SEISMIC PERFORMANCE OF INNOVATIVE STRAW BALE WALL SYSTEMS

Pakistan Straw Bale and Appropriate Building (PAKSBAB)
P.O. Box 1083, Truckee, CA 96160
www.paksbab.org

Principal Investigator:
Darcey Donovan, P.E.

Research Associates:
Shannon Whitnack
Surkhab Khan
Bill Donovan

Sponsored by:
Earthquake Engineering Research Institute (EERI)

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ABSTRACT

On October 8, 2005, the northern mountainous region of Pakistan was struck by a 7.6 magnitude earthquake which killed more than 100,000 people and rendered more than 3 million homeless due to unsafe building construction. Modern conventional building methods are largely unaffordable for the poor in developing countries such as Pakistan. As a solution, Pakistan Straw Bale and Appropriate Building (PAKSBAB) is developing unique earthquake-resistant straw bale building methods that are affordable, energy efficient, and utilize locally-resourced renewable materials.

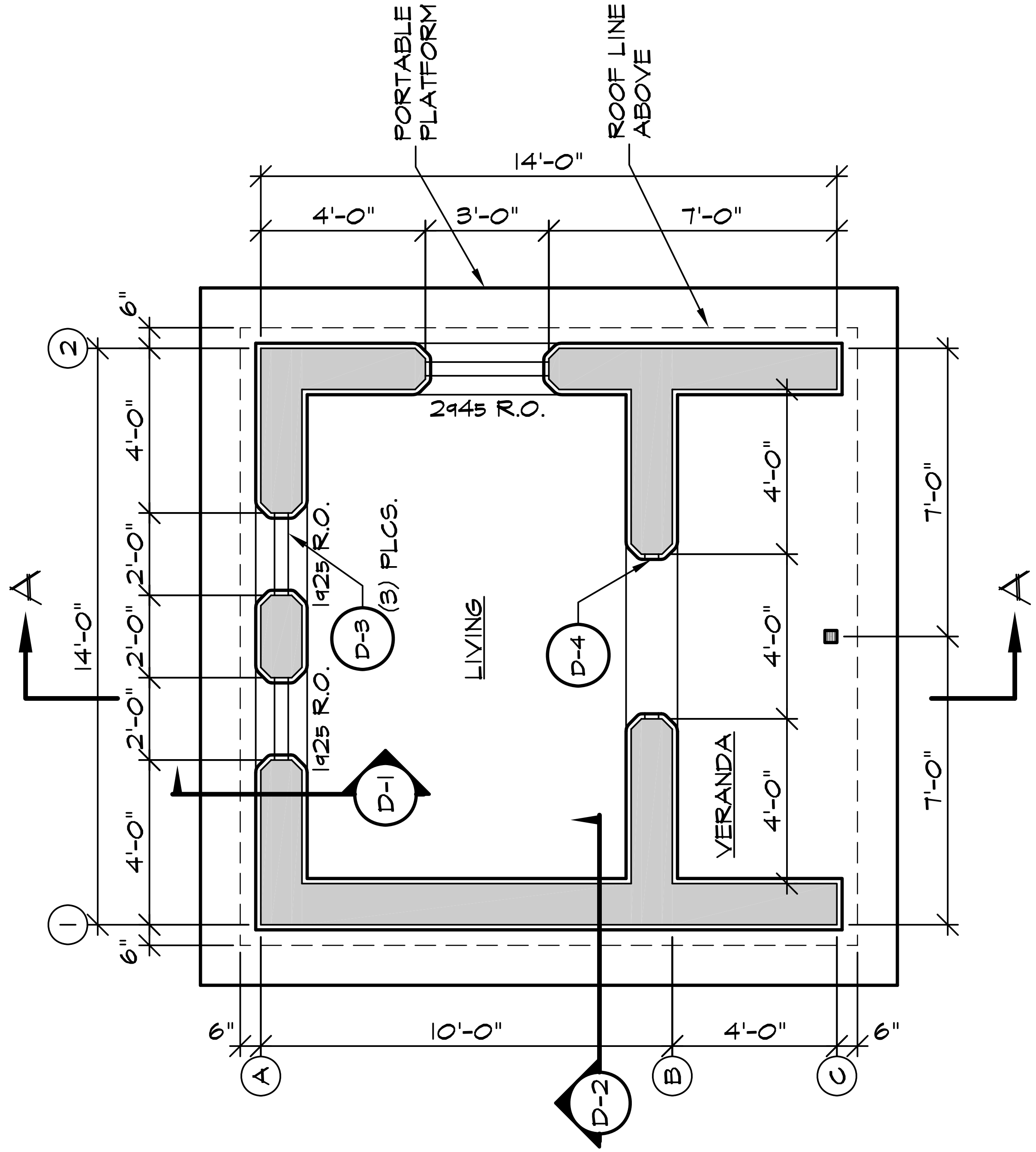
The objective of this research project is to determine the performance of earth plastered, load bearing, thin, straw bale wall assemblies under in-plane cyclic loading, and the performance of a small straw bale house using shake table simulation. The site-fabricated bales are not as wide as those used in a typical straw bale building, and the fishing net reinforcement and gravel bag foundation are non-conventional. Therefore these tests do not duplicate previous work, but rather are necessary to establish the capacity of this unique system. Designated as a shared-use project, the experimental work is being conducted using the NEES facilities at the University of Nevada, Reno (NEES@UNR).

