

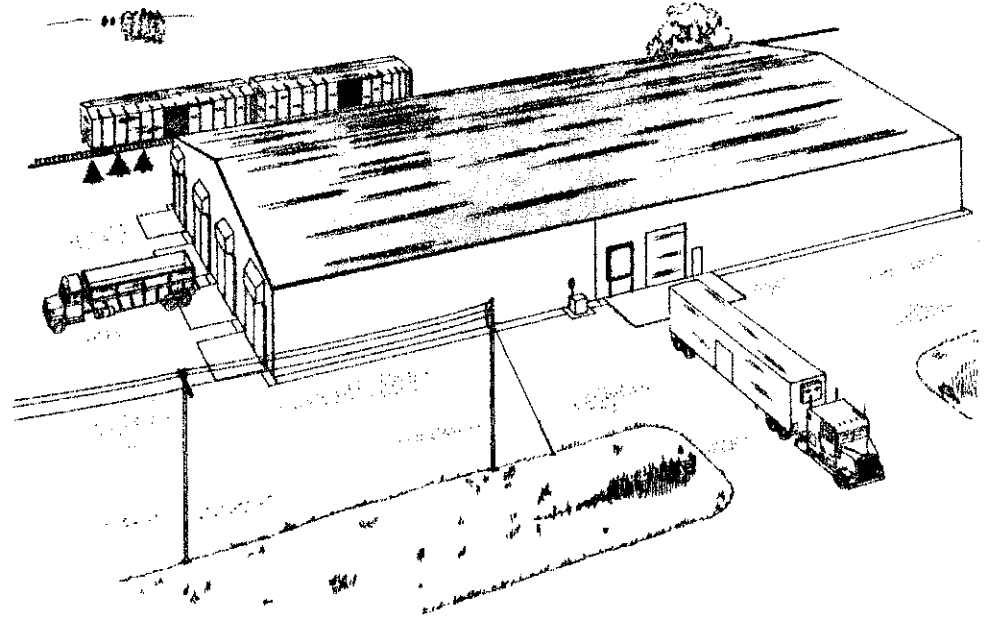
NOTES: These drawings are not complete building plans - rather, their intent is to show concepts, selected design recommendations and application differences based on recent USDA research and field experiences. These drawings in turn can be used in preparation of more complete, individually engineered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

General Design:

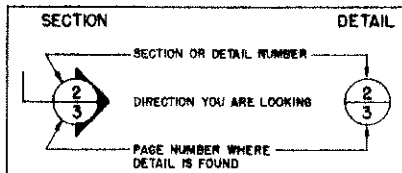
1. Floor/foundation design is from USDA calculation. A soil bearing capacity of 2000 lbs./sq. ft. was used with a concentrated truck wheel load of 4500 lbs.
2. Potato specific weight of 42 lbs. per cubic foot (32 lbs./bu.)
3. Clean, wet, smooth-skinned, rounded potatoes (e.g. Norehip) that exert a horizontal 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 ($F_v = 85$ 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 1988 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 1800 feet per minute (17 mph).
3. "Through" type ventilation with $\frac{1}{4}$ the needed airflow for potatoes along each sidewall and $\frac{1}{2}$ through the bottom-center of the bin. Extra duct capacity is required for wet 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 0.3:1.
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.



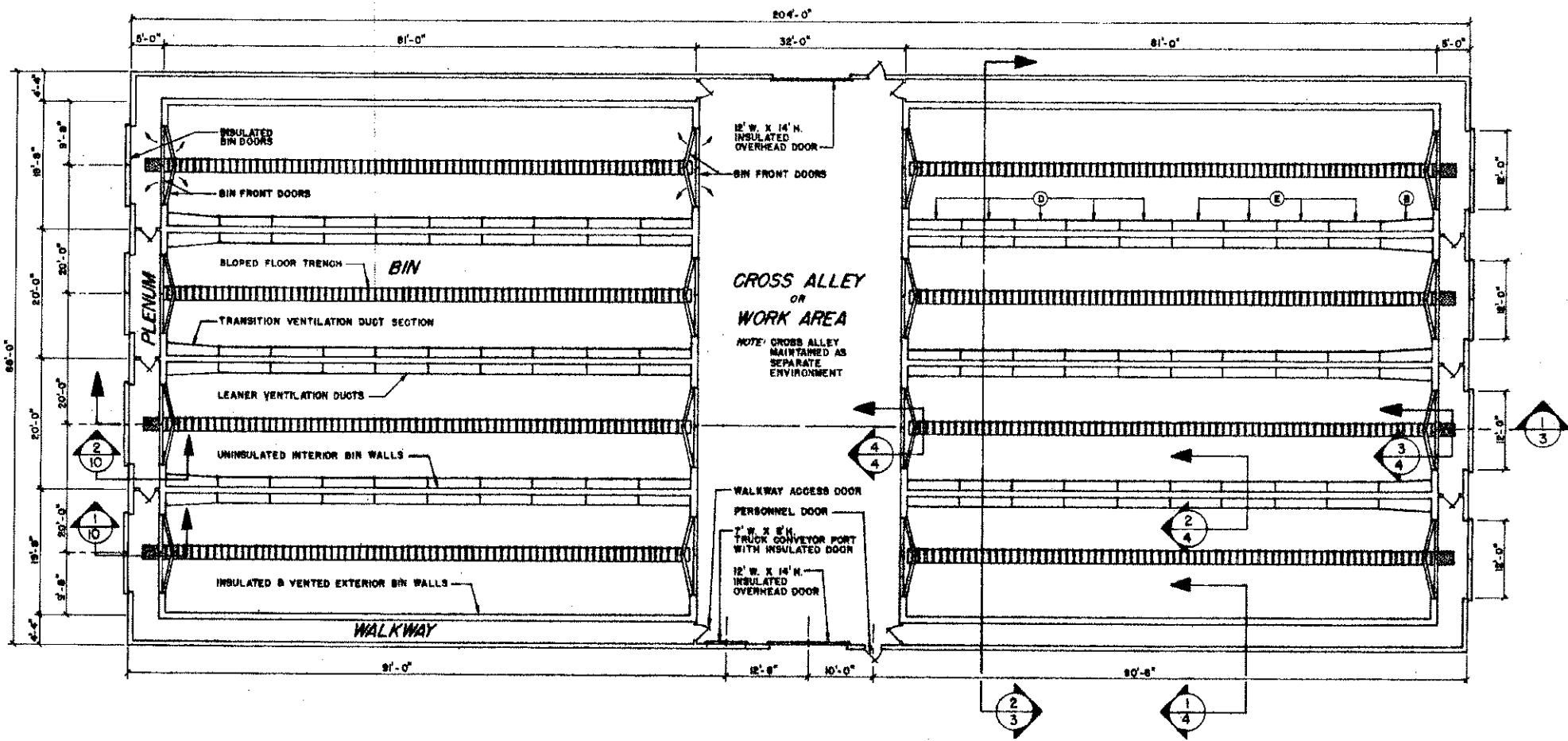
POTATO STORAGE - 86,000 CWT DOUBLE EXTERIOR WALL: Intended for use with more detailed planning, these drawings show the major construction and ventilation features for a 88' x 204' building with 8 storage bins and a cross-aisle work area. These major features change with changes in storage size. Two other sets of drawings are available for storage capacities of 86,000 CWT single exterior wall 88' x 204' and for 68,000 CWT single exterior wall 60' x 172'.



