

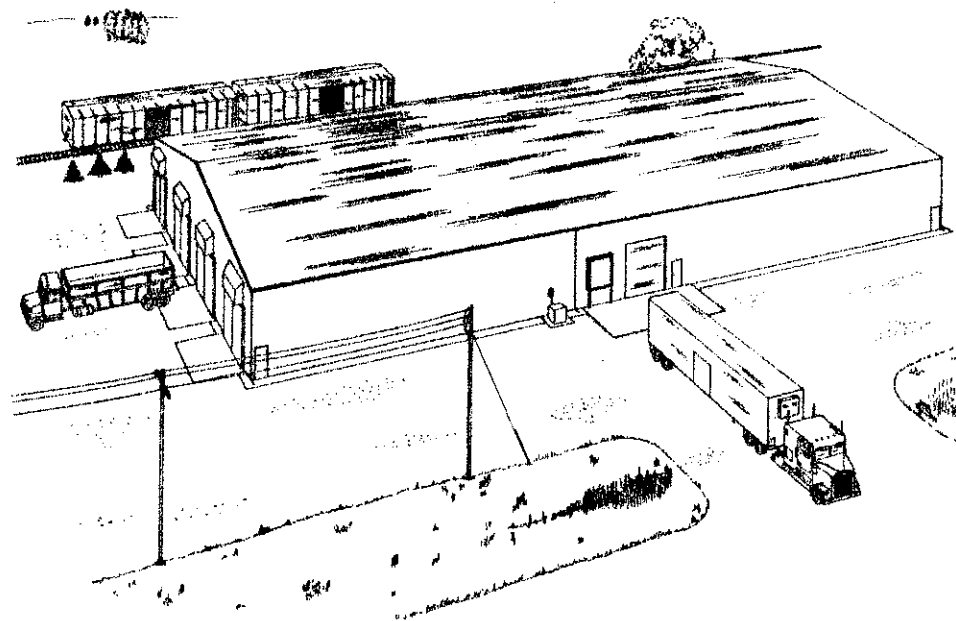
NOTES: These drawings are not complete building plans - rather, their intent is to show concepts, selected design recommendations and application differences based on recent USDA research and field experiences. These drawings in turn can be used in preparation of more complete, individually engineered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

General Design:

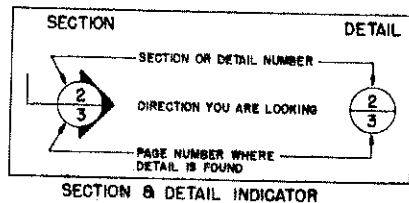
1. Floor/foundation design is from USDA calculation. A soil bearing capacity of 2000 lbs./sq. ft. was used with a concentrated truck wheel load of 4800 lbs.
2. Potato specific weight of 42 lbs. per cubic foot (52 lbs./bu.)
3. Clean, wet, smooth-skinned, rounded potatoes (e.g. Norchip) that exert a horizontal 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 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) sealed 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 $1/4$ the needed airflow for potatoes along each sidewall and $1/2$ 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 area-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.

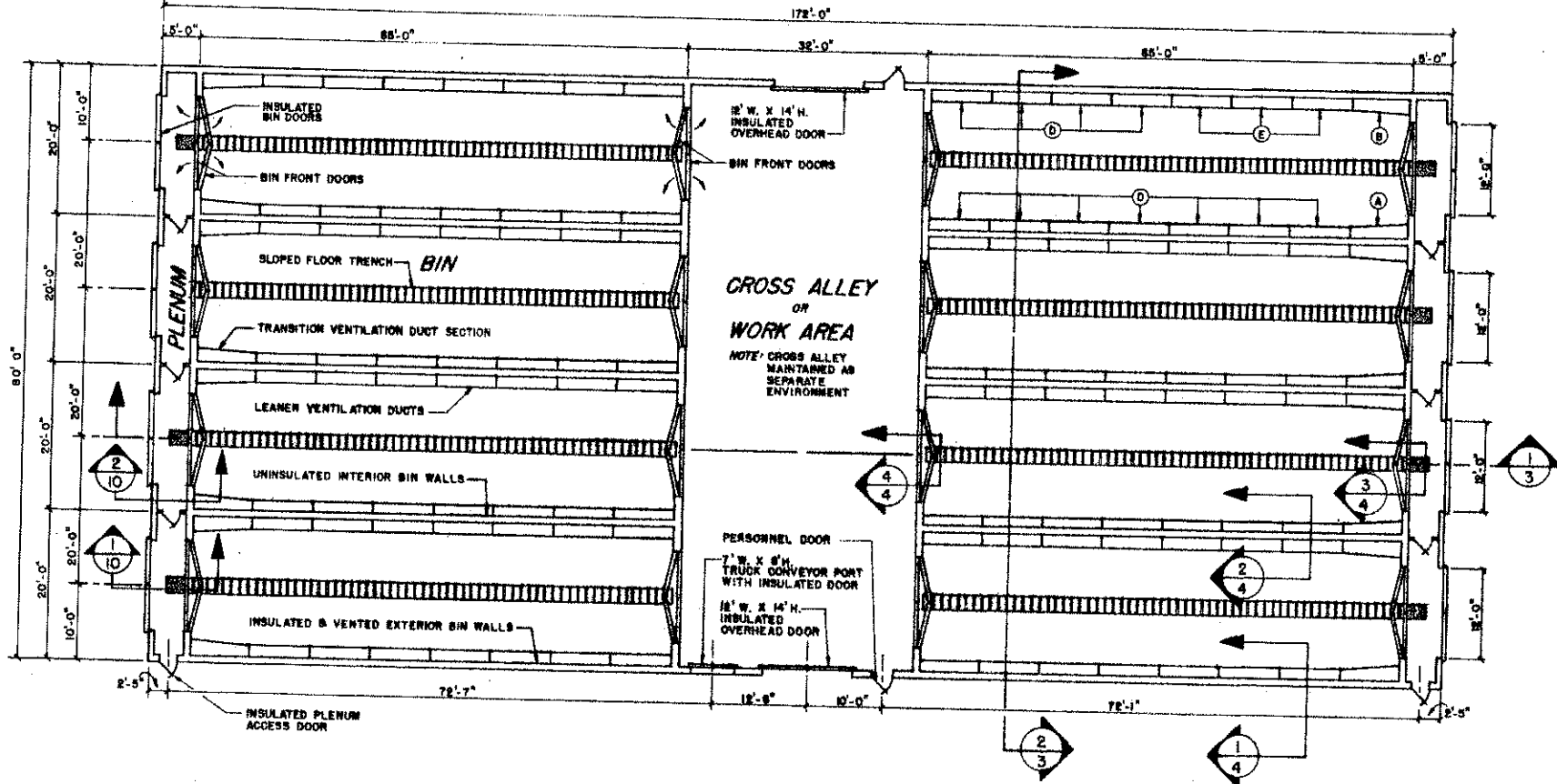


POTATO STORAGE - 58,000 CWT SINGLE EXTERIOR WALL: Intended for use with more detailed planning, these drawings show the major construction and ventilation features for a 80' x 172' building with 8 storage bins and a cross-aisle work area. These major features change with changes in storage size. Two other sets of drawings are available for storage capacities of 88,000 CWT single exterior wall 80' x 204' and for 88,000 CWT double exterior wall 66' x 204'.



