

Speaker Profile



Name	K.G.VENKATESAN
Organisation	FOSBEL INDIA PVT. LTD.
Responsibilities	Managing Director
E-mail	KG.Venkatesan@Fosbel.com
Qualifications	Metallurgical Engineer from Indian Institute of Science, Bangalore
Experience	1. 39 years in Iron & Steel Industry and Ceramic Technologies. 2. Area of specialisation: Development & application of custom-designed speciality refractory and ceramic products for the Iron & Steel plants to improve Productivity & Quality and enhancing asset life.
Major Achievements	1. Author of several technical articles on refractories for Continuous casting, Iron making and Coke Oven repairs. 2. Implemented Ceramic Welding hot repair technology at several leading coke plants in India. 3. Pioneered the Concept of Coke Oven Battery Health Diagnostics & Comprehensive Battery Maintenance (CBM) in India.



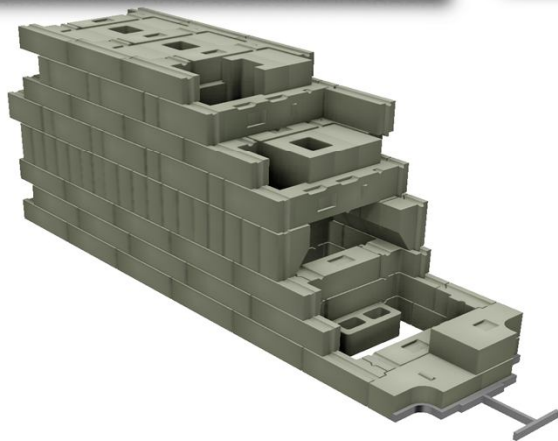
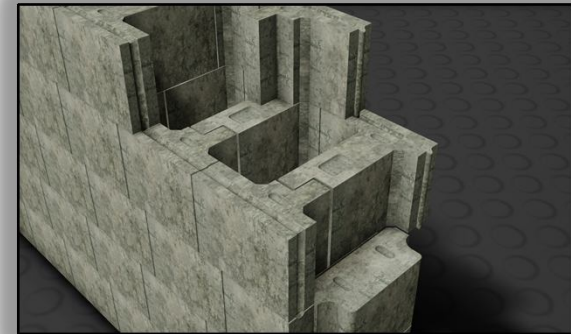
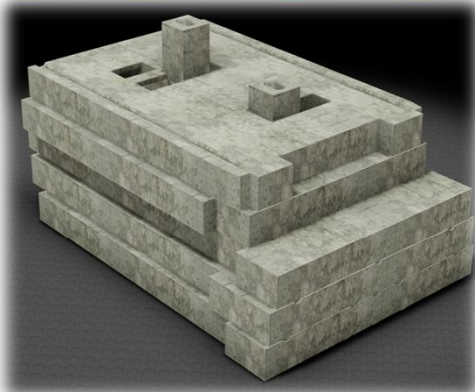
Advancements in Fused Silica Refractory Technology for Coke Oven wall rebuilding

REFIS 4.0

Bokaro Steel City
23rd & 24th September 2022

K.G.Venkatesan
Fosbel India Pvt. Ltd.

Refractory Technologies for Coke Oven Repairs

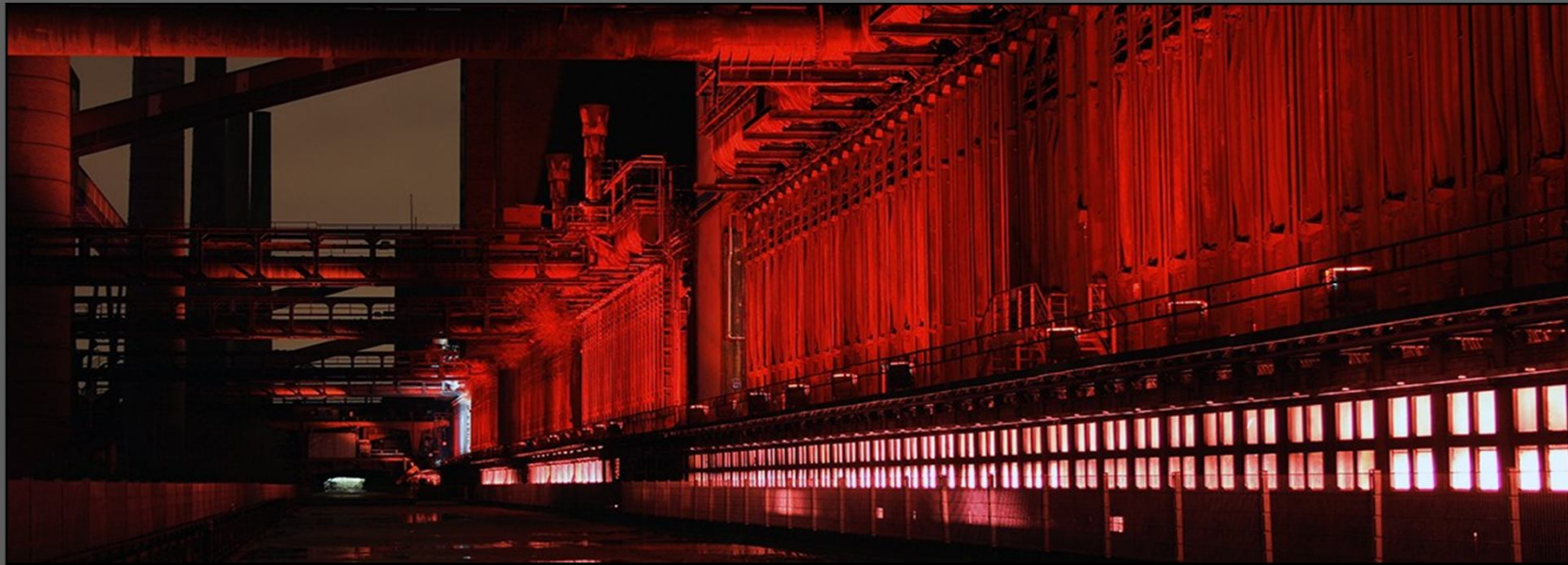


Fosbel Technology Outline

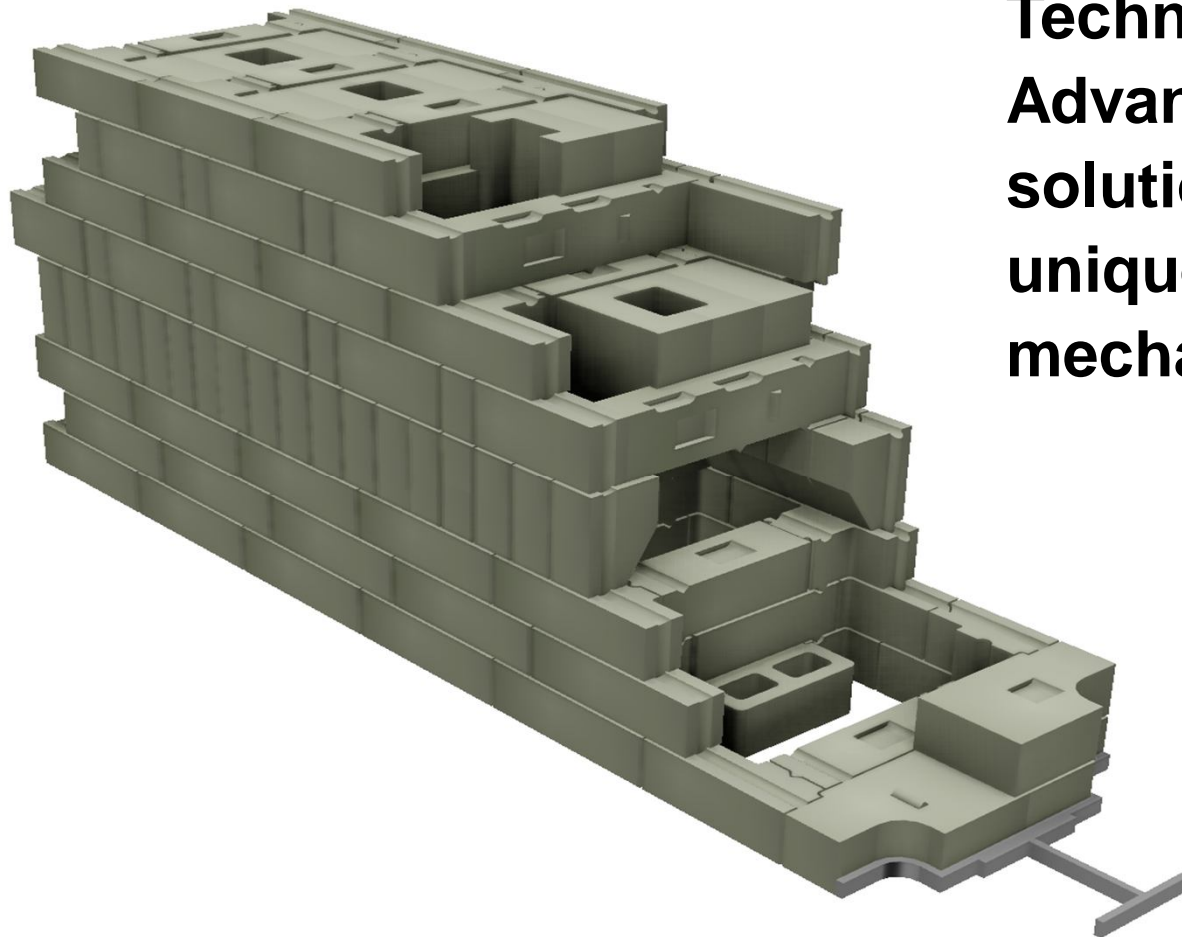
- **MICOWALL™ Technology**
- **MICOWALL™ 2.0 Technology**
- **MICOKAST™ Corbel Technology**
- **MICOKAST™ Modular Wall Technology**
- **Summary**

