



HMA Airfield Pavement Performance-Based Specifications



VI ALACPA Airport Pavements Seminar & IV FAA Workshop

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Major Investment...

- Aircraft take-offs and landings
- Aircraft movements to/from runways to terminal areas



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What is a Pavement?

Engineering structure constructed on subgrade soil that is intended to carry loads from one point to another in as smooth and safe a manner as possible

- Structural requirement: carry loads
- Comfort requirement: smoothness
- Safety requirement: good traction and FOD potential

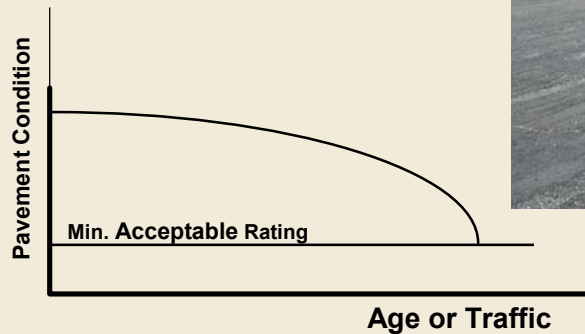


New pavement opened to traffic...



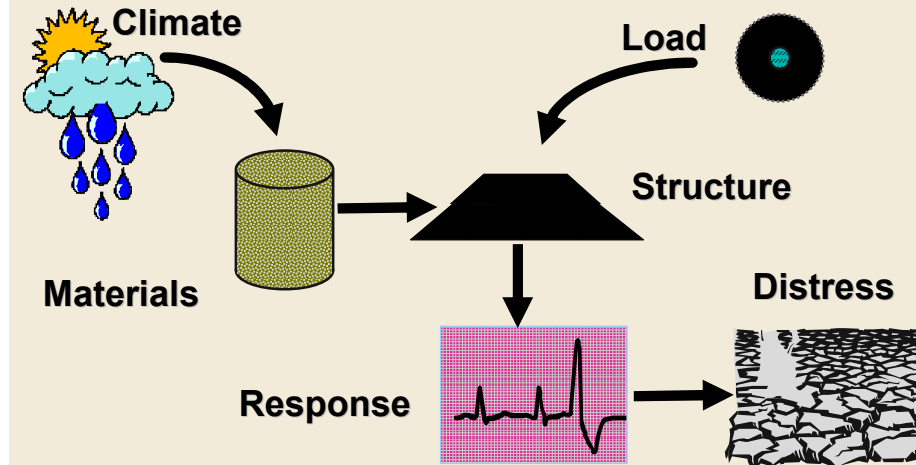
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...over time it deteriorates...



...until "failure" is reached and rehabilitation is needed

Pavement Performance Factors



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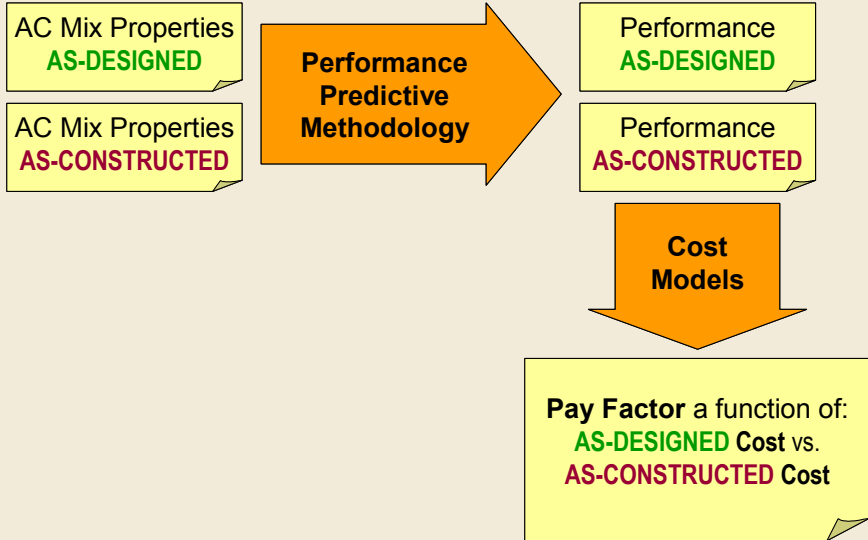
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Pavement Design & Build Process

- Pavement Design
 - FAA nomographs (empirical)
 - FAARFIELD software (mechanistic-empirical)
- Detailed Drawings and Construction Specifications
- Construction and QC/QA

