ARC Database Workshop
Turner-Fairbank Highway Research Center (TFHRC)

September, 2013

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WELCOME AND INTRODUCTIONS

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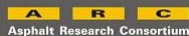
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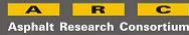
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PROPOSED AGENDA (DAY 1)

- SESSION 1
  - Introductions / ARC project background and goals
- SESSION 2
  - Master data / data upload system / measurement data
- SESSION 3
  - Querying the report and measure repository
- SESSION 4
  - DQA compliance / feedback

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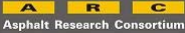
PROPOSED AGENDA (DAY 2)

- SESSION 4
  - On-going development activities and issues
  - Discussion on database security and access rights
- SESSION 5
  - Develop milestone schedule plan
  - Discuss possible transition plans to TFHRC
  - Wrap up

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Session 1

Introductions / ARC project background and goals

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SESSION 1

- Introductions (Hajj)
- Background of the ARC project (Hajj)
- Goals of the ARC project and meeting goals (hajj)
- ARC technology summary (Ekedahl)
- Database access and role-based security implementation (Ekedahl)

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ARC BACKGROUND

- Five organizations under cooperative agreement with the FHWA bring depth & breadth of knowledge to asphalt community.
  - *April 1, 2012 - NCAT joined ARC.*

ARC OVERALL GOALS

- Assess existing technologies for fast-tracking to commercialization.
- Develop technologies, standards, and procedures to improve asphalt paving material performance and predictability.
- Validate new field technologies for industry adoption.
- Improve mechanistic understanding of fatigue and moisture damage.
- Etc.

ARC DELIVERABLES/OUTCOMES

- Research Reports
- Journal and Conference Papers/proceedings
- Theses/Dissertations
- Models and Software
- AASHTO Method/AASHTO Practice
- Data associated with ARC deliverables
- Etc.

Dissemination of Information

- ARC work element TT1d and TT1e: Development of materials and research database

  – *Store information* related to *sources* & *properties* of materials used in various consortium research activities.

  – Includes results update in form of *reports*, *white papers* or *any other type of documents* for each research task.
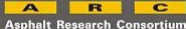
Dissemination of Information

Need for a central Database to serve as

"Storage repository for test data and supporting files and documentation."

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First Attempt…

Challenges / Design Goals

1. No software installation

   Web-based system that does not require "special" client-side technologies;

   Hence minimizing installation and version incompatibility issues.

   Users need only a browser.

Challenges / Design Goals

2. Managing database users: *Create a role-based infrastructure granting privileges to categories of users.*
   – ARC users vs. public users.
   – Number of users is undefined and varies
   – Different user credentials
   – Different user roles
   – etc.

Challenges / Design Goals

3. Common usage of a material
   - Material needs to be unique in the database.
   - Material property can have multiple records/measures.
   - Material may have been used in different experiments and with different other materials.
   - Etc.

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Challenges / Design Goals

4. Flexibility: *Critical to the overall success of ARC database.*
   - Eliminate "hard-coded" data types.
   - Development and data population are being conducted in parallel.
   - Accommodate the development of new test methods and procedures.
   - Accommodate new materials and material types.
   - Accommodate new property types.
   - Etc.

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Challenges / Design Goals

5. Ability to link materials to corresponding pavement and field validation sites.

6. Ability to attach and link documents to associated material(s).
   - E.g.: supplier certificate, raw data files, associated reports, pictures/photos, field survey data, FWD data, etc.

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Challenges / Design Goals

7. Data quality control:
   - Assure the quality and validity of the data before releasing information to the public.
   - Need for a robust system.

8. Adherence to the Federal Data Quality Act (DQA).

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MEETING GOALS

- Demonstrate functionality of the ARC database system.

- Collect constructive feedback.

- Solicit input related to
  - Features that would be needed by external entities (FHWA, regional DOT agencies).