The overall research plan consists of 4 parts:
1. Perform component field tests and material tests.
2. Perform wall assembly tests of varying configurations.
3. Conduct bi-axial shake table tests of a 14’ x 14’ full scale house.
4. Analyze the data and write a detailed report and a set of seismic design and construction recommendations to be published in EERI’s World Housing Encyclopedia.

The objective of this experiment is to assess the seismic response of a 14’ x 14’ full-scale house constructed with heavy detailing. The input ground motion will be the Canoga Park Topanga Canyon record of the 1994 Northridge, California earthquake, Mw 6.7. The house will be subjected to increasing levels of seismic shaking, beginning at 25% of the recorded ground acceleration and increasing at 25% increments until failure.

WALL CONSTRUCTION MATRIX	Wall 1	Wall 2	Wall 3	Wall 4
4' wall length	X	X	X	
8' wall length				X
Light detailing [a)]	X			
Medium detailing [b)]		X		
Heavy detailing [c)]			X	X

[a)] Light detailing: Control specimen without fishing net reinforcement
[b)] Medium detailing: #9 fishing net reinforcement
[c)] Heavy detailing: #12 fishing net reinforcement with additional detailing at foundation



STRAW BALE HOUSE FLOOR PLAN

1/4" = 1'

A-1 DEC. 4, 2008	Pakistan Straw Bale and Appropriate Building POB 1083, Truckee, CA 96160 / www.paksbab.org 0345-9590866 Ph PAK / 530-902-5516 Ph USA	PAKSBAB SEISMIC RESEARCH PROJECT

