortage in the construction industry. ACR's products is uniquely positioned to fill-in this shortage [1, 2, 3].
- **Growth Potential:** Market for automated rebar tying robots is estimated to be $13 million USD in 2024. It is expected to grow by 21.8% compounded annually (CAGR) to $51 million USD by 2031 [4].

What is Not Attractive to VCs (Micro)

- **Negative Earnings:** The company has not posted a profit since inception, and is relying on contributed equity for working capital. Potential bad signal of being unprofitable.
- **Co-Founder Left:** Co-founder Jeremy Searock left the company in 2023, and ACR's websites removed mentions of him. Potential bad signal of being "forced out".
- **Founder "Too Seasoned":** Founder (Stephen Muck) has over 30 years of experience in this industry. May be "too seasoned" and dominate the company's decision making, leaving the VCs as a captive audience.

What is Not Attractive to VCs (Macro)

- **Niche Market:** Rebar tying (especially for bridges) has a small total addressable market. Not the “billion dollar unicorn” VCs are looking for.
- **Long Development Cycles:** Construction robotics products generally tend to have long development cycles. TyBot took over 3 years to develop, and IronBot took an additional 2 more years [1]. May not fit into the 7-10 year return cycle of typical VC funds.
- **Lack of Diversified Revenue Strategy:** Currently only substantial revenue streams is equipment sales and rental (RaaS) of two products (TyBot and IronBot). Do not have any other revenue generating products to diversify.

Position in Market

- Advanced Construction Robotics is a **market leader** in the autonomous rebar tying market, and is a **disruptive force** in the wider rebar tying market.
- The company is **one out of three** major players in the autonomous rebar tying robot market (its major competitors being MAX robotics and Tomorobo).
- However, for industrial-scale rebar tying, ACR currently enjoys **monopoly status** (MAX robotics and Tomorobo are small robots weighing less than 200 kilograms).
- To maintain its position in the market, ACR employs **aggressive IP protection strategies** and uses an “IP moat”.
- ACR’s **first-mover advantage** and technology protection strategies gives the company a **competitive advantage** over newcomers to the industry.
- It is expected that ACR will **maintain its market leader** status over the coming years.

Barriers to Entry

- Niche market
- Industry has economies of scale
- Long R&D lead times
- Technological challenge due to significant IP moats
- Hard to get VC funding

Positive Factors

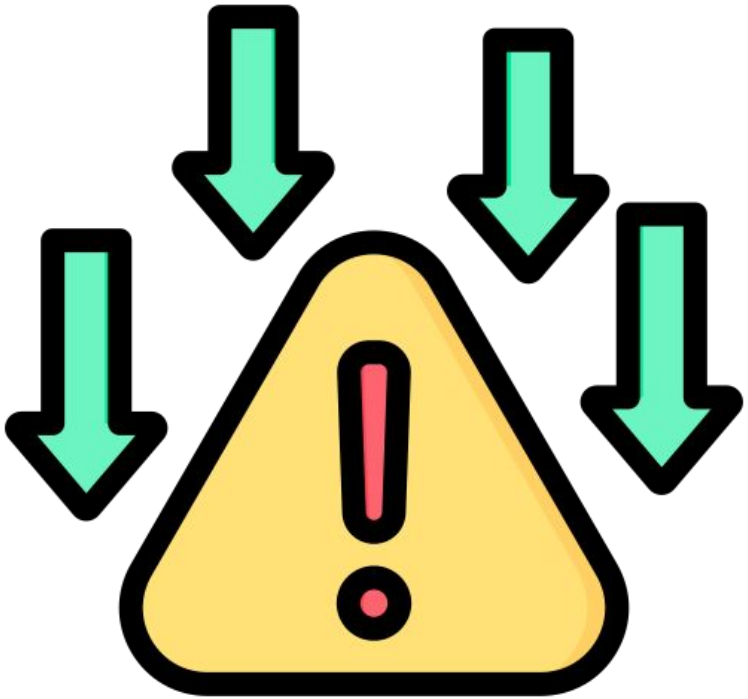
- High growth industry
- Aging construction labour workforce with no replenishment
- First mover advantage
- Established access to distribution channels
- Proven quality track record