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ARC Technology Summary (1)

- Hardware and software platforms were chosen based on well-known and supported technologies
- Database backend is SQL Server 2008 / 2012
  - Database design is fully normalized
- ASP.NET was chosen as the Web development platform
  - Development system upgraded to Visual Studio 2010 and .NET Framework 4.0 (Currently moving to 2012)

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ARC Technology Summary (2)

- Silverlight used for some client-side processing
- jQuery controls used to create a richer visual experience
- AJAX is being used and enhanced to improve system performance and reduce full page refreshes
- System upgraded to Internet Information Server Version 7.5

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ARC Technology Summary (3)

- Utilizes technology not available when LTTP was created
  - Table restrictions on table fields have been eliminated
  - Enhanced data types and capabilities such as
    - Full text search
    - XML field types

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GETTING TO THE APPLICATION

- Using Internet Explorer, visit
  http://www.business.unr.edu/arc

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  Login   Forgot Password   Request Account

- Click the **Login** button and enter credentials
- Click **Request Account** to get a public account
- Contact ARC development to get a consortium account

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ROLE AND USER MANAGEMENT (1)

- Role infrastructure is implemented using the standard ASP provider model
  - Presently, all credentials are local to the ARC database
  - Design allows plug-in of other authentication schemes such as Active Directory

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ROLE AND USER MANAGEMENT (2)

- Users belong to an ARC organization
  - FHWA, UNR, etc...
- Users belong to one or more roles
  - Roles dictate the actions a user can perform
  - New roles can be created as needed
  - Roles are not mutually exclusive

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ROLE AND USER MANAGEMENT (3)

- ARC users are categorized into **ordinary users** and **organizational super users**
  - Ordinary users can only edit data they created
  - Organizational super users can edit data created by an ordinary user within the same organization

- Another group of roles is designed for data approval so as to comply with DQA
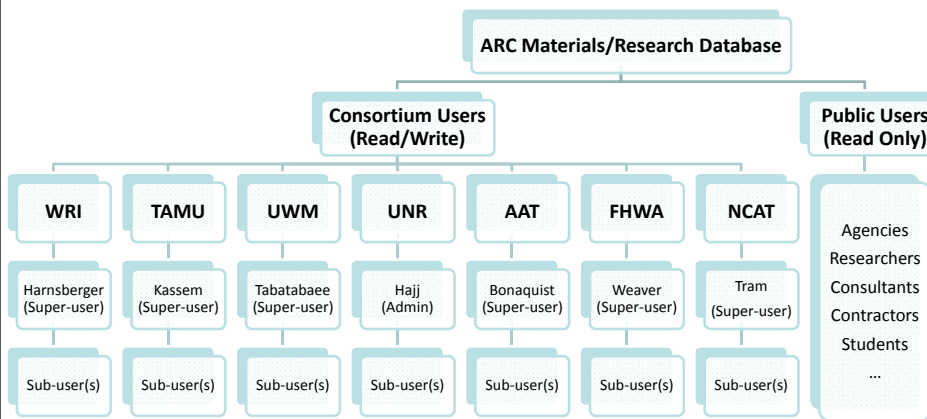
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ROLE AND USER MANAGEMENT (4)

- **User administrator** takes care of account access
- **Master data** administrator takes care of materials / properties / validation sites / etc…
- **Submit data** to create measures and upload files
- **Approve data** role to make submitted data publicly available

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ARC CONSORTIUM USER DIAGRAM

Session 2

Master data / data upload system / measurement data
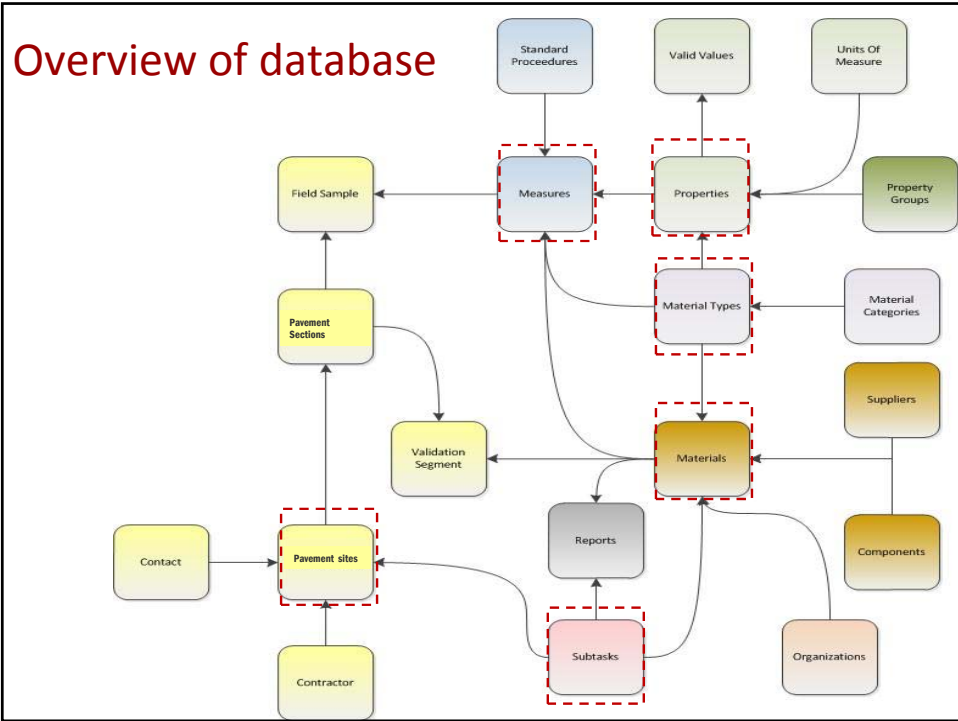
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SESSION 2

