

## TRIENNIAL STRATEGIC PLAN (TSP)

**Evaluation Period: February 1, 2015 to January 31, 2018**

### PART 1: Committee Name and Scope

Committee Code *	<b>AFP70</b>
Committee Name *	<b>Standing Committee on Aggregates</b>
- Date(s) reviewed	2015
- Change, if proposed***	Not Applicable
- No. of official members approving change/total number of members **	Change initiated as part of the DCG Strategic Review in late 2015 Accepted <i>nem con</i> by January 2016 committee meeting (>2/3rds of membership at the time (24/35, see minutes of Jan 13th 2016 committee meeting)) approved by DCG and implemented March 2016.
Committee Scope *	This committee is concerned with all aspects and types of materials used as aggregates in bound and unbound applications.
- Date(s) reviewed	January 2016
- Change, if proposed ***	Not Applicable
- No. of official members approving change/total number of members **	>2/3rds of membership at the time (24/35, see minutes of Jan 13 <sup>th</sup> 2016 committee meeting). Scope review, change and approval occurred under the DCG Strategic Review 2015-2016.

\* Show current, as it currently appears in the [TRB Online Directory](#)

\*\* Includes Chair, Standing Committee Members, Emeritus Members, and Young Members

\*\*\* Show proposed, or Not Applicable

**PART 2: Committee Accomplishments**

**2.1**

Year	2015	2016	2017	2018
Number of Members in Attendance at Annual Meeting		24	27	27
Number of Visitors in Attendance at Annual Meeting		41	34	31
Number of Papers Reviewed		18	27	21
Total Number in Attendance at Mid-Year Meeting	NA	NA	NA	

**2.2**

<p>Sessions and workshops sponsored/cosponsored at the Mid-Year meeting, including name of co-sponsoring committee(s) if applicable (by year):</p> <p>N/A</p>
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**2.3**

<p><b>Provide</b> title(s) and presenter(s) for informal presentations made at Annual Meeting and Mid-Year Committee meetings (by year):</p>		
Year	Topic	Presenter
2015	Mesabi (Taconite) Friction Aggregate Review	Larry Zanko, University of Minnesota, Duluth
2015	Characterization Techniques for Iron and Steel Slags	Kelly Cook, Edw. C. Levy Company
2015	Rapid Prediction of Freeze-Thaw Durability of Recycled Concrete Aggregate (RCA) Using the Hydraulic Fracture Test	Nancy Whiting, Purdue University
2015	3D Laser Scanning Technique for Shape Characterization of Aggregate Materials in South Africa	Joseph Anochie-Boateng, CSIR
2016	Evaluation of Intelligent Compaction Retrofit System for Practical Use in Earthwork Compaction,	Soheil Nazarian, University Texas at El Paso
2016	Moving Toward Modulus-based Compaction Acceptance with Estimated Layer Mechanical Properties from Intelligent Compaction Measurements,	Mehran Mazari and Soheil Nazarian, University of Texas at El Paso
2016	Classifying and Quantifying Mineral Aggregate Quality Using Laser Scanning,	Warren Chesner, Chesner Engineering
2016	The Influence of Mineralogy and Textural Properties on D-Cracking Resistance of Carbonate Aggregates,	Belayneh Desta, Purdue University
2016	Progress report on NCHRP project 1-53 (made to sub-committee)	Bob Lytton, Texas A+M University
2017	Sustainable Aggregate Subgrade Applications of Quarry by-products Mixed with Large-Size Unconventional Rocks”	Issam Qamhia, University of Illinois at Urbana-Champaign