Construction Specifications

- Intended to control pavement construction to facilitate production & placement of materials meeting minimum level of performance
- **Most** require measure of material characteristics at time of construction believed to influence pavement performance
- **Performance-based** require that predicted performance characteristics like pavement distress or roughness meet certain acceptance criteria



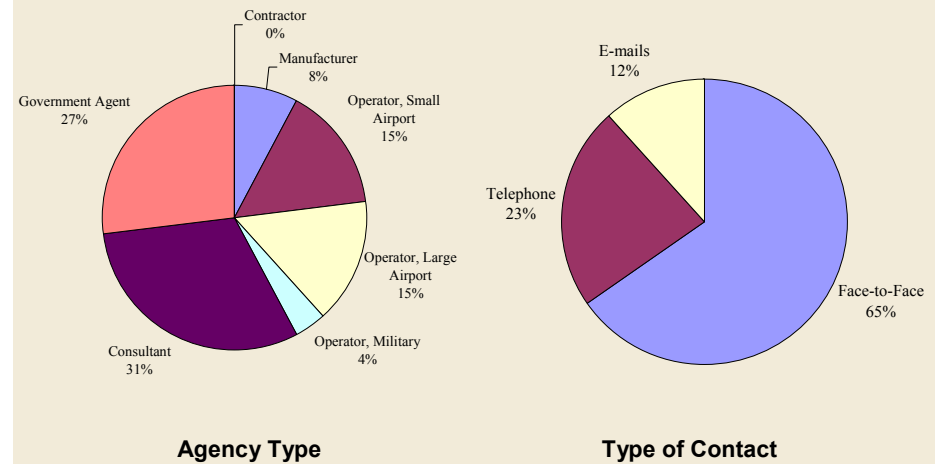
1. Literature review
 - Airports and highway pavements
2. Interviews
 - Airport operators, aircraft manufacturers & pavement experts
3. Identification of Aircraft OPCs
4. Identification of PPCs
5. Identification of AQC's

AAPTIP Project 06-03 Interim Report

Summary of Interviews

Contact Type	Number Contacted	Number Responding
Aircraft Manufacturer	4	2
Airport Operators (Small Airports)	10	4
Airport Operators (Large Airports)	10	4
Military Airport Operators	5	1
Consultants	15	8
Government Agents	11	7
Contractors	2	0
Totals:	57	26

Interview Breakdown





- **Aircraft Operational Performance Characteristics (OPCs)**
 - **Measurements of pavement performance from user perspective**
- **Pavement Performance Characteristics (PPCs)**
- **Acceptance Quality Characteristics (AQC)**



- Ability of aircraft to safely reduce speed & come to complete stop
- Pavement factors affecting OPC:
 - Pavement surface texture (friction)
 - Micro-texture – friction at low speeds
 - Macro-texture – friction at high speeds
 - Drainage (hydroplaning)
 - Ability of water to flow away from pavement surface



No. of Interviews Identifying OPCs



OPCs	Runway	Taxiways	Aprons
Braking – Surface Friction	19	7	4
Braking – Hydroplaning	15	6	2
Dynamic Effects – Aircraft Damage	16	6	2
Dynamic Effects – Pilot Control	16	6	2
Dynamic Effects – Passenger Comfort	3	8	3
Load Carrying Capability – Dynamic	1	1	1
Load Carrying Capability – Static	0	0	8
Directional Control	5	8	3
FOD Potential	13	12	8
Traffic Disruptions	5	2	2
Appearance	0	1	1



Final OPC Priorities



Aircraft Operation Performance Characteristics	All Aircraft/Airports		
	Runway	Taxiway	Apron
Directional Control	Green	Green	Black
Foreign Object Damage (FOD) Potential	Green	Green	Green
Dynamic Effects – Pilot Control	Green	Yellow	Black
Dynamic Effects – Aircraft Damage	Green	Yellow	Black
Braking Capability – Surface Friction	Green	Yellow	Black
Braking Capability – Hydroplaning	Green	Yellow	Black
Traffic Flow Disruptions	Green	Yellow	Black
Load Carrying Capability – Static	Black	Yellow	Green





- **Aircraft Operational Performance Characteristics (OPCs)**
- **Pavement Performance Characteristics (PPCs)**
 - Performance characteristics measured during life of pavement related to OPCs
- **Acceptance Quality Characteristics (AQC)s**



- Permanent deformation
 - Rutting, shoving, swelling, static indentations & roughness
- Cracking
 - Linear, block, fatigue, reflection
- Raveling & weathering
- Surface friction
- Jet blast erosion
- Oil spillage



Example: PPC-OPC Relation for Braking

- Surface friction
 - Bleeding
 - Polished aggregates
- Hydroplaning
 - Rutting
 - Shoving
 - Swelling



