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(C) 631-560-0259	AS	5/6/2014				

# **Commercial Building First Floor Structural Capacity Evaluation**

Location:

Prepared for:

**P יזמו ו by:** A.S. Engir, אב יוחס Cervices, P.C. 112 Vilson Drive Port Jeferson, New York, 11777

Engineer of Record:

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#### **Results and Conclusions**

Based upon the information obtained and relied upon to date, we offer the following opinions:

- 1) The live load capacity of the floor system over the basement area of the building is 100 pounds per square foot.
- 2) The live load capacity of the concrete slab-on-grade floor system is 125 pounds per square foot as well as a 2000 pound rated forklift with a *r* aximum 7,200 pound axle static load and wheel spacing of 32 inches on center.
- 3) The physical evidence observed at the property indicated that the floor system over the basement area was in relatively good containing in a set of concern was noted:
  - a) The metal floor deck was visible trained and rusted in several locations. This occurred primarily adjacent where is well. The roof and exterior wall as well as floor area directly above should be written evestigated to determine if this is the result of an on-going systemic leak

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#### **Introduction**

A.S. Engineering Services, P.C. was retained by, , to perform a structural evaluation of the existing first floor to determine allowable live load capacity. Our work to complete this assignment was performed by Alex Spyrou, PE on April 18th, 2014. site manager, was present during our inspection and provided some of the information pertaining to the building. All measurements and data cited in this report are considered to be approximate values and are based on readily available visual evidence. Minimal destructive testing was performed as part of this evaluation.

#### Background Information

Mr. Smith reported that the building was constructed in the 197 's and that it had been vacant for some time. Mr. Smith was interested in determ, ing the structural capacity of the first floor system to prevent potential future issue .

#### Site <u>ser</u> tions

The subject building was 1-story comme cial building with concrete masonry units (CMU) exterior walls on a concrete slab on tradition for a majority of the building. A small portion of the first floor was by the base ment and the roof framing consisted of open web steel bar joists with steel girler and columns. The building was approximately 93,000 square feet and the hasement area was approximately 11, 000 square feet. For the purpose of this report, the from the building was referenced to face west.

The basement area was sected along the rear east side of the building. It appeared that only a portion of the vacant, Khols retail space, was located over the basement area. The remainder of the basement area appeared to be below the occupied space and consequently we could not observe the first floor in that area of the building. The basement ceiling framing consisted of steel beams with a 1.5 inch metal deck supporting a total slab thickness of 6 inches. The steel framing was supported by steel columns which were spaced at 15 feet on center in the north-south direction and 30 feet on center in the east-west direction. The columns on the first floor, supporting the roof framing, were spaced at 30 feet on center consequently every other basement column also supported roof framing. We observed along the opening in the first floor adjacent to the basement stairs that the concrete floor slab was 6 inches thick. We were unable to drill a hole in the slab-on-grade portion of the building due to no electrical access in that area. Most of the floor slab was covered with

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an interior finish surface and therefore we could not confirm control joint size and spacing but where visible the floor slab was in good condition and no significant cracking was observed. Within the basement of the building several areas, primarily along the rear east wall of the building, the metal floor deck was observed to be either stained or slightly deteriorated. Since the area above was located in the Marshalls portion of the building, it could not be further investigated.

#### Analyses and Discussion and Conclusions

The physical evidence observed at the property and report a information indicated that the first floor system was in relatively good condition and the capacity was determined as follows:

#### Assumptions and Des. 'n Criteria

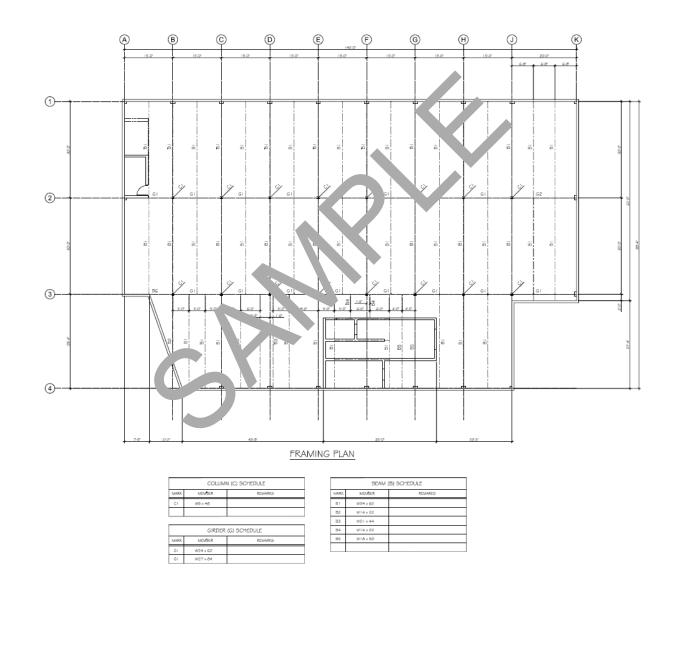
The following assumptions, loads and limitation . v. re . ade . our analysis:

- A36 Steel Members
- Non-Composite steel framing mei . ers
- Total 6 inch thick concrete slab-on-, ra. >
- 18 gage 1.5 inch Non-Computite me, all deck with a total 6" concrete floor for the basement ceiling
- 3000 pounds per squar in rouncrete compressive strength
- 3/4 inch diame er A325 b Its
- slab reinforce per in b, sement ceiling framing is "draped"
- Subgrade Modulus =  $J0 \text{ lbs/inch}^3$
- Collateral load of 15 pounds per square foot to account for mechanical systems
- Partition load of 15 pounds per square foot
- Line Load of 650 plf where full height CMU walls were observed we assumed 8" CMU grouted @ 48" o.c.
- Roof load of 30 pounds per square foot was utilized for point load on columns supporting roof framing
- Footings were not checked and are outside the scope of this report

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#### **Basement Ceiling**

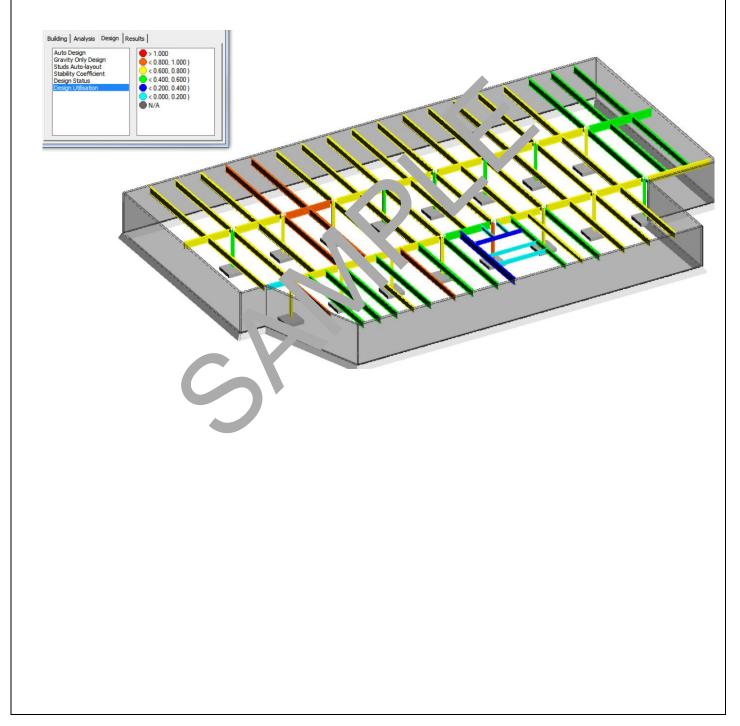
The entire floor system field measured and modeled based on the as-built conditions determined from our site visit in order to determine the allowable live load capacity based on the criteria defined above. The analysis included an evaluation of the floor framing system, metal deck and concrete slab and connections of the individual steel framing members.



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Floor Framing System The steel floor framing system has a live load capacity of 100 pounds per square foot.

The figure below shows the utilization of each framing member based on the criteria defined above and a 100 psf live load.