Coke Oven Repair & Maintenance Expertise

Fosbel has over 35 years of expertise in Coke Oven repair and maintenance.



MICOWALL™ Coke Oven Wall Rebuild Technology



**An Engineered &
Technologically
Advanced rebuild
solution featuring a
unique interlocking
mechanism**

MICOWALL™ Background



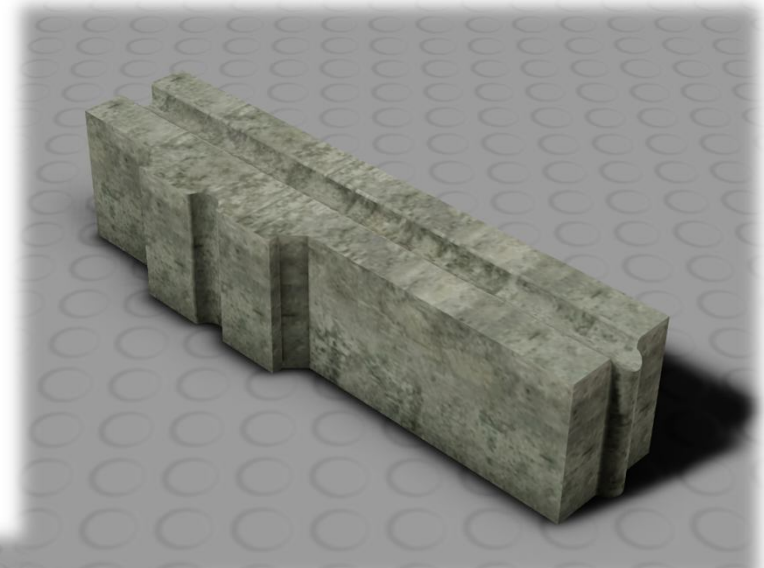
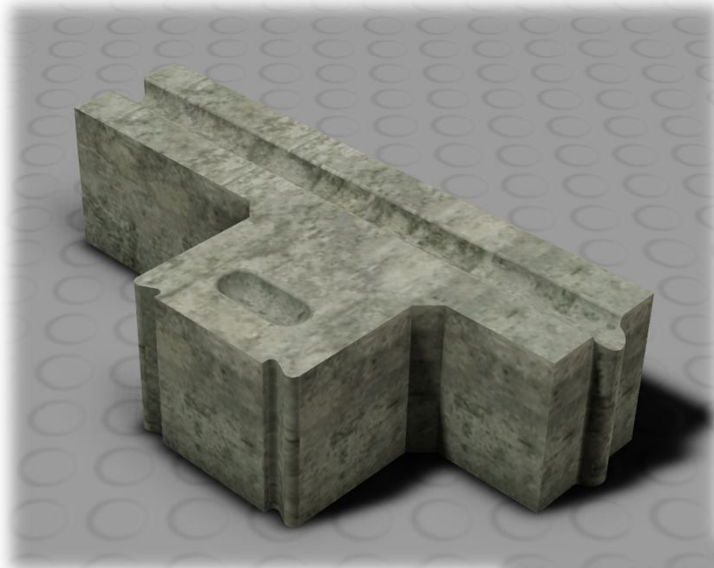
MICOWALL™ (Modular Interlocking Coke Oven WALL)

This unique coke oven wall rebuild technology was developed to:

- **Meet environmental expectations**
- **Extend battery life**
- **Have no compromise to oven wall quality or structural integrity**

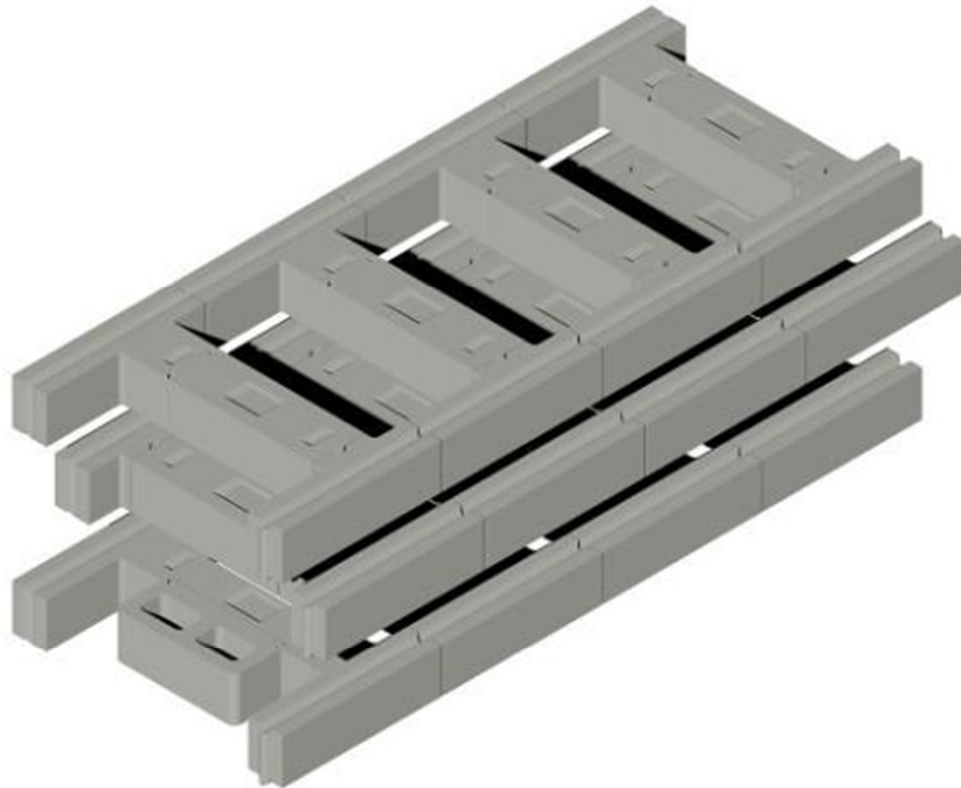
Globally, Fosbel has constructed more than 4000 MICOWALL™ flues and 25 through walls.