SECTION & DETAIL INDICATOR

POTATO STORAGE - 86,000 C.W.T.			
88' X 204' DOUBLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERS, NDSU, GRAND FORKS, ND.			
USDA - RRV POTATO RES. CENTER, E. S. FORKS, MN.			
RRV POTATO GROWERS ASSN., E. S. FORKS, MN.			
DES. BY: D. JOHNSON, R. HELLENBACH, L. SCHRAPER			
DR. BY: D. WAHL	JUL. 1987	PLAN NO 724-G-2	21

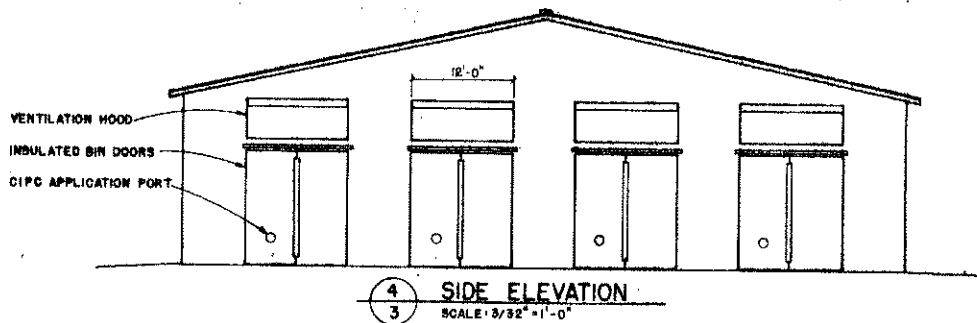
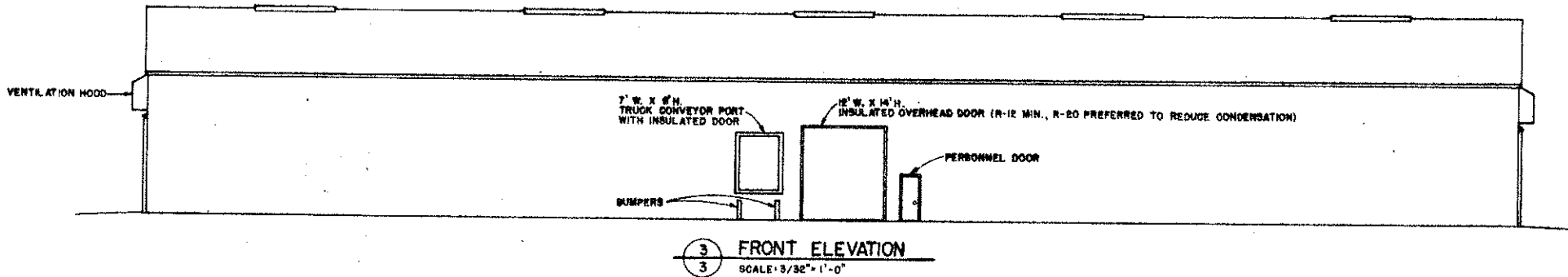
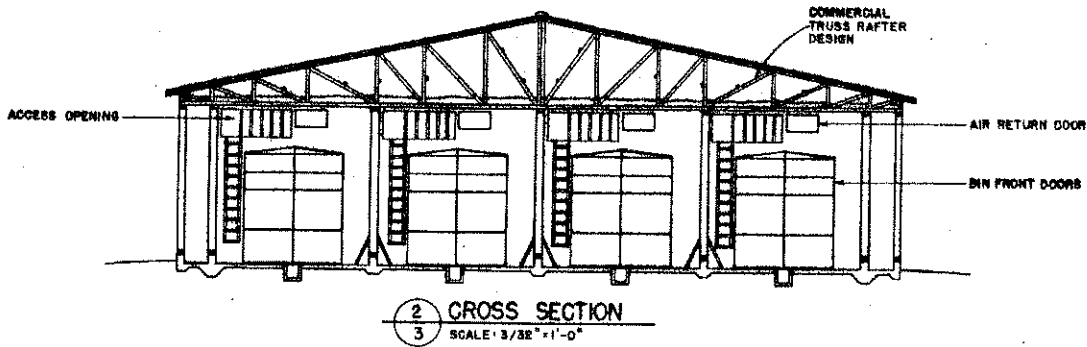
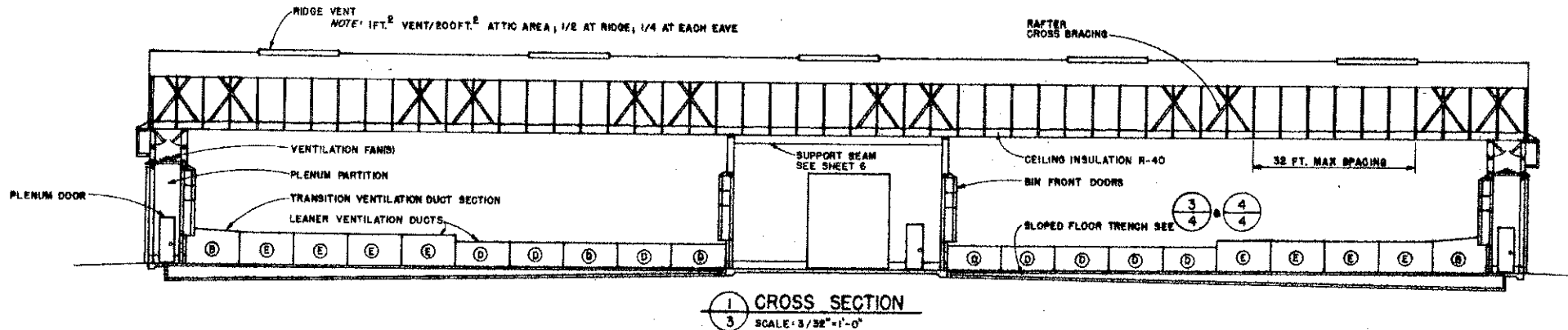
NOTE: (D, E) etc., indicates leaner duct designs (see Sheet 5). Leaner duct placement is the same for all bins.



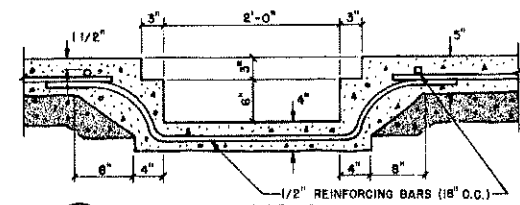
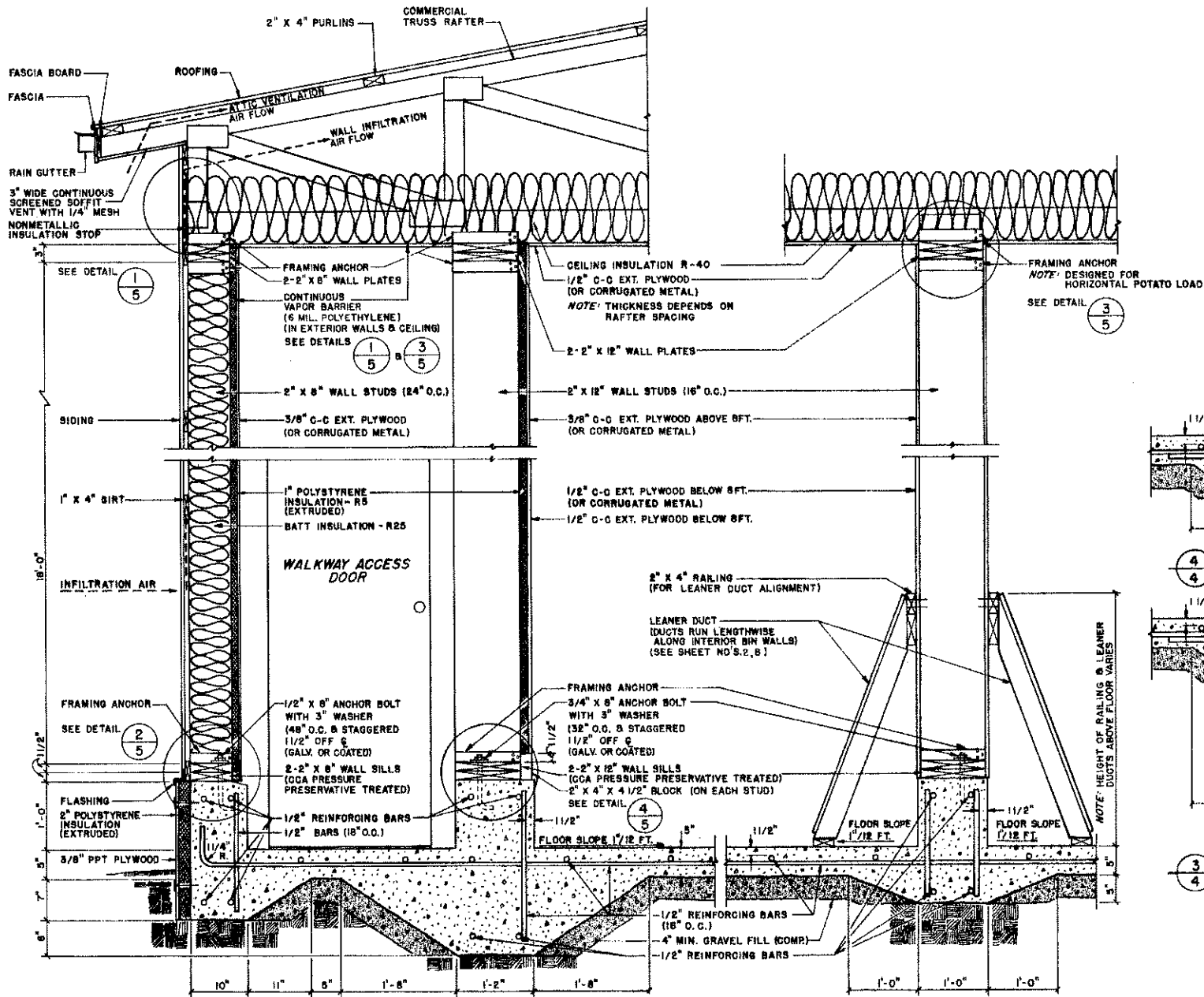
FLOOR PLAN
SCALE: 3/32" = 1'-0"

