Charles D. Baker, Governor
Karyn E. Polito, Lieutenant Governor
Jamey Tesler, Secretary & CEO
Jonathan L. Gulliver, Highway Administrator

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Massachusetts Department of Transportation
Highway Division

MEETING MINUTES

MassDOT Annual HMA Meeting

LOCATION:	Hybrid Meeting MassDOT Research & Materials 5 Macadam Road, Hopkinton, MA, 01748 or Microsoft Teams (Login information below)
DATE:	December 14, 2022
TIME:	9:00 AM to 12:00 PM
FACILITATOR:	Mark Brum

Agenda

1. Introductions
2. E-Ticketing
3. Plants and Labs
    a. Spec Updates
    b. HMA Round Robin
    c. Plant and Lab Inspections
4. Qualified Construction Materials List
5. Independent Assurance Program
6. Research & Pilot Projects
7. Mix Designs
8. Balanced Mix Design
9. Aggregates and Sources
10. MassDOT Observations
11. Industry Observations
12. Open Forum

Minutes

1. Introductions
2. E-Ticketing
    - Taking paper tickets and making them electronic.
    - Three takeaways (Job safety, time savings and quality).
    - Saves to cloud.
3. Plants and Labs
    - Spec Updates
        - 2023 blue book updated to reflect "RAP tents" (RAP must be covered by a framed structure to prevent rain and allow airflow. Must hold a minimum of 500 tons of RAP)
    - HMA Round Robin
        - Any lab performing MASSDOT work will be required to perform round robin. RAP is being added to PSP testing (specific gravity. T-209 plus calculations)
    - Plant and Lab Inspections
        - Scheduling in late February/early March. Review and update QSM (emphasis on employee turnover).
4. Qualified Construction Materials List
    - Crack sealing spec with pre-qualified crack sealers & joint adhesives.
    - Ride trucks also on QCML, must us approved ride truck for QC testing.
    - New Buy America ACT (build back better).
        - Three categories (Iron/Steel, Manufactured products, and construction materials.) Asphalt excluded. In all contract bids starting 11/14/22
5. Independent Assurance Program
    - Mandated by Feds to perform Independent Assurance on "X" amount of lab/field technicians.
    - Contact RMS to schedule by 3/1/23. 1-to-1 specimen comparison.
6. Research & Pilot Projects
7. Mix Designs
    - Recipe mixes will no longer be approved by MassDOT. Completely fill out the workbook before submitting for review. Number of gyratory for each binder content need be more than 1.
    - Record all gyration heights not just the green boxes (all of the heights, from 0-100 (100 heights) if 100 gyratory mix design). Optimum designs must be designed at the target air voids. Mix designs using PG64-28 must have a target compaction temperature below 260˚F (warm mix).

- Mix designs using polymer must have their target compaction temperature pre-approved my RMS.
- RMS will be present for Hamburg fabrication.
- R 30 is now 2-hour aging.
- Change of 5% to a stockpile requires a new correction factor.
- There shall be a correction factor for each mix and for each oven (per AASHTO T-308).
- **Correction factors do not need to be developed for each gyration level if the only thing that is changing is the binder content.**

8. Balanced Mix Design
    - BMD research project is complete.
    - MassDOT will be using: AASHTO T 324 Hamburg & ASTM D8225 IDEAL-CT.
    - In 2022, some initial testing was performed on plant produced mix.
    - In 2023, we will require samples to be taken on all projects to establish baseline program and data.
    - In 2024, we will begin to implement performance test for production testing.
9. Aggregates and Sources
    - Producers are to submit a list of aggregate sources and sizes that will be used for 2023.
    - Aggregates that are trucked in from plants need to have a policy for documenting and tracking delivered aggregates.
10. MassDOT Observations
    - Some labs are not meeting the specifications throughout the paving season.
    - Data needs to be entered within 48 hours.
    - DMF process will consist of:
        - Producer sending request to the DME,
        - DME will review and send the request to RMS,
        - and RMS will record changes in QA SharePoint and LIMMS.
11. Industry Observations
12. Open Forum

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Annual HMA Meeting

December 14, 2022

Hybrid Meeting

Agenda Items

1. Introductions
2. E-Ticketing
3. Plants and Labs
4. Qualified Construction Materials List
5. Independent Assurance Program
6. Research & Pilot Projects
7. Mix Designs
8. Balanced Mix Design
9. Aggregates and Sources
10. MassDOT Observations
11. Industry Observations
12. Open Forum

Introductions

Quality Assurance

Mark Brum

Mark.Brum@dot.state.ma.us

MassDOT Hot Mix Asphalt

massdothma@dot.state.ma.us

Preferred

Key Personnel

Director of Research and Materials

Mary Grieco

Quality Assurance

Nick Antoniadis – State QA Engineer

Adam Pagan

Jacob Podskarbi

Key Personnel

Pavement Management Engineer

Ed Naras

Binder Laboratory

Bryan Engstrom

HMA Laboratory

Larry Andrews

Key Personnel

Field Control – Independent Assurance

- Richard Mulcahy – Field Control Engineer
- Colin O’Brien
- Tim Willsmer
- Thong Ho
- Carlos Flores-Munoz
- George Gilbert
- Timothy Durgin
- Robert Bousquet
- David Manktelow

Key Personnel

District Materials

John Bianco	District 1 DME
Jiang (John) Liang	District 1 DQE
Amy Bisbee	District 2 DME
Eric Grady	District 2 DQE
Bill Walker	District 3 DME
Albert Kwok	District 4 DME
Paul Matthews	District 4 DQE
Jason Lema	District 5 DME
Charles Gurney	District 6 DME

e-Ticketing

- MassDOT e-Ticketing
- Haulhub e-Ticketing

Plants & Labs

Spec Updates

- "RAP stockpiles shall be covered by a framed structure which prevents the intrusion of water but also allows the flow of air to promote drying of the stockpile. The structure shall be capable of storing a minimum of 500 tons of RAP."

Plants & Labs

HMA Round Robin

- All labs intending to do MassDOT work must participate in the NETTCP/CAP Lab HMA round robin.
- Results must be submitted to CAP Lab by required date.
- Laboratories will not be approved until PSP results have been submitted to CAP Lab.

- Samples are prepped and getting ready for delivery.
- RAP added to program.

Plants & Labs

Plant and Lab Inspections

- RMS will reach out to schedule.
- Review and update QSM.
- MassDOT HMA LQP Inspection Checklist.
- Expected to begin in late February.

Qualified Construction Materials List

https://www.mass.gov/massdot-qualified-construction-materials

Qualified Construction Materials List (QCML)

The following are lists of qualified products for use on MassDOT Highway Division construction contracts.

The Research & Materials Section compiled these lists of products. We frequently make additions and deletions to the lists and they are intended for informational use only. Please see note below.

If you have any questions, you may e-mail MassdotQCML@dot.state.ma.us.

