The Masonry Foundation
Grant Application

Project Title:	**Seismic Testing of Adhered Masonry Veneer.** Securing the System during a Seismic Event
Submitted Jointly by:	Ankrom Moisan Architects Kramer Gehlen & Assoc Portland State University Mutual Materials National Gypsum Laticrete International International Masonry Institute Masonry Institute of Washington Masonry & Ceramic Tile Institute of Oregon
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Amount Requested:	**$20,000** (Preferred one installment of $20,000)

Brief Project Summary:
This grant request is written on behalf of the above local, regional and national organizations and companies to request financial assistance to perform seismic shake table testing, produce an independent 3rd party structural report for three adhered masonry assemblies that will provide support and documentation of the structural and aesthetic success of adhered masonry systems for use in code activities and promotion opportunities.

Project Description:
This project involves retaining the consulting services of a Structural Engineer and Portland State University to assist an A/E/C partnership in developing criteria and physical seismic shake table testing provide technical insight for 3 assemblies (2 wood frame, 1 steel frame) fully designed, constructed and tested to identify strengths of adhered masonry systems, regardless of whether the cladding is brick, or manufactured stone veneer.

Project Objective:
The objectives of this project include reports from both Portland State University, a structural engineer, video for use within the masonry industry that will help designers and engineers when choosing a masonry adhered system. Recognizing each project is unique, we will provide follow up resources that have the appropriate information available to help them through the design. Our goal is to provide confidence, technical support and be able to communicate the stability of an adhered masonry system, especially manufactured stone veneer

Many systems have an adhered masonry manufactured stone veneer attachment. It is important for the entire masonry industry to provide documented support that encourages the use of these systems. The masonry industry must provide as much evidence and written documentation as possible to maintain, as well as, increase the current market share.

Our project's goal is designed to assist these professionals by developing a full system support program that competes with our competitors (metal, glass, EIFS, etc.) who have already established this approach in the marketplace. In order to keep pace, we need a unified effort to move our approach from products to systems.

Background and Industry Challenge:

In the west specifically, seismic challenges to the building envelope construction systems have become more complicated due to fire, energy and earthquake building code requirements. Architects continually ask both the product representatives and the masonry institutes how adhered masonry will fair during a seismic event. There is a general lack of knowledge of how the products inter-relate.

We know that current codes spell out a shear strength of 50 PSI as the minimum requirement. We know that the IBC is taking up an amendment to increase it to 300 psi. We know the shearing force exerted by seismic activity is by far the most extreme force that an adhesive must be able to withstand. The shear stress exerted by an earthquake of a magnitude of 7, on the Richter Scale, is approximately 215 psi (15 kg/cm2) so this value is considered the minimum safe shear bond strength of the cladding, adhesive and substrate interfaces.

We also know, virtually all post-earthquake investigations show that the performance of a brick or CMU veneer is determined more by the connection of the anchors to the backing and adherence to proper construction requirements more than to the stresses developed in the anchored brick veneer, aka its more about the movement joints, then the adhesive and substrate interaction.

Laticrete has a technical manual that addresses seismic. ~Direct Adhered Ceramic Tile, Stone, Masonry Veneer, and Thin Brick Facades –Technical Manual~ and can be found here: https://www.laticrete.com.cn/~/media/china/documents/design-manuel/ds0020.ashx?vs=1&d=00010101T000000Z

However, the industry lacks available "science" to point to in order to address the seismic concern that is regularly discussed; and to be able to defend the current codes.

Scope of Project:

Our goal is to prepare a suite of publications, presentations and online resource tools that provides the technical insight to design and construct with adhered brick and manufactured stone veneer that includes specifications, details, YouTube videos and PowerPoint presentations.

The scope of the project will include,

- 3 assemblies (2 wood frames, 1 steel frame) constructed to meet the design as attached (Exhibit A).
    - There will be a total of six specimens: two each consisting of wood frame, weather resistant sheeting, membrane (weather barrier/air barrier), metal lath, Type "S" mortar

scratch coat, Type "S" mortar adhesive, thin brick and manufactured stone veneer These specimens will be labeled "Direct Applied ".

- Two specimens consisting of wood frame, weather resistant sheeting, membrane (weather barrier/ air barrier) 3/8" Drainage matt, cement backer board, adhesive, thin brick and manufactured stone veneer. These specimens will be labeled "Drainage Mat".

