



MnROAD Database Guide

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MnROAD Database Guide

Description of the MnROAD Database

MnROAD, located near Albertville, Minnesota (40 miles northwest of Minneapolis-St. Paul) is one of the most sophisticated, independently operated pavement test facilities of its type in the world. MnROAD's Phase-I was completed in 1991-1993, which consists of two unique road segments located parallel to Interstate 94:

- A 3.5-mile mainline interstate roadway carrying "live" traffic averaging 28,500 vehicles per day with 12.4 % trucks.
- A 2.5-mile closed-loop low-volume roadway carrying a controlled 5-axle tractor-semi-trailer to simulate conditions of rural roads.



MnROAD data is collected in a number of different methods and processes, which impacts the methods that are used to store the data (both calculated and raw). The purpose of this document is to describe what data has been collected and where it is stored for research use. MnROAD Database consists of the following data sources, which will be covered in this report.

MnROAD Database consists of:

- MnROAD Oracle Database
- MnROAD Offline Data
- MnROAD Project Reports
- MnROAD Web Site: <http://www.mrr.dot.state.mn.us/research/mnresearch.asp>
- MnROAD Individual Researcher Files
- Geographical Information System (GIS) Database

Access to the Data

MnROAD is a state run public funded facility, so all of its data and reports are available to anyone at no cost. Some data and information can be found from the web site, but access to the MnROAD database is limited to the key researchers at MnROAD. This allows the MnROAD research experts to work with each data requestor to match the data that has been collected with the data needed for their study. This also allows MnROAD researchers to explain both the methods and any quality issues that might impact the potential use of the data requested. We do request that researchers who use MnROAD data send us their research work plan and any resulting reports. See Appendix A for the research agreement required to receive data relating to the MnROAD test facility.

Requests for MnROAD data should be sent to:

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Types of Data

The types of data collected at MnROAD are summarized in the following table.

Table 1 – Types of data collected at MnROAD

Subject Area	Data Type	Examples of Data Collected at MnROAD
Cell Info	Cell Data	Design, Construction, Maintenance, Cell Layer/Lift Thickness, Cell Events, Elevations, GIS Data
Field Monitoring (Appendix B)	Rutting	Straight Edge, Automated Laser Profile System (ALPS), Paper Traces, Pathways, PaveTech, Dipstick
	Ride	Pathways, PaveTech, Frost Pins, Faulting, Forensics, Friction
	Cracking	Distress Surveys, Crack Mapping, Cupping
	Strength	Dynamic Cone Penetrometer (DCP), Falling Weight Deflectometer (FWD)
Sensor Data	Pavement	Biaxial Strain Gage (BS), Concrete Embedment Strain Gage (CD, CE), Linear Variable Differential Transducer (DT), Horizontal Clip Gage (HC), Longitudinal Embedment Strain Gage (LE), Transverse Embedment Strain Gage (TE), Piezo-Accelerometer (PA), Dynamic Soil Pressure Cell (PG, PK), Steel Strain Gage (SS), Tiltmeter (TM), Vibrating Wire Strain Gage (VW)
	Subsurface	Thermocouple (TC), Moisture Block (WM), Dynamic Pore Water Pressure Cell (DW), Thermistor (XD, XL, XT, XS), Open Stand Pipe (OS), Static Lateral Pressure Cell (PL), Static Soil Pressure Cell (PT), Resistivity Probe (RP), Static Pore Water Pressure Cell (SW), Tipping Bucket (TB), Time Domain Reflectometer (TD)
	Traffic	Mainline and LVR installations of Hydraulic Load cells, Kistler sensors
Lab Testing	Bituminous	Dynamic Shear Rheometer, Bending Beam Rheometer, Direct Tension, Repeated Creep, Zero Shear Viscosity, Dynamic Modulus, Indirect Tension Test, Fracture Toughness, Mix Designs, Gradations
	Concrete	Air Voids, Compression, Coefficient of Thermal Expansion, Poisson's Ratio, Mix Designs
	Unbound	Resilient Modulus, Proctor Curves, Field Density, Gradations, Unsaturated Material Properties

Data Collection Procedures

MnROAD collects and processes many types of data that may or may not have standardized methods for collection. Each type of data has its own method and frequency of collection. MnROAD researchers should be contacted for details on the methods used to collect each type of data. Most of the data collection methods have been documented in individual reports located on the MnROAD web page. Some good references include:

- 97-22 MnROAD Testing Protocols Volume I
- Many Forensic Reports
- 2002 MnROAD Hot Mix Asphalt Mainline Cell Condition Report
- 94-01 Minnesota Road Research Project: Load Response Instrumentation Installation and Testing Procedures
- Assistance in the Validation of the MnROAD Database, 2002

Data Quality

Each set of data is collected, reviewed, and entered into the MnROAD database system by designated research experts. Some data has automatic quality control checks before it gets placed into the MnROAD database. The sensor tables are examples of the quality control range checks that separate data into either the (sensor type)_VALUES or (sensor type)_ERRORS tables. Most of the data quality methods have been documented in individual reports located on the MnROAD web page. Some good references include:

- Database table SENSOR_MODEL_DESCRIPTIONS, which describes sensor models, measurement type, units, expected values, sensor ranges, and related database tables.
- Assistance in the Validation of the MnROAD Database, 2002

MnROAD ORACLE Database

The MnROAD ORACLE database is located at the Office of Materials in Maplewood, Minnesota. Currently this database stores much of the data being collected from MnROAD the early 1990s but does not contain everything. Much of the data is entered into the database tables using data loaders, but it also may be entered by individual researchers or database staff when the data is collected at varying frequencies.

The following tables are located in the database to help describe the database to users.