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

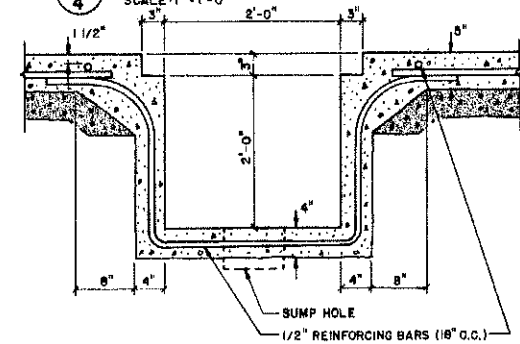
POTATO STORAGE - 86,000 C.W.T.			
86' X 204' DOUBLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING, NDSU, GRAND, ND.			
USDA - RRV POTATO RES. CENTER, E. S. FORKS, MN.			
RRV POTATO GROWERS ASSN., S. S. FORKS, MN.			
DES. BY: D. JOHNSON, K. HELLEWANG, L. SCHAPER			
DR. BY: G. WAHL	SA. 1987	PLAN: RD 734-S-2	R 2



POTATO STORAGE - 86,000 C.W.T. 88' X 204' DOUBLE EXT. WALL (CROSS-ALLEY) EXTENSION AGRICULTURAL ENGINEERING, NDSU, GRAND FORKS, ND. USDA-ARS POTATO RES. CENTER, E. S. FORKS, MN. ARY POTATO GROWERS ASSN., E. S. FORKS, MN. DES. BY: D. JOHNSON, R. HELLEBRAND, L. SCHAPER DR. BY: D. WANK, JUL. 1987, PLAN NO 754-8-2 R 3		
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4 SLOPED FLOOR TRENCH
SCALE: 1" = 1'-0"



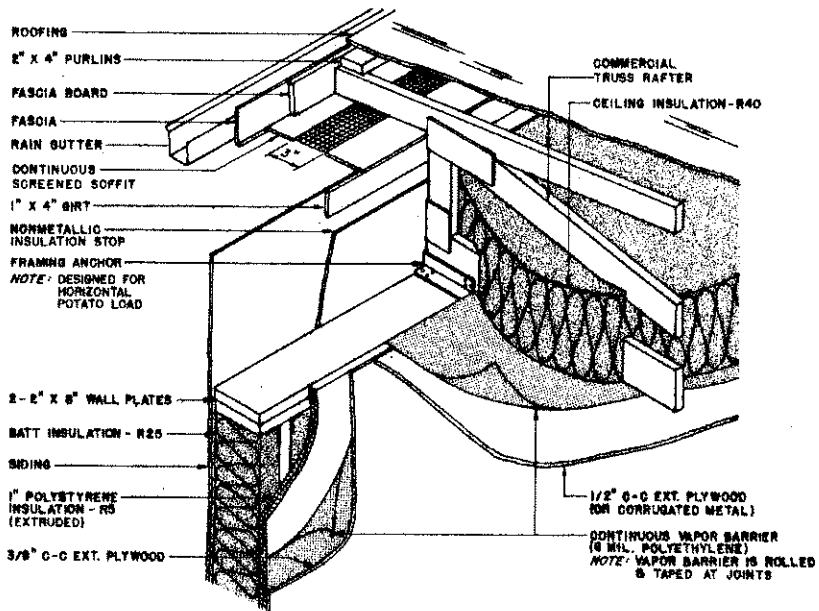
3 SLOPED FLOOR TRENCH
SCALE: 1" = 1'-0"
NOTE: THIS END OF TRENCH LOCATED BELOW PLENUM

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

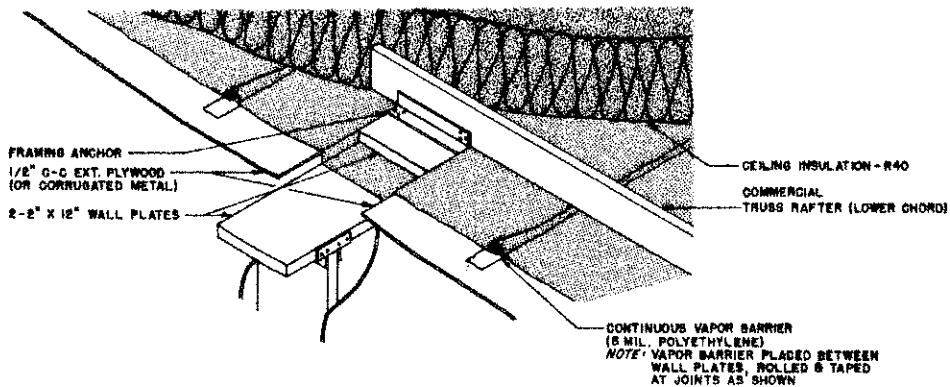
1 EXTERIOR DOUBLE WALL SECTION
SCALE: 1" = 1'-0"

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

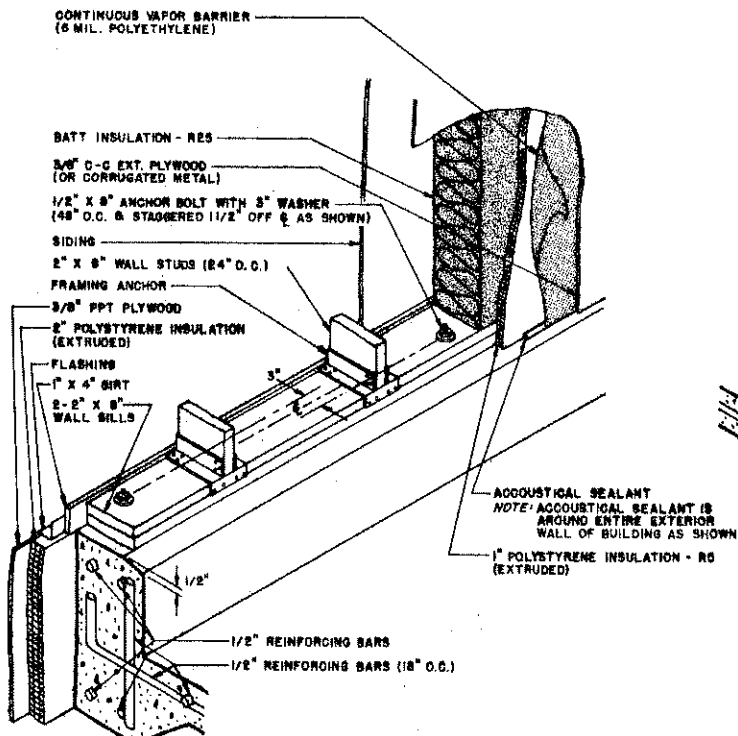
POTATO STORAGE - 86,000 C.W.T.			
88' X 204' DOUBLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING, NDSU, FARGO, ND.			
USDA - RRV POTATO RES. CENTER, E. S. FORKS, MN.			
RRV POTATO GROWERS ASSN., E. S. FORKS, MN.			
DES. BY: D. JOHNSON, K. HELLEVANG, L. SCHAPER			
DR. BY: D. WAHL	JUL. 1987	PLAN NO 734-6-2	P. 4



