DRAFT

Idaho Asphalt IC Demonstration Report

Contents

Project Site

US 95, Garwood to Sagle, ID

May 5-8, 2014

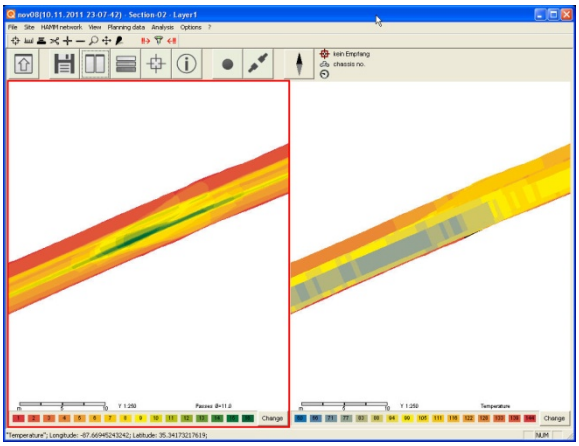
The Idaho site is located at the main lane of US-95, north of Coeur d'Alene, ID, in Direct 1 of ITD. The 2" base course was the focus of this study. The Test Bed 1 location is on the southbound Lane 1 and 2. The Test Bed 2 location is on the northbound Lane 3. The Test Bed 3 location is on the northbound Lane 2. The Hamm IC roller (HD+ 120) was used as the breakdown roller. The Sakai IC roller (SW 880) was .used as the intermediate roller. A conventional steel drum roller was used as the finishing roller.

Project Test Beds

TB	Description	Date	Machine
1	US-95 SB - LN 1 and LN2	5/5	Hamm Sakai
2	US-95 NB - LN 3	5/6	Hamm Sakai
3	US-95 NB - LN 2	5/7	Hamm Sakai

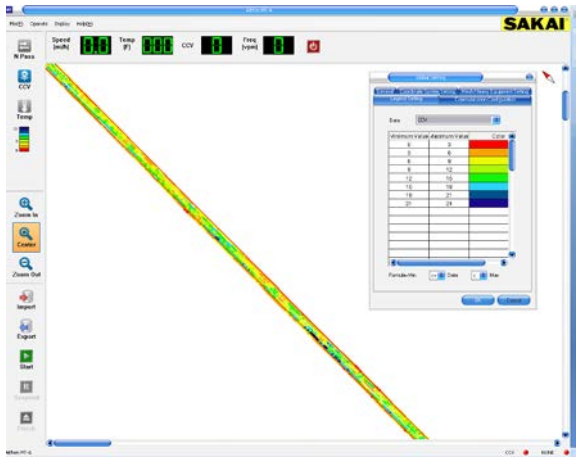
IC Rollers

HAMM Double-Drum IC Roller



Manufacturer/ Vendor	HAMM/Wirtgen
Model Name	HCQ (Hamm Compaction Quality)
Model Number	HD+ 90 / HD+ 110, HD+ 120 / HD+ 140
Drum Width	78" w/offset to 84.7"
Machine Weight	Operating wt. 27,569 lbs. w/max of 32,187 lbs.
Amplitude Settings	High/Low - .028/.011 in. (0.71/0.27 mm)
Frequency Settings	Variable from 2700 - 4020 vpm
Auto-Feedback	NA
Measurement System	HAMM Compaction Quality (HCQ)
Measurement Value	HMV, density estimator, temperature, passes
Measurement Unit	[unitless, % compaction, °C, color coded]
Documentation System	HCQ with ability to export to Veda
Contact	Tim Kowalski (615) 594-4604 tkowalski@Wirtgenamerica.com

Sakai Double Drum IC rollers

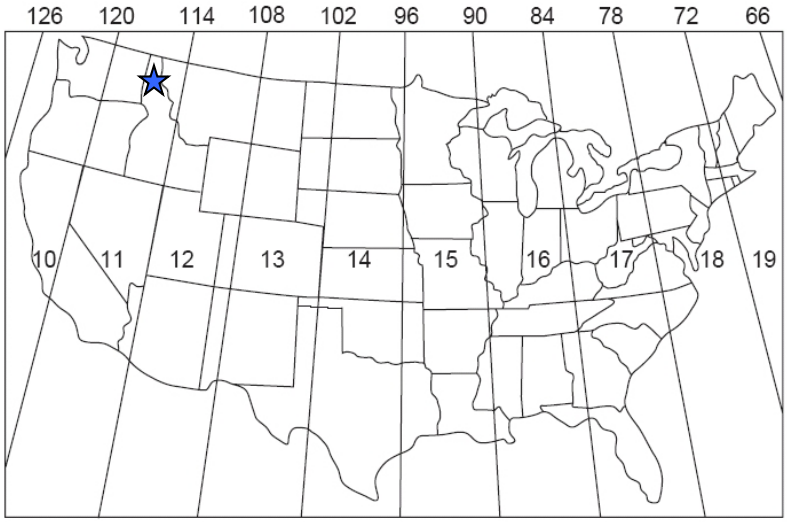


Manufacturer/ Vendor	Sakai America
Model Name	Compaction Information System (CIS)
Model Number	SW880
Drum Width	79”
Machine Weight	29,560 lbs (~ 14 tons)
Amplitude Settings	0.013” , 0.025” (0.33 to 0.64 mm)
Frequency Settings	2500, 3000, 4000 vpm
Auto-Feedback	No
Measurement System	CCV with temperature and passes mapping
Measurement Value	Compaction control value (CCV)
Measurement Unit	Unitless
GPS Capability	Yes
Documentation System	AithonMT and AithonPD with ability to export to Veda
Contact	Brandon Crockett (800) 3234-0535 ext. 205 b-crockett@sakaiamerica.com