Qualified Materials List

Adhesives

- Adhesive Anchors
- Bonding Agents

Asphalt

- Anti-Strip Additives
- Asphalt Binder Suppliers
- Asphalt Emulsion Suppliers
- Asphalt Release Agents
- Hot Mix Asphalt Production Facility
- Pavement Crack Sealers and Joint Adhesives
- Pavement Rideability (IRI) Profilers
- Warm Mix Asphalt Additives

RELATED

Submit a product for review

Products not qualified by MassDOT

Qualified Traffic Control Equipment

Approved Fabricators

Qualified Construction Materials List

Locations

- Asphalt Emulsion Suppliers
- Hot Mix Asphalt Production Facilities
- PG Asphalt Binder Suppliers

Materials

- Asphalt Release Agents
- Pavement Crack Sealers and Joint Adhesives
- Liquid Anti-Strip
- WMA Additives

Equipment

Pavement Rideability Profilers

Build America, Buy America Act (BABA)

- BIL created new Buy America requirements.
- 3 categories
  - Iron & Steel
  - Manufactured Products
  - Construction Materials
    - Non-ferrous metals
    - Plastic and polymer-based products
    - Glass
    - Lumbar
    - Drywall

Build America, Buy America Act (BABA)

- Exclusions to Construction Materials include:
  - An item of primarily iron or steel
  - A manufactured product
  - Cement and cementitious materials
  - Aggregates such as stone, sand, or gravel
  - Aggregate binding agents or additives

Asphalt concrete pavement mixes are typically composed of asphalt cement (a binding agent) and aggregates such as stone, sand, and gravel.

Accordingly, asphalt is also excluded from the term construction materials.

Build America, Buy America Act (BABA)

- MassDOT has been coordinating with FHWA and CIM to identifying which items apply to BABA.
- BABA will be in all contract bids opened starting November 14, 2022.
- For more information: https://www.fhwa.dot.gov/construction/cqit/buyam.cfm

Independent Assurance Program

- Contact RMS if all technicians in the lab/field have not been IA'd in 2022 or if IAs have not been closed.

- Send list of staff for 2023 IAs by:

  March 1st, 2023

  to

  Carlos.Flores-Munoz@dot.state.ma.us

- IA testing should be a 1-to-1 comparison of 1 specimen compared to 1 specimen.

Research and Pilot Projects

- Balance Mix Design Research Project
- High RAP Surface Course Pilot Project
  - Two are ongoing.
  - Additional projects coming.
- High Performance Overlays Research and Pilot Projects
  - ARGG vs. HP vs. SMA vs. SSC-P
- DPS

Mix Designs

- Recipe mixes will no longer be approved by MassDOT.
- Use the latest workbook when submitting new LTMFs.

VALUES IN THIS TABLE WILL BE USED TO POPULATE THE RMS043

Varying Asphalt Data Table					
Asphalt Content	-0.5	0.0	0.5	1	
Max. Theo. Sp. Grav., G_{mm}					
$\%G_{mm}$ at N_{ini}					-
V_a at N_{ini}					-
G_{mb} at N_{des}					
$\%G_{mm}$ at N_{des}					
V_a at N_{des}					
VMA at N_{des}					
VFA at N_{des}					
Eff. Specific Gravity of Agg., G_{se}					
Percent Absorbed Asphalt, P_{ba}					
Percent Effective Binder, P_{be}					
Dust to Binder Ratio					
RAP Binder Ratio					

Optimum Targets for LTMF Verification

Blended Aggregate Gradation			AASHTO T 30		SEE SPECS, LTMF, DMF FIELDS BELOW							
SIEVE SIZE	1.5"	1"	3/4"	1/2"	3/8"	#4	#8	#16	#30	#50	#100	#200
MIN.			100	90			28					2
MAX.				100	90		58					10
Design	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Final Blend												
Difference												

Ignition Oven Correction Factor, %	

Mix Designs

https://massgov.sharepoint.com/sites/DOT-Highway-QA/HMA/Reference%20Documents/Forms/AllItems.aspx

Search | District 1 | District 2 | District 3 | District 4 | District 5 | District 6 | HMA | R & M

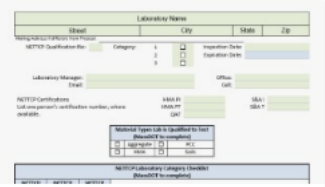
massDOT HMA

- MassDOT QA Home
- HMA Home
- HMA Producers
- Suppliers
- Reference Documents
- HMA Summary
- Site Contents
- Edit

+ New | Upload | Edit in grid view | Sync | Pin to Quick access | Export to Excel | Automate | Integrate | ...

Reference Documents

2022 HMA QSM Checklist.pdf
November 22, 2021



2022 MassDOT HMA LQP Inspec...
November 5, 2021

Name	Modified	Modified By	Comments	+ Add column
2020 HMA Workbook - Rev. 20.xlsm	2 hours ago	McDonald, Maggie (DOT)		
2022 HMA QSM Checklist.pdf	November 22, 2021	McDonald, Maggie (DOT)		
2022 MassDOT Emulsion QC Plan Checklist....	December 8, 2021	McDonald, Maggie (DOT)		
2022 MassDOT HMA LQP Inspection Checkl...	November 5, 2021	McDonald, Maggie (DOT)		
2022 MassDOT PGAB QSM Checklist RED E...	December 8, 2021	McDonald, Maggie (DOT)		

Mix Designs

- Completely fill out the workbook before submitting for review.
  - Number of gyratories for each binder content need be more than 1.
  - Record all gyration heights not just the green boxes.
- Optimum designs need to target 4% air voids.
- Separate gyratories for different gyration levels.

Mix Designs

- Compaction Temperature
  - Mix designs using PG64-28 must have a target compaction temperature below 260˚F.
  - Mix designs using polymer must have their target compaction temperature pre-approved my RMS.
- Hamburgs
  - RMS will go back to being present for Hamburg fabrication.
  - R 30 changed from 4-hour to **2-hour** aging.
- Ignition oven correction factors
  - Change of 5% to one stockpile requires new CF.
  - CF for each mix and each oven.

Balanced Mix Design

- BMD research project is complete.
- MassDOT will be using:
  - AASHTO T 324 Hamburg
    - For rutting and stripping.
  - ASTM D8225 IDEAL-CT
    - For cracking susceptibility.
- Hamburg and IDEAL-CT specimens:
  - 60 mm tall
  - 7.0 ± 0.5 % air voids for standard mixes
  - 4 gyratories for hamburg and 4 for IDEAL-CT

Balanced Mix Design

- 2022 some initial testing was performed on plant produced mix.
- 2023 will require samples be taken on all projects to establish baseline program and data.
- 2024 begin to implement performance tests for production testing.

Balanced Mix Design

- 2023 BMD Sampling Program
  - Mix Designs
    - Hamburgs and IDEAL-CT.
    - For new mix designs (and some DMFs).
  - Sampling and testing of plant produced mix for information only
    - One set of samples (2 boxes) taken within the first 5,000 tons for every lot.
    - Boxes will be taken in conjunction with the district's acceptance sample.
- 2024 begin to implement performance tests for production testing.
- BMD Flowchart

Aggregates and Sources

- Producers to submit a list of aggregate sources and sizes that will be used for 2023.
- Plants that truck in aggregates need to have a policy for documenting and tracking delivered aggregates.
- Policy to be in the QSM.

MassDOT Observations

- Plant and Lab Issues
  - Some labs are not meeting the specifications throughout the paving season.
- QA SharePoint
  - Data needs to be entered within 48 hours.
- Mid-year DMF process
  - Producer to send request to the DME
  - DME will review and send request to RMS.
  - RMS will record change in QA SharePoint and LIMMS.

MassDOT Concerns

- Paving temperatures (E. Naras)
  - UTBO should not be placed below the allowable temperatures.
- MTVs (E. Naras)
  - Need to have a remixer.
- IRI Ride Testing (E. Naras)
  - Need to tie QC testing to actual mile markers.
  - IRI testing needs to be scheduled while there is no other work going on.
  - Possible IRI testing and data processing workshop this winter for those that perform IRI testing.

Open Forum and Questions

Issues with:

- Production?
- Paving?
- Testing?
- Specifications?