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#### Connections

The typical condition for each type of connection was analyzed to determine if the connections were the limiting capacity. The connections have a capacity of nearly 4 times the actual load.

#### Concrete Slab-on-Grade

The concrete slab-on-grade was determined to have a capacity of 125 psf and can support a 2000 pound rated capacity forklift load with a maximum 7.200 pound axle static load and wheel spacing of 32 inches on center. Design assumes  $a_{100}$  pc tire inflation.

Representative photographs are included 1 this epon. The photographs taken but not included in the report are available upon reque

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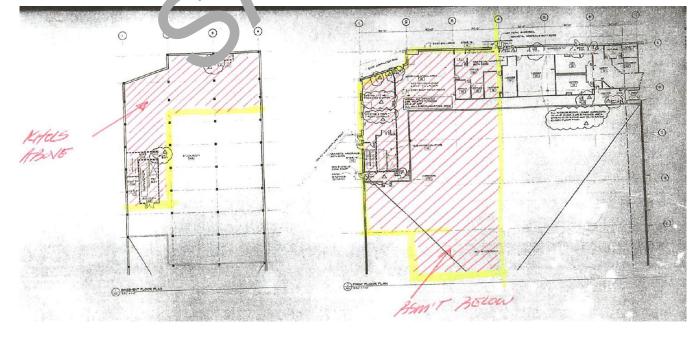
Photograph 1

View of the front (west) side of the subject building.



### Photograph 2

View of the basement '\_\_\_\_uve to the unoccupied space within the building.



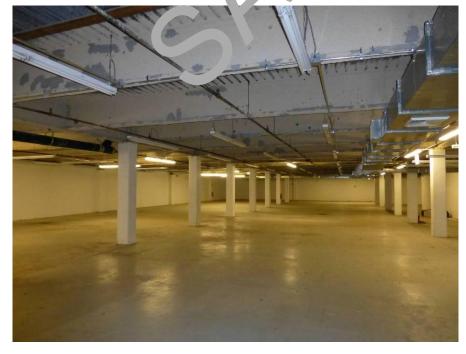
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View of the basement area of the building.



### Photograph 4

View of the basement area of he han ling.



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View of the basement area of the building.



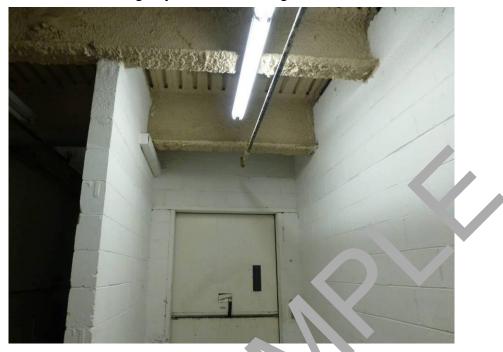
### Photograph 6

View of the elevator and mate al b... "ing room of the basement area of the building.



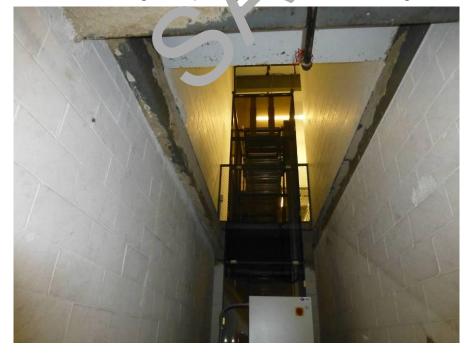
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View of the framing adjacent to the freight elevator of the basement area of the building.



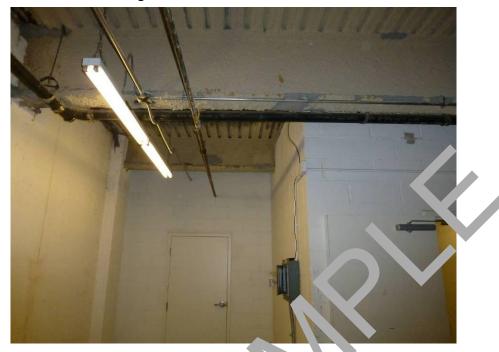
### Photograph 8

View of the framing and opening of a material handling area of the building.