Global Positioning System (GPS)

Grid Reference

UTM-11N is the preferred coordinate reference for all devices.



GPS Devices

- A TopCon GPS receiver and a radio will be mounted on the Sakai IC roller.
- A TopCon GPS base station will be setup to provide RTK correction signals.
- A hand-held TopCon GPS rover will be used for in-situ point measurements.
- A GPS receiver with OmniStar subscription will be mounted on the HAMM IC machine.
- A hand-held GPS receiver with OmniStar subscription will be used for in-situ point measurements..

Test Plans

On-site Activities

Schedule	Activities
Day 0 Sunday (May4)	• Conduct IC rollers/GPS setup and trial runs (equipment vendors and FHWA IC team only) at the staging area. (2PM-5PM)
Day 1 Monday (May 5)	• Set up the GPS base station and IC roller/GPS system (by 6AM). • Conduct project briefing at the staging area and IC training for roller operators (6AM-6:30AM). • Start paving with one IC roller at breakdown and another IC roller at intermediate position. • Select a 500-ft section as a test strip to establish the rolling pattern. Conduct NG/GPS/LWD-a testing immediately behind the paver and at selected locations after each breakdown and intermediate roller pass within the test strip. • Perform production compaction using the rolling pattern. • Conduct NG/GPS/LWD-a at selected locations after the finishing rolling
Day 2 Tuesday (May 6)	• Set up the GPS base station and IC roller/GPS system (by 6AM). • Start paving with one IC roller at breakdown and another IC roller at intermediate position. • Conduct NG/GPS/LWD-a testing immediately behind the paver and at selected locations after each breakdown roller pass within the 1500-ft section. • Conduct NG/GPS/LWD-a testing at selected locations after each intermediate roller pass within the 1500-ft section. • After the finishing rolling, mark 60 locations within the 1500-ft paved section. Conduct NG/GPS tests at marked locations. Conduct ~~FWD and~~ LWD-a tests at designated locations. Conduct coring at the marked locations.
Day 3 Wednesday (May 7)	• Set up the GPS base station and IC roller/GPS system (by 6AM). • Start paving with one IC roller at breakdown and another IC roller at intermediate position. • Select a 500-ft section. Conduct NG/GPS/LWD-a testing immediately behind the paver and at selected locations after each breakdown and intermediate roller pass within the test strip. • Perform production compaction using the rolling pattern. • Conduct NG/GPS/LWD-a at selected locations after the finishing rolling.
Days 4 Thursday (May 8)	• Conduct the Open House event including presentation and equipment demonstration.

- GPS: A base station and a rover will be provided by Sitech West.
- NG: Nuclear density gauge.
- LWD-a: Lightweight deflectometer for asphalt tests.
- ~~FWD: Falling weight deflectometer tests~~.

