APACHE COUNTY — Community Development Department
P.O. Box 238 • St. Johns, AZ 85936 • Phone: (928) 337-7527 • Fax: (928) 337-7633

CONDITIONAL USE PERMIT APPLICATION

APPLICANT

Name Tony & Angi Lugo
Mailing Address 25742 N. 103rd Ave
Peoria AZ 85383

Contact Person Tony Lugo
Phone 602-568-5551 Fax _____
Email Tony@TonyLugoTinting.com

PROPERTY INFORMATION

Assessor's Parcel # 20104102
Township 12N Range 24E Section 29
Subdivision Show Low Pines
Unit # 10 Lot # 102
Address/Location 21 CR 8307

Existing Zoning Ag
Existing Land Use _____
Lot Size 1.17

CONDITIONAL USE PERMIT REQUEST

Please provide a brief description of the request.
Permit for Manufactured home more than 15 yrs old

Temporary Use: ___ Yes X No

SUBMITTAL CHECKLIST

- ☒ Pre-application meeting with a staff planner.
- ☒ A non-refundable filing fee.
- ☒ Proof of Ownership.
- ☒ Application, photographs, diagrams, site plans with the setbacks noted, drainage report and any other required information. Please be precise and detailed.
- ☒ Citizen Review Process as listed in ordinance Section 1106. A list of names and addresses of all the property owners within 300 feet of subject property.
- ☐ ADOT permit granting ingress / egress assess
- ☒ Map to property.
- ☒ All required items need to be submitted to Planning & Zoning at least 30 days prior to the next scheduled meeting.

CERTIFICATION & SIGNATURE

Submittal of this application constitutes consent of the applicant in granting the Community Development Department access to the subject property during the course of project review. No further consent or notice shall be required.

I hereby certify that the information in this application is correct and agree to abide by the regulations of this jurisdiction.

Signature of Applicant
_____ Date 5-16-23

Signature of Property Owner (if not the applicant)
_____ Date _____

OFFICE USE ONLY

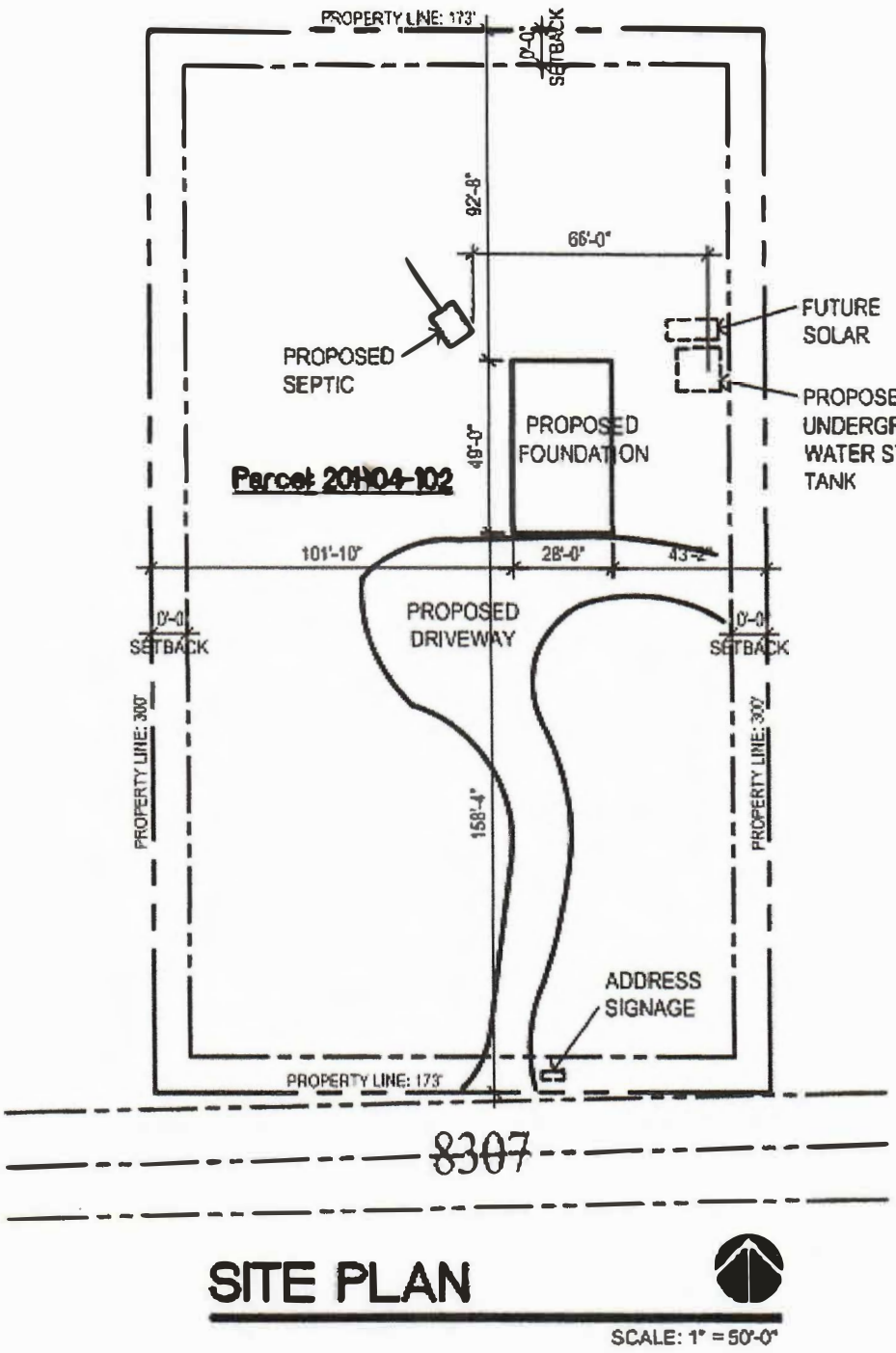
Received By _____ Date 5/23/23
Receipt # 1380 Fee 300
Permit # 2023-19
Related Cases _____
Appeal Filed By _____ Date _____
Receipt # _____ Fee _____