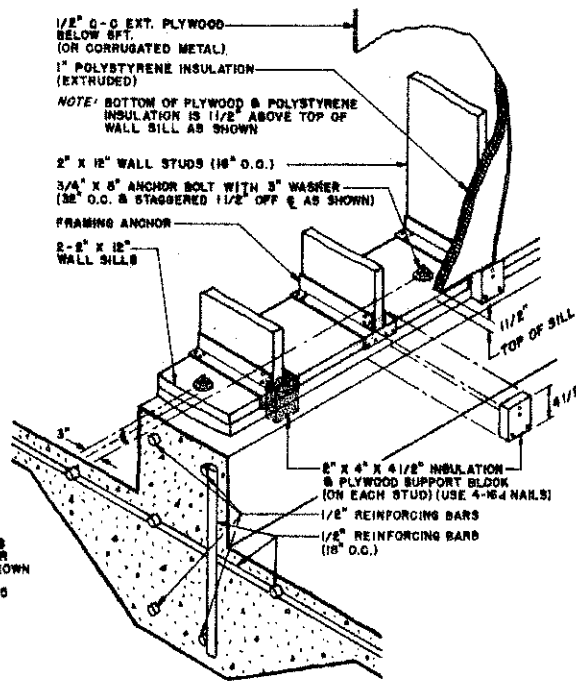
1 EXTERIOR WALL PLATE DETAIL
5 SCALE: 1" = 1'-0"



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

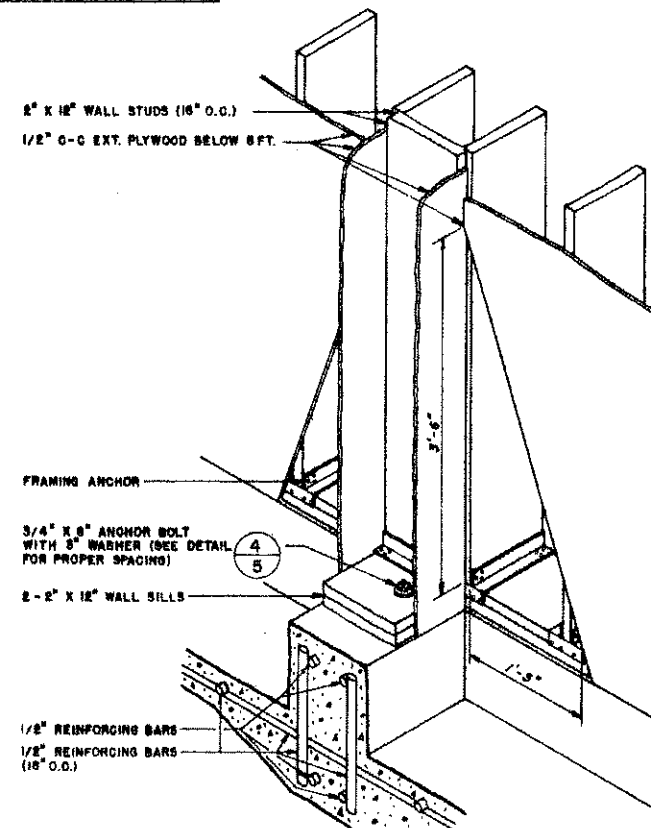


2 EXTERIOR WALL SILL DETAIL (OUTSIDE WALL)
5 SCALE: 1" = 1'-0" NOTE: THERE IS NO POTATO LOAD ON THIS WALL



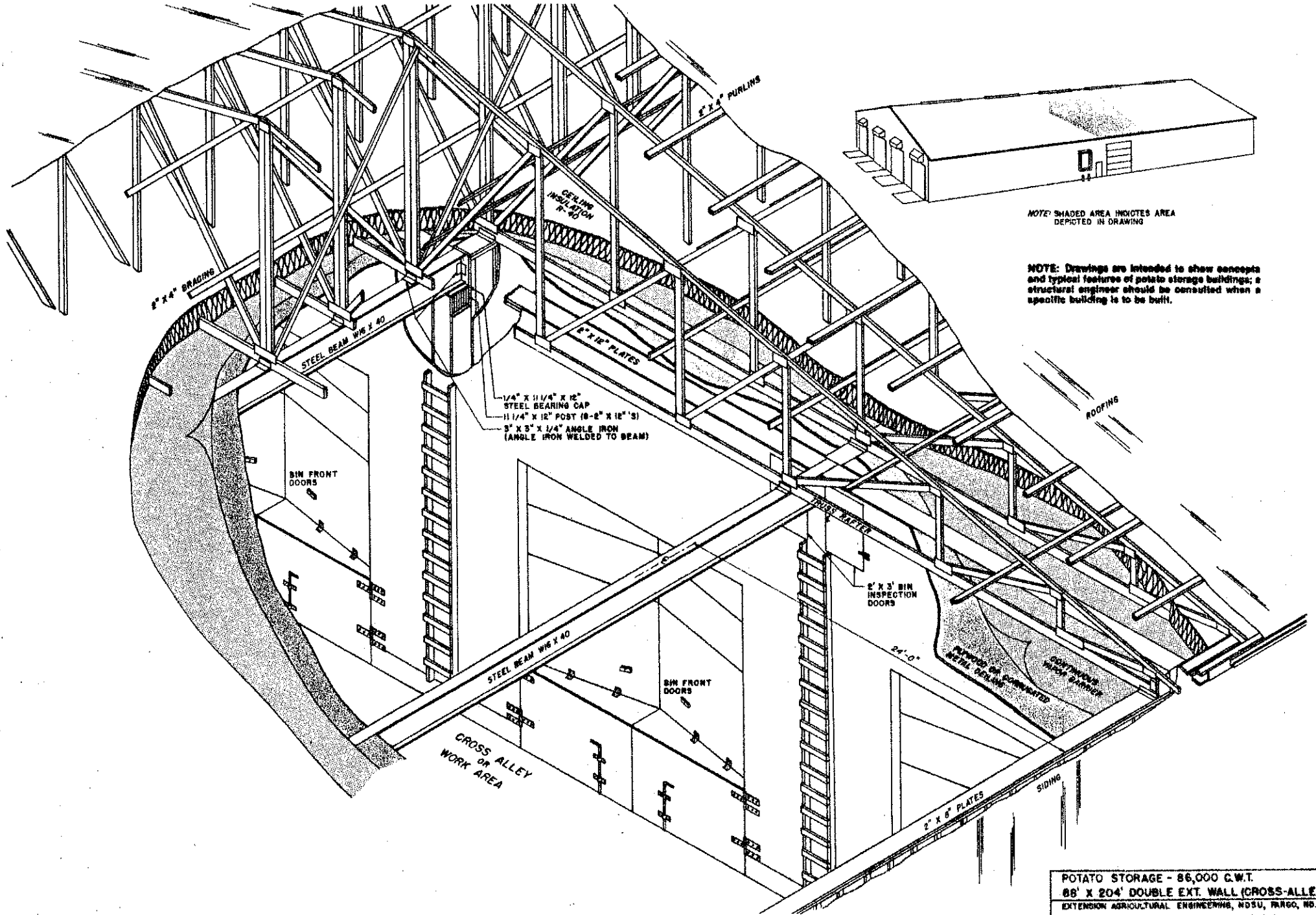
5 WALL SLOT OUTLET DETAIL
5 SCALE: 1" = 1'-0"

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



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

POTATO STORAGE - 86,000 C.W.T.	
88' X 204' DOUBLE EXT. WALL (CROSS-ALLEY)	
EXTENSION AGRICULTURAL ENGINEERING, NDSU, GRAND FORKS, ND.	
MSDA - RRV POTATO RES. CENTER, S. S. FORKS, MN.	
RRV POTATO BREWERS ASSN., S. S. FORKS, MN.	
DES. BY: D. JOHNSON, H. HELLEVANG, L. SCHAPER	
DR. BY: D. WAHL	JUL. 1987 PLAN: NG 734-G-2 2/8



NOTE: SHADED AREA INDICATES 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.