POTATO STORAGE - 58,000 C.W.T.			
80' X 172' SINGLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING NDSU, FARGO, ND 581			
USDA - RRV POTATO RES. CENTER, E. G. FORNS, MN.			
RRV POTATO GROWERS ASSN., E. G. FORNS, MN.			
DES. BY: D. JOHNSON, S. HELLEVANG, L. SHAPIER			
DR. BY: D. WATL	JUL. 1987	PLAN NO 734-6-0	B 1

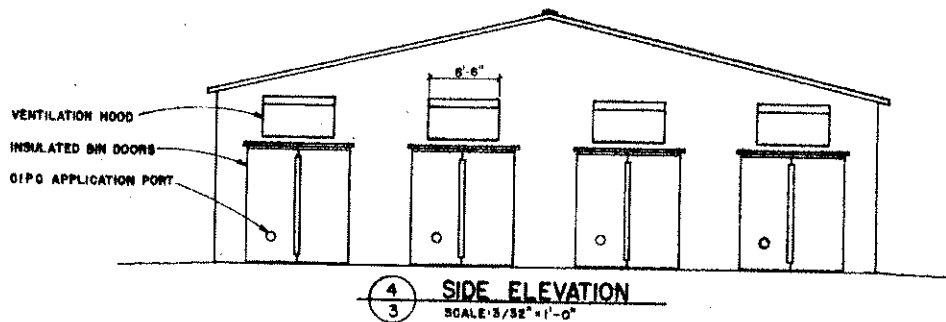
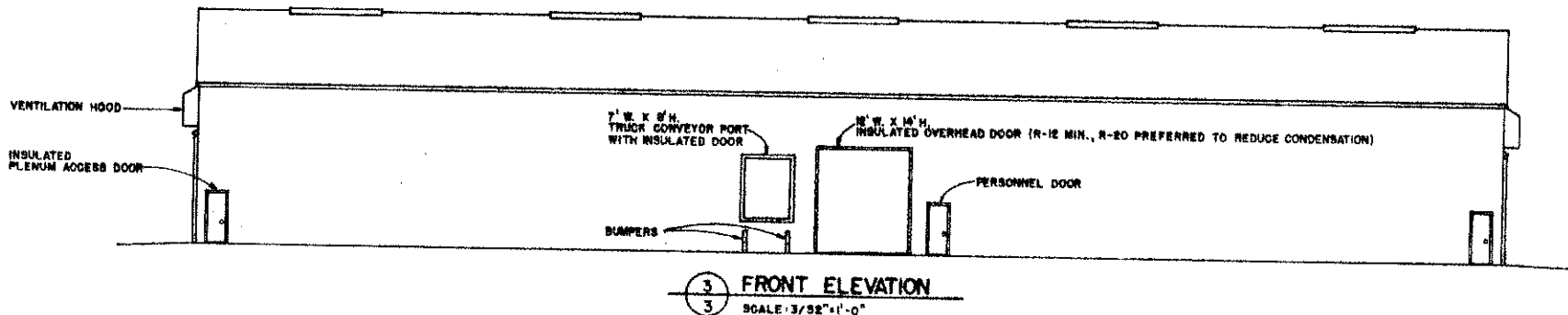
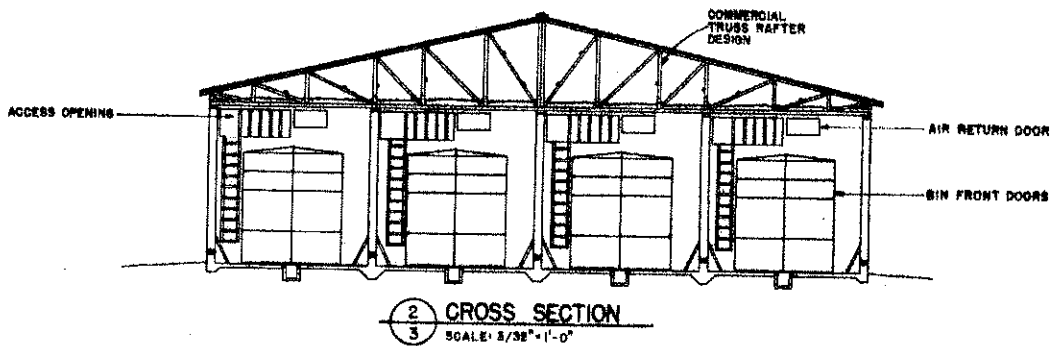
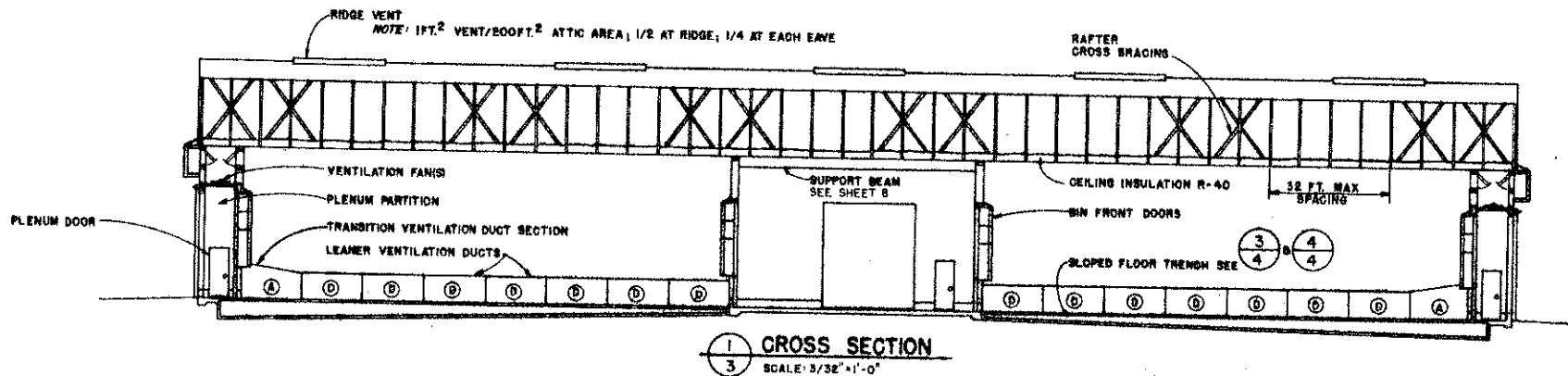
NOTE: (1) (2) etc., indicate learner duct designs (see Sheet 6). Exterior wall learner ducts use (1) (2) ducts as shown and interior learner ducts use (3) and (4) ducts as shown.



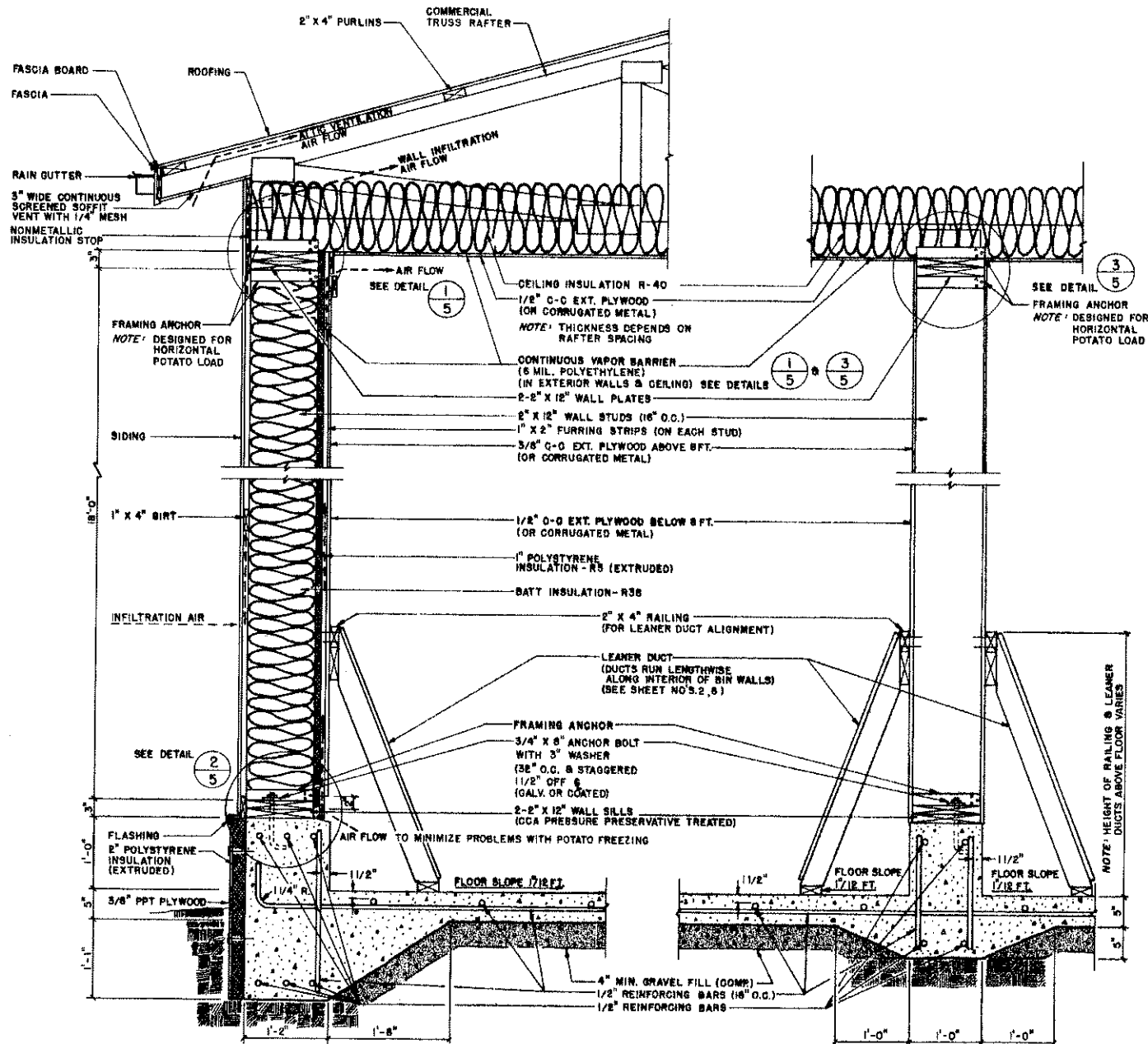
FLOOR PLAN
SCALE: 3/32" = 1'-0"