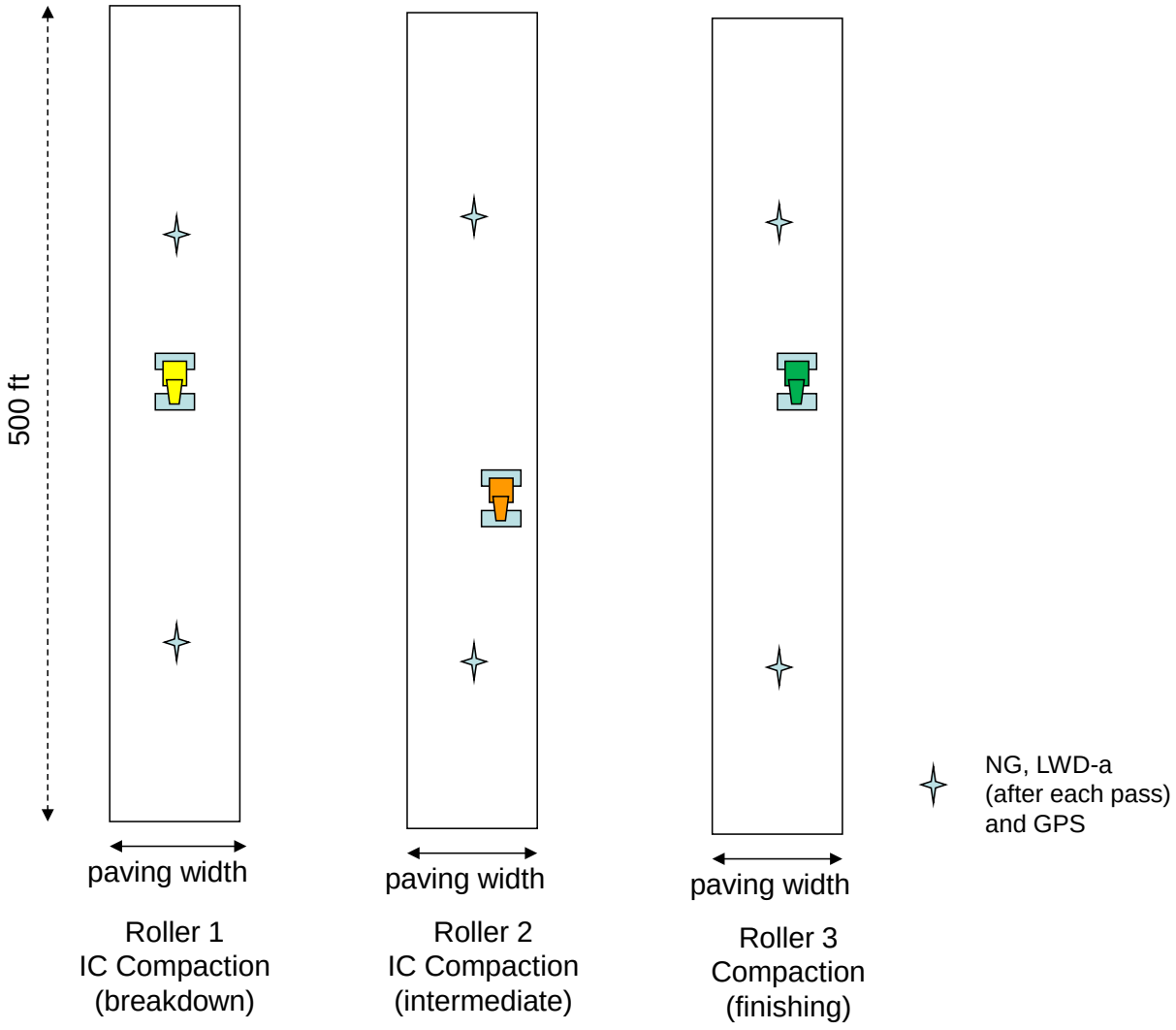
- Coring: 60 X 4” cores will be taken.
- Core tests: Bulk density testing of cores will be performed within 30 days after the demo.

