

論文要旨
Summary of Dissertation

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専攻 Department	Urban Innovation
氏名 Name	Sherzod Allaev
論文題目 Title	Particle shape effect on crushing behaviour of granular media
和訳または英訳 Translation (J->E, or E->J)	Originally, it is written in English
<p>The first section of this study focused on investigating the effect of initial shape on the deformation behavior and particle fragmentation phenomena during compression. High-pressure uniaxial compression tests were conducted under strain-controlled conditions using uniform-sized spherical and angular glass beads. It was found that spherical glass beads were less susceptible to crushing and underwent significant fragmentation only at stresses exceeding 20 MPa, while angular glass beads started to crush at about 10 MPa. The second section establishes an effective experimental methodology involving the QicPic apparatus to investigate the crushing induced shape change of granular material. It was found that both spherical and angular glass beads experienced a decrease in sphericity and roundness with an increase in vertical stress. The general shape index was proposed that can be used with almost any existing shape parameter and simplifies the comparison between differently shaped specimens. The utilization of proposed shape index revealed asymptotic distributions in cumulative curves for sphericity and roundness for both spherical and angular glass specimens.</p> <p>In the third section, the effect of particle shape on peak and residual friction angles was investigated. Direct shear tests were performed at various confining stress levels on glass beads with different shapes but identical particle size distributions. One specimen consisted of glass beads crushed at 80 MPa, while the other comprised well-graded spherical glass beads matching the grading of the first specimen. For comparison, a direct shear test on uniformly graded material was also conducted. It was confirmed that particle shape significantly affects the friction angle of granular materials. As sphericity/roundness decreased, both peak and residual friction angles increased.</p> <p>In the fourth section, methodology was proposed to evaluate the process of crushing continuously throughout the compression for both spherical and angular glass beads. An ordinary smartphone was used for the recording of crushing and digital data was extracted from the sound file and processed using MATLAB. The obtained data was validated with the particle size distribution curves obtained by QicPic apparatus from compression tests at different stress levels. It was clearly shown that assessing breakage through sound analysis of crushing offers distinct advantages of getting the continuous qualitative assessment of the evolution of grain size distribution with an increase in stress. The relationship between grading index and cumulative sound intensity exhibited good agreement, confirming the validity of the proposed methodology.</p>	

4,000字以内 Must not exceed 4,000 Japanese characters or 1,600 words.

英語の論文タイトルについては、センテンスケース（題目の文頭の単語の頭文字のみを大文字にする）とすること。日本語本語（全角文字）で125文字以内、英語（半角文字）で250文字以内とすること。特殊文字（ウムラウトやアクセント記号など）は使用不可。

The English title of the dissertation should be written in sentence case, where only the first letter of the first word is capitalized. It should not exceed 250 characters in English (single-byte characters) and 125 characters in Japanese (double-byte characters). Special characters such as umlauts or accent marks are not permitted.