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

POTATO STORAGE - 68,000 C.W.T.			
80' X 172' SINGLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING NDSU, FARGO, ND.			
USDA - RRV POTATO RES. CENTER, E. G. FORKES, MN.			
RRV POTATO GROWERS ASSN., E. G. FORKES, MN.			
DES. BY: D. JOHNSON, H. HELLEVANG, I. SCHAPIER			
DR. BY: S. WAHL	JUL. 1987	PLAN NO 734-S-0	22



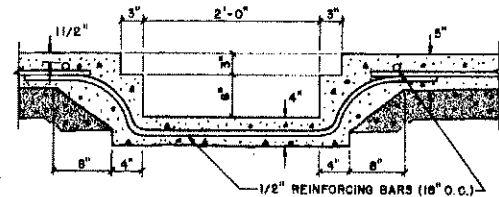
POTATO STORAGE - 66,000 C.W.T.			
80' X 172' SINGLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING NDSU, FARGO, ND.			
USDA - NRY POTATO RES. CENTER, E. S. FORKS, MN.			
NRY POTATO GROWERS ASSN., E. S. FORKS, MN.			
DES. BY: D. JOHNSON, K. HELLEWANG, L. SCHAPER			
DR. BY: D. WAM.	JUL. 1987	PLAN NO 734-B-0	25



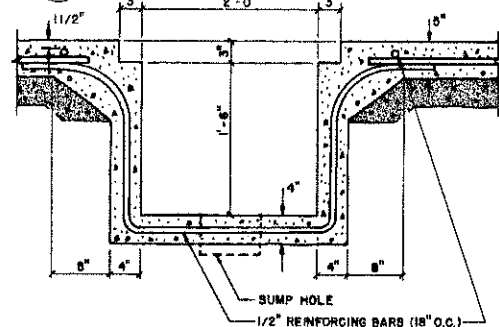
1
4
EXTERIOR WALL SECTION
SCALE: 1" = 1'-0"

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

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



3
4
SLOPED FLOOR TRENCH
SCALE: 1" = 1'-0"

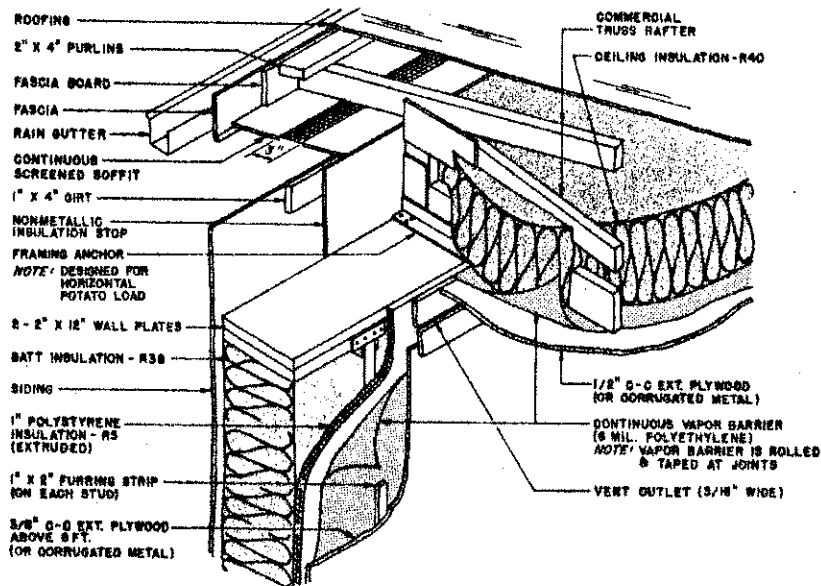


4
4
SLOPED FLOOR TRENCH
SCALE: 1" = 1'-0"

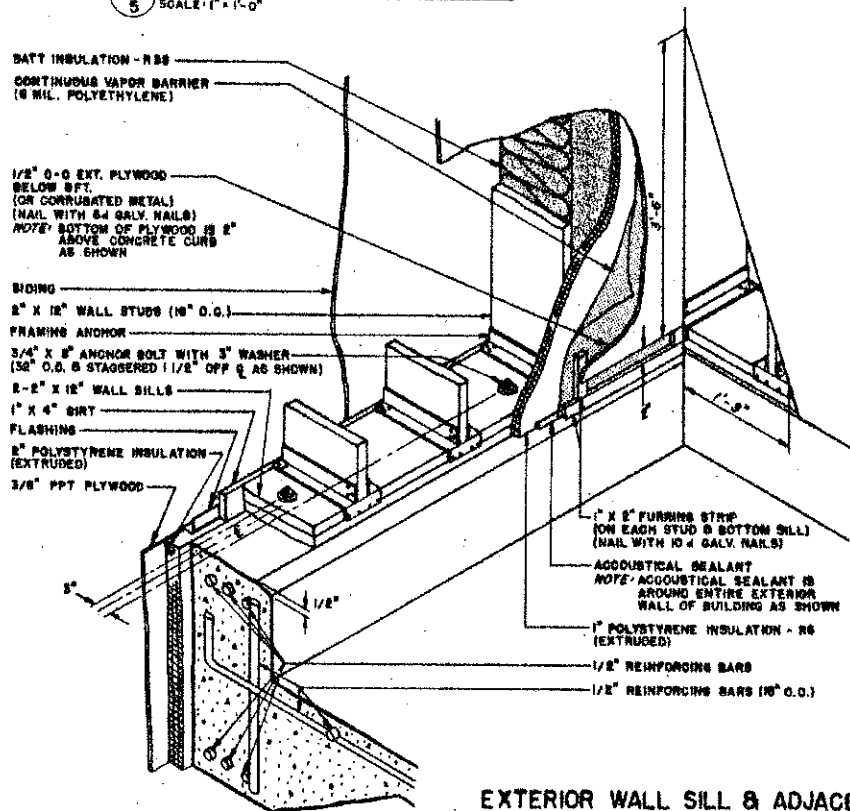
NOTE: THIS END OF TRENCH LOCATED BELOW PLENUM

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.