Machine Settings

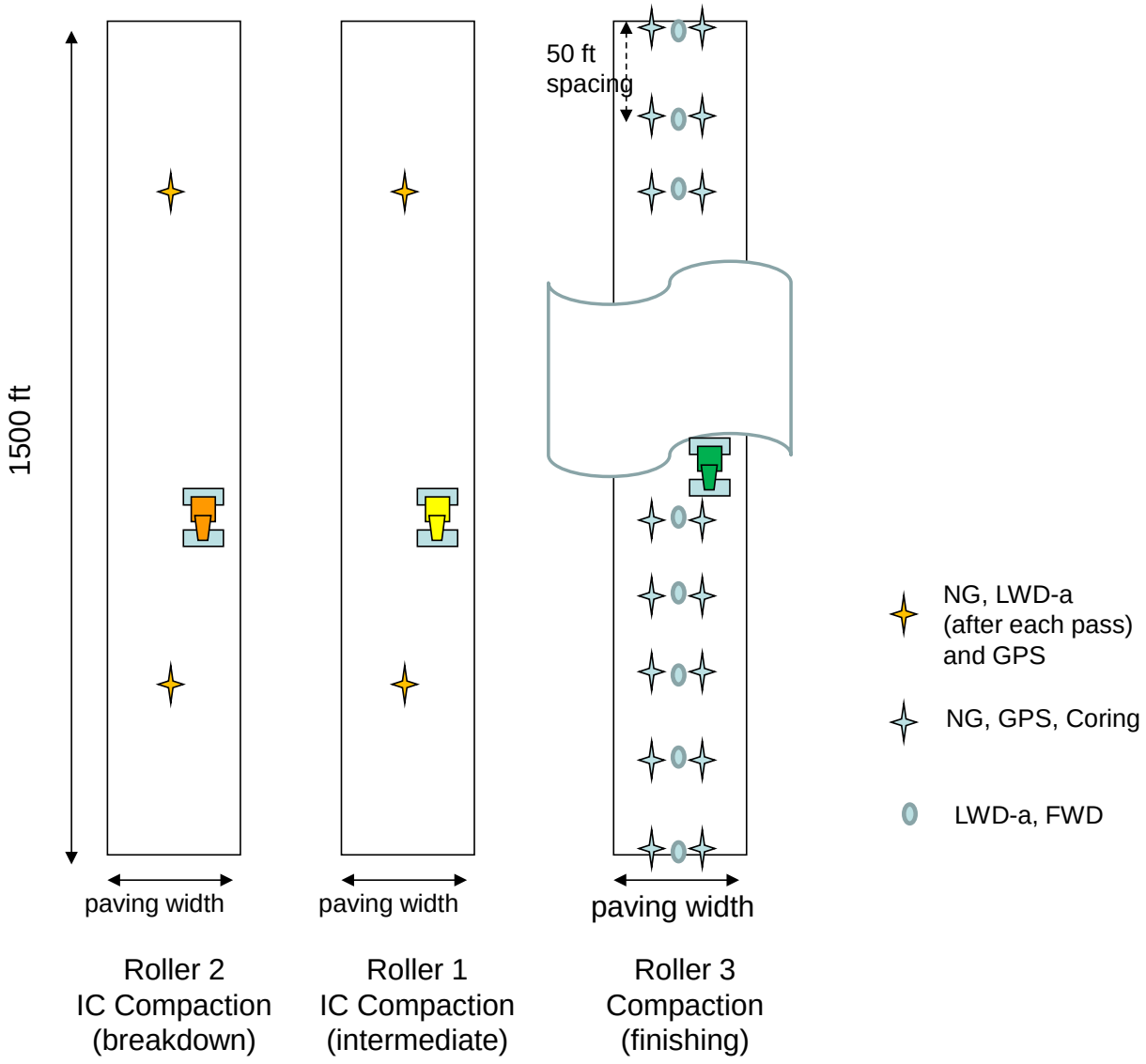
Date	TB	Machine	Setting	Spot Tests	Notes/Comments
Day 1	1A	IC 1	0.3mm at 4000 vpm	NG, GPS, LWD-a	Breakdown compaction for asphalt base course. 1. Compact with normal roller passes. 2. NG/GPS/LWD-a tests after each roller pass at selected locations within the test section.
	1B	IC 2	Low amp at 4000 vpm	NG, GPS, LWD-a	Intermediate compaction for asphalt base course. 1. Compact with normal roller passes. 2. NG/GPS/LWD-a tests after each roller pass at selected locations within the test section.
	1C	Roller3	Static	NA	Finishing rolling 1. Compact with normal roller passes.
Day 2	2A	IC 2	Low amp at 4000 vpm	NG, GPS, LWD-a	Breakdown compaction for asphalt base course. 1. Compact with normal roller passes. 2. NG/GPS LWD-a tests after each roller pass at selected locations within the test section.
	2B	IC 1	0.3mm at 4000 vpm	NG, GPS, LWD-a	Intermediate compaction for asphalt base course. 1. Compact with normal roller passes. 2. NG/GPS LWD-a tests after each roller pass at selected locations within the test section.
	2C	Roller3	Static	NG, GPS, LWD-a, FWD, GPR Coring	Finishing rolling 1. Compact with normal roller passes. 2. NG/GPS/LWD-a/FWD/GPR/Coring tests after the finishing rolling at marked locations within the test section.
Day 3	3A	IC 1	0.3mm at 4000 vpm	NG, GPS, LWD-a	Breakdown compaction for asphalt base course. 1. Compact with normal roller passes. 2. NG/GPS LWD-a tests after each roller pass at selected locations within the test section.
	3B	IC 2	Low amp at 4000 vpm	NG, GPS, LWD-a	Intermediate compaction for asphalt base course. 1. Compact with normal roller passes. 2. NG/GPS LWD-a tests after each roller pass at selected locations within the test section.
	3C	Roller3	Static	NA	Finishing rolling 1. Compact with normal roller passes.

*. The rolling pattern will be designated by the contractor.
*. Roller3: conventional finishing roller(s) (if applicable)

Day 1 & 3 – Test Plans



Day 2 – Test Plans



Data Analysis Results

The IC maps and statistics for the Hamm IC data (breakdown position) are presented in Figure 1 and Figure 2.

Comments on Hamm Data:

- ICMV: The mean HMV value is 36 with standard deviation of 7.9.
- Temperature: The mean surface temperature is 222°F with standard deviation of 35°F.
- Pass Counts: The recorded mean roller passes is 3.
- Frequency: The mean frequency is 3,016 vpm.
- Compaction curve: The ICMV curve grows parabolic with an asymptote at 38 of HMV and pass count of 4.

The IC maps and statistics for the Sakai IC data (intermediate position) are presented in Figure 3 and Figure 4.

Comments on Sakai Data:

- ICMV: The mean CCV value is 10.7 with standard deviation of 14.7. The high CCV values may be due to acceleration and de-acceleration at start and stop locations.
- Temperature: The mean surface temperature is 188°F with standard deviation of 29.6°F. Some lower temperatures values may be due to mobilization and sensor mal-functioning.
- Pass Counts: The recorded mean roller passes is 3.
- Frequency: The mean frequency is 3,880 vpm.
- Compaction curve: The curve grows monotonically without an apparent optimal value.