A-2

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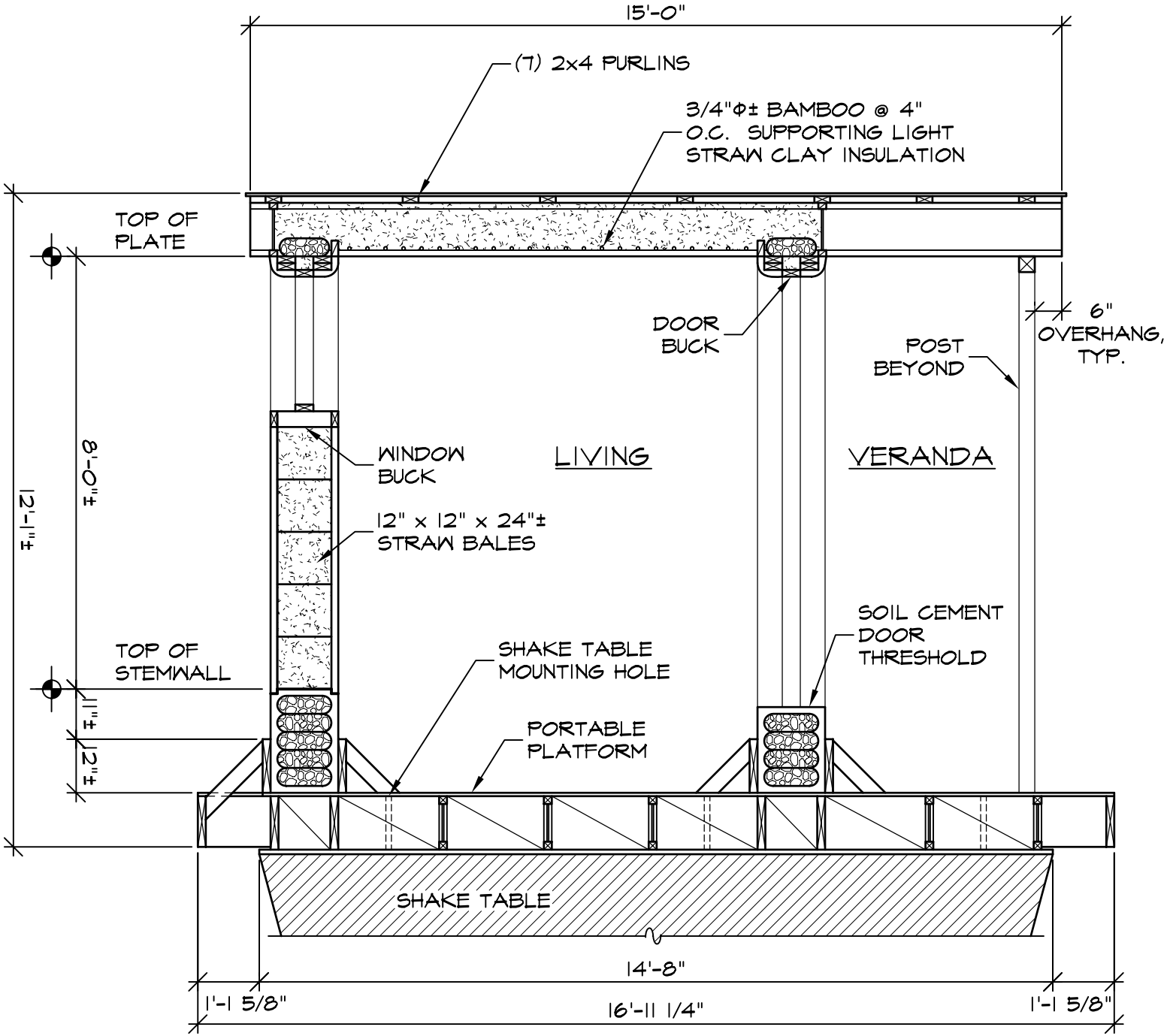