Description Tables	Description
DATABASE_TABLE_DESC <i>(See Appendix-C)</i>	Describes each of the tables and views that make up the MnROAD ORACLE database. This table also breaks the tables into subject areas, categories, and the number of rows of data available in each table.
<u>Subject Areas</u> Cell Information - Geometrics, construction/rehabilitation data, general information. Database – Tables used to describe the MnROAD database. Field Monitoring – Field performance monitoring data. Materials Testing – Laboratory testing of samples taken from MnROAD. Sensor Data – Location and data collected from sensors (both raw and processed data). Traffic Monitoring – Raw data from the field along with calculated parameters.	
SENSOR_MODEL_DESCRIPTIONS	Descriptions of all sensors at MnROAD including model #, measurement type, units, expected values, sensor ranges, and related database table.
CELLS	Description of all MnROAD cells including geometry, mix design, materials, ESALs.
CELL_EVENTS	Tracks activities that could impact pavement performance (construction, maintenance).

MnROAD Offline Data

MnROAD collects some information that is stored offline due to its file size or its complexity. Here are some examples of offline data.

Field Monitoring

- Pathways and PaveTech (ERD) longitudinal elevation data – It is stored offline due to its file size. These files/data are used to produce the summary information entered into the database (International Roughness Index, IRI).
- FWD History Files – Falling Weight Deflectometer produce a peak and history file for its load and deflection. The peak file is entered into the database while the individual history file time trace is stored offline due its file size.
- Dynamic Offline Strain Data – Individual traces of the dynamic strain data is stored offline due to its file size. Peak strains are picked from these files and stored in the MnROAD database.
- Mainline Traffic Raw Data – Single Hydraulic Load Cell (1990-2000) and Kistler Weigh in Motion (2000-on) collects raw data that is reviewed by Traffic Management who gives recommendations for edits in the database. The traffic data is then used to create #ESALS.
- Low Volume Road Traffic Raw Data – KWIM sensors in asphalt and concrete cells are collected and stored offline. Researchers filter the data manually and input a summary file into the database.
- Ground Penetrating Radar – Raw data files are stored offline. Researchers filter the data manually and input a summary file into the database.

MnROAD Project Reports

MnROAD reports may contain data that has not been entered into the MnROAD database. The MnROAD web site contains a listing of these reports. Examples include construction and forensic reports on MnROAD cells. Good MnROAD summary reports include:

- 90-03 Minnesota Road Research Project Work Plan for Research Objectives
- MnROAD Aggregate Base Profiles (aggregate base description)
- MnROAD Semi Tractor Trailer Description
- 94-19 Characterization of the subgrade soils at the Minnesota Road Research Project
- Four CRREL reports (base and subgrade characterization)
- 97-06 Investigation of Hot Mix Asphalt Mixtures at Mn/ROAD (Original HMA properties)

MnROAD Web Site

<http://www.mrr.dot.state.mn.us/research/mnresearch.asp>

The MnROAD web page contains a wealth of information about the MnROAD facility and the research conducted there, including:

- MnROAD Test Cells – includes pavement structures and materials, site layout, distress summaries, distress maps, pictures
- Reports, Articles, Newsletters, Papers – describing MnROAD research results
- Sensors – pavement and subsurface sensors including a description and locations
- Research Products – M-E resources, Test Section Tracking, unbound material properties
- Seasonal Load Limits – Spring Load Restrictions, Winter Load Increases, Permits
- Research Staff – includes biographies and contact information
- MnROAD Workshop/Conference Presentations
- Research Partners and Links
- Calendar – MnROAD Lane Closures, FWD test schedule
- Maps & Directions to MnROAD site and Maplewood Lab

MnROAD Individual Researcher Files

Individual researchers may also have data that has not been entered into the MnROAD database or placed into research reports. Non-Mn/DOT researchers are asked to share data and place it into the MnROAD database when they perform any work with MnROAD materials. This is an example of why it is important to work with the research staff at MnROAD.

Geographical Information System (GIS) Database

Extensive data collection at the Minnesota Road Research Facility over the past 10 years has resulted in a large volume of geospatially related data. Researchers are currently working to incorporate the use of a GIS database to summarize, analyze, and display MnROAD data. The goal of the project is to make the MnROAD data more accessible to Mn/DOT and other researchers via a web based GIS system. A GIS is capable of storing large volumes of geospatial data for the purpose of improved data analysis and decision-making. The development of a MnROAD GIS system will allow researchers to analyze data and present findings that may not otherwise be evident.

There are three phases to the MnROAD GIS project.

- Phase I is focused on creating a MnROAD GIS specifically for researchers in the Road Research Section for the purpose of summarizing, analyzing, and displaying MnROAD data. This primarily consists of building a geodatabase from the existing MnROAD Oracle database with the help of Mn/DOT's GIS Support Unit. To date a MnROAD basemap has been generated from CAD files, aerial photos, and GPS data, and methods for georeferencing scanned images of distress maps have been developed. Over the next six months data such as sensor location, distress maps, water table elevation, soil moisture, pavement strain measurements, and deflection data will be incorporated into the geodatabase.
- Phase II of the project involves building a web-based interface for the MnROAD GIS. This will provide access to other agencies and researchers around the country.
- Phase III is the implementation of broad access to MnROAD Research Partners for the purpose of creating a seamless connection between data collection on specific projects and Research Partners. Phase III is expected to be implemented during the 2006 and 2007 construction seasons at MnROAD.

A key component of the MnROAD GIS project has been the acquisition of a survey grade GPS system. The system uses correction data from GPS base stations at MnROAD and several other locations to achieve 1 centimeter horizontal accuracy and 1.5 centimeter vertical accuracy. The GPS unit is being used to collect distress data that was originally collected manually using hand drawn maps. The conversion to a more automated system will reduce errors, make data collection more efficient and allow researchers to readily access the data for timely and detailed analysis.