- Two specimens consisting of steel frame, weather resistant sheeting, membrane weather barrier/air barrier), 2"x2" galvalume angles @ 16"o.c. with isoclips (or Foriea clips) galvalume @ 16"oc w/ 2" mineral board insulation, ½" Cement backer board, Crack Isolation Membrane (WSS), Adhesive, thin brick and manufactures stone veneer. These specimens will be labeled "Metal Furring".

(Duplicate specimens are required because the shake table only moves in one direction. Therefore, one specimen will be tested in an east to west direction and the duplicate specimen will be placed so that the movement will be diagonal to the east to west direction.)

Deliverables will include:

The structural engineer providing shake table protocol, observing each test, and providing a stamped summary stating which specimens passed or failed and their mode of failure. Portland State University will supply the time lapsed video documenting the actual testing as well as, the structural engineer will record photos as part of their documentation.

Promotion

We will create and develop:

- AIA/CES power point presentations covering the scope identified above for industry to be able to utile for both virtual and in-person presentations.
- AIA/CES Webinar schedule to promote the major applications
- Develop website tools that can be shared by all partners
- Literature development for mail and electronic outreach to all groups

Education

- Incorporate reports and videos into regional universities to teach current engineering and architecture students and provide additional product knowledge.
- Engage with local/regional structural engineers for educational purposes and to support code work
- Train local suppliers to be educators
- Educate mason contractors on expanded bidding options for entire system.

Summary of Qualifications:

Project Oversight - **Harold Friberg,** Executive Director of the Masonry & Ceramic Tile Institute of Oregon has more than 50 years of experience in the construction industry. He has served the MIO for the last three years.

Technical – **Sean Scott, Senior Associate, Ankrom Moisan Architects** - 25 years of experience in building envelope systems for both masonry contemporary and historic buildings, Sean manages projects that include condition assessments for **Ankrom Moisan Architects,** who has offices in Oregon, Washington and California.

Peter Dusicka, PhD, PE Professor, Portland State University has more than 16 years of experience as a professor of Civil and Environmental Engineering at Portland State University. He directs the Infrastructure Testing and Applied Research Laboratory at Portland State University where his research projects are supported by national, state and private sponsors.

Project Development:
Structural Engineer, David Aronson, Associate Principal with Kramer Gehlen & Assoc, Inc. since 1998, and the firm specializes in multi-family housing, schools and retail construction projects.

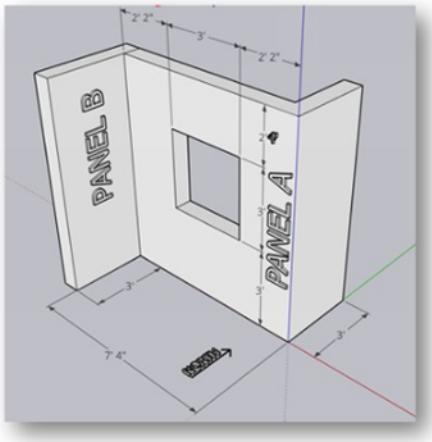
Additional team members involved in this project include:

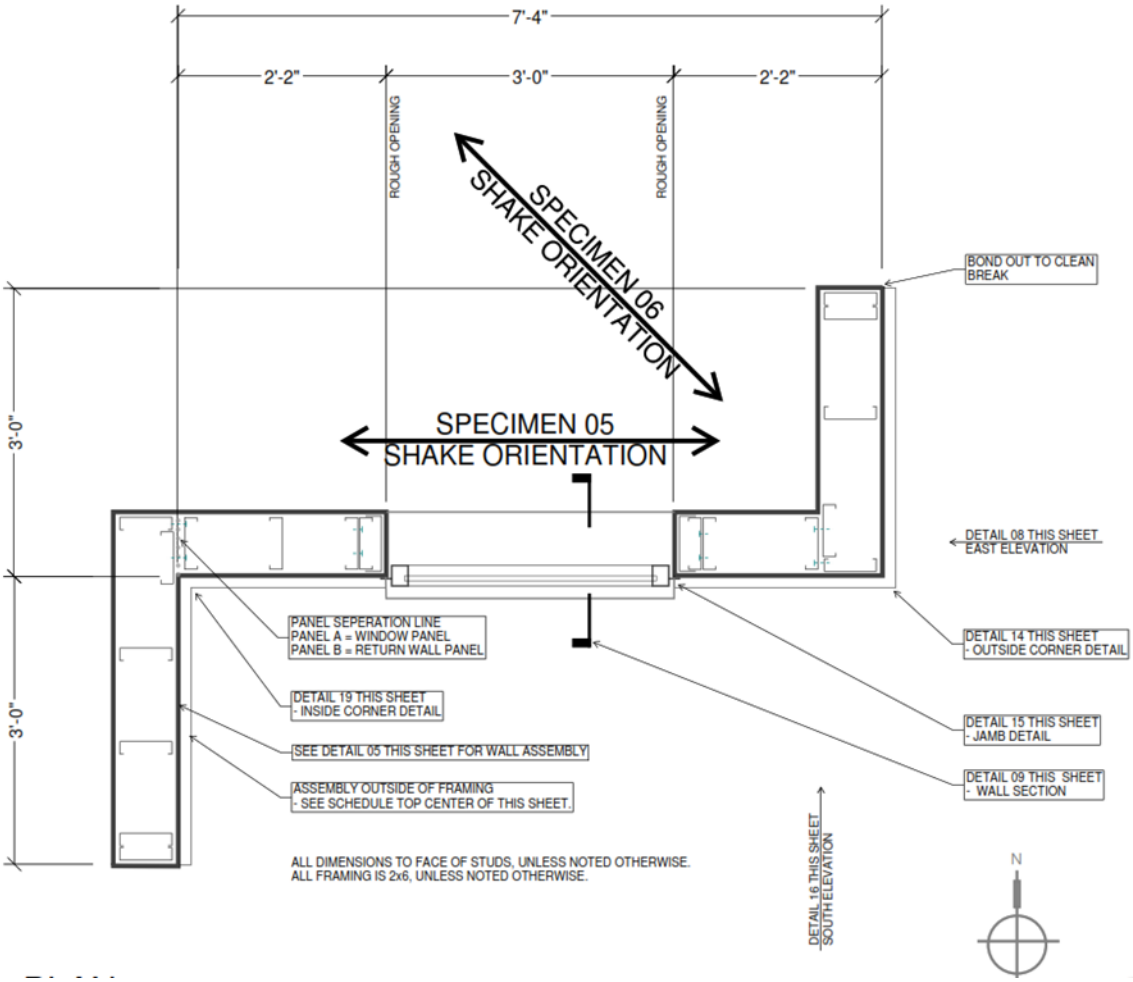
Name	**Title**	**Firm**
Mike Baker	Senior Sales Associate	Mutual Materials
Heidi Clark	Designer Sales	Mutual Materials
Tony Fuller	Product Manager Cement Board	National Gypsum
Robert Duke	Associate Director MVIS	Laticrete International
John Gallup	Technical Sales	Laticrete International

Anticipated Impact for the CMU Industry, Nationally, Regionally, Locally:
Nationally, the industry is dealing with the promotional impacts of promotion by the timber and steel industries. Due to the perceived high costs of masonry on the West Coast, we feel this trend has matured more quickly here. In both the private and public construction arenas, the use of CMU masonry as a traditional structural loadbearing and veneer component is eroding. This trend will continue if we are willing bystanders. To compete, we must offer evidence that adhered masonry component is a viable alternative to our competitors. We must be able to address the seismic concern and be able to push back, with documentation, against unnecessary, overly expensive additional requirements due to a "perception" that our products cannot withstand a seismic event.

The impact to the CMU and Manufactured Stone Veneer industry nationally, regionally and locally could be increased market share by making adhered product more competitive with other products that are currently providing this documentation.

Exhibit A


PANEL B
PANEL A
2' 2"
3'
2' 2"
3'
7' 4"
3'


7'-4"
2'-2"
3'-0"
2'-2"
ROUGH OPENING
ROUGH OPENING
SPECIMEN 06
SHAKE ORIENTATION
SPECIMEN 05
SHAKE ORIENTATION
BOND OUT TO CLEAN BREAK
3'-0"
3'-0"
DETAIL 08 THIS SHEET
EAST ELEVATION
PANEL SEPERATION LINE
PANEL A = WINDOW PANEL
PANEL B = RETURN WALL PANEL
DETAIL 14 THIS SHEET
- OUTSIDE CORNER DETAIL
DETAIL 19 THIS SHEET
- INSIDE CORNER DETAIL
DETAIL 15 THIS SHEET
- JAMB DETAIL
SEE DETAIL 05 THIS SHEET FOR WALL ASSEMBLY
DETAIL 09 THIS SHEET
- WALL SECTION
ASSEMBLY OUTSIDE OF FRAMING
- SEE SCHEDULE TOP CENTER OF THIS SHEET.
ALL DIMENSIONS TO FACE OF STUDS, UNLESS NOTED OTHERWISE.
ALL FRAMING IS 2x6, UNLESS NOTED OTHERWISE.
DETAIL 16 THIS SHEET
SOUTH ELEVATION
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