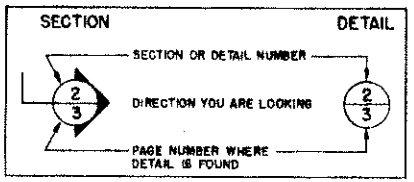
NOTES: These drawings are not complete building plans - rather, their intent is to show concepts, selected design recommendations and application differences based on recent USDA research and field experiences. These drawings in turn can be used in preparation of more complete, individually engineered designs. Consult a registered engineer to prepare your plan.

General Design:

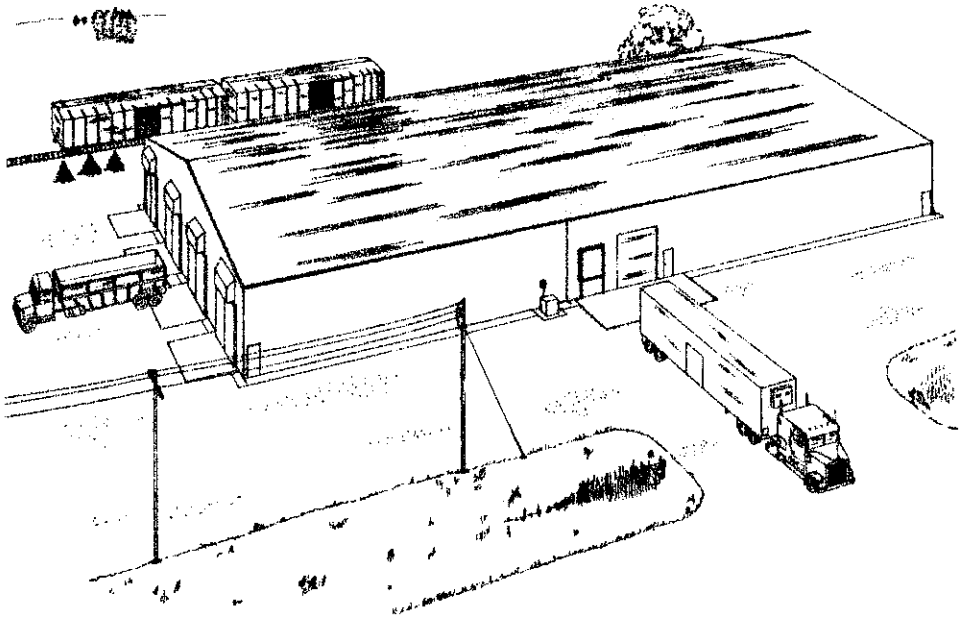
1. **Floor/foundation design is from USDA calculation. A soil bearing capacity of 2000 lbs./sq. ft. was used with a concentrated truck wheel load of 4500 lbs.**
2. **Potato specific weight of 42 lbs. per cubic foot (92 lbs./bu.)**
3. **Clean, wet, smooth-skinned, rounded potatoes (e.g. Norchip) that exert a horizontal wall pressure of an Equivalent Fluid Density of 13 lbs. per cubic foot.**
4. **Maximum potato depth of 17 ft. with binwall stud height of 18 ft. on a 1 ft. high foundation.**
5. **Lumber bending stress (F_b = 1725 psi) was more critical than horizontal shear stress (F_v = 95 psi) for studs. The allowable compression force used was 625 psi perpendicular to grain.**
6. **Lumber design allowable stresses were not adjusted for moisture or temperature as permitted by the 1986 National Design Specifications.**
7. **No special design conditions were used for snow or wind loads. The design snow load was 25 lbs. per sq. ft. of roof.**
8. **Vapor barriers must be correctly installed (so insulation stays dry) caulked along edges with rolled and taped joints.**

Ventilation Design:

1. **Ventilation duct airflow of 1 cu. ft. per minute per CWT (1 CFM/CWT).**
2. **Vent duct maximum airspeed of 1500 feet per minute (17 mph).**
3. **"Through" type ventilation with ½ the needed airflow for potatoes along each sidewall and ½ through the bottom-center of the bin. Extra duct capacity is required for wall venting the single-wall designs.**
4. **Single-wall inside shell ventilation rate of 1 cu. ft. per minute per sq. ft. of wall surface with airflow regulated by restriction at top wall vent opening.**
5. **At vent duct transitions, a downstream duct cross-section area of 0.75 to 0.87 minimum of upstream cross-section duct area.**
6. **A 1:3 approximate ratio of gross duct cross-section area to air exit slot area or an effective slot area to duct cross-section area of 0.9:1.**
7. **Experience is limited with the plywood-covered foamer ducts. Under extreme conditions of wet, muddy, small potatoes and very large ducts a center slot in the plywood may be needed to let some air through - then design for 3 slots instead of 2.**
8. **See NDSU Circular AE-60, "Potato Storage Ventilation," for air heating design recommendations or the most up to date publication.**



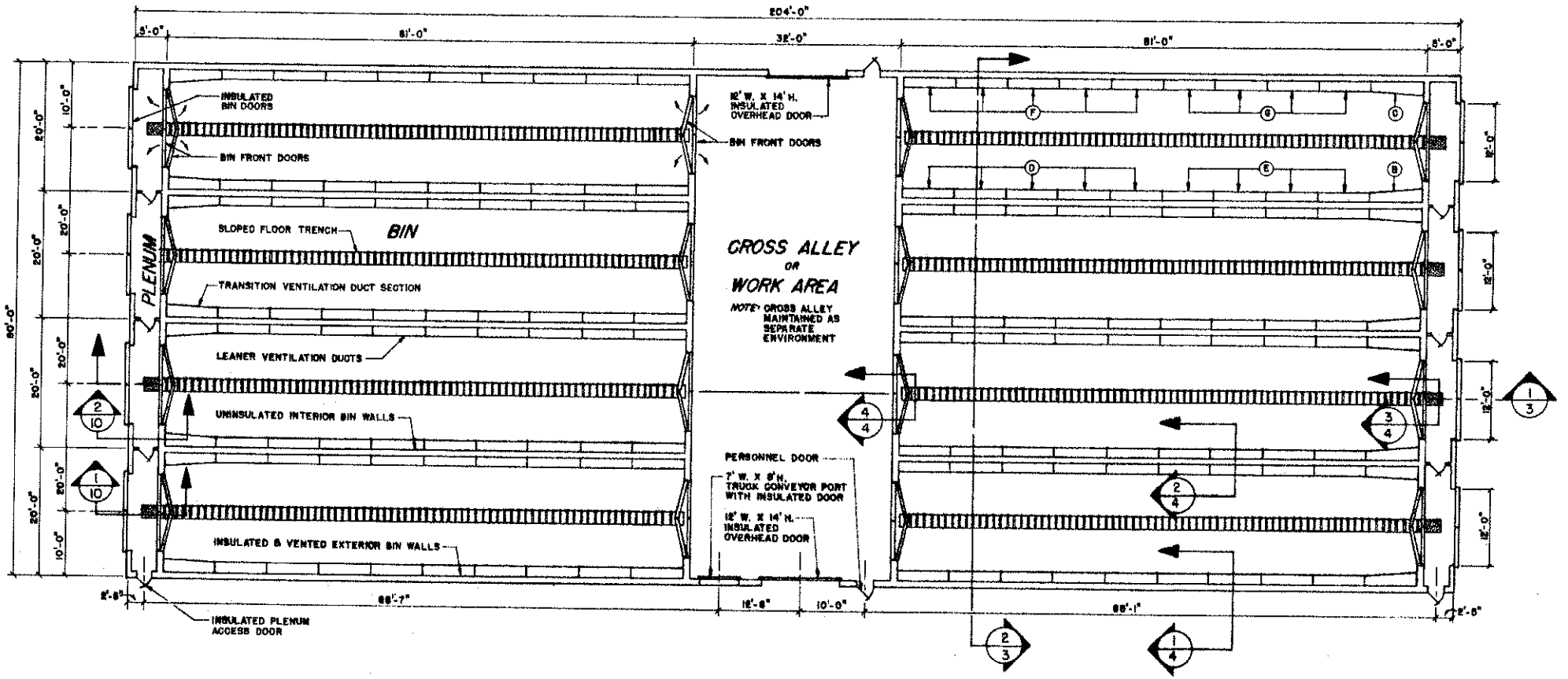
SECTION & DETAIL INDICATOR



POTATO STORAGE - 86,000 CWT SINGLE EXTERIOR WALL: Intended for use with more detailed planning, these drawings show the major construction and ventilation features for a 80' x 204' building with 8 storage bins and a cross-alley work area. These major features change with changes in storage size. Two other sets of drawings are available for storage capacities of 86,000 CWT single exterior wall 80' x 172' and for 86,000 CWT double exterior wall 88' x 204'.