Value Proposition

Value Proposition - Enhanced Labour Productivity

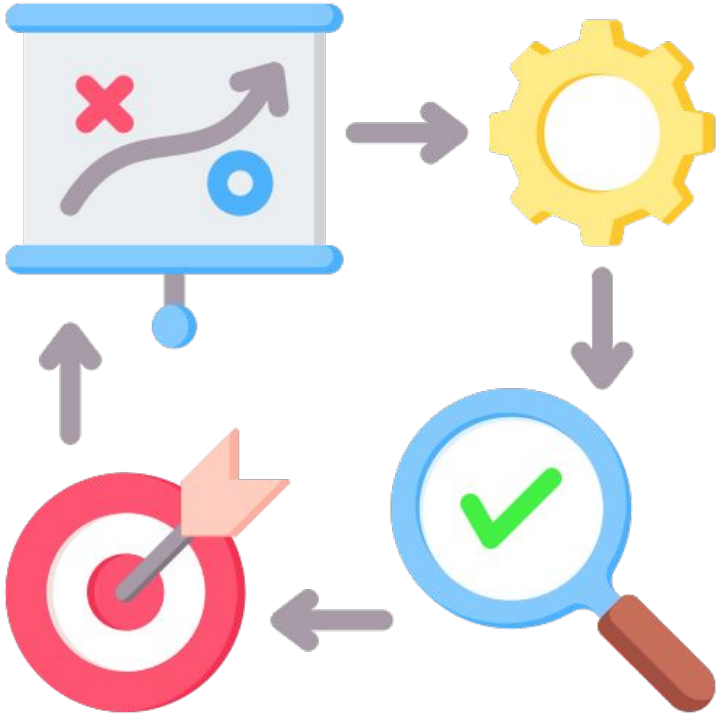
- **Skilled Labour Man-Hour Savings**
  - **15-20%** reduction with *TyBot*
  - **30-40%** reduction with *IronBot*
  - **50%+** combined reduction on entire rebar installation process
  - **Fills skilled labour gaps in the industry**
- Essentially, takes a **2 week job down to 1 week**
- On-the-Job example:
  - Bridge job was bid at **14 work shifts**
  - TyBot and IronBot did it in **6.5 shifts**
  - Expanding to jobs with 25+ shifts

Value Proposition - Reduced Worker Safety Risks



- **Worker exposure to hazardous situations is reduced**
  - Decreased↓ incident rates
  - Improved↑ insurance rates
  - Reduced work-hours attribute to less safety exposure
- **Long Term Benefits**
  - Less repetitive work reduces career limiting health effects - **40%** of lost time injuries are attributable to sprains and strains on the jobsite.
  - Workers are relieved from injury-prone tasks, extending career longevity

Value Proposition - Improved Construction Process



- **Improves consistency**, allowing for predictable production rates
- **Reduces schedule risks** by allowing critical path accelerations (day/night shifts) and minimizing delays
- Collects data and inferences from the construction process – allowing for more **efficient tool usage**, asset management and pitfall identification
- **Reduces exposure** to peak seasonal staffing demands