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View of the framing near the rear wall of the basement area of the building.



Photograph 10

View of the stairwell leading to the comment area of the building.



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View of a typical beam to column condition of the first floor framing.



Photograph 12

View of a typical beam pocket suprover of the first floor framing members.



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View of a typical steel column encasement in the basement of the building.



Photograph 14 View of a typical beam to girder corporation.



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View of some damaged steel floor deck in the first floor of the building.



### Photograph 16

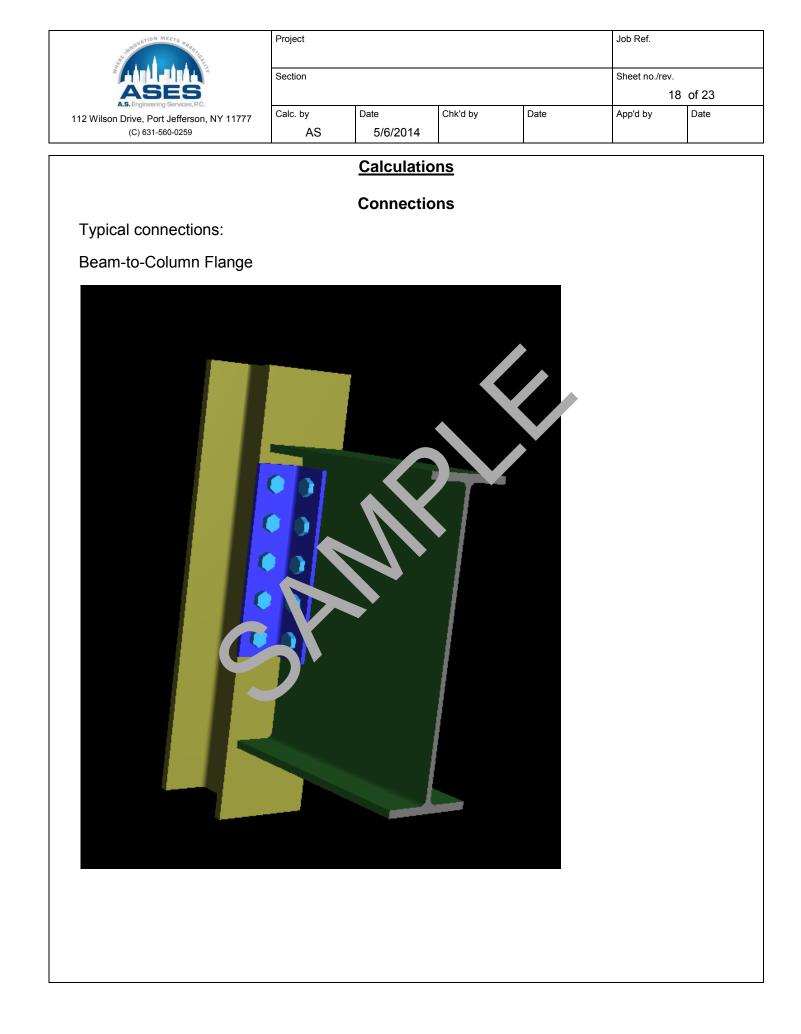
View of some stained and det rior ... metal floor deck.