- Structure of master data (materials, properties, work items, validation sites, batches, test runs) (Pratheep)

- Demonstration of data upload system (Pratheep)

- Custom Batch upload system (Ekedahl)

- Creating measurement data demonstration (Pratheep)

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Overview of database

- Material Types
- Material Properties
- Material Measures
- Pavement Sites
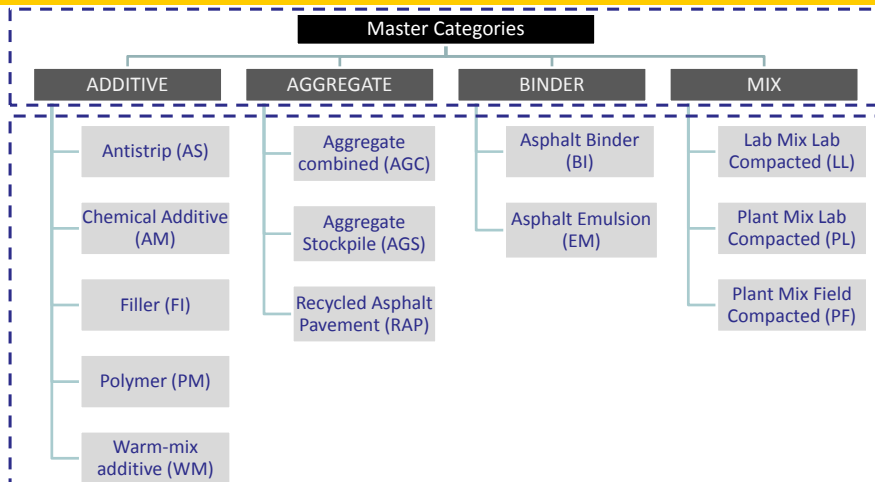- Field Measures
- Documents/Files

MATERIALS

- Material code, description, material type (*aggregate, binder, mix, additives*), and primary organization.
- Material composition (*Material Supplier, sampled date and components*).
- Associated work elements/tasks.
- Validation/Pavement sites.

MATERIAL TYPES

Master Categories			
ADDITIVE	AGGREGATE	BINDER	MIX
Antistrip (AS)	Aggregate combined (AGC)	Asphalt Binder (BI)	Lab Mix Lab Compacted (LL)
Chemical Additive (AM)	Aggregate Stockpile (AGS)	Asphalt Emulsion (EM)	Plant Mix Lab Compacted (PL)
Filler (FI)	Recycled Asphalt Pavement (RAP)		Plant Mix Field Compacted (PF)
Polymer (PM)			
Warm-mix additive (WM)			

Material Types

MATERIALS' NOMENCLATURE
Example

AGC 0051F UNR (GCCo) -- Buellton-CA [BLEND]: Intermediate (Files Attached)
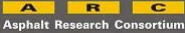
Material Type

Material Code

Primary Organization

Material Supplier

Material Description

Associated Files Attachment

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MATERIALS' COMPONENTS
Example