MICOWALL™ Typical Shapes

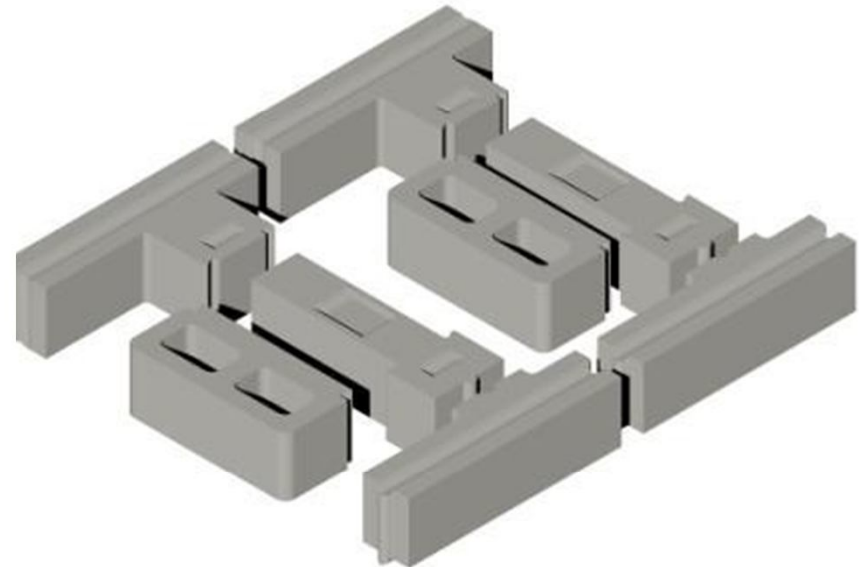


MICOWALL™ Construction Layout

Courses 1 thru 3 exploded



Course 1 and 2 flues exploded



Engineering Design Overview

In the initial design phases of MICOWALL™ demanding specifications were set around multiple facets of the MICOWALL™ development.

From an engineering point of view it was essential to maintain or where possible improve the strength of the original design.

Hence the design causal factors to failure of conventional silica designs are listed below in order of priority and empirical observation:

- Bridging Brick Design Improvement including improved interlocking for most designs.
- Reduction of high pushing force shear failure mechanism at mortise joint of binder to panel brick.
- Maintained Vertical load strength of conventional design maintained in MICOWALL™ .
- Bending Strength of wall improved using I-Beam principles of binder wall in MICOWALL™ as compared to conventional design.

Bridging Brick Design Improvement

This bridging brick design strength is considered fundamental to operational life.

- The bridging brick support significant upper wall and battery top loads including dynamic charge car loads
- Cracking of the bridging will lead to catastrophic failure
- Loss of restraint of the hairpin or horizontal flue brick and the “building” of the wall in this area. The ram can then impact on these areas and tear the wall out.

The bridging brick design calculations take into account the following factors:

- Charge car net weight
- Total coal charge weight
- Wheel span of the charge car
- Oven roof thickness
- Bridging brick height
- Angle of repose forces acting on bridging brick

Normal Silica Vs Fused Silica – Cost Comparison

Estimated costs calculated on a 4 flue end wall, oven sole to oven roof for a 5 metre Wilputte Battery (33 course).

Cost	Days	Silica	Days	ZEB
Lost Production	34	21%	12	7.5%
Installation	14	56%	10	30.5%
Heat Up	20	12%	2	0%
Material Costs		5.5%		26%
	34	100%	12	64%

ॐ ***Fused Silica Option is overall More Cost Effective***

Why MICOWALL™?



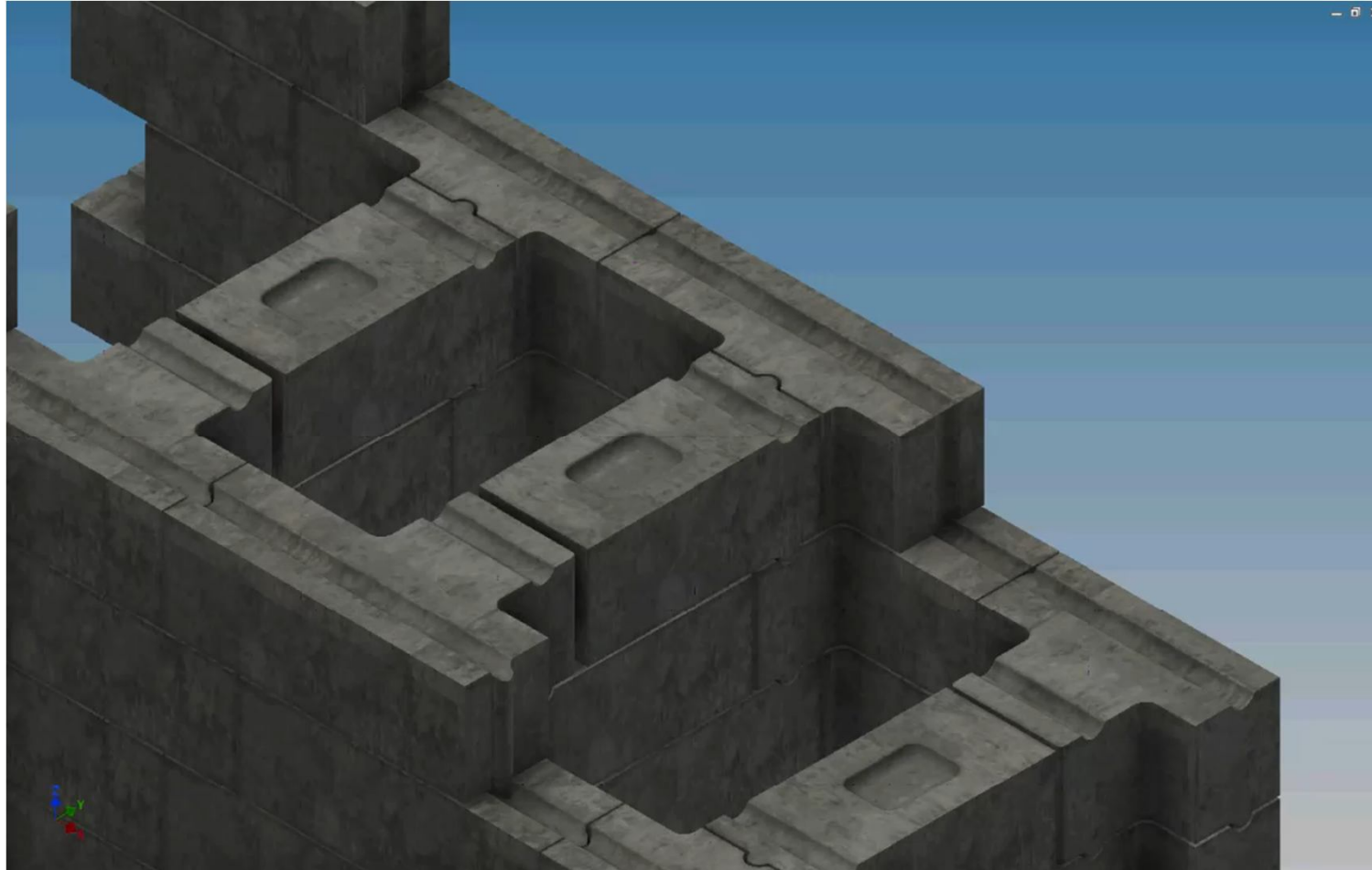
Features include:

- Increased structural integrity
- Can accommodate expanded batteries
 - Fused silica or conventional
- Faster, easier installation
 - Less shapes
 - 200-300 reduced to 15-25 (inventory, moulds)
 - Easier staging, less chance for error
- Adapts to any battery design
- More cost-effective
 - Fused Silica - less coke loss (tear down to heatup)