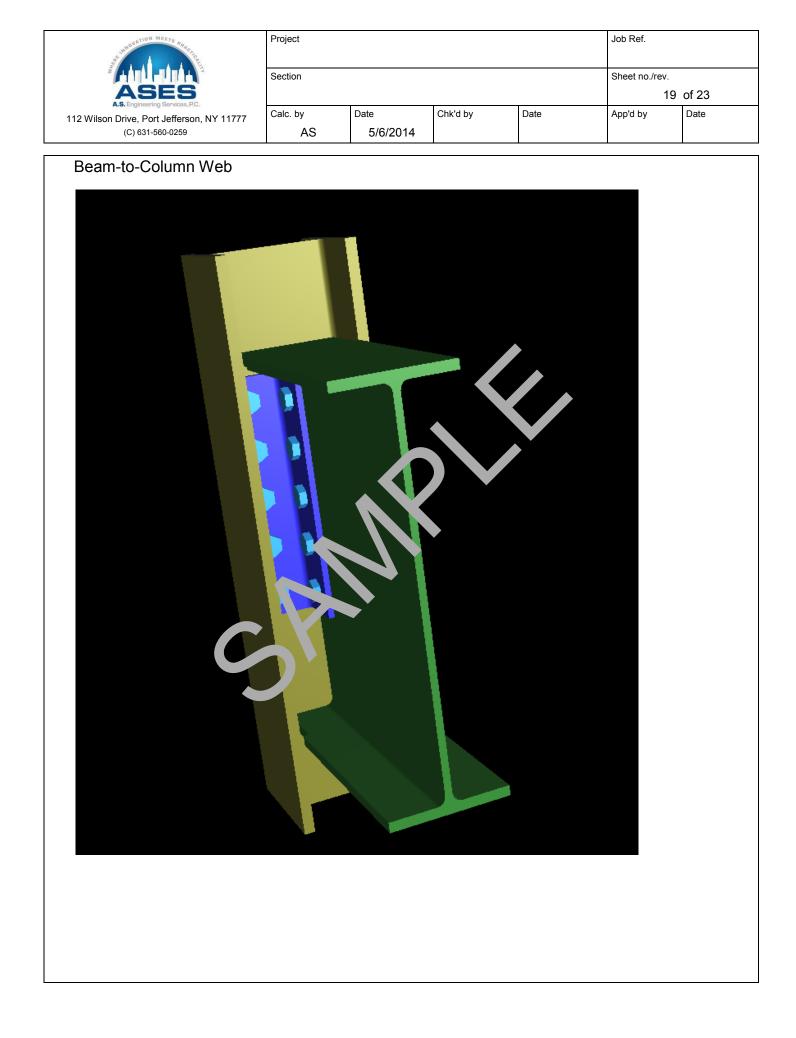


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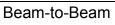
View of some stained and deteriorated metal floor deck.

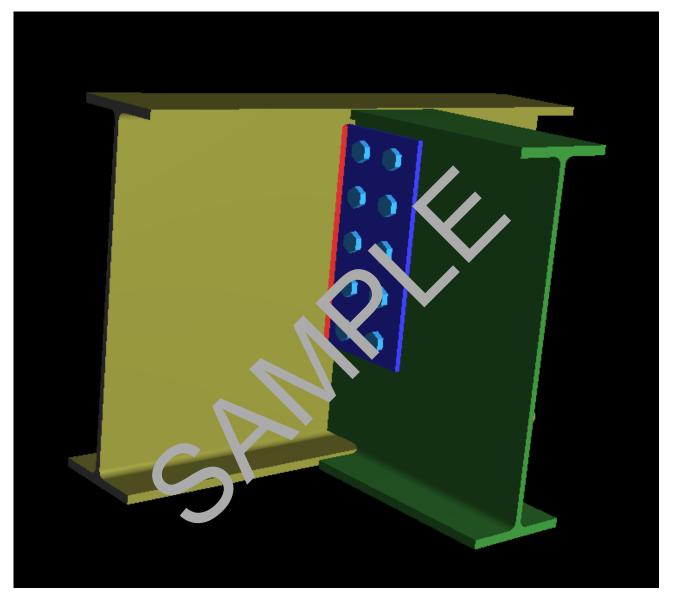






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#### Slab-on-Grade

#### TM 5-809-12/AFM 88-3, Chap. 15

#### 3-3. Stationary live loads.

Floor slabs on grade should have adequate structural live loads. Since floor slabs are designed for moving live loads, the design should be checked for stationary live loading conditions. Table 3-1 lists values for maximum stationary live loads on floor slabs. For very heavy stationary live loads, the floor slab thicknesses listed in table 3-1 will control the design. Table 3-1 was prepared using the equation

w = 257.876s 
$$\sqrt{\frac{kh}{E}}$$
 (eq 3-1)

where

- w = the maximum allowable distributed stationary live load, pounds per square foor
- s = the allowable extreme fiber stress in terms excluding shrinkage stress and is assume be equal to one-half the normal 28-d w concrete flexural strength, the square inch