MassDOT
e-Ticketing

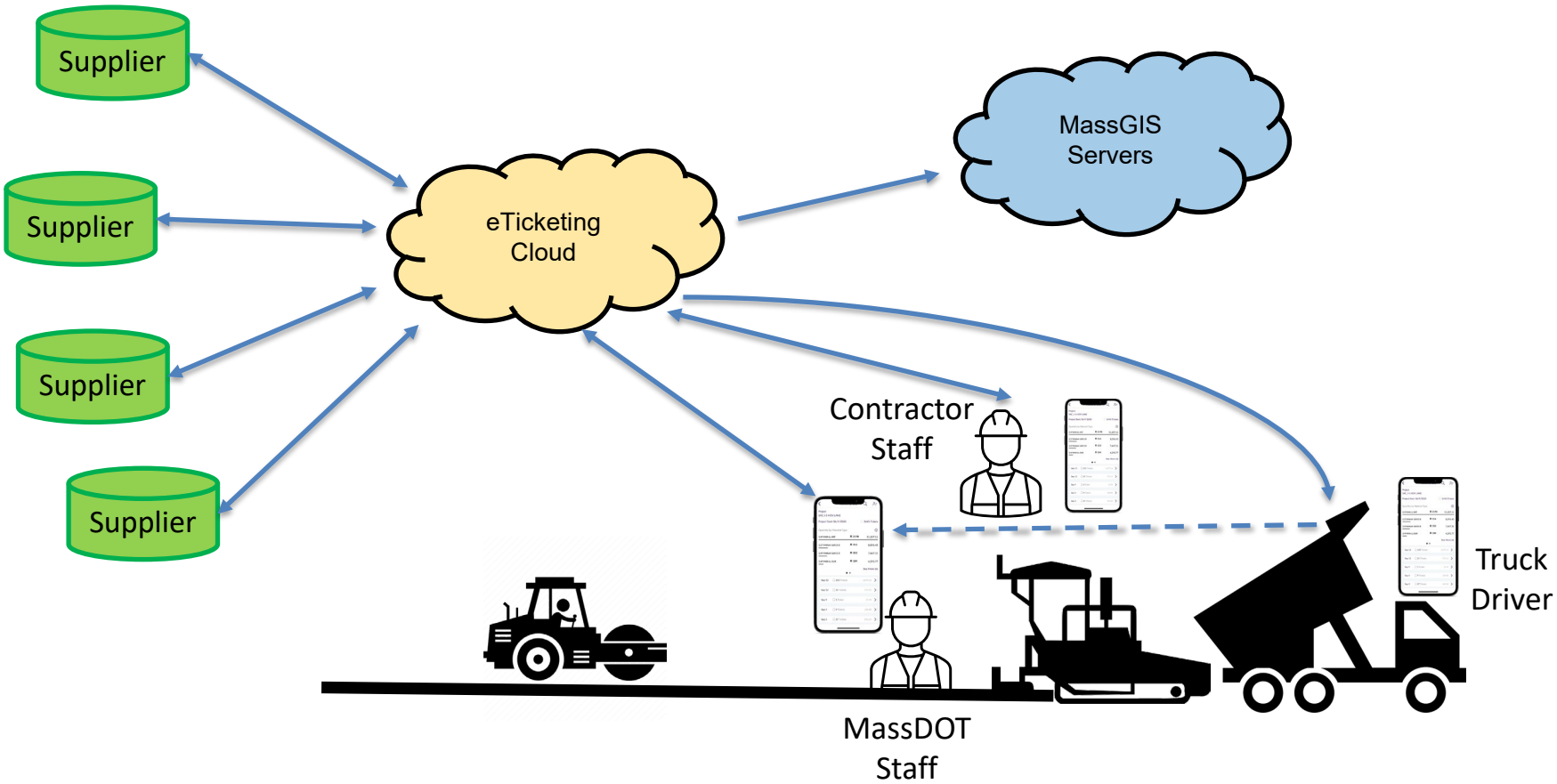
MassDOT's goal is to replace paper tickets with electronic tickets for HMA & Concrete deliveries.

Per FHWA, the benefits in accomplishing this include:

- **Safety** – eTicketing enhances data collection while reducing exposure to adjacent vehicular traffic and construction equipment for inspectors and work crews while retrieving paper tickets.
- **Time Savings** – Real-time access, via electronic handling of tickets, reduces processing time for quality assurance and payment, decreasing the inherent delays in paper-based project administration.
- **Quality** – Project documentation is more consistent and efficient using eTicketing platforms. Standardized data enables archiving for future reference, leading to improved design, construction, maintenance, and operations.

Current Process

eTicketing – Overview



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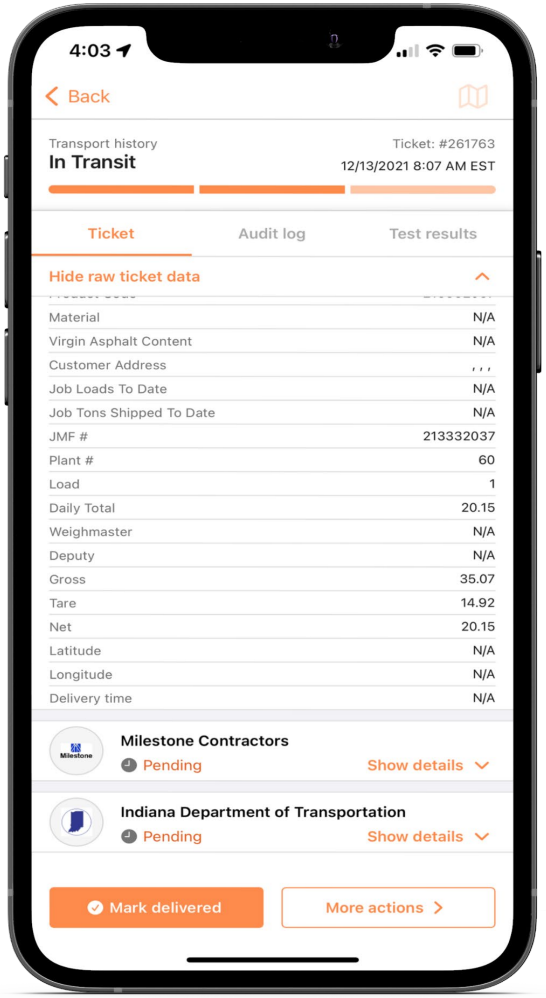
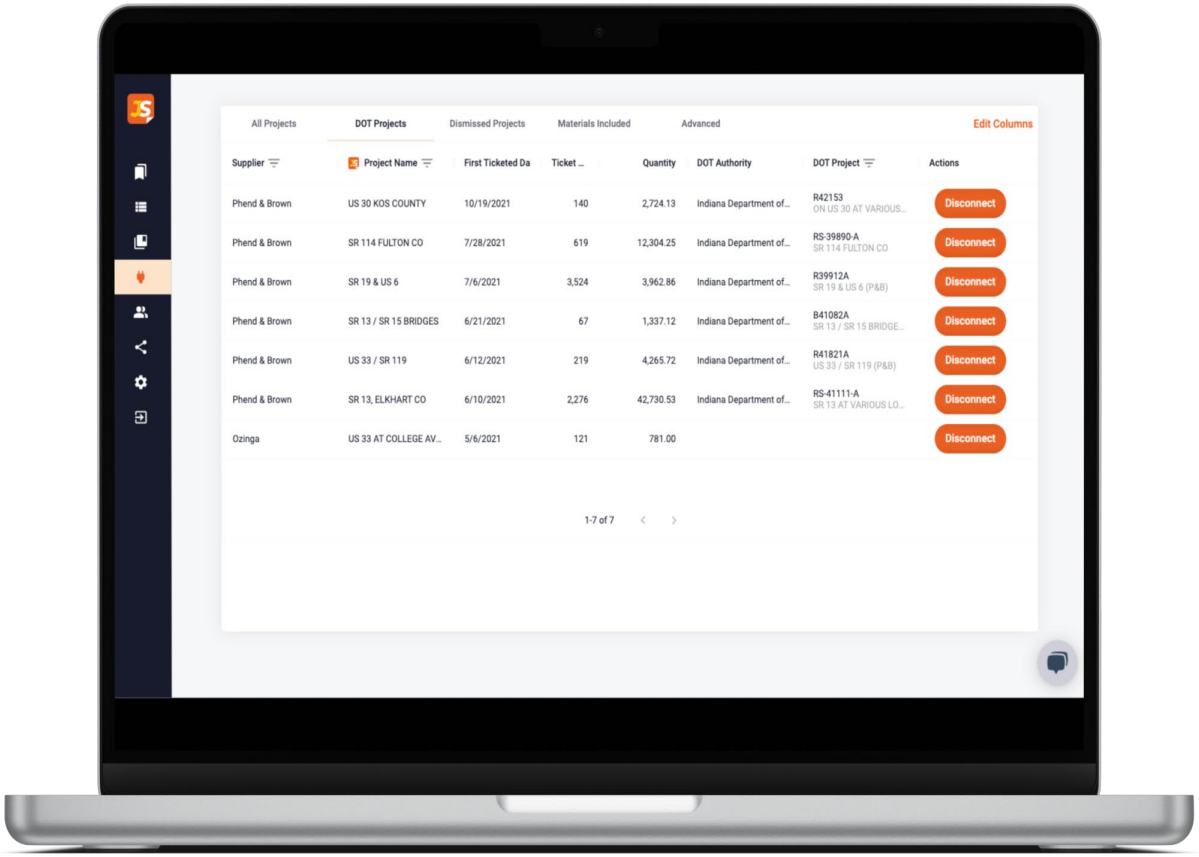
Ticket Level Detail