MICOWALL™ Course Example



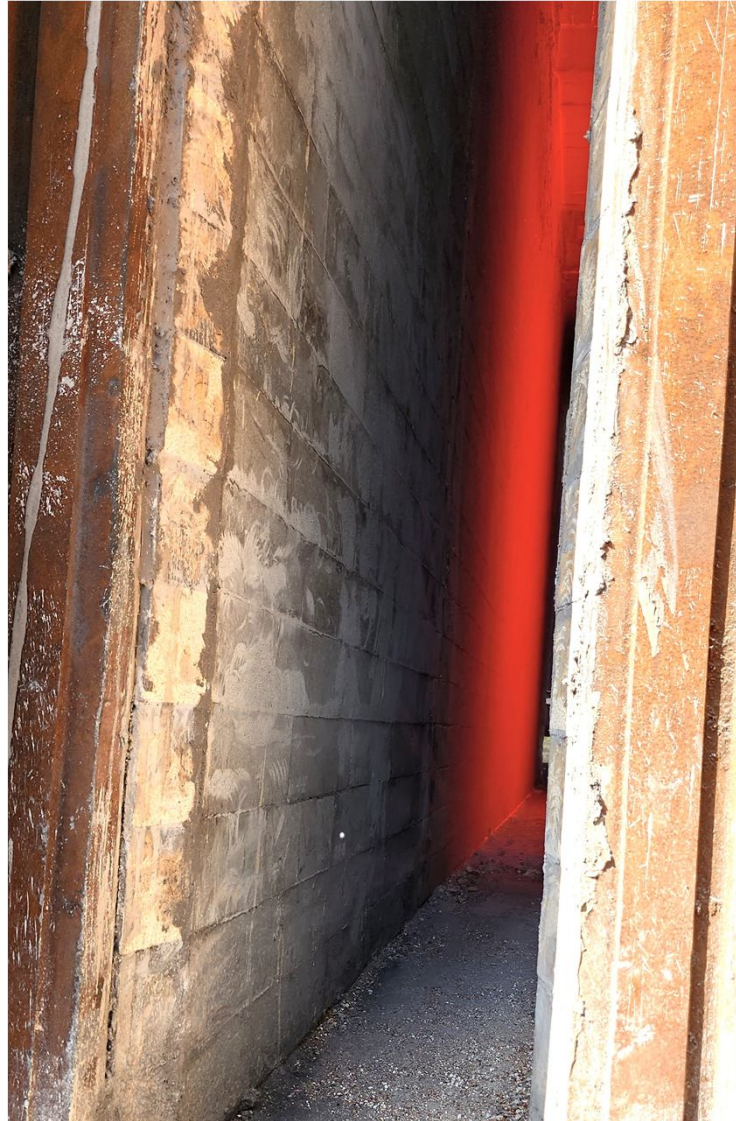
MICOWALL™ Animation



MICOWALL™ Advantages

- **Less heat-up time (Approximately 1 day heat-up v. 5 days, using a fused silica material)**
- **Reduced mold cost (~300 shapes v. ~26 MICOWALL™)**
- **MICOWALL™ is a cut to fit product giving it a more custom fit.**
- **Can be customized to fit all Coke Oven Designs.**

MICOWALL END FLUE – Example 1



MICOWALL END FLUE – Example 2

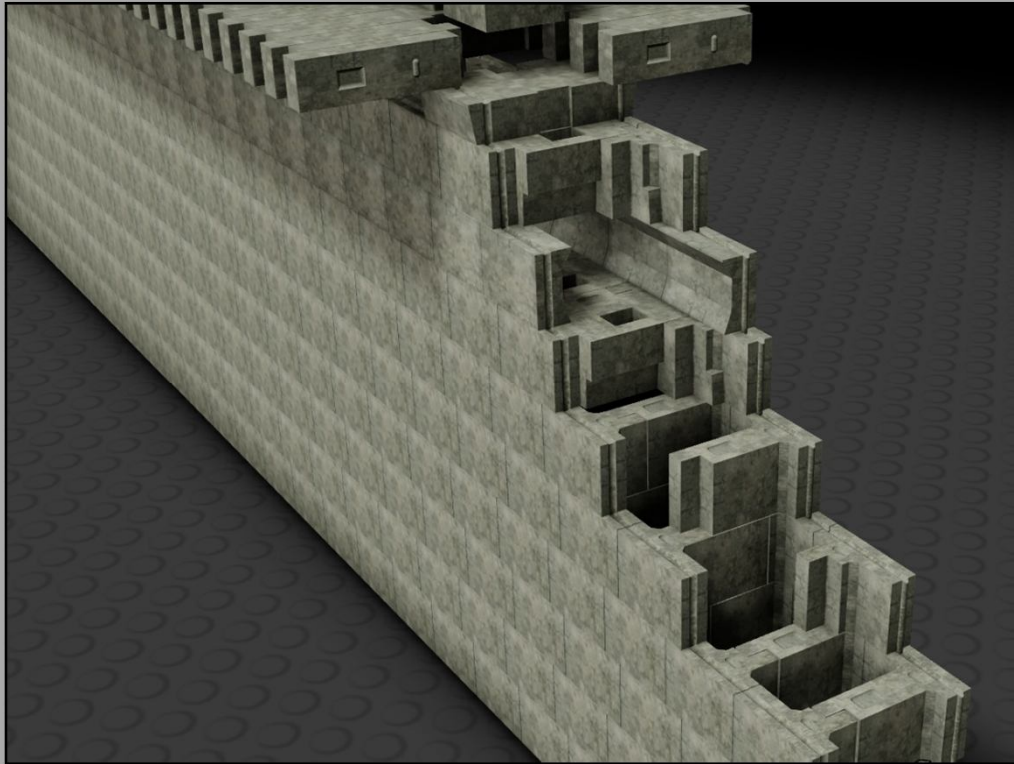


MICOWALL END FLUE – In Service



MICOWALL™ 2.0

Coke Oven Wall Rebuild Technology



A larger shape rebuild solution featuring a unique interlocking mechanism

MICOWALL™ 2.0

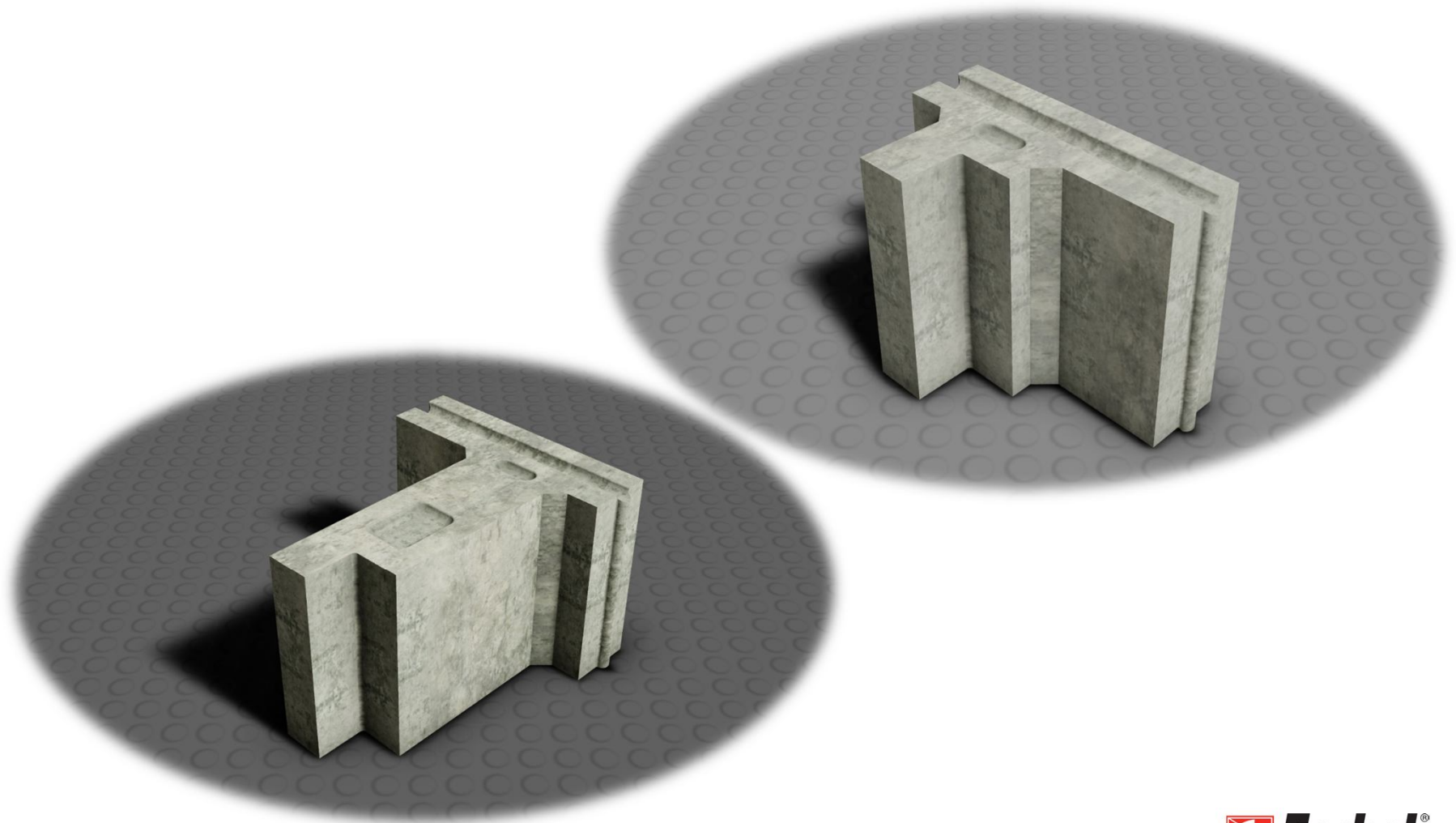
Engineering Design

(MICOWALL™ 2.0 is the larger version of MICOWALL™)