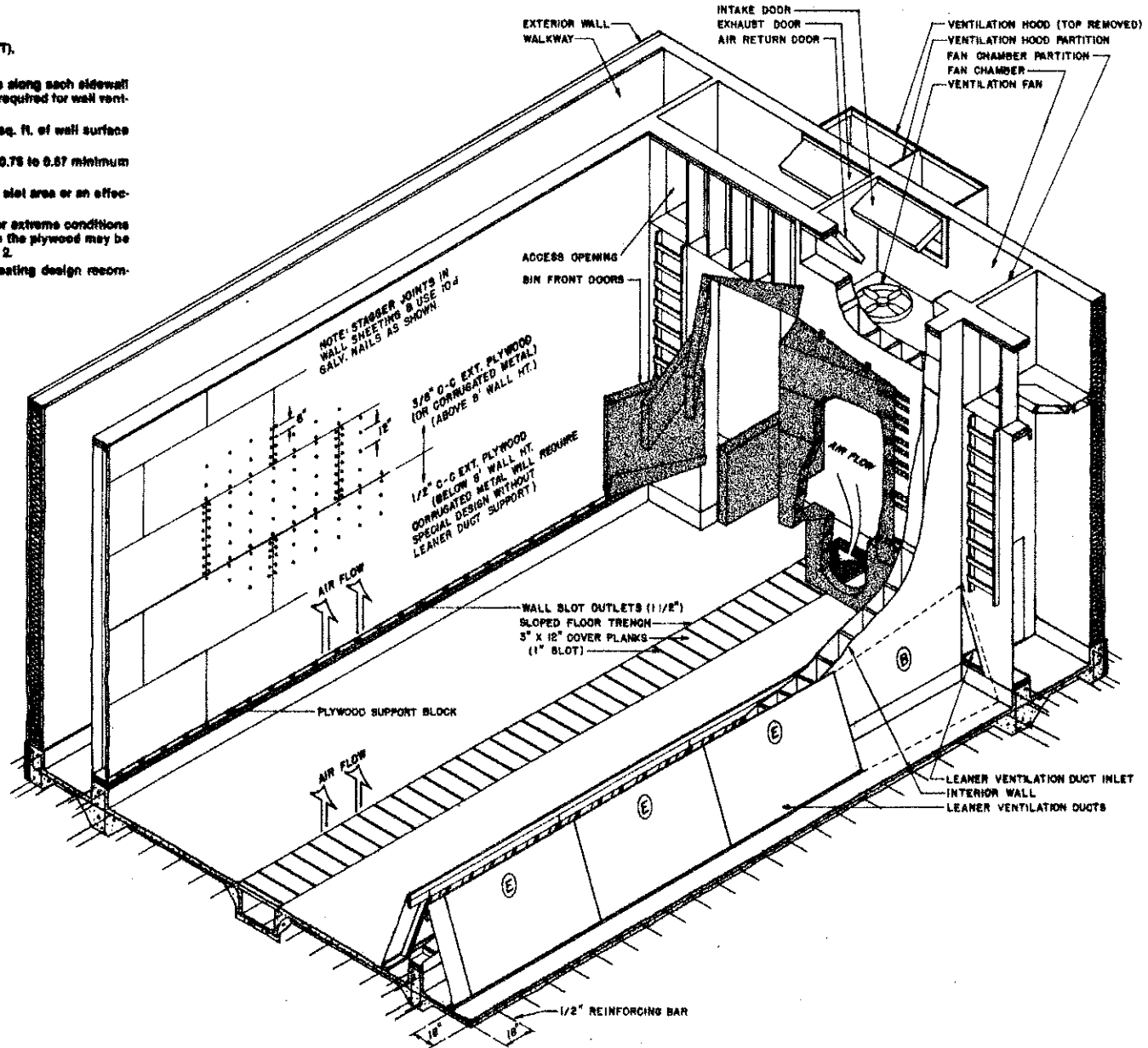
CROSS ALLEY AREA
SCALE: 3/8" = 1'-0"

POTATO STORAGE - 86,000 C.W.T. 86' X 204' DOUBLE EXT. WALL (CROSS-ALLEY)		
EXTENSION AGRICULTURAL ENGINEERING, NDSU, FARGO, ND. 1		
USDA - RRV POTATO RES. CENTER, E. S. FORKS, MN.		
RRV POTATO GROWERS ASSN., E. S. FORKS, MN.		
DES. BY: D. JOHNSON, K. NELLEYS, L. SCHAPIER		
DR. BY: D. WAHL	JUL. 1987	PLAN NO 734-6-E P. 6

Ventilation Design:

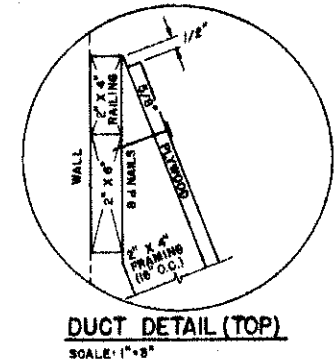
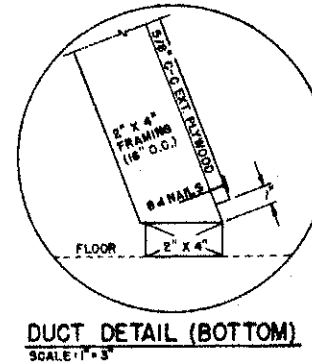
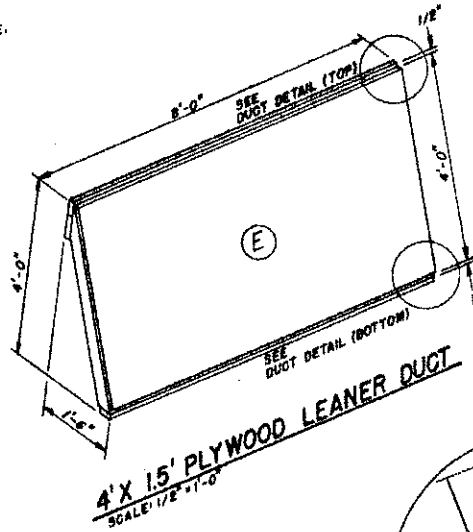
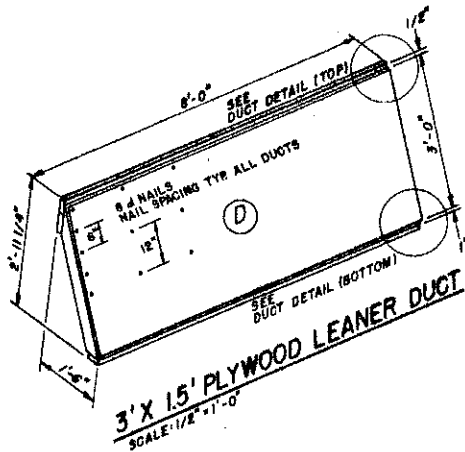
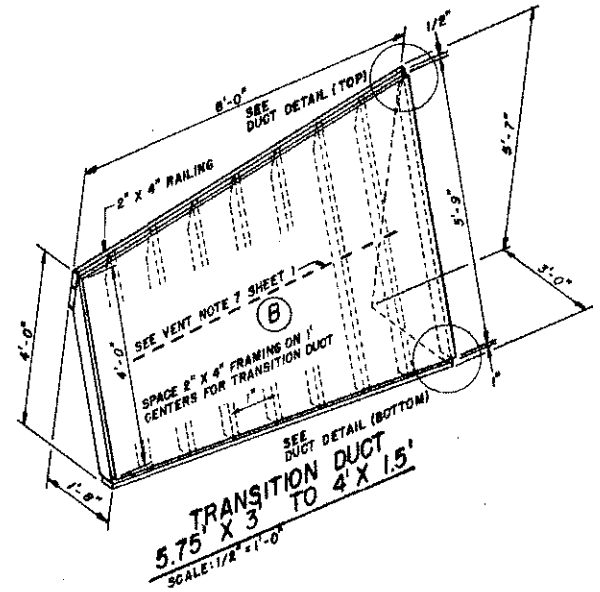
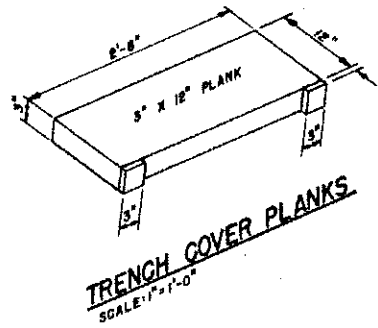
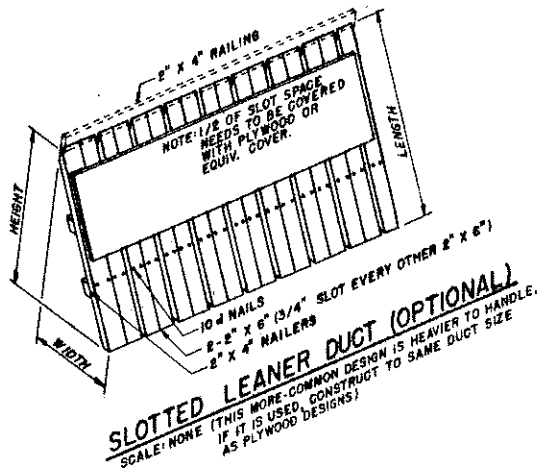
1. Ventilation duct airflow of 1 cu. ft. per minute per CWT (1 CFM/CWT).
2. Vent duct maximum airspeed of 1800 feet per minute (17 mph).
3. "Through" type ventilation with $\frac{1}{4}$ the needed airflow for potatoes along each sidewall and $\frac{1}{2}$ through the bottom-center of the bin. Extra duct 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-80, "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"