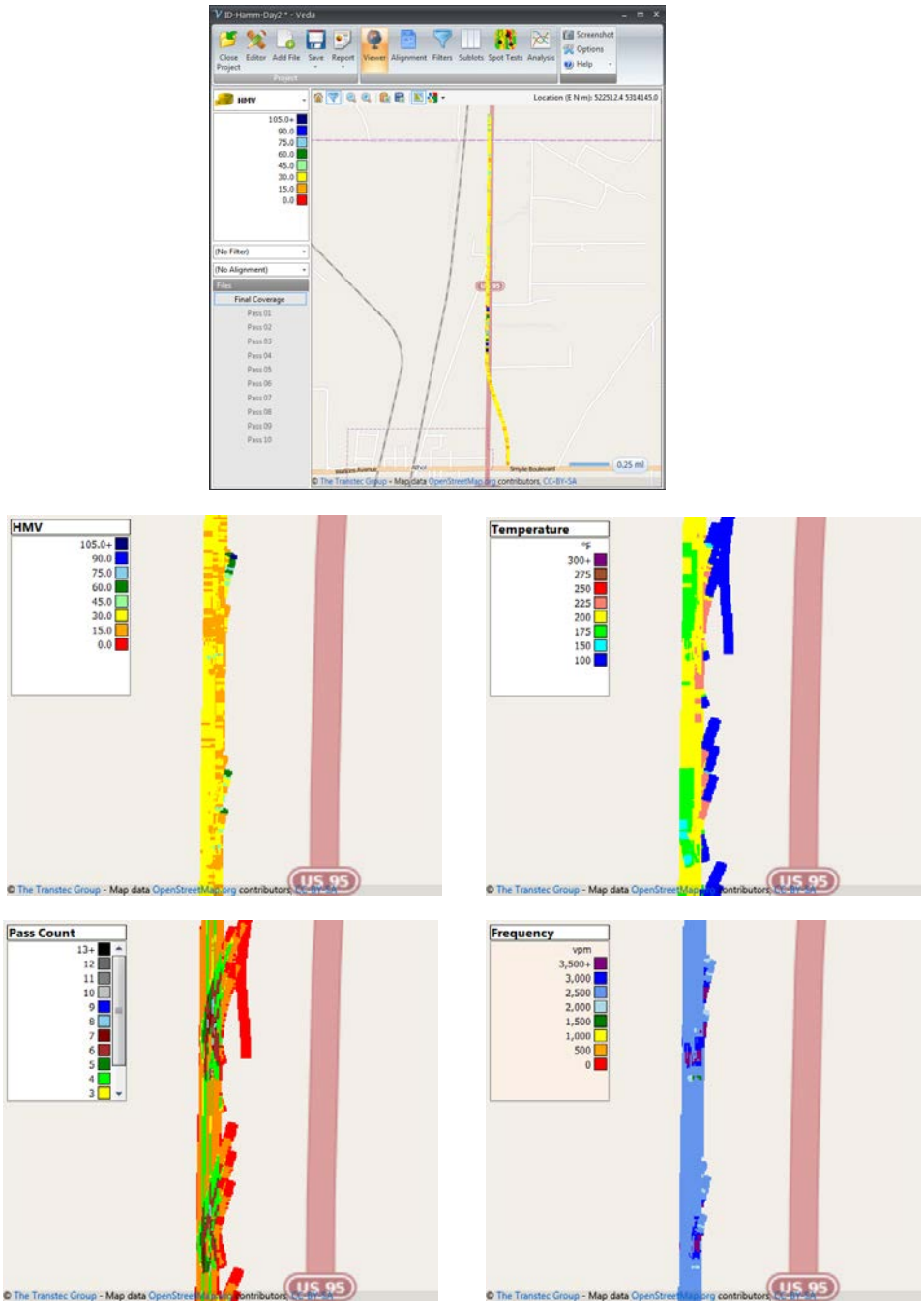


Figure 1. Hamm IC maps (breakdown), TB02, ID site.

