AIR 2003 Airport Runway Pavement Evaluation Proposals — EVAL. -3

[redacted]

Airport Pavement Management Services

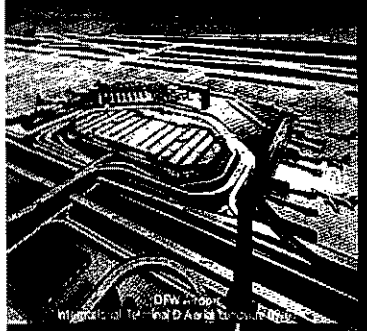
Prepared for:

Addison Airport

Prepared by:

MACTEC

Our Team



- ✓ **Ron Brasel, P.E.**
  Principal Pavement Engineer
- ✓ **Patrick Bolton, P.E.**
  Office Manager; Addison
- ✓ **Greg Williams**
  Program Manager ; Pavement Services Consultancy

Town Of Addison!

MACTEC

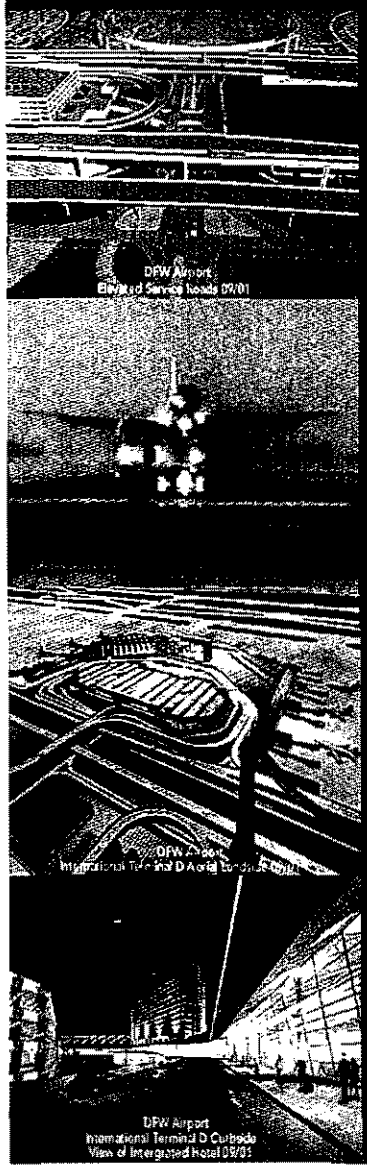
Presentation Outline

- Company Overview (8)
- Airport Pavement Management Services(13)
- Keys to Success for Airport PMS (7)
- Example Projects (5)

Town Of Addison

MACTEC

Evolution of an Industry Leader



MAC =
Management Analysis Company
(founded 1975)

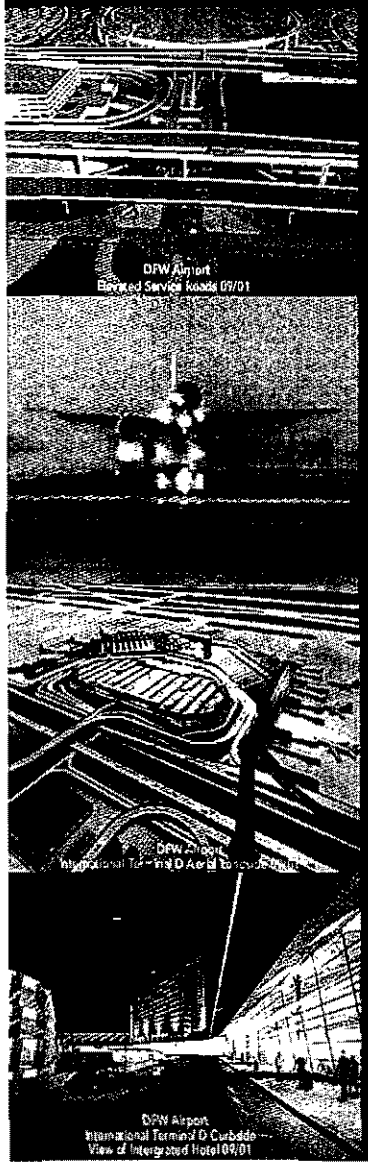
MAC TEC =
MAC Technical Evaluation Company

MACTEC
merged with
Law Engineering and Environmental Services
(2002)

Town Of Addison

MACTEC

MACTEC's Powerful Resources

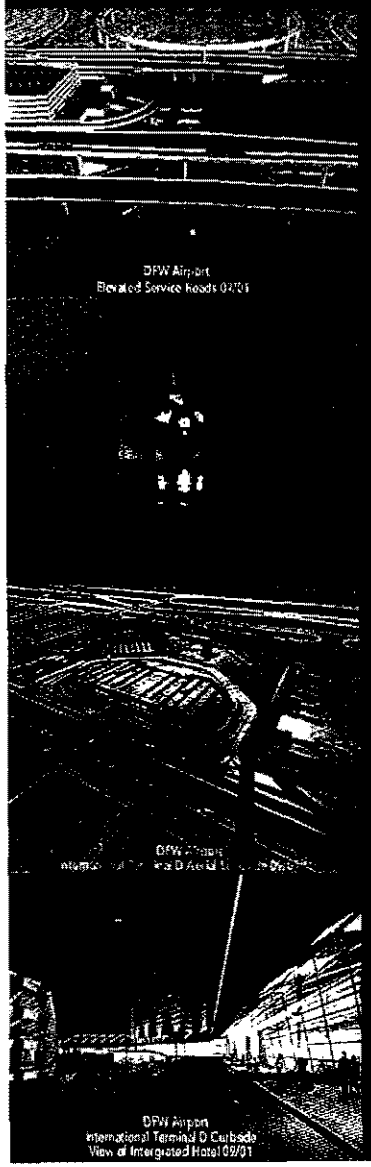


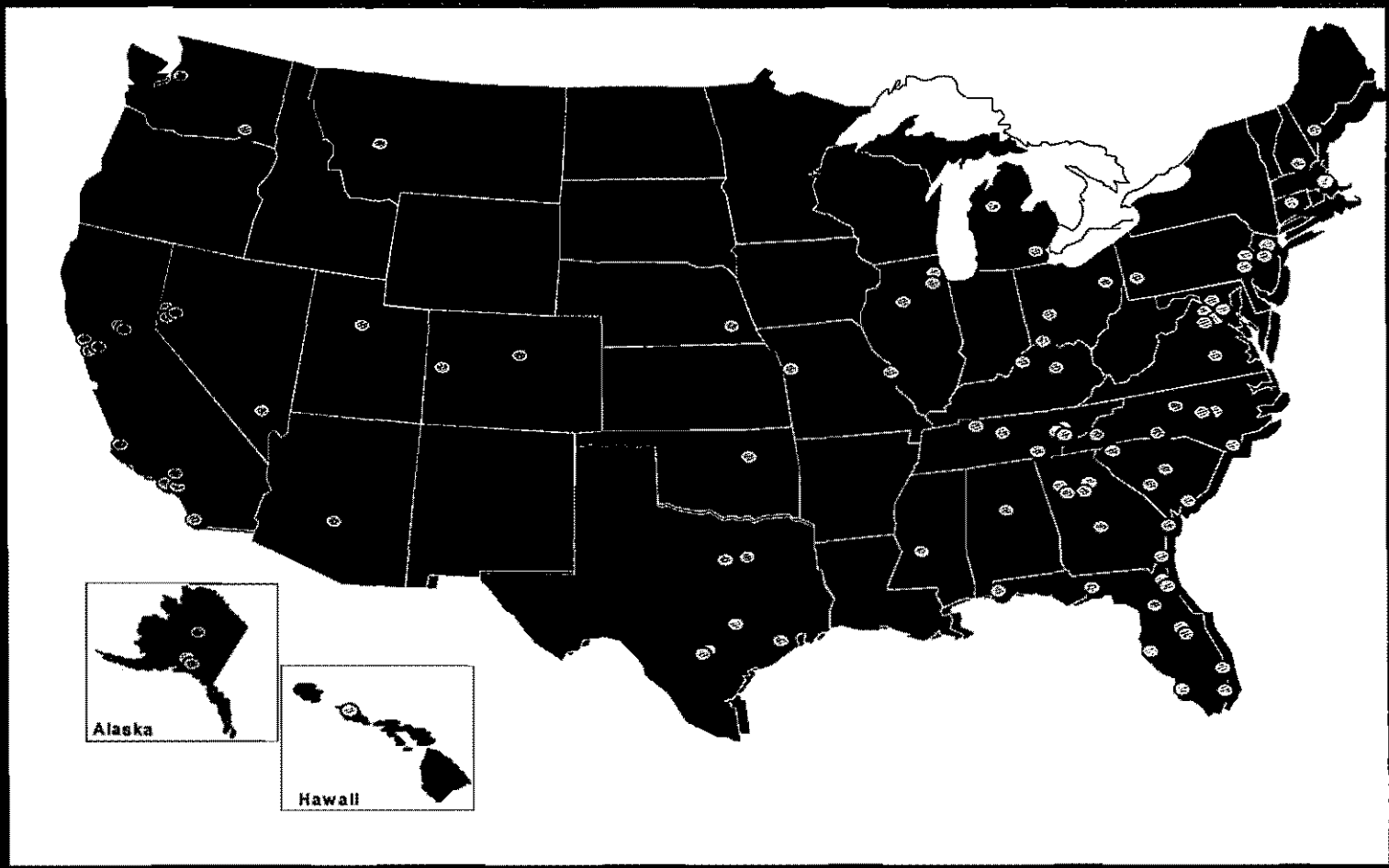
- ✓ **Over 100 U.S. offices – comprehensive geographic coverage**
- ✓ **Over 4,000 plus employees – backed by extensive expertise (technical, regulatory, professional)**
- ✓ **Specialists in over 50 scientific and engineering disciplines – expansive services**

Town Of Addison

MACTEC

Office Locations



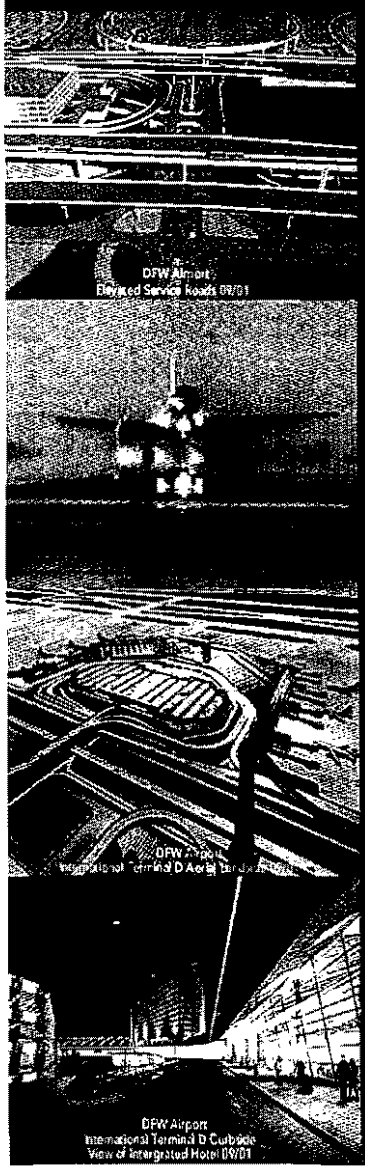


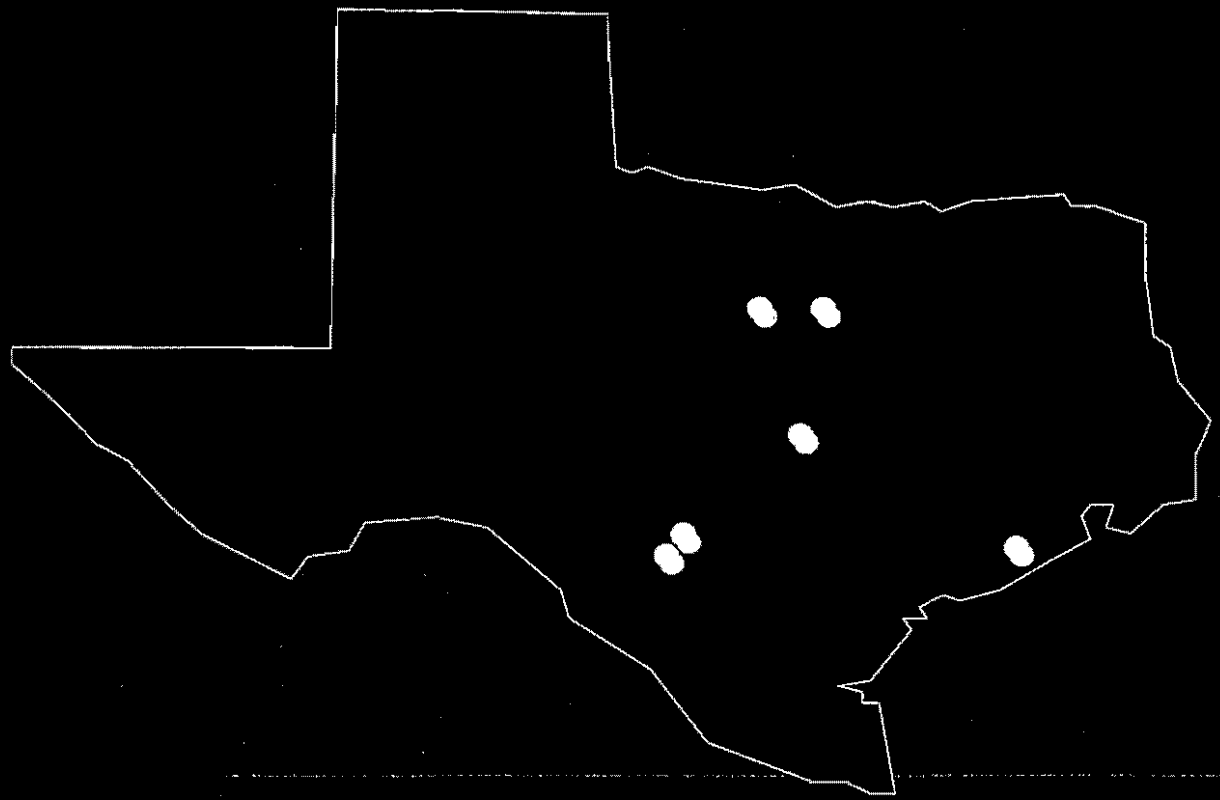
Town Of Addison

MACTEC

MACTEC Texas Resources

Over 128 staff in 6 offices





Town Of Addison

MACTEC

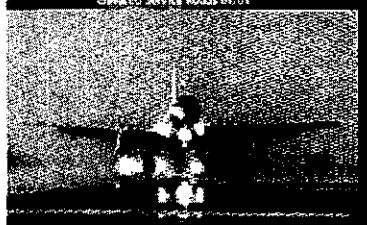
MACTEC's Current Industry Rankings

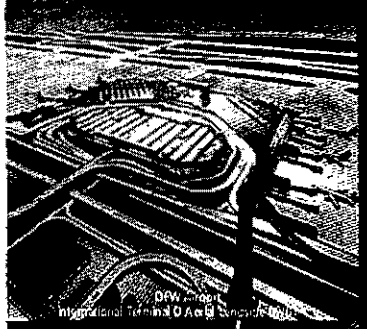
- ✓ **Ranked in top 20 of *Engineering News Record*'s "Top 500 Design Firms"**
- ✓ **Ranked in top 20 of *Engineering News Record*'s "Top 200 Environmental Firms"**

Town Of Addison

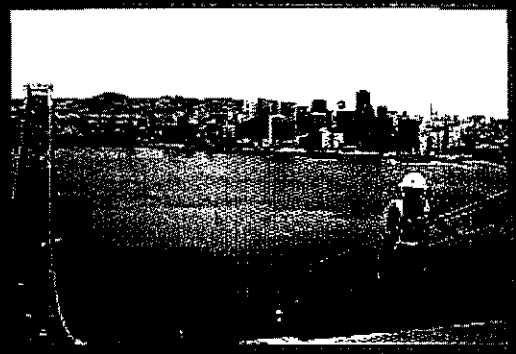
MACTEC

MACTEC's Primary Disciplines





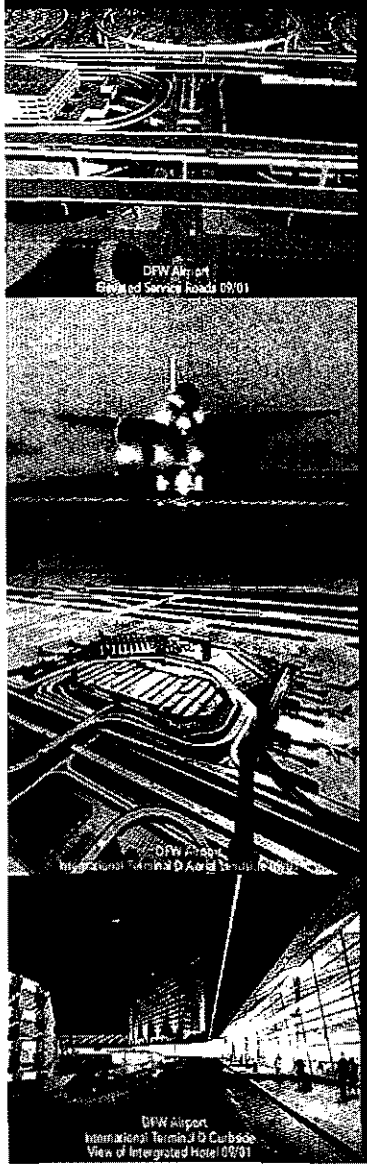
- Airport Engineering
- Architecture
- Biology
- Chemical Engineering
- Civil Engineering
- Construction Engineering
- Electrical Engineering
- Environmental Sciences
- Geology
- Geotechnical Engineering
- Hydraulic Engineering
- Materials Engineering
- Mechanical Engineering
- Pavement Engineering
- Safety & Health Engineering
- Structural Engineering



Town Of Addison

MACTEC

Airport Services

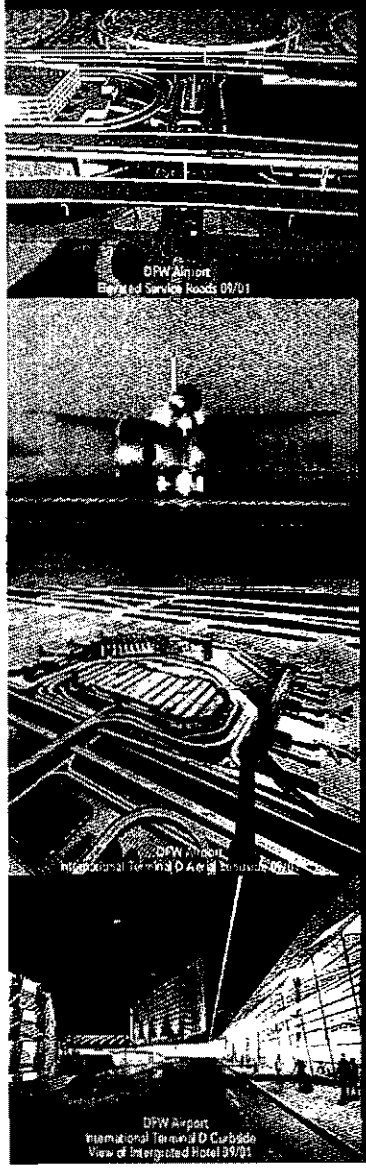


- Airfield Design
- Materials Engineering
- Pavement Engineering &
- Management Systems
- Structural Design/Evaluation
- Geotechnical Engineering
- Environmental Planning and Permitting
- Noise Studies

Town Of Addison

MACTEC

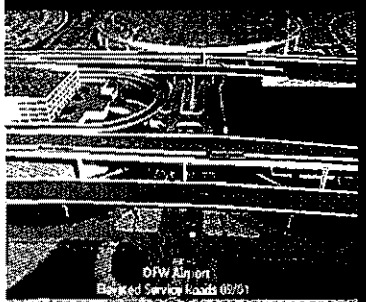
Airport Services (continued)

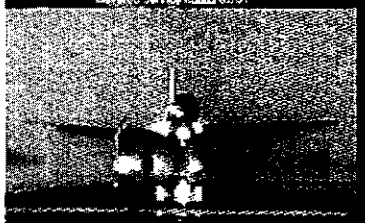


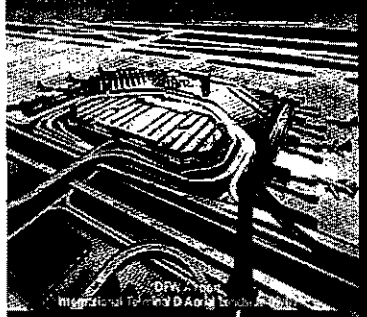
- Planning and Engineering
- Hydrologic and Hydraulic Engineering
- Storm Water Management
- Erosion Control Engineering
- Value Engineering/Life Cycle Cost Analysis
- Construction Management
- Construction QA/QC Inspection and Testing
- Surveying

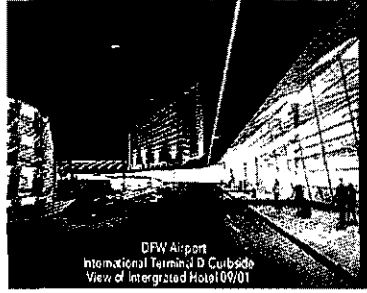
Town Of Addison

MACTEC







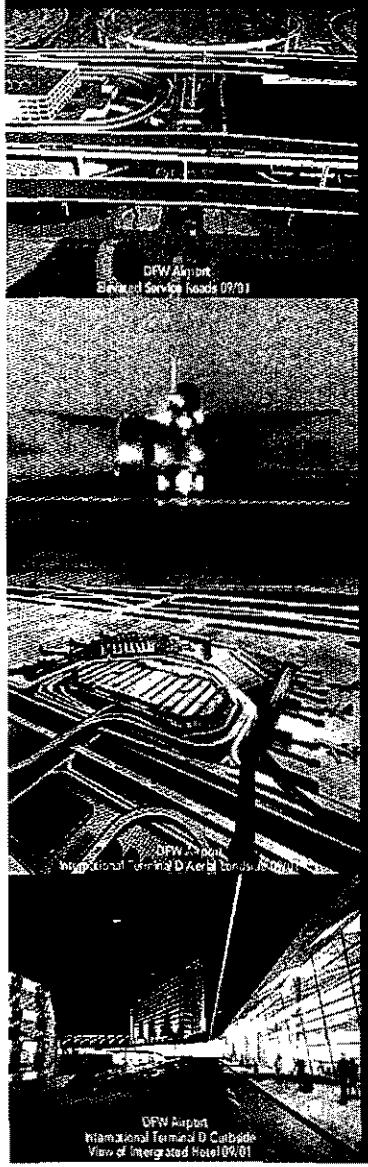


MACTEC's Airport Pavement Management Services

Town Of Addison

MACTEC

Specialized Pavement Services

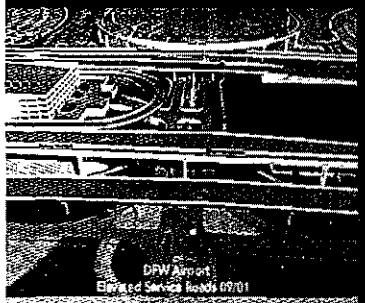


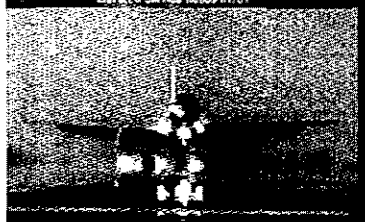
- Pavement Management
- Design
- Evaluation

