

## Competition Topics:

### **Use of Low Carbon Concrete** (Larry Sutter)

Competitive teams will need to **demonstrate the relationship between fresh concrete characteristics and the performance of hardened concrete** through the manufacture of one of the following items using low carbon cementitious materials:

- Bowling Ball
- Frisbee
- Paddle board
- Discus

All structural components of the project must be cementitious in nature. All teams must be able to demonstrate/document the functionality of their product upon form removal, which includes an assessment of material impact toughness tied to analytical assessment of the stresses and strains (the product undergoes upon form removal and subsequent use). The structural and environmental analysis is a requirement, in principle, to be the responsibility of each team.

The projects will be judged with respect to the degree of innovation, homogeneity, aesthetics, and documentation (i.e., in a poster format illustrating manufacture, mixture designs, performance requirements, and construction) associated with the effort as well as what was learned. The poster should illustrate results (production, analysis, field testing, etc.) of their item.

### **Incidence of Roots in a Soil Fill Material** (Charlie Greer)

Competitive teams will need to demonstrate a solution to the presence of tree roots in stockpiled soil materials for use in a taxiway construction project that consists of the following:

- 1) Develop a method/approach to efficiently identify (both in the lab and the field) and to determine if the volume of roots in the fill material was too high?
- 2) If they volume was too high, how would you go about removing them?

All teams must be able to demonstrate/document the utility of their solution in terms of cost and labor efficiency, safety, environmental impact, and long-term sustainability.

### **Nondestructive Assessment of Voids in an Aggregate System** (Dan Zollinger)

Competitive teams will need to demonstrate a nondestructive solution to determine the amount and distribution of voids in an aggregate sample taken from an aggregate stockpile. Teams will need to demonstrate the following:

- 1) The volume (versus the percent) of void space in an aggregate sample.
- 2) The distribution (with respect to size) of the void space.

All teams must be able to demonstrate/document the robustness of their approach with respect to repeatability under lab or field application.

For either a concrete or asphalt surface, propose a way to treat the surface to lower the heat absorption and minimize the reflectivity or the radiated heat into the ambient environment?

### **Reduction of Heat Absorption of a Pavement Surface** (Peter Taylor)

Competitive teams will need to demonstrate a way to treat the surface to lower the heat absorption and minimize the reflectivity or the radiated heat into the ambient environment from a paved surface. Teams will need to demonstrate the following:

- 1) That heat reduction and reflectivity takes place.
- 2) The economic and ecological benefit of surface treatment.

All teams must be able to demonstrate/document the robustness of their approach with respect to its utility under both lab or field applications.

### **Maintenance of Unpaved Roadway Surfaces** (Charles Gurganus)

Many miles of unpaved roadway surfaces are managed by US government, county, and private entities throughout the US that consist of a variety of locally available aggregate materials and types. Maintenance primarily consists of resurfacing by replacing roadway surface materials that have been depleted over time due to dusting or dislodgment under passing vehicular traffic. Up to the time of replacement the roadway surface frequently becomes quickly rough due to wash boarding that is typically corrected by regrading which can only be repeated a limited number of times before resurfacing is required. These types of surfaces are also subject to excessive rutting during and after spring thaw periods but the performance life of these types of roadway surfaces are greatly dependent upon the level of traffic the roadway is subjected to. For this topic, competitive teams will need to propose new innovative engineered methods, procedures, and costs to extend service life of these types of roadway surfaces.

### **Slippage of Asphalt Concrete Between Layers** (Charle Greer)

An asphalt concrete pavement is a layered structure of paving material that is subjected to a variety of stress types due in part to passing wheel loads that can induce shear in between layers of asphalt concrete. Under this effect, the shear stress can become great enough to fail the pavement structure and cause the layers of asphalt concrete to slip between each other which greatly reduces the structural stiffness and the capability of the pavement structure to carry loads. In some cases, interlayer fabric is used between layers of asphalt concrete to help bridge pre-existing cracks in the substrate which has the effect of lessening the strength of the interlayer bond. The use of fabrics in this manner obviously reduces the resistance of the overall pavement structure against shear failure. For this topic, competitive teams will need to propose an approach to analyze a layered asphalt concrete pavement structure for shear failure especially at locations at preexisting cracks in the substrate where a fabric interlayer has been used. The analysis procedure should provide a means to assess the potential for shear failure for a given set of conditions.

The projects will be judged with respect to the degree of innovation, homogeneity, aesthetics, and documentation (i.e., in a poster format illustrating form, mixture designs, performance

requirements, and construction) associated with the effort as well as what was learned. The poster should illustrate the results (production, analysis, field testing, etc.) of their item.