ANSI/ASAE EP446.3 APR2008 (R2017)
Loads Exerted by Irish Potatoes in Shallow Bulk Storage Structures

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Developed under the direction of the SE-202 Committee of the ASAE Structures Group; approved by the ASAE Structures and Environment Division Standards Committee; adopted by ASAE as a Data February 1985; reconfirmed December 1989; revised and reclassified as an Engineering Practice August 1990; revised November 1995; approved as an American National Standard December 1995; reaffirmed January 2001; reaffirmed by ANSI January 2001; reaffirmed by ASABE February 2006; reaffirmed by ANSI March 2006; editorial revision September 2006; revised April 2008; revision approved by ANSI May 2008; reaffirmed by ASABE December 2012; reaffirmed by ANSI February 2013; reaffirmed by ASABE and ANSI November 2017.

Keywords: Loads, Potatoes, Pressure, Storage

1 Purpose and scope

1.1 This practice provides guidelines from which designers may calculate loads on vertical and inclined walls, partitions, bin fronts, ducts, and appurtenances that are to resist lateral pressure of potatoes stored in bulk. These guidelines may be modified for specific, unique load conditions.

1.2 This practice is for bins that are wider than deep (B > H) and not deeper than 5.5 m (18 ft) (see Figure 1 for explanation of symbols).

1.3 This practice is for bins in which length (L) is greater than width (B).

1.4 This practice applies to maximum potato pressures measured in full-sized bins. These occurred with wet potatoes.

1.5 Other types of structural loads are listed in the following standards: ASAE EP475, ASAE EP378.3, ASAE EP538 and ASAE EP545.

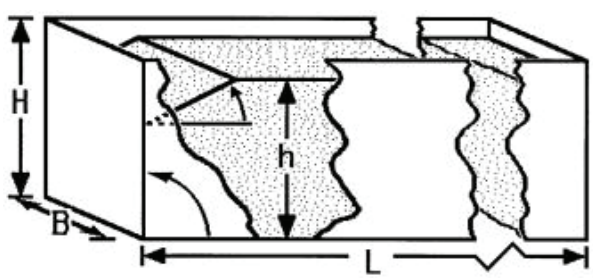

Figure 1 – Bin layout with symbol representation showing dimensions and angle of internal friction (repose). (See clauses 1, 4, 5 and 6 for explanation of symbols.)

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2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Engineering Practice. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Engineering Practice are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Standards organizations maintain registers of currently valid standards.

2.1 ASAE EP475.1 JAN01, Design and Management of Storages for Bulk, Fall-Crop Irish Potatoes

2.2 ASAE EP378.3 FEB04, Floor and Suspended Loads on Agricultural Structures Due to Use

2.3 ASAE EP538 DEC1996, Design Loads for Bunker (Horizontal) Silos

2.4 ANSI/ASAE EP545 MAR1995, Loads Exerted by Free-Flowing Grains on Shallow Storage Structures

3 Terminology

3.1 potatoes, dry: Potatoes put into the bin under normal harvesting moisture conditions without being sprayed with water and/or chemical fungicide or rained on.

3.2 potatoes, wet: Potatoes that have been sprayed with water and/or chemical fungicide or have been rained on during bin filling operations.

3.3 storage, potato: A structure designed and constructed for storing potatoes in bulk.

4 Nomenclature

h is overall height of potato pile, m (ft)

z is distance below top of potato pile, m (ft)

g is acceleration due to gravity, 9.81 m/s^2 (1 lbf/lbm)

m is mass of the product per unit volume, kg/m^3 (lbm/ft^3)

K_a is active pressure ratio of lateral to vertical stress

C is vertical distance from bottom of pile to the resultant force of the pressure p

H is height of bin wall, m (ft)

p is perpendicular pressure caused by the potato pile acting on the wall per unit area of vertical wall surface, kPa (lb/ft^2)

S is summation of frictional force from potato pile acting on the wall surface and in a direction parallel to the wall surface for a unit height of wall, kN/m (lbf/ft)

W is resultant of the wall pressure, p, from potatoes, acting perpendicular to wall face, for a unit length of wall, kN/m (lbf/ft)

α is angle included between bin wall and bin floor, which is covered with potatoes, degrees

φ is internal angle of friction of the stored material, degrees

φ' is angle of friction between the stored material and the wall, degrees

$\mu = \tan \varphi'$ is coefficient of friction between wall surface and stored potatoes, at rest, dimensionless

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