
PARTITION SEPARATION

Partition separation or seasonal truss uplift is a problem that began in the 1970's when standards for insulation of attics were revised. Attic insulation levels were increased to the point where the bottom chords of trusses were buried in insulation and placed in a substantially different environment than the top chords. In cold weather, the top chords of the trusses could take on moisture while the bottom chords remained warm and dry. The top chords expanded longitudinally resulting in uplift of the roof trusses and a separation between the drywall on the ceiling and the top of the partitions. As outdoor temperatures increased, top chord moisture contents decreased and the trusses returned to their original position.

When wood trusses are manufactured they are constructed with kiln dried lumber that has a moisture content of approximately 19%. After the attic has been insulated, wood in the various members of the truss will reach some equilibrium moisture content where, under those particular conditions, no moisture is moving into or out of the material. Bottom chords of trusses that have been in service for a few months will have an equilibrium moisture content of approximately 10 or 11% and will normally maintain that moisture level throughout the year. The top chords of the trusses will normally have a similar equilibrium moisture content during the summer but during colder winter weather their moisture content will increase substantially and will often move back up into the 17 to 18% range. The final moisture content level during cold winter months will depend first of all on how much moisture is moving into the attic space and secondly how well the attic is ventilated to move moisture out of that space.

The potential for a partition separation problem in a particular building can be affected by a number of conditions:

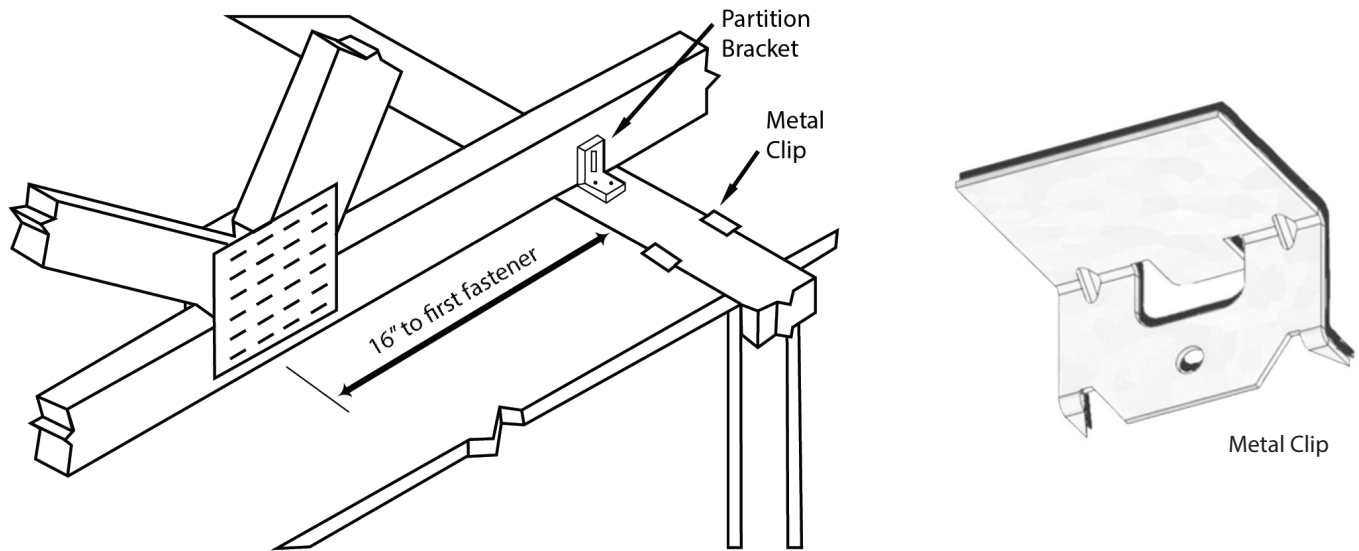
1. The quality of the ceiling vapor barrier that is installed to prevent moisture movement into the attic from the living space is a very important consideration in preventing this problem. Any discontinuities in the vapor barrier will greatly increase moisture flow into the attic during cold winter weather. The greatest potential for leaks occurs where electrical or mechanical equipment passes through the ceiling. These include light fixtures, chimneys, plumbing stacks and attic hatches. Openings can also occur where drywall sheets are trimmed in place with a knife that penetrates the vapor barrier.
2. Despite the best efforts of the builder, some moisture can move into the attic space. Thus the ability of the attic ventilation system to move moisture laden air out of the attic space is very important. Proper intake and exhaust vents are critical.
3. The design of the ventilation system for residential bathrooms is an important consideration because it is possible to have exhaust air moved out through the attic space and exhausted at the under eave soffits in such a way that this warm moisture laden air will return to the attic through the intake vents. Clothes dryer vents can be a source of moisture if located too close to attic air intakes. Gas fired radiant heaters in garages can also deliver significant quantities of moisture to the attic space where exhaust vents are similarly located.
4. Occasionally a residence will be constructed and a family will move in before the ceiling in an attached garage has been installed. In this case, if the attic space above the garage is not separated from the attic space above the living area, there can be substantial movement of moisture from the garage to the main attic. Each time the doors is opened between the residence and the garage a substantial quantity of warm moisture laden air can rise into the attic during cold winter weather. A vehicle running in or near the garage will also exhaust substantial quantities of water vapor that may rise into the attic.
5. Partition separation can also occur during cold weather construction when open flame propane heaters are used for temporary heating after the ceiling material has been installed. Combustion of propane produces carbon dioxide and large quantities of water vapor. Additional moisture from curing concrete may add to the moisture load in the space. If partition/ceiling drywall joints have not been taped at this stage, no damage will occur should the roof trusses move upward from the interior partitions. Gaps between the ceiling and partitions will close when this moisture load is removed during warmer weather.
6. The potential for partition separation is greater for longer span trusses with larger top chords having a greater volume of top chord material available to absorb moisture. In some cases with relatively wide buildings requiring long roof trusses it may be possible to incorporate intermediate load bearing walls with the roof trusses designed in two sections that bear on a common bearing wall. This is a recommended type of design for multi-unit residential buildings.