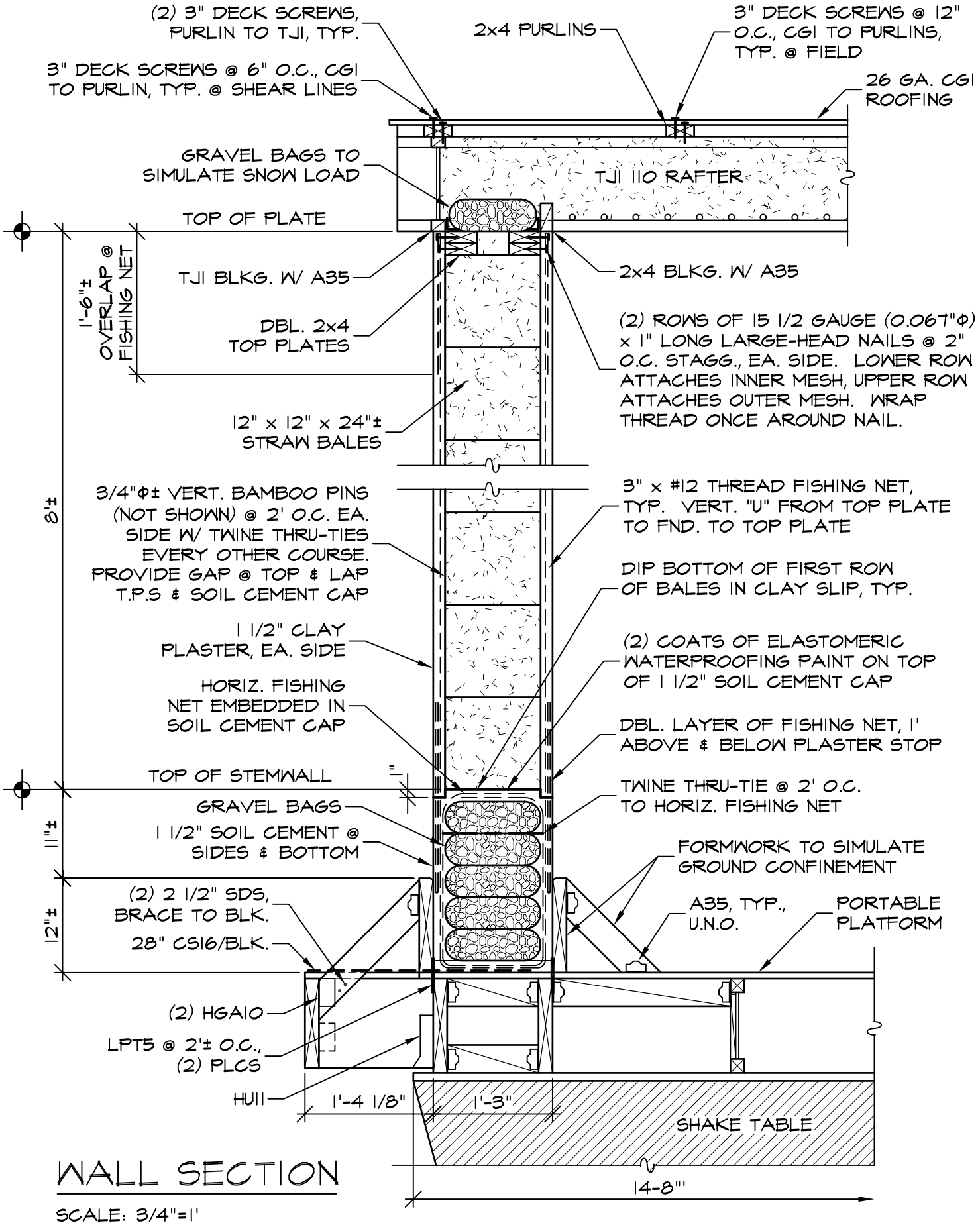
PAKSBAB SEISMIC RESEARCH PROJECT



