Managing, Analyzing, and Tracking Materials through LIMMS

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MassDOT Research & Materials Section

September 17, 2020
MassDOT Generates LIMMS RFP

Brainstorming Session at the Innovation Conference, Fort Devens, MA

Medical Industry

RMS Investigates LIMMS Functionality

MassDOT Selects Vendor and Begins Development

LIMMS “Go-Live” Launch

2016

2013

2009

1980

2018

2020

MassDOT Innovation Series
September 17, 2020
The Problem

For decades, MassDOT has relied on an antiquated system of paper, hand-written test report forms, redundant data entry, and numerous decentralized databases to perform its daily functions, resulting in such inefficiencies as immense paper consumption, misfiling of documentation, delayed contract certification, misidentification, and lack of test data analytics.
The Problem
The Problem
The Solution

Laboratory

Information

Materials

Management

System
Today, we live in a “data-driven” society, compelled by data, rather than by intuition or anecdotal evidence, which should be no different for MassDOT. To resolve these inefficiencies and to bring MassDOT into the “Digital Age”, MassDOT required a much-needed upgrade to its existing system, which is accomplished through the implementation of a newly developed Laboratory Information Materials Management System (LIMMS).
Laboratory Information Materials Management System (LIMMS) is a highly efficient software ecosystem, which uses a system of computers, electronic identification tags, and cloud servers to manage, analyze, and track materials.
Radio-Frequency Identification (RFID)

Diameter 3.8"

QR = C0000001
Programming: Custom

2.00"
radius 0.0625"
1.00"

QR = C0000001
epc = C0000001
8 characters
Radio-Frequency Identification (RFID)
LIMMS Benefits

- Ability to perform data analytics to make informed decisions
- Chain of Custody and Tracking of Materials
- Elimination of Redundancy
- Reduction in Paper
- Electronic Tagging of Samples and Construction Assets
- Statewide Sharing of Data
- Automatic Documentation Filing System
- Time and Cost Savings to MassDOT
<table>
<thead>
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<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
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LIMMS Process Flow

0. “Global” (Statewide) Management

1. Project and Test Plan RMS 360 Creation

2. Log a Sample

2.5. Receive a Sample

3. Test a Sample

4. Test Result Determination and Signoffs

5. Publish “Roll-up” of Final Reports to “Track-IT”
Reporting

Receiving Dashboard

Samples by Material Categories

Material Categories by Physical Locations

Samples by Physical Locations (In quantity values)
### Reporting

#### HMA Tracking Log

<table>
<thead>
<tr>
<th>SampleNo</th>
<th>Date_ / Type</th>
<th>Lot / Sublot</th>
<th>Producer / Mixture</th>
<th>T380 %Pb</th>
<th>T166 %T275 Comb</th>
<th>T289 Gmem</th>
<th>Air Voids %</th>
<th>R35</th>
<th>T30 Percent Passing</th>
<th>T289</th>
<th>D5542 Avg Thick</th>
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Record Count: 17 Of 25
## Binder Tracking Log

**Contract No.:** 108457  
**Lot:** ALL  
**PG Binder Grade:** ALL  
**By Date:** Range  
**Start Date:** 05-05-2020  
**End Date:** 09-02-2020

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Date / Time</th>
<th>Lot</th>
<th>Producer / PG Binder Grade / Additives</th>
<th>T315 Original Binder (Unaged)</th>
<th>T315 Rolling Thin Film Oven Residue</th>
<th>T315 Pressure Aging Vessel Residue</th>
<th>T316</th>
<th>T340</th>
<th>T313</th>
<th>T350</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cfm (kPa)</td>
<td>Test Temp. (°C)</td>
<td>Phase Angle (°)</td>
<td>Cfm (kPa)</td>
<td>Test Temp. (°C)</td>
<td>Phase Angle (°)</td>
<td>Cfm (kPa)</td>
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<td>2020-000322</td>
<td>05/01/2019</td>
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**Record Count:** 1 Of 2
## Global Non Conformity Report (NCR) Log