Value Proposition - Our Thoughts

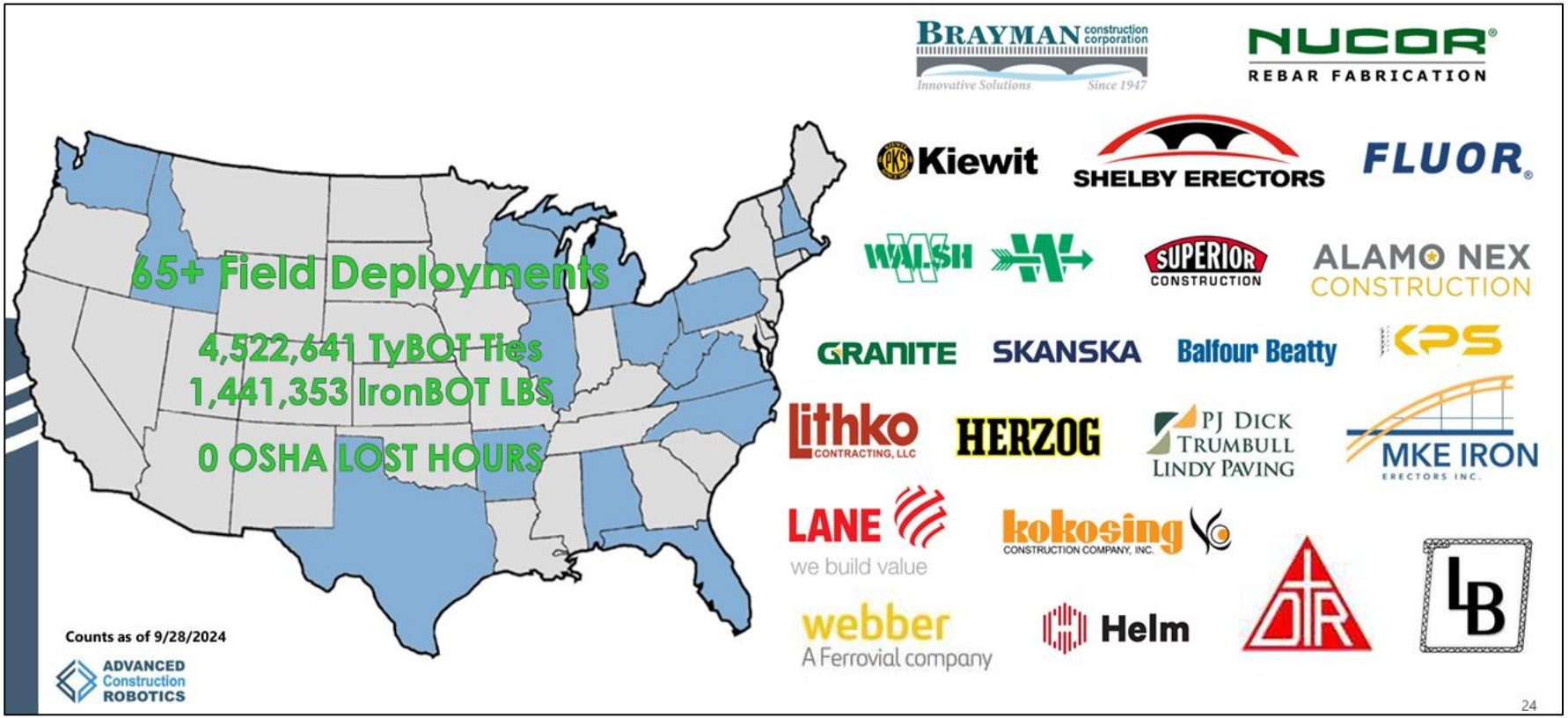
- **Technological adoption in a traditionally manual industry**
  - The marketing strategy of **augmenting workers** rather than replacing them connects with the end user and encourages them to **break the initial adoption barrier**.
- **Cutting-edge technological solution**
  - ACR has **unique, patented and cutting-edge technology** that improves productivity of workers and the construction process. Their ability to innovate and rapidly deploy solutions sets them apart from the competition and **attracts customers**.
- **End-user focused problem solving**
  - ACR is a **customer-obsessed company**. Their business model of RaaS before sales allows them to identify problems and work with their customers to create the **best solutions**.
- **Ability and demand to scale-up**
  - As an established brand name, ACR will become the **go-to company** for all their customers' needs with regards to automation. Additionally, their focus on optimizing the whole construction process **gives customers confidence** in the company and their products.