COMMISSION ACTION

☐ Approved ☐ with Conditions ☐ Denied
Resolution # _____ Date _____
Chairman _____ Date _____

BOARD ACTION

☐ Approved ☐ with Conditions ☐ Denied
Ordinance # _____ Date _____
Supervisor _____ Date _____



SITE PLAN

SCALE: 1" = 50'-0"

ANTHONY J. and ANNJANETTE M. LUGO

PARCEL: 201-04-102

SUBDIVISION: SHOW LOW PINES

UNIT: 10 LOT: 102

SECTION: 29, TOWNSHIP: 12N, RANGE: 24E

FBN DRAFTING 2012
AMD 12-11-2012

ARIZONA CERTIFICATE OF TITLE

ADOT
Motor Vehicle Division
48-7200 R01/16 azdot.gov

Inventory Control
4401423?

Vehicle Identification Number	Year	Make	Model	Body Style
B257688A	1995	SCHULT	.	MH

First Registered	List Price	Mobile Home Manufacturer	Unit Number
	022492	SCHULT HOMES CORP	14X50

ANTHONY JAMES LUGO
25742 N 103RD AVE
PEORIA AZ 85383

Title Number	Issue Date	Film Number	Odometer Reading (no tenths) *
MH000105215	12/19/2022		

Previous Title Number	State	Issue Date	Previous Film Number
MH000101904	AZ	11/17/2022	

* A - Actual Mileage
B - Mileage in excess of the odometer mechanical limits
C - NOT Actual Mileage, WARNING ODOMETER DISCREPANCY

Arizona Brands

Previous Brand	State	Previous Brand	State	Previous Brand	State	Other States With Brands

Owners/Lessees
ANTHONY JAMES LUGO OR
25742 N 103RD AVE PEORIA AZ 85383

ANNJANETTE MARI LUGO

Lienholder(s) as of print date. (Additional liens may exist. Check Motor Vehicle Inquiry on htts://servicearizona.com to find all current liens.)

LIEN RELEASE

Lienholder Name		Acknowledged before me this date.	Notary Public Signature		
Lien Amount	Lienholder Signature	Date	County	State	Commission Expires

VOID WITHOUT FACSIMILE WATERMARK ON BACK

ARIZONA CERTIFICATE OF TITLE

ADOT
Motor Vehicle Division
48-7200 R01/16 azdot.gov

Inventory Control
44014236

Vehicle Identification Number	Year	Make	Model	Body Style
B257688B	1995	SCHULT	.	MH

First Registered	List Price	Mobile Home Manufacturer	Unit Number
	022492	SCHULT HOMES CORP	14X50

ANTHONY JAMES LUGO
25742 N 103RD AVE
PEORIA AZ 85383

Title Number	Issue Date	Film Number	Odometer Reading (no tenths) *
MH000105216	12/19/2022		

Previous Title Number	State	Issue Date	Previous Film Number
MH000101905	AZ	11/17/2022	

* A - Actual Mileage
B - Mileage in excess of the odometer mechanical limits
C - NOT Actual Mileage, WARNING ODOMETER DISCREPANCY

Arizona Brands

Previous Brand	State	Previous Brand	State	Previous Brand	State	Other States With Brands

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ANTHONY JAMES LUGO OR
25742 N 103RD AVE PEORIA AZ 85383