Town Of Addison

MACTEC

Airport Pavement Management





Service provided by MACTEC's Pavement Consultancy Services

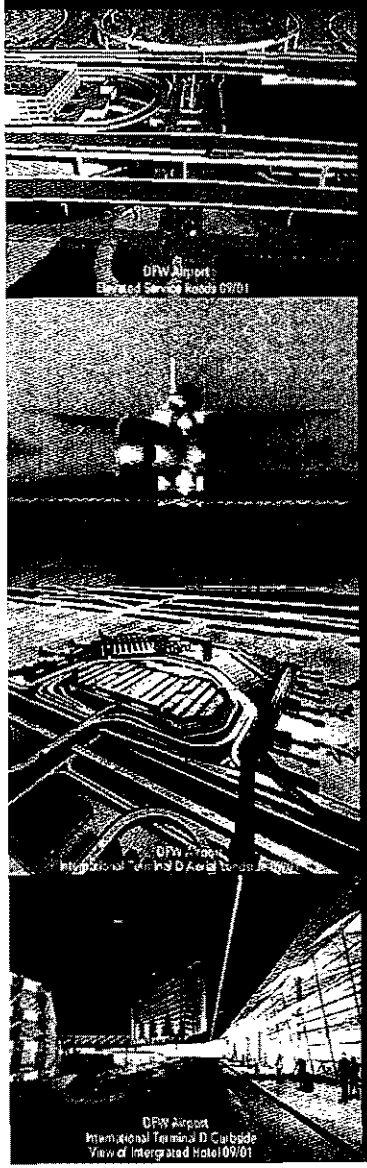
and

MACTEC's local offices

Town Of Addison

MACTEC

MACTEC Pavement Consultancy Services

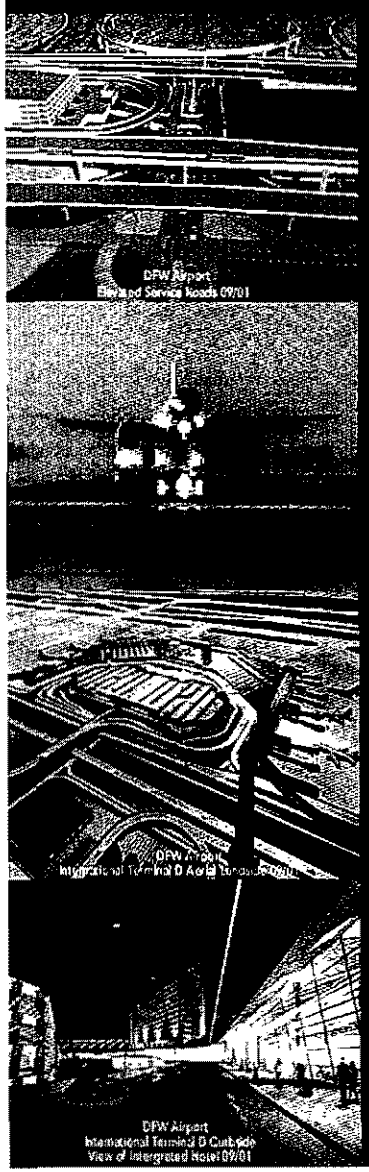


- In-house Center of Expertise for pavement engineering and pavement management
- Staffed with 30 professional staff devoted exclusively to pavement services
- Executes projects nationwide through MACTEC's network of offices
- Powerful combination of specialized expertise and local execution

Town Of Addison

MACTEC

MACTEC Pavement Consultancy Services

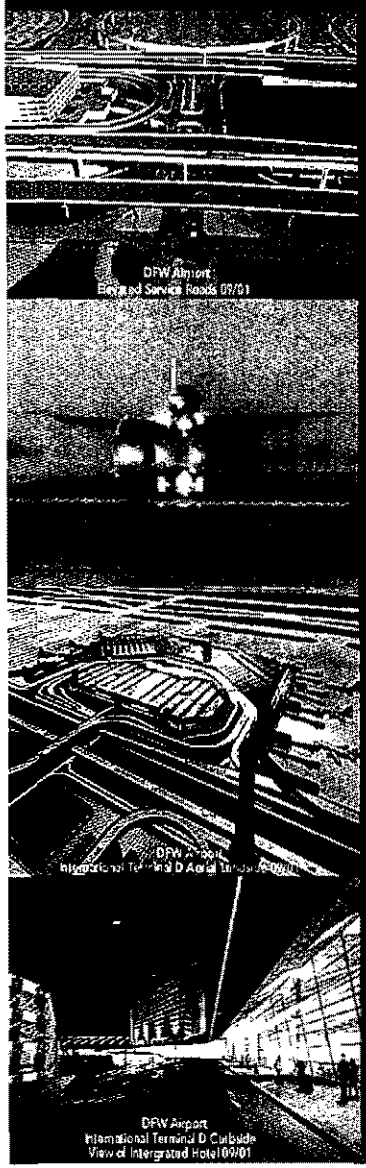


- Originally founded as a stand-alone pavement specialty company in 1982
- Acquired by MACTEC (Law) in 1989
- Located in metro Washington, DC
- Supports the MACTEC network of nearly 100 additional pavement engineers
- Traditionally competes with other pavement specialty firms;
  - Fugro BRE, Nichols Consulting Engineers, ERES Consultants, Aptech

Town Of Addison

MACTEC

The MACTEC advantage



The expertise of a specialty pavement operation

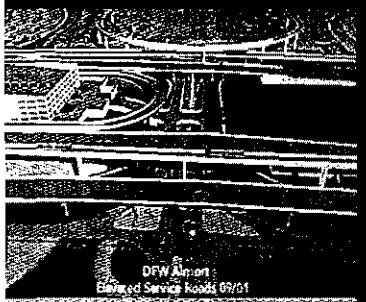
+

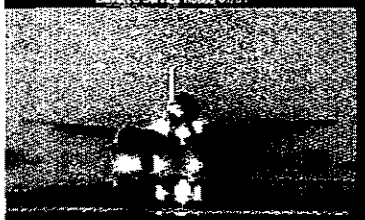
The versatility, resources and stability of an industry leader

Town Of Addison

MACTEC

Airport PMS Software



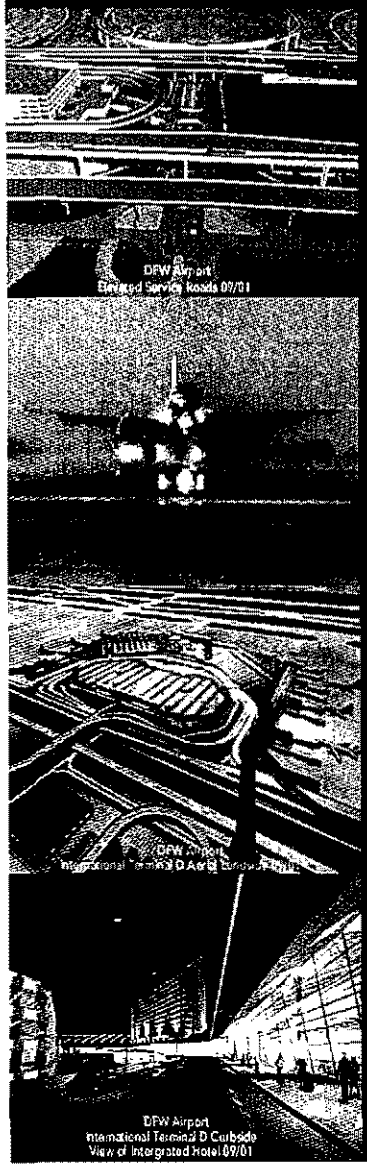


- MicroPAVER
- Integrated Airport Pavement Management System (IAPMS)

Town Of Addison

MACTEC

MicroPAVER



- **Publicly funded / maintained**
- **Uses functional pavement condition**
- **USACE and FAA procedures**

Town Of Addison

MACTEC

IAPMS

- **MACTEC system originally developed in 1986**
- **Same functional condition evaluation as MicroPAVER**
- **PLUS structural condition evaluation**
  - **USACE and FAA based analysis**

Town Of Addison

MACTEC

Mapping Applications

- AutoCAD
- Arcview GIS

Town Of Addison

MACTEC

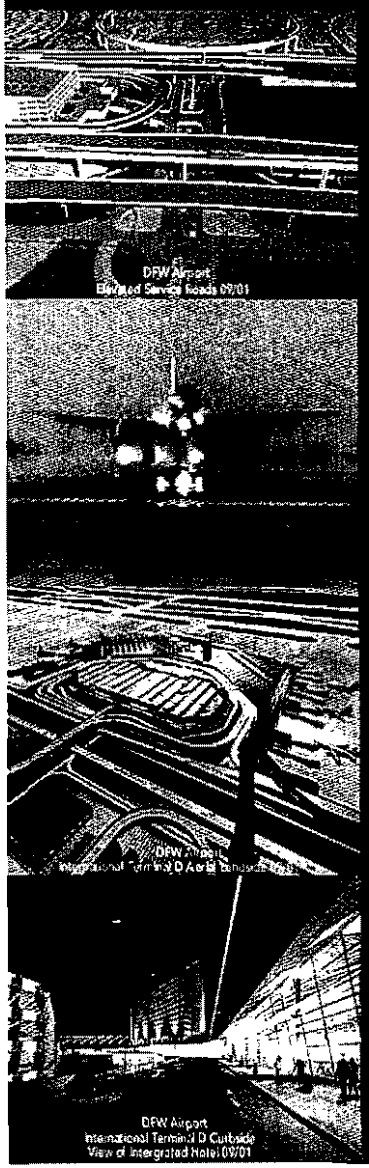
PMS Project Scope

- PMS and mapping software are your choice
- We implement new PMS, or support existing installations
- We support client PMS operation, or provide full-service PMS

Town Of Addison

MACTEC

Full service PMS

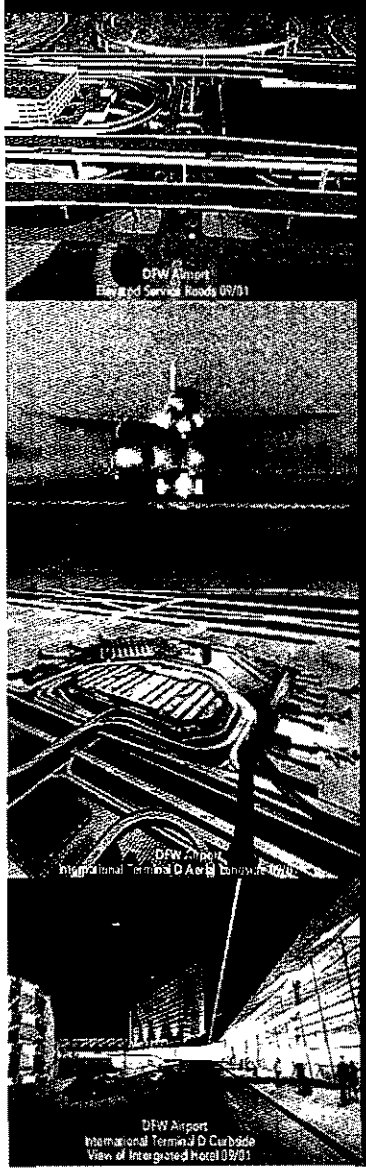


- Software set-up / customization
- Records review
- Pavement inspections
- Database creation and updating
- Forecasting and analysis
- Reporting

Town Of Addison

MACTEC

Full Service Deliverables

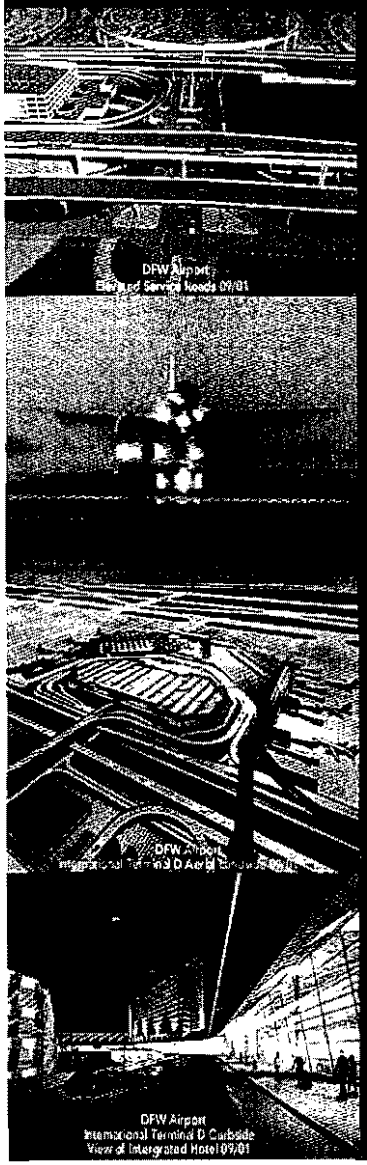


- Condition reports and maps
- Multi-year Maintenance and Rehabilitation Plans
- Multi-year budget
- FAA submittal
- Non-proprietary database

Town Of Addison

MACTEC

Custody of Data



- **Airports need security and ownership of data, even if not internally operating PMS software**
  - **Prudent, responsible and maintains flexibility to choose service provider**
- **MicroPaver and IAPMS both provide data in Access database format**
- **IAPMS may be used for structural analysis, with results stored in MicroPAVER**
- **Purchase of IAPMS not required ; applied as a tool by MACTEC for your benefit**

Town Of Addison

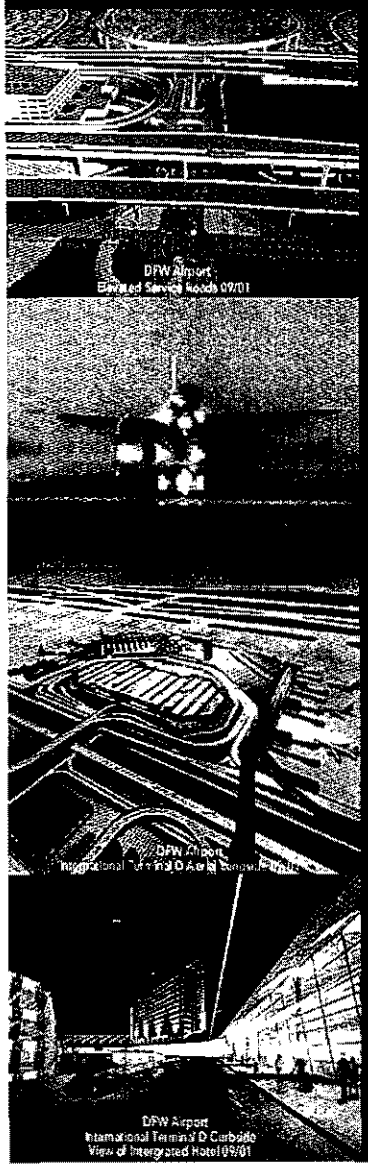
MACTEC

Keys to Success Airport PMS

Town of Addison

MACTEC

Keys to Success

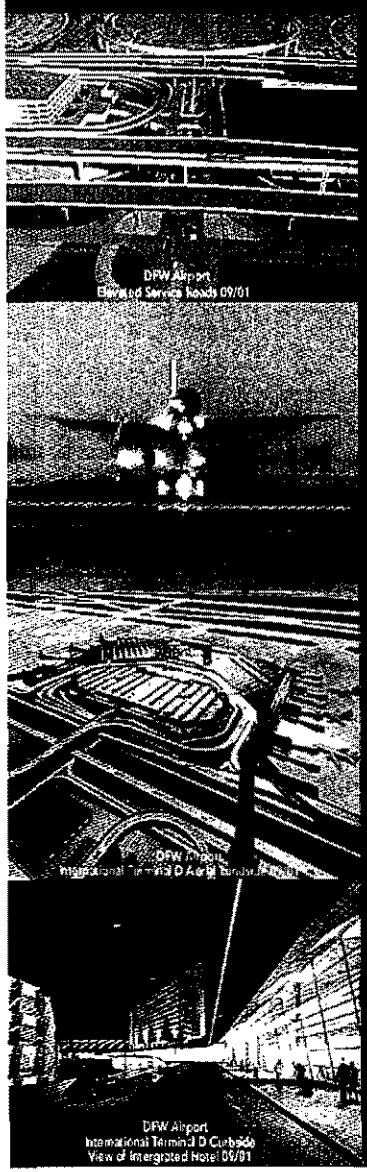


- **Successfully completed PMS projects for nearly 100 airports**
- **Fully familiar and proficient with PMS process for new and existing systems**
- **Experience with some of the world's busiest airports; John F. Kennedy, London Heathrow and Sao Paulo Guarulhos**

Town Of Addison

MACTEC

Keys to Success

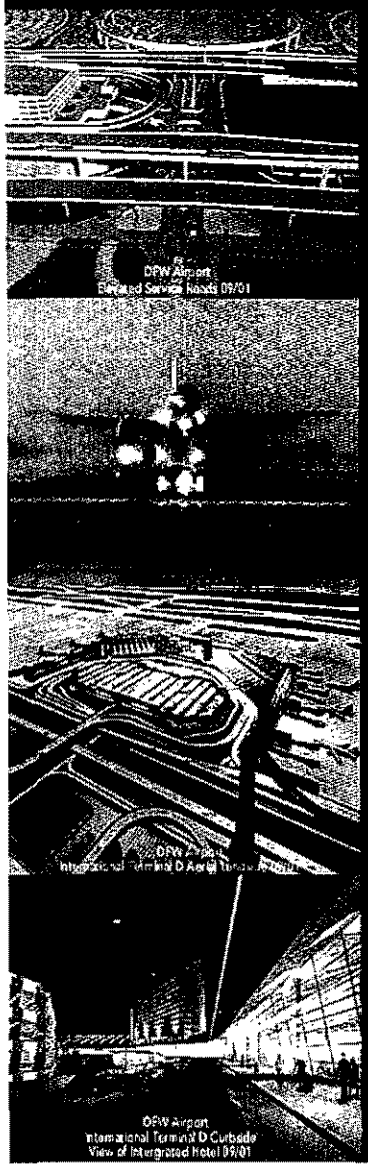


- **Synchronization of Schedule**
  - Responsive to client internal schedules for budgeting, report review, airfield operations
- **PMS software set-up**
  - Many user-defined settings for policies, priorities, unit costs, etc.
  - For existing PMS, updating or confirmation is essential

Town Of Addison

MACTEC

Keys to Success

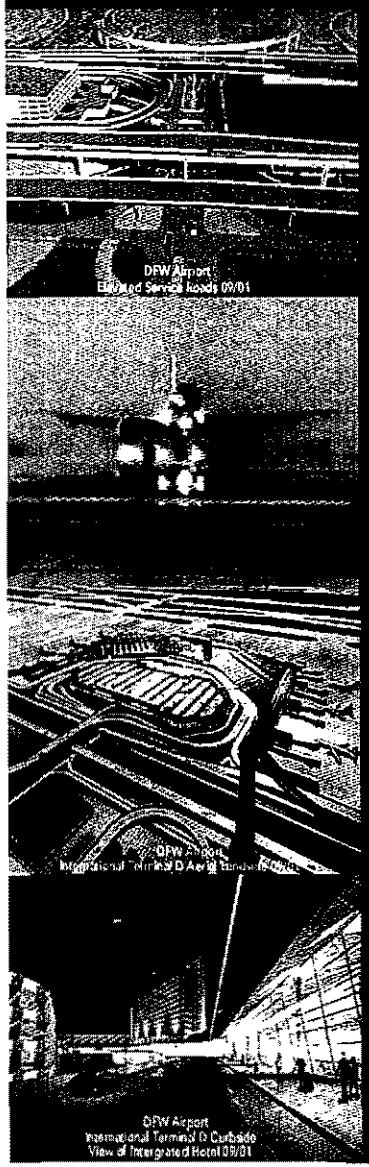


- **Active Pursuit of Records**
  - **Pavement inventory must reflect as-constructed and as-maintained pavement characteristics**
  - **We utilize an "active pursuit" method with on-site staff to ease what can otherwise be a nuisance task for the client**

Town Of Addison

MACTEC

Keys to Success



- **Inspection Plan**
  - **FAA provides for annual and triennial options – 1/3 per year or 100% / 3 years**
  - **We promote "active" PMS with the annual method whenever possible**
  - **Inspection plan developed for client review**
  - **Thoughtful planning to include additions and deletions**
    - **Add- Local performance concerns**
    - **Add- Unexpected performance**
    - **Delete – Planned construction**

Town Of Addison

MACTEC

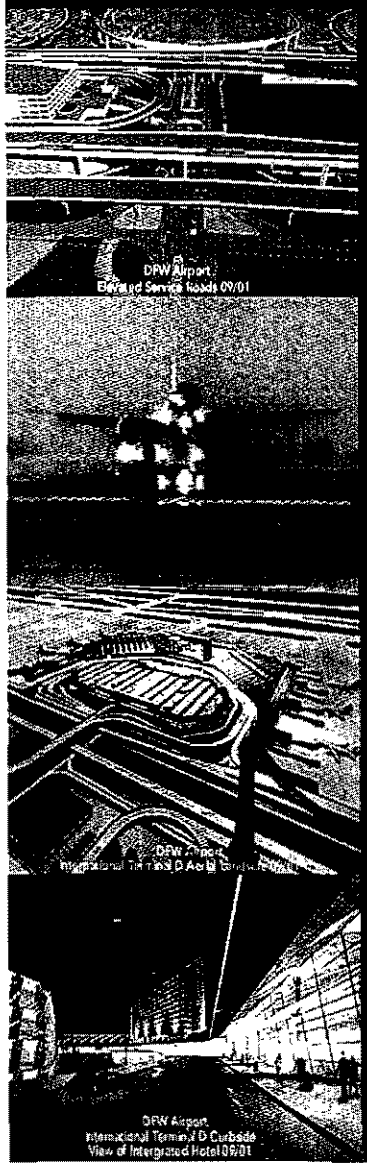
Keys to Success

- **Quality of Visual Condition Surveys**
  - Utilize trained MACTEC pavement specialists
  - 16 flexible pavement distress types / 15 types for rigid
  - Surveys cannot be performed by "anyone" or relegated to subcontractors
  - ENTIRE project results rely upon quality of the surveys !
- **Digital Video Imaging**
  - Mobile operation to overcome access limitations on runways and taxiways
  - Minimizes interruption of airfield operations
  - Trained pavement specialists complete condition surveys from video