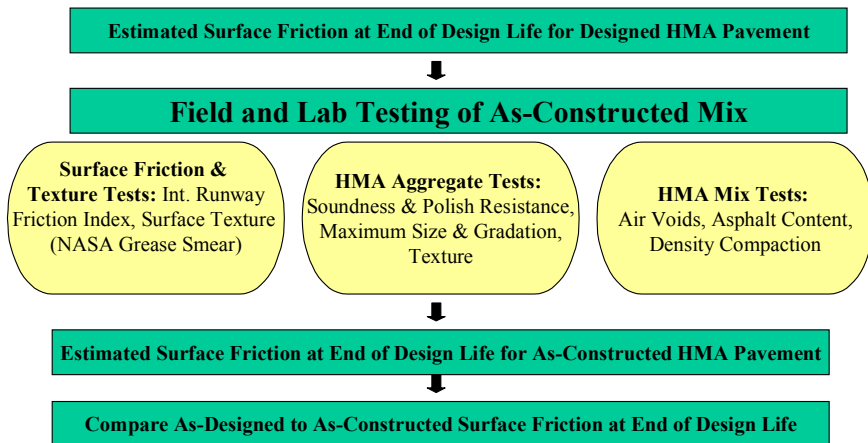
PPCs Affecting OPCs

Aircraft Op. Performance Characteristic (OPC)	Pavement Performance Characteristics (PPCs)	Pavement Requirement Affected
Braking Capability – Surface Friction and Hydroplaning	Surface friction, rutting, shoving and swelling	Safety
Directional Control	Surface friction, rutting, shoving, potholes and roughness	Safety
Dynamic Effects – Aircraft Damage	Roughness	Safety
Dynamic Effects – Pilot Control	Roughness	Comfort
Foreign Object Damage (FOD) Potential	Cracking, raveling and weathering, shoving, jet blast erosion and oil spillage	Safety
Static Load Carrying Capability	Static indentation	Structural Integrity
Traffic Flow Disruptions	All	Structural Integrity

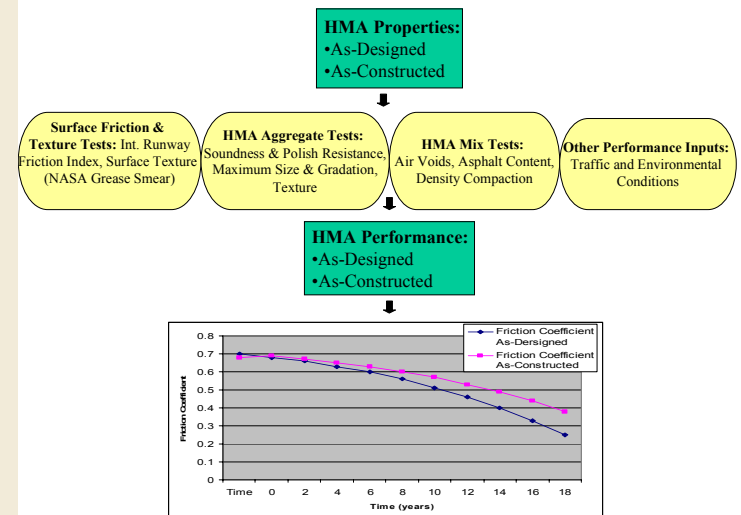
- **Aircraft Operational Performance Characteristics (OPCs)**
- **Pavement Performance Characteristics (PPCs)**
- **Acceptance Quality Characteristics (AQC)**
 - Properties measured at time of construction that relate to PPCs

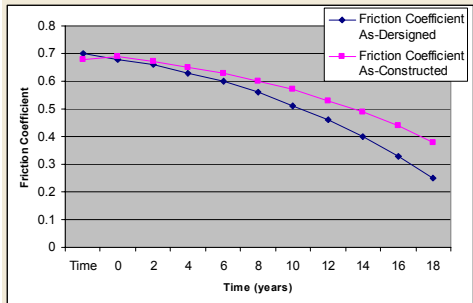
- Mix design parameters
 - % air voids, asphalt content, compaction / density of mix
- Aggregate characteristics
 - Fractured faces, aggregate angularity, gradation
- Stress-strain relationships
 - Dynamic modulus, creep compliance, fatigue relationships

Example: AQC-PPC Relation



Performance Prediction Models





Performance Predictions



Database



- PBS require that predicted performance characteristics like distress & roughness meet acceptance criteria
- PBS framework consists of 3 key elements:
 - OPCs
 - PPCs
 - AQCs
- Challenges: performance predictive methodology, which requires DB



Thank you! Questions?

