CTL | THOMPSON
INCORPORATED

November 2, 2007

City of Fort Collins – Engineering Department
PO Box 580
Fort Collins, Colorado 80522-0580

Attention: Rick Richter
Pavement Management Engineer

Subject: Engineering Consultation
South Transit Center at The Square Shopping Center
Fort Collins, Colorado
CTL|T Project Number: FC04230-135

CTL|Thompson, Inc. has prepared our opinions for paving a concrete pad for a bus stop at the referenced location. You requested these services on October 31, 2007.

We understand a new concrete pad is to be constructed in a private parking area at The Square Shopping Center. An 8-inch thick concrete slab has been proposed. You have provided approximate traffic data and assumed soil conditions for our calculations for determining an appropriate thickness of the proposed concrete slab.

We understand there will be approximately 205 busses per day and each bus weighs 22,000 to 28,000 pounds. You had provided an estimated maximum single load of 20,000 pounds. Using this information, we have estimated an 18,000-pound equivalent daily load application (18k EDLA) of 227.6. We have estimated the equivalent single-axle load application (18k ESAL) of 1,663,000 [205 x (20,000/18,000) x 7,300 days] for a 20-year design life and 831,500 [205 x (20,000/18,000) x 3,650 days] for a 10-year design life.

We performed an analysis using DARWin software, which utilizes 1993 AASHTO design method for estimating an appropriate slab thickness. DARWin requires an aggregate base course layer underneath the concrete, which is common to highway applications. We understand base course may not used for the bus pad. We used an input value of one inch of aggregate base course in order for the software to function. Varying the input values for the reliability factor and design life resulted in concrete pavement thicknesses ranging from 7.86 inches to 9.18 inches. This assumes items, such as reinforcement, doweling, longitudinal joints or tied shoulders that may decrease the recommended slab thickness, will not be constructed, Factors that can increase the calculated design thickness include reducing the terminal serviceability to 2.5 and increasing the reliability level. Factors that can decrease the calculated pavement section include decreasing the design life, increasing the

351 Linden Street | Suite 140 | Fort Collins, Colorado 80524
Telephone: 970-206-9455 Fax: 970-206-9441

concrete strength, adding slab reinforcement and constructing an aggregate base course layer underneath the slab. The slabs should be constructed ¼ inch thicker than the calculated design thickness to account for grinding of the surface for the first rehabilitation. The slab thickness should be rounded up to the ½ inch. Based on our experience, it is our opinion the slab should be at least 8 inches thick and reinforced.

We appreciate the opportunity to work with you on this project. This letter is intended to render our opinion and not to be considered recommendations. We should be contacted in the event you desire a comprehensive subgrade investigation and pavement design for this project. If you have any questions regarding the information provided in this letter, please do not hesitate to contact the undersigned.

Sincerely,
CTL|THOMPSON, INC.

Thomas W. Finley, CPG
Senior Geologist

Reviewed by:

R.B. "Chip" Leadbetter, III, P.E.
Geotechnical Department Manager

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product
IT Administrator

Rigid Structural Design Module

SOUTH TRANSIT CENTER AT THE SQUARE MALL

Rigid Structural Design

Pavement Type	JRCP
18-kip ESALs Over Initial Performance Period	1,663,000
Initial Serviceability	4.5
Terminal Serviceability	2
28-day Mean PCC Modulus of Rupture	650 psi
28-day Mean Elastic Modulus of Slab	3,400,000 psi
Mean Effective k-value	16 psi/in
Reliability Level	90 %
Overall Standard Deviation	0.34
Load Transfer Coefficient, J	4.2
Overall Drainage Coefficient, Cd	1
Calculated Design Thickness	9.18 in

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Rigid Structural Design

Pavement Type	JRCP
18-kip ESALs Over Initial Performance Period	1,663,000
Initial Serviceability	4.5
Terminal Serviceability	2
28-day Mean PCC Modulus of Rupture	650 psi
28-day Mean Elastic Modulus of Slab	3,400,000 psi
Mean Effective k-value	16 psi/in
Reliability Level	80 %
Overall Standard Deviation	0.34
Load Transfer Coefficient, J	4.2
Overall Drainage Coefficient, Cd	1
Calculated Design Thickness	8.73 in

1993 AASHTO Pavement Design

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Rigid Structural Design Module

SOUTH TRANSIT CENTER AT THE SQUARE MALL

Rigid Structural Design

Pavement Type	JRCP
18-kip ESALs Over Initial Performance Period	831,500
Initial Serviceability	4.5
Terminal Serviceability	2
28-day Mean PCC Modulus of Rupture	650 psi
28-day Mean Elastic Modulus of Slab	3,400,000 psi
Mean Effective k-value	16 psi/in
Reliability Level	90 %
Overall Standard Deviation	0.34
Load Transfer Coefficient, J	4.2
Overall Drainage Coefficient, Cd	1
Calculated Design Thickness	8.28 in

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Rigid Structural Design

Pavement Type	JRCP
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Initial Serviceability	4.5
Terminal Serviceability	2
28-day Mean PCC Modulus of Rupture	650 psi
28-day Mean Elastic Modulus of Slab	3,400,000 psi
Mean Effective k-value	16 psi/in
Reliability Level	80 %
Overall Standard Deviation	0.34
Load Transfer Coefficient, J	4.2
Overall Drainage Coefficient, Cd	1
Calculated Design Thickness	7.86 in