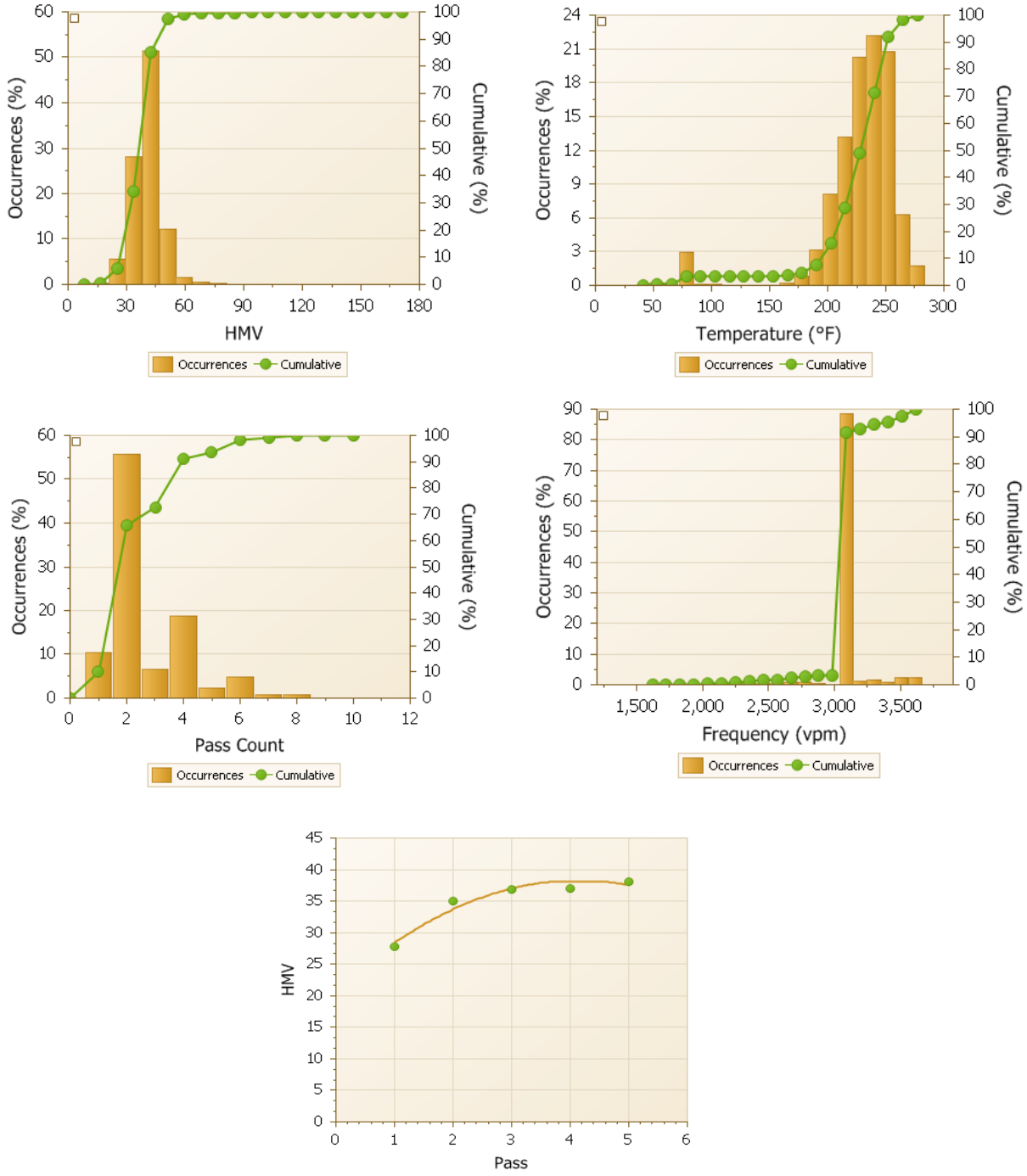


Figure 2. Hamm IC statistics (breakdown), TB02, ID site.