Appendix A – MnROAD Research Materials/Data Agreement

MnROAD is a state run public funded facility, so all of its data and reports are available to anyone at no cost. Some data and information can be found from the web site, but access to the MnROAD database is limited to the key researchers at MnROAD. This allows the MnROAD research experts to work with each data requestor to match the data that has been collected with the data needed for their study. This also allows MnROAD researchers to explain both the methods and any quality issues that might impact the potential use of the data requested.

MnROAD requests the following from each group or individual who uses MnROAD data/materials.

- Research Plan** (what will you do with the materials and/or data). Include a detailed list of materials and/or data that is required.
- MnROAD Acknowledgment** in your report/work.
- Copy of the Final Report** that will be posted on our web site.
- MnROAD Test Results** will be shared with MnROAD for the individual material raw test data. This data will be placed in the MnROAD database for future researcher.

I agree with the terms of the agreement (check the boxes above).

Signature	
Date	
Name	
Organization	
Address	
Phone	()
Fax	()
Email Address	

Appendix B – MnROAD Research Monitoring Guidelines

Mn/ROAD Monitoring Activity	Collection Frequency	Comment
HMA Manual Distress Survey	2 / year	Modified LTPP Survey (April, October). Are working GIS crack mapping and analysis into the process.
HMA 6' Straight Edge	N/A	Mn/DOT Research Manual Survey (100'). (April, August, October). ALPS system has replaced the measurements during the summer of 2003.
ALPS Measurements (Laser Profiles)	3 / year	Advanced Laser Profile System (50'). Collects transverse and longitudinal profiles using a 12.5' beam for measuring ruts, faults, cupping, lane/shoulder drop-off
HMA Transverse Dipstick	N/A	Data collected 1994-1997. ALPS system has replaced the measurements during the summer of 2003.
Longitudinal Profilograph	As needed	Data collected during construction and calibration certifications.
Roll-o-Matic (HMA rutting)	N/A	Paper copies stored. ALPS system has replaced the measurements during the summer of 2003.
PCC & UTW Manual Distress Survey	2 / year	Modified LTPP Survey (April, October). Are working GIS crack mapping and analysis into the process.
PCC Faulting	3 / year	Georgia Faultmeter per modified LTPP protocol (February, June, September)
Friction/Skid	2 / year	Summer runs only – Summary data entered manually into the database. Raw test files stored offline.
Pathways Testing - Research/Pavement Management	Varies	Research will collect its own data when the van is available on a monthly + basis. Summary files will be entered into the database. Videotapes will be given to Pavement Management once a year for a SR rating for each lane and test cell. The ERD files are stored offline.
Ground Penetrating Radar	As needed	Summary data entered manually into the database. Raw test files stored offline.
MnROAD Coring	As needed	Contact the MnROAD Forensic Engineer for any of your coring needs. Samples tracked in MAT_SAMPLES
MnROAD Maintenance	As needed	Maintenance and Rehabilitation activities are entered into the database
MnROAD FWD Testing	Varies per season	Each year a schedule is developed for the basic monitoring being done at MnROAD. Time histories are collected but the data is stored offline.
Laboratory Testing	As needed	HMA, PCC cores & beams, loose mix, binder, aggregates tested in laboratory as needed.
Traffic - LVR	Continuous	KWIM sensors in asphalt and concrete cells are collected and stored offline. Researchers filter the data manually and input a summary file into the database.
	Daily Count	MnROAD Driver collects # of laps and comments from the day's work. Laps entered into database, which are then converted to ESALS for each cell.
Traffic – Mainline	Continuous	MnROAD SLC (1990-2000) and KWIM (2000-on) collects data that is reviewed by Traffic Management who gives recommendations for edits in the database. The traffic data is then used to create #ESALS.

