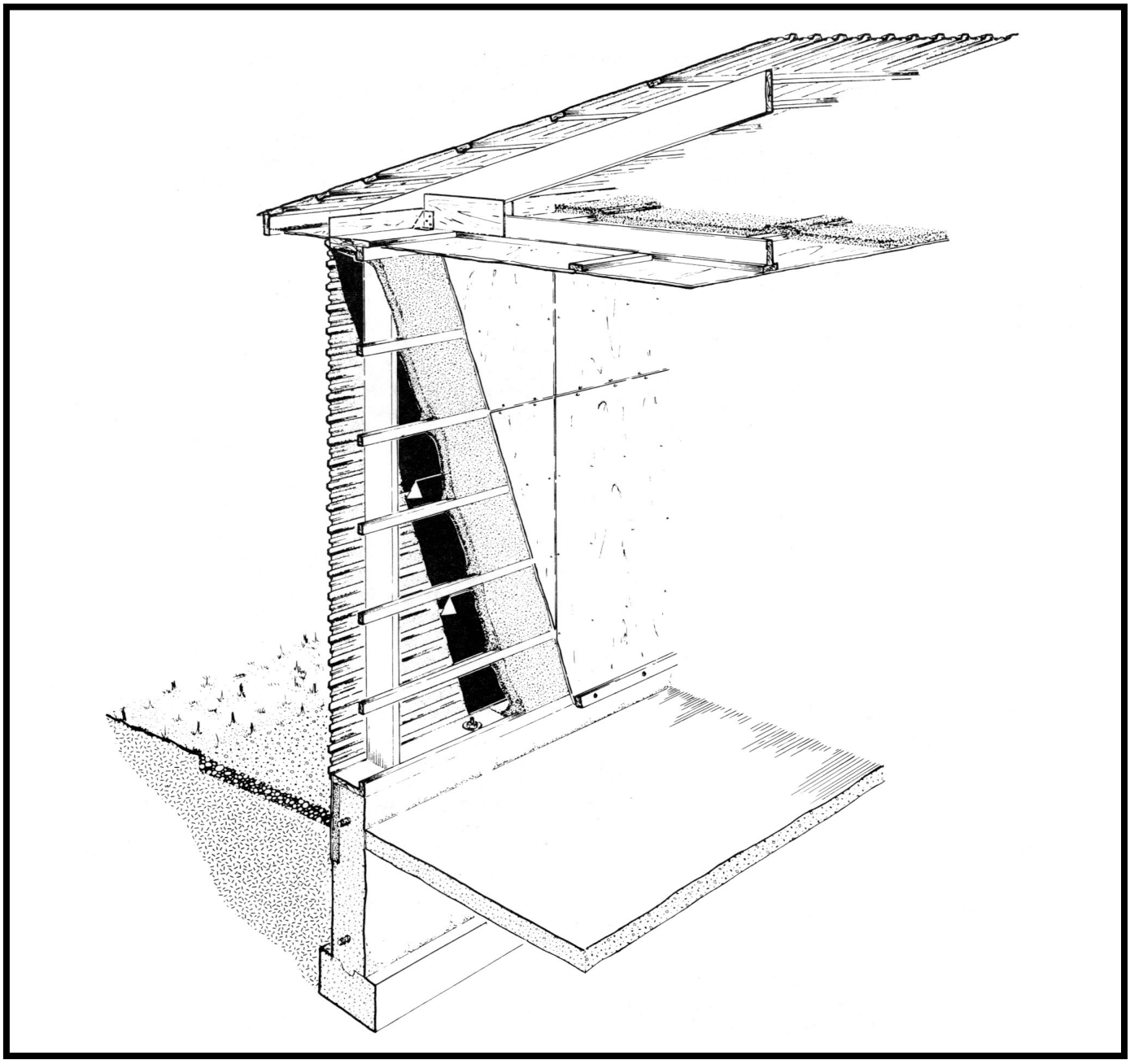
BRITISH COLUMBIA Ministry of Agriculture, Food and Fisheries
Agricultural Building Systems Handbook
PLAN
330-12

# REFRIGERATED PALLET FRUIT & VEGETABLE STORAGE WALL



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# 330-12

# REFRIGERATED PALLET FRUIT AND VEGETABLE STORAGE WALL

**CPS**
**PLAN 6112 REVISED 83:04**

This plan is to be used as a component for large commercial storages for fruits and vegetables handled in boxes or pallets. The important difference between this plan and Plan 330-11 (CPS Plan 6111) is that this wall is not designed for the considerable pressures encountered in bulk storages. This greatly simplifies the structural requirements.