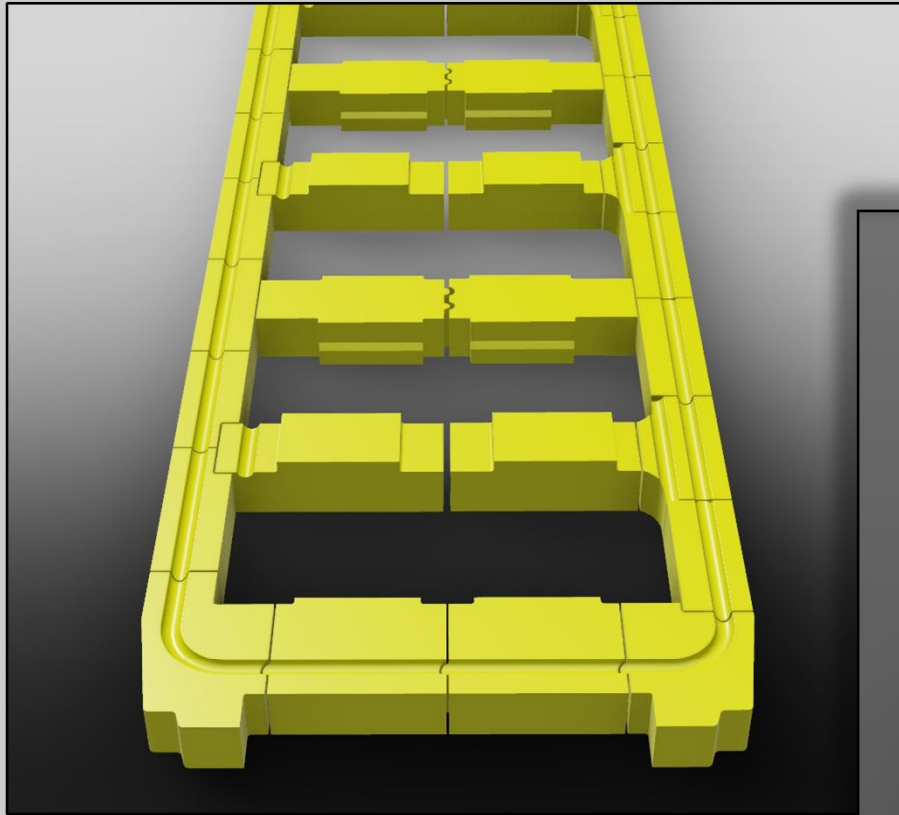
Like the MICOWALL™ technology it was essential to maintain (or improve) the strength of the original design:

- **MICOWALL™ 2.0 utilizes only 2 shapes in the wall area**
- **Reduces mortar joints**
- **Shapes are universal throughout the wall**
- **MICOWALL™ 2.0 utilizes an assisted arm/jib for ease of install**

MICOWALL™ 2.0 Examples



Original & MICOWALL™ 2.0 Typical Layouts



MICOWALL™ 2.0 Typical Layout



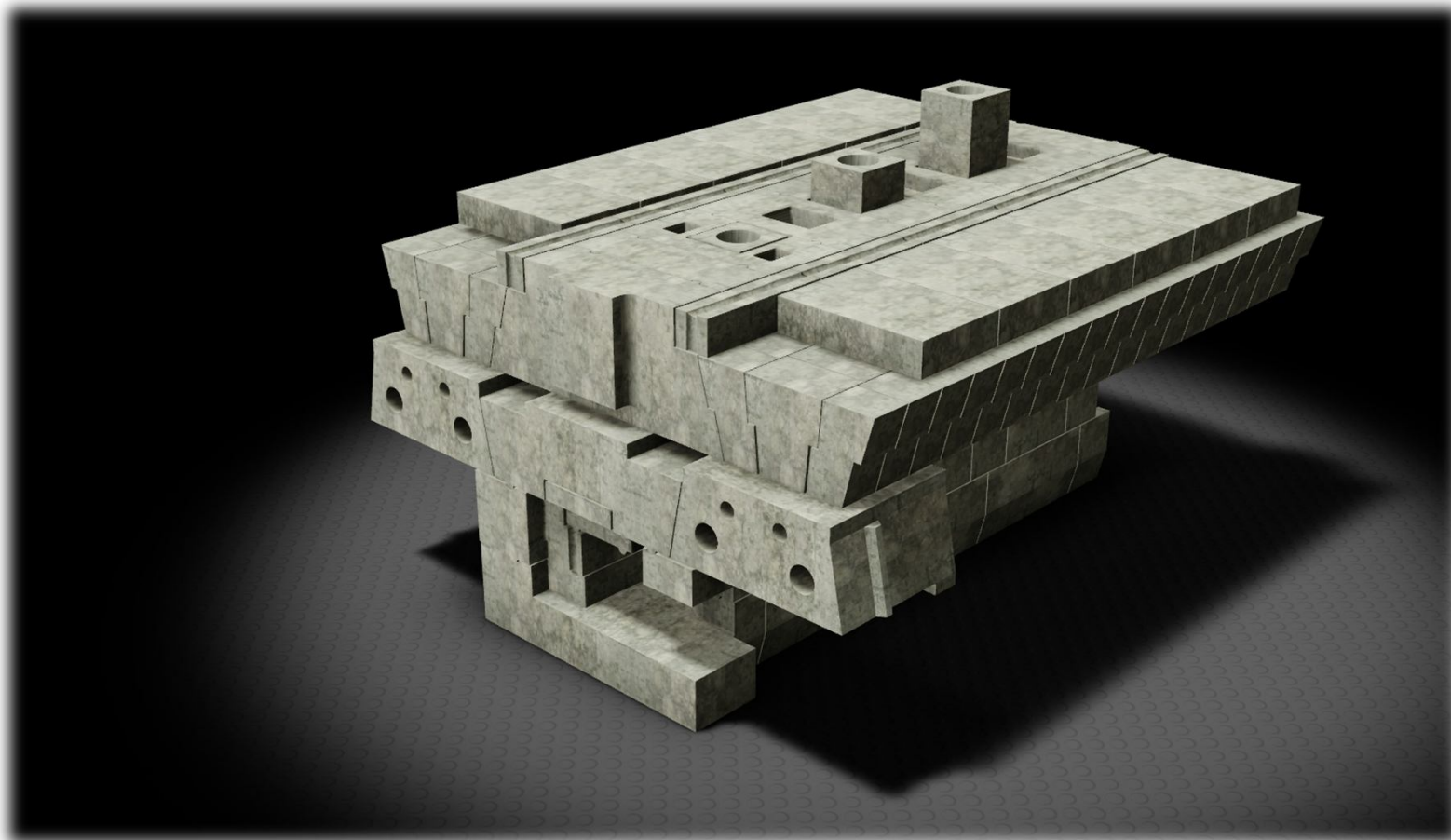
MICOWALL™ 2.0 Animation Slide



MICOWALL™ 2.0 Advantages

- **Less heat-up time (Approximately 1 day heat-up v. 5 days, using a fused silica material)**
- **Allows buckstays to stay in place**
- **Further reduced mold cost (~250 shapes v. 20-25 MICOWALL™ 2.0 shapes)**
- **Further reduced mortar joints**
- **MICOWALL™ 2.0 are universal throughout the wall**
- **MICOWALL™ 2.0 can be made from many different refractories**
- **MICOWALL™ 2.0 height can be multiple courses high, thus speeding up the install**

MICOKAST™ : Modular Corbel Repair



MICOKAST™ Corbel Engineering Design

MICOKAST™ Corbel Utilizes Precast Technology.