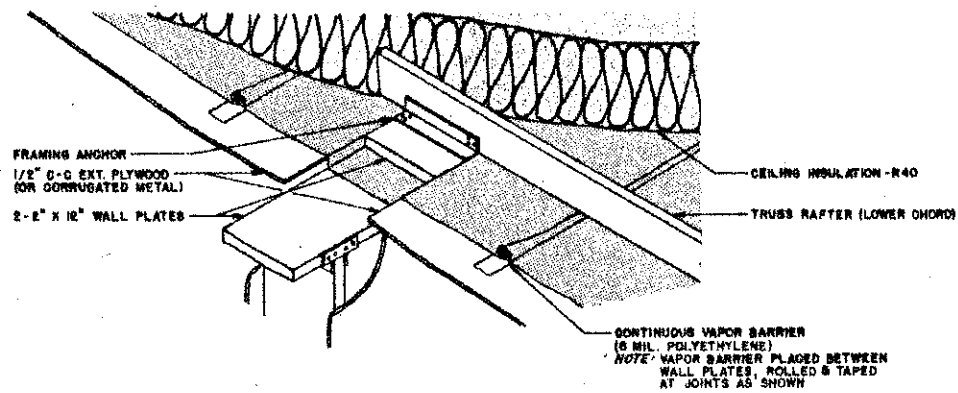
POTATO STORAGE - 68,000 C.W.T.			
80' X 172' SINGLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING WDSU, FARSD, ND.			
USDA- RRV POTATO RES. CENTER, E. S. FORKS, MN.			
RRV POTATO GROWERS ASSN., E. S. FORKS, MN.			
DES. BY: D. JOHNSON, K. HELLEWANG, L. SCHAPER			
DR. ST. D. WAHL	JUL. 1987	PLAN: ND 734-8-0	R 4



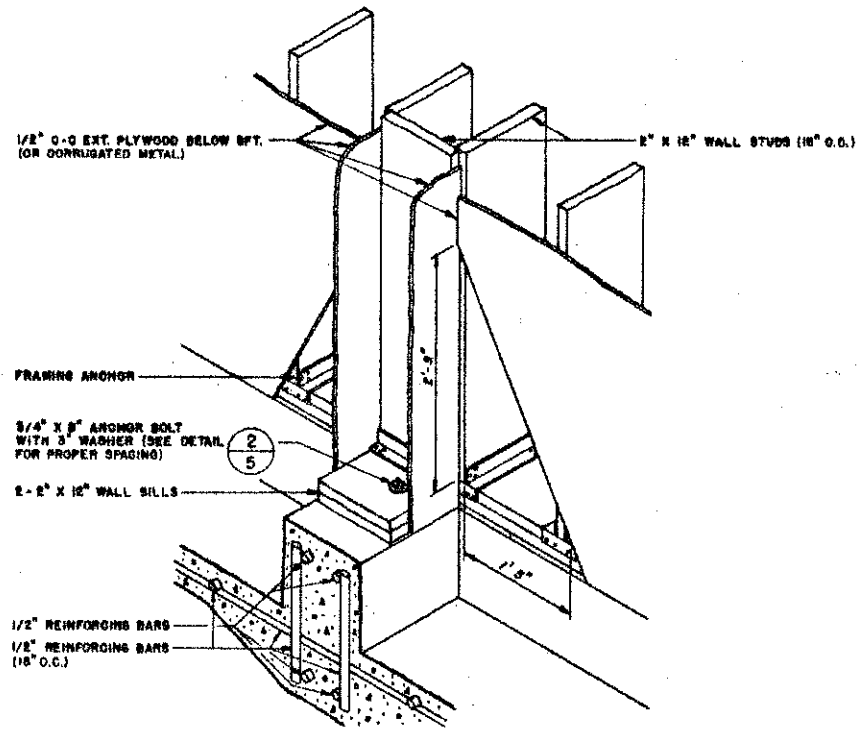
1
5
EXTERIOR WALL PLATE DETAIL
SCALE: 1" = 1'-0"



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



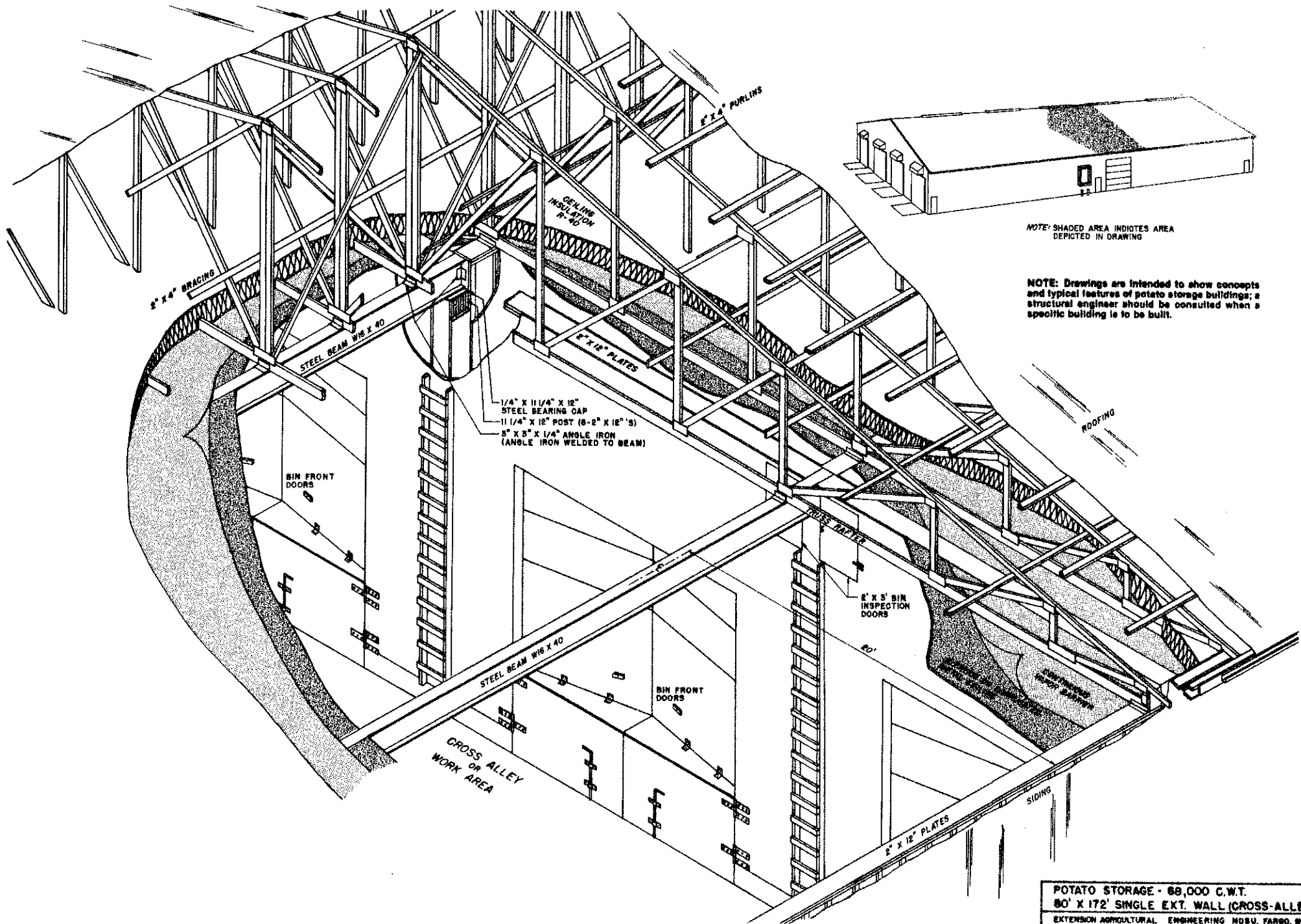
3
5
INTERIOR WALL PLATE DETAIL
SCALE: 1" = 1'-0"



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 - 68,000 C.W.T.	
80' X 172' SINGLE EXT. WALL (GROSS-ALLEY)	
EXTENSION AGRICULTURAL ENGINEERING NSUW, FARGO, ND.;	
USDA - RRV POTATO RES. CENTER, E. S. FORNS, MN.	
RRV POTATO GROWERS ASSN., E. S. FORNS, MN.	
DES. BY: B. JOHNSON, R. HELLEWANG, S. SCHAPIER	
DR. BY: D. WAHL	JUL 1987 PLAN NO 734-S-0 25



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.