Ticket Level Detail

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9:06 LTE

Project Tickets | Tickets for May 13

Project Overview

TOTAL TONS	1,043.44
DELIVERED	1,043.44
REJECTED	0.00
WASTE	0.00
PENDING	0.00

MassDOT 111027 Athol Phillipston Rt 2...

May 13 11:49 AM EDT today

DMO Construction
ODMO07 Loaded
23.42 tons WB 12.5 ARGG 100G 10% AR

28279 Load 43 Delivered

Back Ticket # 28279

Last Updated	May 13, 9:05 PM

Transport History

- 05/13/21 11:49 AM EDT — Ticketed
- 05/13/21 11:59 AM EDT (estimated) — In Transit
- 05/13/21 2:48 PM EDT — Delivered
- At Equipment

All States Materials Group®

Supplier	N/A
Plant	Warner Bros., LLC
Contractor	Warner Bros., LLC
Customer Name	ASMG Jobs
Contract #	111027
Job	MassDOT 111027 Athol Phillipston Rt 2 Resurfacing & Rel Work
Job #	202993-

9:05 LTE

Back Ticket # 28279

Tare	15.72
Net	23.42
Plant Temperature	N/A
Field Temperature	N/A
Temperature Scale	F
Station	24+00 to 23+70 EB main
Waste	N/A
Notes	End days paving at bridge joint.

Edit

Status	Delivered
Inspector Name	Robert Newton
Updated At	5/13/2021 2:48 PM
Reason For Rejection	N/A

Robert Newton

JOBslip

Status	Pending
Name	N/A
Updated At	N/A

Mark Pending

Reject

Performance and Material Tracking

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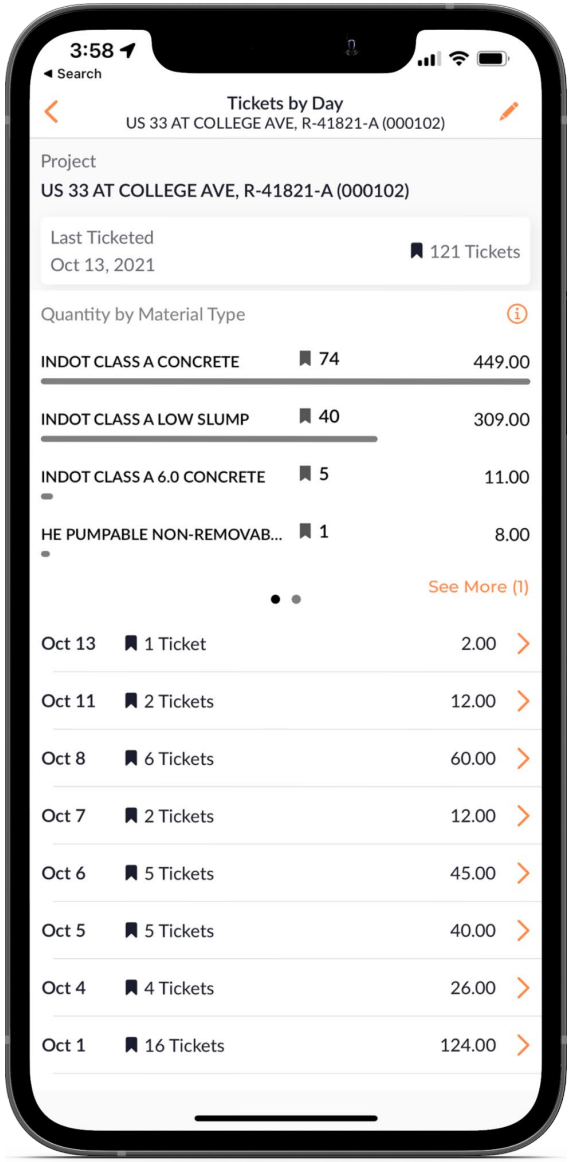

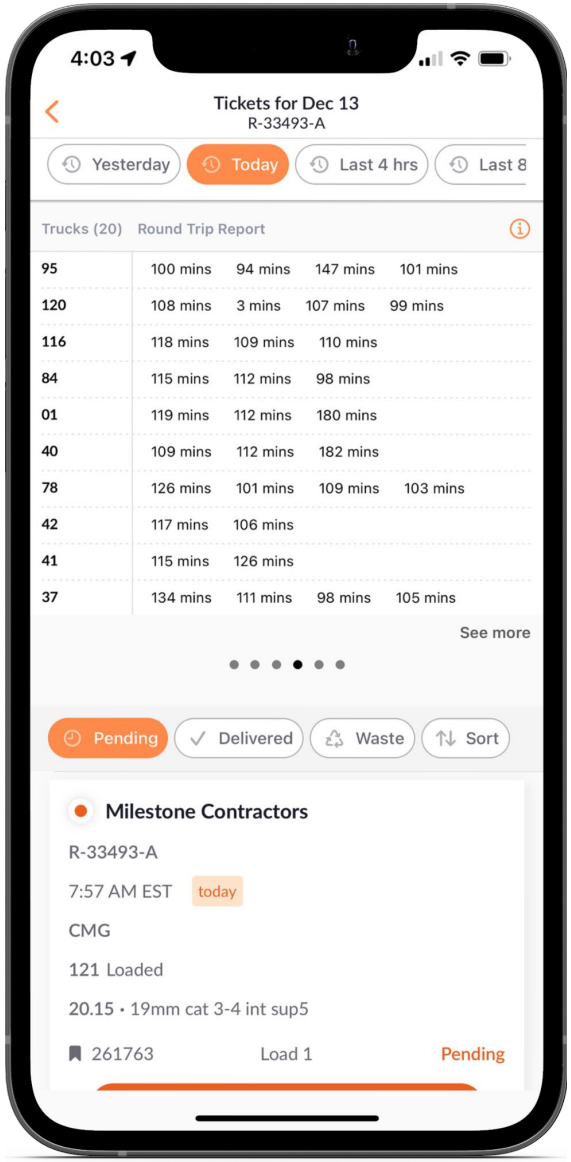

Example of Daily eTicketing Report

Delivery Report
Project Name: **MASSDOT #110346 - PEABODY (RTE 128)**
May 20, 2021 04:50 AM to May 21, 2021 04:49 AM