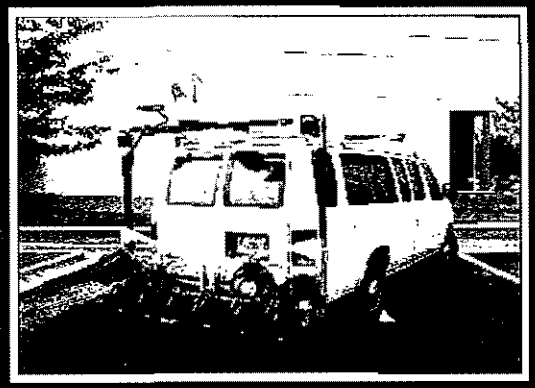
Town Of Addison

MACTEC

Video Data Collection



- High resolution line-scan camera
- Digital images stored directly to computer hard drive
- Rapid data collection
- Lighting system designed for night-time operation
- Owned and operated by MACTEC; no reliance upon third party providers



Town Of Addison

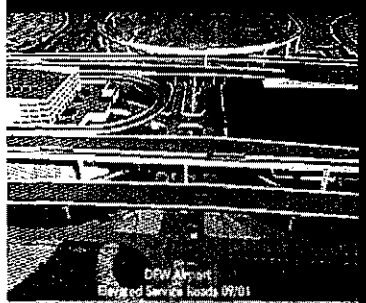
MACTEC

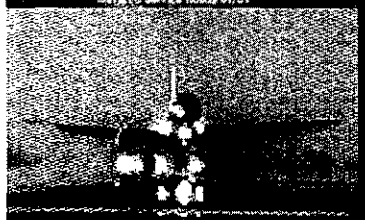
Keys to Success

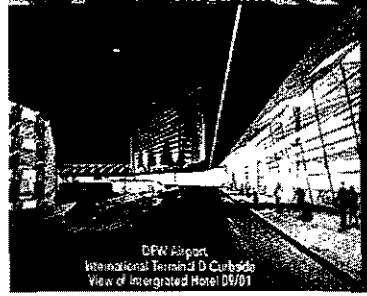
- **Draft Program Development and Ground Truth**
  - **Ground truth inspection performed to confirm overall results**
  - **Engineering judgment applied when borderline, marginal or threshold conditions exist**
  - **Client review prior to finalization**
  - **Allows for consideration of non-PMS requirements such as terminal or lighting work**
  - **Allows for project sequencing review to maintain airfield operations**

Town Of Addison

MACTEC





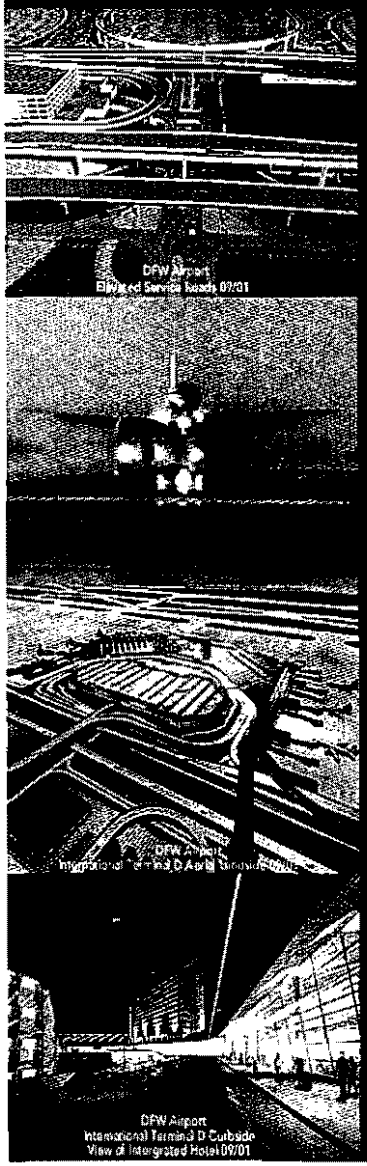


Example Projects

Town Of Addison

MACTEC

John F. Kennedy International Airport



- Providing PMS services since 1986 !
- Initial implementation was for airside pavements
- Landside pavements added in 1998
- Initially supported PMS operation by airport staff ; evolved to full-service approach due to airport staffing in 1999.
- Perform annual updates for both airside and landside pavements
- Annual work includes inspection, records review, analysis and development of rolling 5-year plans with budgets

Town Of Addison

MACTEC

Miami International Airport

- Implemented airside PMS in 1998
- Performed triennial update in 2001

Town Of Addison

MACTEC

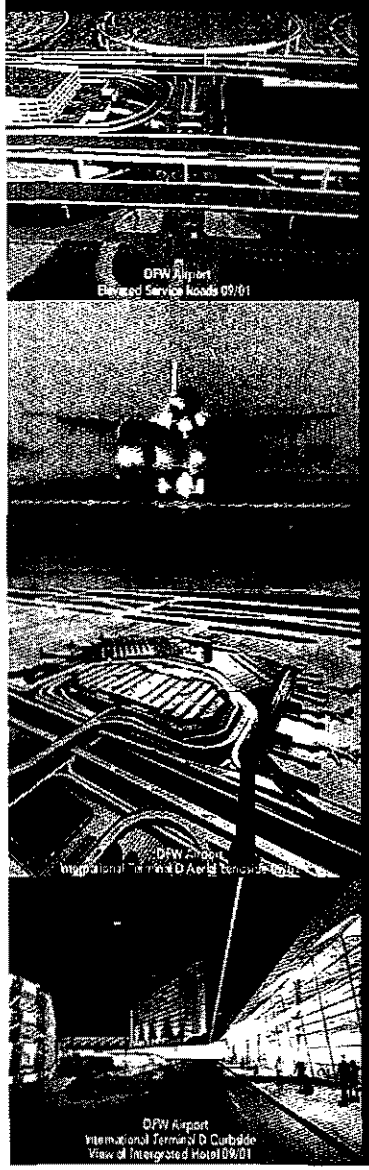
U.S. Army Engineering Support Center

- **New implementations of MicroPAVER**
- **Servicing of existing MicroPAVER systems**
- **Included base airfields and base road networks**
  - + **Presidio of San Francisco, California**
  - + **Fort Campbell, Kentucky**
  - + **Fort Irwin, California**
  - + **Fort Richardson, Alaska**
  - + **Fort Wainwright, Alaska**
  - + **Fort Greely, Alaska**
  - + **Aberdeen Providing Ground, Maryland**
  - + **Dugway Proving Ground, Utah**
  - + **Louisiana Army Ammunition Plant, Louisiana**
  - + **Tooele Army Depot, Utah, and**
  - + **USMCA Worms West Germany**

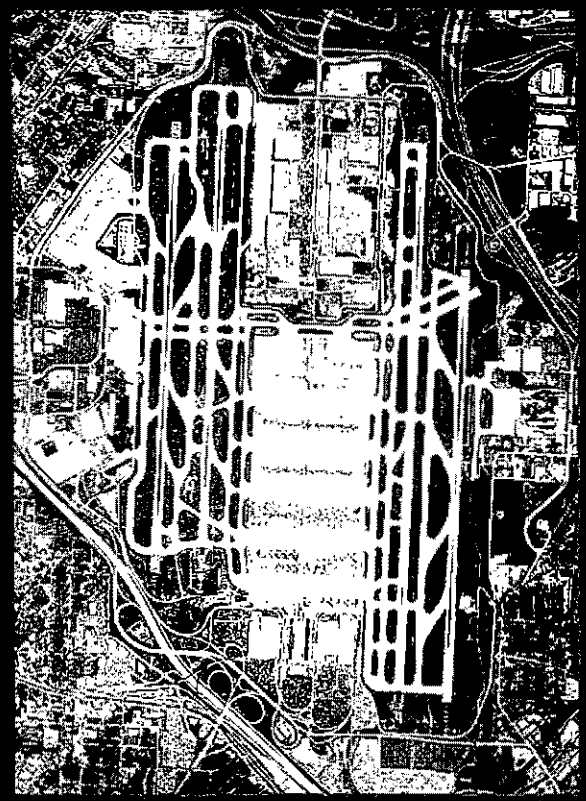
Town Of Addison

MACTEC

Hartsfield Atlanta Int'l Airport



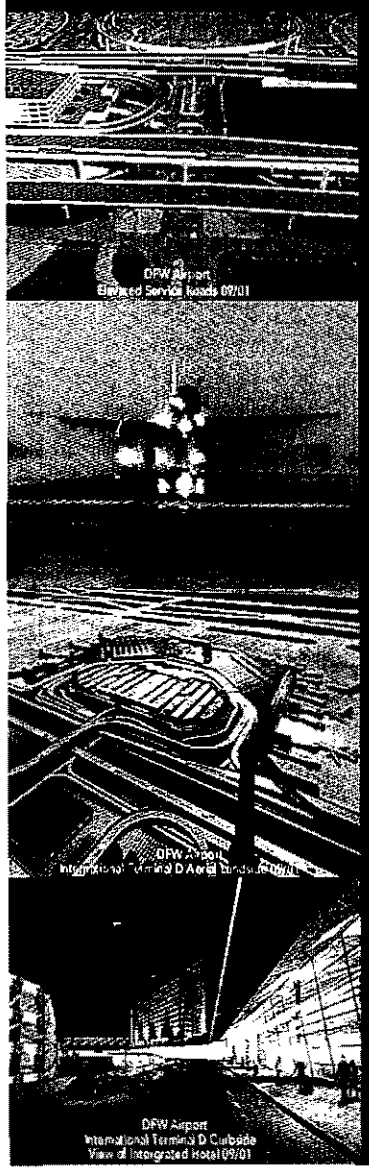
- **Pavement Evaluation and Management**
  - **Supporting internally operated PMS**
  - **Pavement condition data collection for 20 years**
  - **Runway and taxiway smoothness evaluation**



Town Of Addison

MACTEC

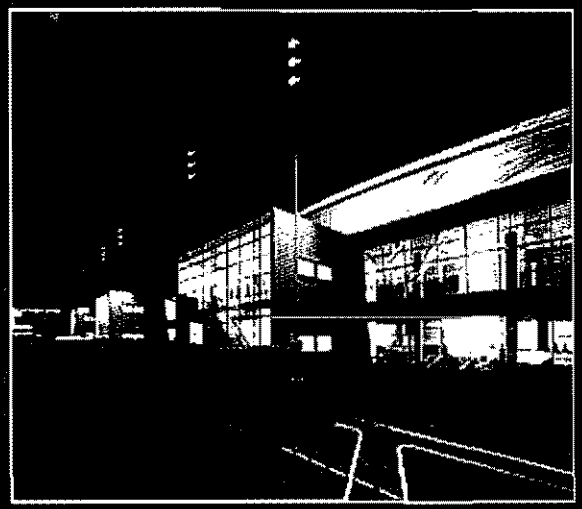
U.S. Army, Ft. Campbell, KY



- **MACTEC linked the MicroPaver database to a CADD file to create a *GIS* for the pavement data.**
  - **The database contains all the pavement related information.**
  - **A map was created to include all the pavement sections as closed polygons.**
  - **ArcCAD was then used to identify and label all the polygons and convert the CADD file into a polygon attribute table.**
  - **The program was used to link the ArcCAD file with the database.**
- **The result was a *GIS* for the pavement data.**
  - **The GIS allows all the pavement data to be graphically viewed and presented using ArcView.**

Town Of Addison

MACTEC



Prepared by:

MACTEC

Patrick Bolton
469-828-4100

June 6, 2003

Gregg Williams
301-210-5105
6/11/03 Does not require GPR to provide the results we need.

Mr. James C. Pierce, Jr., P.E.
Assistant Public Works Director
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Subject: **Proposal for Runway Evaluation - Addison Airport**
MACTEC Proposal No. PROP03DALL-0295

Dear Mr. Pierce:

MACTEC is pleased to provide this proposal for pavement evaluation services at Addison Airport, Texas.

OBJECTIVE AND SCOPE OF WORK

We understand that the Town of Addison is currently working with the FAA and Coffman Associates Airport Consultants to develop an updated master plan for the airport. In support of this planning effort the Town of Addison wishes to undertake an evaluation of the existing RW 15/33. The runway is constructed of asphalt concrete and is approximately 7200 ft long and 100 ft wide. Thickness of the asphalt concrete layer is reported to vary from 7 to 15 inches.

The objective of this work is to provide the Town of Addison with an evaluation of the existing condition of the runway pavement and preliminary design alternatives for rehabilitation or reconstruction, to support the master planning activity.

Our effort is proposed in accordance with FAA Advisory Circular AC 150/5320-6D for pavement evaluations. Detailed design (plans, specifications and estimates) of the selected rehabilitation option is not within the scope of this proposal. Additional materials sampling and testing beyond that proposed here will be required at a later date to comply with FAA requirements for detailed design.

To conduct this work, MACTEC will perform the following tasks:

Task 1. Pavement Inspection and Testing

We understand inspection and testing will be coordinated with airport operations staff, and likely scheduled to occur at night. Any required FAA permits/documents should be obtained for our employees by the Town of Addison.

MACTEC will perform visual condition surveys of the existing asphalt pavement in accordance with procedures adopted by the Federal Aviation Administration and outlined in ASTM D5340 "Standard Test Method for Airport Pavement Condition Index Surveys." The surveys will be completed on a sample basis at a nominal coverage of 50% of the surface area over a three-day (equivalent) period. We recommend this level of inspection based upon the age and likely condition of the runway. Although PCI inspections can be conducted using light cart operations, as a minimum we will require some twilight hour access to the runway.

We will conduct two days (equivalent) of nondestructive testing using a MACTEC owned and operated Dynatest Model 8002 Falling Weight Deflectometer. Testing will be conducted along six adjacent lines across the width of the runway separated by a minimum of 10 ft. Spacing between test points will range from 100 to 300 ft in accordance with Advisory Circular AC 150/5370-11B "Use of Nondestructive Testing in the Evaluation of Airport Pavements."

1st pair 100'
2nd pair 150'
3rd pair 300'

Based upon boring results previously conducted by Reed Engineering and provided to MACTEC to support this proposal, we note considerable variation in the thickness of the existing pavement. We propose to perform one day (equivalent) of additional pavement coring to determine pavement structure thickness. Locations will be selected based upon pavement variations determined from FWD test results.

Task 2. Data Analysis and Pavement Design

Based upon information obtained in Task 1 and other information that the Town of Addison may provide to us, we will evaluate the existing pavement structural and functional condition, and develop alternative preliminary designs.

We will require summary aircraft traffic information from the Town of Addison or Coffman Associates, and we will rely on this information in our analysis. Any drawings or documentation that the Town of Addison is able to provide pertaining to original construction and subsequent maintenance and rehabilitation will aid in the evaluation process.

Design alternatives will include rehabilitation options based upon 8 and 15-year design lives (or substitute analysis periods specified by the Town of Addison), and reconstruction.

Task 3. Reporting

A final report will be prepared which presents the technical approach, existing structural and functional condition of the pavement, results of our analysis, and pavement design options. We will report all data and information used in the analysis.

COMPENSATION, SCHEDULE AND TERMS

MACTEC's firm-fixed price to complete the effort as described above is **$24,990**. On a task basis, the pricing is broken down as follows:

Task 1. Pavement Inspection and Testing	$15,195
Task 2. Data Analysis and Pavement Design	$ 6,545
Task 3. Reporting	$ 3,250

We understand that the Town of Addison wishes to have preliminary design options by early to mid July. To accomplish this, we will require Notice to Proceed by June 12, 2003 and cooperation from airport operations to promptly schedule FWD testing, pavement inspections and coring. Aircraft traffic information and any supporting construction records will be required no later than June 25, 2003 to support timely analysis.

If this proposal meets your approval, please complete the attached Proposal/Work Acceptance Sheet (PWAS) and return it to our offices. The work will be performed in accordance with the scope of work outlined in this letter and the Terms and Conditions contained in the PWAS. Our price is valid for thirty days from the date of this proposal.

We look forward to working with you on this project. If you have any questions or concerns, please feel free to contact us.

Sincerely,
MACTEC Engineering and Consulting, Inc.
Formerly known as,
Law Engineering and Environmental Services, Inc.

Amy L. Simpson, Ph.D., P.E. (TX)
Senior Engineer

Beltsville Md

301-210-5105

Patrick D. Bolton, P.E. (TX)
Principal
Assistant Vice President

Bob Patton
972-484-8301

GPR not req'd initially

Proposal No. 0703-1176
June 6, 2003

Town of Addison
P.O. Box 9010
Addison, Texas 75001-9010

Attn: Mr. Jim Pierce, P.E.
Assistant Public Works Director

Proposal for Pavement Evaluation and Overlay Design of Runway at Addison Airport, Addison, Texas

Fugro South, Inc. is pleased to submit this proposal for the pavement evaluation and design of a runway pavement section at Addison Airport in Addison, Texas. To accomplish this objective the following tasks are anticipated:

Project Level Deflection Testing.
Geotechnical Sampling and Testing
Design, Analysis and Reporting.

The following sections of this proposal describe the scope of our services, a cost estimate for the engineering services to be provided, an estimated schedule, and proposed terms and conditions.

Project Description

The Town of Addison is planning to evaluate the existing pavement section of the existing 7200-foot runway at Addison Airport located near Belt Line Road and Addison Road. The firm of Coffman Associates is performing a master plan and 7 soil borings have been taken through the existing HMAC pavement section.

Project Level Deflection Testing

Nondestructive deflection testing will be performed at a spacing of approximately 100 feet along the center (keel section) and edge (wing section) of the 7,200 foot of runway (approximately 154 test points). The purpose of the deflection test program is to determine the structural response characteristics of the pavement structure to wheel loads as well as variability of the structural

properties along the pavement sections. The deflection testing program will be performed in accordance with ASTM Test Standard D4694 (Standard Test Method for Deflections With a Falling Weight-Type Impulse Load Device) and D4695 (Standard Guide for General Pavement Deflection Measurements). The type of testing to be conducted will be a Level 3 program, for a detailed evaluation of pavement condition.

Pavement Materials Sampling

The material sampling operations may require additional cores and borings to a minimum of 5 feet in depth along the runway at specified locations by the pavement engineer. The additional amount of borings (if any) will be determined after the deflection testing and review of the 7 borings provided by the City of Addison. If additional borings are required, the sampling personnel will identify or note any seepage of water in the underlying pavement and soil layers during the materials sampling program. Thicknesses of each pavement layer will be measured to an accuracy of ¼ in and provided to the pavement engineer. These core holes will be patched using equivalent quality materials. This work will be coordinated by Fugro-South. Fugro-South can provide a proposal for these services if requested.

Design, Analysis and Backcalculation

Using the non-destructive deflection testing data, and borings (which will be provided and will contain pavement layer descriptions and thickness), the roadway will be analyzed to identify those areas that respond differently to loads. Layer moduli will be calculated using the Army Corps of Engineers backcalculation procedures (WESDEF).

Additional information from the City of Addison will be required by Fugro to determine the required thickness of the overlay or other rehabilitation alternatives. This includes the type of aircraft and the anticipated arrivals and departures over the 20-year design period. If changes in aircraft type are expected in the design period, the City of Addison should provide this information as it will have significant impact on the amount of material required to increase the structural capacity of the pavement structure.

Report of Results

An engineering report will be prepared that will document all field work and engineering analyses. All data, test results and pertinent information will be provided in the engineering report. This will include, as a minimum, the following:

1. A general description of the pavement condition based on the deflection testing including deflection profile plots.
2. The results of the backcalculated moduli.

3. The recommended rehabilitation including overlay thickness with construction recommendations.

Cost Estimate

Based on the scope of work outlined above and Fee Schedule P-2002, the following estimated cost for this implementation effort is presented below. It is anticipated that only one night of testing will be required.

Project Level Deflection Testing

Mobilization – 400 Miles @ $2/Mile	$800.00
Security Clearance – 4 Hours @ $70/Hour	$280.00
FWD Testing – 1 night (8 hours @ $250/hour)	$2,000.00
Per Diem – 2 nights @ $100/night	$200.00
(Stand-by time is $75/Hour, if necessary)	
Subtotal	**$3,280.00**

Design, Analysis and Reporting

Project Manager – 20 Hours @ $110/Hour	$2,200.00
Graduate Engineer – 60 Hours @ $70/Hour	$4,200.00
Word Processor – 6 Hours @ $45.00/Hour	$270.00
Principal Engineer – 4 Hours @ $125.00/Hour	$500.00
Subtotal	**$7,170.00**

TOTAL **$10,450.00**

The above estimated fee is based on our understanding of the pavement consulting services anticipated. This estimation may be exceeded if changes in work are required or requested. The estimated maximum fee will not be exceeded however, without the client's prior authorization. Required additions to the above scope of services would be invoiced in accordance with the attached fee schedule.

Schedule

The preparation and planning for the project would begin 3 to 5 days after the notice to proceed is received and the field deflection testing program would begin in 2 to 3 weeks. Analysis of data and pavement design would be presented in an engineering report and would be complete about 2 weeks after completion of field activities. Interim information can be verbally presented

prior to the completion of the final report.

Terms and Conditions

Fees for field work and report preparation are outlined in Schedule P-2002. Schedule 40.01 describes general contractual conditions including identification of client, on-site responsibilities and risks, warranty, invoicing procedures, and record maintenance. Schedules P-2002 and 40.01 are attached to this proposal.

* * *

To indicate acceptance of this proposal, please have the signature block below signed by a duly authorized representative of the client, and return one copy to us for our files. Whoever signs below is identified as our Client as used throughout Schedule 40.01 attached.

We appreciate the opportunity to submit this proposal and look forward to working with you on this project. Please call if we may be of any additional assistance.

Sincerely,
FUGRO SOUTH, INC.

Robert S. Patton, P.E.
Senior Consultant

CLIENT:

.....
Firm Name

.....
Authorizing Signature

.....
Typed Name and Title

.....
Date

GENERAL CONDITIONS FOR TECHNICAL SERVICES

1. Client

CLIENT as used herein is the entity who authorizes performance of services by Fugro-BRE, Inc., and accepts responsibility for payment under the conditions stated herein.

2. On-site Responsibilities and Risks

2.1 Right-of-Entry. Unless otherwise agreed, CLIENT will furnish right-of-entry and obtain permits as required for us to perform the field work.

2.2 Damage to Property. FUGRO-BRE, INC. will take reasonable precautions to minimize damage to land and other property caused by our operations, but we have not included in our fee the cost of repairing such damage. If CLIENT desires us to repair and/or pay for damages, we will undertake the repairs and add the cost to our fee.

