



SGI TESTING SERVICES

A Georgia Limited Liability Company

5 March 2021

Benjamin Horvat
Louis Structures LLC
1001 Main Street, Suite 109
Racine, Wisconsin

Subject: MSWagg™ Lightweight Aggregate
As Backfill Material for Earth Structures

Dear Mr. Horvat,

In the past 20 years, SGI Testing Services, LLC (SGI) has evaluated mechanical properties (i.e., shear strength, compressive strength, and bond strength with geosynthetic and metallic reinforcement) of varying types of aggregate materials including:

- Type 1: Natural gravel;
- Type 2: Aggregate by crushing rock;
- Type 3: Recycled concrete aggregate;
- Type 4: Recycled asphalt pavement aggregate;
- Type 5: Lightweight aggregate made from clay, shale, or slate;
- Type 6: LWA-FG lightweight aggregate made from recycled glass; and
- Type 7: MSWagg™ lightweight aggregate made from municipal solid waste material by Louis Structures LLC.

Types 1 and 2 aggregates have been traditionally used as backfill materials for earth structures, and types 3, 4, 5, and 6 have been accepted as special backfill materials for earth structures in the current practice.

SGI conducted compression and shear strength tests on MSWagg™ lightweight aggregate. The results of compression testing on 2 inch diameter x 4 inch high MSWagg™ lightweight cylinder indicate its compressive strength in the range of 3600 to 6000 psi under dry conditions. The compressive strength of MSWagg™ lightweight cylinder is comparable to the compressive strength of dry-cast concrete (typically 3000 to 4000 psi). The results of large-scale direct shear testing on MSWagg™ lightweight aggregate under both dry and soaked conditions indicate peak friction angle is 43 to 44 degree. The peak friction angle of MSWagg™ lightweight aggregate is generally comparable to internal friction angles of the other six types of aggregates (typically 40 to 50 degree).

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SGI is currently conducting the longterm compression test on MSWagg™ lightweight aggregate under soaked conditions. This test is to address the concern of potential degradation (softening and breaking-down) of MSWagg™ lightweight aggregate when it is submerged in water for sufficient time and under constant overburden pressure. As of today, the limited test data indicate that no softening and breaking-down of MSWagg™ lightweight aggregate has occurred under soaked conditions.

In summary, based on the limited compression and large-scale direct shear tests conducted by SGI, it is tentatively concluded that MSWagg™ lightweight aggregate material has sufficient compressive and shear strength as backfill material for earth structures.

SGI appreciates the opportunity to provide technical services to Louis Structures LLC Should you have any questions regarding the attached document(s), or if you require additional information, please do not hesitate to contact the undersigned.

Sincerely,



A handwritten signature in blue ink, appearing to read "Zehong Yuan".

Zehong Yuan, Ph.D., P.E.
Laboratory Manager