Delivered	Rejected	Pending	Waste
34 | 792.67	0 | 0.00	1 | 23.92	0 | 0.00

Supplier	Ticket #	Ticketed Time	API Time	Truck #	Material	Load #	Contractor	Timestamp	DOT	Timestamp
Brox	350250	5/20/21 11:17 PM	5/20/21 11:20 PM	JAC	MA 19.0 75G SIC WMA 25R	1	23.92	-	23.92	-
Brox	350202	5/20/21 8:05 PM	5/20/21 8:08 PM	5478	MA 19.0 75G SIC WMA 25R	1	24.00	-	24.00	5/24/21 9:17 PM
Brox	350204	5/20/21 8:07 PM	5/20/21 8:10 PM	5479	MA 19.0 75G SIC WMA 25R	2	23.96	-	23.96	5/24/21 9:18 PM
Brox	350205	5/20/21 8:09 PM	5/20/21 8:12 PM	5683	MA 19.0 75G SIC WMA 25R	3	24.09	-	24.09	5/24/21 9:18 PM
Brox	350207	5/20/21 8:11 PM	5/20/21 8:14 PM	2110	MA 19.0 75G SIC WMA 25R	4	24.11	-	24.11	5/24/21 9:18 PM
Brox	350208	5/20/21 8:27 PM	5/20/21 8:30 PM	JG1	MA 19.0 75G SIC WMA 25R	5	23.85	-	23.85	5/24/21 9:19 PM
Brox	350211	5/20/21 8:32 PM	5/20/21 8:34 PM	2209	MA 19.0 75G SIC WMA 25R	6	24.16	-	24.16	5/24/21 9:19 PM
Brox	350212	5/20/21 8:35 PM	5/20/21 8:38 PM	L&I	MA 19.0 75G SIC WMA 25R	7	23.85	-	23.85	5/24/21 9:19 PM
Brox	350213	5/20/21 8:38 PM	5/20/21 8:40 PM	JACOB	MA 19.0 75G SIC WMA 25R	8	24.00	-	24.00	5/24/21 9:19 PM
Brox	350214	5/20/21 8:41 PM	5/20/21 8:42 PM	MCN	MA 19.0 75G SIC WMA 25R	9	24.18	-	24.18	5/24/21 9:20 PM
Brox	350215	5/20/21 9:12 PM	5/20/21 9:14 PM	JIRA1	MA 19.0 75G SIC WMA 25R	10	22.10	-	22.10	5/24/21 9:20 PM
Brox	350216	5/20/21 9:19 PM	5/20/21 9:22 PM	2418	MA 19.0 75G SIC WMA 25R	11	24.05	-	24.05	5/24/21 9:20 PM

Progress to date with e-Ticketing

- Over the past couple of years, we successfully piloted e-Ticketing on several MassDOT HMA projects in various Districts with participating suppliers / contractors.
- Procured HaulHub's DOTSlips product.
- Linked HaulHub's Cloud Data to MassDOT GIS's cloud to allow for MassDOT to ingest all finalized ticketing data on to our systems.

MassDOT survey results from piloted projects

- Ease of use for desktop and mobile application – **4.25** out of 5
- Accuracy of data – **9** out of 10
- Cell service issues reports – **None**
- **No negative feedback received**

Groups involved in e-Ticketing

- MassDOT
- Federal Highway Administration (FHWA)
- Every Day Counts Initiative (EDC-6)
- American Associations of State Highway and Transportation Officials (AASHTO)
- Associations
- Producers
- Contractors
- Technology Vendors
- National e-Ticketing Task Force

Benefits to e-Ticketing

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- **Reliability – Digital vs Paper**
  - Eliminates lost tickets and paper storage
  - Readily available data (current and future)
- **Quality**
  - Real time materials and quantity verification
- **Efficiency**
  - Helps to expedites contractor pay
  - Advanced review of delivery tickets
- **Safety**
  - Reduces project staff around delivery trucks
  - Removes the need to take ticket from driver
- **Timing**
  - National Movement
  - Broad support from across the industry to make this a reality

Suppliers have options to tie into MassDOT Portal

3 Options:

For Producers and Contractors with in-house IT resources:

- MassDOT will provide an API key for you to send ticket data to the DOT Portal

For Producers and Contractors with a current e-ticketing provider (e.g. Fleetwatcher):

- Nothing changes. Your process stays the same. The e-ticketing provider will forward the tickets via API to the MassDOT Portal

For Producers without in-house IT resources or capacity:

- Provide a simple solution to get your tickets flowing into the portal at no cost to you

Proposed Roadmap

- Meet with HMA suppliers, contractors, etc. to present e-Ticketing
- Email blast to all HMA suppliers and contractors to sign-up for DOTSlips product
- Coordinate and connecting all HMA suppliers with DOTSlips product this off season.
- Finalize e-Ticketing specification this off season
- Go-live with e-Tickets statewide for HMA projects in 2023
- Pilot ready mix concrete projects in 2023
- Go-live with ready mix concrete projects in 2024

Proposed Roadmap (MassDOT long term)