2.3 Toxic and Hazardous Materials. CLIENT will provide us with all information within his possession or knowledge as to the potential occurrence of toxic or hazardous materials at the site being investigated. If unanticipated toxic or hazardous materials are encountered, we reserve the right to demobilize our field operations at CLIENT's expense. Remobilization will proceed following consultation with our safety coordinator and CLIENT's acceptance of proposed safety measures and fee adjustments.

2.4 Utilities and Pipelines. While performing our field work, we will take reasonable precautions to avoid damage to subterranean and subaqueous structures, pipelines, and utilities. CLIENT agrees to hold FUGRO-BRE, INC. and its officers, agents, employees and subcontractors harmless for any damages to such structures, pipelines, and utilities which are not called to our attention and correctly shown on plans furnished.

3. Warranty

3.1 Services performed by FUGRO-BRE, INC. will be conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty, either expressed or implied, is made or intended by our proposal, contract, or reports.

3.2 CLIENT acknowledges that conditions may vary from those encountered at the location where borings, surveys, or explorations are made and that our data, interpretations, and recommendations are based solely on the information available to us. We will be responsible for our data, interpretations, and recommendations, but shall not be responsible for the interpretation by others of the information developed.

4. Liability

Our liability to CLIENT for injury or damage to persons or property arising out of work performed for CLIENT and for which legal liability may be found to rest upon us, other than for professional errors and omissions, will be limited to our general liability insurance coverage, which is $1,000,000.00. For any damage on account of any error, omission, or other professional negligence, our liability will be limited to a sum not to exceed $50,000, or 15% of our fee less direct third-party costs, whichever is greater.

5. Invoices and Payment

Invoices will be submitted every four weeks for services rendered. Payment is due upon presentation of our invoice and is past due thirty (30) days from invoice date. CLIENT agrees to pay a financing charge of one percent (1%) per month (or the maximum rate allowable by law, whichever is less), on past due accounts, excepting any portion of the invoiced amount in dispute and resolved in favor of the CLIENT. Payment of invoices is in no case subject to unilateral discounting or set-offs by CLIENT. If CLIENT fails to pay undisputed invoiced amounts within (45) calendar days from invoice date, FUGRO-BRE, INC. may then at any time, without waiving any claims or incurring any liability, suspend this agreement.

6. Data and Records

All pertinent records relating to services performed hereunder shall be retained for two years after completion of the work. CLIENT shall have access to the records at all reasonable times during said period.

7. Indemnification

CLIENT shall, defend, indemnify and hold harmless FUGRO-BRE, INC. and its directors, officers, shareholders, employees, contractors, subcontractors, agents or affiliates from and against any and all suits, actions, legal or administrative proceedings, claims demands, actual damages, fines, punitive damages, losses, costs, liabilities, interest, and attorneys' fees (including any such fees and expenses incurred in enforcing this indemnity) which, irrespective of FUGRO-BRE, INC.'s negligence: (a) exceed the limitation of FUGRO-BRE, INC.'s liability provided for in Article 4 or (b) result from, arise out of, or are in any way connected with: (i) acts or omissions of CLIENT, CLIENT's employees, agents and subcontractors, and their employees or agents; (ii) the release of any hazardous substance; or (iii) any other generation, treatment or transport of waste materials.

8. Consequential Damages

CLIENT shall not be liable to FUGRO-BRE, INC. and FUGRO-BRE, INC. shall not be liable to CLIENT for any consequential damages incurred by either due to the fault of the other, regardless of: the nature of this fault; or whether it was committed by CLIENT or FUGRO-BRE, INC., their employees, agents, or subcontractors; or whether such liability arises in breach of contract or warranty, tort (including negligence), statute, or any other cause of action. Consequential damages include, but are not limited to, loss of use and loss of profit.

9. Oral Acceptance of Agreement

This agreement's General Conditions, of which this provision is a part, have been established in large measure to allocate certain risks between CLIENT and FUGRO-BRE, INC.. FUGRO-BRE, INC. will not initiate service without formal agreement on General Conditions and other terms and conditions set forth in this agreement. For purposes of convenience, CLIENT may choose to accept this agreement orally or to orally authorize to initiate services. In that event, CLIENT specifically agrees that, as a material element of the consideration FUGRO-BRE, INC. requires to execute the services indicated herein, oral acceptance or authorization to initiate services shall be considered by both parties to constitute formal acceptance of all terms and conditions of this agreement. Unilateral modification of this agreement subsequent to FUGRO-BRE, INC.'s initiation of service is expressly prohibited. Furthermore, all preprinted terms and conditions on CLIENT's purchase order or FUGRO-BRE, INC.'s purchase order acknowledgment form are inapplicable to this agreement and FUGRO-BRE, INC.'s involvement in CLIENT's project.

FEES FOR PAVEMENT ENGINEERING SERVICES

1.	**Field Investigation**	
1.1.	Mobilization and demobilization, per mobilization	$ 2.00/Mile
1.2.	Nondestructive Pavement Deflection Testing	
	1.2.1 Falling Weight Deflectometer (daytime)	$ 225.00/Hour
	1.2.2 Falling Weight Deflectometer (nighttime)	$ 250.00/Hour
	1.2.3 Dynaflect (daytime)	$ 125.00/Hour
	1.2.4 Dynaflect (nighttime)	$ 150.00/Hour
1.3	Video edge drain inspection	$ 70.00/Hour
1.4.	Hourly charges for field coordination, layout, and for other reasons beyond our control	$ 100.00/Hour
1.5.	Traffic Control	$ 175.00/Hour
1.6	Per diem for out-of-town assignments, per person	$ 100.00/Night
2.	**Engineering and Technical Personnel**	
2.1.	Senior Consultant	$ 135.00/Hour
2.2.	Senior Project Manager	$ 120.00/Hour
2.3.	Project Manager	$ 110.00/Hour
2.4.	Project Engineer	$ 90.00/Hour
2.5.	Graduate Engineer	$ 70.00/Hour
2.6.	Senior Engineering Technician	$ 60.00/Hour
2.7.	Technician and Draftsperson	$ 45.00/Hour
2.8.	Word Processor	$ 45.00/Hour
3.	**Report Reproduction and Miscellaneous**	
3.1.	Xerox reproduction	$ 0.15/Copy
3.2.	Binding with plastic ring covers	$ 10.00/Copy
3.3.	Outside services, printing, reproduction, etc.	Cost + 15%
3.4.	Computer assistance	Cost + 15%
3.5.	Transportation	$ 0.35/Mile

Rates for other tests and services quoted on request.

FUGRO SOUTH, INC.

2880 Virgo Lane
Dallas, TX 75229
Phone: 972-484-8301
Fax: 972-620-7328

Proposal No. 0703-1176
June 6, 2003

Town of Addison
P.O. Box 9010
Addison, Texas 75001-9010

Attn: Mr. Jim Pierce, P.E.
Assistant Public Works Director

Proposal for Pavement Evaluation and Overlay Design of Runway at Addison Airport, Addison, Texas

Fugro South, Inc. is pleased to submit this proposal for the pavement evaluation and design of a runway pavement section at Addison Airport in Addison, Texas. To accomplish this objective the following tasks are anticipated:

Project Level Deflection Testing.
Geotechnical Sampling and Testing
Design, Analysis and Reporting.

The following sections of this proposal describe the scope of our services, a cost estimate for the engineering services to be provided, an estimated schedule, and proposed terms and conditions.

Project Description

The Town of Addison is planning to evaluate the existing pavement section of the existing 7200-foot runway at Addison Airport located near Belt Line Road and Addison Road. The firm of Coffman Associates is performing a master plan and 7 soil borings have been taken through the existing HMAC pavement section.

Project Level Deflection Testing

Nondestructive deflection testing will be performed at a spacing of approximately 100 feet along the center (keel section) and edge (wing section) of the 7,200 foot of runway (approximately 154 test points). The purpose of the deflection test program is to determine the structural response characteristics of the pavement structure to wheel loads as well as variability of the structural

properties along the pavement sections. The deflection testing program will be performed in accordance with ASTM Test Standard D4694 (Standard Test Method for Deflections With a Falling Weight-Type Impulse Load Device) and D4695 (Standard Guide for General Pavement Deflection Measurements). The type of testing to be conducted will be a Level 3 program, for a detailed evaluation of pavement condition.

Pavement Materials Sampling

The material sampling operations may require additional cores and borings to a minimum of 5 feet in depth along the runway at specified locations by the pavement engineer. The additional amount of borings (if any) will be determined after the deflection testing and review of the 7 borings provided by the City of Addison. If additional borings are required, the sampling personnel will identify or note any seepage of water in the underlying pavement and soil layers during the materials sampling program. Thicknesses of each pavement layer will be measured to an accuracy of ¼ in and provided to the pavement engineer. These core holes will be patched using equivalent quality materials. This work will be coordinated by Fugro-South. Fugro-South can provide a proposal for these services if requested.

Design, Analysis and Backcalculation

Using the non-destructive deflection testing data, and borings (which will be provided and will contain pavement layer descriptions and thickness), the roadway will be analyzed to identify those areas that respond differently to loads. Layer moduli will be calculated using the Army Corps of Engineers backcalculation procedures (WESDEF).

Additional information from the City of Addison will be required by Fugro to determine the required thickness of the overlay or other rehabilitation alternatives. This includes the type of aircraft and the anticipated arrivals and departures over the 20-year design period. If changes in aircraft type are expected in the design period, the City of Addison should provide this information as it will have significant impact on the amount of material required to increase the structural capacity of the pavement structure.

Report of Results

An engineering report will be prepared that will document all field work and engineering analyses. All data, test results and pertinent information will be provided in the engineering report. This will include, as a minimum, the following:

1. A general description of the pavement condition based on the deflection testing including deflection profile plots.
2. The results of the backcalculated moduli.

3. The recommended rehabilitation including overlay thickness with construction recommendations.

Cost Estimate

Based on the scope of work outlined above and Fee Schedule P-2002, the following estimated cost for this implementation effort is presented below. It is anticipated that only one night of testing will be required.

Project Level Deflection Testing

Mobilization – 400 Miles @ $2/Mile	$800.00
Security Clearance – 4 Hours @ $70/Hour	$280.00
FWD Testing – 1 night (8 hours @ $250/hour)	$2,000.00
Per Diem – 2 nights @ $100/night	$200.00
(Stand-by time is $75/Hour, if necessary)	
Subtotal	**$3,280.00**

Design, Analysis and Reporting

Project Manager – 20 Hours @ $110/Hour	$2,200.00
Graduate Engineer – 60 Hours @ $70/Hour	$4,200.00
Word Processor – 6 Hours @ $45.00/Hour	$270.00
Principal Engineer – 4 Hours @ $125.00/Hour	$500.00
Subtotal	**$7,170.00**

TOTAL **$10,450.00**

The above estimated fee is based on our understanding of the pavement consulting services anticipated. This estimation may be exceeded if changes in work are required or requested. The estimated maximum fee will not be exceeded however, without the client's prior authorization. Required additions to the above scope of services would be invoiced in accordance with the attached fee schedule.

Schedule

The preparation and planning for the project would begin 3 to 5 days after the notice to proceed is received and the field deflection testing program would begin in 2 to 3 weeks. Analysis of data and pavement design would be presented in an engineering report and would be complete about 2 weeks after completion of field activities. Interim information can be verbally presented

prior to the completion of the final report.

Terms and Conditions

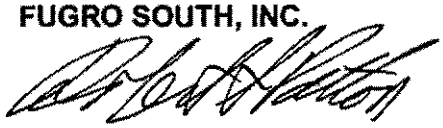
Fees for field work and report preparation are outlined in Schedule P-2002. Schedule 40.01 describes general contractual conditions including identification of client, on-site responsibilities and risks, warranty, invoicing procedures, and record maintenance. Schedules P-2002 and 40.01 are attached to this proposal.

* * *

To indicate acceptance of this proposal, please have the signature block below signed by a duly authorized representative of the client, and return one copy to us for our files. Whoever signs below is identified as our Client as used throughout Schedule 40.01 attached.

We appreciate the opportunity to submit this proposal and look forward to working with you on this project. Please call if we may be of any additional assistance.

Sincerely,
FUGRO SOUTH, INC.



Robert S. Patton, P.E.
Senior Consultant

CLIENT:

.....
Firm Name

.....
Authorizing Signature

.....
Typed Name and Title

.....
Date

GENERAL CONDITIONS FOR TECHNICAL SERVICES

1. Parties to This Agreement
CLIENT as used herein is the entity who authorizes performance of services by Fugro South, Inc. (FUGRO) under the conditions stated herein. FUGRO as used herein includes, Fugro South Inc., its employees and officers, and its subcontractors and subconsultants (including affiliated corporations).

2. On-site Responsibilities and Risks
   2.1 Right-of-Entry. Unless otherwise agreed, CLIENT will furnish unfettered rights-of-entry and obtain permits as required for FUGRO to perform the fieldwork.
   2.2 Damage to Property. FUGRO will take reasonable precautions to reduce damage to land and other property caused by FUGRO's operations. However, CLIENT understands that damage may occur and FUGRO's fee does not include the cost of repairing such damage. If CLIENT desires FUGRO to repair and/or pay for damages, FUGRO will undertake the repairs and add the pre-agreed cost to FUGRO's fee.
   2.3 Toxic and Hazardous Materials. CLIENT will provide FUGRO with all information within CLIENT's possession or knowledge as to the potential occurrence of toxic or hazardous materials, or Biological Pollutants (as defined in 9. below) at the site being investigated. If unanticipated toxic or hazardous materials, or biological pollutants are encountered, FUGRO reserves the right to demobilize FUGRO's field operations at CLIENT's expense. Remobilization will proceed following consultation with FUGRO's safety coordinator and CLIENT's acceptance of proposed safety measures and fee adjustments.
   2.4 Utilities and Pipelines. While performing FUGRO's field work, FUGRO will take reasonable precautions to avoid damage to subterranean and subaqueous structures, pipelines, and utilities. CLIENT agrees to defend, indemnify, and hold FUGRO harmless for any damages to such structures, pipelines, and utilities that are not called to FUGRO's attention and/or correctly shown on plans furnished to FUGRO.
   2.5 Site Safety. FUGRO is not responsible for the job site safety of others, nor does FUGRO have stop-work authority over work by others. However, FUGRO will conduct its work in a safe, workman-like manner, and will observe the work-site safety requirements of CLIENT that have been communicated to FUGRO in writing.

3. Standard of Care
   3.1 FUGRO will perform its services consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions in the same location.
   3.2 CLIENT acknowledges that conditions may vary from those encountered at the location where borings, surveys, or explorations are made and that FUGRO's data, interpretations, and recommendations are based solely on the information available to FUGRO, and FUGRO is not responsible for the interpretation by others of the information developed.

4. **Limitation of Remedies**
To the greatest extent permitted by law, CLIENT's sole remedy against FUGRO for claims and liabilities in any way arising out of or directly or indirectly related to FUGRO's work for CLIENT will not exceed an aggregate limit of $50,000 or the amount of FUGRO's fee, whichever is greater, regardless of the legal theory under which remedy is sought. In the event CLIENT does not wish to limit FUGRO's remedy to this sum, and if CLIENT requests in writing prior to acceptance of this Agreement, FUGRO agrees to negotiate a greater remedy amount in exchange for an increase in scope and fee appropriate to the project and remedy risks involved.

5. Invoices and Payment
At FUGRO's discretion, invoices will be submitted at the completion of task elements, or monthly for services rendered. Payment is due upon presentation of FUGRO's invoice and is past due thirty (30) days from invoice date. CLIENT agrees to pay a financing charge of one percent (1%) per month (or the maximum rate allowable by law, whichever is less), on past due accounts, and agrees to pay attorney's fees or other costs incurred in collecting any delinquent amount.

6. Data, Records, Work Product and Report(s), and Samples
Data, Records, Work Product and Report(s) are FUGRO's property. All pertinent records relating to FUGRO's services shall be retained for a minimum of two (2) years after completion of the work. CLIENT shall have access to the records at all reasonable times during said period. FUGRO will retain samples of soil and rock for a minimum of 30 days after submission of FUGRO's report unless CLIENT advises FUGRO otherwise. Upon CLIENT's written request, for an agreed charge FUGRO will store or deliver the samples in accordance with CLIENT's instructions.

7. Indemnification
FUGRO and CLIENT shall indemnify each other from any claims, damages, losses, and costs, including, but not limited to, reasonable attorney's fees and litigation costs, to the proportionate extent caused by each party's own negligence, including the negligence of the indemnifying party, and its employees, affiliated corporations, officers, and sub-tier parties in connection with the project.

8. Consequential Damages
CLIENT and FUGRO each agree that neither of them will be liable to the other for any consequential damages incurred by either due to the fault of the other, their employees, agents, or subcontractors. Consequential damages include, but are not limited to, loss of use and loss of profit.

9. Biological Pollutants
FUGRO's scope of work does not include the investigation, detection, or design related to the presence of any Biological Pollutants. The term "Biological Pollutants" includes, but is not limited to, mold, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms. CLIENT agrees that FUGRO will have no liability for any claim regarding bodily injury or property damage alleged, arising from, or caused directly or indirectly by the presence of or exposure to any Biological Pollutants. In addition, CLIENT will defend, indemnify, and hold harmless FUGRO from any third party claim for damages alleged to arise from or be caused by the presence of or exposure to any Biological Pollutants. If CLIENT requests in writing prior to acceptance of this Agreement, FUGRO will negotiate a greater limitation amount, and remove CLIENT's responsibilities, in exchange for an increase in fee to develop an expanded scope of work to provide biological pollutant protection.

10. Acceptance of Agreement
These GENERAL CONDITIONS have been established in large measure to allocate certain risks between CLIENT and FUGRO. FUGRO will not initiate service without formal agreement on the terms and conditions set forth in these GENERAL CONDITIONS. Acceptance or authorization to initiate services shall be considered by both parties to constitute formal acceptance of all terms and conditions of these GENERAL CONDITIONS. Furthermore, all preprinted terms and conditions on CLIENT's purchase order or purchase order acknowledgment forms are inapplicable to these GENERAL CONDITIONS and FUGRO's involvement in CLIENT's project.

11. Termination of Contract
CLIENT and FUGRO may terminate services at any time upon ten (10) days written notice. In the event of termination, CLIENT agrees to fully compensate FUGRO for services performed including reimbursable expenses to the termination date, as well as demobilization expenses. FUGRO will terminate services without waiving any claims or incurring any liability.

FEES FOR PAVEMENT ENGINEERING SERVICES

1.	**Field Investigation**	
1.1.	Mobilization and demobilization, per mobilization	$ 2.00/Mile
1.2.	Nondestructive Pavement Deflection Testing	
1.2.1	Falling Weight Deflectometer (daytime)	$ 225.00/Hour
1.2.2	Falling Weight Deflectometer (nighttime)	$ 250.00/Hour
1.2.3	Dynaflect (daytime)	$ 125.00/Hour
1.2.4	Dynaflect (nighttime)	$ 150.00/Hour
1.3	Video edge drain inspection	$ 70.00/Hour
1.4.	Hourly charges for field coordination, layout, and for other reasons beyond our control	$ 100.00/Hour
1.5.	Traffic Control	$ 175.00/Hour
1.6	Per diem for out-of-town assignments, per person	$ 100.00/Night
2.	**Engineering and Technical Personnel**	
2.1.	Senior Consultant	$ 135.00/Hour
2.2.	Senior Project Manager	$ 120.00/Hour
2.3.	Project Manager	$ 110.00/Hour
2.4.	Project Engineer	$ 90.00/Hour
2.5.	Graduate Engineer	$ 70.00/Hour
2.6.	Senior Engineering Technician	$ 60.00/Hour
2.7.	Technician and Draftsperson	$ 45.00/Hour
2.8.	Word Processor	$ 45.00/Hour
3.	**Report Reproduction and Miscellaneous**	
3.1.	Xerox reproduction	$ 0.15/Copy
3.2.	Binding with plastic ring covers	$ 10.00/Copy
3.3.	Outside services, printing, reproduction, etc.	Cost + 15%
3.4.	Computer assistance	Cost + 15%
3.5.	Transportation	$ 0.35/Mile

Rates for other tests and services quoted on request.

FUGRO SOUTH, INC.

2880 Virgo Lane
Dallas, TX 75229
Phone: 972-484-8301
Fax: 972-620-7328

Proposal No. 0703-1176
June 6, 2003

RETURN COPY

Town of Addison
P.O. Box 9010
Addison, Texas 75001-9010

Attn: Mr. Jim Pierce, P.E.
Assistant Public Works Director

Proposal for Pavement Evaluation and Overlay Design of Runway at Addison Airport, Addison, Texas

Fugro South, Inc. is pleased to submit this proposal for the pavement evaluation and design of a runway pavement section at Addison Airport in Addison, Texas. To accomplish this objective the following tasks are anticipated:

Project Level Deflection Testing.
Geotechnical Sampling and Testing
Design, Analysis and Reporting.

The following sections of this proposal describe the scope of our services, a cost estimate for the engineering services to be provided, an estimated schedule, and proposed terms and conditions.

Project Description

The Town of Addison is planning to evaluate the existing pavement section of the existing 7200-foot runway at Addison Airport located near Belt Line Road and Addison Road. The firm of Coffman Associates is performing a master plan and 7 soil borings have been taken through the existing HMAC pavement section.

Project Level Deflection Testing

Nondestructive deflection testing will be performed at a spacing of approximately 100 feet along the center (keel section) and edge (wing section) of the 7,200 foot of runway (approximately 154 test points). The purpose of the deflection test program is to determine the structural response characteristics of the pavement structure to wheel loads as well as variability of the structural

properties along the pavement sections. The deflection testing program will be performed in accordance with ASTM Test Standard D4694 (Standard Test Method for Deflections With a Falling Weight-Type Impulse Load Device) and D4695 (Standard Guide for General Pavement Deflection Measurements). The type of testing to be conducted will be a Level 3 program, for a detailed evaluation of pavement condition.

Pavement Materials Sampling

The material sampling operations may require additional cores and borings to a minimum of 5 feet in depth along the runway at specified locations by the pavement engineer. The additional amount of borings (if any) will be determined after the deflection testing and review of the 7 borings provided by the City of Addison. If additional borings are required, the sampling personnel will identify or note any seepage of water in the underlying pavement and soil layers during the materials sampling program. Thicknesses of each pavement layer will be measured to an accuracy of ¼ in and provided to the pavement engineer. These core holes will be patched using equivalent quality materials. This work will be coordinated by Fugro-South. Fugro-South can provide a proposal for these services if requested.

Design, Analysis and Backcalculation

Using the non-destructive deflection testing data, and borings (which will be provided and will contain pavement layer descriptions and thickness), the roadway will be analyzed to identify those areas that respond differently to loads. Layer moduli will be calculated using the Army Corps of Engineers backcalculation procedures (WESDEF).

