

Quality Assurance Manual



**Roy D. McQueen & Associates, Ltd
22863 Bryant Court
Suite 101
Dulles, VA 20166**

(703) 709-2540 • (703) 709-2535

www.rdmqueen.com

TABLE OF CONTENTS

Section	Page
1.0 Management Approach	1 - 1
1.1 Background	1 - 1
1.2 Overview Approach to Quality Assurance	1 - 1
2.0 Management Structure	2 - 1
3.0 Quality Control Procedures	3 - 1
3.1 Project Start-up	3 - 1
3.2 Periodic Team Reviews	3 - 2
3.3 Computations Checks	3 - 3
3.4 Peer Review	3 - 4
3.5 NDT Equipment Calibration	3 - 4
4.0 Planning and Scheduling	4 - 1
Appendix Project Start-up Forms	



1.0 MANAGEMENT APPROACH

1.1 Background

ROY D. McQUEEN & ASSOCIATES, LTD. (RDM) is a small business specializing exclusively in pavement evaluation, design, and management studies. Since our practice is limited to these services, we are able to maintain the specialized skill levels, equipment, and analytical tools necessary for project accomplishment. Very simply, the firm tries “not to be all things to all people”, but concentrates on what it does best.

Since its inception, RDM has completed over 700 pavement engineering projects in 45 states and 17 foreign countries for a wide variety of clients, including the United States (US) military (US Army, Navy, Marine Corps, Air Force), other US federal agencies (Federal Aviation Administration (FAA), Department of Transportation (DOT), Federal Highway Administration (FHWA), foreign governments, state and local governments, and commercial clients. This diversity has enabled RDM, not only to refine and optimize analytical skills, but also to learn from and share the experiences of our clients. Principals and key staff are members of the Transportation Research Board, American Society of Civil Engineers, Strategic Highway Research Program Expert Task Group, American Society for Testing and Materials, and the FAA’s Industry Working Group for Pavement Research.

1.2 Overview Approach to Quality Assurance

RDM's commitment to quality control is quite direct. Since we are a small business with a well managed project load, our clients can be assured of the personal attention of principals and key staff during all phases of any project undertaken by the firm. A highly trained staff with extensive experience in pavement engineering assures unique expertise and the confidence to tackle the most difficult engineering problems.

To support the pavement engineering needs of our clients, RDM maintains personnel skills in the following specialized areas:

Nondestructive Testing (NDT) –Two nondestructive testing devices:

- Heavy Mass Dynamic Loading System; and
- High Force Falling Weight Deflectometer (HWD)

are owned and operated by RDM and are used to measure the in-situ strength of pavement and subgrade layers rapidly with minimal or no interference with vehicular traffic or airport operations.

Condition Surveys - Our staff is certified to conduct condition surveys and implement MicroPAVER pavement management programs for airports, highways, municipal roads/streets, and seaports. Key personnel receive recurrent training at the University of Illinois every two to three years. RDM is also a beta test site for the MicroPAVER program.

Pavement Management Systems – RDM has implemented over 100 pavement management systems for airports, military installations, municipal roads, and seaports since 1987.

Pavement Evaluation/Design - Combining NDT, conventional testing, and condition survey results with layered elastic and finite element design output, detailed designs are performed for new pavements and for pavement rehabilitation including specifications and special construction requirements. Key staff have worked with the FAA on development of design procedures (LEDFAA) and construction specifications (P-401 and P-501), so clients are assured that the latest design and construction standards are properly applied.

Software Development - Our Engineers develop customized software for pavement management, design, and construction quality control to meet specific client requirements. Examples include customized layered elastic methods for general aviation and highway pavements.

Research - Our vast experience and "hands-on" approach has enabled us to focus our pavement research efforts on practical application and implementable results. To date, we have conducted pavement-related research for government and commercial clients on materials, layered elastic design methods, statistical quality assurance procedures, nondestructive testing, roughness, and new and recycled materials.

Contract Documents – Due to experience with development of design and construction standards for the FAA, RDM routinely assists design professionals and owners with development of pavement details and specifications for inclusion in construction contract bid documents.



Construction Consultation - Typical services include value engineering, tender review, mix design review, trouble-shooting, and dispute resolution.

Geographic Information Systems (GIS) - Since most of the information needed to manage a pavement network is related to geographic location, a well planned GIS can integrate all information in a spatial database. We are currently linking MicroPAVER data with new or existing GIS applications for pavement management and evaluation, as well as other applications.

We are also aware of Department of Defense (DOD)'s commitment to Total Quality Management (TQM) principles. RDM is firmly committed to the application and integration of innovative engineering, advanced technology, and economics. We pride ourselves on applying new technologies for the solution of engineering and construction problems and have invested heavily in equipment, software, and trained personnel to provide our clients with the highest level of professional service. Our clients are always assured that their project will always receive the personal attention of principals and key staff from initiation through completion.