SECTION A

3/8" = 1'



WALL SECTION

SCALE: 3/4"=1'

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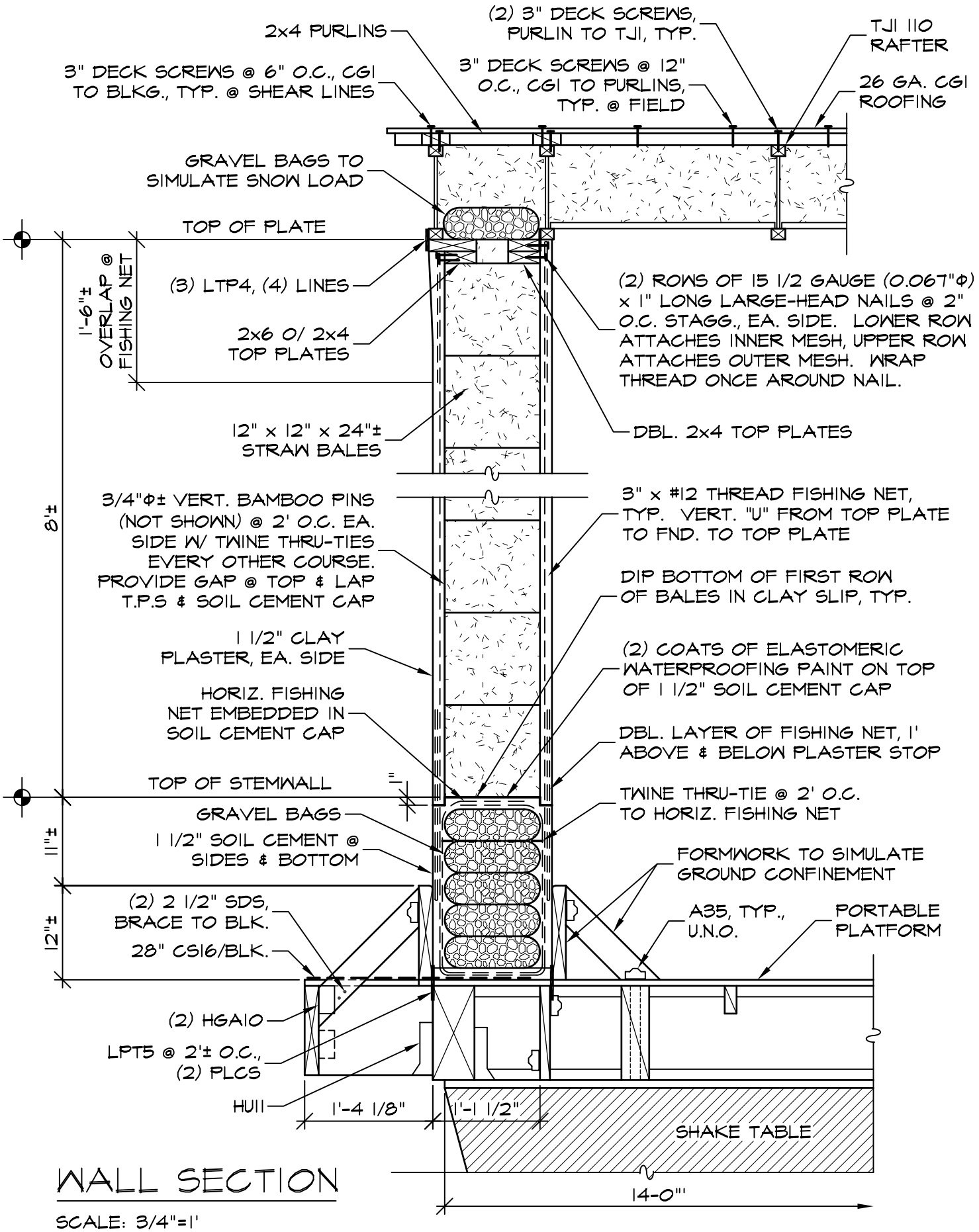

WALL SECTION

SCALE: 3/4"=1'