POTATO STORAGE - 86,000 C.W.T.			
80' X 204' SINGLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING, NDSU, FARGO, ND.; USDA - RRV POTATO RES. CENTER, E.G. FORKS, MN. RRV POTATO GROWERS ASSN., E.G. FORKS, MN.			
DES. BY: D. JOHNSON, K. HELLEVANG, L. SCHAPER			
DR. BY: D. WAHL	JUL. 1987	PLAN NO 734-8-1	8 1

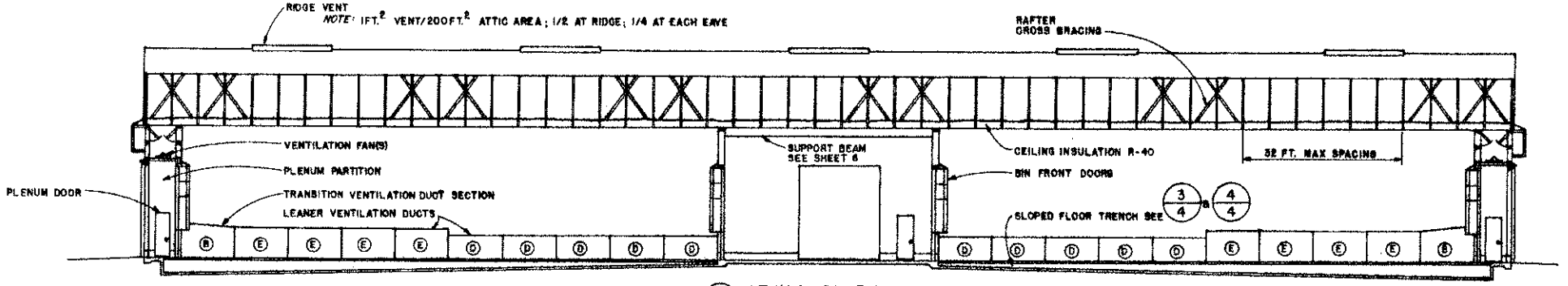
NOTE: ⒷⒺ etc., indicates leaner duct designs (see Sheet 5). Exterior wall leaner ducts use ⒸⒼⒻ ducts shown and interior wall leaner ducts use ⒹⒺⒷ ducts as shown.



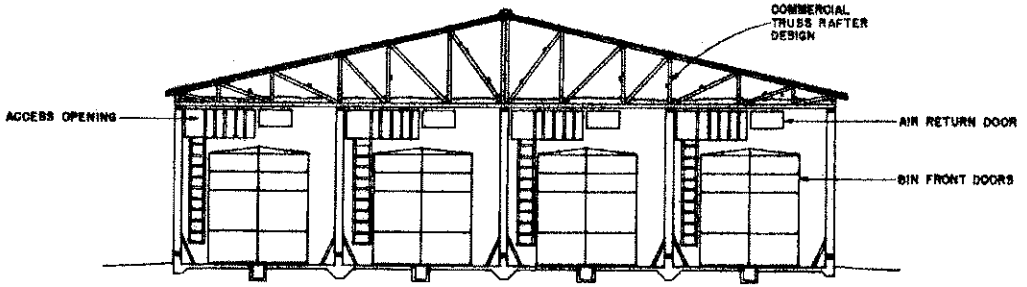
FLOOR PLAN
SCALE: 3/32" = 1'-0"

NOTE: Changing dimensions of potato bin will change ventilation requirements.

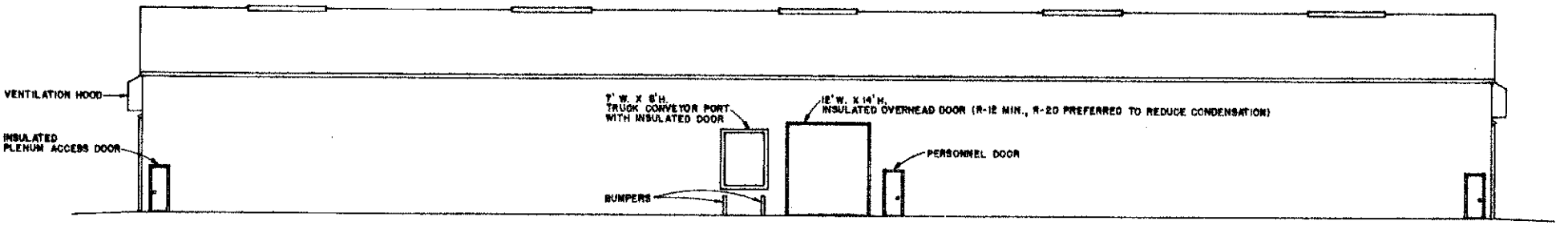
POTATO STORAGE - 86,000 C.W.T. 80' X 204' SINGLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING, NDSU, FARGO, ND.; USDA - ARV POTATO RES. CENTER, E.G. FORKS, MN. ARV POTATO GROWERS ASSN., E.G. FORKS, MN.			
DES. BY: D. JOHNSON, K. HELLEVANG, L. SCHAFER			
DR. BY: D. WAHL	JUL. 1987	PLAN: ND 734-6-1	R 2



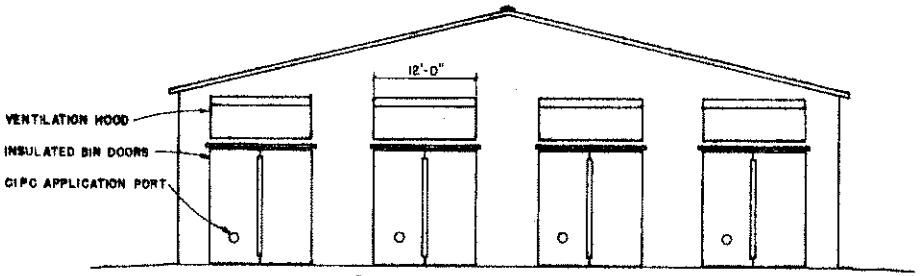
1/3 CROSS SECTION
SCALE: 3/32" = 1'-0"



2/3 CROSS SECTION
SCALE: 3/32" = 1'-0"

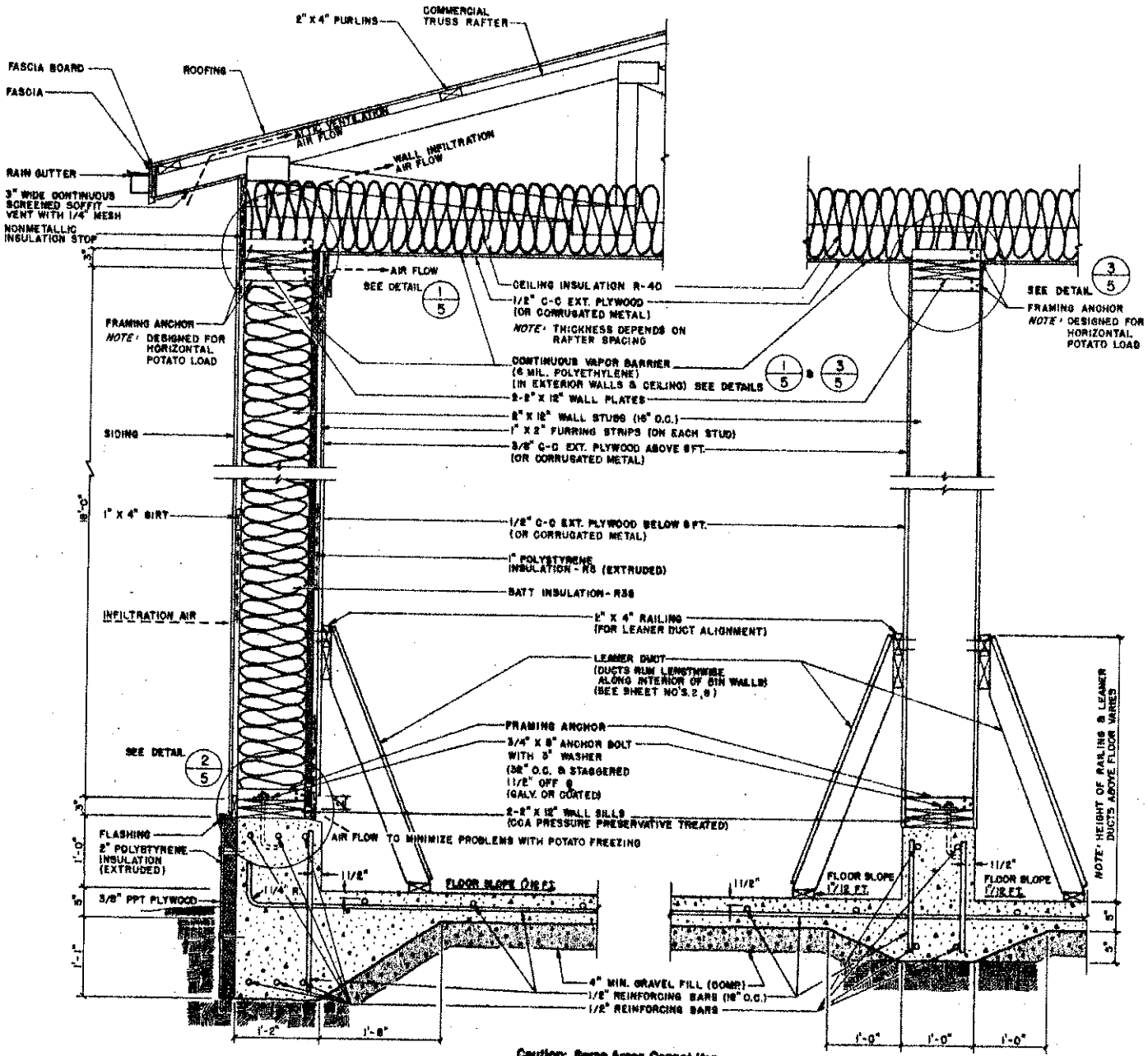


3/3 FRONT ELEVATION
SCALE: 3/32" = 1'-0"