Value Proposition - What more can they do?

- **Expand product functionality**
  - Create **more functionalities** for tougher construction tasks such as
    - carrying payloads (upcoming product: CarryBot)
    - concrete pouring and monitoring
    - inspection and sustainability
- **Make more versatile products**
  - TyBot and IronBot are highly specialized robots. ACR should aim to create products that can **address multiple problems**.
- **Provide additional value to the construction process**
  - Expand their data analytics and asset management deck to **increase the customer's insight into the construction process.**

Existing Traction

Current Customers



Customer: Brayman Construction Corporation

Koppel Bridge
Client: Pennsylvania DoT
Contractor: Brayman Construction
October 2019

- **$27 Million Project** for 4-span 1240-feet long bridge
- TyBot deployed for half of the width of the bridge
- **Man hour savings: 34%**
- **Schedule savings: 34%**
- Award-winning bridge
- Excellent performance in the field and added real value to the customer – **Good Traction Indicator**

Customer: MKE Iron Erectors

IH-39 B-11-166 Bridge
Client: Wisconsin DoT
Contractor: MKE Iron Erectors
May 2023

- Accomplished **17,823 ties in two shifts** for this project across a 7,775 sq. ft. area.
- Rate of over **1,100 ties per hour.**
- Barb Sheedy (President, MKE) publicly stated the benefits of using TyBot.
- Committed to using TyBot in more projects in Wisconsin
- Returning Customers with public commitment: **Great Traction Indicator**

Growing Demand and Reach: RaaS to Sales Model

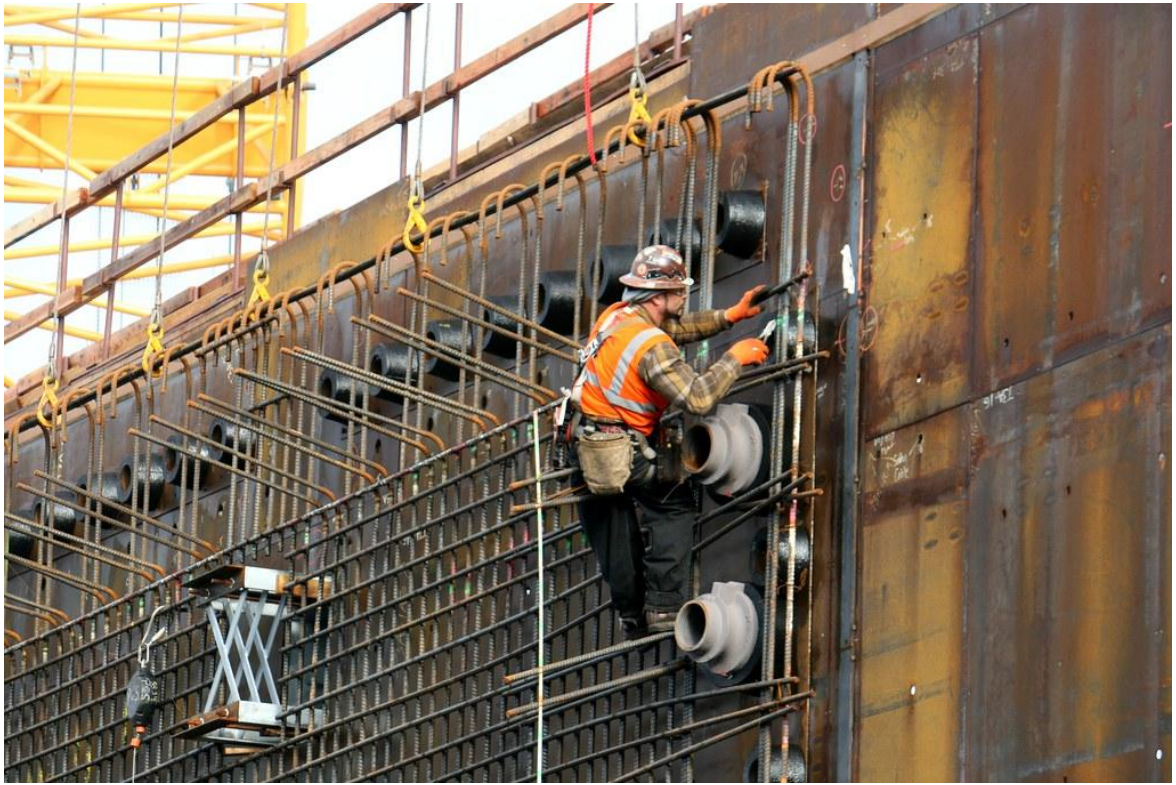
Advanced Construction Robotics Announces TyBOT®, the Rebar Tying Robot, is Now Available for Purchase to Meet the Growing Demand in the Construction Industry

