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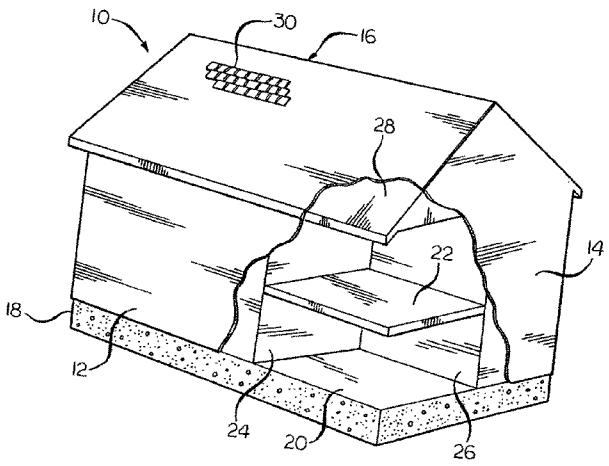

(57) Abstract: A wood sheathing panel, suitable for use in building construction, includes reinforcement strips of fiber reinforced polymer material incorporated into the panel. The reinforcement strips cover an area that is within the range of from about 5 to about 50 percent of the surface area of the panel. The reinforcement strips of fiber reinforced plastic material can be incorporated in the perimeter of the panel, or can be incorporated into the corners of the panel. The spacing of the intermittently incorporated reinforcement strips can generally coincide with a standard spacing of framing members so that when the wood sheathing panel is applied to a building frame, the reinforcement strips are generally aligned with framing members of the building. Preferably, the reinforcement strips are sufficient to provide an increased ductility over an equivalent unreinforced wood sheathing panel in an amount within the range of from about 75 percent to about 500 percent. A plurality of the wood sheathing panels of the invention can be assembled together in building construction (10) as one element of a group consisting essentially of shear walls (12, 14, 24, 26), horizontal diaphragms (20, 22) and roof diaphragms (28).

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WOOD COMPOSITE PANELS FOR DISASTER-RESISTANT CONSTRUCTION

BACKGROUND OF THE INVENTION

This invention relates in general to panels useful in making strengthened wood-frame construction so that the construction has increased resistance to high wind, earthquake and blast loadings.

A very common wood frame construction method uses wood or steel studs or wood or steel framing with plywood or Oriented Strand Board (OSB) sheathing panels or stucco sheathing. The framing/sheathing combination forms shear walls and horizontal diaphragms which resist horizontal and vertical loads applied to the structure. This form of construction is used in the majority of single family homes in the United States, as well as a significant portion of multi-family, commercial and industrial facilities.

While the system has generally performed well, the economic losses in the United States due to natural disasters, such as hurricanes, earthquakes and tornadoes, have been mounting. The economic losses caused by these natural disasters in the United States has averaged about $1 billion/week in recent years. Most of these losses are due to hurricanes (80%) and earthquakes (10%). For example, the loss of roof sheathing under hurricane winds has often been attributed to improper fastening of the sheathing to the framing, such as by the use of larger nail spacing than allowed by code, nails missing the support framing members, or over-driven nails. Inadequate panel-to-framing nailing schedules do not allow the full shear strength of the panel to be developed, resulting in premature failures of shear walls, possibly leading to severe damage or collapse of the structure. Loss of sheathing in hurricanes weakens the roof structure and can lead to roof failures. The water damage resulting from a loss of roof sheathing or roof failures has been a major contributor to economic losses in hurricanes. Surveys also show that a significant portion of the damage resulting from

hurricanes or earthquakes occurs in nonstructural parts of the home due to excessive deformation or movements of the structure. The cost to repair nonstructural damage often makes it necessary to rebuild the structure rather than to repair it.

While the knowledge to mitigate hurricane and earthquake damage exists today, building code provisions are often misunderstood by builders, and compliance with regulations is difficult to enforce because of the difficulty of inspecting in the field. As a result, surveys show that a significant portion of the damage to homes and property caused by natural disasters is due to lack of conformance to codes. Improper connections between walls at building corners, such as non-overlapping top plates or improper or missing hold-downs to tie the shear walls to the foundations, are further examples of poor construction practices that are difficult to inspect.