ANNJANETTE MARI LUGO

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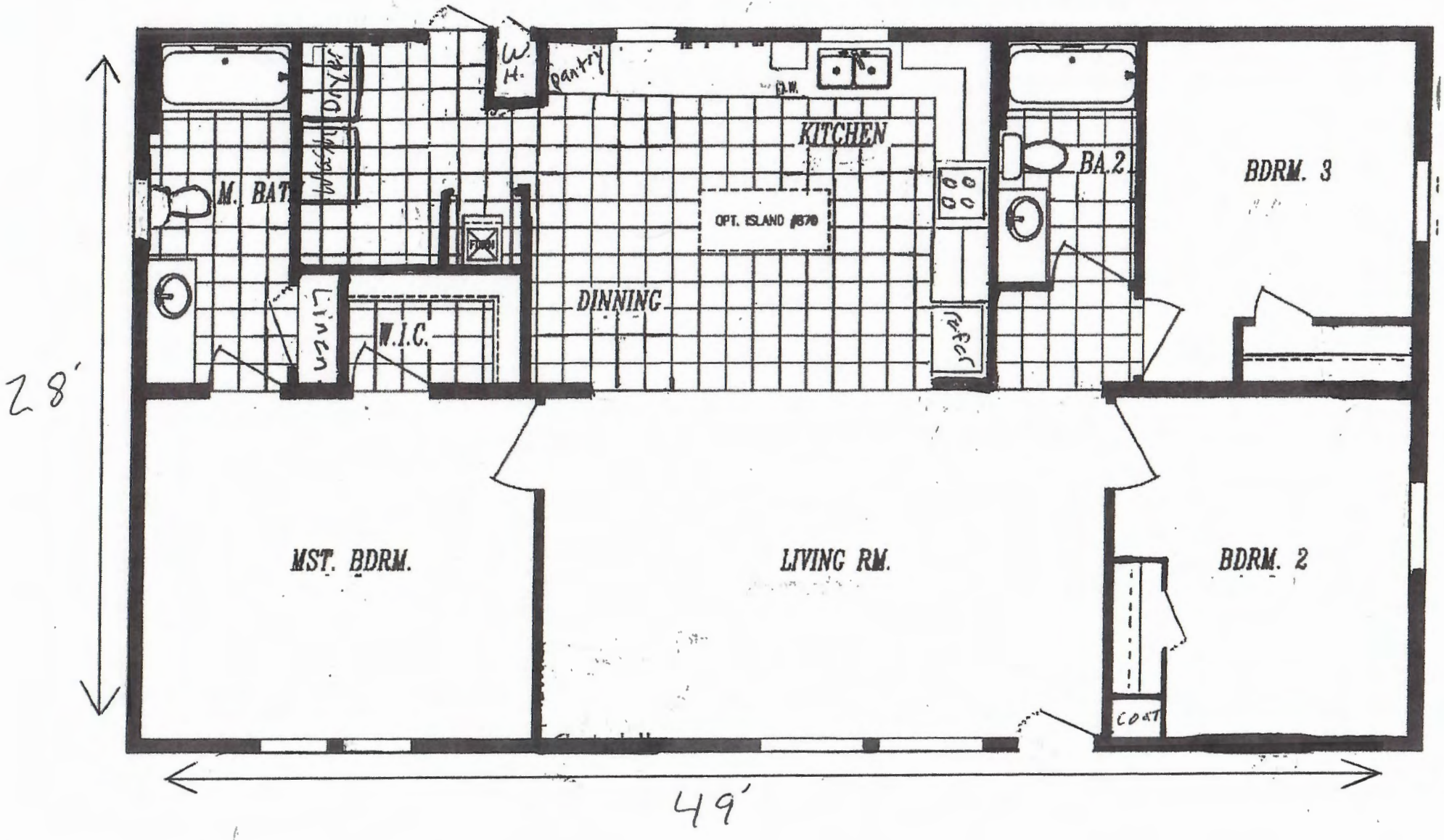
LIEN RELEASE

Lienholder Name		Acknowledged before me this date.	Notary Public Signature		
Lien Amount	Lienholder Signature	Date	County	State	Commission Expires

1372 S.F.

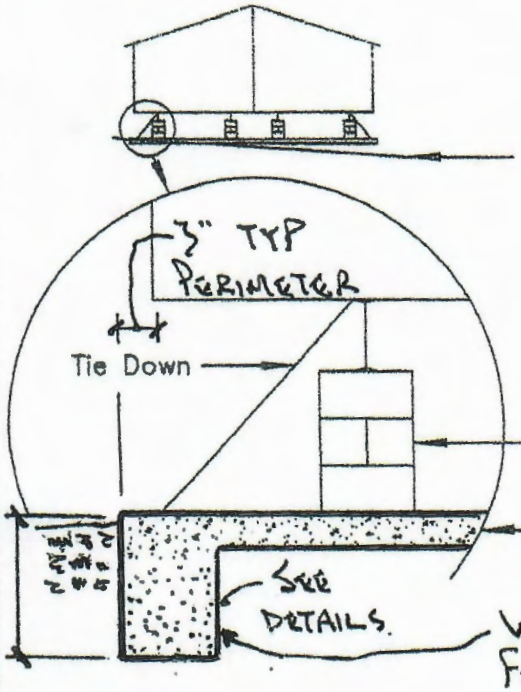

W.H.
pantry
D.W.
KITCHEN
BA.2
BDRM. 3
M. BATH
Linen
OPT. ISLAND #670
DINNING
Linen
W.I.C.
Refr
MST. BDRM.
LIVING RM.
BDRM. 2
COAT
28'
49'

NOTES:

1. Concrete to be a minimum of 2,500 psi 28-day compressive strength.
2. Saw cut joints at 16' on center, maximum spacing.
3. Grade adjacent area to drain away from pad. 5% minimum slope for a minimum distance of 10' around pad.
4. Chassis supports and lateral tie downs in accordance with manufacturer's instructions.
5. Alternative tie downs are acceptable, including LLBS, xi2 or similar.
6. Concrete pad to be poured 6" wider and longer than home footprint to ensure 3" extension around the perimeter.
7. Design is approved for frost depth requirements.