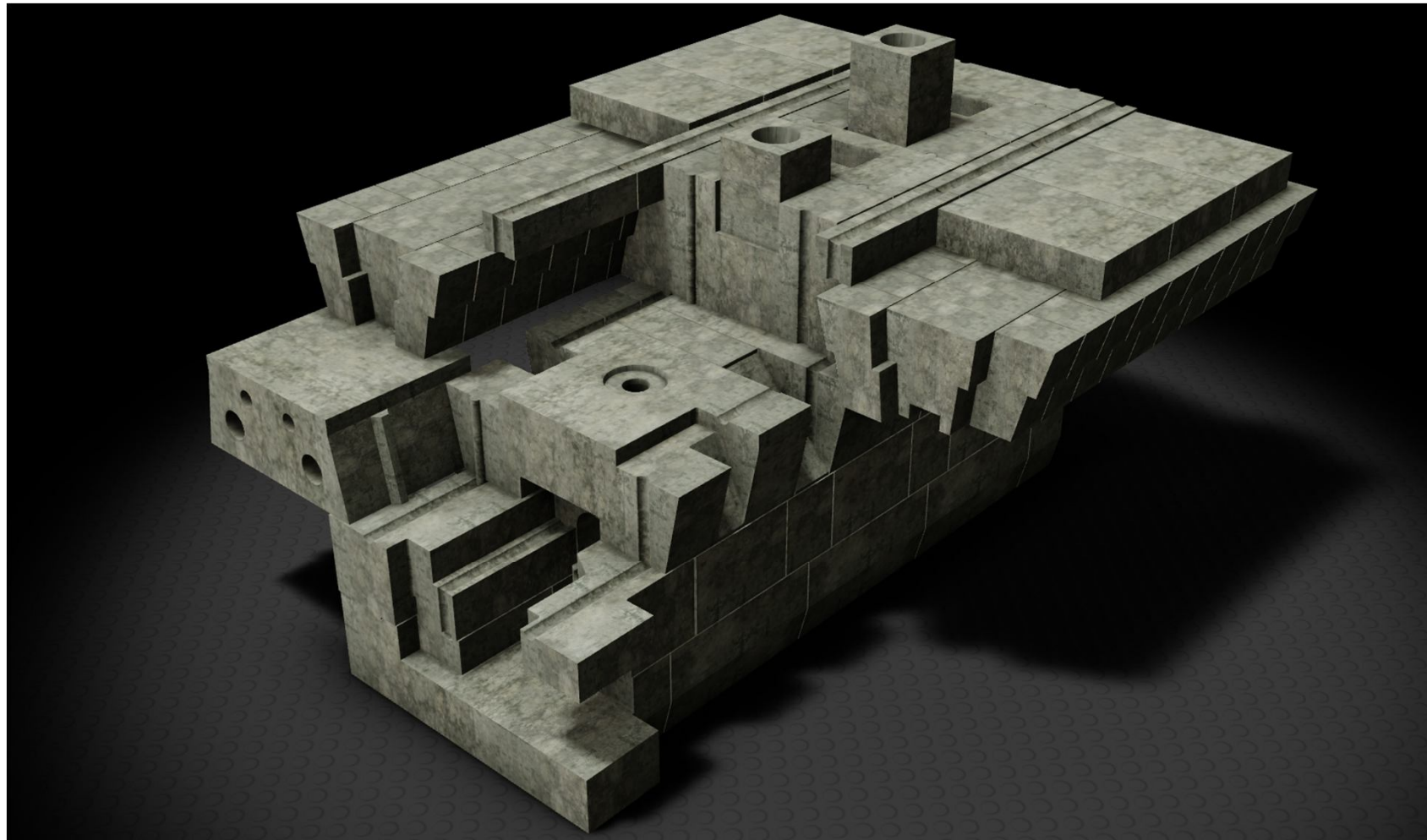
This technology allows us to form large shapes.

- **MICOKAST™ designs are modular**
- **Shapes interlock forming an air tight seal which greatly reduces a chance for environmental issues.**
- **Minimal to no cutting**
- **Reduces shapes from ~300 to 28 MICOKAST™**
- **Speeds up installation**

MICOKAST™ Shape Examples



MICOKAST™ Typical Assembly Sectioned



MICOKAST™ Animation Slide



MICOKAST™ Advantages

- **Less heat-up time (Approximately 1 day heat-up v. 5 days, using a fused silica material)**
- **Allows buckstays to stay in place**
- **Further reduced mold cost (~350 shapes v. ~28 MICOKAST™)**
- **Further reduced mortar joints**
- **MICOKAST™ are modular**
- **MICOKAST™ are multi courses high, further reducing install time**
- **MICOKAST™ large shapes interlock to form a strong, air tight base**

MICOKAST™ Corbel Slabs Engineering Design

MICOKAST™ Corbel Slabs Utilizes Modular Precast Technology.

This technology allows us to form large shapes.

- **MICOKAST™ designs are modular**
- **Reduces mortar joints**
- **Corbel Slabs make up a complete course of brick**
- **Can be cut to fit existing wall face making a tight seal between old and new**
- **Reduces shapes from ~300 to 4 MICOKAST™ Corbel Slabs**