Whenever refrigeration is used to extend the storage period into warm, humid weather, a vapor pressure reversal is likely to occur; this tends to drive atmospheric moisture into the wall and ceiling insulation from outside (normally protected by a vapor barrier only at the "inside" face). The ideal solution is the "inside-out" construction given here, using moisture resistant foamed-in-place polyurethane insulation.

**INSIDE-OUT INSULATED CONSTRUCTION** The stud walls are framed in quite conventional fashion, except that the inside sheathing (plywood, in this case) is installed first. Then urethane foam is sprayed (in several layers) to the **outside** face of the **inside** sheathing (and, of course, around the adjacent wood framework). The only framing not sprayed is the outside edges of the studs; they must be left straight and smooth. Exterior cladding such as prepainted galvanized steel is applied last. This technique has several important advantages:

- urethane foam has enough airtightness and moisture resistance that it seals the entire structure, effectively controlling heat losses and wet wall spaces;
- inside sheathing (either steel or plywood) provides the fire protection needed for the highly combustible urethane foam (in case of welding sparks or other fire hazards);
- urethane foam adds structural rigidity, effectively "gluing" the various building parts into a single unit;
- although relatively expensive, urethane foam is a very effective insulation (3" thickness of urethane is roughly equivalent to 5" of **dry** fiber-glass insulation).

Inside-out construction with polyurethane insulation has two important limitations. When insulating, the weather must be warm and dry, so that the fresh urethane mix can 'foam up' and harden outdoors. Any moisture contained in the wood framing when spraying the foam can be trapped there indefinitely, causing rapid decay and wood failure. Do **not** use green wood, and wait long enough after rain for the framework to dry out thoroughly before going on with the insulating.

The plan shows horizontal strapping between the studs and the interior plywood sheathing. The only purpose for this strapping is to allow foam insulation to penetrate spaces between the studs and the interior plywood sheathing. This is to minimize 'cold spots' on the interior wall due to 'thermal bridging' at the studs.

**FOUNDATION** Plan 330-12 shows 'deep' or 'shallow' foundation options. The shallow foundation is used in well-drained gravel and sand soils where frost-heave is no problem, or in mild climates (such as the Fraser Valley of British Columbia) where winters are mild. The deep foundation is more suitable for most of Canada.

Perimeter insulation is important with either deep or shallow foundations. The best way is to tack polystyrene insulation board (Dow SM, or equal) with finishing nails to the inside face of the outside concrete form. When the wet concrete is placed, it hardens and bonds with the porous face of the polystyrene. Then, when the forms are stripped, the finishing nails easily pull through the insulation, leaving it bonded securely to the concrete wall. This guarantees a perfect "fit" between insulation and concrete, and eliminates the problems of gluing the insulation to the concrete afterwards. A final outside cover of steel stucco-lath and cement plaster, or high-density asbestos board, provides weather and rodent protection. The insulation is cut 2" narrower than the asbestos board, so that the board can extend high enough to be screwed to the outside edge of the treated wood sill.

**DIAPHRAGM CEILING FOR WIND BRACING** The structural diaphragm ceiling is a superior way to stiffen the top of the walls, as well as to provide lateral wind bracing for the building as a whole. The ceiling may consist of nailed softwood "sheathing grade" plywood (Plan 305-13), or screwed prepainted galvanized steel (Plan 305-10). Plywood (being absorbent) is less prone to condensation and dripping, but it becomes quickly discolored by humidity and molds. Steel is easier to install, since it eliminates the extra "grid" of wood strapping required for four-edge support of the plywood.

The ceiling can be foam-insulated from the attic space in the same way as the walls, except that the insulation contractor will have to work in the limited space between ceiling and roof. Additional insulation is sometimes called for on top of the urethane foam in the attic; in this case, expanded mica ('Vermiculite') is recommended, as it is easy to spread and it discourages tunneling by rodents.