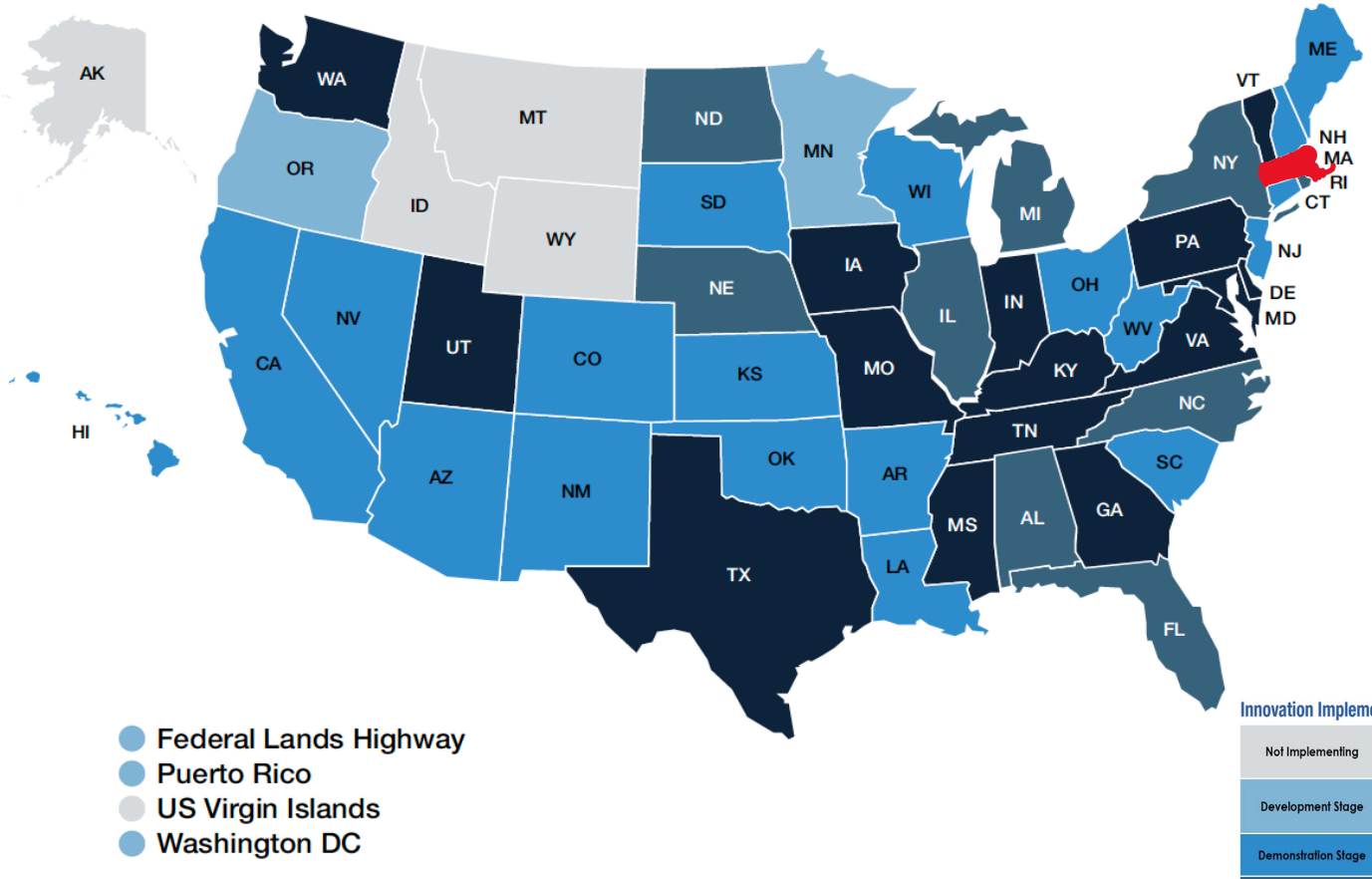
- Establish a large dataset for all HMA e-Tickets
- Review the data for consistency and potentially any improvements required
- Begin Work Stream with MassDOT IT to develop/automate existing software to incorporate this data:
  - Automate HMA and select concrete PaySlips in SAM to help REs reduce time spent producing pay estimates
  - Automate commodity price adjustments for liquid asphalt and portland cement

Worth noting:

43+ State DOTs are moving ahead with e-Ticketing as an initiative in 2022

– This is the most adopted EDC Initiative **EVER**

Goal (December 2022)



Innovation Implementation Stages

Not Implementing	The State is not using the innovation anywhere in the State and is not interested in pursuing the innovation.
Development Stage	The State is collecting guidance and best practices, building support with partners and stakeholders, and developing an implementation process.
Demonstration Stage	The State is testing and piloting the innovation.
Assessment Stage	The State is assessing the performance of and process for carrying out the innovation and making adjustments to prepare for full deployment.
Institutionalized	The State has adopted the innovation as a standard process or practice and uses it regularly on projects.

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Questions?

HAULHUB TECHNOLOGIES

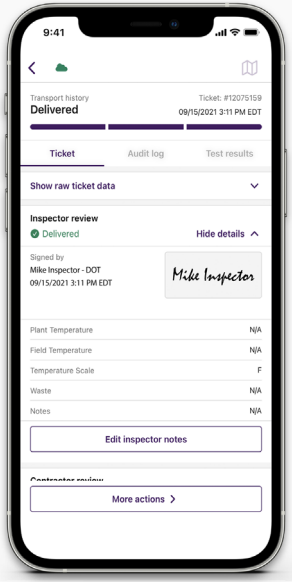
e-Ticketing in Massachusetts

Leading the Way in Construction Materials Digitization

Dec 14th, 2022

What is e-Ticketing?

It's streamlining the way the materials information is delivered to all parties involved in the supply chain.



From this → **To this**

How To Get Connected

Option 1

For Producers and Contractors with Internal IT Resources

Massachusetts DOT will provide an API key for you to send ticket data to the Massachusetts Portal

Option 2

For Producers and Contractors with existing e-Ticketing Solutions

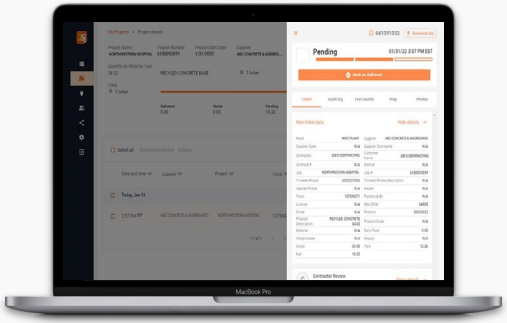
Nothing changes. Your process stays the same. The e-ticketing provider will forward the tickets via API to the Massachusetts DOT Portal

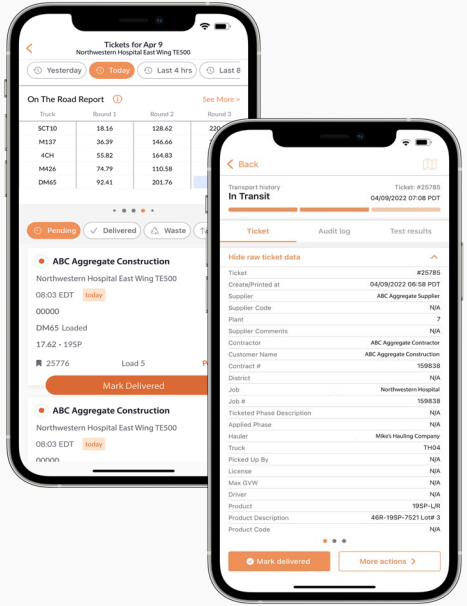
Option 3

For Producers with Limited to No IT Resources and no e-Ticketing Solution

Provide a simple solution to get your tickets flowing into the portal at no cost to you.

For the Supplier: What Does e-Ticketing Look Like?