4/3 SIDE ELEVATION
SCALE: 3/32" = 1'-0"

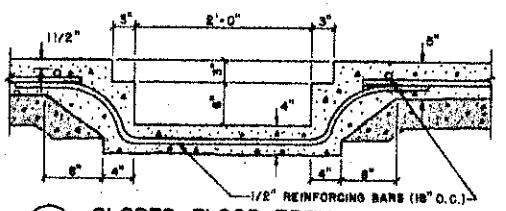
POTATO STORAGE - 86,000 C.W.T. 80' X 204' SINGLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING, NDSU, FARGO, ND.; USDA-ARS POTATO RES. CENTER, E.G. PARKS, MN. ARS POTATO GROWERS ASSN., E.G. PARKS, MN.			
DES. BY: D. JOHNSON, K. HELLEVANG, L. SCHAPER			
DR. BY: D. WAHL	JUL. 1987	PLAN: ND 734-6-1	R 3



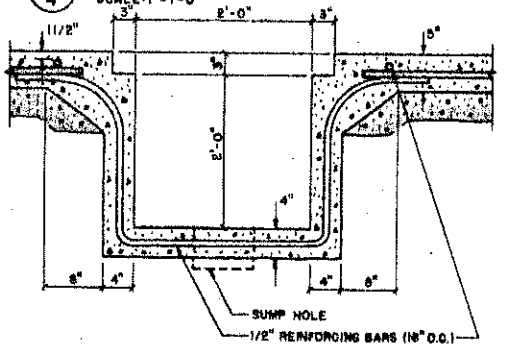
Caution: Some Areas Cannot Use "Floating" Slab Foundation Shown.

1/4 EXTERIOR WALL SECTION
SCALE: 1" = 1'-0"

2/4 INTERIOR WALL SECTION
SCALE: 1" = 1'-0"



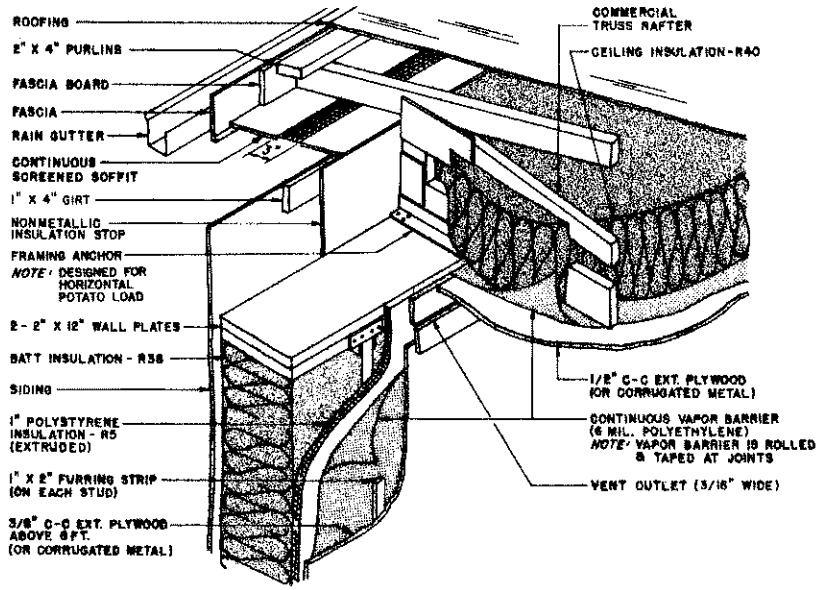
4/4 SLOPED FLOOR TRENCH
SCALE: 1" = 1'-0"



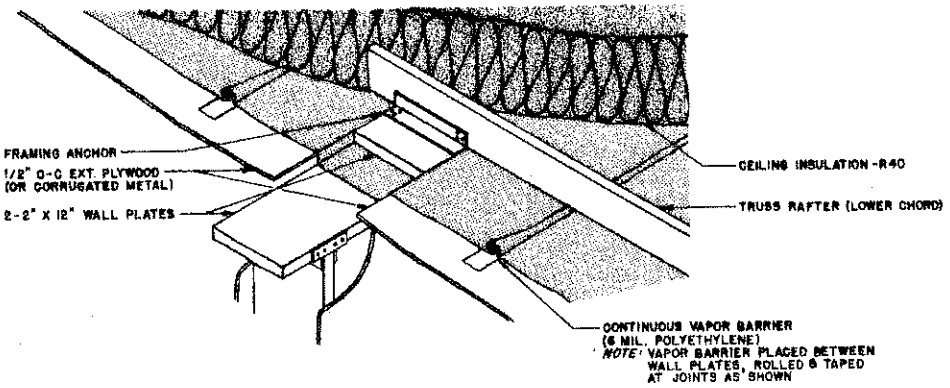
3/4 SLOPED FLOOR TRENCH
SCALE: 1" = 1'-0"
NOTE: THIS END OF TRENCH LOCATED BELOW PLENUM

NOTE: Drawings are intended to show concepts and typical features of potato storage buildings; a structural engineer should be consulted when a specific building is to be built.

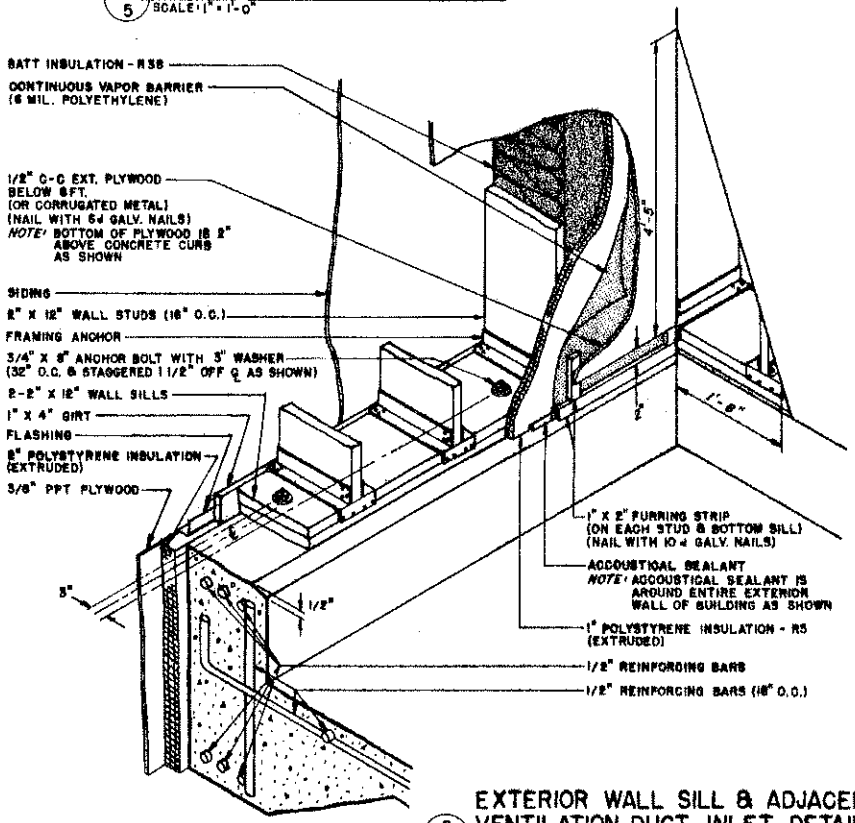
POTATO STORAGE - 85,000 C.W.T. 80' X 204' SINGLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING, NDSU, FARGO, ND.; USDA - RRV POTATO RES. CENTER, E.G. FORKS, MN. RRV POTATO GROWERS ASSN., E.G. FORKS, MN.			
DES. BY: B. JOHNSON, R. HELLEVANG, L. SCHAFER			
DR. BY: D. WAHL	JUL. 1987	PLAN NO 734-6-1	R 4