MICOKAST™ CORBEL SLABS

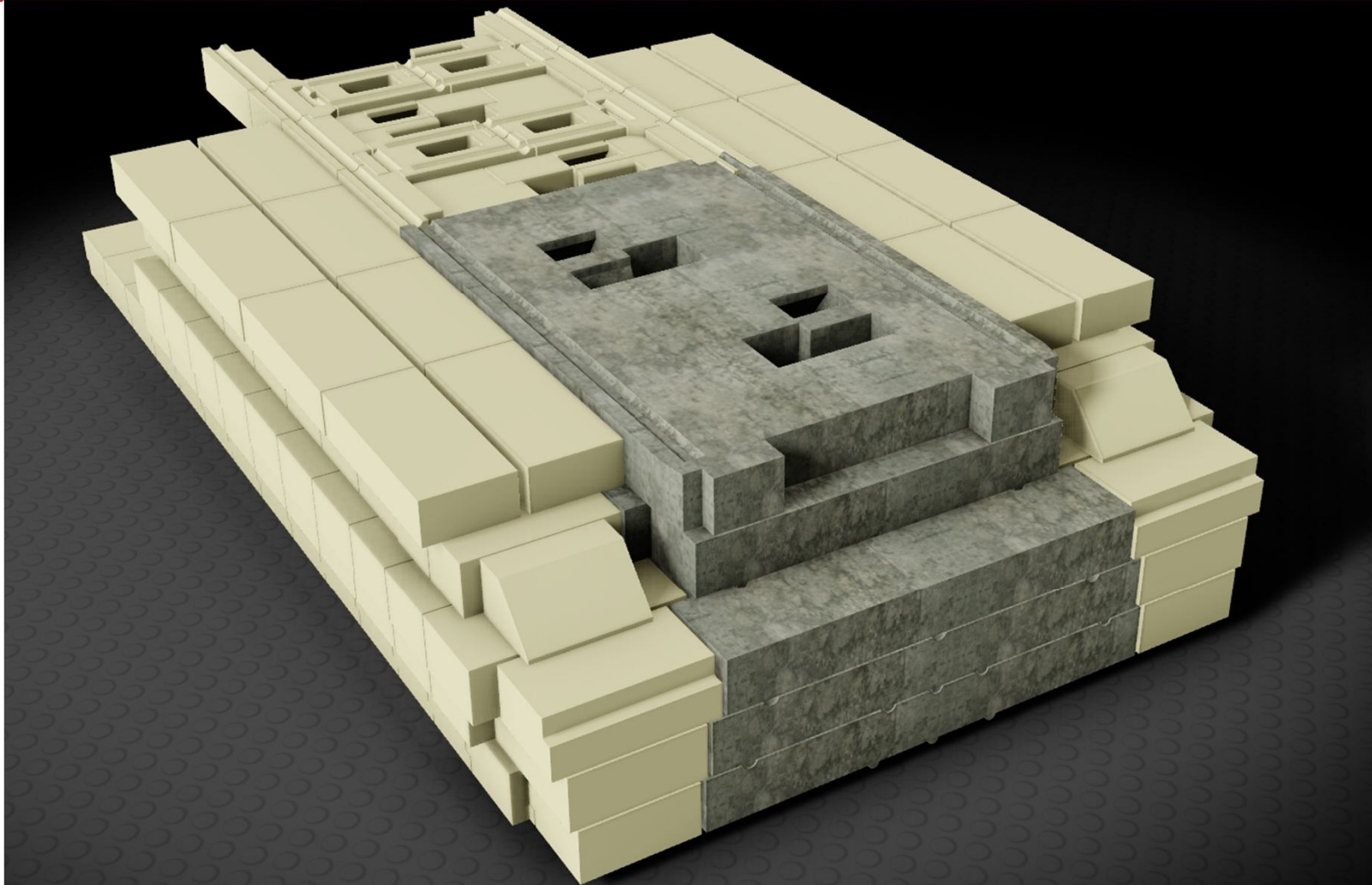


Example of Corbel Slabs



Slabs weigh between 500 – 650 pounds

MICOKAST™ with original brick



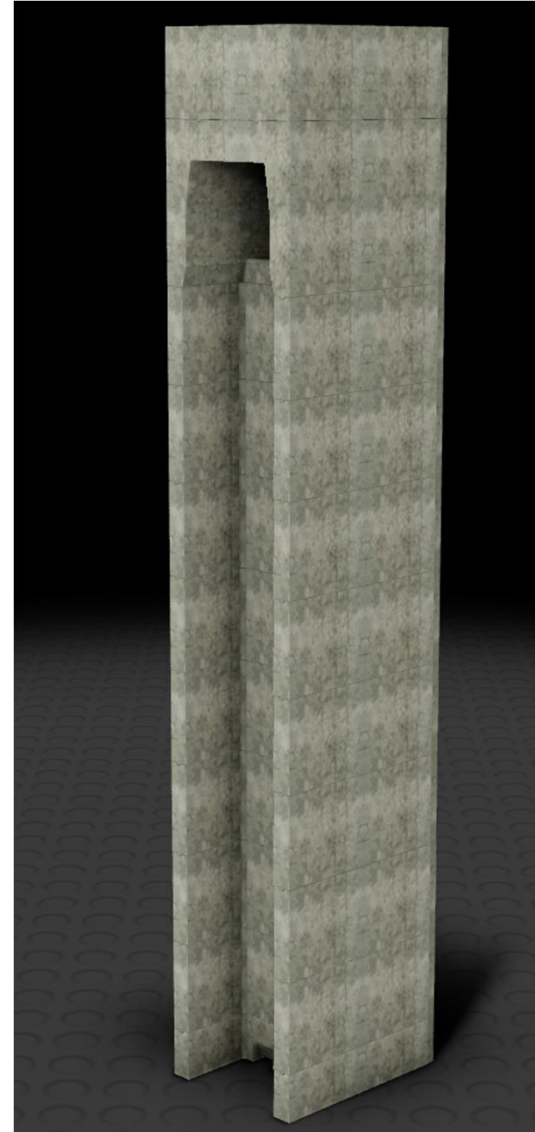
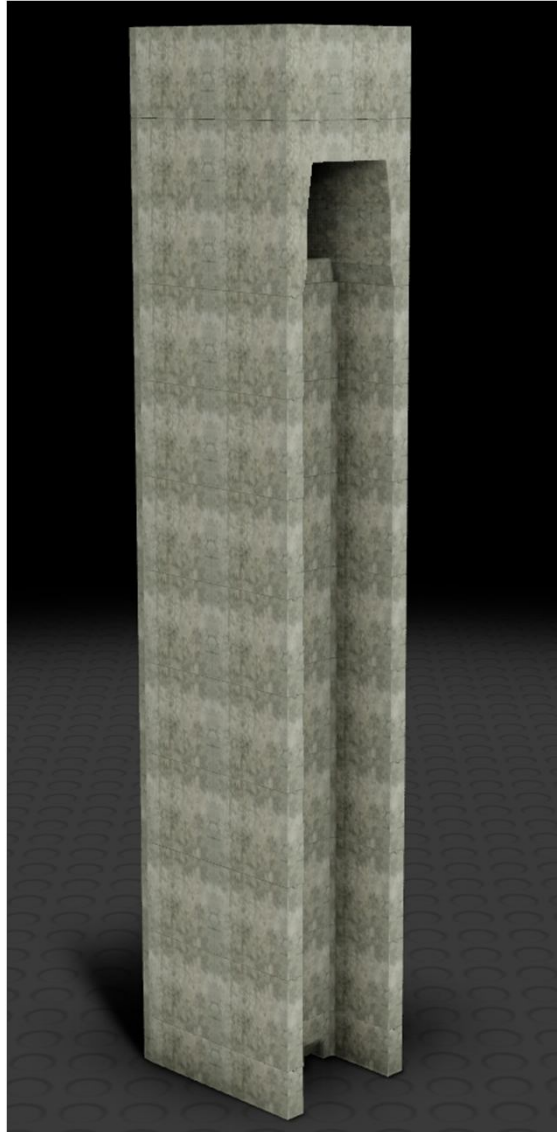
MICOKAST™ Example casts



MICOKAST™ Corbel Slab Advantages

- **Ability to install full course of brick multiple flues deep in one shape**
- **Further reduced mold cost (~350 shapes v. 4-5 MICOKAST™ Corbel Slabs)**
- **Reduced skilled labor required to install**
- **Just a few mortar joints**
- **Ability to cut ends to fit existing refractory layout. (i.e., no straight joints)**

MICOKAST™ Modular Wall Repair



Length 48"
Width 36"
Height 18'

