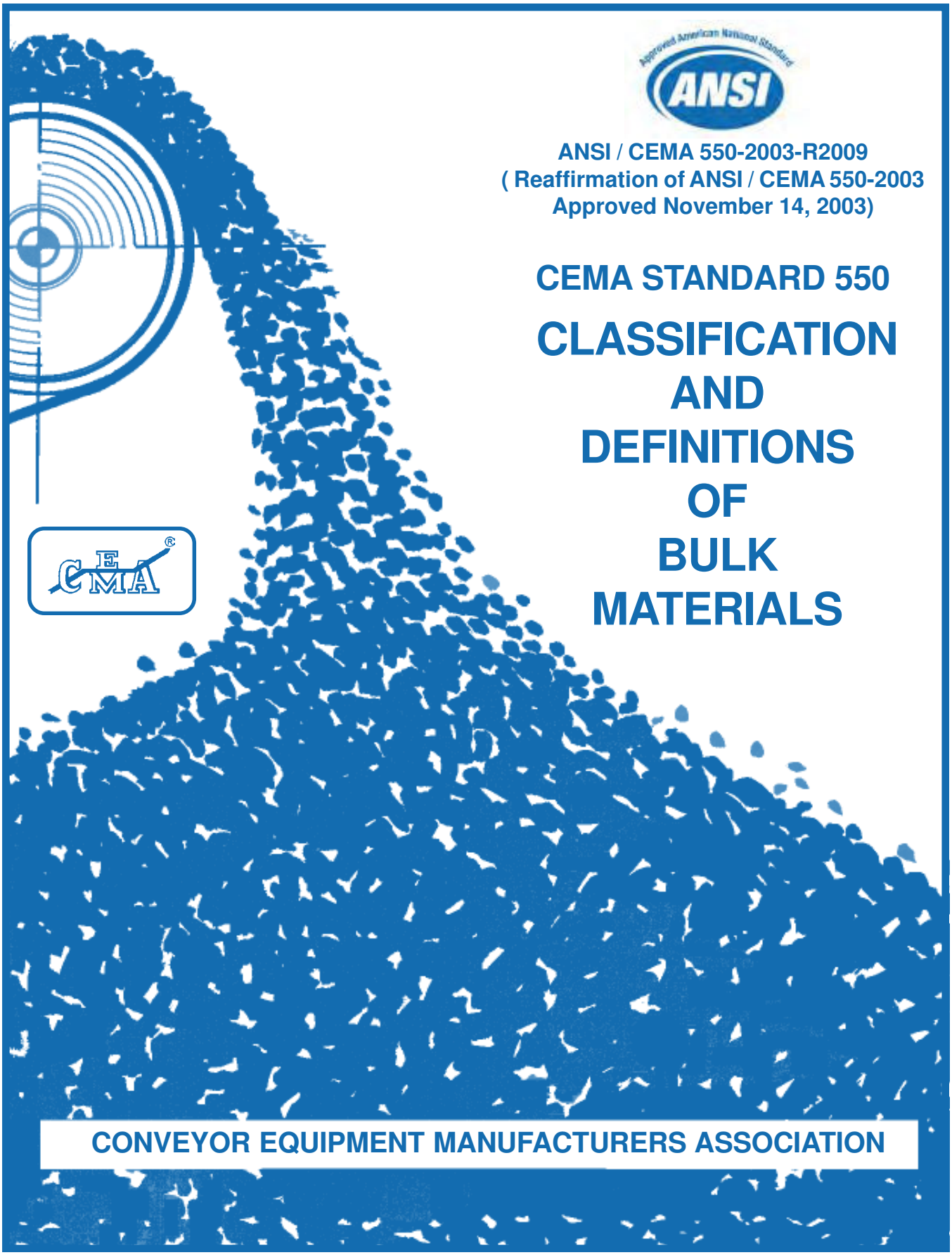


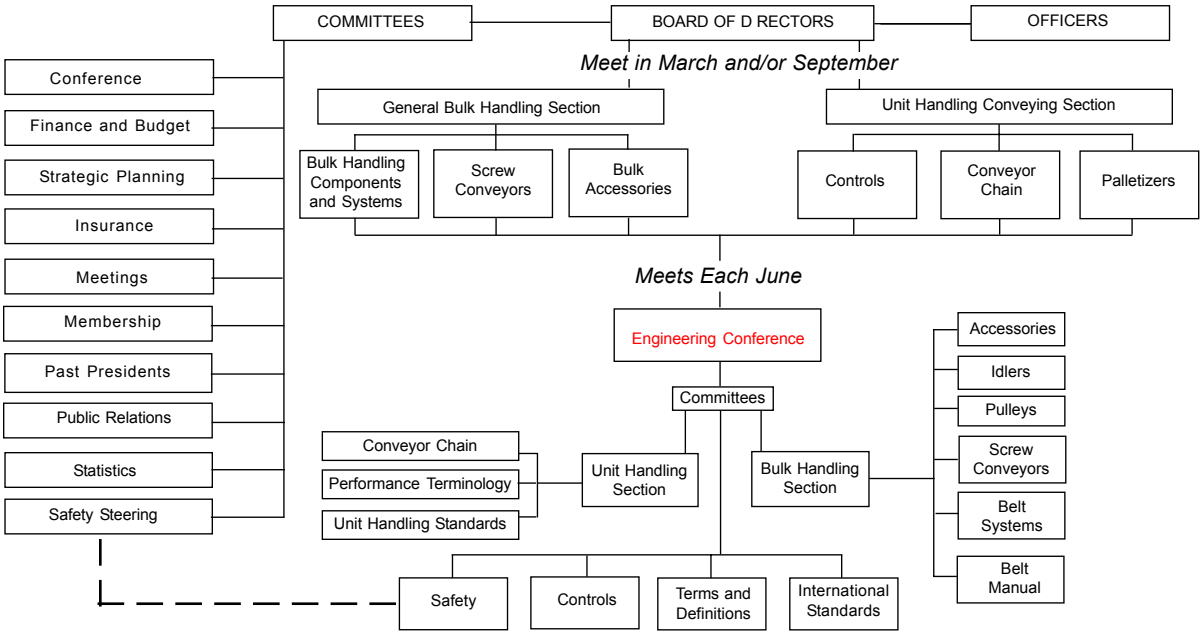
ANSI / CEMA 550-2003-R2009
(Reaffirmation of ANSI / CEMA 550-2003
Approved November 14, 2003)

CEMA STANDARD 550

CLASSIFICATION AND DEFINITIONS OF BULK MATERIALS

CONVEYOR EQUIPMENT MANUFACTURERS ASSOCIATION

CEMA ORGANIZATIONAL CHART



For Information on Company Membership
visit the CEMA Web Site at
http://www.cemanet.org

SAFETY NOTICE

The Conveyor Equipment Manufacturers Association has developed Industry Standard Safety Labels for use on the conveying equipment of its member companies.

The purpose of the labels is to identify common and uncommon hazards, conditions, and unsafe practices which can injure, or cause the death of, the unwary or inattentive person who is working at or around conveying equipment.

The labels are available for sale to member companies and non-member companies.

A full description of the labels, their purpose, and guidelines on where to place the labels on typical equipment, has been published in CEMA's *Safety Label Brochure* No. 201. The Brochure is available for purchase by members and non-members of the Association. Safety Labels and Safety Label Placement Guidelines, originally published in the Brochure, are also available free on the CEMA Web Site at http://www.cemanet.org/CEMA_Safety_Pg.htm

PLEASE NOTE: Should any of the safety labels supplied by the equipment manufacturer become unreadable for any reason, the equipment USER is then responsible for replacement and location of these safety labels.

Replacement labels and placement guidelines can be obtained by contacting your equipment supplier or CEMA.

CLASSIFICATION & DEFINITIONS OF BULK MATERIALS

FOREWORD

The CEMA Engineering Conference recognizes that the basis of all bulk material conveyor engineering is the precise definition and accurate classification of materials according to their individual handling characteristics under a specific combination of conditions of temperature, humidity, sizes and distribution of lumps, friability, and so on, including all factors that influence the selection of proper types and sizes of conveyors, horizontal, inclined or vertical.

This exacting task of cataloging bulk materials was assigned by the Conference to the CEMA Committee for Materials Classification & Definition, a task that was greatly magnified by the increasing flow of new materials from the world's geometrically expanding technology in all fields and the alteration of older materials into forms with different handling characteristics.

This task can, therefore, never be considered as having been completed. The Committee fully realizes that its conclusions at the time of any publication represents only that part of the work that has been completed to date.

For that reason, it is the earnest recommendation of the members of the Conveyor Equipment Manufacturers Association that competent engineering and technological assistance be sought whenever there is the slightest doubt as to how any material will behave under specific conditions.

It is desirable and necessary that materials and conditions be described precisely and completely whenever equipment manufacturers and consulting engineers are called in to make recommendations.