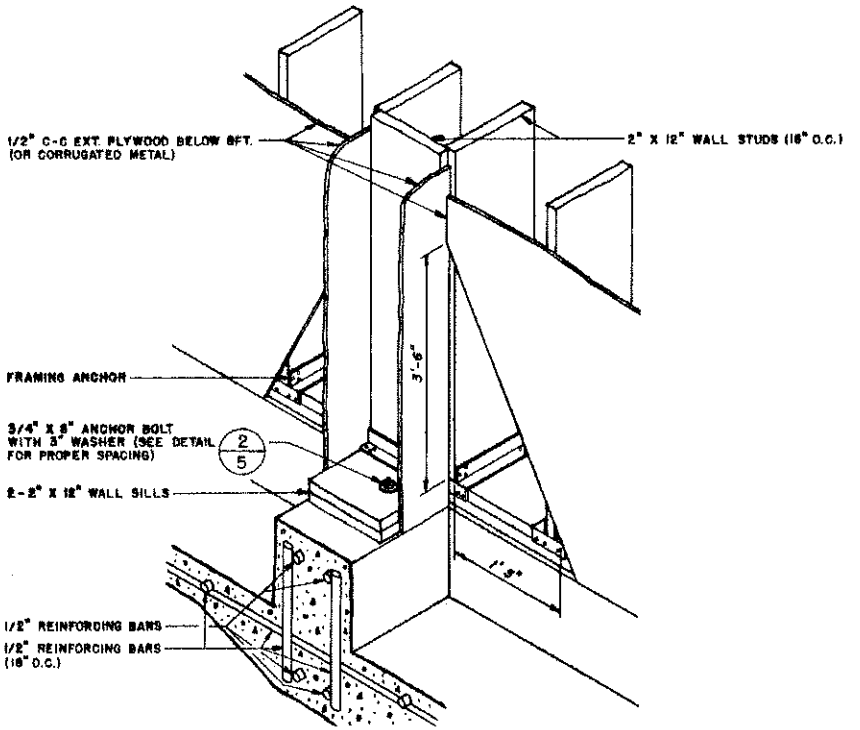
1/5 EXTERIOR WALL PLATE DETAIL
SCALE: 1" = 1'-0"



3/5 INTERIOR WALL PLATE DETAIL
SCALE: 1" = 1'-0"



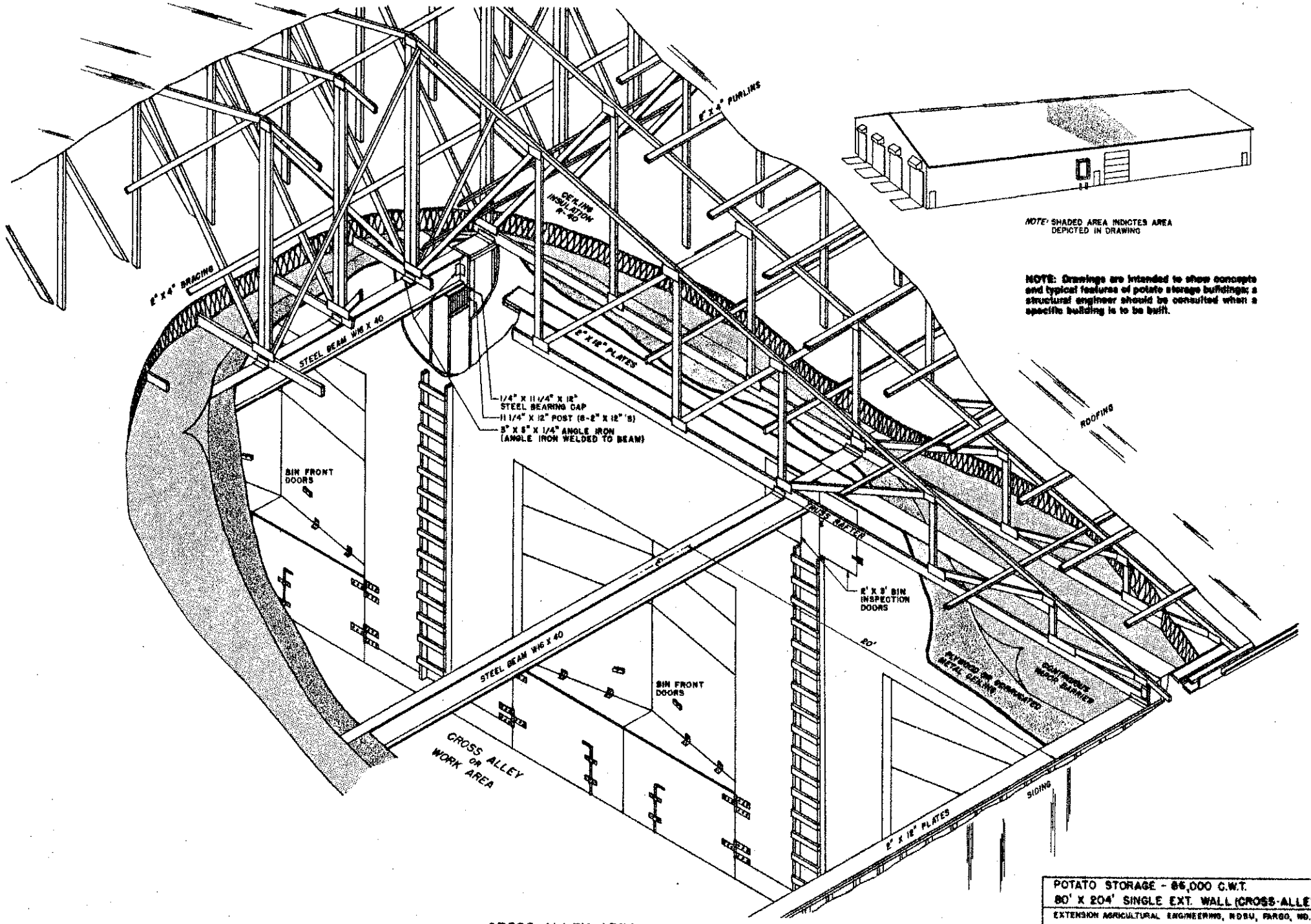
2/5 EXTERIOR WALL SILL & ADJACENT LEANER VENTILATION DUCT INLET DETAIL
SCALE: 1" = 1'-0"



4/5 INTERIOR WALL SILL & ADJACENT LEANER VENTILATION DUCT INLET DETAIL
SCALE: 1" = 1'-0"

NOTE: SEE EXTERIOR & INTERIOR WALL SECTION DETAILS FOR SPECIFIC TYPES OF MATERIALS LISTED. SEE DETAILS 1/4 & 2/4

POTATO STORAGE - 96,000 C.W.T. 80' X 204' SINGLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING, NDSU, FARGO, ND.; USDA - RRV POTATO RES. CENTER, E.G. FORKS, MN. RRV POTATO GROWERS ASSN., E.G. FORKS, MN.			
DES. BY: D. JOHNSON, K. HELLEWANG, L. SCHAFER			
DR. BY: D. WAHL	JUL. 1987	PLAN NO 734-6-1	P.5



NOTE: SHADED AREA INDICTES AREA DEPICTED IN DRAWING

NOTE: Drawings are intended to show concepts and typical features of potato storage buildings; a structural engineer should be consulted when a specific building is to be built.