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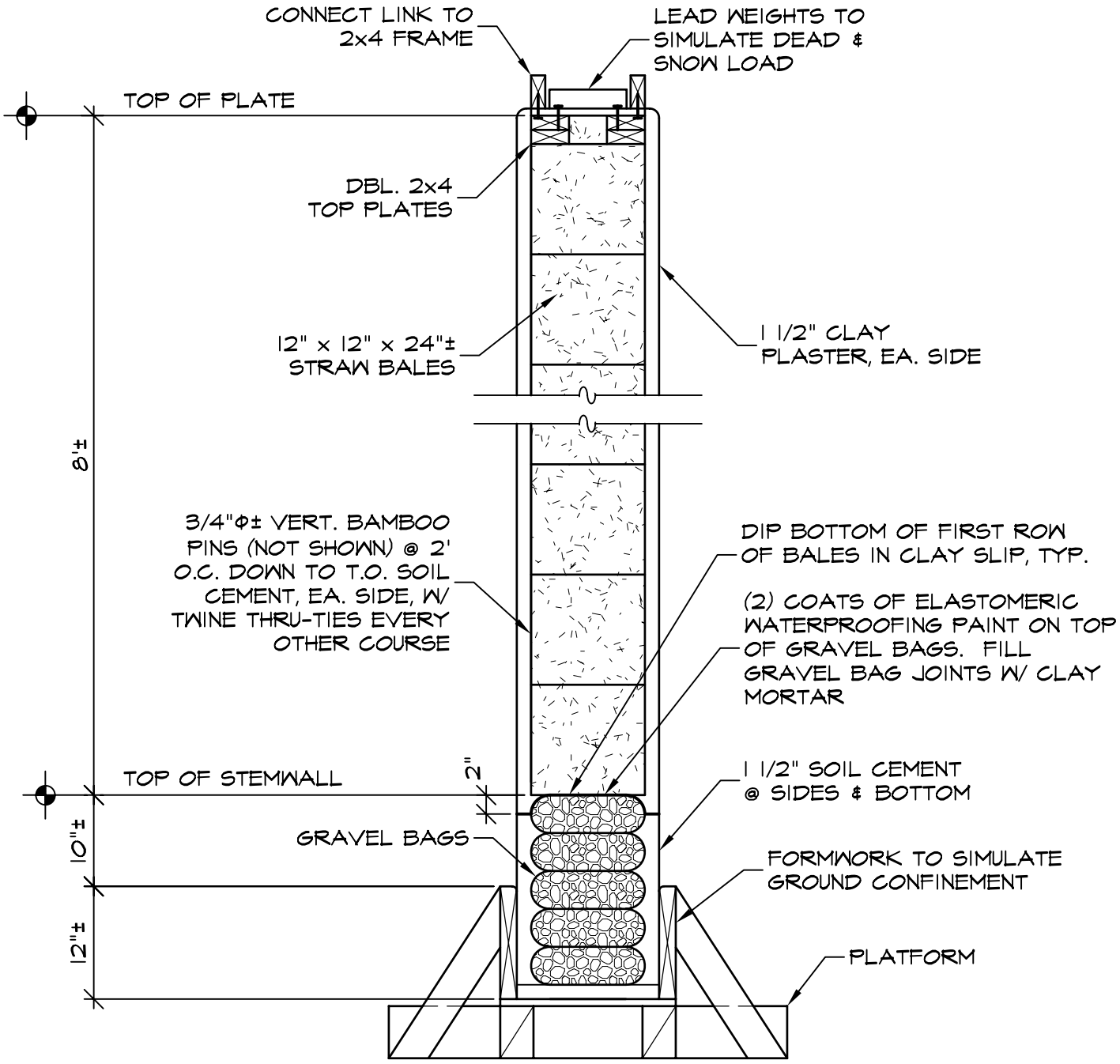
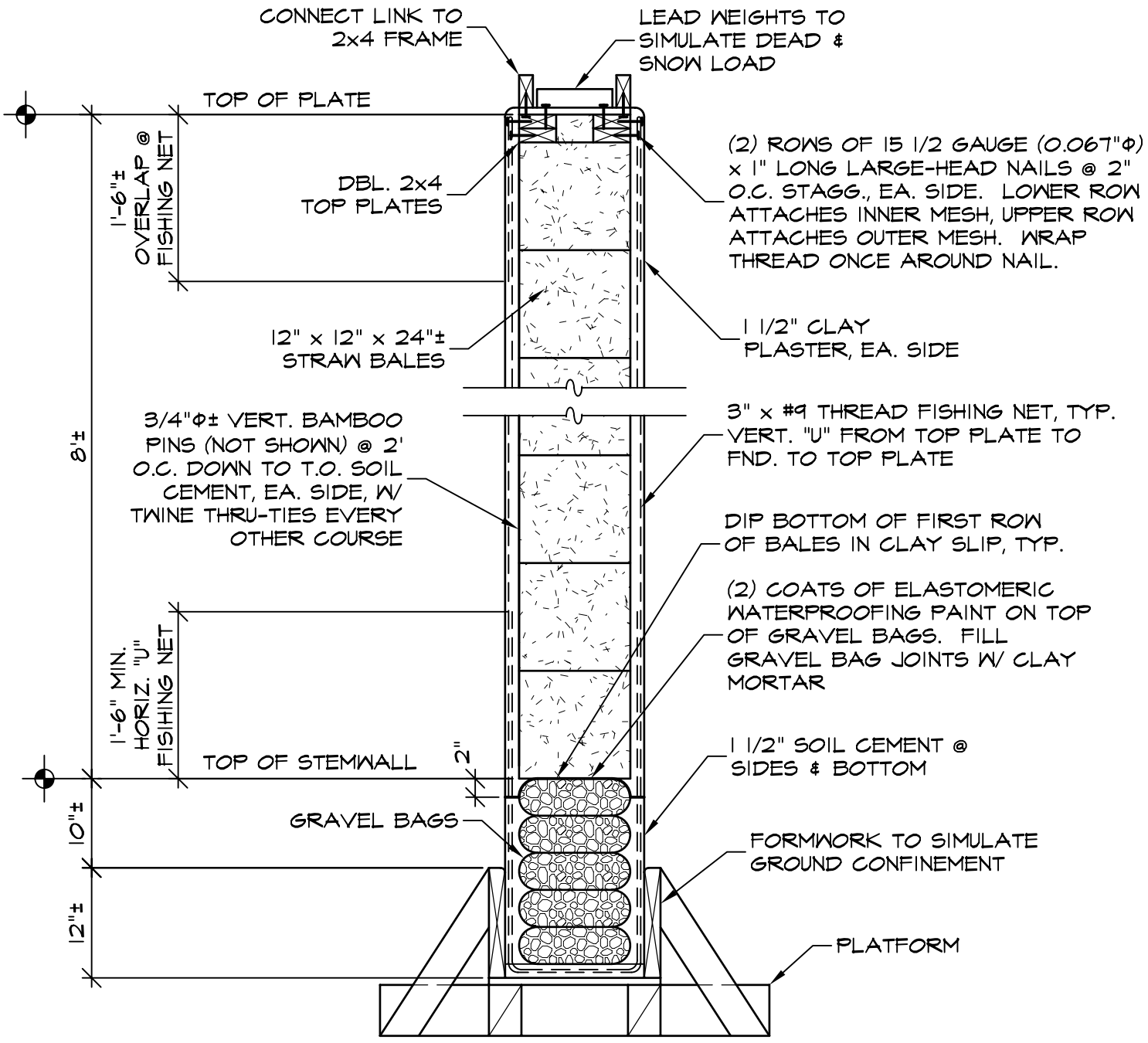