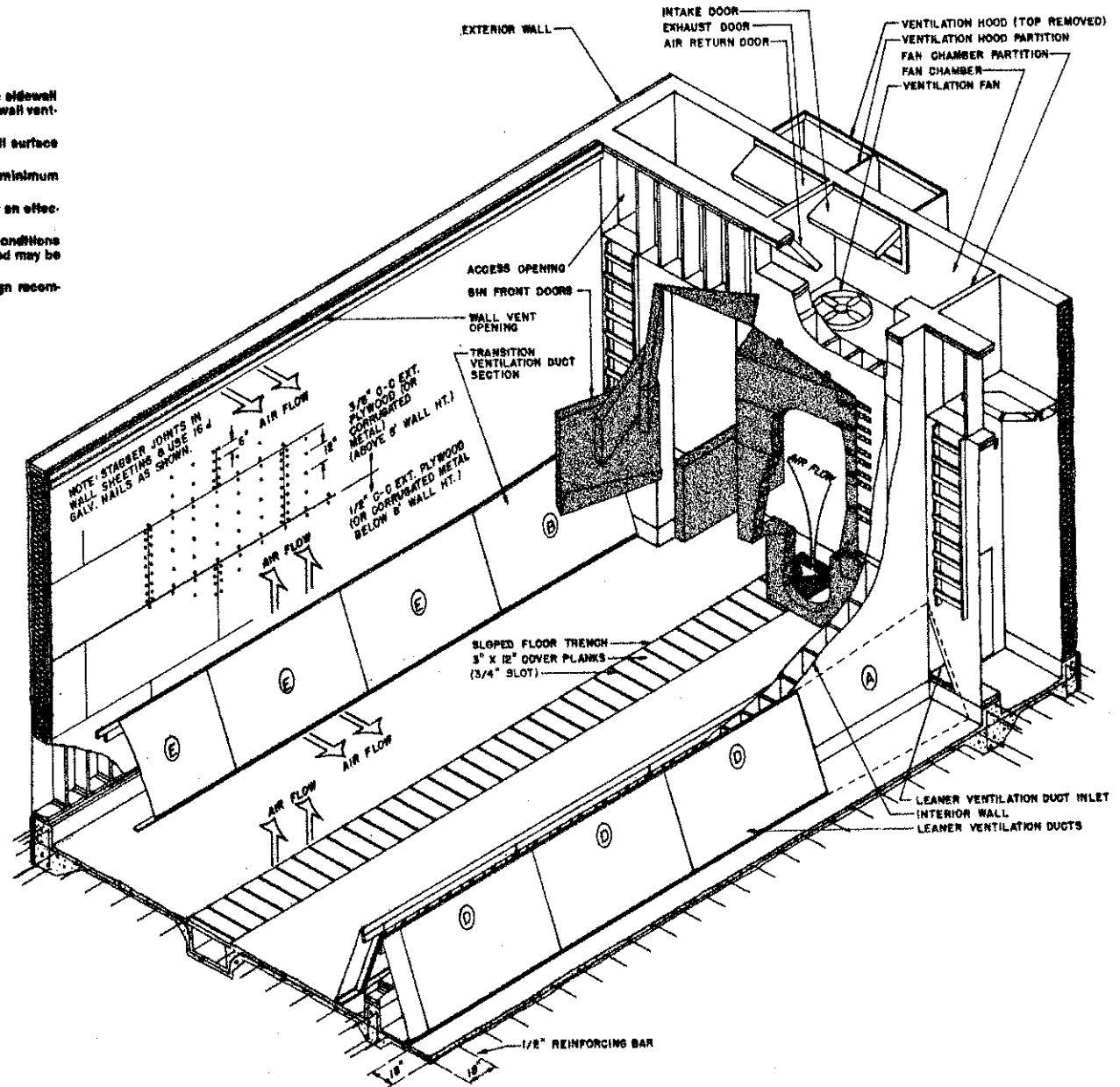
CROSS ALLEY AREA
SCALE: 3/8" = 1'-0"

POTATO STORAGE - 68,000 C.W.T.			
80' X 172' SINGLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING MDSU, FARGO, ND.			
USDA - RRV POTATO RES. CENTER, E. G. FORKS, MN.			
RRV POTATO BROWERS ASSN., E. G. FORKS, MN.			
DES. BY: D. JOHNSON, K. HELLEVANG, L. SCHAPER			
DR. BY: D. WAHL	JUL. 1967	PLAN NO 734-6-0	86

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 $\frac{1}{4}$ 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 shall 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-80, "Potato Storage Ventilation," for air heating design recommendations or the most up to date publication.

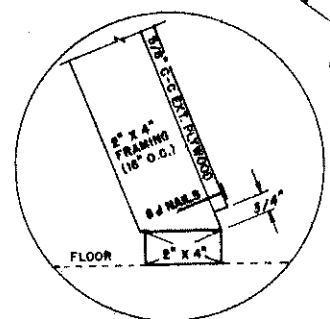
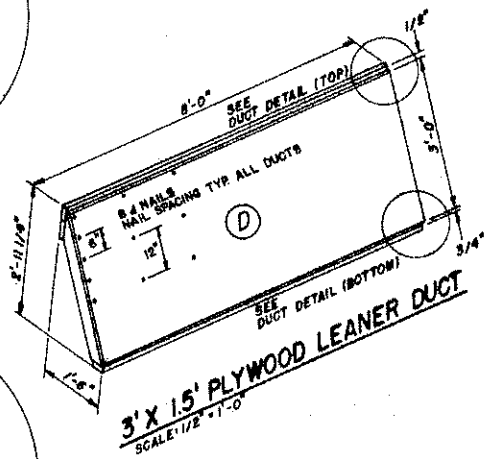
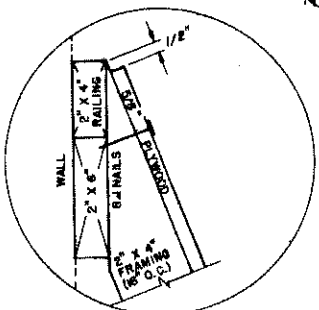
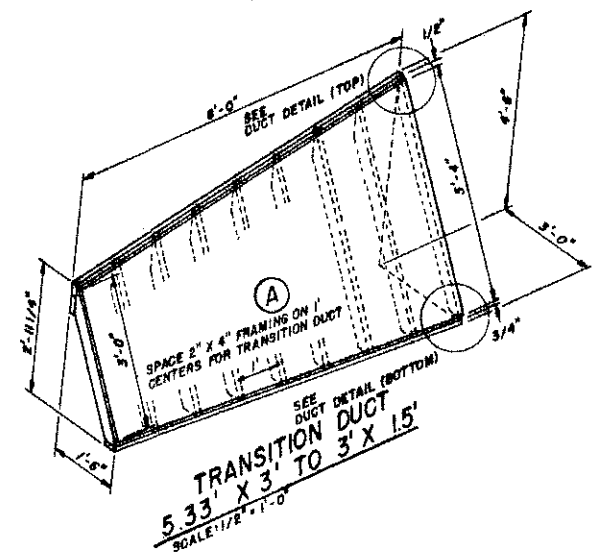
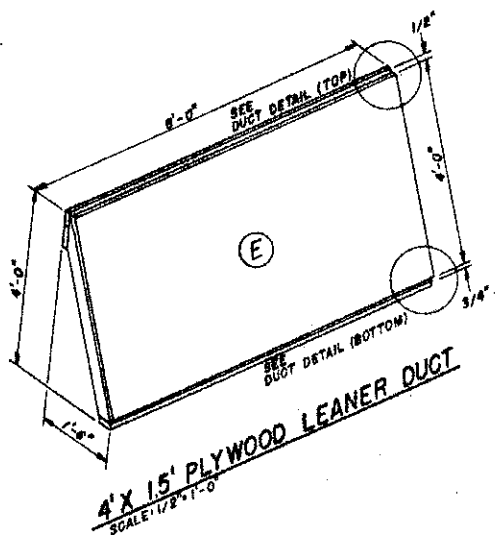
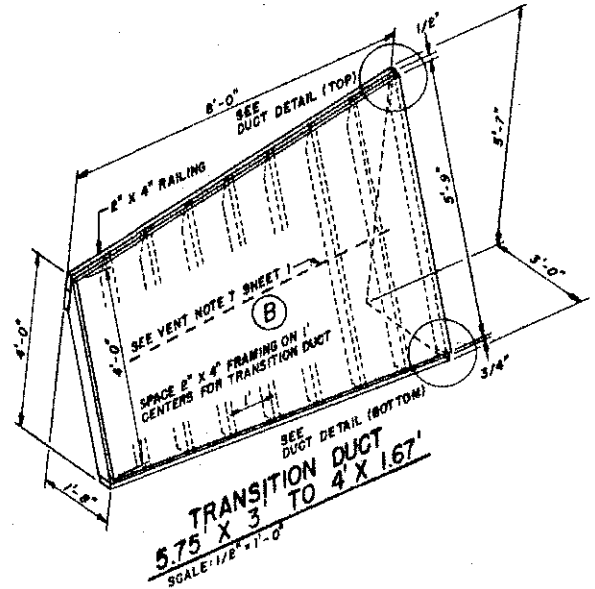
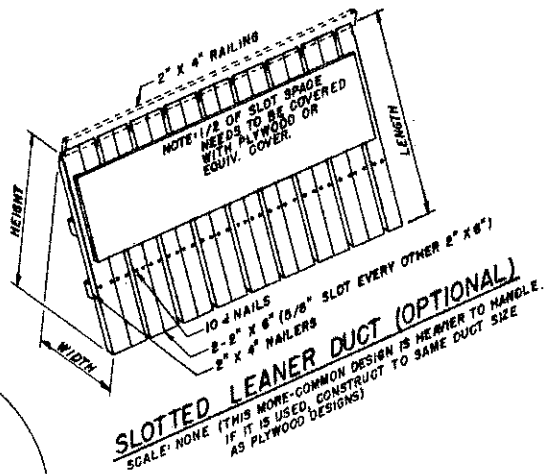
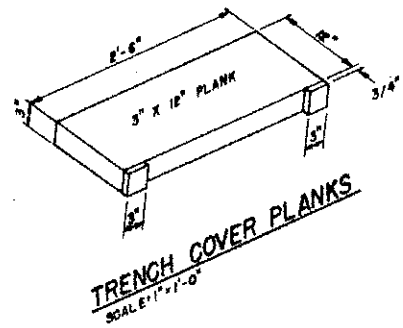
NOTE: Changing dimensions of potato bin will change ventilation requirements.