Appendix C – MnROAD Database Table Listing

TABLE_NAME	SUBJECT	CATEGORY1	TABLE_DESC	COUNT
ASBUILT_JOINTS	Cell Information	Geometrics	Asbuilt Joint locations in concrete test cells	3812
CELLS	Cell Information	Geometrics	"General Cell characteristics (Description-Stationing-Grades-Drainage)"	83
CELL_THICKNESS_HMA_LIFTS	Cell Information	Layers	Design thickness of each HMA lift (starting with 1 on the bottom working up)	76
CELL_THICKNESS_SUMMARY	Cell Information	Layers	Summary of all thickness information from test cells	360
CELL_AGGREGATE_GRADING_LOG	Cell Information	Maintenance/Rehab	Needs updating. Site documentation of the maintenance of the equipment in cabinets 1995-1996	55
CELL_MAINT_CRACKSEAL	Cell Information	Maintenance/Rehab	Crack Seal maintenance data collected	1
CELL_MAINT_PATCHING	Cell Information	Maintenance/Rehab	Patching maintenance data collected	2
CELL_MAINT_SHOULDERPAVEWEDGE	Cell Information	Maintenance/Rehab	Shoulder pavement wedge maintenance data collected	1
CELL_REHAB_MAINT_HISTORY	Cell Information	Maintenance/Rehab	Rehabilitation history data	28
CELL_REHAB_MILLING	Cell Information	Maintenance/Rehab	Milling rehabilitation data collected	1
CELL_CONSTRUCTION_DATES	Cell Information	Project	Date of each layers construction	198
CELL_DOWEL_BAR_LOCATIONS	Cell Information	Project	Locations of the dowel bars	2830
CELL_HISTORY	Cell Information	Project	History of construction and other events at each research cell	190
CELL_HORIZONTAL_CURVES	Cell Information	Project	Horizontal curve data for the layout of MnROAD	19
CELL_LAYERS_ORIGINAL_DESIGN	Cell Information	Project	Original layer designed used for MnROAD	468
CELL_VERTICAL_CURVES	Cell Information	Project	Vertical curve data for the layout of MnROAD	46
CELL_STATION_ELEVATIONS	Cell Information			29483
COLUMN_DESCRIPTIONS	Database	Documentation	Description of the table fields in the MnROAD Database	1191
DATABASE_TABLE_DESC	Database	Documentation	List of tables in the MnROAD Database	372
UNITS	Database	Documentation	Description of the table field units in the MnROAD Database	26
DIPSTICK_PIN_ELEV	Field Monitoring	Pavement Condition	Dipstick elevations	220
DISTRESS_AC	Field Monitoring	Pavement Condition	Asphalt manual distress survey	1252
DISTRESS_AGG_SURVEY_SEMI	Field Monitoring	Pavement Condition	Condition survey of Mn/ROAD gravel sections by truck driver	661
DISTRESS_ALPS_DATA	Field Monitoring	Pavement Condition	Automated Laser Profile Rutting data traces	910548
DISTRESS_ALPS_RESULTS_RUT	Field Monitoring	Pavement Condition	Automated Laser Profile Rutting results from traces	1872
DISTRESS_CUPPING	Field Monitoring	Pavement Condition	Manual paper trace transverse cupping measurements	3108
DISTRESS_FRICTION_DATA	Field Monitoring	Pavement Condition		1019
DISTRESS_JPCC	Field Monitoring	Pavement Condition	Concrete manual distress survey	624
DISTRESS_PATHWAYS_RUN_LOG	Field Monitoring	Pavement Condition		24
DISTRESS_PATHWAYS_VALUES	Field Monitoring	Pavement Condition		5085
DISTRESS_PAVETECH_VALUES	Field Monitoring	Pavement Condition		1265
DISTRESS_PCC_FAULTS	Field Monitoring	Pavement Condition		38309
DISTRESS_RIDE_SUMMARY	Field Monitoring	Pavement Condition		5771
DISTRESS_RUTTING_DIPSTICK	Field Monitoring	Pavement Condition	Dipstick data	626
DISTRESS_RUTTING_DIPSTICK_PINS	Field Monitoring	Pavement Condition	Dipstick pins	220

TABLE_NAME	SUBJECT	CATEGORY1	TABLE_DESC	COUNT
DISTRESS_RUTTING_DIPSTICK_RAW	Field Monitoring	Pavement Condition	Dipstick data	6916
DISTRESS_RUTTING_STRAIGHT_EDGE	Field Monitoring	Pavement Condition	Straight Edge data	8182
FORENSIC_DENSITY	Field Monitoring	Pavement Condition		281
FORENSIC_ROD_LEVEL	Field Monitoring	Pavement Condition		487
FORENSIC_RUTTING_SUMMARY	Field Monitoring	Pavement Condition		70
FP_VALUES	Field Monitoring	Pavement Condition	Elevations of the frostpins in the roadway.	31944
FROST_PINS	Field Monitoring	Pavement Condition	MnROAD frost pin elevation data	34314
GROUND_PENET_RADAR_1994	Field Monitoring	Pavement Condition	Ground Penetrating Data collected in 1994	3503
GROUND_PENET_RADAR_1999	Field Monitoring	Pavement Condition	Ground Penetrating Data collected in 1998	245715
GROUND_PENETRATING_RADAR	Field Monitoring	Pavement Condition	Data from ground penetrating radar runs done in 1996	250507
DCP_DROP_DATA	Field Monitoring	Strength	Data from DCP tests including blow counts and depths	1047
DCP_LOCATION	Field Monitoring	Strength	DCP tests locations	1047
DCP_TESTS	Field Monitoring	Strength		714
DCP_TESTS_OTHER	Field Monitoring	Strength	DCP tests locations not from MnROAD	194
DCP_VALUES	Field Monitoring	Strength	Data from Mn/ROAD DCP tests including blow counts and depths	26999
DCP_VALUES_OTHER	Field Monitoring	Strength	Data from non-Mn/ROAD DCP tests including blow counts and depths	6673
FWD_BACKCALC_RESULTS_V50	Field Monitoring	Strength	FWD back calculation results - Evercalc	1528263
FWD_IMAGES	Field Monitoring	Strength	FWD images	25180
FWD_LOAD_HISTORY	Field Monitoring	Strength	FWD Load Histories	3530
FWD_PEAK_CALCULATIONS	Field Monitoring	Strength	Calculated AASHTO subgrade modulus and effective structural number from FWD data	447410
FWD_PEAKS	Field Monitoring	Strength	Peak deflection and load information/data for each drop from the FWD	1222872
FWD_SETUP_CALCULATIONS	Field Monitoring	Strength	Mean air temperature for five days (used in BELLS computation) and the derived spring Benkelman beam values (Mn/DOT Inv. 183)	6677
FWD_SETUPS	Field Monitoring	Strength	FWD test setups and machine characteristics.	13349
FWD_STANDARDS	Field Monitoring	Strength	FWD test protocols used for Mn/ROAD project.	14
FWD_SURVEY	Field Monitoring	Strength	FWD test location information.	1335
FWD_TC_SENSORS	Field Monitoring	Strength	FWD TC sensors	66
FWD_TEST_CALCULATIONS	Field Monitoring	Strength	"Calculated AASHTO temperature corrections-BELLS temperature and thermocouple temperature nearest to the time of FWD test. In addition derived Benkelman beam deflections are also tabulated (based on Mn/DOT Inv. 183)."	49724
FWD_TESTS	Field Monitoring	Strength	FWD test locations and file information for the testing done.	128034
MAT_BINDER_BBR_TEST	Materials Testing	HMA	Material testing results - Binder BBR tests	1006
MAT_BINDER_CRITICAL_CRACK_TEMP	Materials Testing	HMA		6
MAT_BINDER_DSR_TESTS	Materials Testing	HMA	Material testing results - Binder DSR tests	2379
MAT_BINDER_DT_TEST	Materials Testing	HMA		19
MAT_BINDER_FATIGUE	Materials Testing	HMA		8256