Licensed Dealer:
The Home Source
2250 E. Deuce of Clubs
Show Low, AZ 95901
License #7845

STATE OF ARIZONA
REVIEWED FOR CODE COMPLIANCE
Review does not imply compliance with the requirements of local codes and ordinances governing zoning, fire zones, fire separation, and site development requirements.
Date 5/19/2021 By PES
Approval No. U-292T (AS NOTED)
Sheet 1 of 16
Review of this document does not authorize or approve any omission or deviation from applicable codes and standards.



Existing Grade.
Pad can be placed on existing grade if soil bearing capacity is at least 1,000 PSF. If pad is placed on fill, it shall be compacted to 95% density in maximum lifts of 12".

Blocking materials and procedures as per manufacturers instructions.

Concrete Pad, 5 1/2" Thick, Reinforced with #4 bar @ 24" EW, Centered.

18" MIN

WHEN CONCRETE PAD IS POURED ON GRADE, FOOTING TO EXTEND 12" BELOW GRADE, MIN

Approval Block
State of Arizona

By: _____

Title: _____

Date: _____

Registered Professional Engineer (Civil)
CERTIFICATE NO. 38336
THOMAS E. PAIGE
Date Signed 4.28.21
ARIZONA, U.S.A.

Exp. 12.31.22

Typical Foundation Plan
For
Manufactured Home
In
Apache County

Drawn By: T.P		Date: 4.28.21

Structural Engineering Solutions, LLC

Thomas E. Paige, P.E.
255 Point of View
Prescott, AZ 86303
Phone: (480) 231-1928

Structural Calculations

Manufactured Home Foundation System w/ Cast-In-Place Concrete Slab and Perimeter CMU Wall Skirt

Registered Professional Engineer (Civil)
CERTIFICATE NO.
38336
THOMAS E.
PAIGE
Date Signed 4.18.21
ARIZONA, U.S.A.

Thomas Paige
Expires 12.31.22

STATE OF ARIZONA
REFER TO SHEET #1

MAY 19 2021

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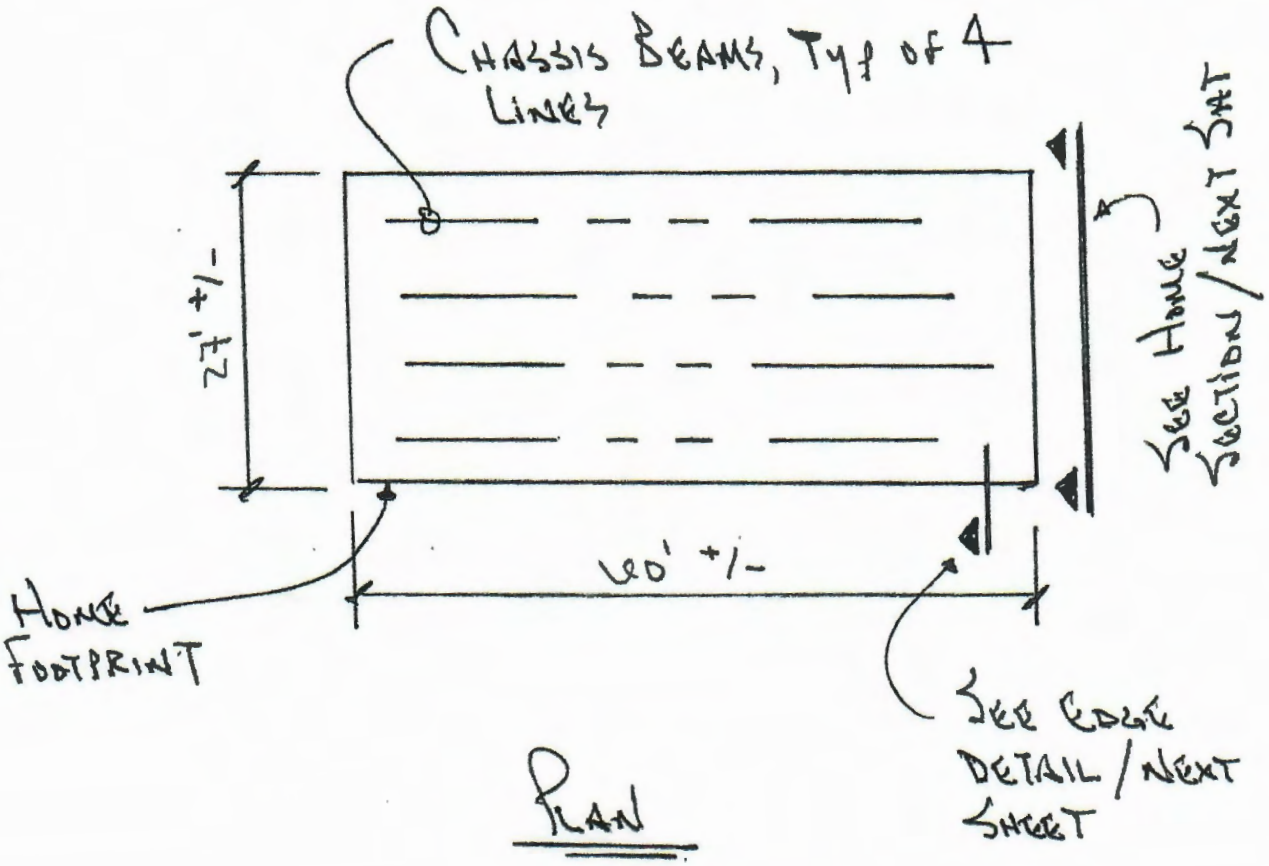
U-292T