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<tr>
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<th>Project</th>
<th>NCR No</th>
<th>NCR Date</th>
<th>Lab No.</th>
<th>Non-Conformance</th>
<th>Initiated By(District)</th>
<th>Initiated By(RMS)</th>
<th>Proposed By</th>
<th>Accepted By</th>
<th>Review By</th>
<th>NCR Status</th>
<th>Photo</th>
<th>Version</th>
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<tr>
<td>000083</td>
<td>VER-CON-2...</td>
<td>RMS(VER)</td>
<td>08/20/2020</td>
<td>00017</td>
<td>2020-000402(...)</td>
<td>Timothy Will...</td>
<td>08/20/2020</td>
<td>...</td>
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<td>...</td>
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<td>v2</td>
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<tr>
<td>000082</td>
<td>VER-CON-2...</td>
<td>RMS(VER)</td>
<td>08/20/2020</td>
<td>00016</td>
<td>2020-000456(...)</td>
<td>John Bianco</td>
<td>08/20/2020</td>
<td>3/8 sieve 5% passing</td>
<td>Timothy Will...</td>
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<td>000081</td>
<td>10/677</td>
<td>09/17/2020</td>
<td>Field</td>
<td>00003</td>
<td>2020-000623(...)</td>
<td>3000 psi @ 28 Days Air Content - ...</td>
<td>08/17/2020</td>
<td>...</td>
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<td>000080</td>
<td>District 3/AC...</td>
<td>00002</td>
<td>08/17/2020</td>
<td>09466</td>
<td>2020-000885(...)</td>
<td>90.9%</td>
<td>Thomas Kula...</td>
<td>08/17/2020</td>
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<td>...</td>
<td>...</td>
<td>Open</td>
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<tr>
<td>000079</td>
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<td>RMS(VER)</td>
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<td>2020-000437(...)</td>
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<td>...</td>
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<tr>
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<td>RMS(VER)</td>
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<td>08/14/2020</td>
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<td>...</td>
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## Reporting

### Test Results Summary Report

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<th>Project No.</th>
<th>Report</th>
<th>Status</th>
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<th>Item No.</th>
<th>SubItem</th>
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<th>End Date</th>
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<td>1D9297</td>
<td>T22/C39 Concrete Compressive Strength</td>
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<td>ALL</td>
<td>04/01/2018</td>
<td>09/02/2020</td>
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### Concrete Mix Design

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<th>Sample, Test No., SN</th>
<th>Lab Name</th>
<th>Equip.</th>
<th>Mix Design No./ Specimen No.</th>
<th>Bid Item/ Substance</th>
<th>Date of Test</th>
<th>28 Day</th>
<th>5000</th>
<th>6490</th>
<th>5000 min</th>
<th>Pass</th>
<th>Test Result Details</th>
<th>Discard</th>
<th>Closed</th>
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<td>2020-000552-42-02</td>
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<td>6490</td>
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<td>Sub-Cement Con...</td>
<td>07/24/2020</td>
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<td>6290</td>
<td>5000 min</td>
<td>Pass</td>
<td>Conforms w/...</td>
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<td>2020-000552-37-01</td>
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<td>07/22/2020</td>
<td>5642</td>
<td>5000</td>
<td>5900</td>
<td>5000 min</td>
<td>Pass</td>
<td>Conforms w/...</td>
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<td>5000 min</td>
<td>Pass</td>
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<td>6996</td>
<td>5000</td>
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<td>6870</td>
<td>5000 min</td>
<td>Pass</td>
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Data Analysis

Research & Materials
Materials Received - Consolidated
Calendar Year 2019

Total Materials Received

4644
Total Materials 2019

Number of Materials Received by Month

Top 10 Material Manufacturers

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<th>Manufacturer</th>
<th>Number of Materials Received</th>
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<td>Concrete System Inc.</td>
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<tr>
<td>Dauphinias Concrete</td>
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<tr>
<td>United Concrete</td>
<td>171</td>
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<tr>
<td>Michie Corporation</td>
<td>166</td>
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<tr>
<td>East Jordan Foundry</td>
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<tr>
<td>Fort Miller</td>
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<tr>
<td>Ennis Flint</td>
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<tr>
<td>Tri State Materials</td>
<td>115</td>
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<tr>
<td>Benenvento</td>
<td>111</td>
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<td>Total</td>
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Materials Received by Lab

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<th>Lab Name</th>
<th>Total Materials 2019</th>
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</thead>
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<tr>
<td>Soils/Aggregate</td>
<td>220</td>
</tr>
<tr>
<td>QA Lab</td>
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<tr>
<td>Chemical</td>
<td>671</td>
</tr>
<tr>
<td>Cement/Concrete</td>
<td>3062</td>
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<td>Bituminous</td>
<td>674</td>
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<tr>
<td>Total</td>
<td>4644</td>
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</tbody>
</table>

Number of Contracts R&M Contributed To

275
Total Contracts
Moving Forward

Knowledge Management Cognitive Pyramid

WISDOM

SHARED UNDERSTANDING

Knowledge Management

Focus:
- Create
- Organize
- Apply
- Transfer

KNOWLEDGE

Cognition

Information Management

Focus:
- Collect
- Process
- Disseminate
- Store
- Display
- Protect

INFORMATION

Processing

DATA

Decision Risk

Know Why

Know How

Know What

Source: Matthew.viel (https://commons.wikimedia.org/wiki/File:KM_Pyramid_Adaptation.png), https://creativecommons.org/licenses/by-sa/4.0/legalcode
Questions?