2017	Proposed Enhancements to Pavement ME Design: Improved Consideration of the Influence of Subgrade and Unbound Layers on Pavement Performance (made to sub-committee)	Bob Lytton, Texas A+M University
2017	Sustainable Aggregate Subgrade Applications of Quarry by-products Mixed with Large-Size Unconventional Rocks (made to sub-committee)	Issam Qamhia, University of Illinois at Urbana-Champaign
2018	Updates on NCHRP 48-10: Synthesis Aggregates Quality requirements for Pavements.	Maziar Moaveni
2018	Use of Local Materials for Road Construction - Outcomes and Application	Diego Barbieri
2018	Demo on "Aggregate Games"	Andrew Dawson
2018	Optimizing the Gradation of Fine Processed Reclaimed Asphalt Pavement and Aggregate Blends for Unbound Base Courses (made to sub-committee)	Burak Tanyu, George Mason University

**2.4**

**Provide** titles of new research need statements (RNS) posted in TRB’s RNS database (by year):

- Sustainable use of available aggregate sources in highway pavements - Best value engineering (April 2016)
- Development of a Permanent Deformation Test Procedure for Evaluating Rutting Potentials of Pavement Granular Base/Subbase Layers ((May 2015)
- Improved Rutting Prediction of Unbound Granular Materials for Mechanistic-Empirical Pavement Design (May 2015)
- Aggregate Quality Requirements for Thin Asphalt Overlays (March 2007, Modified January 2017))

**2.5**

**Provide** title(s) of RNS submitted for funding consideration:

- Sustainable use of available aggregate sources in highway pavements - Best value engineering (April 2016)
- Development of a Permanent Deformation Test Procedure for Evaluating Rutting Potentials of Pavement Granular Base/Subbase Layers ((May 2015)
- Improved Rutting Prediction of Unbound Granular Materials for Mechanistic-Empirical Pavement Design (May 2015)
- Aggregate Quality Requirements for Thin Asphalt Overlays (March 2007, Modified January 2017))

## 2.6

**Provide** titles of synthesis topics submitted (by year):

- Permanent Deformation Test Procedures for Evaluating Unbound Aggregate Base/Subbase Performance (February 2016)

NOTE: **List** any synthesis topic(s) funded in a research program.

- NCHRP Synthesis 48-10: Aggregate Quality Requirements for Pavements (commenced September 2016)

## 2.7

**Membership** Make-up:

The membership of the committee is currently at virtually full strength – there is one main vacancy and one international member vacancy. In the early part of the next 3 year period, the membership will be reviewed, partly due to normal rotation requirements and partly due to interests and employments of members changing that prompts replacement. At present the Committee has 6 state DoT employees, 6 consultants and 4 industry/Research/non-profit employees as members compared with 16 members from Academia. Therefore, if possible, the Committee will seek to reduce the number of academic members a little to redress the balance. It has 4 young members and will seek to increase this number if suitable, technically active, persons are identified. However, on the whole, no great structural changes are needed to deliver the plan described in Section 3 as the current membership has shown itself to be active, effective and engaged over the last three years and there are already enthusiastic candidates enquiring about future vacancies.

Regarding racial and gender balance, the membership is 5 female and 31 male – so, if possible, changes to the membership will seek to redress this somewhat, though the female candidate pool (Friends) seems small. 9 of the current membership are declared as Asian or Black in origin, but a subjective review of the list indicates a greater number than this who are non-Caucasian – being approximately 50% of the membership. Thus addressing racial imbalances does not seem so pressing as do gender imbalances.

The strategy is, first to inspect the list of Friends and the Annual Meeting Committee attendance lists to identify potential and interested members. Second to review those who have made a positive enquiry about joining. Thirdly to approach current members to see if they can recommend future members who would provide enthusiasm, expertise and who would help to address imbalance targets.

In addition, while not having a formal membership, the Committee's sub-committee on Unbound Granular Materials maintains an active informal membership, somewhat less than the parent committee (inevitably) but around 15-20. They consider critical, relevant issues and actively create and support committee activities in their focus area.