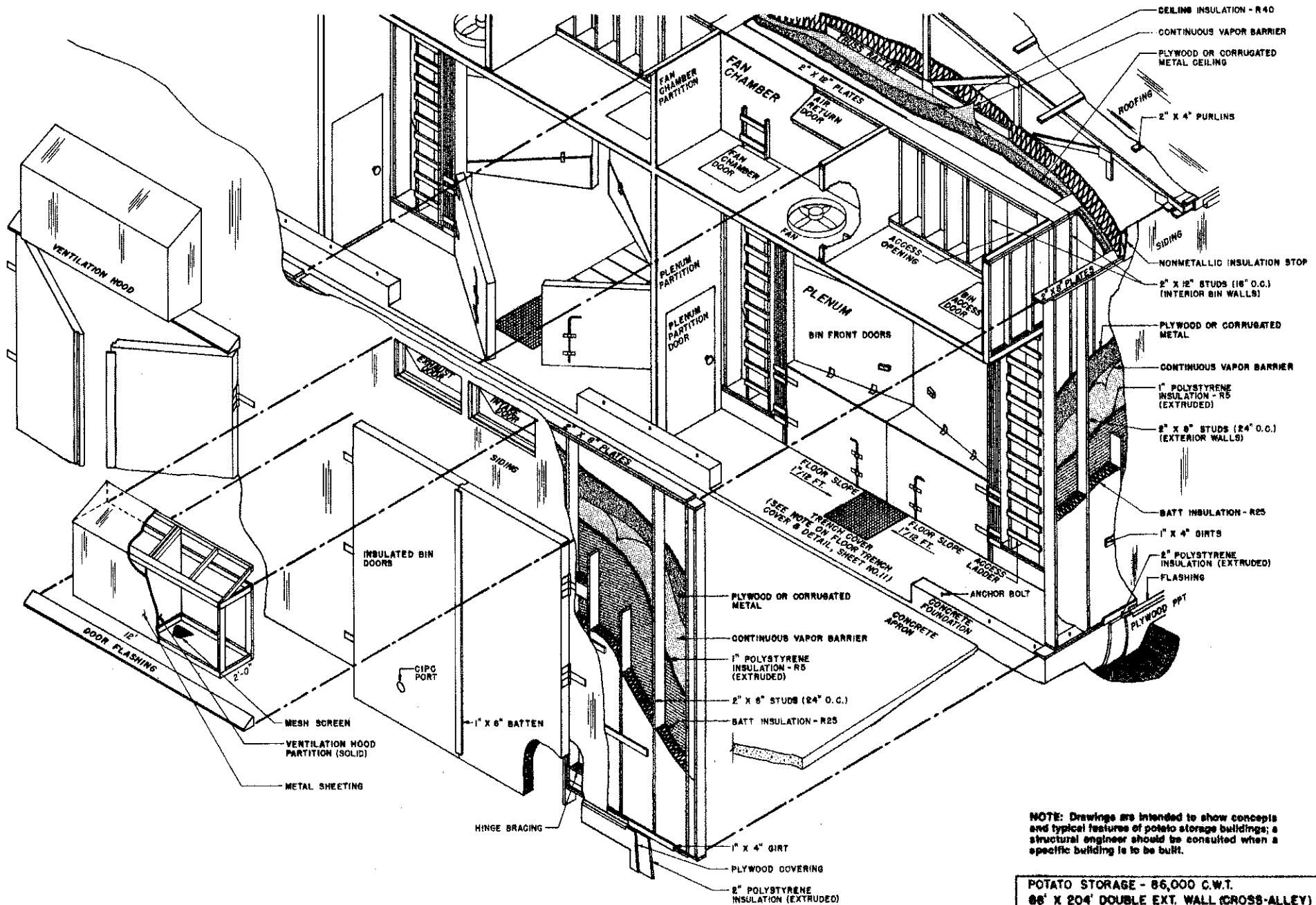
POTATO STORAGE - 86,000 C.W.T.			
88' X 204' DOUBLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING, NDSU, FARGO, N.D.			
USDA - RRV POTATO RES. CENTER, E. S. FORKS, MN.			
RRV POTATO GROWERS ASSN., E. S. FORKS, MN.			
DES. BY: D. JOHNSON, K. NELLEWANG, L. SCHAPIER			
DR. BY: D. WAHL	JUL. 1967	PLAN NO 734-0-2	2.7