SUBJECT Foundation sketches BY Paige SHEET NO 1 OF 14 DATE PROJECT NO

Calculations are based on the 2018 International Building Code (IBC)



Plan

See Section, Detail & Notes on Following Sheets

STATE OF ARIZONA
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MAY 19 2021

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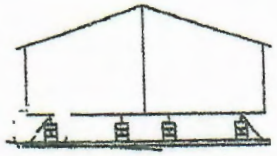
U-292T

SUBJECT Foundation Sketches BY Paige

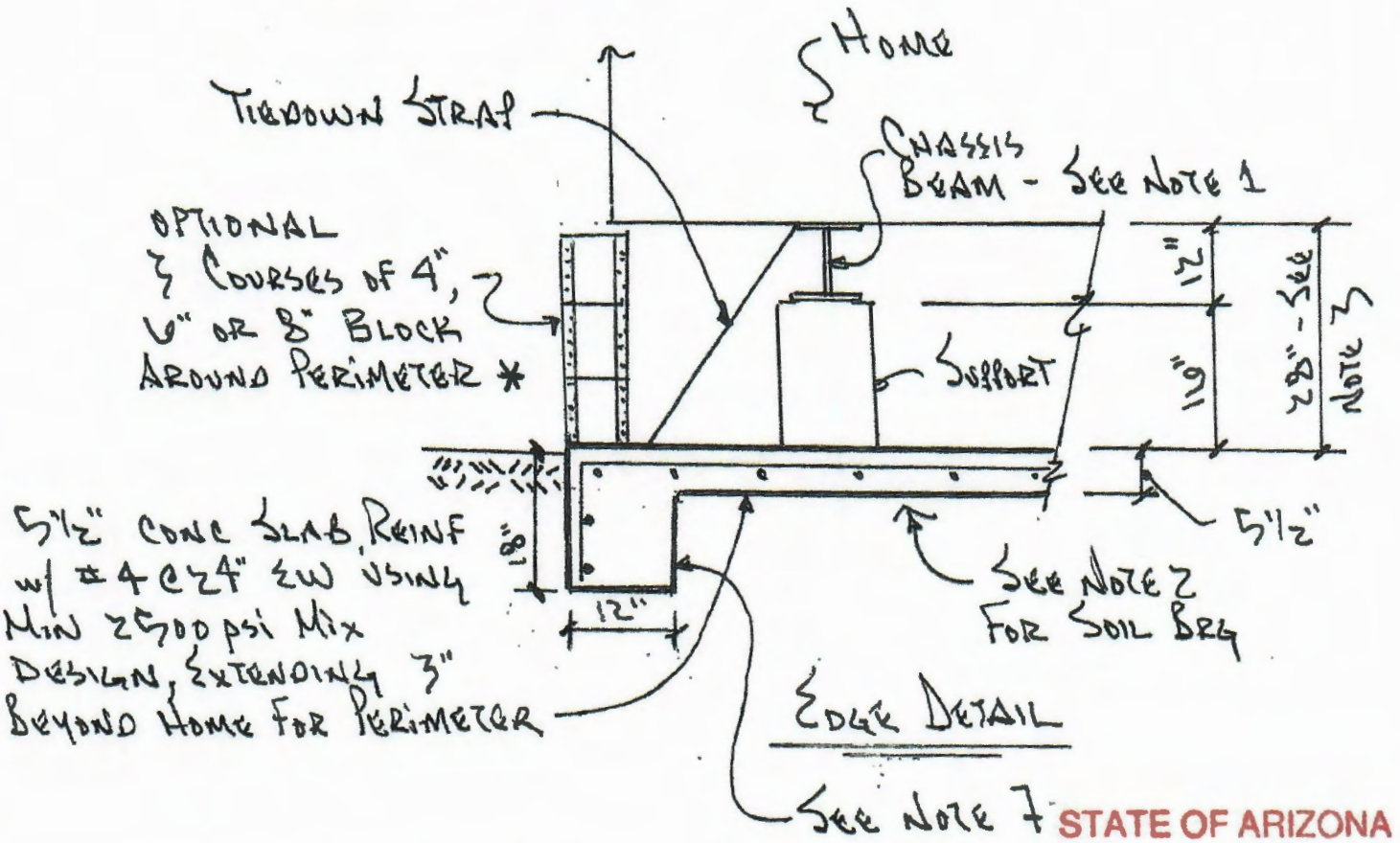
SHEET NO. 2 DATE

PROJECT NO.

* For backfilled skirts, use 8" CMU fully grouted w/ #4 @ 24" vertical rebar w/ 1'-0" hooks into slab



Home Section



Edge Detail

For notes, see the following sheet

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MAY 19 2021

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U-292T

SUBJECT Foundation Sketches BY PAIGE

SHEET NO 3 of ___ DATE ___

PROJECT NO ___

NOTES:

1. Chassis support types and lateral tiedowns shall be in accordance with the home manufacturer's standards. Alternate tiedowns LLBS, xi2 or similar are acceptable.