⊞ LL 0052B UNR -- Morrison-CO-I-28

⊟ LL 0053A UNR -- Lockwood-NV-F-28

    BI 0051 UNR (PPC) -- PG64-28 SBS

    ⊟ AGC 0053G UNR (GCCo) -- Lockwood-NV [BLEND]: Fine

        AGS 0053A UNR (GCCo) -- Lockwood-NV: NMAS 3/4"

        AGS 0053B UNR (GCCo) -- Lockwood-NV: NMAS 1/2"

        AGS 0053C UNR (GCCo) -- Lockwood-NV: NMAS 3/8"

        AGS 0053D UNR (GCCo) -- Lockwood-NV: Crushed Dust

        AGS 0053E UNR (GCCo) -- Lockwood-NV: Wadsworth Sand

⊞ LL 0053B UNR -- Lockwood-NV-I-22

⊞ LL 0053C UNR -- Lockwood-NV-I-28
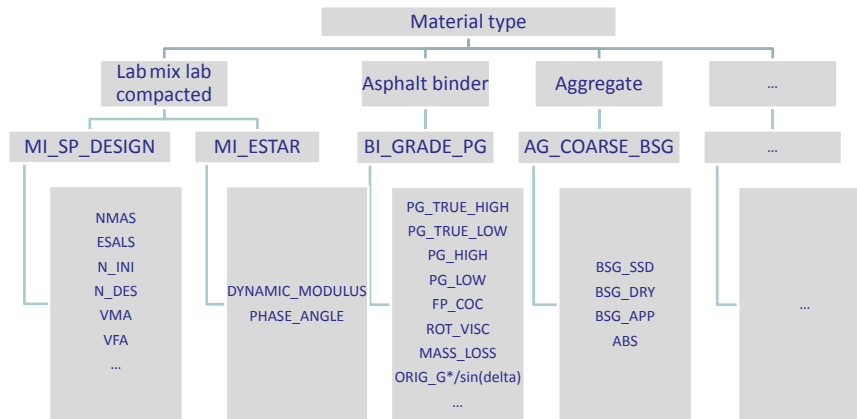
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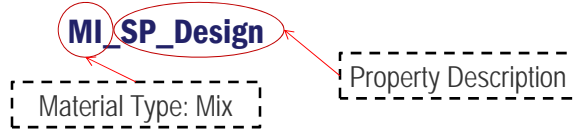
MATERIAL PROPERTIES

- **Properties are directly associated with materials**
  - Categorized as qualitative or quantitative
  - Property group (name and description)
  - Property
    - Name
    - Range of values (S_{min}, S_{max}, H_{min}, and H_{max})
    - Multi-factors (name, unit, Range of values)

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MATERIAL PROPERTIES (cont..) Examples

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PROPERTIES' NOMENCLATURE Example

MI_SP_Design

Property Description

Material Type: Mix

MI_SP_DESIGN   [Copy Selected] [Copy Group] [Remove Selected] [Remove Group] [Update Group] [Create New Property]

Property Name	Unit	S Min	S Max	H Min	H Max	Comment		S	
NMAS	mm ▾	3	50	0	100	Nominal maximum aggrega	Dims	☐	1
ESALS	Millions ▾		200	0	500	Design ESALs	Dims	☐	1
N_INI	▾			0	50	Number of gyration to Nini	Dims	☐	1
N_DES	▾			0		Number of gyration to Ndes	Dims	☐	1
N_MAX	▾			0		Number of gyration to Nma:	Dims	☐	1
AC_OPTIMUM_TWM	% ▾			0		Optimum binder content by	Dims	☐	1
AC_OPTIMUM_DWA	% ▾			0		Optimum binder content by	Dims	☐	1

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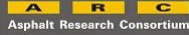
MULTI-FACTOR PROPERTIES

Property Name	Unit	S Min	S Max	H Min	H Max	Comment		S
DYNAMIC_MODULUS	kPa ▾			0		Dynamic modulus	Dims	☐
PHASE_ANGLE	° ▾			0	90	Phase angle	Dims	☐

MI_ESTAR   [Copy Selected] [Copy Group] [Remove Selected] [Remove Group] [Update Group] [Create New Property]

Add/Edit Factors for DYNAMIC_MODULUS

New Factor

Name: _____

Units: [NONE] ▾

S Min/Max, H Min/Max: ___ ___ ___

Standard Levels:

Factors

ID	T		Units		
969	1	TEMPERATURE	°C	Edit	Delete
123	2	FREQUENCY	Hz	Edit	Delete
182	3	FREEZE_THAW_CYC		Edit	Delete
185	4	AIR_VOIDS	%	Edit	Delete
621	5	AGING_TIME	Months	Edit	Delete
622	6	MOIST_COND_SAT	%	Edit	Delete
623	7	MOIST_COND_TIME	hr	Edit	Delete

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PAVEMENT SITES

- Pavement sites: used for material field tests
  - Description/Site code/ state/contractor
  - Site type (validation site/field site)
- Pavement section
  - Description
  - Start and end location
- Pavement layer
  - Description
  - Layer thickness and unit
  - Date of placement

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PAVEMENT SITES (cont..)

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MEASURES

- Directly associated to properties
  - Create and/or edit test run
    - Select/create a batch
    - Select material
    - Create test run (*name, created by, created date, approved by, status of batch, associated pavement sites*)
  - Measure editor (*Value, units, replicates, Stdv, temp*)
    - Direct entry
    - Import from excel sheet

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MEASURES (cont..)

- There might be multiple tests performed on the same material and properties
- Test runs allow for tests to be performed by different users at different times
- Any number of test runs can be created

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MEASURES (cont..)

SUPPORT FILES

- Support files include reports, scanned documents, pictures, and just about anything related to the ARC project

SUPPORT FILES (cont..)

- Support files are uploaded to a user-defined hierarchical file system
- Folders can be created as needed and upload files
  - Multiple files can be selected and uploaded at once
- Support files can be filtered by work items (program area, category, work element, subtask)
- Support files also have associated metadata

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SUPPORT FILES (cont..)

- A semantic grouping of files is now possible
  - (under construction)
- Any number of semantic groupings can be created
  - Materials, validation sites, etc… can point to one or more of these semantic groupings.

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SUPPORT FILES (cont..)

Upload (Illustration)

BATCH FILE UPLOAD

Import Files - Batch Entry

Session 3

Querying the file-report repository / Querying the measure repository

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SESSION 3

- Querying the report repository – Demonstration and hand-on activity (Ekedahl)

- Querying the measure repository – Demonstration and hands-on activity (Ekedahl)

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QUERYING THE REPORT REPOSITORY

- Reports and files can be queried and downloaded based on several filters

CHECK FILTERS TO APPLY

☐ User	☐ Prop Group	☐ Folder	☐ Keywords	☐ Date Range
☐ Organization	☐ Material			
☐ Batch	☐ File Types	☐ Subtask		

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FILTERS

- User
- Date
- Material
- Work task
- Property group
- File type
- Keyword
- Folder
- Batch

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QUERYING THE REPORT REPOSITORY

- A logical AND is applied to all filters
- Matching files are displayed in a grid
- Select files to download
- Files are rolled into a .zip file, which is downloaded
  - Working on background download and e-mail notification when query is complete

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QUERYING THE REPORT REPOSITORY

- Internals
  - Complex stored procedures are employed so as to reduce / eliminate the need to write custom queries
  - Save query facility is under development

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QUERYING THE MEASURE REPOSITORY

- Development is underway but not complete
- Query infrastructure for quantitative single factor measures is operational
- Queries are being developed for multi-factor measures is under
- Linkage between reports and measures via report linker

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Session 4

DQA compliance / Feedback and discussion

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SESSION 4

- Federal Data Quality Act compliance (DQA) and the ARC approval process (Ekedahl / Hajj)

- Feedback and discussion (All)

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DQA COMPLIANCE

- Implement soft and hard limits
- Enforced referential integrity
- Batch upload and data quality check
  - Create status for measures
  - Create status for reports
  - Preliminary status levels: Entered, Checked, Missing, Final

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DQA COMPLIANCE (cont..)

- Check for statistical abnormally in measures
- Flag incomplete record
- Establish QA/QC procedures for implementation

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DISCUSSION

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SESSION 5

- Reflection on feedback from day one training (All)
- On-going development activities and issues (Ekedahl / Hajj)
- Round-table discussion on database security and access rights (All)

SESSION 6

- Develop milestone schedule plan (All)
- Discuss possible transition plans to TFHRC (All)
- Wrap up (All)