Additional information from the City of Addison will be required by Fugro to determine the required thickness of the overlay or other rehabilitation alternatives. This includes the type of aircraft and the anticipated arrivals and departures over the 20-year design period. If changes in aircraft type are expected in the design period, the City of Addison should provide this information as it will have significant impact on the amount of material required to increase the structural capacity of the pavement structure.

Report of Results

An engineering report will be prepared that will document all field work and engineering analyses. All data, test results and pertinent information will be provided in the engineering report. This will include, as a minimum, the following:

1. A general description of the pavement condition based on the deflection testing including deflection profile plots.
2. The results of the backcalculated moduli.

3. The recommended rehabilitation including overlay thickness with construction recommendations.

Cost Estimate

Based on the scope of work outlined above and Fee Schedule P-2002, the following estimated cost for this implementation effort is presented below. It is anticipated that only one night of testing will be required.

Project Level Deflection Testing

Mobilization – 400 Miles @ $2/Mile	$800.00
Security Clearance – 4 Hours @ $70/Hour	$280.00
FWD Testing – 1 night (8 hours @ $250/hour)	$2,000.00
Per Diem – 2 nights @ $100/night	$200.00
(Stand-by time is $75/Hour, if necessary)	
Subtotal	**$3,280.00**

Design, Analysis and Reporting

Project Manager – 20 Hours @ $110/Hour	$2,200.00
Graduate Engineer – 60 Hours @ $70/Hour	$4,200.00
Word Processor – 6 Hours @ $45.00/Hour	$270.00
Principal Engineer – 4 Hours @ $125.00/Hour	$500.00
Subtotal	**$7,170.00**

TOTAL $10,450.00

The above estimated fee is based on our understanding of the pavement consulting services anticipated. This estimation may be exceeded if changes in work are required or requested. The estimated maximum fee will not be exceeded however, without the client's prior authorization. Required additions to the above scope of services would be invoiced in accordance with the attached fee schedule.

Schedule

The preparation and planning for the project would begin 3 to 5 days after the notice to proceed is received and the field deflection testing program would begin in 2 to 3 weeks. Analysis of data and pavement design would be presented in an engineering report and would be complete about 2 weeks after completion of field activities. Interim information can be verbally presented

prior to the completion of the final report.

Terms and Conditions

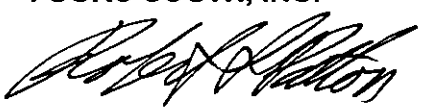
Fees for field work and report preparation are outlined in Schedule P-2002. Schedule 40.01 describes general contractual conditions including identification of client, on-site responsibilities and risks, warranty, invoicing procedures, and record maintenance. Schedules P-2002 and 40.01 are attached to this proposal.

* * *

To indicate acceptance of this proposal, please have the signature block below signed by a duly authorized representative of the client, and return one copy to us for our files. Whoever signs below is identified as our Client as used throughout Schedule 40.01 attached.

We appreciate the opportunity to submit this proposal and look forward to working with you on this project. Please call if we may be of any additional assistance.

Sincerely,
FUGRO SOUTH, INC.



Robert S. Patton, P.E.
Senior Consultant

CLIENT:

.....
Firm Name

.....
Authorizing Signature

.....
Typed Name and Title

.....
Date

GENERAL CONDITIONS FOR TECHNICAL SERVICES

1. Parties to This Agreement
CLIENT as used herein is the entity who authorizes performance of services by Fugro South, Inc. (FUGRO) under the conditions stated herein. FUGRO as used herein includes, Fugro South Inc., its employees and officers, and its subcontractors and subconsultants (including affiliated corporations).

2. On-site Responsibilities and Risks
   2.1 Right-of-Entry. Unless otherwise agreed, CLIENT will furnish unfettered rights-of-entry and obtain permits as required for FUGRO to perform the fieldwork.
   2.2 Damage to Property. FUGRO will take reasonable precautions to reduce damage to land and other property caused by FUGRO's operations. However, CLIENT understands that damage may occur and FUGRO's fee does not include the cost of repairing such damage. If CLIENT desires FUGRO to repair and/or pay for damages, FUGRO will undertake the repairs and add the pre-agreed cost to FUGRO's fee.
   2.3 Toxic and Hazardous Materials. CLIENT will provide FUGRO with all information within CLIENT's possession or knowledge as to the potential occurrence of toxic or hazardous materials, or Biological Pollutants (as defined in 9. below) at the site being investigated. If unanticipated toxic or hazardous materials, or biological pollutants are encountered, FUGRO reserves the right to demobilize FUGRO's field operations at CLIENT's expense. Remobilization will proceed following consultation with FUGRO's safety coordinator and CLIENT's acceptance of proposed safety measures and fee adjustments.
   2.4 Utilities and Pipelines. While performing FUGRO's field work, FUGRO will take reasonable precautions to avoid damage to subterranean and subaqueous structures, pipelines, and utilities. CLIENT agrees to defend, indemnity, and hold FUGRO harmless for any damages to such structures, pipelines, and utilities that are not called to FUGRO's attention and/or correctly shown on plans furnished to FUGRO.
   2.5 Site Safety. FUGRO is not responsible for the job site safety of others, nor does FUGRO have stop-work authority over work by others. However, FUGRO will conduct its work in a safe, workman-like manner, and will observe the work-site safety requirements of CLIENT that have been communicated to FUGRO in writing.

3. Standard of Care
   3.1 FUGRO will perform its services consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions in the same location.
   3.2 CLIENT acknowledges that conditions may vary from those encountered at the location where borings, surveys, or explorations are made and that FUGRO's data, interpretations, and recommendations are based solely on the information available to FUGRO, and FUGRO is not responsible for the interpretation by others of the information developed.

4. Limitation of Remedies
To the greatest extent permitted by law, CLIENT's sole remedy against FUGRO for claims and liabilities in any way arising out of or directly or indirectly related to FUGRO's work for CLIENT will not exceed an aggregate limit of $50,000 or the amount of FUGRO's fee, whichever is greater, regardless of the legal theory under which remedy is sought. In the event CLIENT does not wish to limit FUGRO's remedy to this sum, and if CLIENT requests in writing prior to acceptance of this Agreement, FUGRO agrees to negotiate a greater remedy amount in exchange for an increase in scope and fee appropriate to the project and remedy risks involved.

5. Invoices and Payment
At FUGRO's discretion, invoices will be submitted at the completion of task elements, or monthly for services rendered. Payment is due upon presentation of FUGRO's invoice and is past due thirty (30) days from invoice date. CLIENT agrees to pay a financing charge of one percent (1%) per month (or the maximum rate allowable by law, whichever is less), on past due accounts, and agrees to pay attorney's fees or other costs incurred in collecting any delinquent amount.

6. Data, Records, Work Product and Report(s), and Samples
Data, Records, Work Product and Report(s) are FUGRO's property. All pertinent records relating to FUGRO's services shall be retained for a minimum of two (2) years after completion of the work. CLIENT shall have access to the records at all reasonable times during said period. FUGRO will retain samples of soil and rock for a minimum of 30 days after submission of FUGRO's report unless CLIENT advises FUGRO otherwise. Upon CLIENT's written request, for an agreed charge FUGRO will store or deliver the samples in accordance with CLIENT's instructions.

7. Indemnification
FUGRO and CLIENT shall indemnity each other from any claims, damages, losses, and costs, including, but not limited to, reasonable attorney's fees and litigation costs, to the proportionate extent caused by each party's own negligence, including the negligence of the indemnitying party, and its employees, affiliated corporations, officers, and sub-tier parties in connection with the project.

8. Consequential Damages
CLIENT and FUGRO each agree that neither of them will be liable to the other for any consequential damages incurred by either due to the fault of the other, their employees, agents, or subcontractors. Consequential damages include, but are not limited to, loss of use and loss of profit.

9. Biological Pollutants
FUGRO's scope of work does not include the investigation, detection, or design related to the presence of any Biological Pollutants. The term "Biological Pollutants" includes, but is not limited to, mold, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms. CLIENT agrees that FUGRO will have no liability for any claim regarding bodily injury or property damage alleged, arising from, or caused directly or indirectly by the presence of or exposure to any Biological Pollutants. In addition, CLIENT will defend, indemnify, and hold harmless FUGRO from any third party claim for damages alleged to arise from or be caused by the presence of or exposure to any Biological Pollutants. If CLIENT requests in writing prior to acceptance of this Agreement, FUGRO will negotiate a greater limitation amount, and remove CLIENT's responsibilities, in exchange for an increase in fee to develop an expanded scope of work to provide biological pollutant protection.

10. Acceptance of Agreement
These GENERAL CONDITIONS have been established in large measure to allocate certain risks between CLIENT and FUGRO. FUGRO will not initiate service without formal agreement on the terms and conditions set forth in these GENERAL CONDITIONS. Acceptance or authorization to initiate services shall be considered by both parties to constitute formal acceptance of all terms and conditions of these GENERAL CONDITIONS. Furthermore, all preprinted terms and conditions on CLIENT's purchase order or purchase order acknowledgment forms are inapplicable to these GENERAL CONDITIONS and FUGRO's involvement in CLIENT's project.

11. Termination of Contract
CLIENT and FUGRO may terminate services at any time upon ten (10) days written notice. In the event of termination, CLIENT agrees to fully compensate FUGRO for services performed including reimbursable expenses to the termination date, as well as demobilization expenses. FUGRO will terminate services without waiving any claims or incurring any liability.

FEES FOR PAVEMENT ENGINEERING SERVICES

1.	**Field Investigation**	
1.1.	Mobilization and demobilization, per mobilization	$ 2.00/Mile
1.2.	Nondestructive Pavement Deflection Testing	
	1.2.1 Falling Weight Deflectometer (daytime)	$ 225.00/Hour
	1.2.2 Falling Weight Deflectometer (nighttime)	$ 250.00/Hour
	1.2.3 Dynaflect (daytime)	$ 125.00/Hour
	1.2.4 Dynaflect (nighttime)	$ 150.00/Hour
1.3	Video edge drain inspection	$ 70.00/Hour
1.4.	Hourly charges for field coordination, layout, and for other reasons beyond our control	$ 100.00/Hour
1.5.	Traffic Control	$ 175.00/Hour
1.6	Per diem for out-of-town assignments, per person	$ 100.00/Night
2.	**Engineering and Technical Personnel**	
2.1.	Senior Consultant	$ 135.00/Hour
2.2.	Senior Project Manager	$ 120.00/Hour
2.3.	Project Manager	$ 110.00/Hour
2.4.	Project Engineer	$ 90.00/Hour
2.5.	Graduate Engineer	$ 70.00/Hour
2.6.	Senior Engineering Technician	$ 60.00/Hour
2.7.	Technician and Draftsperson	$ 45.00/Hour
2.8.	Word Processor	$ 45.00/Hour
3.	**Report Reproduction and Miscellaneous**	
3.1.	Xerox reproduction	$ 0.15/Copy
3.2.	Binding with plastic ring covers	$ 10.00/Copy
3.3.	Outside services, printing, reproduction, etc.	Cost + 15%
3.4.	Computer assistance	Cost + 15%
3.5.	Transportation	$ 0.35/Mile

Rates for other tests and services quoted on request.

Jim Pierce

From: Nishantha Bandara [nbandara@dynatest.com]
Sent: Tuesday, June 03, 2003 11:05 AM
To: Jim Pierce
Subject: Proposal for HWD testing on Addison Airport runway

Hello Jim,

Please find our proposal for HWD testing, GPR testing and analysis for the above airport.

As I indicated in the proposal, if the testing is performed in the month of July, we can offer the reduced rate for GPR testing since the GPR unit will be in Texas at that time. Otherwise, WaveTech-GeoVision has to mobilize the unit from California and the cost will be higher.

Please do not hesitate to contact me if you have any questions or need additional information.

Thank you,

Nishan

Nishantha Bandara, Ph.D, P.E.
Dynatest Consulting, Inc.
13953 US Highway 301 South
Starke, FL 32091 USA

Phone: 904-964-3777
Fax: 904-964-3749
www.dynatest.com
<<Proposal for Addison Airport Testing.doc>> <<Annual Aircraft Operations.doc>>

Dynatest®

DYNATEST CONSULTING, INC.

13953 US Highway 301 South
Starke, Florida 32043 USA
Telephone +1 904 964-3777
FAX +1 904 964-3749

Webpage: www.dynatest.com
E-mail: usa@dynatest.com

Pavement Engineering Specialists
and Equipment

June 3, 2003

Mr. Jim Pierce, P.E.
Assistant Public Works Director
Town of Addison
P.O. Box 9010
Addison, TX 75001-9010

Tel: (972) 450-2879

Re: Nondestructive Testing and Analysis for Addison Airport Runway

Dear Mr. Pierce:

I appreciate your allowing us to provide this proposal for nondestructive testing and analysis on the above mentioned airport. We look forward to working with you on this project.

Dynatest proposes to utilize its Heavy Weight Deflectomber to collect pavement surface deflection data on this runway. The deflections will be used along with traffic data and pavement thickness information obtained from pavement corings and Ground Penetration Radar (GPR) testing to determine the overall structural condition of the runway. Specifically, Dynatest will utilize this data to calculate the approximate remaining life at each point tested. If the remaining life is found to be deficient, the asphalt overlay thickness required to achieve the desired service life (20 years) will be calculated as well.

We propose to test at 50 ft. intervals along three lines, one along the runway centerline and the other two on either side of the centerline. Each series of test points will be staggered by roughly 16 ft. (in the longitudinal direction) with respect to the previous series to improve coverage. The total number of test points is estimated at 432 which will require 16 hours to complete assuming we have continuous access to the runway at 8 hour shifts. Thus we can anticipate 2 workdays to complete the testing portion of the job. If the testing is extended more than 16 hours due to accessibility limitations, additional testing time will be charged at $240 per hour. We can work either during daylight hours or at night, whichever is most productive or convenient for the airport.

Dynatest®

WaveTech-GeoVision will provide the Ground Penetration Radar (GPR) testing services and subsequent layer thickness data at each HWD testing locations. The cost estimate for GPR testing and analysis services is included as a separate item in our cost proposal.

My estimate to perform this work is as follows:

Item	*Quantity*	*Unit Cost*	*Total*
Mobilization	16 hrs.	$175/hr	$2,800
Perdiem	5 days	$135/day	$675
Data Collection	16 hrs.	$240/hr	$3,840
Engineering Analysis	48 hrs.	$100/hr	$4,800
Admin Assistant	8 hrs.	$45/hr	$360
Engineering Report	1 ea.	$500	$500
		Sub Total	***$12,975***
GPR testing and Analysis*	Lump sum		***$6,450***
		Total	***19,425***

*This estimate is assuming the testing will be performed during the month of July; otherwise the cost estimate for GPR testing/analysis will be increased to $10,475.

In order to complete the analysis, we require:

- traffic projections (aircraft types, annual number of operations for each type, annual growth factors) as shown in the attached sheet
- Autocad or other electronic plans/drawings of the runway

I appreciate the opportunity to provide this quote and look forward to working with Town of Addison on this project. If you have any questions, or require additional information, please do not hesitate to contact me at the numbers above or by email at nbandara@dynatest.com.

Sincerely,

NBandara

DYNATEST CONSULTING, INC.
Nishantha Bandara, Ph.D., P.E.
Staff Engineer

Predicted Number of Annual Aircraft Operations

Aircraft	Annual Number of Operations	Anticipated Growth Rate (%)

625 Grants

623/56570 @ 0.5 M

Funds available for Runway Pavement Evaluation

MACTEC

June 6, 2003

Mr. James C. Pierce, Jr., P.E.
Assistant Public Works Director
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Subject: **Proposal for Runway Evaluation - Addison Airport**
MACTEC Proposal No. PROP03DALL-0295

Dear Mr. Pierce:

MACTEC is pleased to provide this proposal for pavement evaluation services at Addison Airport, Texas.

OBJECTIVE AND SCOPE OF WORK

We understand that the Town of Addison is currently working with the FAA and Coffman Associates Airport Consultants to develop an updated master plan for the airport. In support of this planning effort the Town of Addison wishes to undertake an evaluation of the existing RW 15/33. The runway is constructed of asphalt concrete and is approximately 7200 ft long and 100 ft wide. Thickness of the asphalt concrete layer is reported to vary from 7 to 15 inches.

The objective of this work is to provide the Town of Addison with an evaluation of the existing condition of the runway pavement and preliminary design alternatives for rehabilitation or reconstruction, to support the master planning activity.

Our effort is proposed in accordance with FAA Advisory Circular AC 150/5320-6D for pavement evaluations. Detailed design (plans, specifications and estimates) of the selected rehabilitation option is not within the scope of this proposal. Additional materials sampling and testing beyond that proposed here will be required at a later date to comply with FAA requirements for detailed design.

To conduct this work, MACTEC will perform the following tasks:

Task 1. Pavement Inspection and Testing

We understand inspection and testing will be coordinated with airport operations staff, and likely scheduled to occur at night. Any required FAA permits/documents should be obtained for our employees by the Town of Addison.

MACTEC will perform visual condition surveys of the existing asphalt pavement in accordance with procedures adopted by the Federal Aviation Administration and outlined in ASTM D5340 "Standard Test Method for Airport Pavement Condition Index Surveys." The surveys will be completed on a sample basis at a nominal coverage of 50% of the surface area over a three-day (equivalent) period. We recommend this level of inspection based upon the age and likely condition of the runway. Although PCI inspections can be conducted using light cart operations, as a minimum we will require some twilight hour access to the runway.

We will conduct two days (equivalent) of nondestructive testing using a MACTEC owned and operated Dynatest Model 8002 Falling Weight Deflectometer. Testing will be conducted along six adjacent lines across the width of the runway separated by a minimum of 10 ft. Spacing between test points will range from 100 to 300 ft in accordance with Advisory Circular AC 150/5370-11B "Use of Nondestructive Testing in the Evaluation of Airport Pavements."

Based upon boring results previously conducted by Reed Engineering and provided to MACTEC to support this proposal, we note considerable variation in the thickness of the existing pavement. We propose to perform one day (equivalent) of additional pavement coring to determine pavement structure thickness. Locations will be selected based upon pavement variations determined from FWD test results.

Task 2. Data Analysis and Pavement Design

Based upon information obtained in Task 1 and other information that the Town of Addison may provide to us, we will evaluate the existing pavement structural and functional condition, and develop alternative preliminary designs.

We will require summary aircraft traffic information from the Town of Addison or Coffman Associates, and we will rely on this information in our analysis. Any drawings or documentation that the Town of Addison is able to provide pertaining to original construction and subsequent maintenance and rehabilitation will aid in the evaluation process.

Design alternatives will include rehabilitation options based upon 8 and 15-year design lives (or substitute analysis periods specified by the Town of Addison), and reconstruction.

Task 3. Reporting

A final report will be prepared which presents the technical approach, existing structural and functional condition of the pavement, results of our analysis, and pavement design options. We will report all data and information used in the analysis.

COMPENSATION, SCHEDULE AND TERMS

MACTEC's firm-fixed price to complete the effort as described above is **$24,990**. On a task basis, the pricing is broken down as follows:

Task 1. Pavement Inspection and Testing	$15,195
Task 2. Data Analysis and Pavement Design	$ 6,545
Task 3. Reporting	$ 3,250

We understand that the Town of Addison wishes to have preliminary design options by early to mid July. To accomplish this, we will require Notice to Proceed by June 12, 2003 and cooperation from airport operations to promptly schedule FWD testing, pavement inspections and coring. Aircraft traffic information and any supporting construction records will be required no later than June 25, 2003 to support timely analysis.

If this proposal meets your approval, please complete the attached Proposal/Work Acceptance Sheet (PWAS) and return it to our offices. The work will be performed in accordance with the scope of work outlined in this letter and the Terms and Conditions contained in the PWAS. Our price is valid for thirty days from the date of this proposal.

We look forward to working with you on this project. If you have any questions or concerns, please feel free to contact us.

Sincerely,
MACTEC Engineering and Consulting, Inc.
Formerly known as,
Law Engineering and Environmental Services, Inc.

Amy L. Simpson WITH PERMISSION BY ALS

Amy L. Simpson, Ph.D., P.E. (TX)
Senior Engineer

Patrick D. Bolton WITH PERMISSION BY mce

Patrick D. Bolton, P.E. (TX)
Principal
Assistant Vice President

MACTEC

PROPOSAL/WORK ACCEPTANCE SHEET

Project Name ("Project"): Runway Evaluation - Addison Airport

Proposal No.: PROP03DALL-0295

Project Location ("Site"): Addison Airport, Addison, Texas **Office Designation: Dallas**

CLIENT INFORMATION

Client Name: Town of Addison

Attention: Mr. James C. Pierce, Jr.

Address: 16801 Westgrove Drive, Addison, Texas 75001

Telephone Number: **Fax Number:**

TERMS AND CONDITIONS

1. **SERVICES TO BE PROVIDED. MACTEC Engineering and Consulting, Inc** ("MACTEC") is an independent consultant and agrees to provide the Services to CLIENT for its sole benefit and exclusive use. There are no third party beneficiaries to this Agreement, except as permitted by MACTEC in writing.

2. **DEFINITIONS.** These terms will have the following meanings when used in this Agreement:
   a. Claims - All actions, suits, arbitrations, administrative proceedings, demands and claims for any and all damages, injunctive or any other relief based upon any cause of action whatsoever.
   b. Contaminants - Asbestos, fungal, bacterial, viral or any other hazardous or toxic substances, pollutants and constituents.
   c. Environmental Health and Safety Claims - All Claims related to or arising out of exposure to or release of Contaminants at or from the Site, before, during or after performance of the Services.
   d. Environmental Liabilities - All Liabilities related to or arising out of any and all Environmental Health and Safety Claims.
   e. Indemnitees - MACTEC, its parent, subsidiaries, affiliates and subcontractors, including their respective officers, directors, employees, principals, partners, agents, successors and assigns.
   f. Liabilities - All liabilities, damages, losses, costs, expenses, settlements, judgments, awards, and governmental penalties and sanctions, including reasonable attorneys' and experts' fees, including those attributable to bodily injury (including death), personal injury and property damage.
   g. Materials - Used storage tanks or any associated equipment, contaminated soils or materials.
   h. Orders - Any orders or other form writings issued or signed by the parties, such as purchase orders or work orders.
   i. Samples - Specimens or representative pieces, segments or the like and/or the residue therefrom.
   j. Services – The consulting services set forth in the attached Scope of Authorized Work.
   k. Use or Used – Any distribution, publication, use or reuse of Work Product.
   l. Wastes - Surpluses, by-products, residues and the like and/or fluids produced by the Services.
   m. Work Product - All documents, whether a work-in-progress or final and paid for or not, including, but not limited to, analyses, drawings, specifications, reports and related documents generated by MACTEC under this Agreement.