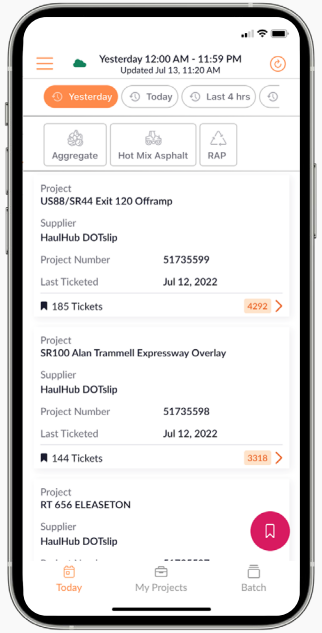


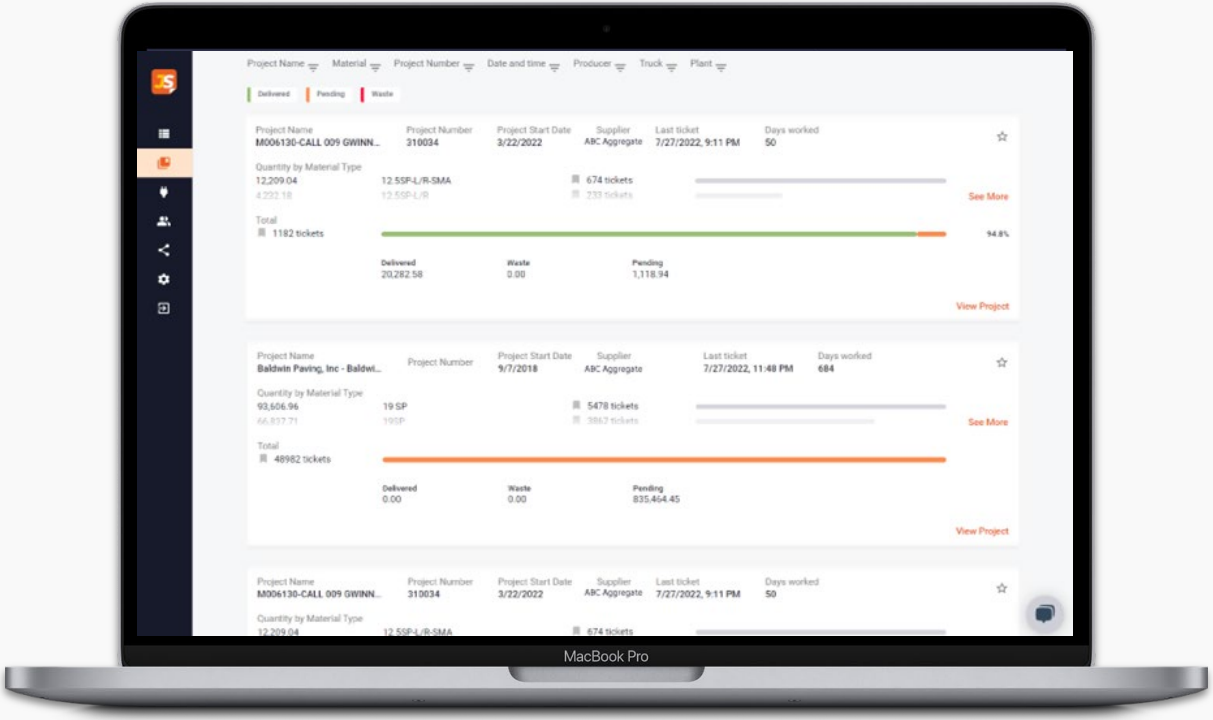
JOBslip

e-Ticketing tool **JOBslip** simplifies sharing critical construction materials data between project stakeholders. Making you the easiest construction partner to do business with.

Save countless hours searching for paper tickets on delivered loads. e-Ticketing eases the administrative burden for you and your customer.

Project Visibility on Desktop and Mobile





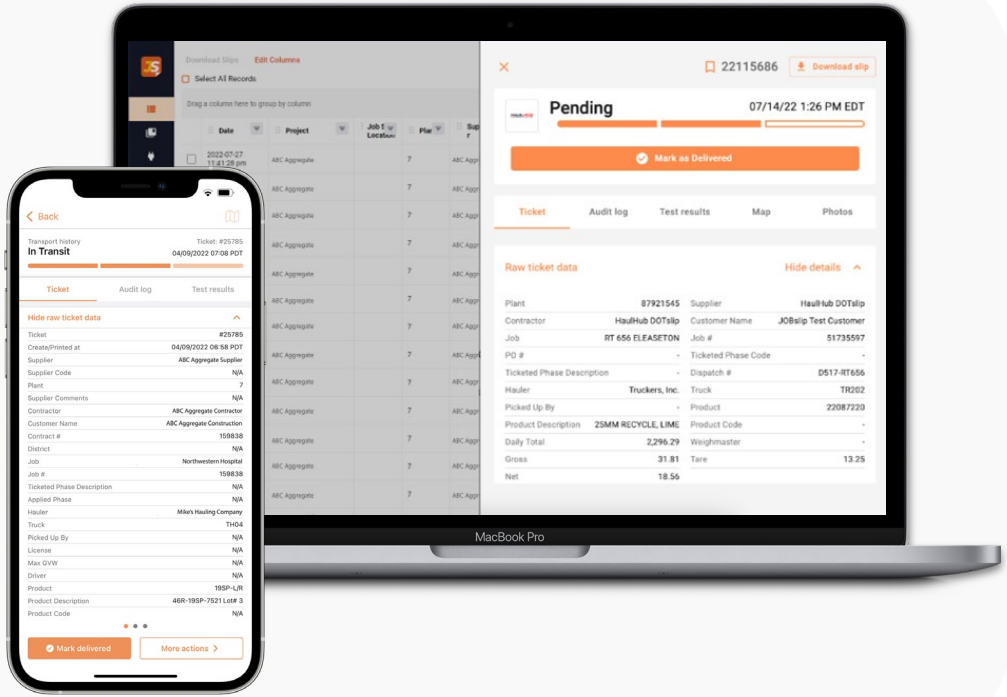
Ticket Level Data

Web:

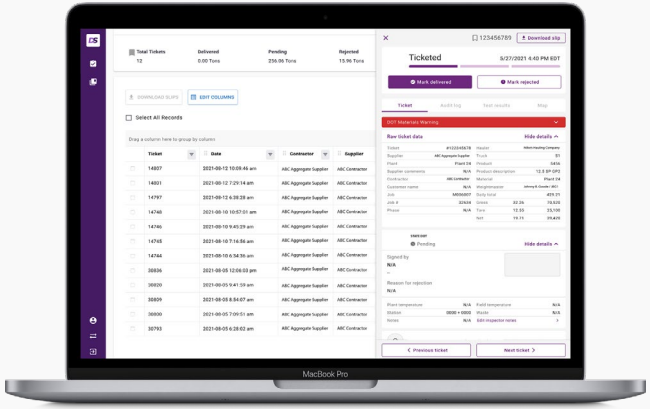
- Download
- PDF or Excel
- Auto Reporting

Mobile

- View DOT Acceptance
- See ticket details

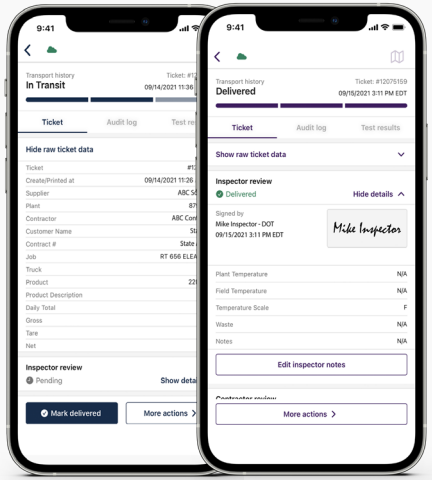


For the DOT: What Does e-Ticketing Look Like?

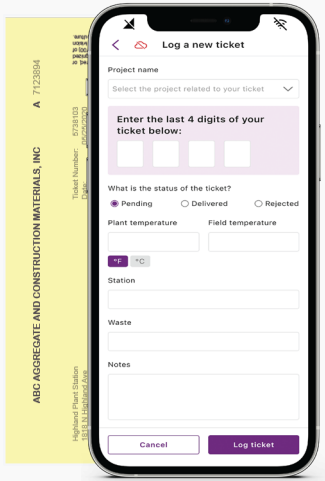


Web Based Agency Portal Access

The Agency Portal ™ comes with access to **DOTslip** for your field inspectors, and JOBslip for your vendors, two simple mobile apps connecting the same data to one point of truth. It's all included as part of The Agency Portal ™ experience at no additional cost.