2. Minimum soil bearing capacity required is 1,000 psf (pounds per square foot). If native soil does not provide this, use fill with a compacted density of 95% using maximum 12" vertical lifts.
3. Minimum crawl space to be 28" clear height under the home.
4. Crawl space to be accessible by at least one access door, approximately 24" x 24". When access to crawl space is below grade, space will be dug out and supported.
5. * Venting in skirting is to be provided with one foundation vent per 75 square feet of home. When vents in block skirting are not possible, trimboard between the home and the block skirting will be a vented soffit board.
6. Design is not intended for use in a flood prone area.

REF * VENTILATION PER 2018 IBC SECT. 1202.4

STATE OF ARIZONA
REFER TO SHEET #1

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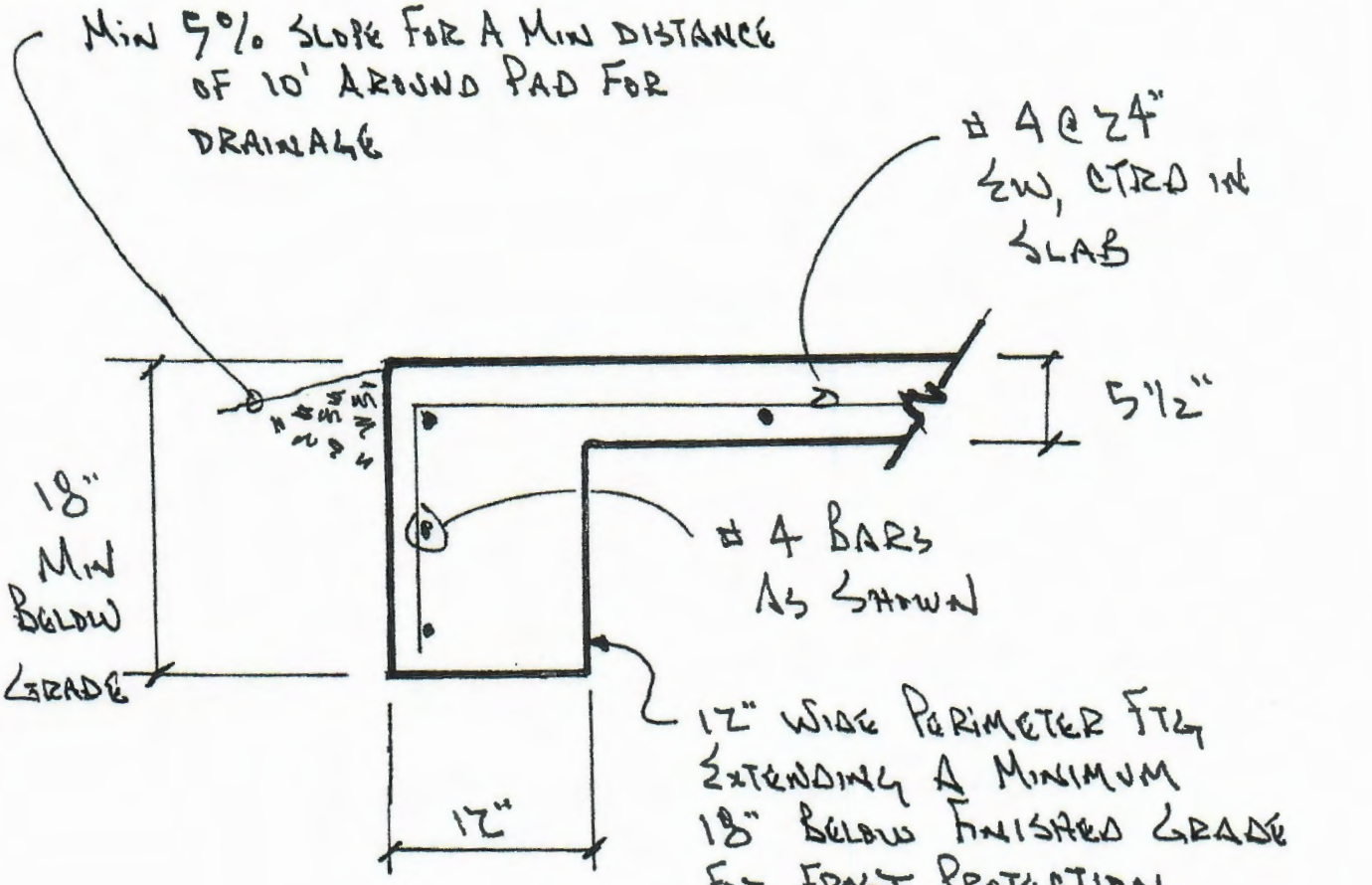
U-292T