## 2.8

Provide any of the following:

### **No special publications**

Papers appear in TRR 2509 (2015), TRR 2578 (2016), TRR 2655 (2017),

### **Conferences**

#### **2015**

- 15<sup>th</sup> Pan-American Conference on Soil Mechanics & Geotechnical Engineering (PCSMGE XV), Buenos Aires, Argentina

#### **2016**

- Transportation Geotechnics 3<sup>rd</sup> Int'l. Conf, Guimaraes, Portugal
- International Conference on Transportation Infrastructure and Materials, Xi'an, China

#### **2017**

- 10<sup>th</sup> Bearing Capacity of Roads, Railways and Airfields
- IICTG 2017: Intelligent Construction Technologies (ICT)
- Int'l Conf. on Transportation Infrastructure and Materials (ICTIM2017)
- 3<sup>rd</sup> International Symposium on Transportation Soil Engineering in Cold Regions , Guide, Qinghai, China (TranSoilCold2017)
- GoeMEast International Conference, 2017 – Innovative Infrastructure Geotechnology, Sharm ElSheik, Egypt

### **Workshops**

#### **2016**

- Inverted Pavements
- Use of Byproduct Fines and Recycled Materials for Sustainable Construction of Transportation Infrastructure (with AFP40)

#### **2017**

- Natural Resources, Sustainability and their Intermodal Connections (Summer, Duluth, MN with ADC60)
- Unbound Aggregate Layer Characterization for Pavement Design and Performance (with AFD80)

#### **2018**

- Intelligent Compaction for Granular and Asphalt Materials (with AFS00, AFP70(1), AFK40, AFH60, AFS20, AFS10)
- Best Practices for Pavement Design Using Geosynthetics (with AFS70, AFS60)

### **Webinars**

#### **2015**

- Materials for Unbound Granular Pavement Layers (arranged by AFP70(1) sub-committee; based on NCHRP material)
- Non-Nuclear Methods for Compaction Control of Unbound Materials (with AFP30; based on NCHRP material)

#### **2016**

- Inverted Pavements
- Moisture and Compaction Measurement During Unbound Aggregate Layer Construction (with AFP60)

- Construction, Quality Control and Performance of Unbound Granular Layers (arranged by AFP70(1) sub-committee)

**2017**

- Application of Petrography to Highway Materials (Straight to Recording)
- Application of Intelligent Compaction Technology for Compaction Quality Control of Pavement Layers (with AFS20)

**Sessions****2016**

- Aggregate Properties and Modeling Behavior: Imaging, Polishing, and Pavement Skid Resistance
- Characterization and Performance Prediction of Unbound Aggregates
- Performance of Traditional and Nontraditional Aggregates as Unbound Pavement Layers
- With **AFS80, AFP70, AFS90** – Cementitious Stabilization

**2017**

- **With AFS 20** - Aggregate Particles: Their Form and Formation and Their Influence on Material Properties
- Mechanical Behavior of Unbound Base and Subbase Materials
- Sustainability in Geological and Geo-environmental Engineering
- **With AFS 20** - Instrumentation and Performance Monitoring of Pavement Base and Subbase Layers
- Characterization of Aggregates

**2018**

- Characterizing Granular Materials in Laboratory and Field
- Evaluating and Characterizing Aggregates and Granular Materials
- **With AFP 40** – Characterizing of Alternative Aggregates

**PART 3: Committee Future Outlook Statement and Committee Three-Year Plan (Limit 1,500 words total)****Committee Future Outlook Statement****BACKGROUND**

While the Committee's scope allows for activity on all areas associated with aggregates, in practice this can be divided into two parts – the particles that are aggregates and which end up in a wide range of construction materials (particularly asphalt concrete and Portland concrete); and the combination of those aggregates into unbound granular materials as dealt with by the Committee's sub-committee (as there is no other TRB committee charged with this role). Both aspects are covered here.

**FUTURE OUTLOOK****Longer term**

Aggregate continues to be a key material, underwriting the vast majority, by mass, of transportation infrastructure materials (whether unbound or bound into asphaltic, Portland cement based or pozzolanic mixtures). Aggregates will continue to provide fundamental strength, stiffness, permeation, sorptive and even shock- and noise-limiting properties alone or as the major component of derived materials. After water, aggregates constitute the most widely consumed raw material in the world, at around 6-8 tons/capita.