BIN VENTILATION DIAGRAM

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

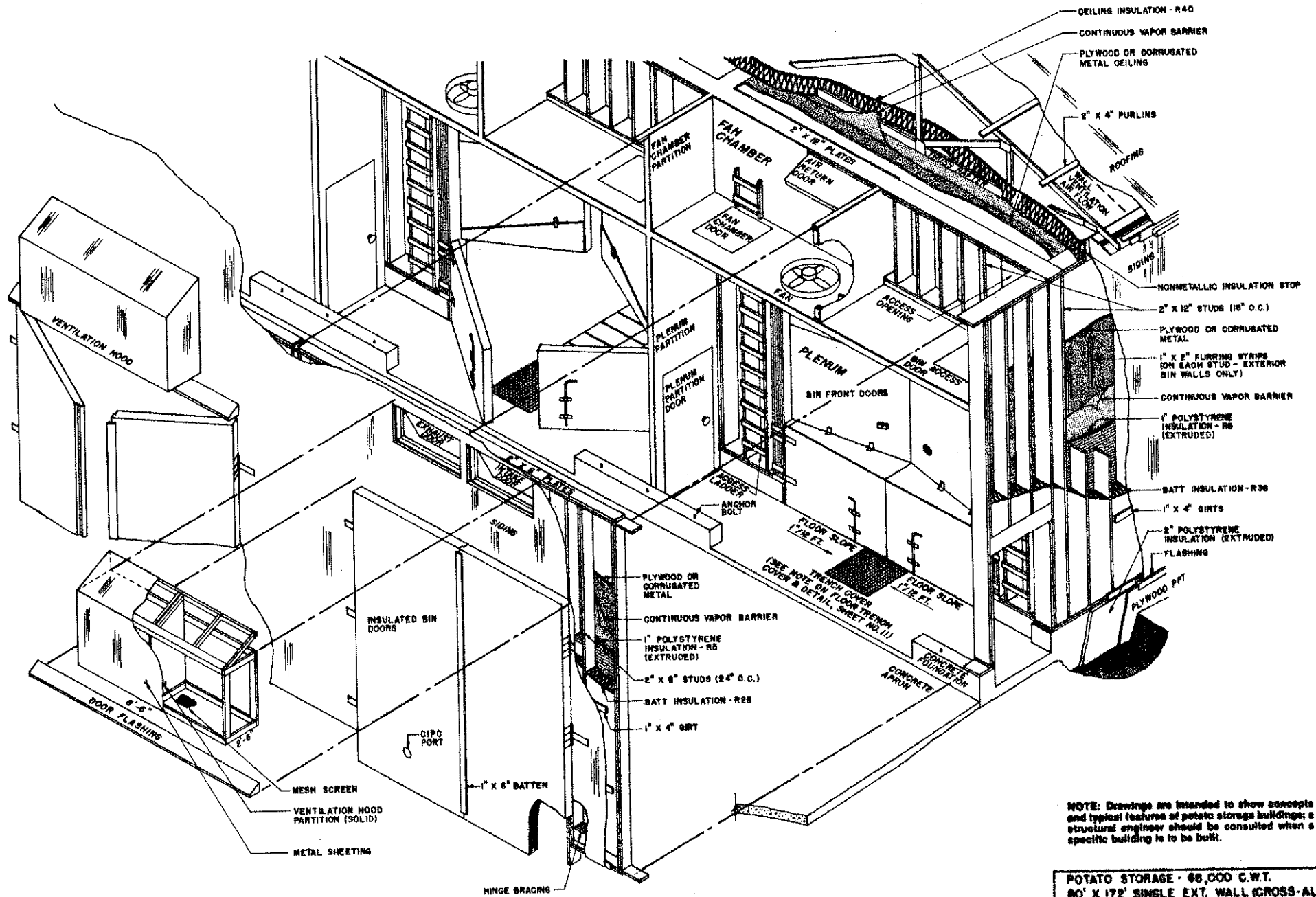
POTATO STORAGE - 88,000 C.W.T.		
80' X 172' SINGLE EXT. WALL (CROSS-ALLEY)		
EXTENSION AGRICULTURAL ENGINEERING NDSU, FARGO, ND.		
NADA - RRV POTATO RES. CENTER, E. S. FORKS, MN.		
RRV POTATO GROWERS ASSN., E. S. FORKS, MN.		
DES. BY: D. JOHNSON, R. HELLEMAN, L. SCHAPER		
DR. BT. D. WAHL	JUL. 1987	PLAN: ND 734-S-0 87