TABLE_NAME	SUBJECT	CATEGORY1	TABLE_DESC	COUNT
MAT_BINDER_REPEATED_CREEP	Materials Testing	HMA		26700
MAT_BINDER_STRAIN_SWEEPS	Materials Testing	HMA		628
MAT_BINDER_TRADITIONAL_TEST	Materials Testing	HMA	Material testing results - Binder common tests	14
MAT_BINDER_ZERO_SHEAR_VIS	Materials Testing	HMA		18
MAT_BITUMINOUS_SAMPLES	Materials Testing	HMA		2524
MAT_HMA_AGING	Materials Testing	HMA		32
MAT_HMA_CORE_TESTS	Materials Testing	HMA	Material testing results - HMA Core testing results	900
MAT_HMA_DYNAMIC_MODULUS	Materials Testing	HMA	Material testing results - HMA testing results	603
MAT_HMA_FRACTURE_TOUGHNESS	Materials Testing	HMA		256
MAT_HMA_IDT_TEST	Materials Testing	HMA		148
MAT_HMA_MIX_TESTS	Materials Testing	HMA	Material testing results - HMA mix testing results	326
MAT_HMA_ORIGINAL_DENSITY_AIR	Materials Testing	HMA	Material testing results - Original testing results	65
MAT_HMA_SIEVE_DATA	Materials Testing	HMA		627
LIMS	Materials Testing	LIMS	Copy of selected data from Mn/DOT's Laboratory Information Management System	711840
MAT_CONC_AIR_VOID_RESULTS	Materials Testing	PCC	Results of concrete air void tests	40
MAT_CONC_FIELD_RESULTS	Materials Testing	PCC	Results of concrete testing	95
MAT_CONC_FREEZE_THAW_RESULTS	Materials Testing	PCC	Results of concrete sample freeze/thaw testing	206
MAT_CONC_MOD_POISSON_RESULTS	Materials Testing	PCC	Results of concrete poisson ratio tests	235
MAT_CONC_STRENGTH_RESULTS	Materials Testing	PCC	Results of concrete sample strength tests	1193
MAT_CONCRETE_MIX_GRAD_RESULTS	Materials Testing	PCC		13
MAT_PCC_COEF_THERM_EXP	Materials Testing	PCC		44
MATCONCMODPOISSONRESULTS030616	Materials Testing	PCC		133
MAT_SAMPLES	Materials Testing	Sampling	List of all the samples taken (MNROAD_ID) from the Mn/ROAD test facility	8440
MAT_MR_SOILS_LAB_DATA	Materials Testing	Soils	Material testing results - Soils testing data for MR	4440
MAT_MR_SOILS_LAB_DATA_A	Materials Testing	Soils		3540
MAT_MR_TESTING_LOG	Materials Testing	Soils		861
MAT_MR_TESTING_LOG_A	Materials Testing	Soils		508
MAT_MR_TESTING_LOG_B	Materials Testing	Soils		770
MAT_MR_TESTING_LOG_NOFIELDIDS	Materials Testing	Soils		48
MAT_PROCTOR_CURVES	Materials Testing	Soils	Material testing results - Proctor curve data	56
MAT_SOIL_GRAD_RESULTS	Materials Testing	Soils	Results of soil gradations tests	377
MAT_SOIL_MR_PEAKS	Materials Testing	Soils	Material testing results - Soils testing peak data for MR	28254
MAT_SOIL_MR_PEAKS_UMN	Materials Testing	Soils		2700
MAT_SOIL_MR_RAW	Materials Testing	Soils	Material testing results - Soils testing raw data for MR	3403625
MAT_SOIL_MR_RESULTS	Materials Testing	Soils	Results of the soil resilient modulus tests	4499
MAT_SOIL_SHEAR_INITSTROKE	Materials Testing	Soils		360
MAT_SOIL_SHEAR_STAGE	Materials Testing	Soils		238670
MAT_SOIL_SHEAR_TEST	Materials Testing	Soils	Material testing results - Soil shear testing data	1526100
MAT_SOIL_SHEAR_TEST_UMN	Materials Testing	Soils		266921
MAT_SOIL_TESTS	Materials Testing	Soils	Results of the soils tests	6537