CROSS ALLEY AREA

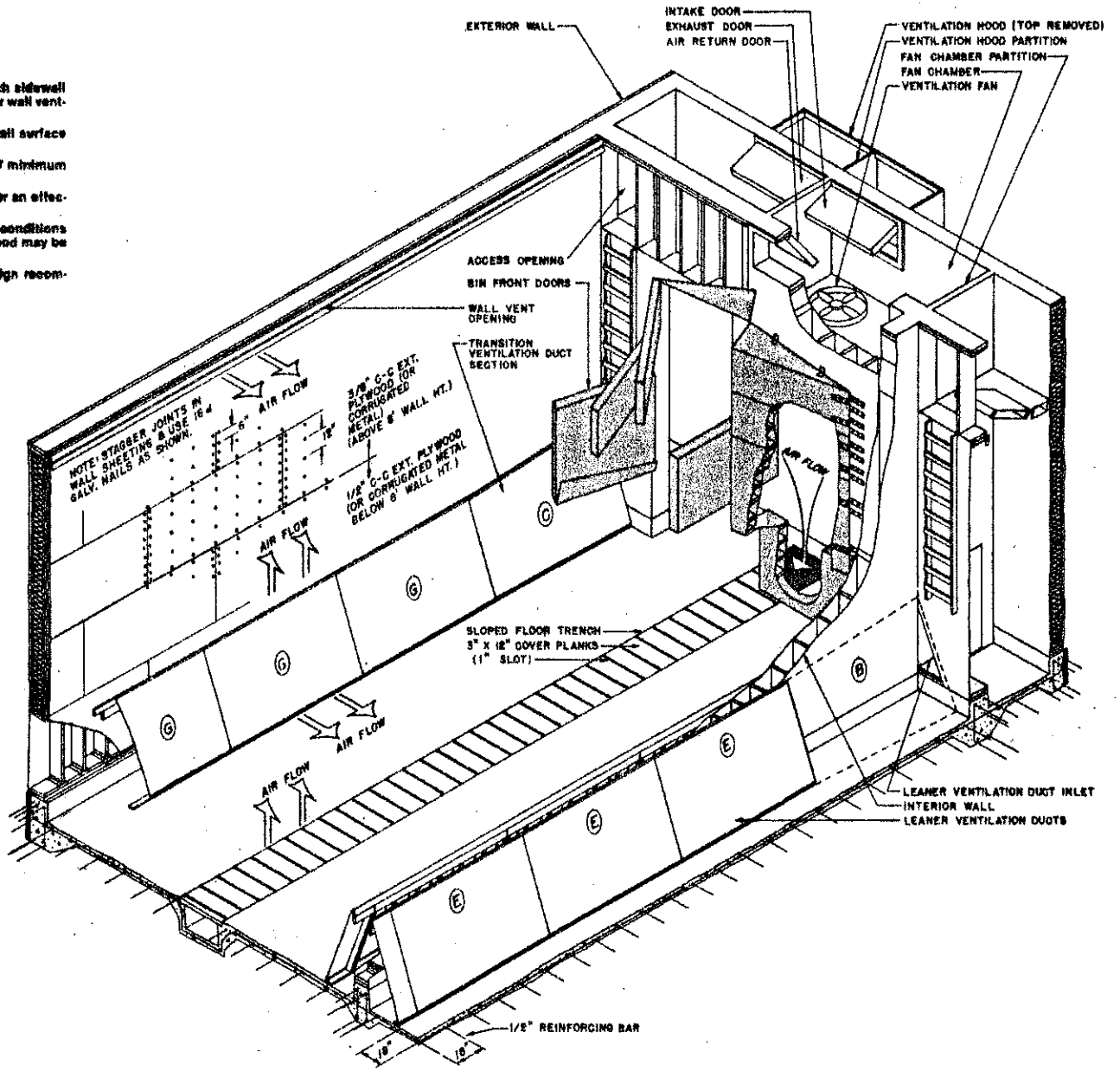
SCALE: 3/8" = 1'-0"

POTATO STORAGE - 85,000 C.W.T. 80' X 204' SINGLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING, NDSU, FARGO, ND.; USDA - NRV POTATO RES. CENTER, E.G. FORKS, MN. NRV POTATO GROWERS ASSN., E.G. FORKS, MN.			
DES. BY: D. JOHNSON, R. HELLEVANG, L. SCHAFER			
DR. BY: D. WAHL	JUL. 1987	PLAN NO 734-8-1	P-8

Ventilation Design:

1. Ventilation duct airflow of 1 cu. ft. per minute per CWT (1 CFM/CWT).
2. Vent duct maximum airspeed of 1500 feet per minute (17 mph).
3. "Through" type ventilation with ¼ the needed airflow for potatoes along each sidewall and ½ through the bottom-center of the bin. Extra duct capacity is required for wall venting the single-wall designs.
4. Single-wall inside shell ventilation rate of 1 cu. ft. per minute per sq. ft. of wall surface with airflow regulated by restriction at top wall vent opening.
5. At vent duct transitions, a downstream duct cross-section area of 0.75 to 0.87 minimum of upstream cross-section duct area.
6. A 1:3 approximate ratio of gross duct cross-section area to air exit slot area or an effective slot area to duct cross-section area of 0.9:1.
7. Experience is limited with the plywood-covered leaner ducts. Under extreme conditions of wet, muddy, small potatoes and very large ducts a center slot in the plywood may be needed to let some air through - then design for 3 slots instead of 2.
8. See NDSU Circular AE-90, "Potato Storage Ventilation," for air heating design recommendations or the most up to date publication.

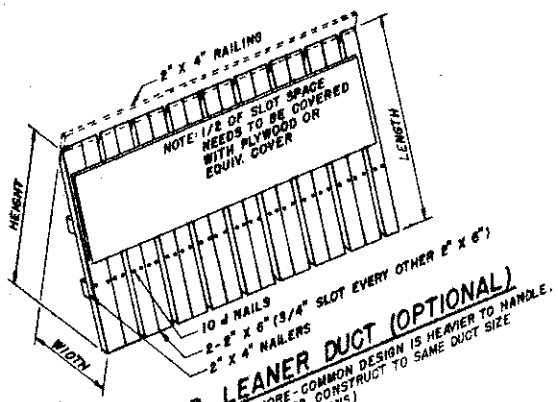
NOTE: Changing dimensions of potato bin will change ventilation requirements.



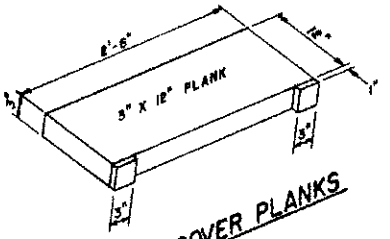
BIN VENTILATION DIAGRAM

SCALE: 1/4" = 1'-0"

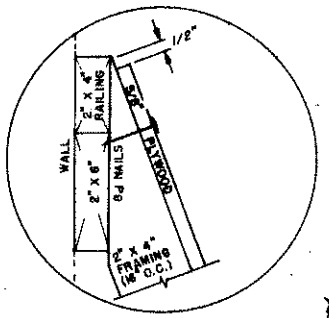
POTATO STORAGE - 86,000 C.W.T. 80' X 204' SINGLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING, NDSU, FARGO, ND.; USDA - ARV POTATO RES. CENTER, E.G. FORKS, MN. ARV POTATO GROWERS ASSN., E.G. FORKS, MN.			
DES. BY: D. JOHNSON, K. HELLEVANG, L. SCHAPER			
DR. BY: B. WAHL	JUL. 1987	PLAN: ND 754-8-1	P. 7



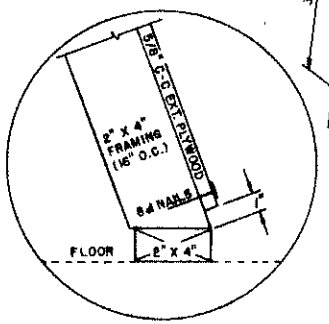
SLOTTED LEANER DUCT (OPTIONAL)
SCALE: NONE (THIS MORE-COMMON DESIGN IS HEAVIER TO HANDLE. IF IT IS USED, CONSTRUCT TO SAME DUCT SIZE AS PLYWOOD DESIGNS)



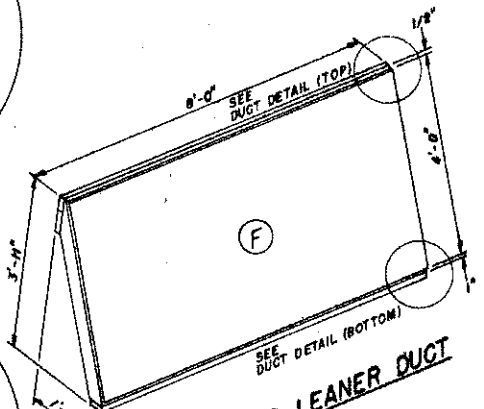
TRENCH COVER PLANKS
SCALE: 1" = 1'-0"



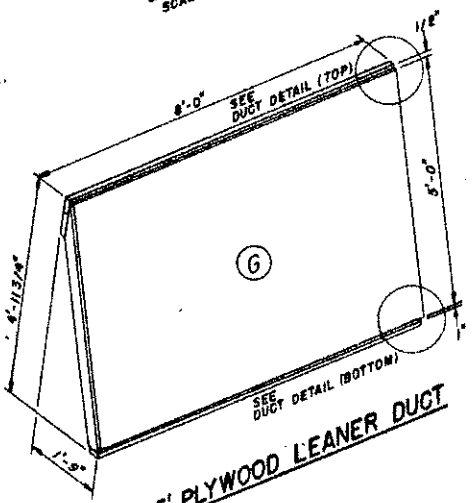
DUCT DETAIL (TOP)
SCALE: 1" = 3"