SOLUTIONS FOR NEW CONSTRUCTION

No practical economic method of preventing partition separation or truss uplift has been developed despite some attempts involving such things as the application of coatings to top chords to limit moisture movement into the material. Attempting to tie roof trusses down to prevent movement is not recommended. The forces involved can be very high, resulting in upward movement of partitions creating gaps at the bottom rather than the top.

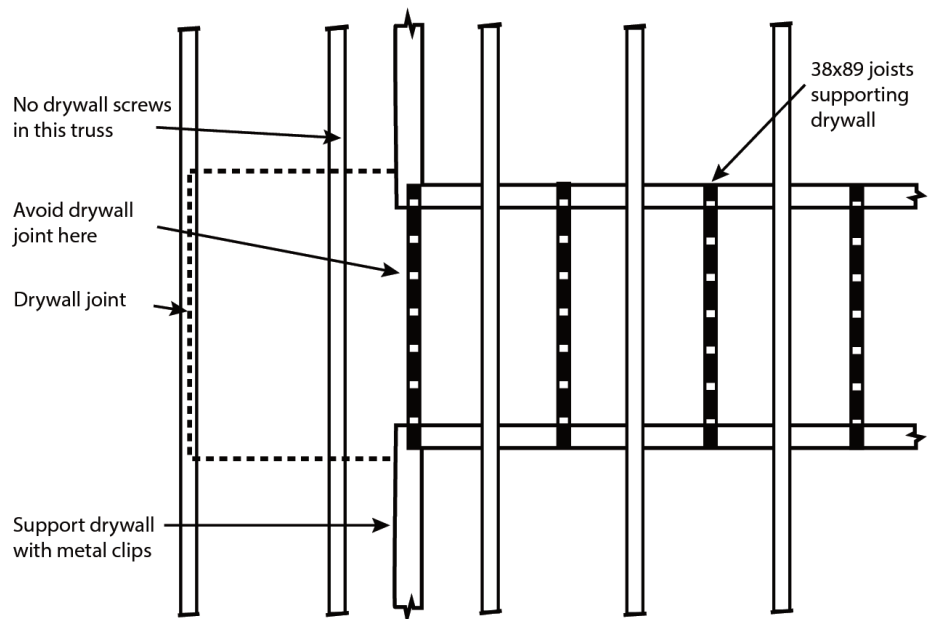
With no practical method available to prevent the movement, it is necessary to develop design details that permit the movement to occur without damaging the interior finish of the building. For walls and ceilings finished with drywall, some steps can be taken at the drywall application stage to prevent separation at the wall/ceiling joint by floating the corners. This involves:

- Using brackets with vertical control slots to connect the trusses to the top plate of the partitions.
- Holding the ceiling drywall screws back approximately 400mm from the partitions.
- Connecting the ceiling drywall to the top plate with metal clips spaced at approximately 600mm.