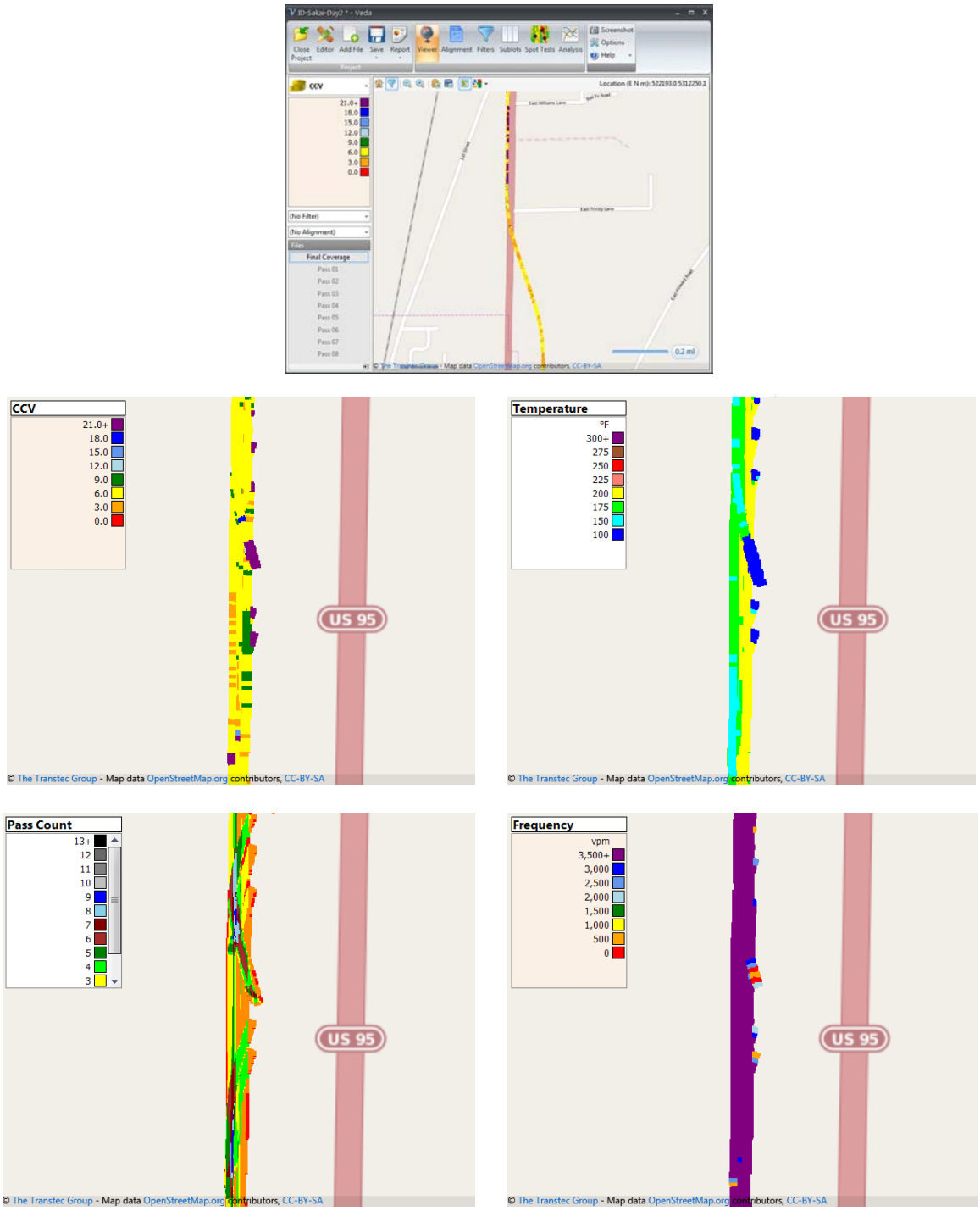


Figure 3. Sakai IC maps (intermediate), TB02, ID site.

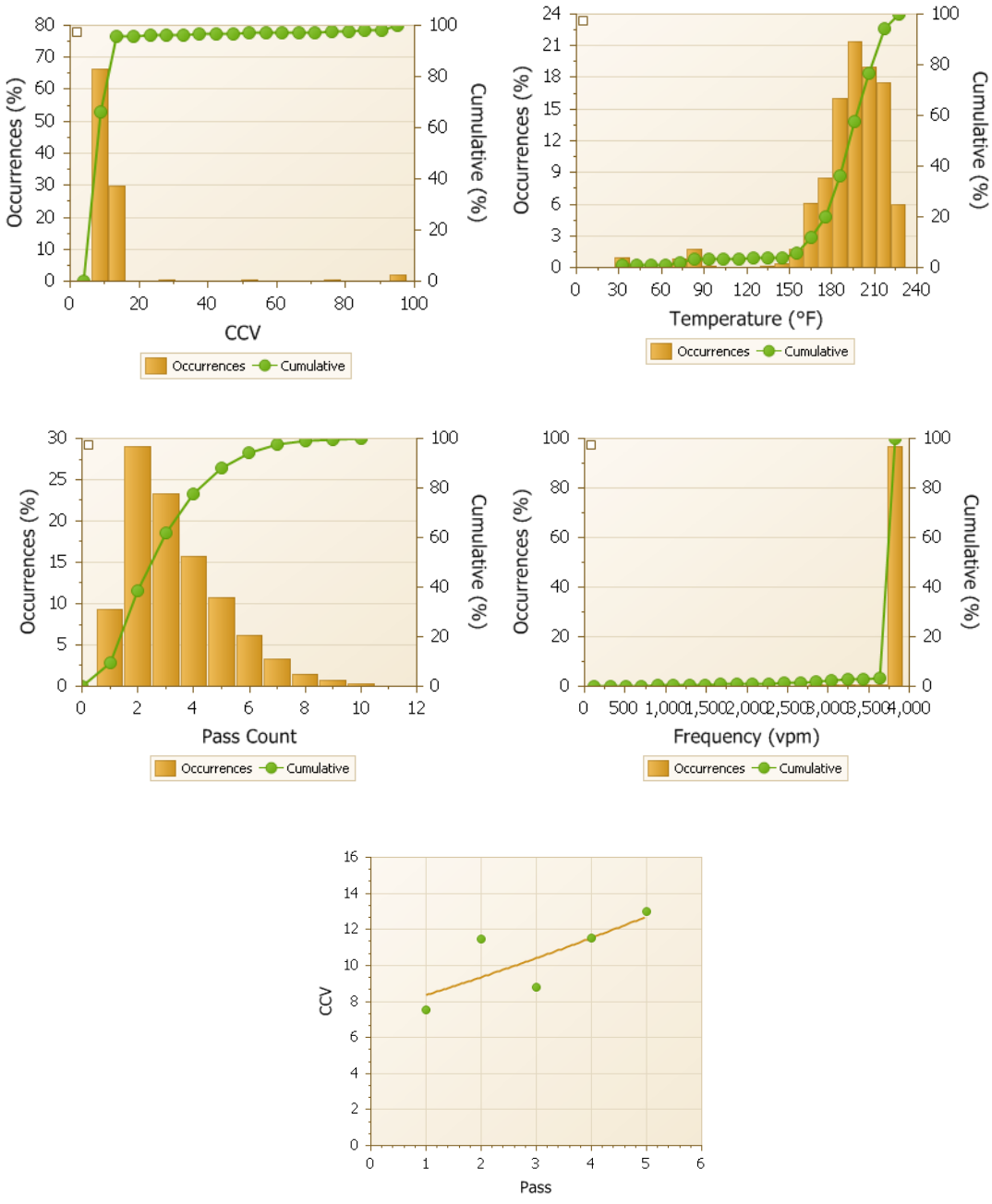


Figure 4. Sakai IC statistics (intermediate), TB02, ID site.

