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Performance of cold-formed steel framed structures under extreme events: Seismic, fire and blast

Cold-formed steel (CFS) framed construction can offer considerable economic and performance advantages for certain structures subject to extreme events such as seismic, fire, and blast. Examples include mid-rise buildings in high seismic regions such as the western United States, and blast resistant modules (BRMs) for protection of personnel and equipment against accidental and man-made explosive threats. Structural systems of this type consist of light-gauge framing (e.g. studs, tracks, joists) attached with sheathing materials (e.g. composite panels in the form of gypsum or other cement-based material bonded to a layer of sheet steel). CFS-framed structures can lead to lower installation and maintenance costs than other structural types, particularly when erected with prefabricated assemblies. They are also durable, formed of an inherently ductile material of consistent behavior, light weight, and can be manufactured from recycled materials. Compared to other lightweight framing solutions, CFS is non-combustible, an important characteristic to minimize fire spread. Although CFS-based structural systems offer potential advantages, the state of understanding regarding their behavior in response to extreme events, such as those noted previously, remains relatively limited. In an effort to improve this situation, a series of research collaborations, led by the University of California, San Diego (UCSD), between academia, government and industry were formed and two major programs were executed. In one, a full-scale six-story CFS wall braced building was constructed and subject to earthquake and fire testing via the world's largest outdoor shake table- the Large High Performance Outdoor Shake Table (LHPOST) at UCSD. In the other, CFS-based BRMs were fabricated and subject to blast events via UCSD's unique Blast Simulator and full-scale live explosive field tests. This keynote address describes these programs and their results.

Biography

Gilbert A Hegemier received his PhD from the California Institute of Technology (Caltech) in Solid Mechanics and Structures. He currently serves as Distinguished Professor of Structural Engineering at the University of California, San Diego (UCSD) where he initiated the formation of the Department of Structural Engineering, guided the development of UCSD's unique large-scale test facilities, and there he also serves as Associate Director of the Center for Extreme Events Research (CEER). His research areas include large-scale laboratory experiments, field testing, and computational analysis of civil structures subject to dynamic loading events such as blast, impact, and seismic. He has published over 100 journal papers on these topics and is an internationally recognized expert on protective technologies for civil structures.

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