Therefore, there is a need for easy-to-manufacture, inexpensive construction panels suitable for providing a strengthened and stiffened construction for improved resistance to high wind loadings, and increased ductility and energy dissipation capacity to reduce earthquake damage. The construction panels should increase the strength and ductility of wood buildings and reduce the deformation of the buildings to limit damage to non-structural members.

SUMMARY OF THE INVENTION

The above objects as well as other objects not specifically enumerated are achieved by a wood sheathing panel, suitable for use in building construction, that includes reinforcement strips of fiber reinforced polymer material incorporated into the panel. The reinforcement strips cover an area that is within the range of from about 5 to about 50 percent of the surface area of the panel.

In a specific embodiment of the invention, the reinforcement strips of fiber reinforced plastic material are incorporated in the perimeter of the panel. In another specific embodiment of the invention, the reinforcement strips of fiber reinforced plastic material are incorporated into the corners of the panel.

In another specific embodiment of the invention, the spacing of the intermittently incorporated reinforcement strips generally coincides with a standard

spacing of framing members so that when the wood sheathing panel is applied to a building frame, the reinforcement strips are generally aligned with framing members of the building.

According to this invention, there is also provided a plurality of wood sheathing panels assembled together in building construction as one element of a group consisting essentially of shear walls, horizontal diaphragms and roof diaphragms, where the wood sheathing panels are suitable for use in building construction, and include reinforcement strips of fiber reinforced polymer material incorporated into the panel. The reinforcement strips cover an area that is within the range of from about 5 to about 50 percent of the surface area of the panel.

Various objects and advantages of this invention will become apparent to those skilled in the art from the following detailed description of the preferred embodiment, when read in light of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic plan view of a building and roof incorporating the wood sheathing panels of the invention.

Figure 2 is a schematic plan view of a panel assembly of two wood sheathing panels of the invention, indicating how the panels react to a lateral stress load.

Figure 3 is a schematic plan view of a wood sheathing panel of the invention, showing corner tear-out in a panel.

Figure 4 is a schematic plan view of a wood sheathing panel having reinforcement strips incorporated into the perimeter of the panel according to the invention.

Figure 5 is a schematic plan view of a wood sheathing panel having reinforcement strips in a truss arrangement according to the invention.

Figures 6-8 are schematic plan views of a wood sheathing panel having reinforcement strips in the corners according to the invention.

Figure 9 and 10 are schematic plan views of a wood sheathing panel having reinforcement strips incorporated intermittently into the panel according to the invention.

Figure 11 is a schematic cross-sectional view of a portion of a wood sheathing panel, illustrating reinforcement strips incorporated into the interior of the panel according to the invention.

Figure 12 is a schematic cross-sectional view of a portion of a wood sheathing panel, illustrating reinforcement strips incorporated onto the major surfaces of the panel according to the invention.

Figure 13 is a schematic cross-sectional view of a portion of a wood sheathing panel, illustrating reinforcement strips incorporated into the interior of the panel, positioned at various and different angles to the edges of the panel according to the invention.

Figure 14 illustrates a pure in-plane shear test being performed on a panel of the invention.

DETAILED DESCRIPTION OF THE INVENTION

In general, this invention consists of a simple and effective design for reinforcing wood sheathing panels that can be used to strengthen conventional wood construction and increase its resistance to loading from blasts of various types, from earthquakes, and from high winds such as generated by tornadoes or hurricanes. The wood sheathing panels of the invention can be used with either wood, wood composite or steel framing. The wood sheathing panels of the invention, which can be for example fiber-reinforced Oriented Strand Boards (hereinafter "OSB") or plywood panels, significantly improve the disaster resistance and lower the ownership cost of conventional wood-frame construction. The invention involves incorporating synthetic fibers or fiber reinforced polymer (also known as fiber reinforced plastic), both hereinafter referred to as "FRP strips" and also as "reinforcement strips") into wood sheathing panels used to build a structure or building to enhance the resistance of the structure to earthquakes and high winds from hurricanes and tornadoes. For

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