Prepared as a service to the industry by the CEMA Bulk Handling Section

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SUMMARY OF CHANGES IN THIS EDITION

This 2003 Edition updates, Chapter 1, Table 2, "Comparison of U.S. Standard Sieves and Tyler Sieves".

The updated table has been renamed "Comparison of U.S., ISO, and Tyler Standard Sieves". It incorporates ISO Sieve desigations as well as the current U.S. measurement changes to accommodate ISO Standard 133. These changes are also reflected in changes to Table 6 "Average Size System from Screen Analysis".

This Edition includes a more readable version of Chapter 2, Figure 9, "CEMA Size Code Classes vs Particle Size - Inches."

This Edition updates, Chapter 3, "The Material Table".

The updated table amalgamates virtually all of the CEMA Material Handling Characteristics Data that the Association has available and has published in its two other documents which deal with material handling characteristics; Belt Conveyors for Bulk Materials and CEMA Book 350: Screw Conveyors.

To keep this document updated, and of maximum utility to the industry, we welcome, and are prepared to consider for inclusion in future editions, new material and characterizations submitted to us from any members of the bulk material conveying industry.

CEMA Standard No. 550-2003 (R2009)
Reviewed and Revised by
Bulk Handling Section
of the
CEMA Engineering Conference

CONTENTS

CHAPTER

1 TERMINOLOGY: DEFINITIONS, TEST PROCEDURES OR EXAMPLES PAGE

DISCLAIMER

The information provided in this document is advisory only. These recommendations are provided by CEMA in the interest of promoting safety in the work place. These recommendations are general in nature and are not intended as a substitute for a thorough safety program. Users should seek the advise, supervision or consultation of qualified engineers or other safety professionals. Any use of this document, the information contained herein, or any other CEMA publication may only be made with the agreement and understanding that the user and the user's company assume full responsibility for the design, safety, specifications, suitability and adequacy of the system component, or mechanical or electrical device designed or manufactured using this information. The user and the user's company understand and agree that CEMA, its member companies, its officers, agents and employees shall not be liable in any manner under any theory of liability for the user or user's reliance on these recommendations. The users and the user's company agree to release, hold harmless and indemnify CEMA, its member companies, successors, assigns, officers, agents and employees from any and all claims of liability, costs, fees (including attorney's fees), or damages arising in any way out of the use of this information. CEMA and its member companies, successors, assigns, officers, agents and employees make no representations or warranties whatsoever, either express or implied, about the information contained in this document, including, but not limited to, representations or warranties that the information and recommendations contained herein conform to any federal, state or local laws, regulations, guidelines or ordinances.

CHAPTER I

Terminology: Definitions, Test Procedures or Examples

This chapter is devoted to establishing consistent terminology for the various properties and characteristics of bulk materials that are considered to affect conveyability or design in the proper selection of materials handling equipment. Definitions are given and test procedures are established where practicable.

Two general classes are established. The first class is "Physical Characteristics" and includes those properties that can generally be physically tested and numerical values determined. These carry an "A" prefix. The second class is "Hazards Affecting Conveyability." This latter group is more difficult to test and determine quantitative results. They carry a "B" prefix. Where possible, suggested test procedures are given to determine a qualitative, generally yes or no, answer. Typical examples of materials having the particular property being described are given to facilitate a better understanding of the characteristic involved.

If a given material sample is analyzed for all thirty-seven characteristics given in the following pages, much more will be known about the material than generally found heretofore and the problem of proper equipment selection for the application will be made easier. A classification coding system is established in Chapter II and a suggested format for listing these characteristics is contained in Chapter III.

1. PHYSICAL CHARACTERISTICS

A-I Abrasiveness

Definition: Abrasiveness is a combination of the physical characteristics of a material that enables it to abrade particles from surfaces with which it comes into moving contact.
Test: It seems from observations that the following 4 characteristics are those which would contribute to the abrasive character of a material.

(1) Particle hardness (See A-16)
(2) Particle shape (See B-17)
(3) Bulk Material Density (See A-8)
(4) Size (See A-17 & A-18)

The following factors are assigned to each of the above characteristics:

Hardness

Mohs No.	Factor
I	1
2	4
3	9
4	16
5	25
6	36
7	49
8	64
9	81
10	100

Density	Wt./Ft.^{3}	Factor
	0-60	1.0
	61-120	1.1
	121-180	1.2
	181-240	1.3
	241-300	1.4
	301-460	1.5
	461-520	1.6

Shape	Type	Factor
	Rounded	1.0
	Subround	1.5
	Subangular	
	Sharp angular	2.0

Size	CEMA	Factor
	A	1.0
	B	1.1
	C	1.2
	D	1.3
	E	1.3

To determine the relative abrasiveness of a particle, determine the factors from observation of the material. Multiply the factors together to determine the abrasive index number.