NOTES:
1) TRIM BALES AND FILL VOIDS WITH LIGHT STRAW CLAY BEFORE PLASTERING.
2) LIGHTLY MOISTEN THE SURFACE WITH WATER BEFORE EACH COAT OF PLASTER.
3) WORK THE FIRST COAT OF PLASTER DEEPLY INTO THE STRAW.

WALL SECTION W/ LIGHT DETAILING

SCALE: 3/4"=1'

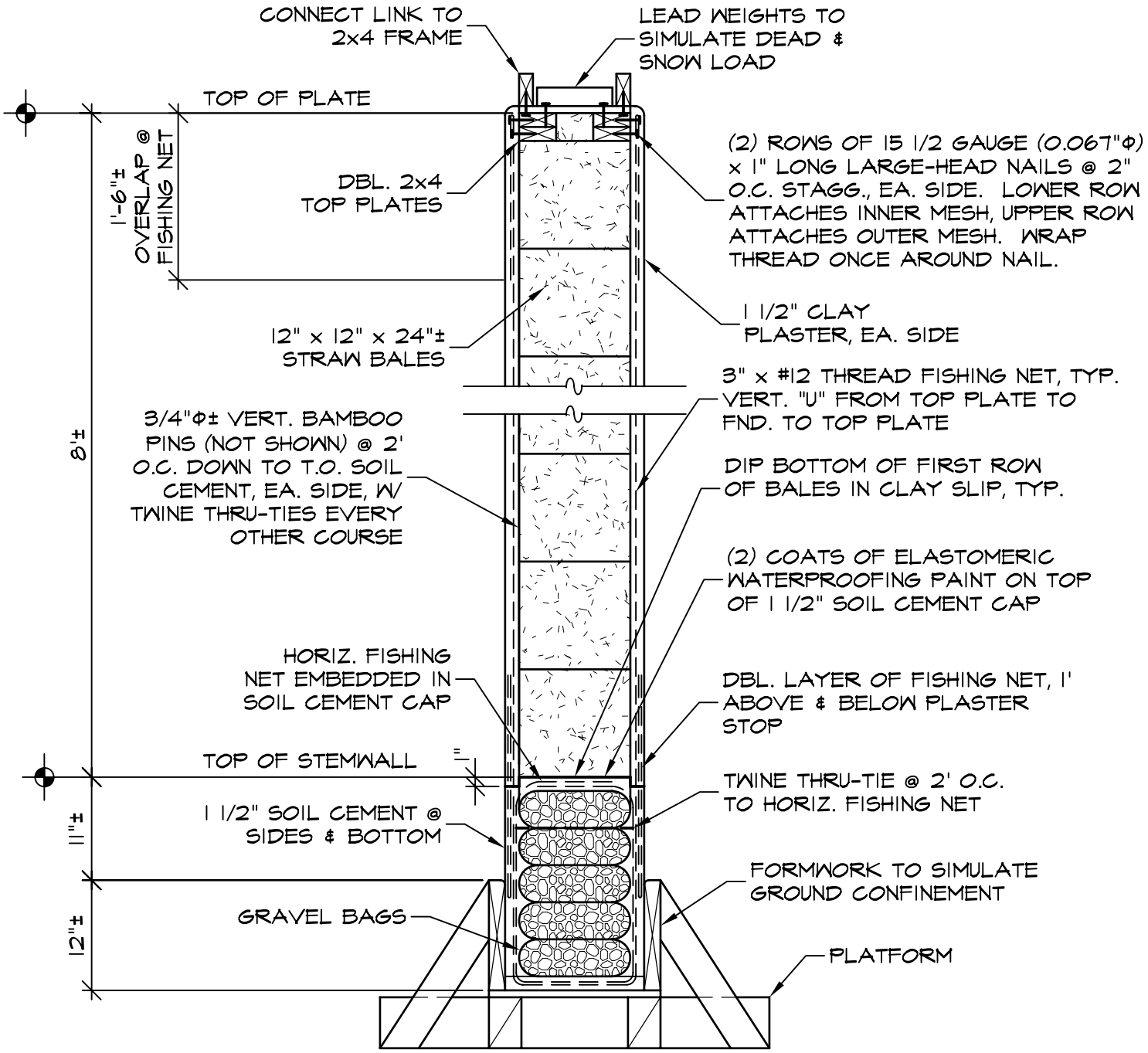


NOTES:

1) 1' MIN. FISHING NET LAP, TYP. SPREAD & PIN FISHING NET TO BALES WITH STEEL LANDSCAPE PINS OR SIM.
2) TRIM BALES AND FILL VOIDS WITH LIGHT STRAW CLAY BEFORE PLASTERING.
3) LIGHTLY MOISTEN THE SURFACE WITH WATER BEFORE EACH COAT OF PLASTER.
4) WORK THE FIRST COAT OF PLASTER DEEPLY INTO THE STRAW.

WALL SECTION W/ MEDIUM DETAILING

SCALE: 3/4"=1'



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2) TRIM BALES AND FILL VOIDS WITH LIGHT STRAW CLAY BEFORE PLASTERING.
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WALL SECTION W/ HEAVY DETAILING

SCALE: 3/4"=1'

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