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

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

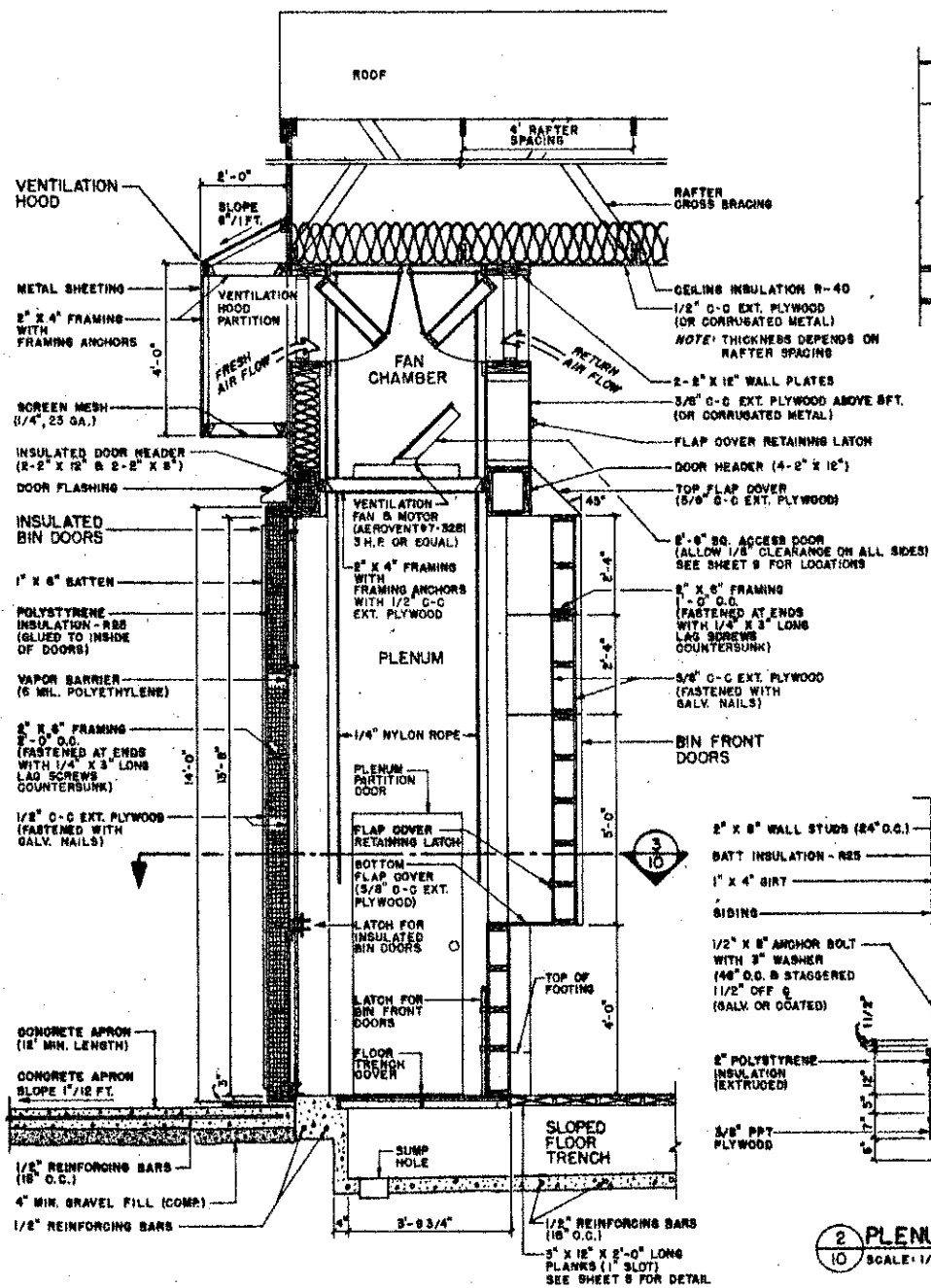
POTATO STORAGE - 85,000 C.W.T.			
85' X 204' DOUBLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING, NDSU, WAGG, RD. 1			
NEDA - RRV POTATO RES. CENTER, E. S. FORKS, MN.			
RRV POTATO GROWERS ASSN., E. S. FORKS, MN.			
DES. BY: D. JOHNSON, R. HELLEVANG, L. SCHAPER			
DR. BY: D. WAHL	JUL. 1987	PLAN NO 734-S-2	P. 3



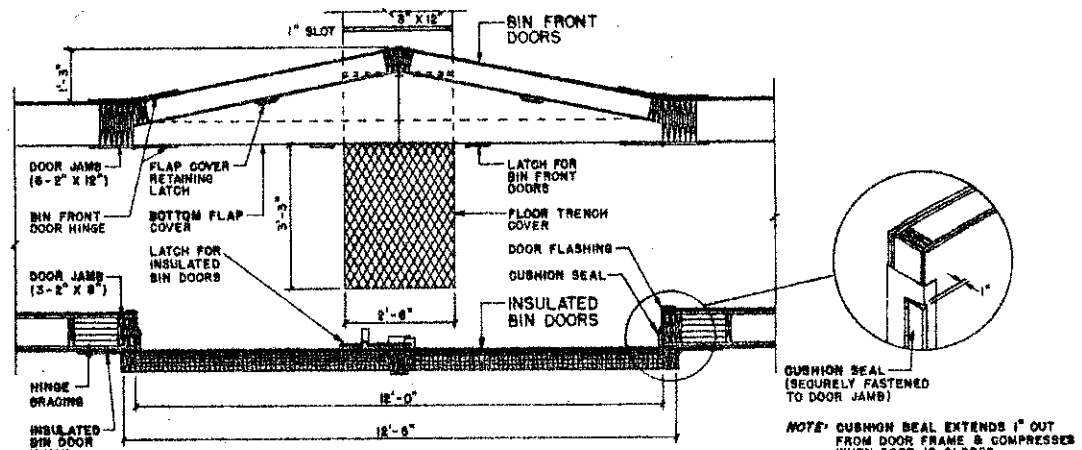
PLENUM AREA - EXPLODED VIEW
SCALE: NOT TO SCALE

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.

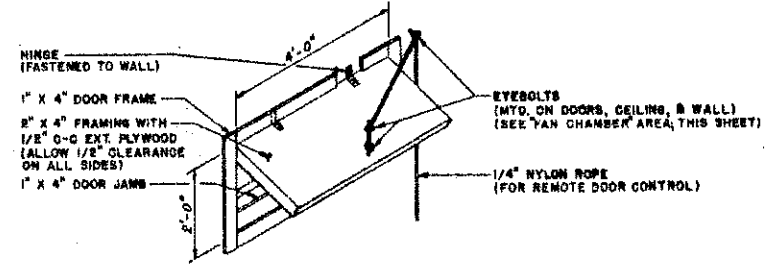
POTATO STORAGE - 86,000 C.W.T.	
86' X 204' DOUBLE EXT. WALL (CROSS-ALLEY)	
EXTENSION AGRICULTURAL ENGINEERING, NDSU, FARGO, ND.;	
USDA - RRV POTATO RES. CENTER, E. S. FORKS, MN.	
RRV POTATO BROWERS ABBN., E. S. FORKS, MN.	
DES. BY: D. JOHNSON, K. HELLEVANS, L. SCHAPER	
DR. BY: D. WAHL	JUL. 1967
PLAN NO 734-6-2	P. 9



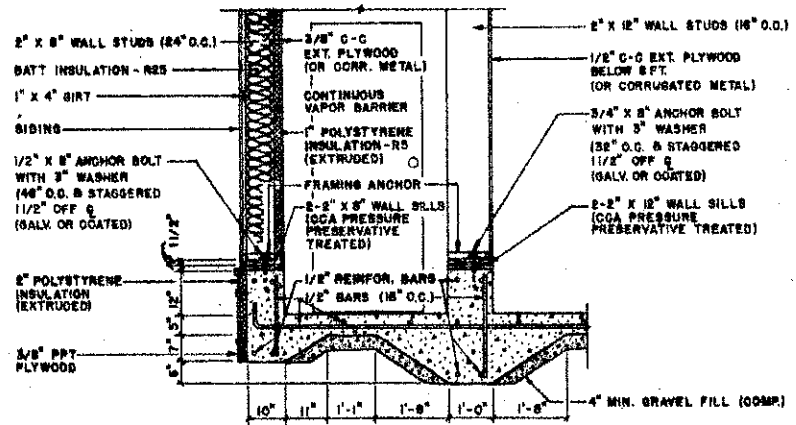
1 PLENUM SECTION THRU BIN DOORS
SCALE: 1/2" = 1'-0"