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

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

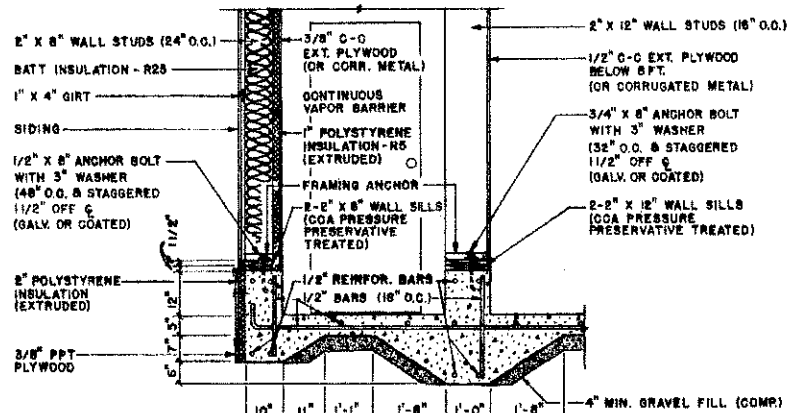
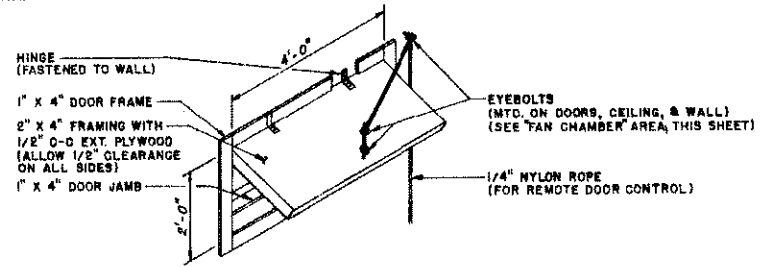
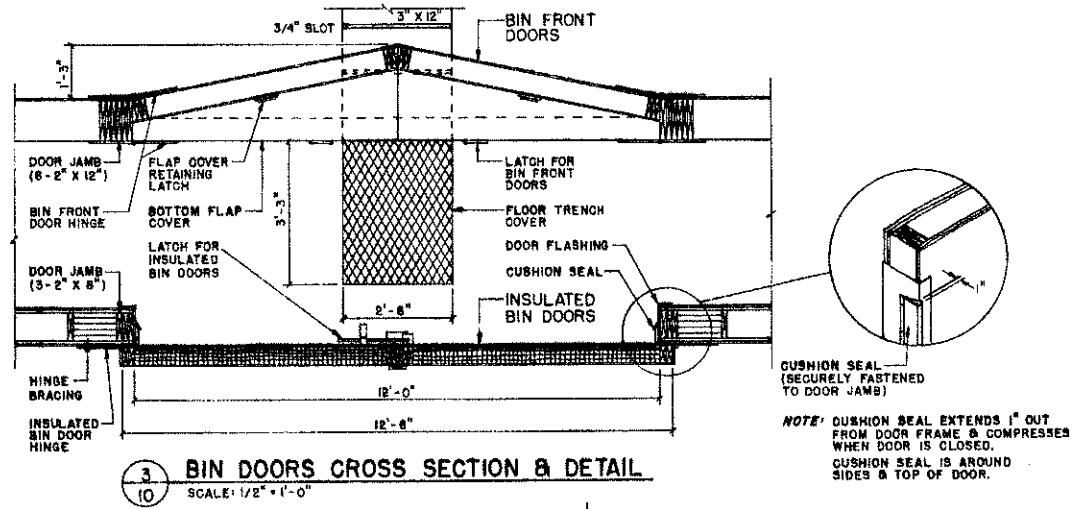
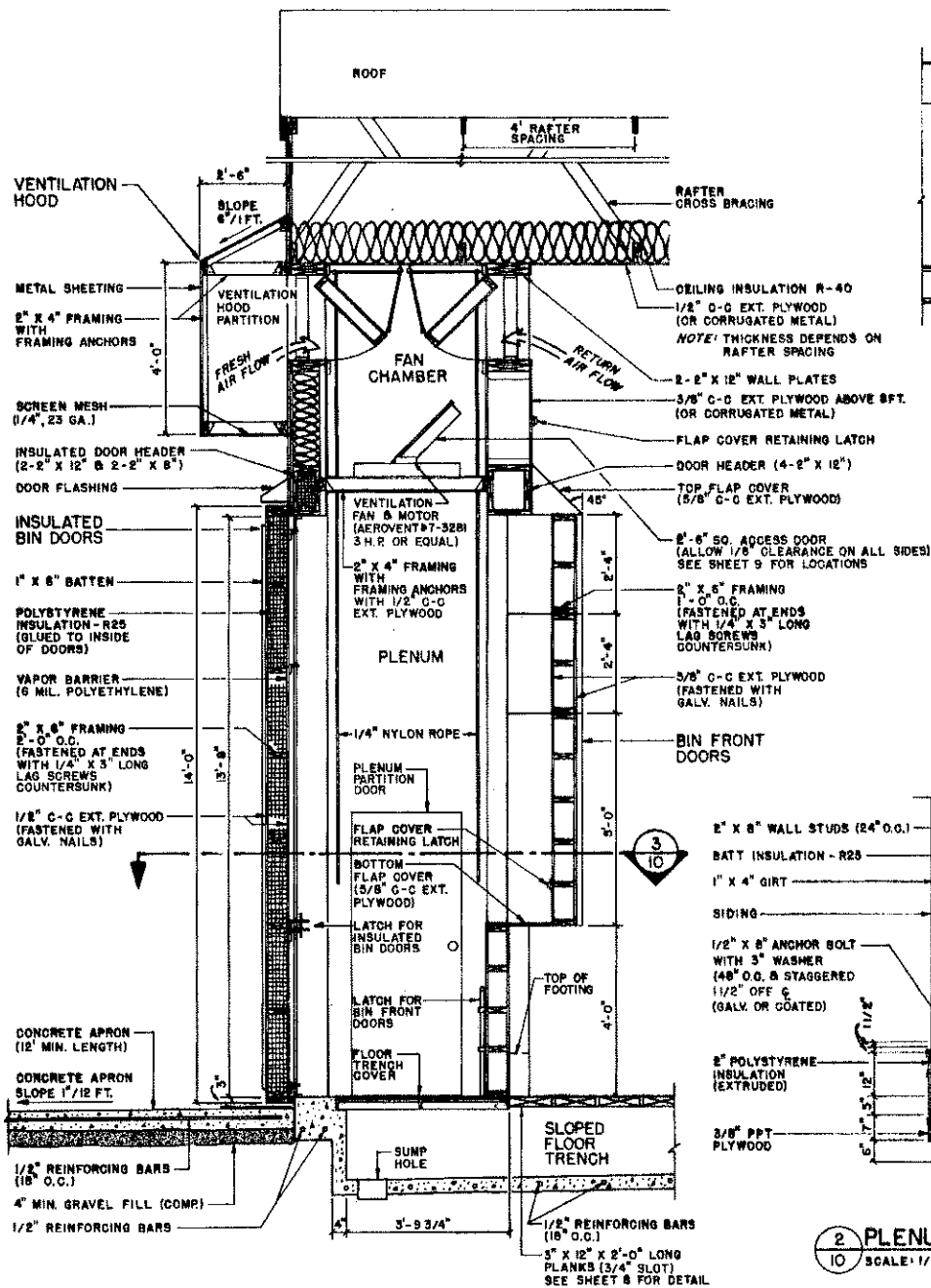
POTATO STORAGE - 68,000 C.W.T.
80' X 172' SINGLE EXT. WALL (CROSS-ALLEY)
EXTENSION AGRICULTURAL ENGINEERING MDSU, FARRO, MO.
MESA - RRY POTATO RES. CENTER, E.S. FORKS, MN.
RRY POTATO OWNERS ASSN., E.S. FORKS, MN.
DES. BY: D. JOHNSON, K. HELLVING, L. SCHAPER
DR. BY: D. WAIL JUL. 1987 PLAN NO 724-B-0 2 1



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 - 68,000 C.W.T.			
80' X 172' SINGLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING WDSU, 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: B. WAM	JAN. 1987	PLAN NO 734-G-D	8 8



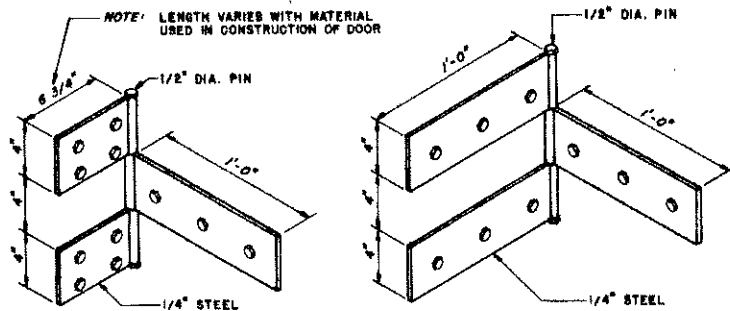
NOTE: SEE SHEET 11 FOR DETAIL DRAWINGS OF THE FOLLOWING ITEMS:

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

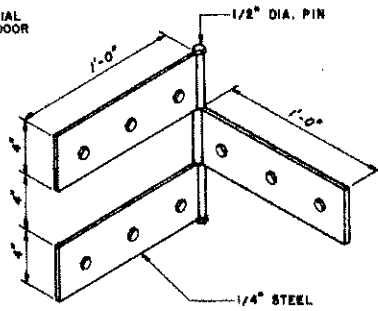
NOTE: Drawings are intended to show concepts and typical features of potato storage buildings; a structural engineer should be consulted when a specific building is to be built.