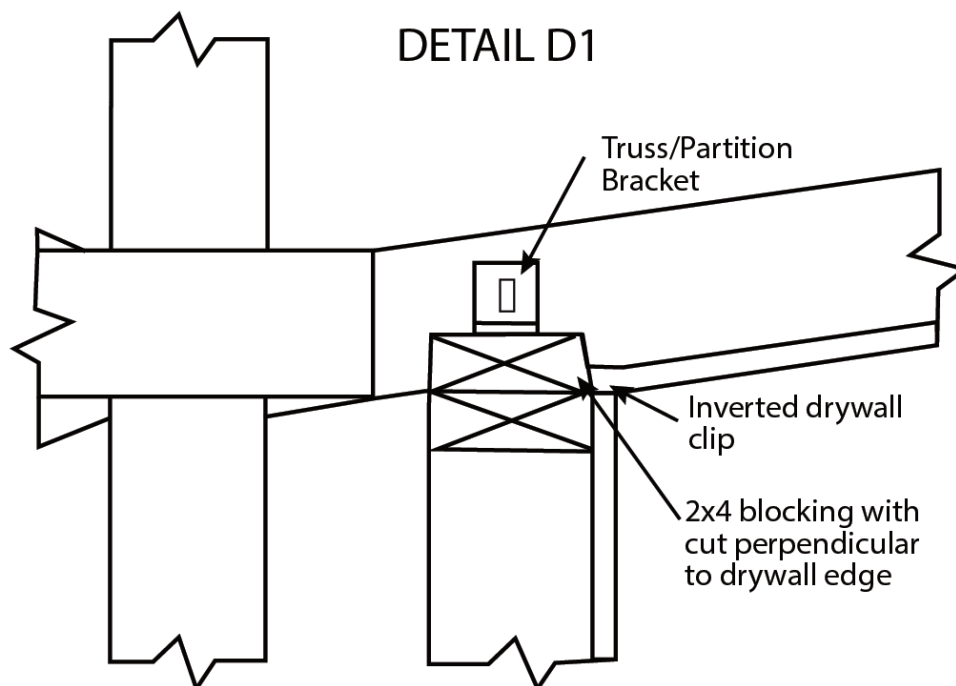
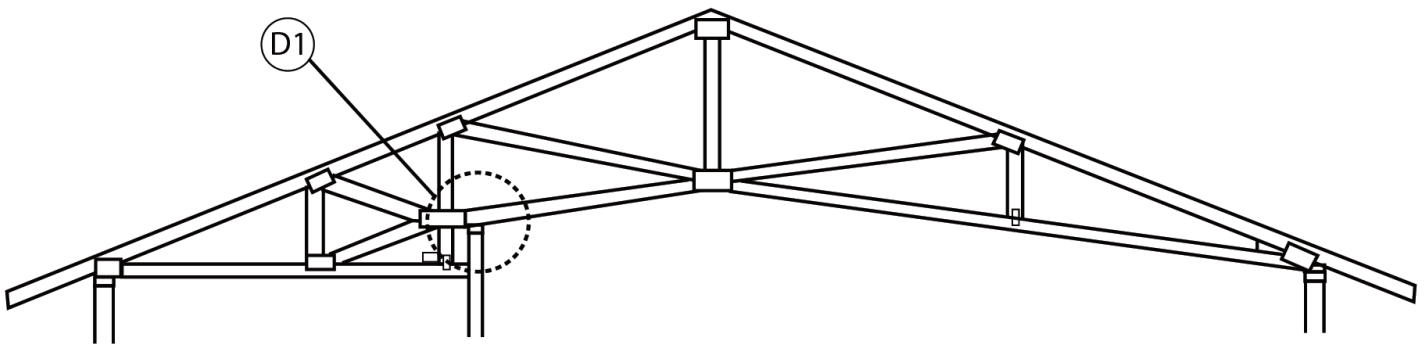
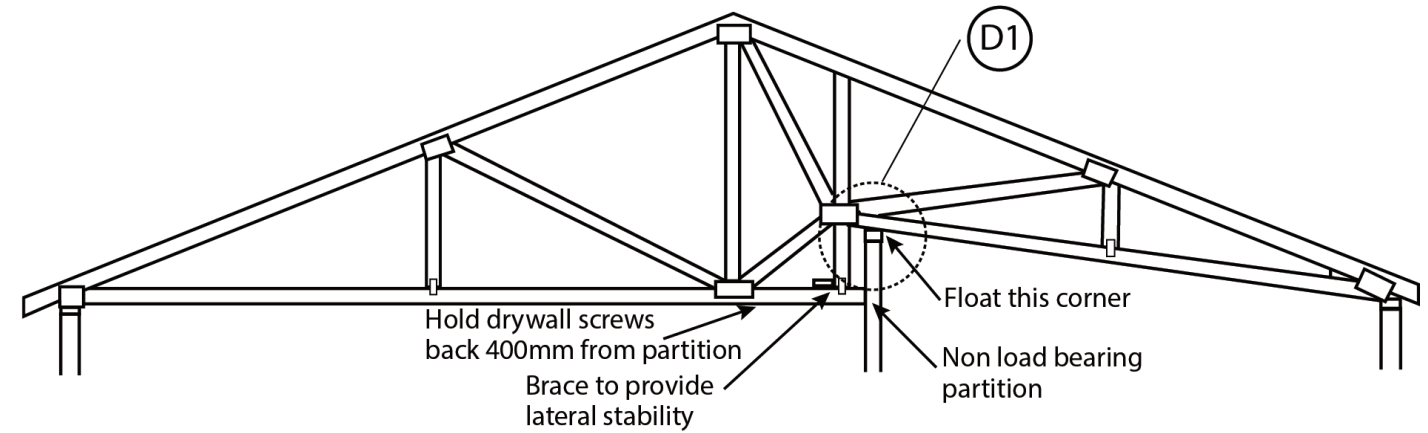
Where a narrow hallway is located at right angles to the roof trusses and drywall screws are held back 400mm from the wall on each side, there may be insufficient bottom chord length available to attach the drywall to the trusses. In this case, the best solution is to install separate 38x39 ceiling joists that are supported at each end by the partitions, fasten the drywall to these joists and avoid fastening the drywall to the truss bottom chords.