3. **STANDARD OF CARE.** MACTEC will perform the Services using that degree of skill and care ordinarily exercised under similar conditions by reputable members of MACTEC's profession practicing in the same or similar locality at the time of performance. NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS MADE OR INTENDED AND THE SAME ARE SPECIFICALLY DISCLAIMED.

   CLIENT shall not be entitled to assert a Claim against MACTEC based on any theory of professional negligence or violation of the standard of care unless and until CLIENT has obtained the written opinion from a licensed, independent and reputable engineering and/or environmental professional, as appropriate for the Services in question, that MACTEC has violated the standard of care applicable to MACTEC's performance of those Services under this Agreement. CLIENT shall promptly provide such independent opinion to MACTEC and the parties shall endeavor in good faith to resolve the claim within 30 days. If MACTEC fails to perform the Services in accordance with the applicable Standard of Care, CLIENT agrees that the damages for which MACTEC shall be liable are limited to that proportion of such damages which is attributable to MACTEC's percentage of fault, subject to the limitations otherwise set forth in Sections 4 and 5 of this Agreement. In any event, any claims that CLIENT may bring against MACTEC with respect to the Services to be performed by MACTEC must be commenced within one (1) year after the date of the report which MACTEC issues with respect to those Services.

4. **LIMITATION OF LIABILITY.** THE INCLUSION OF A LIMITATION OF LIABILITY PROVISION IN THIS AGREEMENT UNDER THE TERMS SET FORTH BELOW IS A MATERIAL CONSIDERATION FOR MACTEC'S WILLINGNESS TO PERFORM THE SERVICES. TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW AND FOR ADDITIONAL CONSIDERATION OF $10.00 FROM MACTEC, CLIENT HEREBY EXPRESSLY AGREES THAT THE LIABILITY OF MACTEC, ITS PARENT, SUBSIDIARIES, AFFILIATES AND SUBCONTRACTORS, INCLUDING THEIR RESPECTIVE OFFICERS, DIRECTORS, EMPLOYEES, AGENTS, SUCCESSORS AND ASSIGNS, FOR ANY AND ALL CAUSES OF ACTION WHATSOEVER, ARISING OUT OF OR IN CONNECTION WITH THIS AGREEMENT, AND/OR ANY SERVICES PERFORMED AND WORK PRODUCT DEVELOPED PURSUANT TO THIS AGREEMENT, EXCEPT FOR THOSE CAUSES OF ACTION FOR BODILY INJURY (INCLUDING DEATH) AND/OR PROPERTY DAMAGE RESULTING FROM AN OCCURRENCE CAUSED BY MACTEC DURING THE PERFORMANCE OF ITS FIELD OPERATIONS, SHALL BE LIMITED TO THE AGGREGATE SUM, INCLUSIVE OF AMOUNTS PAID TO SECONDARY CLIENTS, IF ANY, TO WHOM WORK PRODUCT IS PROVIDED UNDER A SECONDARY CLIENT AGREEMENT WITH MACTEC AND TO ANY OTHER THIRD PARTIES, INCLUDING ATTORNEYS' FEES AND ALL OTHER LITIGATION COSTS AND EXPENSES, IF ANY, THAT MACTEC IS OBLIGATED TO PAY, OF $50,000 OR THE TOTAL FEES PAID TO MACTEC BY CLIENT UNDER THIS AGREEMENT, WHICHEVER IS GREATER. ALL THIRD PARTY BENEFICIARIES TO THIS AGREEMENT, IF ANY, ARE INTENDED TO BE AND HEREBY ARE BOUND BY THE TERMS OF THIS LIMITATION OF LIABILITY AND THE AGGREGATE LIMITATION OF LIABILITY CONTAINED HEREIN.

5. **INDIRECT DAMAGES.** NEITHER PARTY SHALL BE RESPONSIBLE TO THE OTHER OR TO ANY THIRD PARTY FOR ANY ECONOMIC, CONSEQUENTIAL OR INCIDENTAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, LOSS OF USE, INCOME, PROFITS, FINANCING OR REPUTATION) ARISING OUT OF OR RELATING TO THIS AGREEMENT OR THE PERFORMANCE OF THE SERVICES.

6. **ARBITRATION**. Any controversy or Claim arising out of this Agreement, or the breach thereof, shall be settled by binding arbitration administered by the American Arbitration Association (AAA), or such other binding arbitration as mutually agreed to by the parties. AAA arbitration shall be administered under its Construction Industry Arbitration Rules, or its Commercial Arbitration Rules, whichever the arbitrator(s) deem more applicable. Judgment on the award rendered by the arbitrator(s) shall be final and may be entered, in accordance with applicable law, in any court having jurisdiction thereof. Notwithstanding anything above to the contrary, the parties agree that the arbitration shall be held in Atlanta, Georgia.

7. **DOCUMENTS**. MACTEC will furnish CLIENT with the agreed-upon number of written reports and supporting documents. All Work Product shall be MACTEC's sole property, as author and owner, and MACTEC hereby reserves and shall retain all common law, statutory and other rights thereto, including copyrights. MACTEC may retain copies of any or all Work Product and CLIENT-provided documents. CLIENT agrees that all Work Product furnished to CLIENT or its agents or designees, if not paid for or if improperly Used, will be returned upon demand and will not be Used for any purpose whatsoever. CLIENT acknowledges that the Work Product is intended for the exclusive use and benefit of, and may be relied upon only by, CLIENT. CLIENT agrees that under no circumstances shall any Work Product be used at any location or for any project not expressly provided for in this Agreement without MACTEC's prior written permission. CLIENT does not require MACTEC's permission for regulatory submittal of the Work Product, reliance on the Work Product by CLIENT's design team, of which MACTEC is a member, solely for the design of the projeet for which the Work Product was intended, or for disclosure of the Work Product without the right to rely. If CLIENT wishes to distribute any Work Product for relianee to any third party to which distribution for reliance is not authorized above, CLIENT and the third party must first execute MACTEC's Seeondary Client Agreement. MACTEC makes no representation as to and specifically disclaims any express or implied warranties as to the suitability of any Work Produet for any such third party's purposes. CLIENT acknowledges that a request for MACTEC to release any Work Product to a third party ereates a potential conflict of interest and agrees that any such request shall serve as a waiver by CLIENT of any such conflict. CLIENT agrees to defend, indemnify and hold Indemnitees harmless from and against all Claims and Liabilities related to or arising from any unauthorized Use of the Work Product. Upon CLIENT's request, Work Product may be provided on electronic media; however, the written copy retained by MACTEC shall be the official document. The electronic copy is subject to all conditions contained in this Agreement. MACTEC makes no representation or warranty and specifically disclaims any express or implied warranty that the electronic copy is accurate or complete. Any modifications of the electronic eopy by CLIENT shall be at CLIENT's sole risk and without liability to MACTEC. CLIENT further acknowledges that (i) the Work Product may be based in part or in whole on facts and/or assumptions provided to, but not independently verified by, MACTEC, (ii) the Work Product will reflect MACTEC's findings as to conditions that existed at the time the Services were performed and may not reflect conditions at a later time and (iii) MACTEC makes no representations as to such conditions subsequent to the time the Services were performed or with respect to any facts or assumptions provided to, but not independently verified by, MACTEC.

8. **SITE RESPONSIBILITY**. CLIENT will arrange for right-of-entry to the Site and will execute any necessary site access agreement. CLIENT shall provide MACTEC with an accurate description of the Site, all available Site information, and all documents deemed necessary by MACTEC. The Services do not include supervision or direction of the means, methods or actual work of contractors, other professionals or consultants not retained by MACTEC. The presence of MACTEC's representative will not relieve any such contractor, other professional or consultant of its responsibility to perform its work and services in accordance with its contractual and legal obligations and in conformity with the plans and specifications for the Project. CLIENT agrees that each contractor or subcontractor not retained by MACTEC shall be solely responsible for: (i) working conditions on the Site; (ii) security and safety of persons and property during the performance of its work; (iii) compliance with OSHA regulations; and (iv) providing any and all safety equipment necessary for the protection of its personnel. MACTEC's monitoring of any contractor's or any subcontractor's procedures is not intended to include a review of the adequacy of such contractor's or subcontractor's safety measures on or near the Site. It is agreed that MACTEC is not responsible for safety or security at the Site, other than for MACTEC's employees, and that MACTEC does not have the right or duty to stop the work of others.

9. **PRIORITY OVER FORM AGREEMENTS/PURCHASE ORDERS**. The parties agree that the provisions of this Agreement shall control and govern over any Orders, and that Orders may be issued by CLIENT to, or accepted by, MACTEC without altering the terms hereof, regardless of any contrary language appearing therein, unless the parties specify in writing that such contrary term(s) apply to the Services which are the subject of such Orders.

NOTE: SECTIONS 10 – 12 SHALL APPLY IF SAMPLING OR OTHER INTRUSIVE SERVICES ARE PART OF MACTEC'S SCOPE OF SERVICES.

10. **SITE OPERATIONS**. Unless expressly stated otherwise, MACTEC's proposal or opinion of costs does not include the costs associated with surveying the Site to determine accurate horizontal and vertical locations of any tests, borings or well installation locations. CLIENT will be responsible for establishing test or boring locations. If surveying is required, such services will be provided by CLIENT or secured by MACTEC upon written request of CLIENT and at CLIENT's expense. Field tests or boring locations described in MACTEC's report or shown on sketches are based on specific information furnished by others or estimates made in the field by MACTEC's personnel. Such dimensions, depths or elevations are approximations. Unless expressly stated otherwise, MACTEC's charges do not include the costs of restoration of damage which is reasonably incidental to the performance of the Services. MACTEC shall not be responsible for any damage or loss due to undisclosed or unknown surface or subsurface conditions on the property owned or leased by CLIENT or third parties, except to the extent such damage or loss is a result of MACTEC's sole negligence. CLIENT shall defend, indemnify and hold Indemnitees harmless from and against all Liabilities and Claims related to or arising from such undisclosed or unknown surface or subsurface conditions, except to the extent such Liabilities and/or Claims are determined to have been caused solely by the negligence of MACTEC.

11. **ENVIRONMENTAL INDEMNITY**. CLIENT (i) hereby releases Indemnitees from all Environmental Health and Safety Claims and (ii) shall defend, indemnify and hold Indemnitees harmless from and against all Environmental Liabilities, except to the extent such Environmental Health and Safety Claims and/or Environmental Liabilities are determined to have been caused solely by the negligence of, or the willful violation of any applicable environmental health or safety law by, MACTEC.

12. **SAMPLE AND WASTE DISPOSAL**. Samples generally are consumed or altered during testing and are disposed of immediately upon completion of the tests. If CLIENT wishes MACTEC to retain any Samples, at CLIENT's written request, MACTEC will use its best efforts to retain preservable Samples, but only for a mutually acceptable time and for an additional charge. MACTEC reserves the right to refuse storage of any Samples. CLIENT agrees that MACTEC is not responsible or liable for loss of Samples retained in storage. If CLIENT requests MACTEC to containerize Wastes, CLIENT will provide a secure storage location at or near the Site to prevent tampering with the Wastes. Non-hazardous Wastes will be disposed of by MACTEC for an additional charge at an appropriately licensed facility.

In the event that Samples or Wastes contain Contaminants, MACTEC will either (i) return the Samples or Wastes to CLIENT for proper disposal or (ii) using a manifest signed by CLIENT as generator and for an additional fee, have the Samples or Wastes transported to a location selected by CLIENT for final disposal. In such event, CLIENT acknowledges and agrees that MACTEC will be acting solely as agent for CLIENT and will at no time assume title, constructive or express, to any Samples or Wastes. CLIENT agrees to pay all costs associated with the storage, transport, and disposal of Samples and Wastes.

Should MACTEC be requested as part of the Services to hire a subcontractor for the removal of any Materials from the Site, title to the Materials will remain with CLIENT, and MACTEC will act solely as an agent for CLIENT in arranging for and coordinating the removal and transport of the Materials by MACTEC's subcontractor. At no time will MACTEC or its subcontractor take title, constructive or express, to the Materials, and all manifests incidental to such Services shall be executed by CLIENT. If CLIENT wishes MACTEC to execute the manifests, CLIENT shall provide written authorization for MACTEC to sign solely as an agent for CLIENT, and CLIENT hereby expressly agrees to remain the sole generator of such Materials. CLIENT shall defend, indemnify and hold Indemnitees harmless from and against all Liabilities and Claims resulting from the rendering of Services as set forth in this Section 11, except to the extent such Liabilities and/or Claims are determined to have been caused solely by the negligence of, or the willful violation of any applicable environmental law by, MACTEC.

13. **UNANTICIPATED CONDITIONS.** CLIENT agrees to advise MACTEC of all known Contaminants and conditions existing on or near a Site that present a potential danger to health, the environment or MACTEC's equipment, if any. Should MACTEC encounter conditions on or near any Site which were not reasonably anticipated and/or which increase the risk involved in MACTEC's performance of the Services, upon notice to CLIENT, MACTEC, in its sole discretion, may (i) continue to perform the Services to completion, (ii) suspend activities and prepare a Change Order Request prior to proceeding or (iii) terminate all Services. Such termination shall not be a breach of this Agreement by MACTEC. In the event that the unanticipated condition is the presence of any Contaminants or other condition that presents a potential danger to health, safety, the environment or MACTEC's equipment, MACTEC has no obligation to assume, and does not assume, control of or responsibility for the Site or the person(s) in charge of the Site, or responsibility to report any such Contaminants or conditions to any federal, state or local authority. In such event, CLIENT agrees to notify the appropriate federal, state or local agencies, as required by law, and otherwise to disclose in a timely manner any information that may be necessary to ensure Site safety and to prevent damage to health and/or the environment. CLIENT acknowledges that MACTEC may be required to provide such notice or to make such disclosures if CLIENT fails to do so and agrees to hold MACTEC harmless therefor.

14. **TESTIMONY.** Should MACTEC or any employee of MACTEC be requested by any party, including CLIENT, or compelled by law to provide testimony (either as a fact or expert witness), produce documents or provide other evidence in a proceeding with respect to the Project or the Services to which MACTEC is not a party, CLIENT shall compensate MACTEC for its preparations, document retrieval and reproduction, and testimony at 2.0 times the rates shown on its then current Fee Schedule. CLIENT also agrees to reimburse MACTEC for reasonable travel, lodging and meal expenses that are incurred in conjunction with providing the above testimony and other related services.

15. **EXCUSABLE DELAY.** MACTEC shall not be in breach of this Agreement nor liable for damages due to delay or failure to perform any obligation under this Agreement if such delay or failure results from circumstances beyond the control of MACTEC. In the event of such delay, the time for MACTEC's performance shall be extended for the duration of the delay.

16. **INTELLECTUAL PROPERTY.** Unless expressly stated otherwise, MACTEC's proposal or opinion of costs does not include the costs associated with a search for the existence and procurement of any patent, copyright, service mark or trademark licenses, rights or other entitlements which are applicable to the Services, if any. CLIENT hereby releases Indemnitees from, and shall defend, indemnify and hold Indemnitees harmless against, all Claims and Liabilities caused by, resulting from, arising out of or occurring due to the infringement of patents, copyrights, service marks or trademarks by MACTEC, except to the extent such Claims and Liabilities are determined to have been caused solely by the negligence of MACTEC.

17. **ADVERTISING.** CLIENT agrees that MACTEC in any manner may advertise and publish the fact that MACTEC has contracted to furnish CLIENT with Services, as well as use any trademark, service mark and trade names of CLIENT in MACTEC's advertising and promotional materials, web sites, client lists, etc. MACTEC agrees not to publish any confidential information provided by CLIENT.

18. **PAYMENT TERMS.** CLIENT agrees to pay each and every one of MACTEC's invoices upon receipt, time being of the essence. If payment is not received by MACTEC within 30 days from the date of MACTEC's invoice, CLIENT agrees to pay the lesser of 1% per month or the maximum legal rate on the past due amount until the amount is paid in full, plus the hourly rate for the time of MACTEC's employees, reasonable attorneys' fees and all other costs incurred by MACTEC in collecting the amounts due MACTEC under this Agreement. If CLIENT reasonably objects to all or any portion of an invoice, CLIENT shall notify MACTEC in writing within 10 days from the date of receipt of MACTEC's invoice, give reasons for the objection, and pay that portion of the invoice not in dispute. Failure of CLIENT to provide such written notice within the allowed 10 day period shall be deemed to be a waiver of all objections to that invoice. MACTEC may suspend any and all of the Services if payment of any invoiced amount not reasonably in dispute is not received by MACTEC within 60 days from the date of MACTEC's invoice.

19. **INSURANCE.** MACTEC maintains the following insurance coverages:
    a. Workers' Compensation Insurance – statutory amount.
    b. Commercial General Liability Insurance - $1,000,000 per occurrence/$2,000,000 aggregate.
    c. Automobile Liability Insurance- $1,000,000 combined single limit.
    d. Professional Errors & Omissions - $1,000,000 per claim/$1,000,000 aggregate.

20. **GOVERNING LAW.** This Agreement shall be governed by the laws of the State of Georgia. Each of the parties acknowledges that it has had an opportunity to review and negotiate this Agreement, and this Agreement shall not be construed more strictly against one party as drafter.

21. **OPINIONS OF COST.** If included in the Services, MACTEC will provide opinions of cost for installation of materials, remediation or construction based upon MACTEC's experience on similar projects. However, such opinions are not intended for use in firm budgeting or negotiation unless specifically agreed otherwise in advance by MACTEC in writing. CLIENT understands the actual cost of work depends on many factors beyond MACTEC's control and may vary significantly from MACTEC's opinion.

22. **TERMINATION.** Either party may terminate this Agreement without cause upon 14 days' prior written notice. In such event, CLIENT shall take possession of the Site and the materials and equipment paid for and belonging to CLIENT, and MACTEC shall be paid for all Services performed to the date of termination. In the event CLIENT requests termination without cause, MACTEC shall also be paid all reasonable expenses and costs incurred in Project close out. This Agreement will terminate automatically and without notice upon the insolvency of, or upon the filing of a bankruptcy petition by or against, CLIENT.

23. **SURVIVAL.** All of CLIENT's obligations and liabilities, including, but not limited to, its indemnification obligations and limitations, and MACTEC's rights and remedies with respect thereto, shall survive completion of the Services and the expiration or termination of this Agreement.

24. **SEVERABILITY.** In the event any provision of this Agreement is deemed invalid or unenforceable, the remaining provisions shall continue in full force and effect, and the invalid or unenforceable provision shall be interpreted and enforced as closely as possible to the intent of the parties.

25. **ASSIGNMENT.** This Agreement may not be assigned by either party without the prior written permission of the other. CLIENT acknowledges that MACTEC may subcontract portions of the Services to its affiliated companies and/or utilize employees of its affiliated companies in performing the Services, without the approval of CLIENT.

26. **INTEGRATION.** This Agreement, its attachments and all Orders, if any, constitute the entire Agreement between the parties and supersede any previous written or oral contracts or negotiations. This Agreement can be changed only by a written instrument signed by both parties.

27. **ATTORNEY AUTHORITY.** If MACTEC is being retained by CLIENT's counsel, such counsel represents that he or she has reviewed this Agreement with CLIENT, has provided CLIENT with a copy hereof, and by its signature hereto has the authority to bind, and hereby expressly binds, CLIENT to the terms and conditions of this Agreement.

28. **CONSIDERATION.** Each grant of indemnity hereunder is intended to be to the maximum extent permitted by law and for additional consideration of $10.00 from MACTEC. The parties agree that the charges for the Services are sufficiently adjusted to include any specific consideration recited herein as being payable to CLIENT, the receipt and sufficiency of which are hereby acknowledged by CLIENT.

SCOPE OF AUTHORIZED WORK

Please refer to MACTEC proposal number PROP03DALL-0295, June 9, 2003 or as described below:

Accepted this

_____ day of _____ 200___	_____ day of _____ 200___
MACTEC Engineering and Consulting, Inc	Town of Addison
_____	_____
Signature of Authorized MACTEC Representative	Signature of Authorized CLIENT Representative
_____	_____
Print Name and Title	Print Name and Title

THIS SECTION FOR MACTEC'S INTERNAL USE ONLY IF PREPARED AS A WORK ACCEPTANCE SHEET

_____	_____
Signature of Preparer	Signature of Reviewer
_____	_____
Print Name and Title	Print Name and Title

5-23-03

01MP15__5/20/03

ADDISON RD

AIRPORT PROPERTY LINE

DALLAS AREA RAPID TRANSIT

CONVENTIONAL HANGARS

EXECUTIVE HANGARS

CONVENTIONAL HANGARS

FUEL FARM

CONVENTIONAL HANGARS

CONVENTIONAL HANGARS

MILLION AIR

408' RUNWAY EXTENSION / DISPLACED THRESHOLD

WESTGROVE RD

RUNWAY 15-33 EXISTING 7,202' x 100' ULTIMATE 7,550' x 100'

B-1 B-2 B-3 B-4 B-5 B-6 B-7

300'

LINDBERGH RD

RELOCATED GLIDESLOPE ANTENNA

EXISTING GLIDESLOPE ANTENNA

GLIDESLOPE ANTENNA

DISPLACED THRESHOLD

T-HANGARS

EXECUTIVE HANGARS

MIDWAY RD

PLANNED ARAPAHO RD. EXTENSION

LEGEND

- Airport Property Line
- Runway Safety Area (RSA)
- Object Free Area (OFA)
- Runway Protection Zone (RPZ) Not Lower than 1 Mile Visibility
- Lower than 1 Mile Visibility RPZ
- Departure RPZ
- B-1 Core Sample

DECLARED DISTANCES

	Runway 15	Runway 33
Accelerate-Stop Distance Available (ASDA)	7,000'	7,202'
Landing Distance Available (LDA)	6,592'	6,431'

Addison Airport

Exhibit __
RECOMMENDED CONCEPT

Jim Pierce

From: Ed Oshinski [EOSHINSK@dot.state.tx.us]
Sent: Monday, June 02, 2003 11:28 AM
To: Bruce Ehly
Cc: Jim Pierce
Subject: Re: Jim Pierce's E-mail address

Bruce, Jim;

My plans are to talk to the folks in the pavement testing section of TxDOT to see if we can develop a better, more timely method of accomplishing non-destructive field testing (NDT) with the TxDOT falling weight deflectometer, ground penetrating radar, and profilometer. These are the types of data that should be collected at Addison, and in theory, could be collected by TxDOT.

In addition to the NDT, additional coring and lab testing should be performed, and TxDOT typically does not do this work on airports. Therefore, even if we are able to get TxDOT to perform the NDT data collection, they will still need a consultant to do coring, lab work, and data analysis.