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

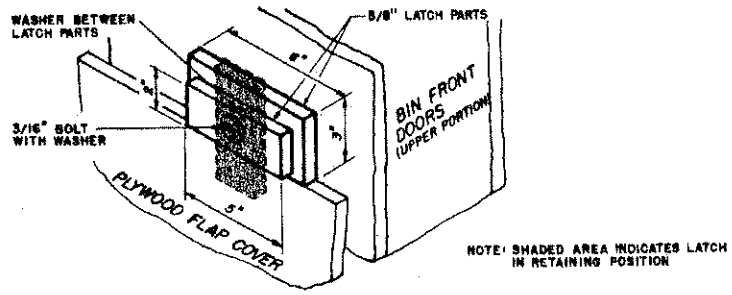
POTATO STORAGE - 68,000 C.W.T.			
80' X 172' SINGLE EXT. WALL (CROSS-ALLEY)			
EXTENSION AGRICULTURAL ENGINEERING NDSU, FARGO, ND;			
USDA - RRV POTATO RES. CENTER, E. S. FORKS, MN.			
RRV POTATO GROWERS ASSN., E. S. FORKS, MN.			
DES. BY: D. JOHNSON, K. NELLEWANG, L. SCHAPER			
DR. BY: D. WAHL	JUL. 1987	PLAN: ND 734-6-0	R 10



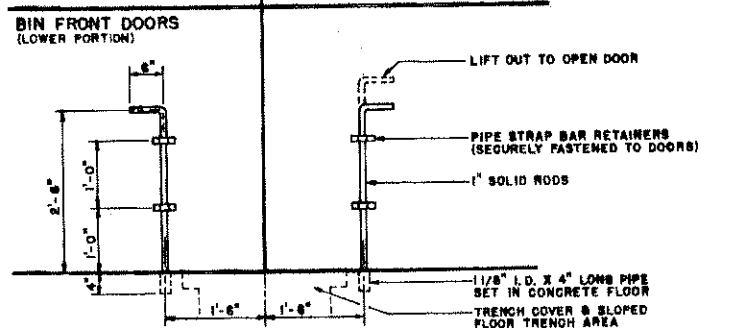
INSULATED BIN DOOR HINGES
SCALE: NOT TO SCALE



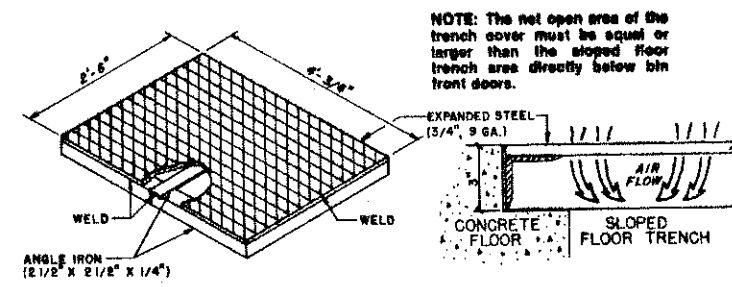
BIN FRONT DOOR HINGES
SCALE: NOT TO SCALE



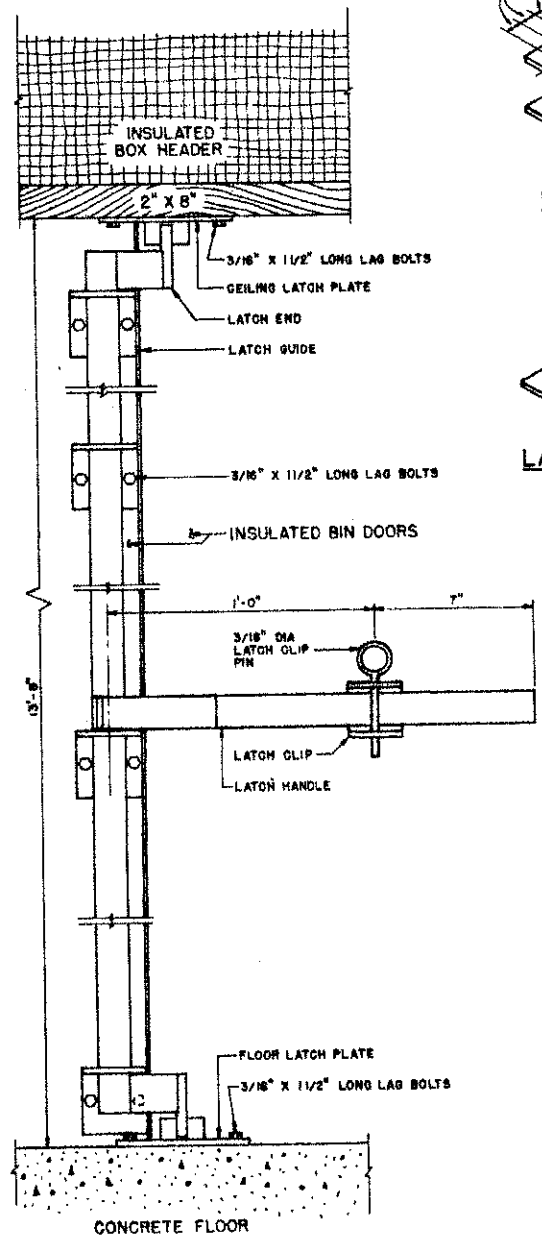
FLAP COVER RETAINING LATCH
SCALE: 1/4" = 1"



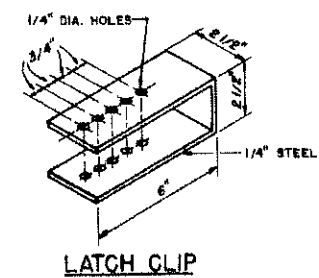
BIN FRONT DOOR LATCHES
SCALE: 3/4" = 1'-0"



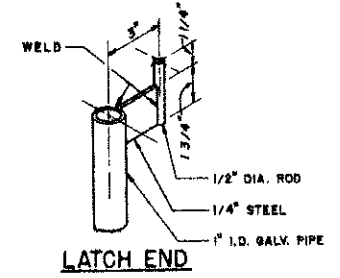
FLOOR TRENCH COVER & DETAIL
SCALE: NOT TO SCALE



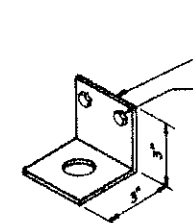
LATCH FOR INSULATED (EXTERIOR) BIN DOORS
SCALE: 3" = 1'-0"



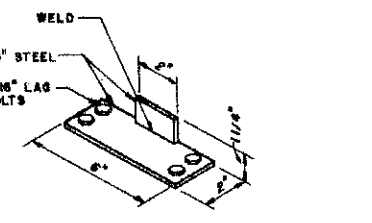
LATCH CLIP



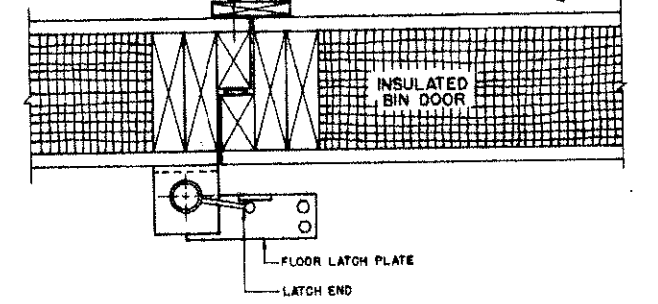
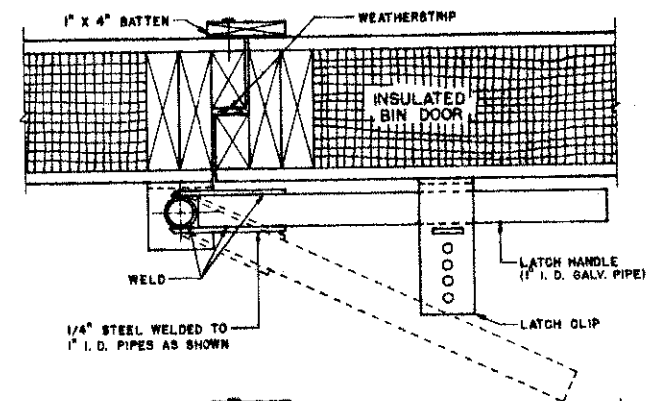
LATCH END



LATCH GUIDE



CEILING / FLOOR LATCH PLATE



POTATO STORAGE - 68,000 C.W.T.
80' X 172' SINGLE EXT. WALL CROSS-ALLEY
EXTENSION AGRICULTURAL ENGINEERING HBSU, FARGO, ND.
USDA - RRV POTATO RES. CENTER, E. G. FORNS, MN.
RRV POTATO GROWERS ASSN., E. G. FORNS, MN.
DES. BY: D. JOHNSON, K. HELLEVANG, L. SCHAPER
DR. BY: B. WAHL JUL. 1987 PLAN NO 784-S-0 2/11