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



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



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

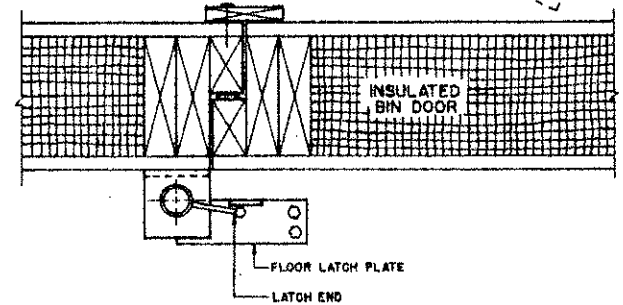
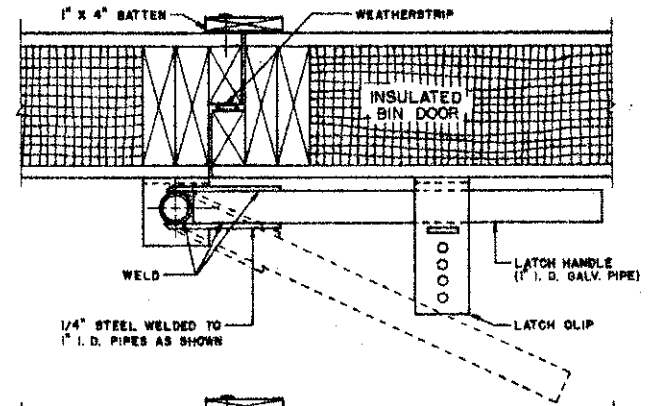
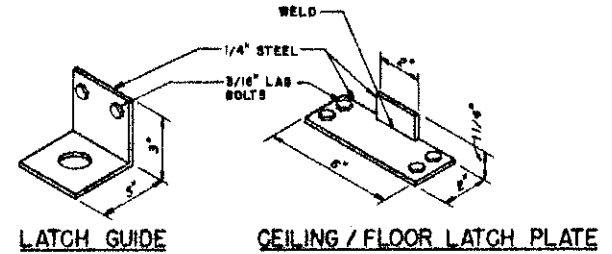
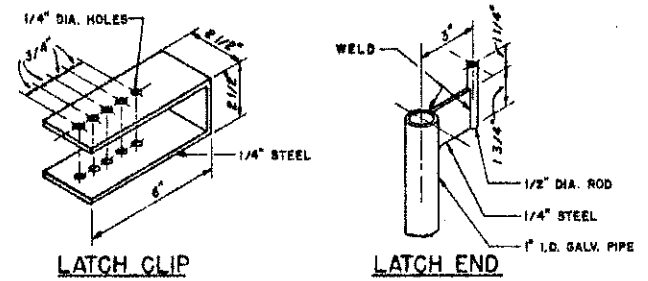
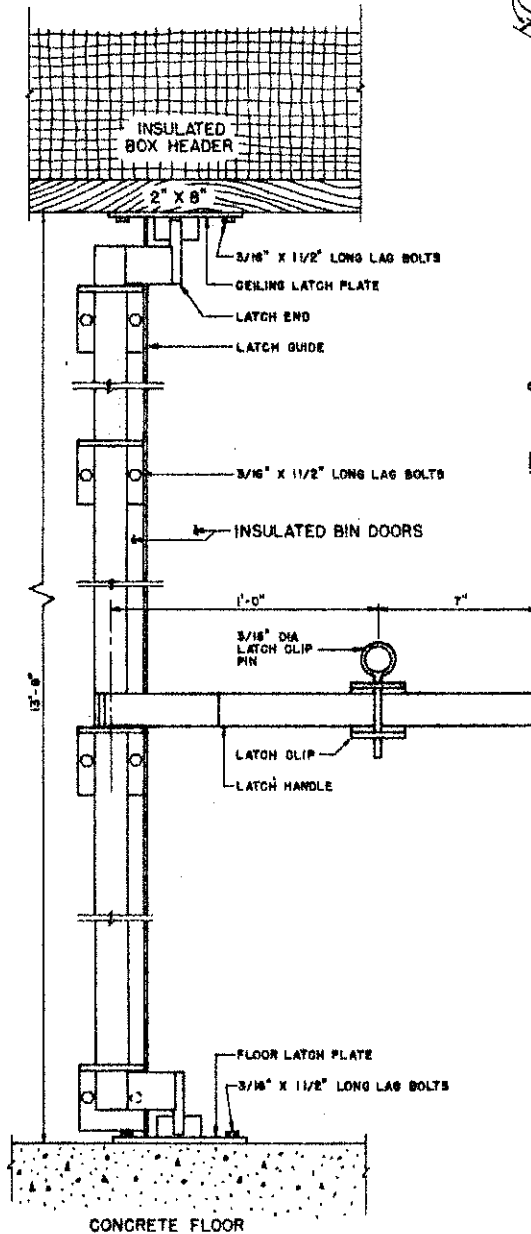
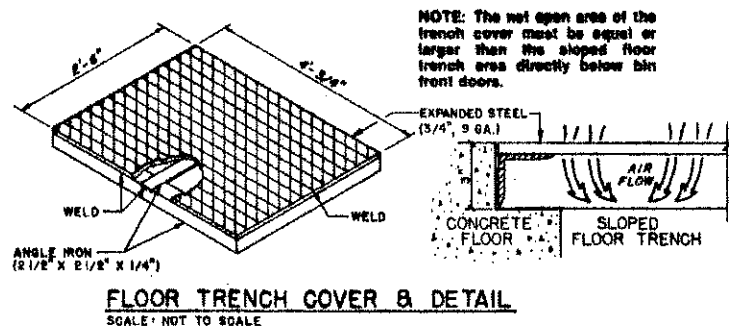
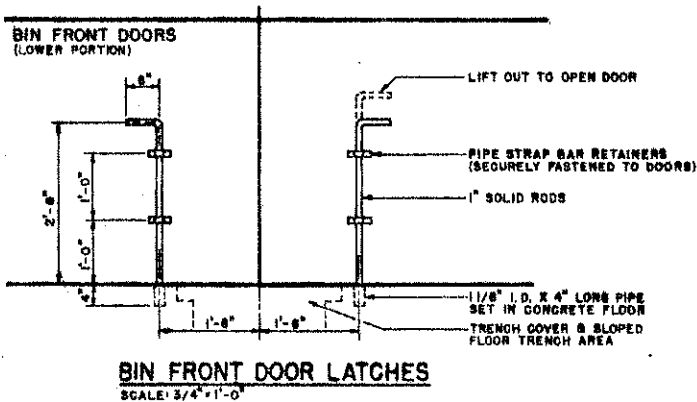
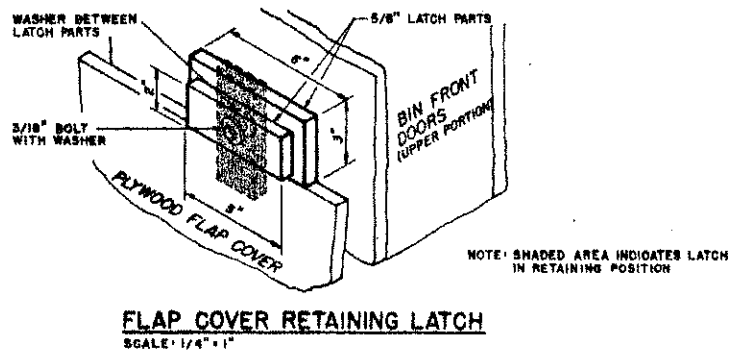
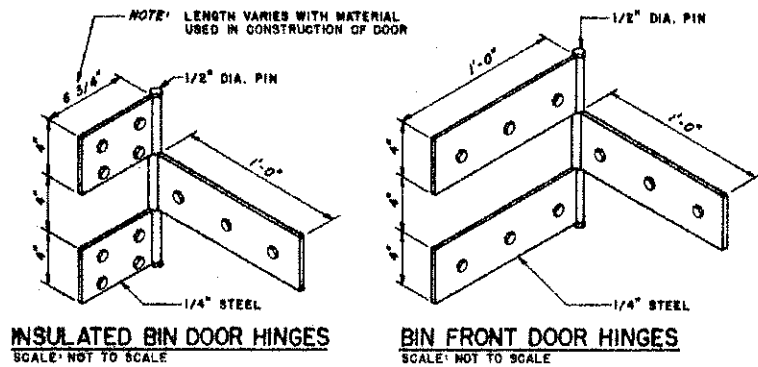
NOTE: SEE SHEET 11 FOR DETAIL DRAWINGS OF THE FOLLOWING ITEMS:

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

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

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

POTATO STORAGE - 65,000 C.W.T.	
88' X 204' DOUBLE EXT. WALL (CROSS-ALLEY)	
EXTENSION AGRICULTURAL ENGINEERING, WOOD, HARRIS, INC.	
USDA - BRV POTATO RES. CENTER, E. S. FORKES, MD.	
BRV POTATO GROWERS ASSN., E. S. FORKES, MD.	
DES. BY: D. JOHNSON, R. WELLS, L. SCHMIDT	
DR. BY: D. WALK	JULY 1987 PLAN NO 734-S-2 R 10



POTATO STORAGE - 66,000 C.W.T.
66' X 204' DOUBLE EXT. WALL (CROSS-ALLEY)
EXTENSION AGRICULTURAL ENGINEERING, WDSU, BANGOR, ME.;
USDA-RRV POTATO RES. CENTER, E. S. FORNS, MN.
RRV POTATO GROWERS ASSN., E. S. FORNS, MN.
DES. BY: D. JOHNSON, K. HELLEVANG, L. SCHAEFER
DR. W. D. WALKER JUL 1967 PLANS 102 734-6-2 (211)