SUBJECT Foundation Sketches BY Paige SHEET NO 4 OF DATE PROJECT NO.



PERIMETER THICKENED SLAB

STATE OF ARIZONA
REFER TO SHEET #1

MAY 19 2021

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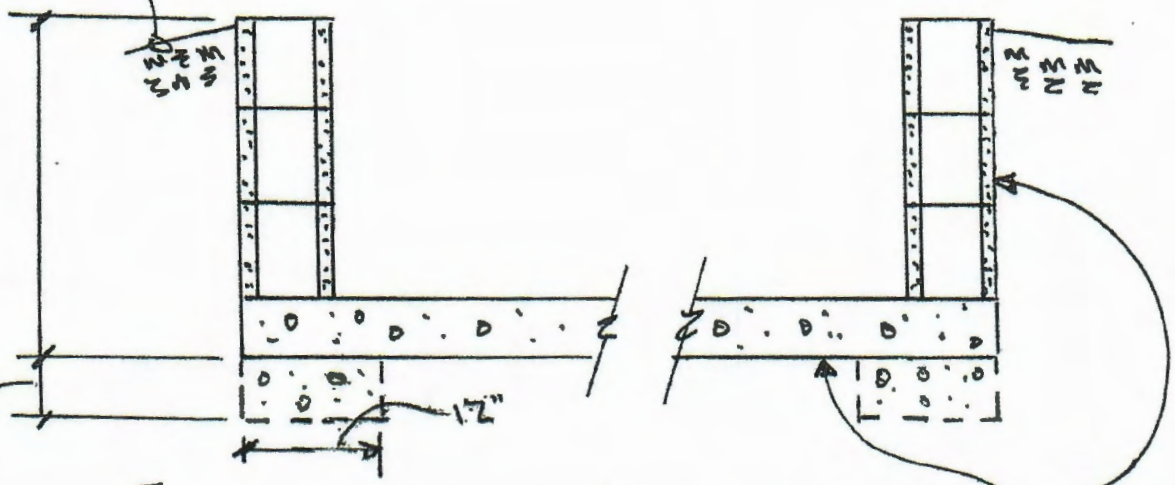
U-292T