Advanced Construction Robotics Named Finalist for Pittsburgh Technology Council's Tech50 Awards

- **ACR is getting noticed!**
  - Consistent growth in partnerships
  - Long-term returning customers
  - Good presence in the media
- **Lauded for technology innovation** and delivering great products
- Customers are enjoying the product and want more!
- **Great indicator** of **healthy traction and future demand**.

Competition

Competitor Analysis: Manual Labour



Competitor Analysis: Manual Labour

Strengths

- Low initial investment
- No R&D expenditure
- Flexible construction settings
- Status quo (institutionalized process) – what has been done for many decades

Weaknesses

- Slow process
- Sensitive to weather
- Skill dependent
- High injury rate

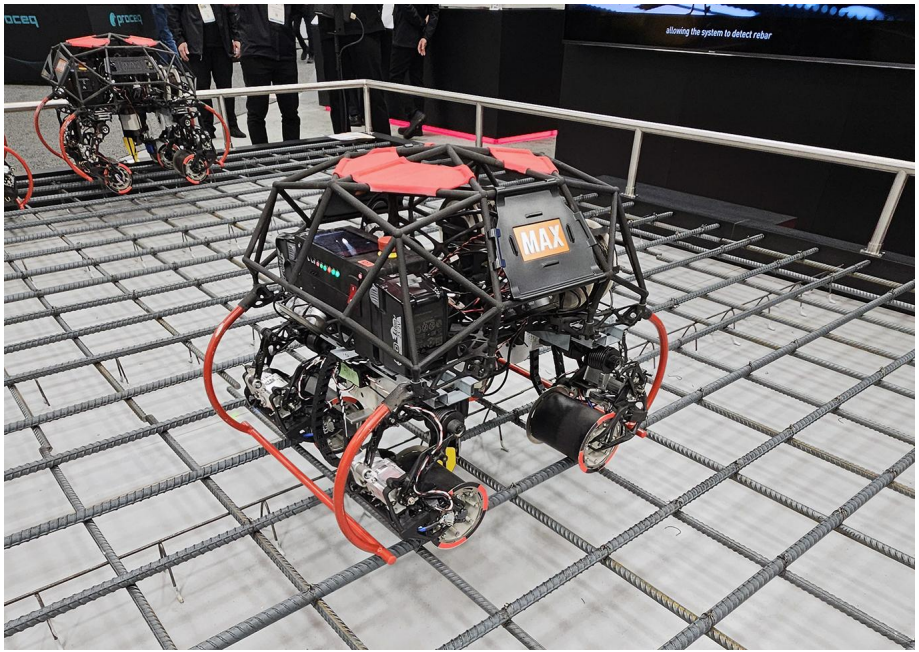
Opportunities

- Semi-autonomous integrated rebar tying tools
- Strong labor unions (AFL-CIO)
- Strong government support for protecting blue-collar workers