- k = the modulus of subgrade reaction, pounds per cubic inch
- h = the slab thickness, inches
- E= the modulus of elasticity for the slab (assumed to equal 4.0 x 106 pounds per square inch)

The above equation may be used to find allowable loads for combinations of values of s, h, and knot given in table 3. Further safety may be obtained by reducing allocable entered fiber stress to a smaller percentage on the concrete flexural strength have been presented. Griebend Werner, Waddell, and Hammitt (see Biblen on the selection of the modulus of such table reaction for use in table 3-1 is discussed in a table of the design should be examined for the post that y of differential settlements which conding result from nonuniform subgrade support. aso, consideration of the effects of long-term areal settlement for stationary live loads may be necessary for compressible soils (see TM 5-818-VAFM 88-3, Chap. 7).

FLEXURAL STRENGTH ASSUMED TO E J% OF COMPRESSIVE STRENGTH (3000 PSI) = 150 PSI

THEREFORE w = 237 PSI - THIS THATE LOAD SO REDUCE BY 1.6 = 148 PSF HOWEVER LIMIT TO 125 PSF

WHEEL LOADS - AS FOLLOWS:

#### SLAB ON GROUND (ACI 360R)

In accordance with Guide to Design of Slab-on-Ground per ACI 360R-10

Tedds calculation version 1.0.00

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Slab foundation-refer to Section 4.1 of ACI 360R

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Concrete working stress; Slab stress / 1000 lb axle load; Required slab thickness (Fig. A1.1); $f_{t} = r_{t_{t_{t_{t_{t_{t_{t_{t_{t_{t_{t_{t_{t_$	Concrete working stress; Slab stress / 1000 lb axle load; Required slab thickness (Fig. A1.1); $f_{t} = r_{t_{t_{t_{t_{t_{t_{t_{t_{t_{t_{t_{t_{t_$	Slab thickness design						
Slab stress / 1000 lb axle load; Required slab thickness (Fig. A1.1); $f_t = r_{1-x/y} / (P_a / 1 \text{ kips}) = 34.2 \text{ psi}$ $h_t = 4.74 \text{ in}$ $f_{min} / h = 0.791$ PASS - Slab thickness is adequate to avoid live load-induced crass	Slab stress / 1000 lb axle load; Required slab thickness (Fig. A1.1); $f_t = r_{t_o} / (P_a / 1 \text{ kips}) = 34.2 \text{ psi}$ $h_t = \frac{4.74}{1 \text{ in}}$ $h_{min} / h = 0.791$ PASS - Slab thickness is adequate to avoid live load-induced crassing of the stress of the s	Modulus of rupture of concrete;		$f_r = \times r_c \times r_c$	ι ρsi) = <u>493</u> p	si		
Required slab thickness (Fig. A1.1); $h_{min} = \frac{4.74}{0.791}$ PASS - Slab thickness is adequate to avoid live load-induced crack	Required slab thickness (Fig. A1.1); $h_{min} = \frac{4.74}{0.791}$ PASS - Slab thickness is adequate to avoid live load-induced crassical structure in the stru	Concrete working stress;		f allow = fr / S	= <u>246.5</u> psi			
h <sub>min</sub> / h = 0.791 PASS - Slab thickness is adequate to avoid live load-induced crac	h = 0.791 PASS - Slab thickness is adequate to avoid live load-induced cra	Slab stress / 1000 lb axle load;		$f_t = r_t / (P_a)$	/ 1 kips) = <u>34</u>	<mark>.2</mark> psi		
PASS - Slab thickness is adequate to avoid live load-induced crac	PASS - Slab thickness is adequate to avoid live load-induced cra	Required slab thickness (Fig. A1.1)	);					
				PASS - Slai	b thickness i	s adequate to	o avoid live load-i	nduced cra
		;						