If a roof truss is located close to a parallel partition, the ceiling drywall can be attached to the parallel partition with metal clips. With no connection of the drywall to the adjacent truss, the truss can move vertically with no damage to the drywall joint at the top of the parallel partition.



PARTITION SEPARATION

Special cases occur where ceilings are partially vaulted. The following illustrations indicate potential solutions involving partitions that are framed through to the underside of the sloping portion of the bottom chords of the trusses.



SOLUTIONS FOR EXISTING BUILDINGS

Where partition separation is occurring in an existing structure, the first step that might be taken to alleviate the problem should be to check for major moisture leaks into the attic space. This can only be done during very cold winter weather when moisture leaks can be detected by looking for frost formation on the upper surface of the insulation at spots where there are openings in the vapor barrier. Typically, under these conditions, you will observe patches of frost above leaks at ceiling light fixtures, chimneys, plumbing stacks, attic hatches, etc. These are locations where it may be possible to seal off these vapor leaks and reduce moisture movement into the attic space.

A check should be made to ensure that the attic space is properly ventilated and that air inlets have not become plugged with insulating material. Check also that exhaust air from clothes dryers, kitchen fans, etc., is not moving back into the attic by looking for frost formation at the air inlets.

Where the problem cannot be overcome by reducing moisture movement into the attic space and the drywall corners have not been floated during construction, the following method can be used to make a final repair:

- During the summer or early fall the moisture content of the top chords of the trusses will have reduced and the gap between ceiling and wall will have closed. At that time the insulation above the partitions where the gaps are occurring can be moved aside to allow installation of 19mm plywood, OSB or lumber pieces above the top plate of the partition. These pieces should be located between the trusses, extend approximately 38mm on each side of the partition and be fastened to the top of the partition with wood screws. The insulation can then be replaced.
- The ceiling drywall screws adjacent to the partition can be located with the type of magnetic device used to locate nails in studs. One such device, called a 'stud finder' is made by Stanley Tools. When the screws have been located, they can be removed and additional screws installed to connect the ceiling drywall to the members that have been fastened to the top of the partition. Final repairs can then be made to fill the holes and refinish the wall/ceiling corner.