Threats

- Increasing automation
- Aging workforce
- New workforce unwilling to do manual labor

Competitor Analysis: MAX & Tomorobo



Competitor Analysis: MAX & Tomorobo

Strengths

- Established company for manufacturing rebar tying tools
- Small and agile
- Easy to set up
- Can operate in all weather conditions
- Improved safety

Weaknesses

- Unsuitable for industrial scale projects
- High R&D cost
- Can only tie small diameter rebars (below 29 mm)
- No rebar carrying capability

Opportunities

- Human-robot interactive rebar tying
- High demand for rebar tying without sufficient workforce
- Improved worker safety regulations

Threats

- Both are from Japan, global tariff war could make imports very expensive
- Tendency for US government to protect blue-collar workers

Competitor Analysis: ACR

Competitor Analysis: ACR

Strengths

- Suitable for large infrastructure projects
- Automated with option for teleop control
- Can operate in all weather conditions
- Improved safety
- Can carry excess rebars with IronBot

Weaknesses

- Need trained operator onsite
- High set-up and transportation cost
- Large machine footprint, unsuitable for small projects (e.g. detached homes)
- Limited construction setting flexibility

Opportunities

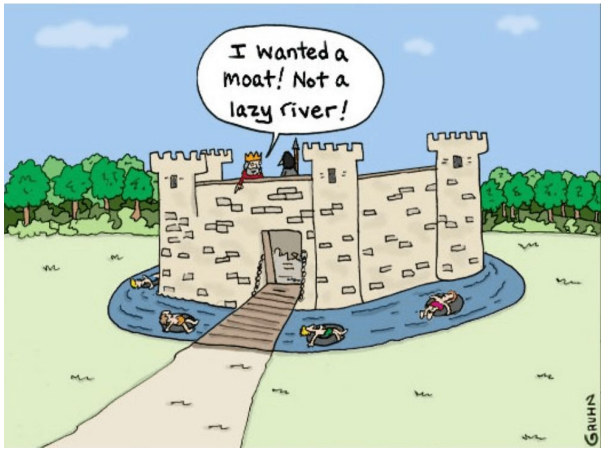
- Aging US infrastructure (especially bridges)
- High demand for rebar tying without sufficient workforce
- Improved worker safety regulations

Threats

- Tendency for US government to protect blue-collar workers
- Resistance from labor unions (AFL-CIO)
- Competition from cheaper alternatives

Competitor Analysis: Addressing Threats

- Competitors in **autonomous** rebar tying industry are Japanese companies **MAX** and **Tomorobo**.
- However, **no direct competition** as MAX and Tomorobo focuses on small projects (e.g. Japanese detached homes) rather than industrial-scale projects (e.g. bridges)
- ACR's IronBot product is unique in that it can **store excess and self-place new rebars**. Competitor offerings can only do rebar tying, but cannot self-place new rebars.
- Also hopes to utilize recent US **protectionist trade policies** for reducing foreign competition
- For emerging competitors, utilizes an **IP moat** to protect key technologies
- **Established connections** from founder Stephen Muck also deter new competitors
- Industry inherently has **first-mover advantage** and significant **barriers to entry** (e.g. R&D).



Competitor Analysis: Addressing Threats

- Strongest competitor in **overall** rebar tying industry is **manual laborers**.
- **Actively addressing this threat** with **constant communication** with labor unions and **educating laborers**
- **Gained traction from labor union leaders**. They did this by:
  - Educating that the robots are "**tools of the trade**" instead of replacements for manual labor
  - Showing the **efficiency gained** from adopting the technology
  - Showing the **increased safety** from adopting the technology
- However, **labor workers still hesitant to adopt technology**. ACR is currently addressing this by:
  - **Providing training** to transition manual laborers to **technicians** and **operators** of equipment (ACR Bots University)
  - **Educate** manual laborers about the **increased safety** of autonomous rebar tying robots

Pros & Cons

Pros

First-Mover Advantage:

- Pioneer in **autonomous rebar tying and placement**, giving it a strong foothold in the industry.
- Proven track record with over **65 completed projects** establishes credibility and trust in the market.