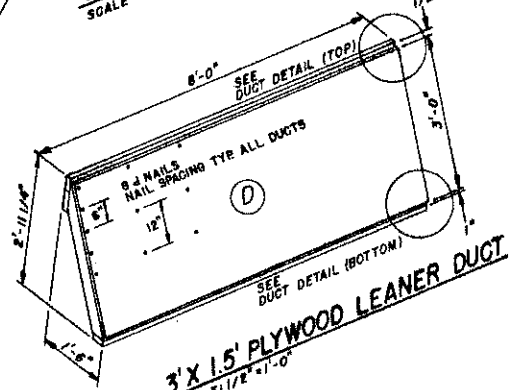
DUCT DETAIL (BOTTOM)
SCALE: 1" = 3"



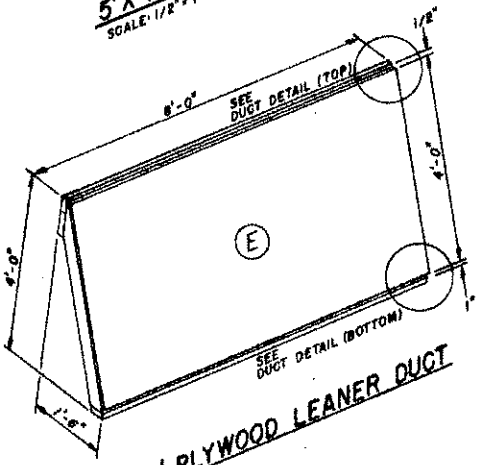
4' X 1.75' PLYWOOD LEANER DUCT
SCALE: 1/2" = 1'-0"



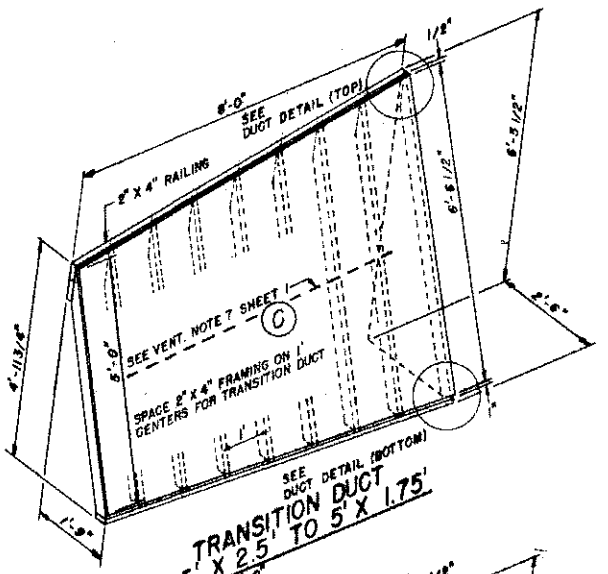
5' X 1.75' PLYWOOD LEANER DUCT
SCALE: 1/2" = 1'-0"



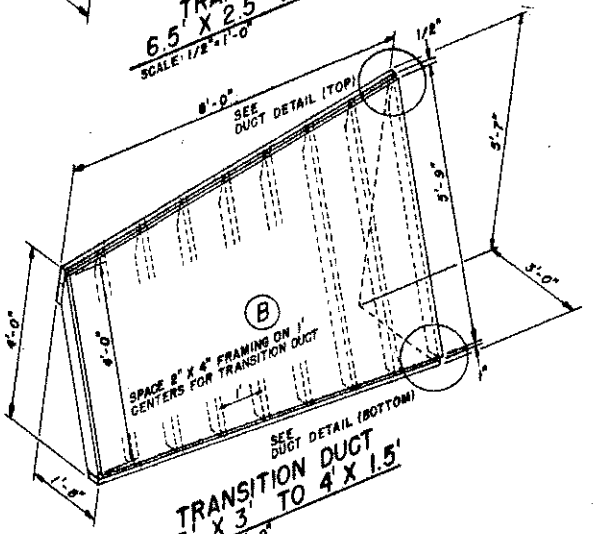
3' X 1.5' PLYWOOD LEANER DUCT
SCALE: 1/2" = 1'-0"



4' X 1.5' PLYWOOD LEANER DUCT
SCALE: 1/2" = 1'-0"



6.5' X 2.5' TO 5' X 1.75' TRANSITION DUCT
SCALE: 1/2" = 1'-0"

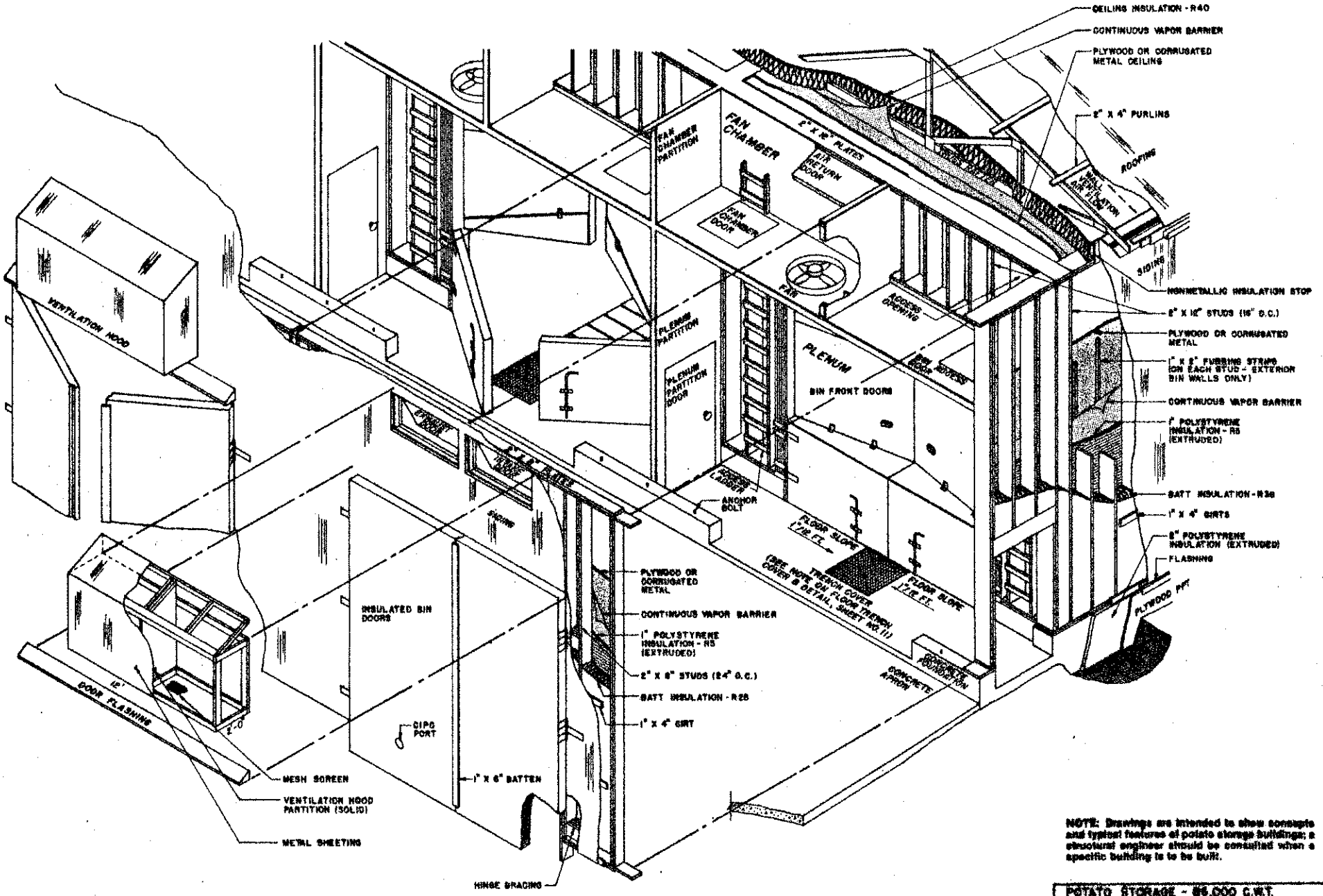


5.75' X 3' TO 4' X 1.5' TRANSITION DUCT
SCALE: 1/2" = 1'-0"

NOTE: Proper slot size is critical to provide uniform air distribution.

NOTE: Changing dimensions of potato bin will change ventilation requirements.