There are two consultants that I know of that have the equipment and experience to do that type of work. They are:

HVJ Engineering
Austin
Linda Barlow
512-447-9081

Fugro
Dallas
972-484-8301

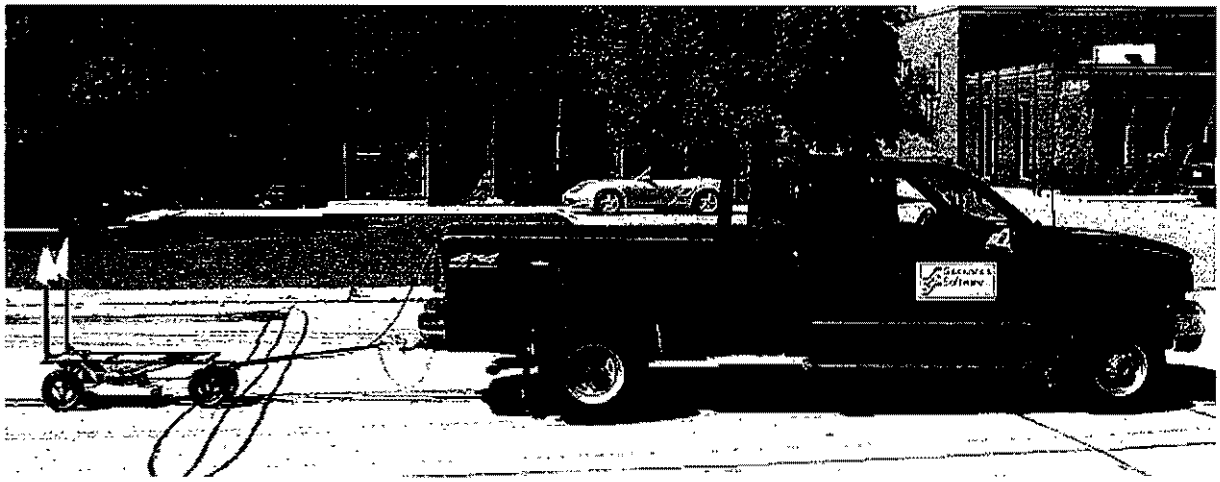
That's all I have for now.

Ed

>>> Bruce Ehly 06/02/03 10:44AM >>>
Jim's E-mail address is in the CC block. You might want to describe what you plan to discuss at your meeting with the TxDOT folks.

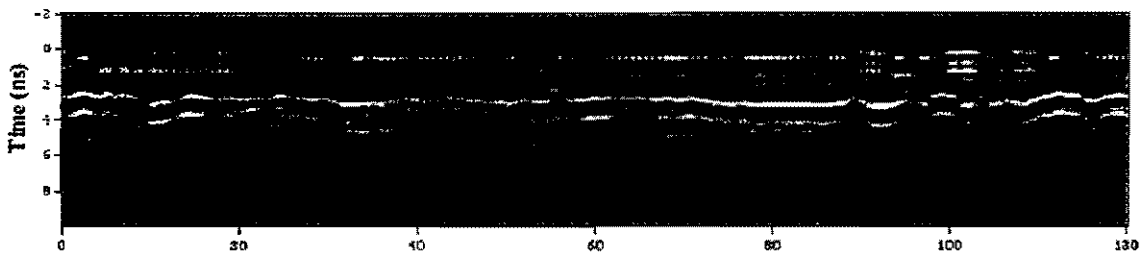
Sensors & Software — Noggin® RoadMap™ System

The Noggin® RoadMap™ System with vehicle mount is perfect for GPR profiling on asphalt and concrete pavement.

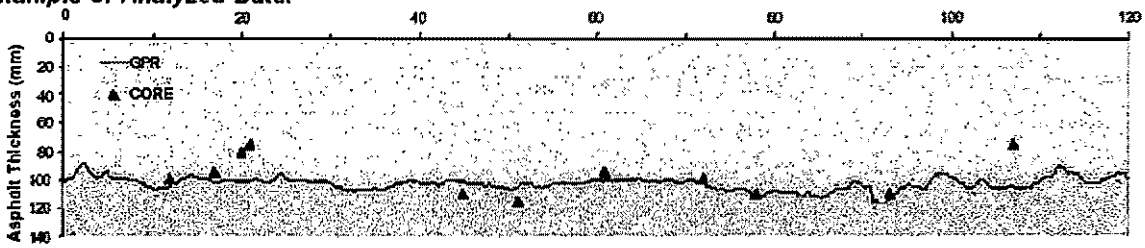


Noggin® RoadMap™ is a new system from Sensors & Software Inc. Building on the Noggin® Ice Road Profiling™ System, Noggin® RoadMap™ provides easy-to-use, affordable GPR profiling for asphalt and concrete pavement on roads, runways, and bridge decks.

Example Data:



Example of Analyzed Data:



Noggin® RoadMap™ is an integrated system including:

- 250 or 500 or 1000 MHz Noggin*plus* GPR
- transmission odometer
- DVL data logger and display
- integrated cabling
- vehicle mount for surface or elevated operation

Optional:

- integrated GPS positioning
- event picking and plotting software
- extended image plotting and processing software

321-03

subsurface imaging solutions

Sensors & Software Inc.
1040 Stacey Court
Mississauga, ON L4W 2X8 Canada

Tel: (905) 624-8909
Fax: (905) 624-9365

E-mail: sales@sensoft.ca
Website: www.sensoft.ca

6-2-03

Bruce Eddy
Ed O'Shinski

Pavement Evaluation TXDOT — can request the tests — questionable to get work done.
Would us hiring a consultant be reimbursable?
Karen Weidman
Only be reimbursed if part of a grant projects

Results should be ~~on~~ the master plan

HVJ
Fugro } merged?
BRE }

ADDISON CONFERENCE THEATRE CENTRE

Troy

Sensors & Software 1-800-267-6013

Mfg radar systems — Do not do the service

Noggin —

17K to 23K Purchase

or Rent the systems —

195.00 / day

225.00 set ready fee

Plus Shipping

1.5 days Training $500/day

plus travel & living expenses

Volume 6 Number 3

EYE ON ERES

Eye on ERES is a quarterly publication of ERES Consultants, a Division of Applied Research Associates, Inc.

Issue Highlights

Rolling Wheel Deflectometer

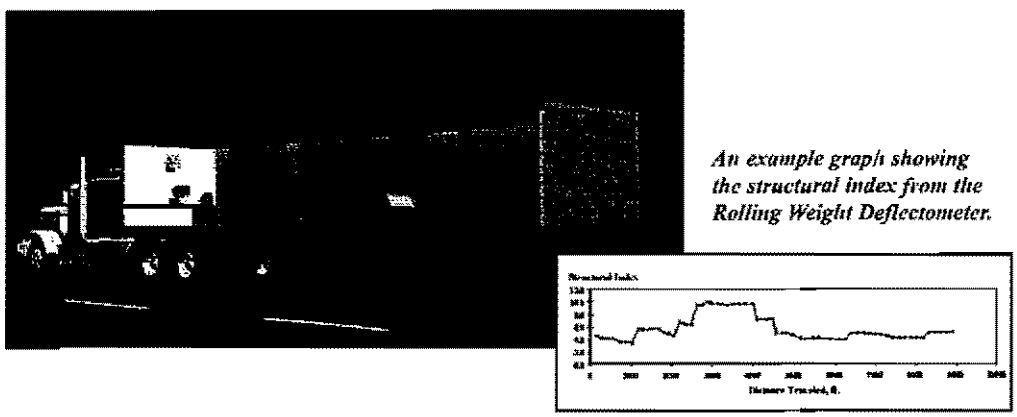
One of the most critical tasks facing the Nation's transportation community is maintaining existing assets in a sound condition. This readiness is essential to support the level of operations and provide the degree of serviceability the transportation infrastructure was designed to handle.

In the ongoing quest to create better data collection and assessment tools, the Federal Highway Administration (FHWA), through the Small Business Administration, contracted ARA to develop the Rolling Wheel Deflectometer (RWD). This device is suitable for network-level analysis (i.e., pavement management-type applications) of the pavement's structural capacity.

Currently, the data collected for use in a pavement management system (PMS) include assessment of the surface distress condition of pavements and generally ignore the structural support and integrity. However, a pavement that exhibits little or no distress may not be structurally adequate to support anticipated traffic. Conversely, a pavement with a highly distressed surface may be structurally sound, requiring only surface maintenance and renovation. Therefore, it is advantageous for an agency to collect information on both the functional and structural condition of its pavement network to provide a complete analysis of pavement maintenance/rehabilitation and funding needs.

Progressing from a Static to a Moving Load

Unlike the Falling Weight Deflectometer (FWD), which takes data while stopped at designated test points, the RWD collects data while traveling at normal highway speeds. This allows a significant increase in the



An example graph showing the structural index from the Rolling Weight Deflectometer.

The Rolling Weight Deflectometer travels at highway speeds while collecting deflection response data.

ERES's mission is to provide innovative and cost-effective solutions for pavements.

Rolling Wheel Deflectometer—continued from page 1

amount of data collected, and it eliminates safety risks and lane closures.

A number of factors can influence the measurement of pavement deflection under a moving wheel load, including:

- Wheel load and geometry.
- Tire pressure.
- Vehicle speed.
- Temperature of the pavement surface.

The RWD takes into account all of these factors, except for one. Currently, the RWD does not monitor wheel load variations, but future improvements to the device will add this capability.

Also, because the deflection basin under rolling wheels is not symmetrical, the research team had to determine the best location to collect deflection data. Historically, most data have been collected using the basin behind (trailing) the wheel. However, the RWD uses the basin ahead of (leading) the wheel because it can more easily be compared to the undeflected pavement ahead of the load wheel. Additionally, the leading part of the basin may be less influenced by hysteresis effects.

The ARA RWD uses a scanning laser system (SLS) developed by Phoenix Scientific, Inc. The SLS scans a 14-ft length of pavement in 1 millisecond from a single reference point. This is a significant difference from other rolling wheel deflection systems, both operational and prototype, in which a single sensor only measures the point on the pavement directly beneath the sensor. Advantages of the scanning laser include the following:

- More powerful laser.
- Larger laser footprint.
- High sampling rate.
- Longer standoff distance.
- No limitations on measurement distance.
- No concern for reference beam alignment.
- Measures full deflection basin.
- Collects both deflected and undeflected surface data in one sweep.

Data Processing

The RWD data processing unit includes software that was developed to provide two methods of statistical treatment: low resolution and high resolution. The low-resolution method averages the deflection basin from a specified length of roadway (say, 500 ft or 0.25 miles) and averages the results into a single representative deflection basin. The high-resolution method produces deflection basins at more closely spaced increments.

The deflection basin can then be converted to a structural index that rates the pavement structural capability on a numerical scale from 1 to 10.

Status of RWD Development

ARA has completed the first generation RWD, and initial testing on roadways near our Vicksburg, Mississippi, office have demonstrated that the RWD can measure deflection basins under the moving wheel load at speeds up to 55 mph. However, tests at the Ohio Test Road failed to validate the RWD deflection measurements when compared to linear variable differential transformers (LVDTs) in the Test Road pavements. Based on these results, further work on the SLS was deemed necessary. A second round of validation tests will be made at the Ohio Test Road once this work has been completed.

The Rolling Weight Deflectometer travels at highway speeds while collecting deflection response data to be used in computation of the Pavement Structural Index.

The FHWA has also funded ARA to conduct initial RWD demonstrations at two States following the validation tests in Ohio. The demonstrations will include a test run on a selected highway, data processing, and a presentation on the RWD and the test results. It is anticipated that the States selected for the demonstrations will have instrumented pavements so that comparisons can be made between deflection gage data and the RWD measurements.

For more information about this project, contact Dr. Jim Hall at (601) 638-5401 (e-mail: jhall@ara.com). Jim is the group leader of our Vicksburg, Mississippi, office.

Software Solutions

2D and 3D Finite Element Analysis

The performance of rigid pavements depends on the stresses and deflections imposed by repeated traffic and environmental loadings. For example, transverse cracking in jointed plain concrete pavement (JPCP) is governed by the maximum tensile stresses at the bottom (or, as recently discovered, at the top) of the concrete slab. In contrast, crack deterioration in jointed reinforced concrete pavements (JRCP) and continuously reinforced concrete pavements (CRCP) can be related to the shear stresses at the crack surface. Therefore, reliable predictions of pavement responses are essential for a mechanistic-empirical design procedure. The structural model used for those predictions must satisfy the following requirements:

- Adequately describe the pavement structure (constructed layers and subgrade).
- Model discontinuities (cracks and joints) in the pavement structure.
- Analyze multi-wheel loading with nonuniform tire print distribution.
- Analyze environmental loading such as temperature curling and moisture warping.

Finite element methods permit development of structural models that satisfy all these requirements.

A variety of finite element programs are available to pavement engineers today. These programs may be broadly categorized as general-purpose finite element programs and special-purpose codes developed for the analysis of pavement systems. The general-purpose programs have much broader application and are of interest to many disciplines of science and engineering, and many sophisticated commercial products can conduct three-dimensional nonlinear dynamic analysis. These programs have been used successfully for pavement analysis in several research studies, and a number of finite element models built using these products are available today. However, these programs usually demand considerable computational resources, as well as time for developing a structural model for each problem.

Most of the programs developed especially for analysis of concrete pavement systems, including ILLI-SLAB (Tabatabaie and Barenberg 1980), can analyze multi-wheel loading of one- or two-layered medium thick plates resting on a Winkler foundation or an elastic solid. The latest enhancements to ILLI-SLAB include ILSL2, developed at the University of Illinois, and a revised version of ILSL2 developed by ERES Consultants (Khazanovich 1994, Khazanovich and Yu 1998). These two programs contain many advanced features that distinguish them from other pavement programs that are based on plate theory.

2D and 3D Finite Element Analysis—continued from page 3

For comparison purposes, let us look at a couple of representative general-purpose and specialized finite element programs.

ABAQUS and ILSL2

ABAQUS is a very powerful and reliable general-purpose, production-oriented, finite-3D, dynamic, nonlinear finite element code designed to address structural and heat transfer problems. ABAQUS incorporates implicit and explicit dynamic solvers to allow analysis of a wide range of linear and nonlinear applications. The ABAQUS solvers are well integrated, allowing a single analysis to switch between solvers as needed. ABAQUS is the most powerful general-purpose code available, and most 3D finite element models, including NCHRP 1-30 (Darter et al. 1995) were developed using it.

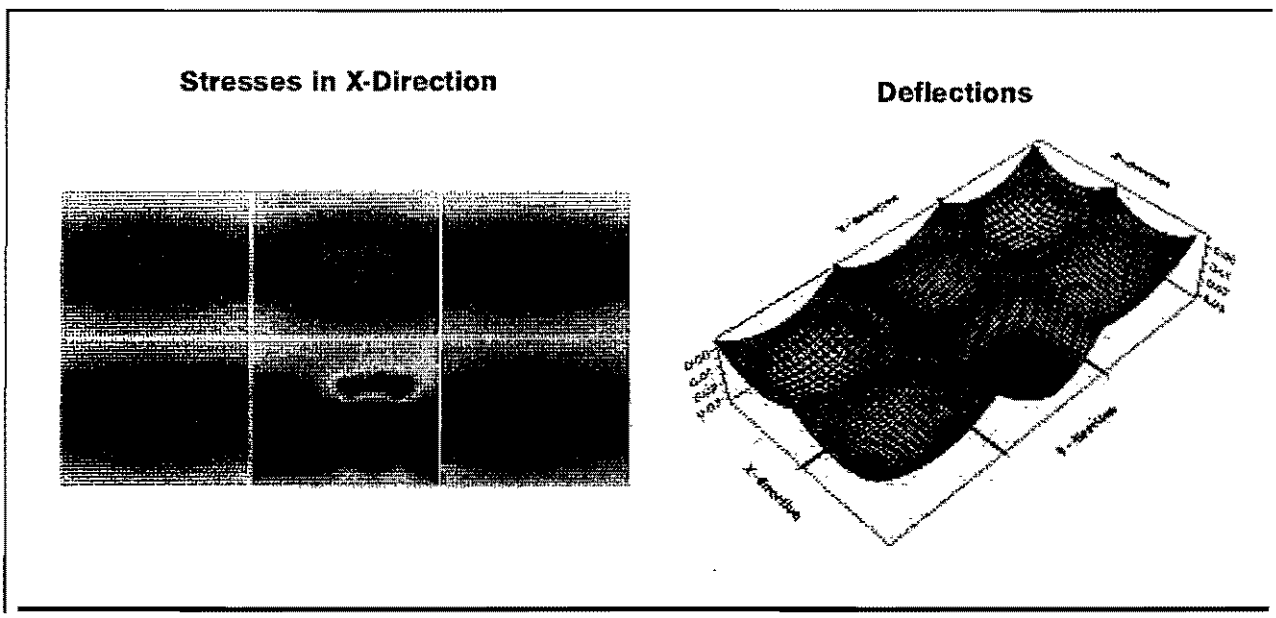
ILSL2 (Khazanovich 1994) is the latest public domain revision of the finite element program ILLI-SLAB. The features that distinguish it from all other programs are as follows (Khazanovich 1994, Khazanovich and Yu 1998):

- A wide selection of subgrade models, including Winkler, elastic solid, Pasternak, Kerr-Vlasov, and Zhemochkin-Sinitsyn-Shtaerman.
- An ability to analyze the effect of the independent actions of two pavement layers.
- An ability to analyze the effect of linear and nonlinear temperature distribution throughout the pavement thick-ness.
- An ability to analyze partial-depth cracks.

Comparison of ABAQUS and ILLI-SLAB

Hammons (1997) conducted a comprehensive comparison of ABAQUS and ILLI-SLAB. He considered several cases of a single slab resting on a Winkler foundation and loaded by a single load at its interior or at the edge. The following conclusions were made:

1. A very good correlation was found between ILLI-SLAB and ABAQUS for the maximum bending stresses when an interior loading condition was considered.
2. The maximum deflections predicted by ILLI-SLAB were consistently 1 to 2 percent lower than those predicted by ABAQUS (when an acceptable level of accuracy is achieved in ABAQUS).
3. The greatest discrepancy was found for maximum bending edge stresses. Whereas ILLI-SLAB predicts the location of the maximum edge stresses right at the slab edge, results from comprehensive 3D ABAQUS



Graphical output from ISLAB2000 depicting slab analysis.

models show that the maximum edge stress occurs within 0.1 radii of relative stiffness from the slab edge and is approximately 10 percent less than predicted by ILLI-SLAB. However, this difference is consistent and should not affect performance prediction, since a consistent discrepancy can be accounted for in the fatigue model calibration.

Hammons also examined the joint model used in ILLI-SLAB. Based on analysis of field test data and on comparison with the ABAQUS model, he concluded that although the ILLI-SLAB model is dramatically less computationally demanding than the ABAQUS model, it provides sufficient accuracy for a gross analysis of pavement systems. Although explicit modeling of the dowel in the 3D model is perhaps useful for research purposes, it is unnecessarily complicated for practical purposes.

New Program Development

The newest finite-element program dedicated to pavement analysis is currently under development. ERES, in cooperation with the Michigan and Minnesota Departments of Transportation, Michigan Technical University, the University of Michigan, Michigan State University, and the University of Minnesota, is developing a new finite element code, ISLAB2000. The new program will retain all the positive features of ILLI-SLAB but will be more computationally efficient, contain many improved capabilities, and provide a user-friendly interface.

Like ILSL2, the first version of ISLAB2000 will support only plate elements, but the system was designed for the future addition of other elements. ISLAB2000 will be a significant improvement over all existing finite-element programs for pavement analysis–even the first version will enable users to analyze a wide range of problems that are not possible with the existing programs. For example, ISLAB2000 will be able to analyze mismatched joints, partially bonded layers, and the effect of widened base. A detailed description of ISLAB2000 is scheduled to appear in a future issue of *Eye on ERES*.

Conclusion

Although general-purpose 3D finite element programs are powerful tools for sophisticated research studies, specialized pavement programs–like ILSL2 and ISLAB2000–are better suited for routine pavement analysis. They are much easier to use and are able to model all of the important features of the pavement systems. ILSL2 and ISLAB2000 are also much less computationally demanding than general-purpose programs.

For more information about finite element analysis, contact Dr. Lev Khazanovich at (217) 356-4500 (e-mail: lkhazanovich@ara.com). Dr. Khazanovich is a senior research engineer at ERES.

References

Darter, M.I., K.T. Hall, and C. Kuo. (1995). *Support Under Portland Cement Concrete Pavements*. NCHRP Report 372. National Cooperative Highway Research Program, Washington, DC.

Khazanovich, L. (1994). "Structural Analysis of Multi-Layered Concrete Pavement Systems." Ph.D. Thesis, University of Illinois, Urbana, IL.

Khazanovich, L., and T. Yu. (1998). "ILSL2–A Finite Element Program for Analysis of Concrete Pavements and Overlays," *Proceedings*, Fifth International Conference on Bearing Capacity of Roads and Airfields, Trondheim, Norway.

Hammons M.I. (1997). *Development of an Analysis System for Discontinuities in Rigid Airfield Pavements*. FAA, Technical Report GL-97-3.

Tabatabaie, A.M., and E.J. Barenberg. (1980). "Structural Analysis of Concrete Pavement Systems." ASCE, *Transportation Engineering Journal*. Vol. 106, No. 5, pp. 493-506.

PCI Surveys for the U.S. Air Force

As a result of the ERES/ARA merger, the ERES Division can now provide new engineering services to its clients. That is, ERES Consultants, Inc. provided some services that ARA did not, and vice versa. The merger has also allowed us wider coverage in some services in which both companies excelled. One of the areas in which both ERES and ARA have enjoyed tremendous success is in pavement condition surveys.

For the past 3 years, ARA has been conducting pavement condition surveys for the U.S. Air Force. This work is funded by various Air Force Commands through contracts administered by the Air Force Civil Engineering Support Agency (AFCESA) at Tyndall Air Force Base (AFB). Our 1999 work includes 12 Air Force bases under three commands.

The work consists of using the pavement condition index (PCI) method to survey the airfield pavements at specified Air Force bases. Visual distress data are an excellent source of pavement condition information and are used in many ways by airfield pavement engineers, planners, and maintenance personnel. Pavement distress data are used to evaluate pavement performance and are a basic input to pavement management systems. The key to a useful pavement condition evaluation lies in the objectivity and reliability of the survey procedures. The PCI procedure, outlined in AFR 93-5 and further refined in ASTM Standard D5340, is used by the aviation industry to visually assess current airfield pavement condition. Dr. Michael Darter, a Principal Engineer in the ERES Division, was one of the co-developers of this procedure.