Strong Intellectual Property (IP) Protection:

- ACR has three approved patents, eight pending patents, and four trademarks, creating a **significant barrier for competitors**.

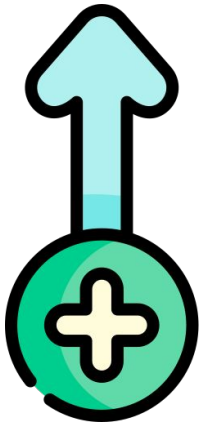
Maximizing Productivity and Savings:

- TyBOT and IronBOT reduce labor needs and **faster project completion** reduces overall construction costs and enhances efficiency.

Pros

Market Demand:

- The construction industry faces **labor shortages, making automation an attractive solution** and automated rebar tying market is **growing** at 21.8% CAGR.
- Government infrastructure projects and an **aging U.S. bridge network** create a steady demand for ACR's solutions.



Strategic Location and Leadership Team:

- ACR is based in Pittsburgh, known as the "City of Bridges", aligning perfectly with its focus on **bridge construction automation.**
- **Strong leadership experience** helps navigate market challenges and drive growth.

Cons

High Operational Costs and Slow Profitability:

- ACR has been **unprofitable** since inception.
- **High R&D costs** and expensive robotic systems make profitability challenging in the short term.

Regulatory Challenges and Slow Adoption:

- Government policies favor **blue-collar job protection**, which may slow ACR's expansion.
- **Long development cycle** and adoption of automation is slow compared to other industries.

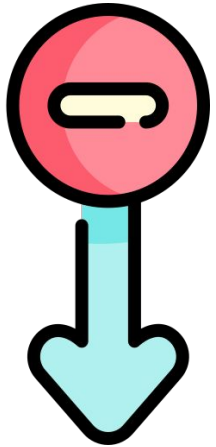
Cons

Emerging Competition:

- Competitors like MAX and Tomorobo are **improving their solutions** with multi-robot deployment to increase speed and efficiency.
- If competitors develop cheaper or more efficient solutions, ACR could **lose market share**.

Limited Market Size & Niche Focus:

- The total addressable market (TAM) for rebar tying automation is only $2.7 billion, which is **not attractive for large-scale venture capitalists**.
- Focused primarily on bridge and large-scale infrastructure projects, which **limits growth opportunities** beyond rebar tying automation.

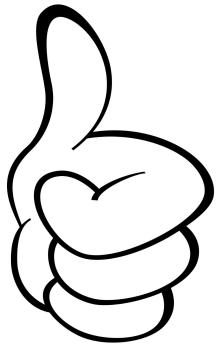


Conclusion

Conclusion

- **SUMMARY:**
  - **Pros:** Innovative tech leadership with proven project success and a robust IP portfolio that anchors market relevance.
  - **Cons:** High R&D costs and historical unprofitability combined with a narrow market focus and emerging competitive/regulatory risks.

- **OVERALL ASSESSMENT:**
  ACR's innovative technology and well-aligned market position present substantial growth opportunities, as long as financial and market challenges are effectively addressed.
  With targeted initiatives, the strengths can outweigh the risks, paving the way for sustainable long-term success.



Conclusion

- **STRATEGIC RECOMMENDATIONS:**
  - **Expand Beyond Niche Automation:** Develop modular, multi-purpose robots for broader construction applications.
  - **Stakeholder Engagement:** Engagement with regulators and labor unions can mitigate external risks
  - **Leverage AI & Data Analytics:** Use real-time data for predictive insights to customers, and an integrated automation ecosystem.
  - **Enhance Financial Stability:** Optimizing cost management, strategic partnerships, offer RaaS and cost-effective solutions to mid-sized firms.

Questions ?