The principal problems, challenge areas and cross-cutting issues that impinge on, and are associated with, aggregates, are for:

- suppliers – abstraction causes visual, noise and ecological impacts and is becoming very restricted near consumption locales,
- material suppliers – who wish to deliver their products with lower environmental footprints and costs,
- immediate users – who demand higher, more durable and multi-functional performance for reasons of economy and environmental responsibility,
- indirect consumers – who want the objects incorporating aggregates to have long-lives with maintenance that does not interrupt the service provided by the objects.

Therefore, research continues to be needed so as to identify means of achieving these goals. The Aggregates Committee has identified the following key areas that require strategic research activity:

- how to move from an input specification framework for supply of aggregates (which places minimum performance demands on suppliers, restricting usage) to a framework that allows / encourages the exploitation of their available performance, yet without compromising performance at the point-of-use. This is critical given diminishing accessible high-quality sources and the greater availability of aggregates from recycle/reuse schemes and previously rejected / wasted materials,
- determining and obtaining best performance to enable aggregates to replace materials with higher environmental footprints / embodied energy levels. This will require 'best performance' to be defined in an agreed manner, acceptable to stakeholders,
- development of a fundamental understanding of how individual stones combine into a compacted skeleton, deliver their containing material's properties. This is a newly emerging area now practically enabled by increased computational power and software development.

Aggregates design to deliver optimum properties for each application and matching available materials to optimal uses become feasible,

- characterization approaches for aggregates from recycling and reuse sources to place them on a ‘level playing field’ with, and beneficially exploitable alongside, conventional aggregates, and to limit or prevent down-valuing (in properties and price),
- an emerging need is to explore the potential for non-traditional purposes (e.g. energy storage and water purification) so as to obtain multiple functionality.

Many of these issues are likely to be a continuing requirement beyond 7 years, but research within this period has the potential to significantly address these high-level challenges. More specifically, research will be needed regarding:

- Practical tests, with scientific rigor, to assess mechanical, chemical and environmental properties of stones and compacted materials.
- In-situ evaluation techniques to assess performance capability.
- Computational modelling of particle assemblages to discover the mechanics of particle interactions.
- Source-blind / end-performance specifications\*.
- Defining best practice of, so-called, inverted pavements.
- Assessing chemical leaching and sorption capacities; so as to understand in-situ capabilities rather relying on regulatory targets\*.
- Studying aggregate blending options to optimize mechanical and hydraulic performances.
- Assessing heat storage capabilities and the means of passing heat energy into and out of the aggregate\*

\* *Working with other TRB committees will be crucial*

### **Shorter Term**

In the next three years the expected major issues will center on the need for increasing efficiency (economical and technical) in aggregate selection and use. This will require development of interpretative and application procedures to enable the results of aggregate and compacted granular material characterizations to be practically usable. Aggregate characterization needs to be sufficiently wide-ranging so that their wide variety of applications can each have appropriate input information.

- Aggregates to improve water quality will need appropriate assessment,
- Increasing pressure to reuse/recycle materials as aggregates will need advances in
  - leaching characterization and description,
  - fundamental mechanical characterization of stones so that historic index properties developed for traditional geologically-sourced materials don’t constrain use.

Unbound granular materials have limited utility by themselves so, in most cases, these materials must be used in combination with, e.g., geosynthetics, stabilizing agents, asphaltic concrete surfacings, drainage pipes, pervious surfacings, etc.

- Such use requires fundamentally appropriate, yet practical, evaluation procedures.
- Outputs from current NCHRP studies (e.g. improving mechanistic-empirical pavement design procedures with better unbound granular material models) will need critiquing and stress-testing for practical implementation with consequential assessment and specification research.