TABLE_NAME	SUBJECT	CATEGORY1	TABLE_DESC	COUNT
MAT_CORE_LENGTHS	Materials Testing	Testing	Material sample core length information from the Laboratory	876
MAT_MATERIALS	Materials Testing	Testing	Material used for testing - codes	34
MAT_TEST_TYPES	Materials Testing	Testing	Material testing results - Binder BBR tests	23
MAT_UNBOUND_GRADATIONS	Materials Testing	Testing		399
CABINET_EVENT_ACTIONS	Sensor Data	Cabinets	MnROAD Cabinet documentation	1547
CABINET_EVENTS	Sensor Data	Cabinets	MnROAD Cabinet documentation	609
CABINET_TEMPS	Sensor Data	Cabinets	MnROAD Cabinet documentation	179992
CABINETS	Sensor Data	Cabinets	MnROAD Cabinet documentation	27
HC_ERRORS	Sensor Data	Deflection	Horizontal Clip Gauge sensor values that fail the data range checks	10957823
HC_VALUES	Sensor Data	Deflection	Horizontal Clip Gauge sensor values	10265946
TL_ERRORS	Sensor Data	Deflection	Tiltmeter Longitudinal sensor values that did not fall in the data range checks	869077
TL_VALUES	Sensor Data	Deflection	Tiltmeter Longitudinal sensor values	4399423
TT_ERRORS	Sensor Data	Deflection	Tiltmeter Transverse sensor values that fail the data range checks	190737
TT_VALUES	Sensor Data	Deflection	Tiltmeter Transverse sensor values	5107800
OFFLINE_BASELINE_SENSOR_VALUES	Sensor Data	Dynamic Data		321
OFFLINE_DATA_COLLECTION	Sensor Data	Dynamic Data		22
OFFLINE_DY_PK_B4_REPICK	Sensor Data	Dynamic Data		54430
OFFLINE_DYNAMIC_PEAK_VALUES	Sensor Data	Dynamic Data		69920
OFFLINE_DYNAMIC_TESTS	Sensor Data	Dynamic Data		4056
RH_ERRORS	Sensor Data	Equipment	Interior cabinet humidity data that did not fall in the data range checks	447496
RH_VALUES	Sensor Data	Equipment	Interior cabinet humidity data	221098
SITE_CABINET	Sensor Data	Equipment	Site data	26
CSL_INV	Sensor Data	Equipment	Campbell Scientific Inventory	91
CT_ERRORS	Sensor Data	Equipment	Thermocouple in cabinet to read interior temperatures not within a set data range.	1102713
CT_VALUES	Sensor Data	Equipment	Thermocouple in cabinet to read interior temperatures	8580145
MODELS	Sensor Data	Equipment	Description of the sensor models	97
RT_VALUES	Sensor Data	Equipment		3206951
SENSOR_AVG	Sensor Data	Equipment		17856
SENSOR_CALIBRATION_FACTORS	Sensor Data	Equipment		287
SENSOR_CHECKS	Sensor Data	Equipment		3581
SENSOR_COUNTS	Sensor Data	Equipment		5571347
SENSOR_EVENT_LOG	Sensor Data	Equipment		16593
SENSOR_LOCATIONS	Sensor Data	Equipment		6230
SENSOR_MODEL_DESCRIPTIONS	Sensor Data	Equipment		89
SENSORS	Sensor Data	Equipment	Description of the asbuilt data for each sensor	9454
FROST	Sensor Data	Frost	Calculated frost zones using MnROAD data	8273
FROZEN_SOIL	Sensor Data	Frost	Frost depth summary for MnROAD	4909
RP_VALUES	Sensor Data	Frost	Resistivity Probe values	437991
MC_VALUES	Sensor Data	Moisture	Moisture content values	6242033
OS_COAX_RAW_VALUES	Sensor Data	Moisture	Open sandpipe data	2453115
OS_MANUAL_VALUES	Sensor Data	Moisture	Open sandpipe data	4589
OS_REFERENCE_ELEVATIONS	Sensor Data	Moisture	Open sandpipe data	40
OS_TRANS_RAW_VALUES	Sensor Data	Moisture	Open sandpipe data	289579

TABLE_NAME	SUBJECT	CATEGORY1	TABLE_DESC	COUNT
TB_CALIBRATIONS	Sensor Data	Moisture	Tipping Bucket calibrations	14
TB_ERRORS	Sensor Data	Moisture	Tipping Bucket sensor values that did not fall in the data range checks	80367
TB_VALUES	Sensor Data	Moisture	Tipping Bucket sensor values	869960
TD_AUTOMATED	Sensor Data	Moisture	Time Domain Reflectometer values	170150
TD_ERRORS	Sensor Data	Moisture	Time Domain Reflectometer values not in the expected data range	6697
TD_VALUES	Sensor Data	Moisture	Time Domain Reflectometer values	2136760
TDR_LOG	Sensor Data	Moisture	Temporary table for loading TDR data.	210
TDR_RECALC	Sensor Data	Moisture	TDR recalculated values	10570
WM_ERRORS	Sensor Data	Moisture	Watermark Moisture Block sensor values that fail the data range checks	31624791
WM_ERRORS_DUPLICATES	Sensor Data	Moisture	Watermark Moisture Block sensor values that fail the data range checks	26920
WM_ERRORS_MAX_DUPES	Sensor Data	Moisture	Watermark Moisture Block sensor values that fail the data range checks	13460
WM_TEMP_2005	Sensor Data	Moisture	Watermark Moisture Block sensor values	6965732
WM_VALUES	Sensor Data	Moisture	Present year - Watermark Moisture Block sensor values	15405520
WM_VALUES_1993	Sensor Data	Moisture	Watermark Moisture Block sensor values for 1993	169700
WM_VALUES_1994	Sensor Data	Moisture	Watermark Moisture Block sensor values for 1994	3132348
WM_VALUES_1995	Sensor Data	Moisture	Watermark Moisture Block sensor values for 1995	5345313
WM_VALUES_1996	Sensor Data	Moisture	Watermark Moisture Block sensor values for 1996	12213540
WM_VALUES_1997	Sensor Data	Moisture	Watermark Moisture Block sensor values for 1997	22982212
WM_VALUES_1998	Sensor Data	Moisture	Watermark Moisture Block sensor values for 1998	23098402
WM_VALUES_1999	Sensor Data	Moisture	Watermark Moisture Block sensor values for 1999	18050460
WM_VALUES_2000	Sensor Data	Moisture	Watermark Moisture Block sensor values for 2000	16994635
WM_VALUES_2001	Sensor Data	Moisture	Watermark Moisture Block sensor values for 2001	16104344
WM_VALUES_2002	Sensor Data	Moisture	Watermark Moisture Block sensor values for 2002	17148652
WM_VALUES_2003	Sensor Data	Moisture	Watermark Moisture Block sensor values for 2003	15798869
WM_VALUES_2004	Sensor Data	Moisture	Watermark Moisture Block sensor values for 2004	16469386
WM27	Sensor Data	Moisture	Watermark Moisture Block sensor values	94
WM28	Sensor Data	Moisture	Watermark Moisture Block sensor values	94
WM34	Sensor Data	Moisture	Watermark Moisture Block sensor values	91
PG_ERRORS	Sensor Data	Pressure	Dynamic Soil Pressure sensor values that did not fall in the data range checks	1238177
PG_VALUES	Sensor Data	Pressure	Dynamic Soil Pressure sensor values	3007980
PK_ERRORS	Sensor Data	Pressure	Dynamic Soil Pressure sensor values that did not fall in the data range checks	393187
PK_VALUES	Sensor Data	Pressure	Dynamic Soil Pressure sensor values	28
PL_ERRORS	Sensor Data	Pressure	Static Lateral Pressure sensor values that did not fall in the data range checks	1725966