POTATO STORAGE - 86,000 C.W.T. 80' X 204' SINGLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING, NDSU, FARGO, ND.; USDA - ARV POTATO RES. CENTER, E.G. FORKS, MN. ARV POTATO GROWERS ASSN., E.G. FORKS, MN.			
DES. BY: D. JOHNSON, K. HELLEVANG, L. SCHAFER			
DR. BY: G. WAHL	JUL. 1987	PLAN NO 734-8-1	R 8

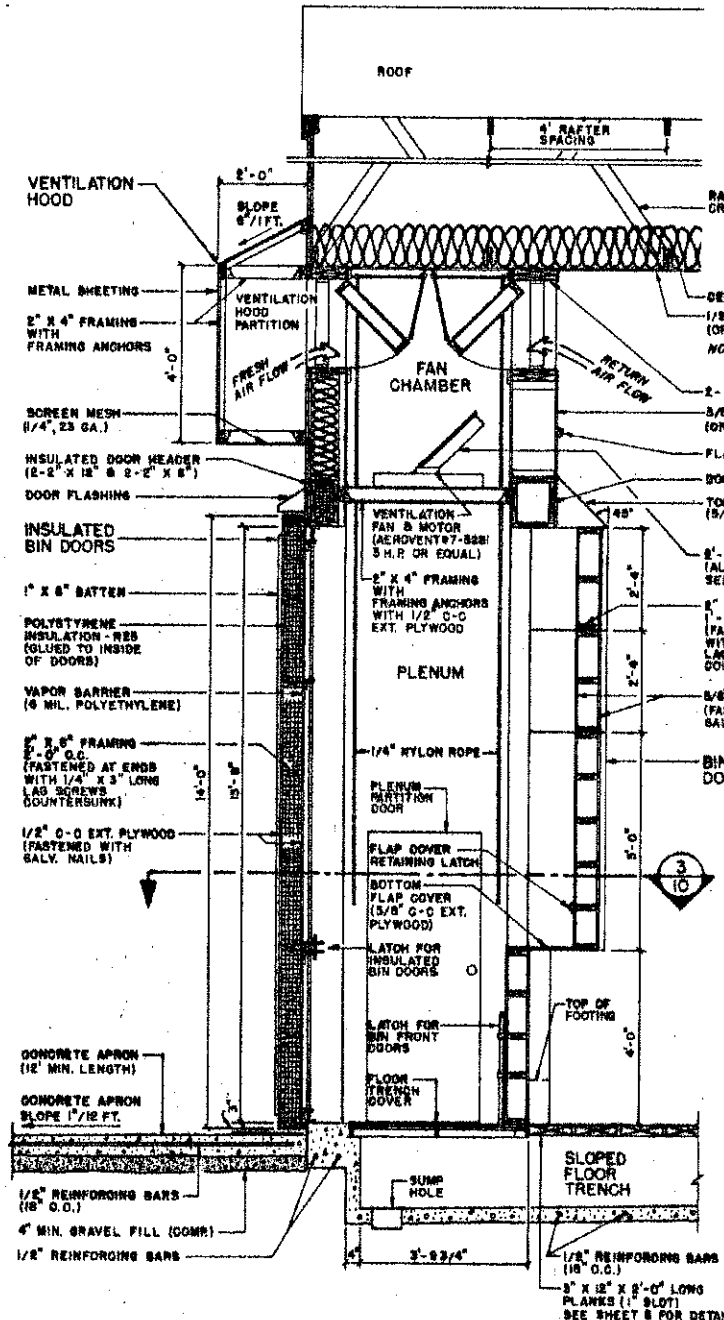


PLENUM AREA - EXPLODED VIEW

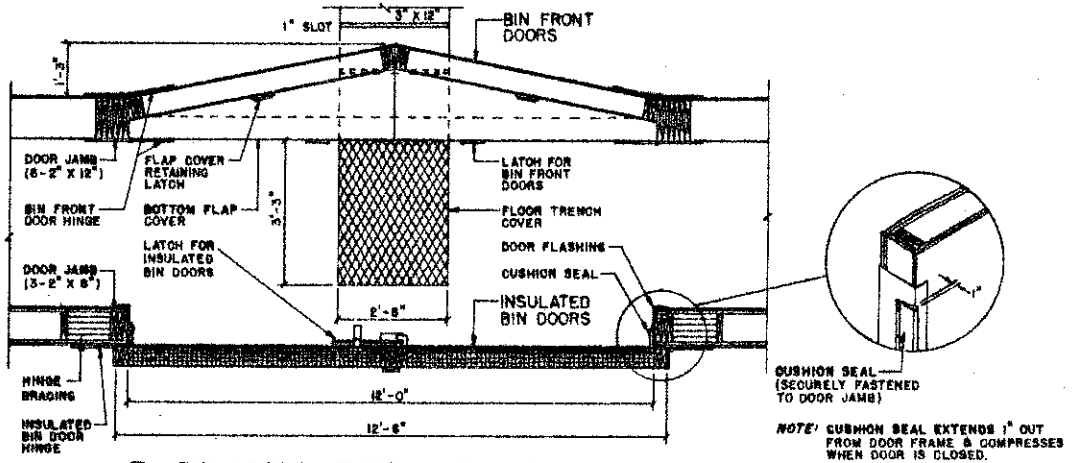
SCALE: NOT TO SCALE

NOTE: Drawings are intended to show concepts and typical features of potato storage buildings; a structural engineer should be consulted when a specific building is to be built.

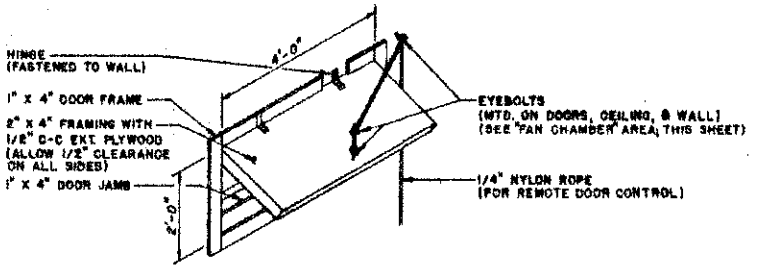
POTATO STORAGE - 85,000 C.W.T.			
80' X 204' SINGLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING, NDSU, FARGO, ND.			
USDA - ARS POTATO RES. CENTER, E.G. PARK, MN.			
ARV POTATO GROWERS ASSN., E.G. PARK, MN.			
DES. BY: G. JOHNSON, K. MELLEVANG, L. SCHAPER			
DR. BY: D. WAHL	JUL. 1987	PLAN-MP 734-8-1	R 0



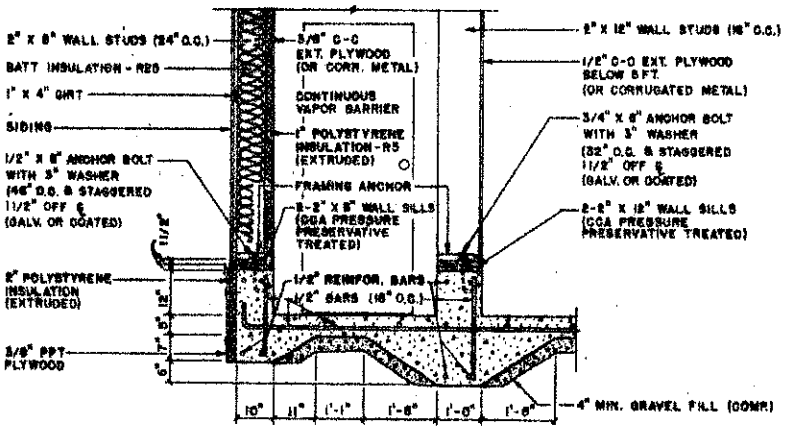
1/10 PLENUM SECTION THRU BIN DOORS
SCALE: 1/2" = 1'-0"



3/10 BIN DOORS CROSS SECTION & DETAIL
SCALE: 1/2" = 1'-0"



4/10 PLENUM INTAKE & EXHAUST DOORS
SCALE: 1/2" = 1'-0"



2/10 PLENUM SECTION THRU WALLS (PARTIAL)
SCALE: 1/2" = 1'-0"

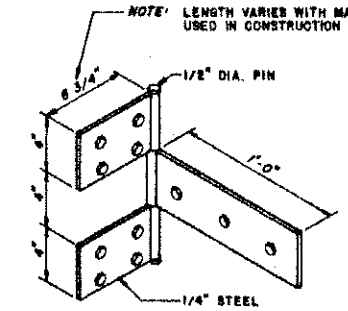
NOTE: SEE SHEET 11 FOR DETAIL DRAWINGS OF THE FOLLOWING ITEMS:

1. INSULATED BIN DOOR HINGES
2. BIN FRONT DOOR HINGES
3. FLAP COVER RETAINING LATCH
4. LATCH FOR BIN FRONT DOORS
5. LATCH FOR INSULATED BIN DOORS
6. FLOOR TRENCH COVER

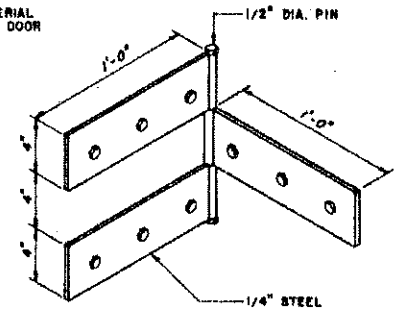
Caution: Some Areas Cannot Use "Floating" Slab Foundation Shown.