**Committee Three-Year Plan****Dissemination / Education**

This will be achieved via

- Annual Meeting sessions (poster & podium) and workshops. Annually, the Committee will attempt to sponsor, at least:
  - one workshop per year, individually or with other committees,
  - one session with other committee(s). to ensure inter-disciplinary aspects of the ‘Outlook’ topics can be adequately explored,
  - a poster session.
- Joint session sponsorships with Railroad Committees on issues related to ballast (2019/20).
- Webinars. On average 2 will be offered per year, mostly in the areas previously identified as key issues.
- State-of-knowledge outputs. It will submit one Synthesis topic for consideration by NCHRP each year.
- Promotion of current NCHRP synthesis findings via the Annual Meeting and Webinars. Where the NCHRP chooses not to commission syntheses, authorship of state-of-the-art/practice papers will be encouraged from its members for publication in other journals – the Committee acting as a broker to establish authorship teams.

**Research Promotion**

This will be achieved by

- Maintaining a Research Needs Task Group, led by the Committee Research Co-ordinator (CRC), which will review/ revise the Research Needs Statements (RNSs) annually.
- Adding one new RNS annually, using the Aggregate Research Roadmap to help identify areas where technological and sustainability innovations are needed. Closely work with State DOT representatives, as well as those serving on AASHTO subcommittees, and pursue co-support by other committees.
- Thoroughly examining the RNSs (by the entire committee) every 3 years based on current needs and identification of recent related research, leading to reprioritization and revision, as necessary.
- Promoting RNSs as opportunity arises with various funding organizations (including those outside the TRB/AASHTO arrangements).
- Submitting at least 2 RNS statements for consideration in the NCHRP process.
- Encouraging young members, especially, to work with the CRC to maintain RNS website content and update RNS priority listing.
- Supporting other researchers making research bids, offering letters of support and assisting in cementing relationships between proposers and potential entities that might offer in-kind contributions.
- Using state-of-knowledge papers to identify key barriers to forward movement and publicizing these to members and friends (progressively, ~2 each year).
- Being involved in the development of the Aggregate Research Roadmap with Industry, FHWA, ICAR and others. AFP70 plans to publish the “Aggregates Research Roadmap” in the form of a TRB eCircular by 2019 end.
- Encouraging development of mix design software that integrates aggregate characteristics, performance requirements, and specifications to optimize aggregate usage, perhaps by providing a clearinghouse of aggregate-related software (by end 2020).
- Promoting the topics of “Permanent Deformation Testing, Characterization and Modeling of Unbound Aggregates,” “Alkali-Carbonate Reaction,” and “Methods to Optimize Source Allocation and Field Evaluation of Construction Aggregates” as RNS and promote as NCHRP Research Problem Statements (2018-2019).

**Encouraging Participation & Involvement**

This will be achieved by

- Older members actively encouraging young members by acting as mentors and internal reviewers so as to enhance and value of young members outputs and their careers.
- Awarding a 'best-poster' certificate each Annual Meeting.
- Developing an "AFP70 Best Paper Award" to encourage the submission of more papers.
- Conducting a survey of members and friends to improve committee communications.
- Establishing committee activities on transportation use of aggregates related to two new FHWA-related sustainability initiatives: INVEST version 1.1; and the "Sustainable Pavements Technical Working Group". In this way the Committee will promote constructions with thinner bound layers and thicker unbound aggregate layers and/or use of inverted pavements to reduce GHG emissions and energy and resource consumption.

**General**

The Committee will continue to

- work with a variety of TRB committees and expand liaisons as needed.
- have a functioning subcommittee AFP70(1) on "Unbound Granular Materials" under the umbrella of the Aggregates Committee. The "Unbound Granular Materials" subcommittee's focus is all types of materials formed by unbound aggregates, whether from natural rock or other natural, artificial, by-product or recycled sources, without the addition of cementitious or adhesive binders but relying wholly or principally on particle interaction and pore suction effects. It also addresses the means by which the arrangement of individual particles can be optimized to benefit the resulting granular layer. AFP70(1) subcommittee has made plans to invite PIs of the currently ongoing NCHRP projects in related topics to present at the subcommittee meetings.
- publicize its work on the AFP70 Committee website.

*1492 words*