2.0 MANAGEMENT STRUCTURE

For all major projects undertaken by RDM, our management structure consists of:

Project Manager - The Project Manager (PM) is a registered professional engineer with overall responsibility for successful project accomplishment. The PM is responsible, not only for schedule and cost control, but also for reviewing all engineering computations, providing technical guidance to staff, and for preparation of final reports.

Principal in Charge – The Principal in Charge is a registered engineer who assists the PM, provides overall guidance and has ultimate responsibility for quality assurance.

Project Engineer - Project Engineers have ten or more years of experience and are either licensed engineers or Engineers in Training (EIT). They organize and/or direct field data acquisition and CAD work, perform design computations, review field data, and organize and review processing and reduction of field data.

Pavement Engineer - Pavement Engineers have five or more years of experience and are licensed engineers. They perform field investigations to support analysis and design, which consists of condition survey, operation of nondestructive testing (NDT) equipment, acquisition of traffic, as-built and cost data, and direct field geotechnical investigations (e.g. cores and borings). The Pavement Engineers are also responsible for processing and reduction of condition survey and NDT data. Pavement Engineers have successfully completed University of Illinois MicroPAVER training courses.

Administrative/Quality Control Specialist - RDM's administrative personnel are responsible, not only for report preparation, but also for quality control and error checking of all prepared documents. Key staff members have successfully completed the University of Illinois MicroPAVER training course.

Tech/CAD Specialist - RDM utilizes computer-aided-drafting (CAD) for preparation of drawings in either the AutoCAD or INTERGRAPH environment. CAD specialists have a minimum of five years of experience in CAD operation. The CAD specialist also assists the engineering staff with GIS integration.



Quality Assurance Specialist - the Quality Assurance (QA) specialist is someone who was not involved in the technical analysis for a particular project. As such, he/she is able to review computations and reports from the clients viewpoint for accuracy, responsiveness, and completeness. This individual also performs the very necessary "peer review" function for the firm.

Since RDM emphasizes upward mobility for technical staff and is a small business, key personnel, including the Project Manager, have performed all technical functions and services. This includes field investigations, data processing, analytical computations, and report preparation. The ability to "wear different hats" results in complete understanding of project technical requirements, as well as a thorough check and verification process.

3.0 QUALITY CONTROL PROCEDURES

Specific quality control procedures for pavement evaluation and design projects include:

- Project Start-up
- Periodic Team Reviews
- Computations Check
- Peer Review
- NDT Equipment Calibration

3.1 Project Start-up

Quality control begins with a start-up meeting. The meeting is chaired by the Project Manager, with free exchange of ideas and information encouraged by all team members.

The group addresses project objectives and the means by which they will be carried out. This includes:

1. Overview of Project
 - a. Scope of services to be performed
 - b. Client requirements
 - c. Project schedule
 - d. Budget constraints

2. Details of Project Execution
 - a. Installation contact
 - b. Field data acquisition requirements
 - c. Network size and definition requirements
 - d. Computations/analytical software requirements
 - e. Equipment requirements
 - f. Milestone dates
 - g. Logistical requirements
 - h. CAD requirements

3. Identification of Deliverables

- a. Data requirements
- b. CAD format and requirements
- c. MicroPAVER version
- d. Report requirements

4. Quality Assurance Requirements

- a. Designation of QA Specialist
- b. Procedures for reviews and error checking
- c. Peer review requirements

The basic purpose of the project start-up meeting is to create a reliable framework from which to begin work. Schedule dates, personnel assignments, fiscal controls, and technical, equipment, and software requirements are discussed and recorded on the project start-up form. The Project Manager follows up on these items as work progresses. By the close of the meeting, all those involved with the project have a clear understanding of the project objectives and their role in carrying them out.

3.2 Periodic Team Reviews

Periodic reviews of work are conducted at key intervals during project implementation. During these reviews, personnel in charge of a particular task describe work accomplished to date, problems encountered, adherence to schedule, and results. These reviews are normally accomplished at the following times:

- In-progress Field Investigation
- Completion of Field Investigation
- Completion of Field Data Processing (NDT/MicroPAVER)
- Start of Pavement Analysis
- Completion of Pavement Analysis Computations
- Completion of CAD Drawings
- Draft Report
- Final Report

3.3 Computations Checks

At the completion of the periodic review meetings, independent checks of work and computations are performed by higher level staff, as follows:

- The Project Engineer will check the progress of the field investigation being performed by the Pavement Engineers and Technicians during a site visit. Data acquired to date will be reviewed by the Project Engineer for completeness and responsiveness to project objectives. Any deficiencies are noted, and procedures for completing the field investigations are reviewed.
- Before data processing, the Project Engineer will review all field data with the Pavement Engineer. Data processing requirements will be reviewed.
- Since condition survey data is normally entered into MicroPAVER by the Pavement Engineer, the Project Engineer will review all preliminary reports (e.g. List, Inventory, Inspection, PCI) for completeness and perform error checking. Error checking is performed by comparing Inspection Reports against PCI reports, and by performing Family Curve Analysis to identify outliers.
- Since NDT data processing is normally performed by the Project or Pavement Engineer, the layered elastic reduction computations are checked by the Project Manager. This includes deflection basin checking and ensuring the resultant elastic moduli that are checked for consistency and reasonableness.
- Analytical results are normally checked by the Project Manager for accuracy and adherence to client construction budget constraints. The Project Manager will ensure that the proper inputs were used, alternative design sections were computed, and sensitivity analysis (for structural computations) performed. M&R policies and costs for MicroPAVER implementation are also checked, both for technical soundness and responsiveness to installation practice.
- CAD drawings for network and section identification records (SIR) are checked for accuracy

by the lead Pavement Engineer, and for format, by the Project Engineer.

3.4 Peer Review

A detailed peer review is performed by the Quality Assurance (QA) Specialist upon completion of the draft report. Since the QA Specialist was not involved in the detail design, he/she is in a position to review the project as a whole, both for technical content and responsiveness to client requirements. This usually involves:

- verification that correct standards were used;
- review of design criteria and inputs;
- review of field data (e.g., NDT, condition survey, geotechnical, traffic, construction history);
- review of design concepts and design assumptions to determine if they conform with the design criteria, are technically correct, and encompass all major aspects of the project;
- verification that life cycle cost techniques were used for selection of an economical design scheme; and
- where applicable, perform constructability review; and examine deliverables for consistency and reasonableness, and for their responsiveness to client requirements.

A similar, albeit less detailed, peer review is also conducted before submittal of final reports to determine the disposition of draft report comments. Any draft report review comments not incorporated in the final report must be satisfactorily explained by the Project Manager.

3.5 NDT Equipment Calibration

Before the start of each project involving nondestructive testing (NDT), the following calibration tests are performed on the NDT equipment:

- perform test on garage test pad and compare results to prior data;
- perform dead load test to check load cell calibration and adjust, if required; and
- perform field tests on response sensors by recording displacement recorded by each sensor on calibration tower and, replace individual sensor(s) as required.



Quality Assurance Manual

In addition, all displacement sensors are factory calibrated on a shaker table at least once per year.

4.0 PLANNING AND SCHEDULING

For each project, planning and scheduling begins at the project start-up meeting. Key dates are recorded on the start-up form for tracking by the Project Manager.

In addition, when required, a detailed bar or CPM chart is developed for each contract. Major activities include:

- Notice to proceed
- Preparation of Network ID drawings (when required)
- Nondestructive testing and field condition survey
- Geotechnical/Materials investigation
- Acquisition of construction history, pavement composition, and M&R costs data
- Field data processing
- Pavement analysis computations (structural & functional)
- Preliminary output
- Review meeting and finalization of recommendations
- Draft report
- Client review
- Final report
- Contract completion

RDM Job No. _____

Meeting Date: _____

Client Contract No. _____

Project Description: _____

1

) **Client Contacts:**

Name:

Phone:

2

) **Staff Assignments:**

Project Manager

QA Specialist

Project Engineer

Pavement Engineers

3

) **Functional Responsibility:**

Function

Lead Person

Nondestructive Testing

Condition Survey

Data Processing

Geotechnical

Traffic, History, Composition

MicroPAVER Implementation

Structural Analysis

Rehabilitation Analysis

Cost/Budget Estimates

Report Preparation

4
) **Project Schedule**

	<u>Due Date:</u>	<u>Completion Date:</u>
Contract Start Date	_____	_____
Contract Completion Date	_____	_____
Network ID	_____	_____
Begin Field Work	_____	_____
	<u>Due Date:</u>	<u>Completion Date:</u>
Complete Field Work	_____	_____
Begin Data Processing	_____	_____
Complete Data Processing	_____	_____
Data Review/Error Checking	_____	_____
Begin Computer Aided Drafting	_____	_____
Complete Computer Aided Drafting	_____	_____
Begin Pavement/Structural Analysis	_____	_____
Complete Pavement/Structural Analysis	_____	_____
Analysis Review/Computations Checking	_____	_____
Draft Report	_____	_____
Client Review	_____	_____
Final Report	_____	_____
Exit Briefing/ Training	_____	_____
Other Milestones (List):	_____	_____
	_____	_____

5
) **Fiscal Control:**

Client Construction Budget	\$	_____
Manhour Allocation:	\$	_____
Program Manager		_____
Project Engineer		_____
Pavement Engineer		_____
Computer Aided Drafter		_____
Admin/Quality Control		_____

6
) **NDT Requirements:**

Heavy Weight Deflectometer	_____
Falling Weight Deflectometer	_____
Load Cell Calibration Date	_____
Displacement Sensor Calibration Date	_____