TABLE_NAME	SUBJECT	CATEGORY1	TABLE_DESC	COUNT
PL_VALUES	Sensor Data	Pressure	Static Lateral Pressure sensor values	1513264
PT_ERRORS	Sensor Data	Pressure	Static Soil Pressure sensor values that did not fall in the data range checks	4668723
PT_VALUES	Sensor Data	Pressure	Static Soil Pressure sensor values	6513550
SW_ERRORS	Sensor Data	Pressure	Static Pore Water pressure sensor values that did not fall in the data range checks	7763112
SW_VALUES	Sensor Data	Pressure	Static Pore Water pressure sensor values	5180026
CD_ERRORS	Sensor Data	Strain	Merge into CD_VALUES table with flags on the data as possible source of error.	13
CD_VALUES	Sensor Data	Strain	Dynatest Concrete Embedment Strain Gauge sensor values	244206
CE_ERRORS	Sensor Data	Strain	Tokyo Sokki Concrete Embedment Strain Gauge sensor values that did not pass the data range checks	121
CE_VALUES	Sensor Data	Strain	Tokyo Sokki Concrete Embedment Strain Gauge sensor values	822592
LE_ERRORS	Sensor Data	Strain	Longitudinal Embedment Strain Gauge sensor values that fail the data range checks	68437
LE_VALUES	Sensor Data	Strain	Longitudinal Embedment Strain Gauge sensor values	631951
TE_ERRORS	Sensor Data	Strain	Transverse Embedment Strain Gauge sensor values not in the expected data range	67
TE_VALUES	Sensor Data	Strain	Transverse Embedment Strain Gauge sensor values	339084
VW_ADJ	Sensor Data	Strain	Vibrating Wire Strain Gauge sensor values - adjusted	6950423
VW_ERRORS	Sensor Data	Strain	Vibrating Wire Strain Gauge sensor values not in expected data range checks	19005250
VW_ERRORS_NEW	Sensor Data	Strain	Vibrating Wire Strain Gauge sensor values	2626116
VW_INITIAL_VALUES	Sensor Data	Strain	Vibrating Wire Strain Gauge sensor values	264
VW_VALUES	Sensor Data	Strain	Vibrating Wire Strain Gauge sensor values	56612179
TCS_DATA_CHANNELS	Sensor Data	TCS Information	Test Control Software channels	89286
TCS_DATA_PEAKS	Sensor Data	TCS Information	Test Control Software peaks	333680
TCS_DATA_SETUP	Sensor Data	TCS Information	Test Control Software setup	17001
TCS_TEST_RECORDING_PARAMS	Sensor Data	TCS Information	Test Control Software parameters	616
TCS_TEST_SENS_ENGR_UNITS	Sensor Data	TCS Information	Test Control Software units	6637
TCS_TEST_SENSORS	Sensor Data	TCS Information	Test Control Software sensors	7373
TCS_TEST_TAG_ENGR_UNITS	Sensor Data	TCS Information	Test Control Software engineering units	7101
TCS_TEST_TAGS	Sensor Data	TCS Information	Test Control Software tags	6821
TCS_TEST_TRANSFORMS	Sensor Data	TCS Information	Test Control Software	4130
TC_ERRORS	Sensor Data	Temperature	that did not fall in the data range checks	6406341
TC_PVMT_1993	Sensor Data	Temperature	Quarter hour thermocouple values for bound surface layers for 1993	263333
TC_PVMT_1994	Sensor Data	Temperature	Quarter hour thermocouple values for bound surface layers for 1994	4814964
TC_PVMT_1995	Sensor Data	Temperature	Quarter hour thermocouple values for bound surface layers for 1995	9086570