Inspector View on Mobile App

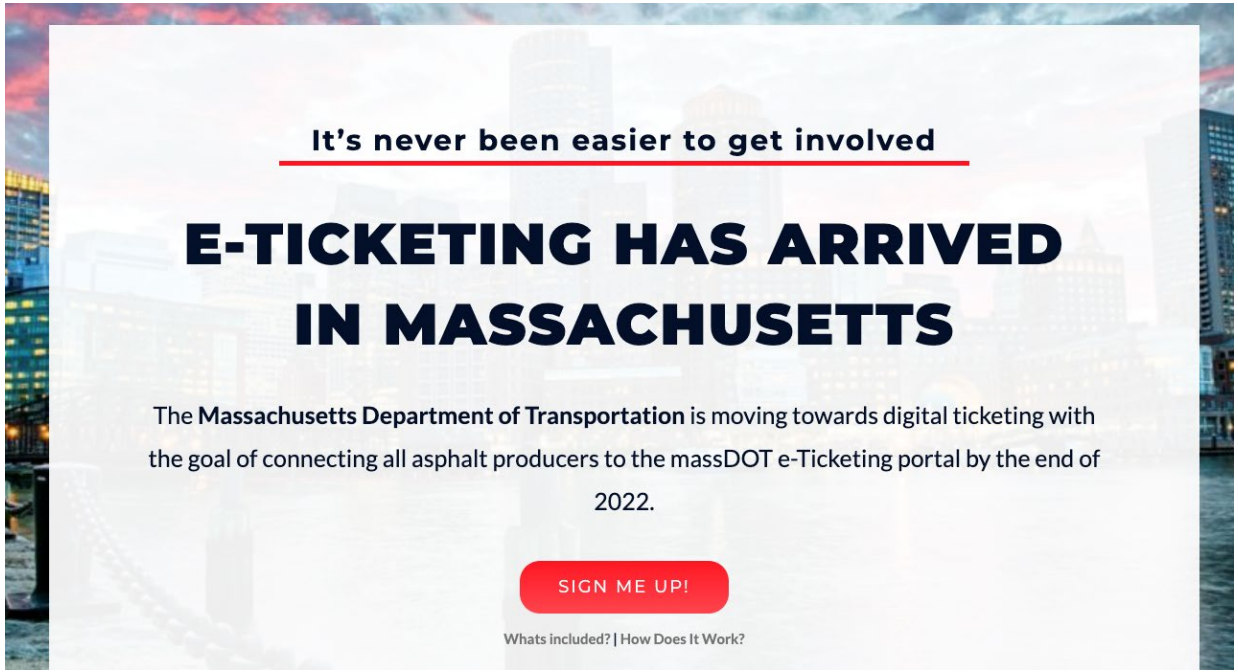


Patented Offline Mode

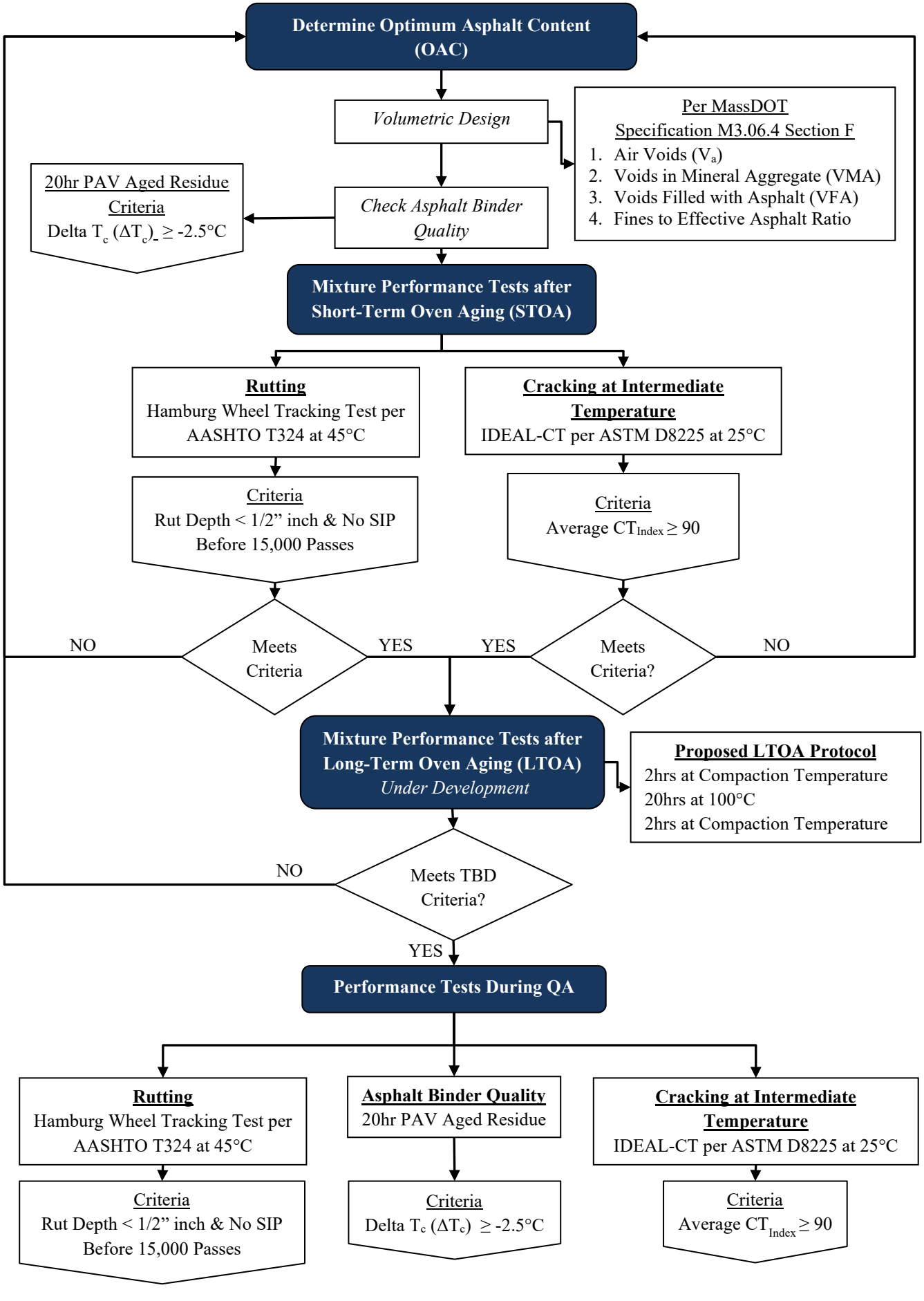
DOTslip

Get Connected!

Helpful training videos can be found at:
https://learn.haulhub.com/



https://www.haulhub.com/mass-dot-portal-22/


Determine Optimum Asphalt Content (OAC)
Volumetric Design
Per MassDOT Specification M3.06.4 Section F
1. Air Voids (V_a)
2. Voids in Mineral Aggregate (VMA)
3. Voids Filled with Asphalt (VFA)
4. Fines to Effective Asphalt Ratio
Check Asphalt Binder Quality
20hr PAV Aged Residue Criteria
Delta T_c (ΔT_c) ≥ -2.5°C
Mixture Performance Tests after Short-Term Oven Aging (STOA)
Rutting
Hamburg Wheel Tracking Test per AASHTO T324 at 45°C
Cracking at Intermediate Temperature
IDEAL-CT per ASTM D8225 at 25°C
Criteria
Rut Depth < 1/2" inch & No SIP Before 15,000 Passes
Criteria
Average CT_{Index} ≥ 90
NO
Meets Criteria
YES
YES
Meets Criteria?
NO
Mixture Performance Tests after Long-Term Oven Aging (LTOA)
Under Development
Proposed LTOA Protocol
2hrs at Compaction Temperature
20hrs at 100°C
2hrs at Compaction Temperature
NO
Meets TBD Criteria?
YES
Performance Tests During QA
Rutting
Hamburg Wheel Tracking Test per AASHTO T324 at 45°C
Asphalt Binder Quality
20hr PAV Aged Residue
Cracking at Intermediate Temperature
IDEAL-CT per ASTM D8225 at 25°C
Criteria
Rut Depth < 1/2" inch & No SIP Before 15,000 Passes
Criteria
Delta T_c (ΔT_c) ≥ -2.5°C
Criteria
Average CT_{Index} ≥ 90