The correlation analysis is presented as follows:

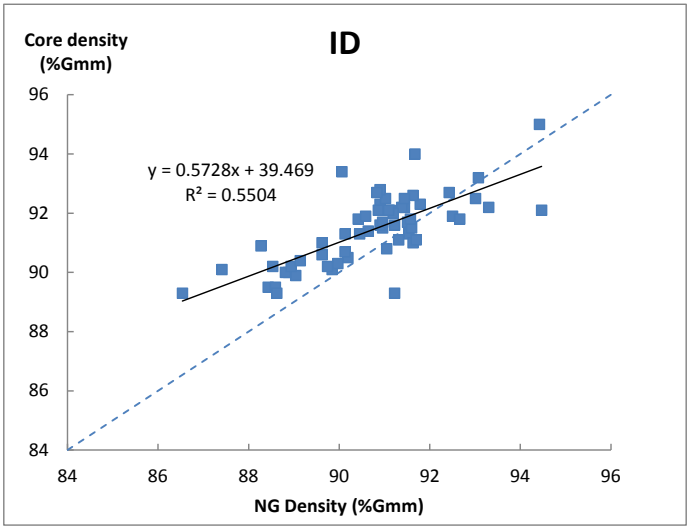


Figure 5. Correlation between core densities and NG measurements.

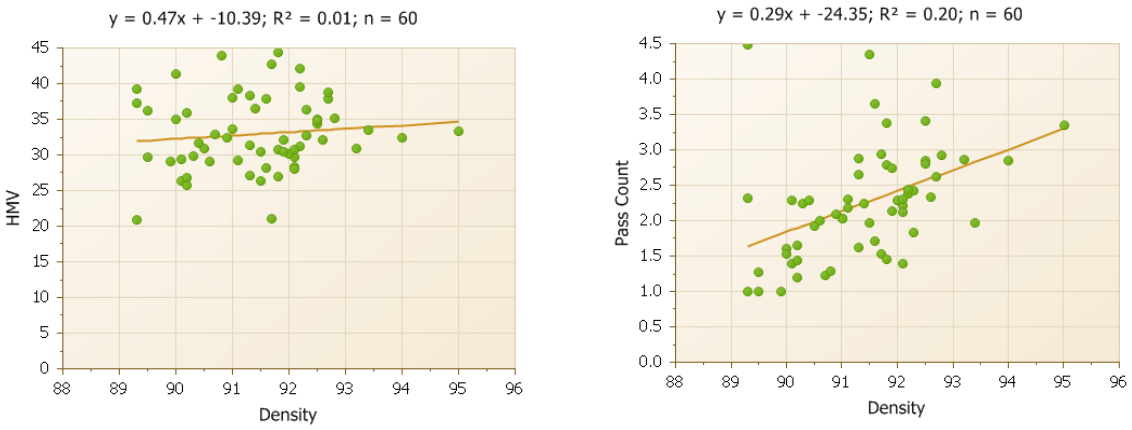


Figure 6. Correlation between core densities and Hamm IC data (breakdown roller).

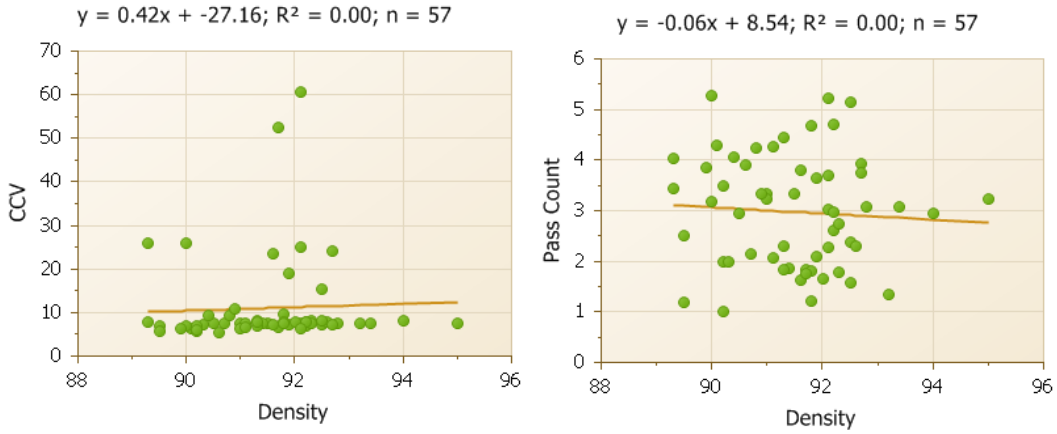


Figure 7. Correlation between core densities and Sakai IC data (intermediate roller).