Empire Laboratories, Inc.

GEOTECHNICAL ENGINEERING & MATERIALS TESTING

P.O. Box 503 • (303) 484-0359
301 No. Howes • Fort Collins, Colorado 80522

June 22, 1987

RBD, Inc.
2900 South College Avenue
Fort Collins, Colorado 80525

Attention: Mr. Stan Meyers

Re: Centre for Advanced Technology, 2nd and 3rd Filings
Fort Collins, Colorado
ELI Project No. 6433-2-87

Gentlemen:

Empire Laboratories, Inc. has evaluated the pavement thicknesses for the proposed parking areas for the 2nd and 3rd filings at the above-referenced project. Based on subsurface data obtained at the site and described in our "Report of a Pavement Design" dated February 6, 1987, the following minimum pavement thicknesses should be used for parking areas for the proposed 2nd and 3rd filing developments. These pavement thicknesses are based on existing subsurface data and an average group index of 20.

Passenger Car Parking

Asphaltic Concrete	2½"
Crushed Aggregate Base Course	8"
Total Pavement Thickness	10½"
Asphaltic Concrete	2"
Plant Mix Bituminous Base Course	3½"
Total Pavement Thickness	5½"

Driveways and Truck Loading Areas

Asphaltic Concrete	3"
Crushed Aggregate Base Course	10"
Total Pavement Thickness	13"
Asphaltic Concrete	2"
Plant Mix Bituminous Base Course	5"
Total Pavement Thickness	7"

The crushed aggregate base course should meet City of Fort Collins Class 5 or 6 specifications. The subgrade below the proposed asphalt pavement should be prepared in accordance with the recommendations discussed in the "Site Grading and Utilities" section of our report. Upon proper preparation of the subgrade, the base course should be placed and compacted at optimum moisture to at least ninety-five percent (95%) of Standard Proctor Density ASTM D 698-78.

It is recommended that the asphaltic concrete and/or plant mix bituminous base course be placed in two (2) to three (3) inch lifts. All plant mix bituminous base course and asphaltic concrete shall meet City of Fort Collins specifications and should be placed in accordance with these specifications. The crushed aggregate base course shall have an "R" value between 78 and 83, the plant mix bituminous base course shall have an Rt value of 90 or greater, and the asphaltic concrete shall have an Rt value of 95 or greater. The "R" value of the pavement materials used should be verified by laboratory tests. Field density tests should be taken in the aggregate base course, bituminous base course and asphaltic concrete under the direction of the geotechnical engineer.

A feasible pavement alternate at the site would be rigid pavement. Using the eighteen (18) kip equivalent daily load application described above, a modulus of subgrade reaction of one hundred (100) pounds per square inch per inch based on an "R" value of 5, a design life of twenty (20) years, and concrete designed with a modulus of rupture of six hundred (600) pounds per square inch, the following minimum pavement thicknesses are recommended:

Passenger Car Parking
Nonreinforced Concrete - 5"

Driveways and Truck Loading Areas
Nonreinforced Concrete - 5½"

Subgrade below proposed paved areas should be prepared in accordance with the recommendations discussed in the "Site Grading and Utilities" section of the pavement report. Concrete pavement should be placed directly on the subgrade that has been uniformly and properly prepared in accordance with the above recommendations. All concrete used in the paving shall meet ASTM specifications, and all aggregate shall conform to ASTM C-33 specifications. The concrete should be designed with a minimum modulus of rupture of six hundred (600) pounds per square inch in twenty-eight (28) days. It is recommended that laboratory mix designs be done to determine the proper proportions of aggregates, cement, and water necessary to meet these requirements. It is essential that the concrete have a low water-cement ratio, an adequate cement factor, and

sufficient quantities of entrained air. Joints should be carefully designed and constructed in accordance with the City of Fort Collins "Design Criteria and Standards for Streets" to ensure good performance of the pavement. It is recommended that all concrete pavement be placed in accordance with City of Fort Collins specifications. If paving is done during cold weather, acceptable cold weather procedures as outlined in the City specifications should be utilized. The concrete pavement should be properly cured and protected in accordance with the above specifications. Concrete injured by frost should be removed and replaced. It is recommended that the pavement not be opened to traffic until a flexural strength of four hundred (400) pounds per square inch is obtained or a minimum of fourteen (14) days after the concrete has been placed.

If you have any questions regarding the pavement thicknesses at the site, please do not hesitate to contact us.

Very truly yours,

EMPIRE LABORATORIES, INC.

Neil R. Sherrod
Senior Engineering Geologist

Reviewed by:

Chester C. Smith, P.E.
President

clc

cc: Everitt Enterprises - Mr. Bob Zakely