NOTE: Drawings are intended to show concepts and typical features of potato storage buildings; a structural engineer should be consulted when a specific building is to be built.

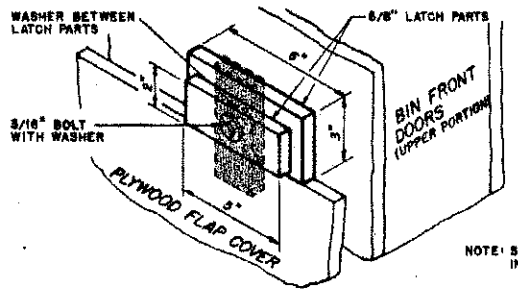
POTATO STORAGE - 85,000 C.W.T.			
80' X 204' SINGLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING, NDSU, FARGO, ND.; USDA - ARV POTATO RES. CENTER, E.G. FORKS, MN. ARV POTATO GROWERS ASSN., E.G. FORKS, MN.			
DES. BY: G. JOHNSON, R. HELLEVANG, L. SCHAFER			
DR. BY: G. WAHL	JUL. 1987	PLAN NO 734-6-1	SHT 10



INSULATED BIN DOOR HINGES
SCALE: NOT TO SCALE

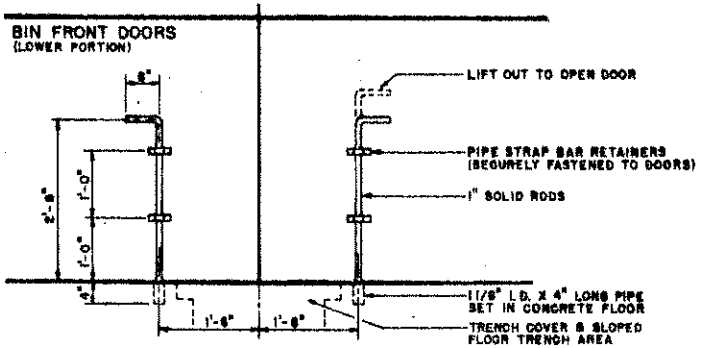


BIN FRONT DOOR HINGES
SCALE: NOT TO SCALE

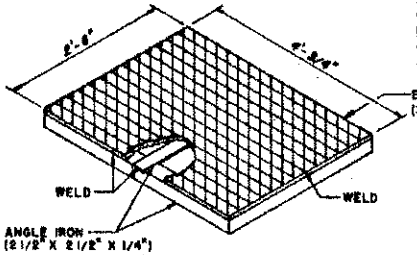


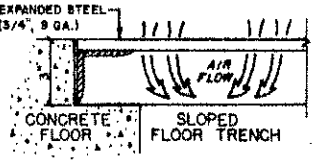
NOTE: SHADED AREA INDICATES LATCH IN RETAINING POSITION

FLAP COVER RETAINING LATCH
SCALE: 1/4" = 1"



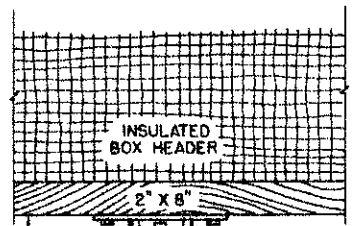
BIN FRONT DOOR LATCHES
SCALE: 3/4" = 1'-0"

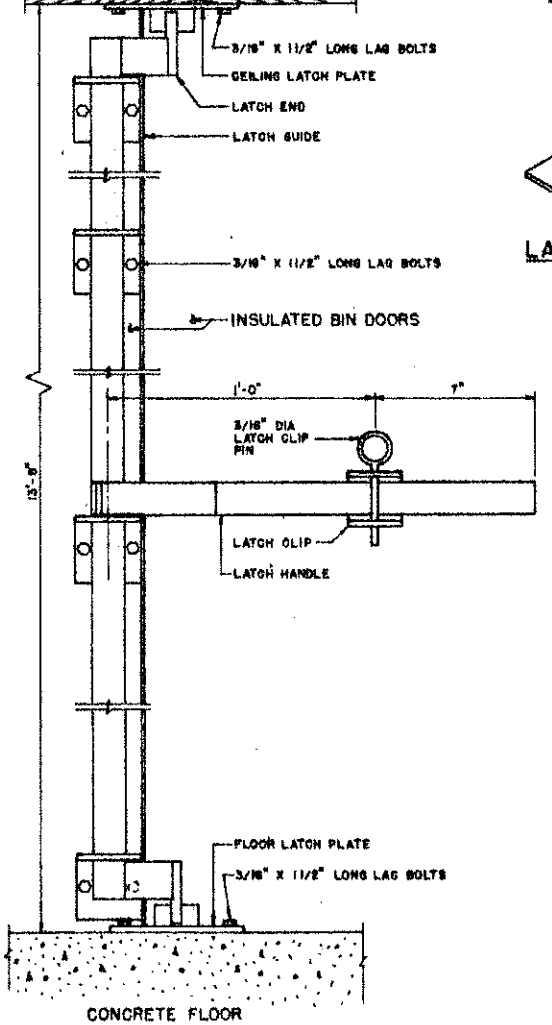


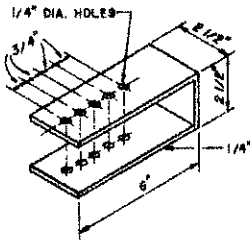


NOTE: The net open area of the trench cover must be equal or larger than the sloped floor trench area directly below bin front doors.

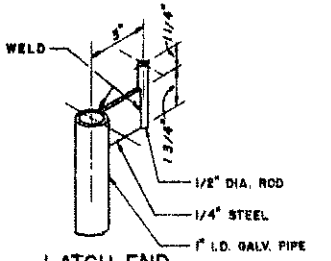
FLOOR TRENCH COVER & DETAIL
SCALE: NOT TO SCALE



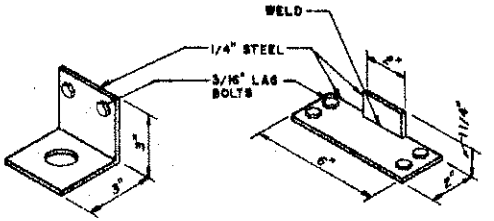




LATCH CLIP

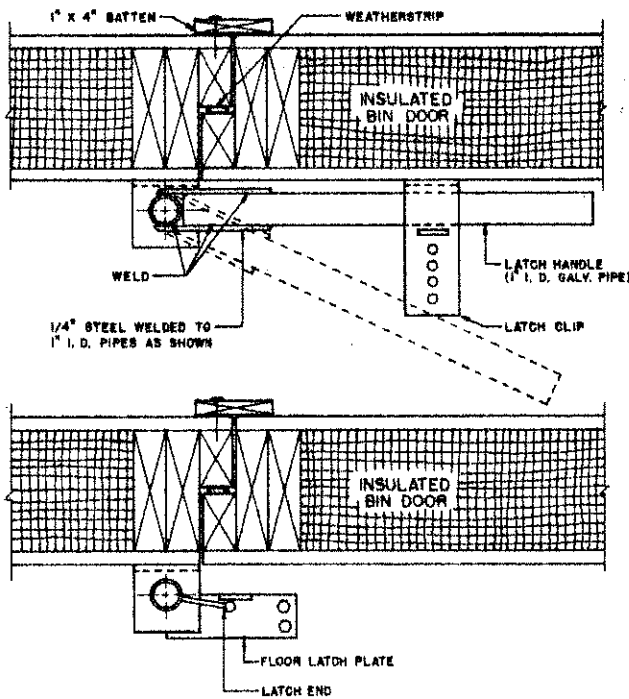


LATCH END



LATCH GUIDE

CEILING / FLOOR LATCH PLATE



LATCH FOR INSULATED (EXTERIOR) BIN DOORS
SCALE: 3" = 1'-0"

POTATO STORAGE - 85,000 C.W.T.			
80' X 204' SINGLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING, NDSU, FARGO, ND.; USDA - RRV POTATO RES. CENTER, E.G. FORKS, MN. RRV POTATO GROWERS ASSN., E.G. FORKS, MN.			
DES. BY: G. JOHNSON, K. HELLEVANG, L. SCHISLER			
DR. BY: D. WAHL	JUL. 1987	PLAN NO 734-8-1	2 11