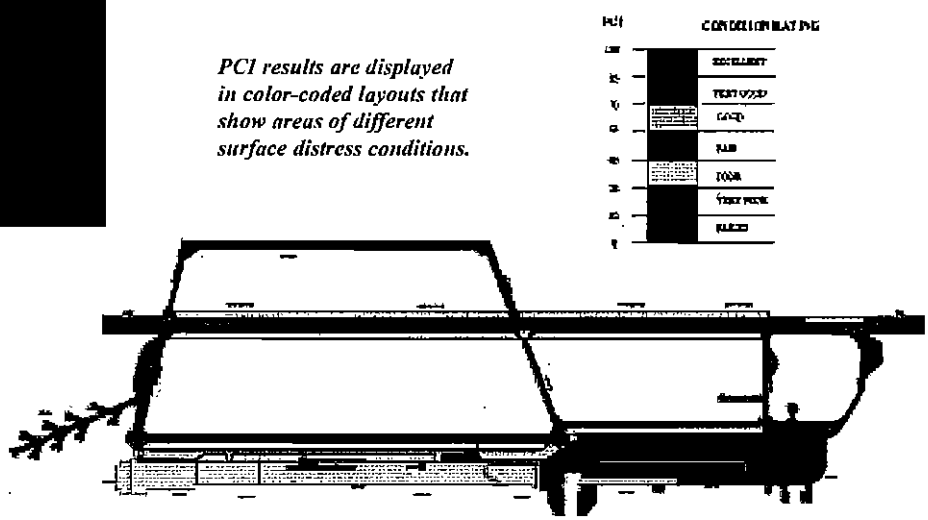
The current Air Force project involves entering the measured distress data into a computerized pavement management system (MicroPAVER). The condition information is then analyzed, along with local maintenance and materials costs and other data, to develop a 5-year work plan for the maintenance of each base's pavements. ARA is also providing a variety of reports and documents, CAD drawings, and color-coded maps that show the PCI results for the surveyed pavements. Upon submittal of the draft report to each base, Dr. Jim Hall conducts a 2-day training session to base personnel on the use and applications of the pavement management system.

For more information about this project, contact Dr. Jim Hall at (601) 638-5401 (e-mail: jhall@ara.com). Jim is the group leader of our Vicksburg, Mississippi, office.

Severely cracked airfield pavement.

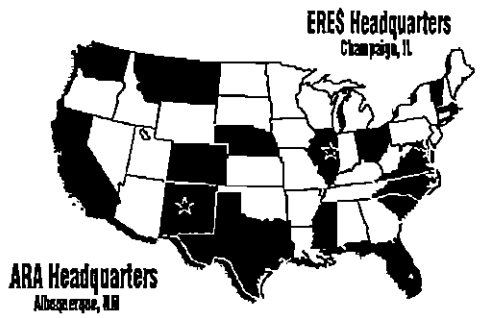
The PCI survey requires measurement of distress types, severity level, and extent.

PCI results are displayed in color-coded layouts that show areas of different surface distress conditions.



The Best of Both Worlds

Some readers may be wondering, "Why are so many of the articles in this issue about ARA?" For those who do not already know, we would like to announce the merger of ERES Consultants, Inc. into Applied Research Associates, Inc. The effective date of the merger was April 5, 1999. ERES is now the ERES Division of ARA and is led by Robert B. (Bo) Underwood (see below). Dr. Michael Darter, former President of ERES, has stayed on as the senior technical advisor and will oversee the Division's research efforts.



ERES and ARA now have over 25 operating locations in the United States to better serve our clients.

This merger creates the largest highway and airport pavement research and consulting venture in the United States. The ERES Division now includes pavement engineering experts in six locations in North America who can provide more localized–and more comprehensive–services to our clients throughout the country and throughout the world. We will continue to provide the same high-quality pavement engineering services, research, training, and software, but we will now have the support and resources of a large, diverse engineering company behind us.

ARA is a national research and engineering firm with headquarters in Albuquerque, New Mexico, and 25 other operating locations throughout the U.S. ARA is an entirely employee-owned company with a progressive attitude. ARA has achieved a 31.7 percent compound growth rate during its first 20 years in business, and last year's sales topped $48 million.

For more information about ARA, contact the corporate office or visit our website, www.ara.com.

Bo Underwood has been named the manager of the ERES Division.

When ERES merged with ARA, Bo Underwood was named the manager of the ERES Division.

Bo previously managed the ARA Southern Division, located in Vicksburg, Mississippi. He is a registered professional engineer, and he has conducted a wide variety of engineering research, service, and software projects during his 19-year career. Bo's pavement engineering experience includes performing, supervising, and contracting for the evaluation, design, and reconstruction of a variety of war-damaged AC and PCC highway and airfield pavements in Kuwait.

Says Bo, "I am please to find myself in the company of the immensely talented professionals at ERES Consultants." ERES is excited about the merger with ARA, and we are confident that Bo's leadership will benefit our clients and staff alike.

ERES CONSULTANTS
A Division of Applied Research Associates, Inc.

www.eresnet.com
Info@eresnet.com

ERES Division
505 West University Avenue
Champaign, IL 61820
Phone (217) 356-4500 ▪ Fax (217) 356-3088

ARA Headquarters
4300 San Mateo Boulevard, NE
Suite A-220
Albuquerque, NM 87110
Phone (505) 881-8074 ▪ Fax (505) 883-3673

***Eye on ERES* is published quarterly by ERES Consultants, a division of Applied Research Associates, Inc. All comments and inquiries are appreciated.**

Division Manager	**Robert B. Underwood III, P.E.,** *bo@ara.com*
Editor	**Robin L. Jones,** *rljones@ara.com*
Design	**Sonya C. Darter,** *sdarter@ara.com*

ERES CONSULTANTS
A Division of Applied Research Associates, Inc.

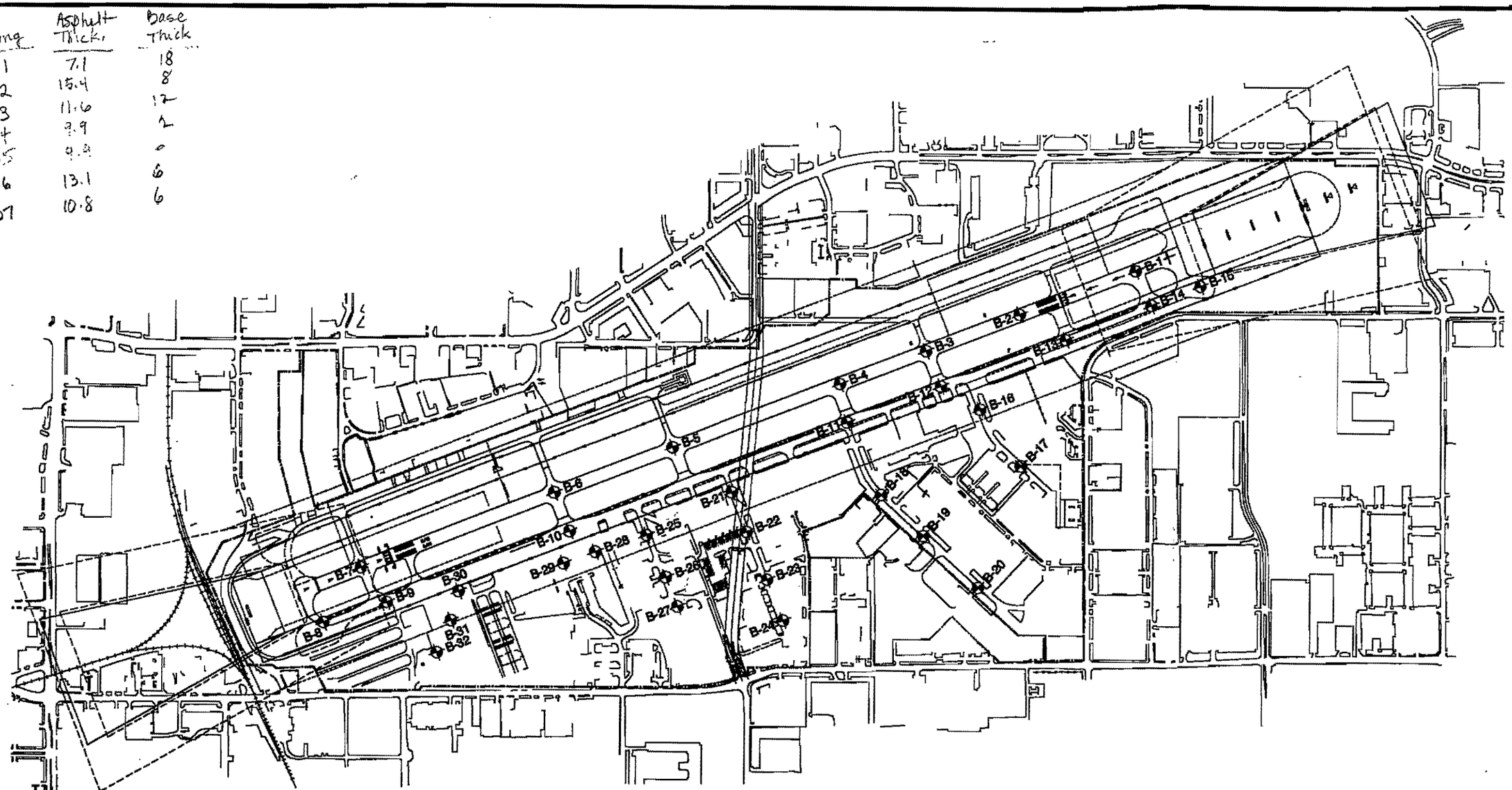
505 West University Avenue
Champaign, IL 61820-3915

www.eresnet.com

BULK RATE
U.S. POSTAGE
PAID
PERMIT 410
CHAMPAIGN, IL

Coffman 1-800-892-7772
Associates 1-816-304-5432 cell
Airport Consultants
www.coffmanassociates.com
Mike W. Dmyterko, C.M.
Senior Planner
Kansas City • Phoenix
237 N.W. Blue Parkway, Suite 100, Lee's Summit, MO 64063
816-524-3500 • FAX 524-2575
miked@coffmanassociates.com

Boring	Asphalt Thick.	Base Thick
B1	7.1	18
B2	15.4	8
B3	11.6	12
B4	9.9	2
B5	9.9	0
B6	13.1	6
B7	10.8	6



0 400' 800' 1600'

REED ENGINEERING GROUP
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

PLAN OF BORINGS

Addison Airport

Runway & Taxiways
Addison, Texas

PLATE 1

reed engineering GROUP

Project No. 8614

Date: 01-26-02

Addison Airport
Runway and Taxiways
Addison, Texas

Location: See Plate 1

DEPTH, feet	DESCRIPTIVE SYMBOLS	SAMPLES	CORE % REC.	CORE % RQD	DESCRIPTION OF STRATA
0					ASPHALT (7.1")
					CLAYEY SAND, brown & reddish-brown, fine to medium (Fill) (SC)
					CLAY, dark brown, very stiff, w/tan & gray limestone fragments (Fill) (CH)
5					LIMESTONE FRAGMENTS, tan, w/some brown clay (Fill) (GP)
					CLAY, dark brown, w/trace of calcareous particles & limestone fragments (Fill) (CH)
					Total Depth = 6 feet
10					
15					
20					

Pocket Penetrometer Readings
Tons Per Sq. Ft. -*
Standard Penetration Tests
Blows per Foot - +

* +	1 10	2 20	3 30	4 40	4.5+ 50	4.5++ 60

BORING LOG B-1

PLATE 2

reed engineering GROUP

Project No. 8614

Date: 01-26-02

Addison Airport
Runway and Taxiways
Addison, Texas

Location: See Plate 1

DEPTH, feet	DESCRIPTIVE SYMBOLS	SAMPLES	CORE % REC.	CORE % RQD	DESCRIPTION OF STRATA
0					ASPHALT (15.4")
					GRAVEL BASE, fine to coarse, w/some sand (crushed limestone base) (Fill) (GP)
5					SAND, reddish-brown, fine-grained, w/trace of clay (SP)
10					Total Depth = 10 feet
15					
20					

Pocket Penetrometer Readings
Tons Per Sq. Ft. - *
Standard Penetration Tests
Blows per Foot - +

*	1	2	3	4	4.5+	4.5++
+	10	20	30	40	50	60

BORING LOG B-2

PLATE 3

GEOTECHNICAL CONSULTANTS

reed engineering GROUP

Project No. 8614

Date: 01-26-02

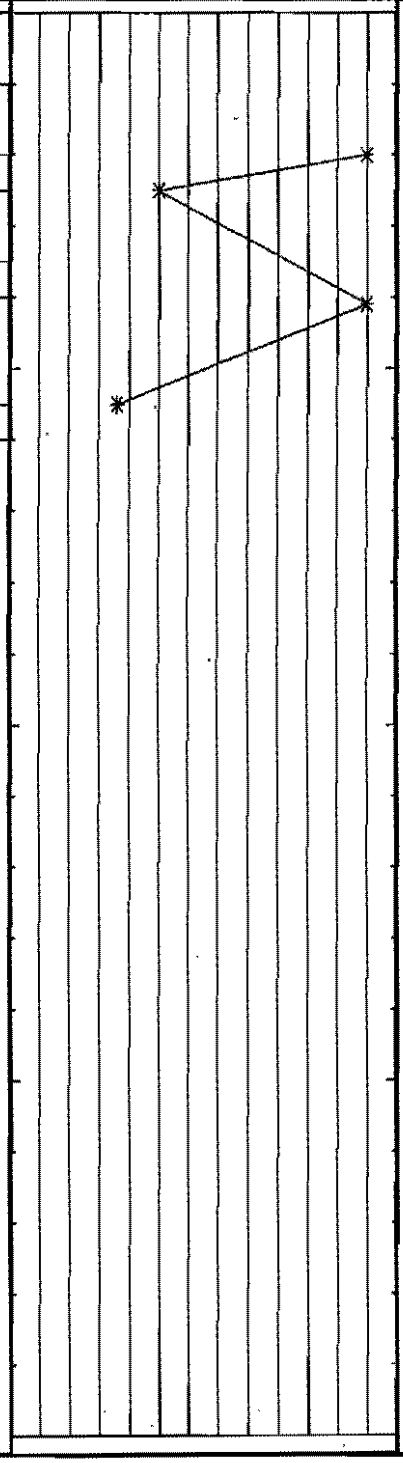
Addison Airport
Runway and Taxiways
Addison, Texas

Location: See Plate 1

DEPTH, feet	DESCRIPTIVE SYMBOLS	SAMPLES	CORE % REC.	CORE % RQD	DESCRIPTION OF STRATA
0					ASPHALT (11.6")
					CLAYEY SAND, reddish-brown, fine-grained, w/some limestone fragments (Fill) (SC)
					CLAY, dark grayish-brown & light yellowish-brown, very stiff, w/fine limestone fragments, gravel & sand (Fill) (CH - CL)
5					LIMESTONE FRAGMENTS, tan, w/some clay (Fill) (GP)
					GRAVELLY CLAY, yellowish-brown, w/limestone fragments & fine gravel (Fill) (GC)
					CLAY, dark grayish-brown, stiff, w/some fine limestone fragments (Fill) (CH)
10					LIMESTONE FRAGMENTS, tan, w/some clay (Fill) (GP)
					Total Depth = 6 feet
15					
20					

Pocket Penetrometer Readings Tons Per Sq. Ft. - *
Standard Penetration Tests Blows per Foot - +

* 1	2	3	4	4.5+	4.5++
+ 10	20	30	40	50	60



BORING LOG B-3

PLATE 4

GEOTECHNICAL CONSULTANTS

reed engineering GROUP

Project No. 8614

Date: 01-26-02

Addison Airport.
Runway and Taxiways
Addison, Texas

Location: See Plate 1

DEPTH, feet	DESCRIPTIVE SYMBOLS	SAMPLES	CORE % REC.	CORE % RQD	DESCRIPTION OF STRATA
0					ASPHALT (9.9")
					GRAVEL BASE, medium to coarse, w/some sand (Fill) (GP)
					GRAVELLY CLAY, yellowish-brown, very stiff, w/some coarse, calcareous sand & fine to medium calcareous gravel & limestone fragments (Fill) (CL)
5					CLAY, yellowish-brown, calcareous, w/limestone fragments (Fill) (CL)
					GRAVELLY CLAY, reddish-brown, very stiff, w/fine to medium rounded calcareous gravel & coarse sand (GC)
					SANDY CLAY, yellowish-red, stiff to very stiff, w/calcareous sand & some fine calcareous gravel (CL)
10					Total Depth = 7-1/2 feet
					Dry @ completion.
15					
20					

Pocket Penetrometer Readings
Tons Per Sq. Ft. - ✱
Standard Penetration Tests
Blows per Foot - ✦

✱ 1 2 3 4 4.5+ 4.5++
✦ 10 20 30 40 50 60

BORING LOG B-4

PLATE 5

GEOTECHNICAL CONSULTANTS

reed engineering GROUP

Project No. 8614

Date: 01-26-02

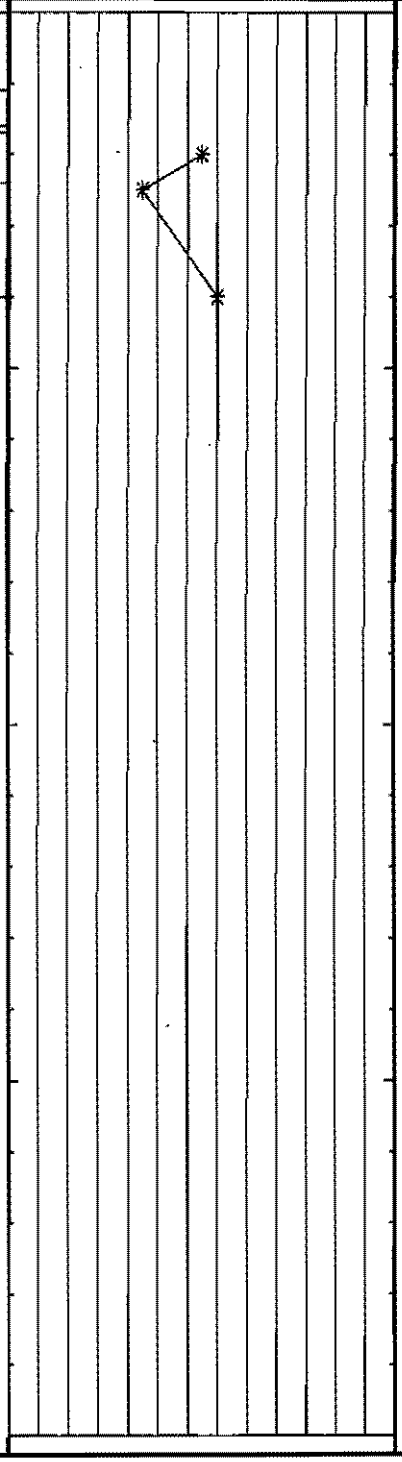
Addison Airport
Runway and Taxiways
Addison, Texas

Location: See Plate 1

DEPTH, feet	DESCRIPTIVE SYMBOLS	SAMPLES	CORE % REC.	CORE % RQD.	DESCRIPTION OF STRATA
0					ASPHALT (9.9")
					SANDY GRAVEL, yellowish-gray, angular, fine to coarse, w/clay (crushed limestone gravel) (GP)
					SANDY CLAY, yellowish-brown, w/medium angular gravel
5					CLAY, gray & yellowish-gray, very stiff, w/tan & gray limestone fragments (CL)
					CLAY, dark gray, very stiff, w/trace of calcareous particles (CH)
					Total Depth = 4 feet
10					
15					
20					

Pocket Penetrometer Readings
Tons Per Sq. Ft. – ✱
Standard Penetration Tests
Blows per Foot – ✚

✱ 1 2 3 4 4.5+ 4.5++
✚ 10 20 30 40 50 60



BORING LOG B-5

PLATE 6

GEOTECHNICAL CONSULTANTS

reed engineering GROUP

Project No. 8614

Date: 01-26-02

Addison Airport
Runway and Taxiways
Addison, Texas

Location: See Plate 1

DEPTH, feet	DESCRIPTIVE SYMBOLS	SAMPLES	CORE % REC.	CORE % RQD	DESCRIPTION OF STRATA
0					ASPHALT (13.1")
					SANDY GRAVEL, fine to coarse, angular, calcareous, w/fine to coarse sand & some clay (GP)
5					SANDY GRAVEL, fine to coarse, sub-angular to sub-rounded, w/fine to coarse sand & some clay (GP)
					CLAY, dark gray, very stiff, w/trace of calcareous particles (CH)
					Total Depth = 3 feet
10					
15					
20					

Pocket Penetrometer Readings
Tons Per Sq. Ft. - *
Standard Penetration Tests
Blows per Foot - +

* +	1 10	2 20	3 30	4 40	4.5+ 50	4.5++ 60

BORING LOG B-6

PLATE 7

GEOTECHNICAL CONSULTANTS

reed engineering GROUP

Project No. 8614

Date: 01-26-02

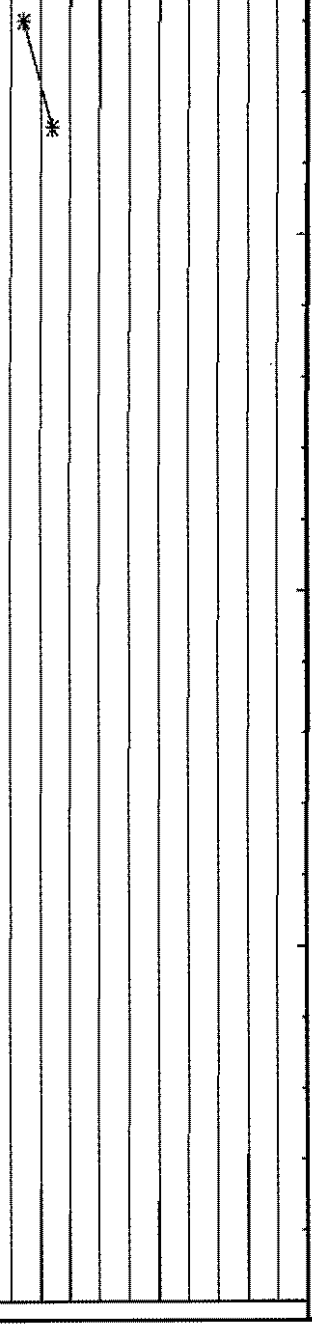
Addison Airport
Runway and Taxiways
Addison, Texas

Location: See Plate 1

DEPTH, feet	DESCRIPTIVE SYMBOLS	SAMPLES	CORE % REC.	CORE % RQD	DESCRIPTION OF STRATA
0					ASPHALT (10.8")
					CLAYEY GRAVEL, fine to coarse, angular, w/some fine sand (GC)
					CLAY, gray to dark gray, stiff, w/limestone fragments (CH)
5					CLAY, dark gray, very stiff, w/trace of calcareous particles (CH)
					Total Depth = 3-1/2 feet
10					
15					
20					

Pocket Penetrometer Readings
Tons Per Sq. Ft. - *
Standard Penetration Tests
Blows per Foot - +

*	1	2	3	4	4.5+	4.5++
+	10	20	30	40	50	60



BORING LOG B-7

PLATE 8

GEOTECHNICAL CONSULTANTS