

A Short Lesson in Building Effective Shutters

Additional information and illustrations available at: <http://www.aoml.noaa.gov/hrd/shutters>

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With the current increase in Atlantic hurricane activity that began in 1995², a new focus needs to be placed on the issue of preparedness. Although hurricane-track forecast errors have been decreasing on the average (i.e., forecasts have been improving), the accuracy still leaves much to be desired. In addition there are major problems with hurricane intensity forecasts. Even if residents have perfect track and intensity forecasts, however, they still need to understand how to respond to the danger posed by an approaching hurricane. Obviously, there are certain cases when evacuation is the only effective answer such as sub-standard housing (mobile homes, huts, etc.) which would be easily destroyed by the winds and areas affected by deadly storm surge (or even rain produced) flooding. Well-built structures still need the added protection of hurricane shutters, however. Without shutters, substantial damage can still be experienced even if the main structure is not affected due to window breakage and the intrusion of the hurricane winds and rain into the building. Well-designed shutters can result in substantially reduced damages. There are a number of commercial shutters on the market and various hand-made plywood designs. It is important for the public to become informed about which types of shutters are the most effective. Obviously, the more effective types of shutters need advanced preparations. It is oftentimes difficult or impossible to obtain the materials and to construct or install the shutters after a hurricane watch or warning is already in place.

What are the best shutters? The best kind are those that are affordable, are easy to install, and offer the greatest protection. Which of these properties is most important depends on individual circumstances. For a disabled or elderly person it may be ease of installation with either an automatic closing mechanism or accordion type shutters. For those with limited incomes plywood shutters may be the only affordable option. For most people the best compromise would be steel panels, which offer good protection, but are certainly more expensive than plywood. The most worthless type of protection is the often employed use of various types of tape over the windows. This practice does little or nothing to prevent breakage, may result in large, more dangerous pieces of flying glass, and is extremely difficult to remove after the storm. Some people are experiencing a certain level of protection by covering their windows with special impact resistant protective film. Others are using a new type of impact-resistant storm window. Various types of commercial storm shutters can be effective but many are untested and have been found to fail in stronger hurricanes (e.g., Hurricane Andrew in 1992). Miami-Dade county (Florida) now requires that all commercial shutters pass rigorous tests before they can be approved for sale and installation. It is recommended that commercial shutters are not used that have not passed these types of tests. The shutters range from the most inexpensive (but still highly effective) metal corrugated panels type -- aluminum or steel (heavier but stronger!) to electrically operated roll-down shutters, also effective if properly constructed.

¹ Some information is from "**What About Shutters**" (National Hurricane Center/NWS/NOAA)

² <http://www.noaanews.noaa.gov/stories/s682.htm>

Many people, however, cannot afford any type of commercial shutter. Most resort to using plywood attached to the structure using various types of methods. The least effective method, used by many people with minimal time to prepare, is to let the plywood overlap the window opening and attach it to the structure using concrete nails. This technique can cause more harm than good since in even moderately high winds, most of these poorly-attached boards will be ripped off and become dangerous flying missiles! The most publicized method is to cut the board to overlap the window opening and then use tapping screws through the wood fastened into lead sleeve anchors in the wall. Although better than the first method, many boards attached using this technique have failed in the more intense hurricanes. If the windows have at least a 2-inch inset there is a much more effective technique to use with plywood. Plywood shutters made with this second technique performed extremely well even in the maximum winds of Hurricane Andrew when it hit South Miami.

Most people can construct this special type of plywood shutter with only reasonable effort and cost. The basic concept is that the wood is cut to fit inside the inset of the window and is fastened to the windowsill using barrel bolts. The design is effective for two main reasons. Firstly, because the wood is recessed, the hurricane winds cannot get under the wood. Secondly, because the wood is fastened perpendicular to the force of the wind (both the forces that try to push the shutter into the house and the forces that can work to suck the shutter away from the structure) it is far more difficult for the wind to pull the fasteners out from the structure. Figures describing this design are included at the end of this summary. Note that there are other, equally effective, attachment methods for this particular technique. The main characteristics need to be that the wood fits inside the inset and that the fastening is into the inset (windowsill).

A few basic comments on the construction of these plywood shutters....

- 1) Use 5/8 or 3/4 inch exterior grade plywood and 3- or 4-inch heavy duty barrel bolts.
- 2) For a small or medium size window, only four barrel bolts are needed -- one for each side or two each on the left- and right-hand sides. Large windows need additional bolts. A good rule of thumb is to use one bolt every two feet or so.
- 3) A good fit is important for the window to be protected. Some window frames may not be square, so be sure to carefully measure each side and corner angle and cut the plywood to fit. (Some planing of the wood might also be needed.) It is helpful to mark which side of the panel is on top, and which side should face out. Also write on the panel which window or door it is meant to cover.
- 4) Screw the barrel bolts to the panel, place the plywood up against the window, and mark where each barrel bolt slides up against the wall. Once the marks have been made, remove the panel and drill the bolt holes into the window recess. Use a drill bit *just large enough* to accommodate the bolt. (The fit will be tight enough that a gentle tap with a hammer is usually needed to fasten the bolt.)
- 5) For panels covering very large areas (such as sliding glass doors) you can connect additional pieces of plywood with 2x4's (or even a full-length piano hinge to make the panel easier to fold, handle, and store).
- 6) Once your panels are done you may waterproof them with a coat of varnish or paint.

Which ever type of shutter is selected, it is important to remember that shutters are only as good as the quality of their installation. Also, no shutter can fully compensate for a poorly constructed house, an unprotected garage or various large objects that can impact homes and other structures during a major hurricane. *But*, the **higher** the degree of preparation, the **greater** the probability that damage will be minimized!



Barrel Bolt Plywood Shutters Schematic