Compare this number to the abrasive index range in the table below to determine the CEMA abrasive code number.

Characteristics	Code Number	Abrasive Index Range
Mildly Abrasive	5	I thru 17
Moderately Abrasive	6	18 thru 67
Extremely Abrasive	7	68 thru 416

(1) The following factors were used to determine the abrasive index range:

	Hardness	Density	Shape	Size
Mildly	1&4	1&1.6	I&2	1&1.3
Moderately	16	1.6	2	1.3
Extremely	100	1.6	2	1.3

(2) Assume the hardness of all vegetable and animal products which cannot be measured to be Mohs #l or less.

(3) The hardness of other materials can be found in various handbooks and by using Mohs test.

(4) Density is the “as conveyed” weight per cubic foot.

(5) The shape may be described as follows:

Rounded - Those pieces that are nearly spherical with no sharp edges or sharp points. (river gravel) (B-17 Class D)

Subround-Subangular-Those pieces which approach rounded or angular shapes but with all edges well rounded so that there are no sharp edges or sharp points. (river gravel) (B-17 Classes A, B, C, & E, except all sharp edges & points removed)

Angular- Pieces having various flat sided shapes, all of which produce sharp edges and sharp points. (crushed stone) (B-17 Classes A, B, & C)

A-2 Angle of External Friction

Definition

The angle of external friction of a bulk material is the angle in degrees, 0', between the normal stress (horizontal) axis and the wall yield locus or curve of a plot showing the relationship of shearing resistance to normal stress acting between the bulk material and the surface of another material on which it slides as found from direct shear tests.

This is also known as wall friction and should be closely related to the angle of slide on the same surface.

The tangent of this angle is the coefficient of friction of the bulk material on the surface of the material tested.

The type, condition, and surface finish of the material on which the test is performed must be included with the angle and coefficient to be specific, i.e., new hot rolled 0.15-0.20 carbon steel plate at 80100 MuRMS or type 304 stainless steel with 2B surface at 15-25 MuRMS.

Test

The test is performed on a direct shear controlled strain tester in the manner described in Appendix 10. The plot of the shear stress versus the normal stress is the wall yield locus. The angle is measured between the abscissa and a straight line through the origin to the intersection of the wall yield locus with the Mohr circle for the major consolidation stress at the point of higher normal stress as shown in Figure l.

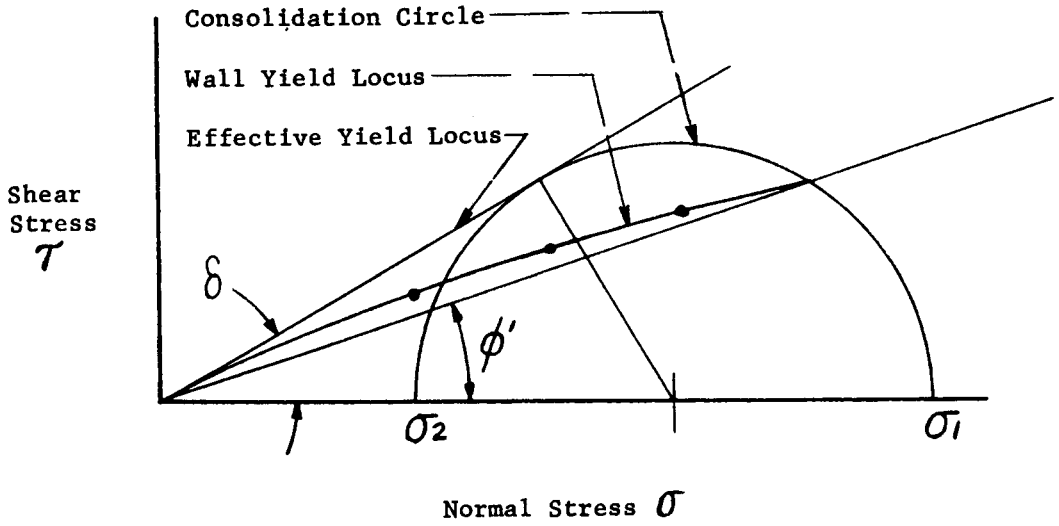

Figure 1