TABLE_NAME	SUBJECT	CATEGORY1	TABLE_DESC	COUNT
TC_PVMT_1996	Sensor Data	Temperature	Quarter hour thermocouple values for bound surface layers for 1996	10314316
TC_PVMT_1997	Sensor Data	Temperature	Quarter hour thermocouple values for bound surface layers for 1997	10445204
TC_PVMT_LIST	Sensor Data	Temperature	Pavement sensors for the TC_PVMT tables	315
TC_SENSORS_1993	Sensor Data	Temperature	Pavement sensors for the TC_PVMT tables for 1993	288
TC_SENSORS_1994	Sensor Data	Temperature	Pavement sensors for the TC_PVMT tables for 1994	1050
TC_SENSORS_1995	Sensor Data	Temperature	Pavement sensors for the TC_PVMT tables for 1995	782
TC_SENSORS_1996	Sensor Data	Temperature	Pavement sensors for the TC_PVMT tables for 1996	1047
TC_SENSORS_1997	Sensor Data	Temperature	Pavement sensors for the TC_PVMT tables for 1997	1030
TC_SUMMARY	Sensor Data	Temperature	Thermocouple sensor values	1001
TC_TEMP_2005	Sensor Data	Temperature	Thermocouple sensor values	15361393
TC_TEST	Sensor Data	Temperature	Thermocouple sensor values	30036
TC_VALIDATION_PROTO	Sensor Data	Temperature	Thermocouple sensor values	5166304
TC_VALUES	Sensor Data	Temperature	Thermocouple sensor values	34325277
TC_VALUES_1993	Sensor Data	Temperature	Quarter hour thermocouple values for 1993	219082
TC_VALUES_1994	Sensor Data	Temperature	Quarter hour thermocouple values for 1994	4303957
TC_VALUES_1995	Sensor Data	Temperature	Quarter hour thermocouple values for 1995	7687273
TC_VALUES_1996	Sensor Data	Temperature	Quarter hour thermocouple values for 1996	8642946
TC_VALUES_1997	Sensor Data	Temperature	Quarter hour thermocouple values for 1997	8772617
TC_VALUES_1998	Sensor Data	Temperature	Quarter hour thermocouple values for 1998	36381937
TC_VALUES_1999	Sensor Data	Temperature	Quarter hour thermocouple values for 1999	31616277
TC_VALUES_2000	Sensor Data	Temperature	Quarter hour thermocouple values for 2000	34936806
TC_VALUES_2001	Sensor Data	Temperature	Quarter hour thermocouple values for 2001	35115242
TC_VALUES_2002	Sensor Data	Temperature	Quarter hour thermocouple values for 2002	35601486
TC_VALUES_2003	Sensor Data	Temperature	Quarter hour thermocouple values for 2003	34827002
TC_VALUES_2004	Sensor Data	Temperature	Quarter hour thermocouple values for 2004	34544120
TC_VALUES_NEW_COUNT	Sensor Data	Temperature	Quarter hour thermocouple values for new	1131
TC27	Sensor Data	Temperature	Thermocouple sensor values	94
TC34	Sensor Data	Temperature	Thermocouple sensor values	91
TC35	Sensor Data	Temperature	Thermocouple sensor values	91
TM_ERRORS	Sensor Data	Temperature	Cabinet temperature that did not fall in the data range checks	605781
TM_VALUES	Sensor Data	Temperature	Cabinet temperature	5772965
XD_ERRORS	Sensor Data	Temperature	Dynamic Water Pore Temperature sensor values that fail the data range checks	0
XD_VALUES	Sensor Data	Temperature	Dynamic Water Pore Temperature sensor values	0
XL_ERRORS	Sensor Data	Temperature	Lateral Pressure Temperature sensor values that fail the data range checks	207944

TABLE_NAME	SUBJECT	CATEGORY1	TABLE_DESC	COUNT
XL_VALUES	Sensor Data	Temperature	Lateral Pressure Temperature sensor values	3003204
XS_ERRORS	Sensor Data	Temperature	Static Water Pressure temperature values that fail the data range checks	264713
XS_VALUES	Sensor Data	Temperature	Static Water Pressure temperature values	12588774
XT_ERRORS	Sensor Data	Temperature	Soil Pressure temperature values that fail the data range checks	233388
XT_VALUES	Sensor Data	Temperature	Soil Pressure temperature values	12650400
XV_ERRORS	Sensor Data	Temperature	Vibrating Wire Strain Gage Temperature sensor values that fail the data range checks	1125000
XV_VALUES	Sensor Data	Temperature	Vibrating Wire Strain Gage Temperature sensor values	75577145
NW_WEATHER	Sensor Data	Weather	Northwest site weather station (MAR-97 to Present)	282629
RG_CALIBRATIONS	Sensor Data	Weather	Rain gauge calibrations	1
RG_VALUES	Sensor Data	Weather	Rain gauge data	31621
WEATHER_AWS	Sensor Data	Weather	Weather station data	101397
WEATHER_BECKER	Sensor Data	Weather	Weather station data - Becker	15970
WEATHER_BUFFALO_AIR_TEMPS	Sensor Data	Weather	Weather station data - Buffalo air temps	1248
WEATHER_COMPOSITE	Sensor Data	Weather	Weather station data	428640
WEATHER_CRREL	Sensor Data	Weather	Weather station data - MnROAD CRREL data	84194
WEATHER_ENGLISH	Sensor Data	Weather	Weather station data summary for MnROAD (english data)	0
WEATHER_METRIC	Sensor Data	Weather	Weather station data summary for MnROAD (metric data)	0
WEATHER_SE	Sensor Data	Weather	Needed?	261343
WEATHER_STATES	Sensor Data	Weather	Weather station data	8
CR_VALUES	Sensor Data			4572423
LVR_CONSTRUCTION_ESALS	Traffic Monitoring	Low Volume Road		182
LVR_DAILY_LOG	Traffic Monitoring	Low Volume Road	A daily log of loadings on the low volume road	1981
LVR_ESAL_FACTORS	Traffic Monitoring	Low Volume Road	Factors used to determine ESALS for the low volume road cells	117
LVR_KWIM	Traffic Monitoring	Low Volume Road	Kistler HMA and PCC data collected on the low volume road	6776
LVR_TRUCK_WEIGHTS	Traffic Monitoring	Low Volume Road		6
LANES	Traffic Monitoring	Mainline	Roadway lane codes	21
LAT_VEHICLES	Traffic Monitoring	Mainline	IRD vehicle data collected for each vehicle that crosses the WIM - Location Information	3043942
ORG_AXLE_W9	Traffic Monitoring	Mainline	WIM traffic data work area	282
ORG_W9	Traffic Monitoring	Mainline	WIM traffic data work area	5640
TRAFFIC_SWITCHES	Traffic Monitoring	Mainline	Log of dates and times traffic was not on the mainline	167
TRAFFIC_SWITCHES_HOUR	Traffic Monitoring	Mainline	Date and hour of traffic switches for documentation	2236