 **Fosbel**[®]
CERAMIC TECHNOLOGIES

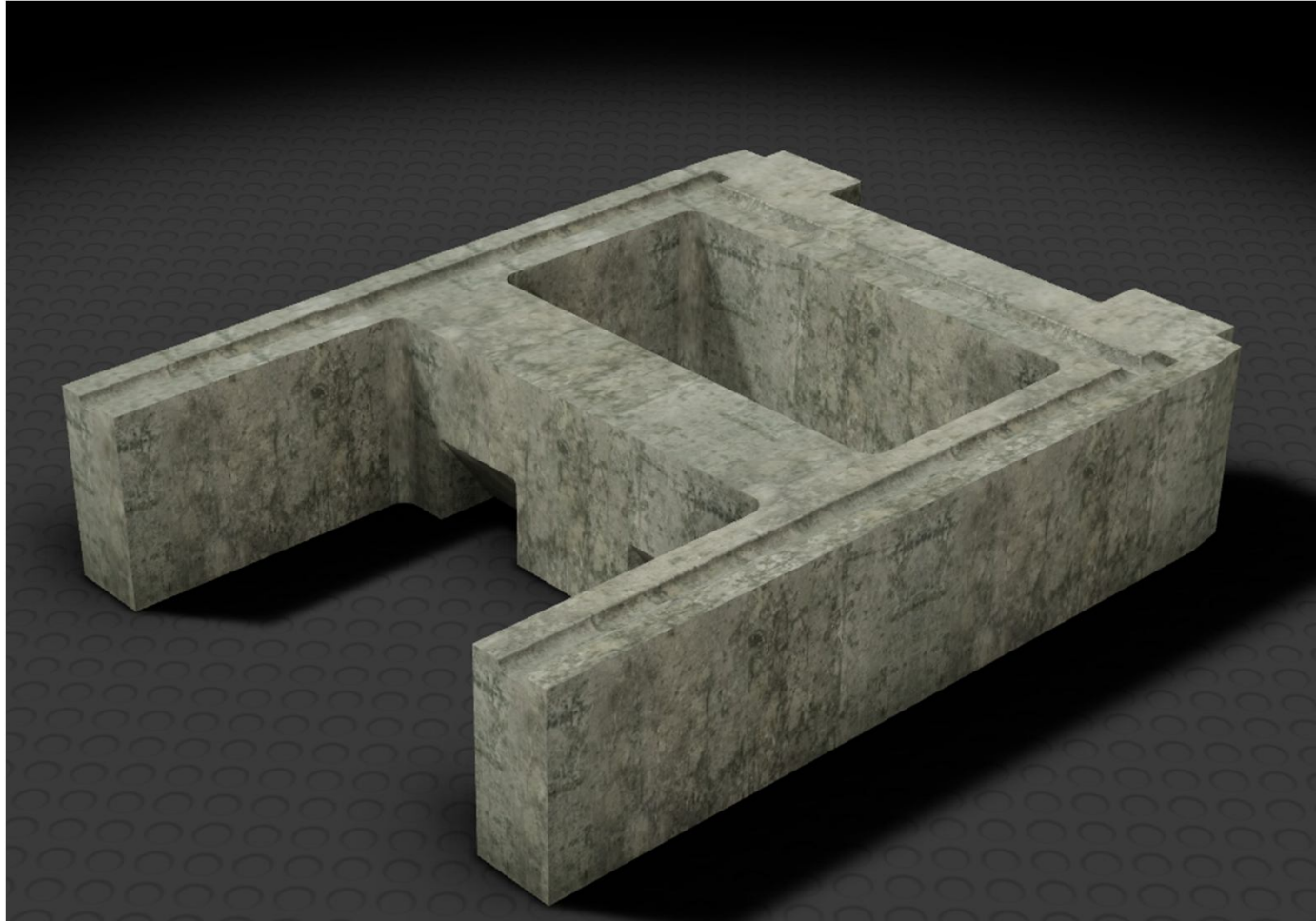
MICOKAST™ Wall Engineering Design

MICOKAST™ Wall Utilizes Modular Precast Technology.

This technology allows us to form large shapes.

- **MICOKAST™ designs are modular**
- **Reduces mortar joints**
- **Shapes interlock forming an air tight seal which greatly reduces a chance for environmental issues.**
- **Minimal to no cutting**
- **Reduces shapes from ~300 to 4 MICOKAST™**

MICOKAST™ Wall Shape Examples



WEIGHT
547 LBS.

41

LENGTH 48" WIDTH 36" HEIGHT 10 ½"

 **Fosbel**[®]
CERAMIC TECHNOLOGIES

MICOKAST™ Wall Shape Examples



WEIGHT
1066 LBS.

42

LENGTH 48" WIDTH 36" HEIGHT 19 3/4"

 **Fosbel**[®]
CERAMIC TECHNOLOGIES

MICOKAST™ Wall Shape Examples



WEIGHT
2052 LBS.

43

LENGTH 48" WIDTH 36" HEIGHT 33"

 **Fosbel**[®]
CERAMIC TECHNOLOGIES

MICOKAST™ Wall Shape Examples



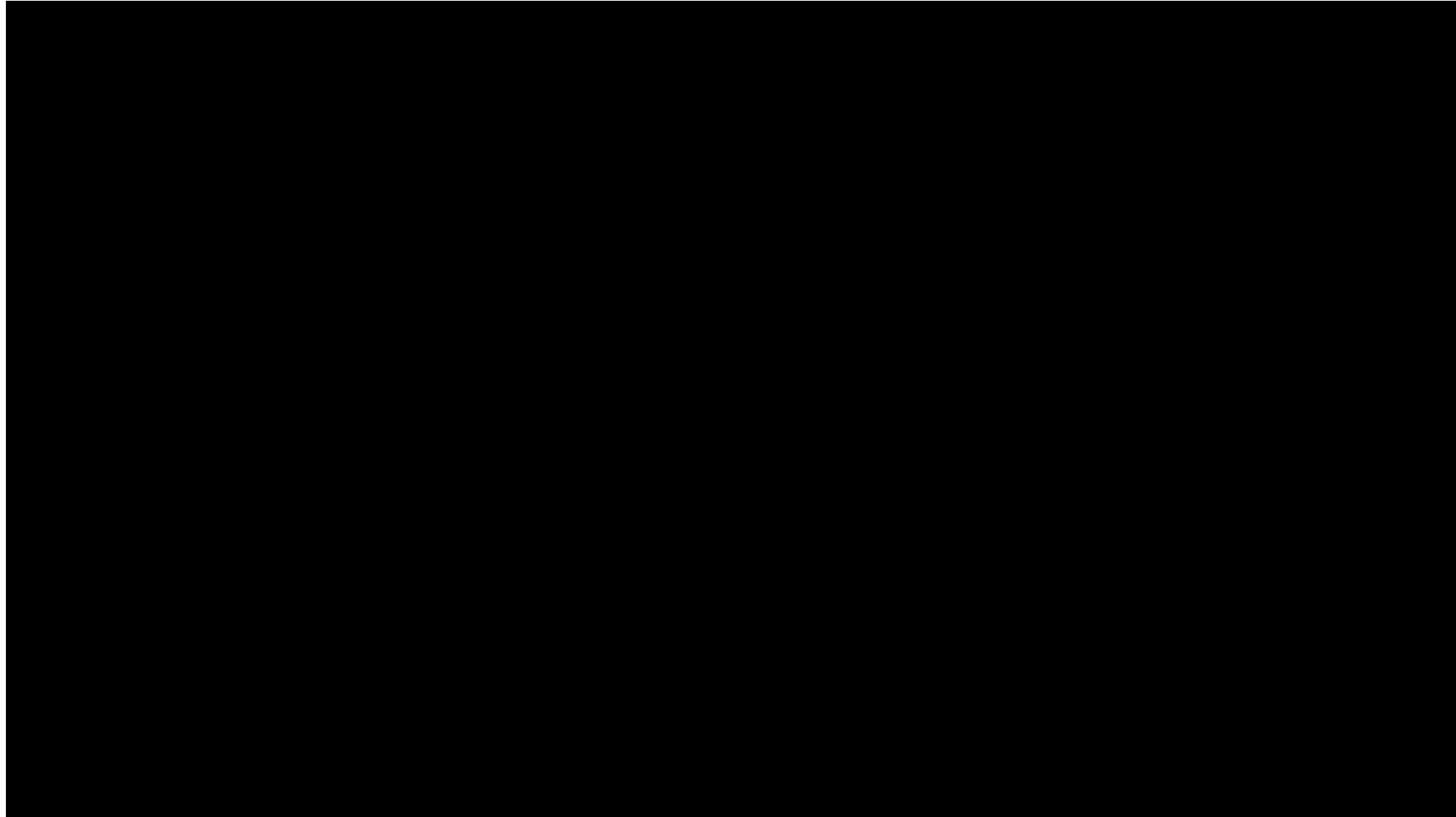
WEIGHT
1741 LBS.

44

LENGTH 48" WIDTH 36" HEIGHT 17 3/4"

 **Fosbel**[®]
CERAMIC TECHNOLOGIES

MICOKAST™ Wall Animation



MICOKAST™ Wall Advantages

- **Ability to install multiple courses at a time, thus saving time and money.**
- **Further reduced mold cost: ~350 shapes v. 4 MICOKAST™**
- **Reduced skilled labor required to install**
- **Just a few mortar joints**

MONOWALL™ Advantages

- **Monolithic wall poured insitu**
- **Eliminates need for brick inventory**
- **Quick turnaround = less production loss**
- **Easy alignment to existing brick work**
- **Manpower cost may be reduced by 30% as compared to conventional re-bricking method**

In Summary

➤ **MICOWALL™**

- ✓ Reduced mold cost (~250 original shapes v. 26 MICOWALL™)

➤ **MICOWALL™ 2.0**

- ✓ Larger shapes/lay multiple courses at a time

➤ **MICOKAST™**

- ✓ Large Modular Shapes

All 3 technologies reduce brick inventory and give repair flexibility.



THANK YOU !

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of coke producers
around the world.*

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