SUBJECT FOUNDATION SKETCHES BY RAIGE
SHEET NO 5 DATE
PROJECT NO

MIN 5% SLOPE FOR A MIN DISTANCE OF 10' AROUND PAD FOR DRAINAGE



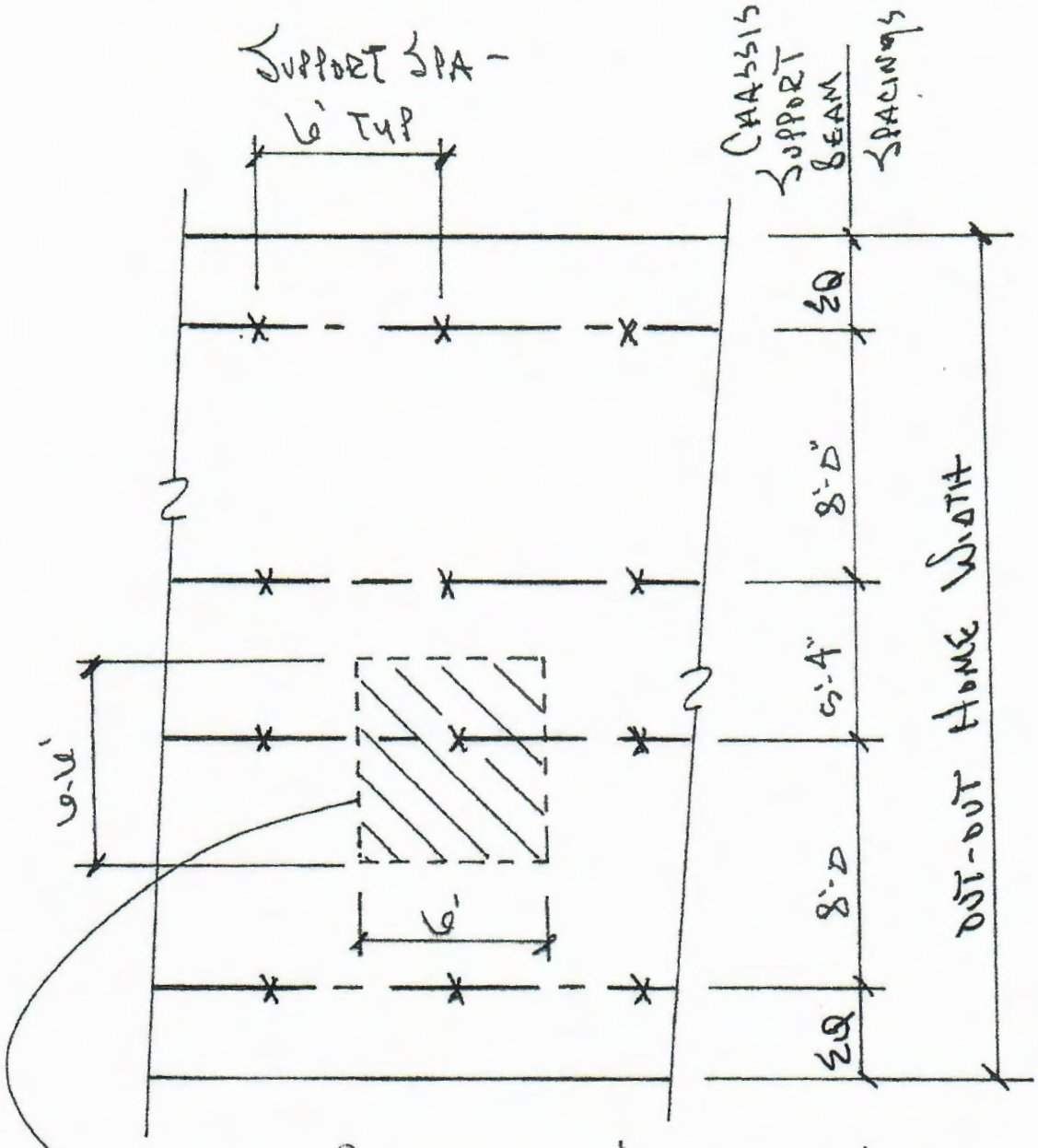
FOR 5 1/2" CONCRETE SLAB AND 8" CMU BLOCK SKIRT INFO, REFER TO "EDGE DETAIL" ON SHEET 2

IN THE EVENT THAT ANY PORTIONS OF THE PERIMETER FINISHED GRADE ELEVATIONS (F.G.) ARE SUCH THAT THEIR HEIGHT ON THE CMU SKIRT ARE LOWER THAN SHOWN, ADD A 12" WIDE CONCRETE x DEPTH REQ'D TO BE AT 18" BELOW F.G. IN THE AFFECTED AREAS. ALSO - SEE NOTE 7 ON SHEET 3

PIT OR GROUND SET FOUNDATION

Foundation Analysis

Support Spa - 6' Typ



Typical Interior Support (Maximum Loaded) Tributary Area

= 6' × 6.6' = Approx 40 sq. ft. of foundation slab

SUBJECT Foundation Analysis

PAGE 7 Paige

Bearing pressure on tributary area

$$\frac{13{,}000^{\#}}{40\ SF} \quad \text{(Max applied support load - see page 3)}$$

$$= 325\ \#/ft^2\ (PSF) < 1{,}000\ PSF\ \text{allowable bearing pressure}$$

∴ Soil bearing is adequate

For concrete slab analysis - see the following pages.

∴ Concrete slab is adequate

SHT 8

Install Footings

As the location and load for each support is determined, note it on the sketch. When selecting locations for supports, keep in mind that increasing the spacing between supports will increase the load on that support and the size of the required footing.

DETERMINE LOCATIONS

Point loads exist where a bearing/structural weight is concentrated and transferred to the foundation at a specific point. Locate a support under each point load, including the following examples:

- Exterior doors in side walls at both sides of each door (blocking is not required at exterior doors in end walls supported by the steel header).
- Other exterior wall openings four feet and greater at both sides of each opening (including multiple windows that total four feet wide or more without intermediate supports, even if individual windows are less than four feet).
- Marriage line openings four feet or greater at both sides of each opening (where marriage line openings are greater than 10 feet, intermediate supports must be placed at maximum 10 feet on center).
- Locations where through-the-rim crossover ducts penetrate the rim joist at the marriage line (unless otherwise noted in supplemental documents provided with the home or unless the home is constructed with a perimeter frame system).
- Marriage line columns.
- Load-bearing porch posts.
- Under heavy (400 lbs or greater) items, such as heavy furniture, waterbeds, fireplaces and large fish tanks.

Adjustable outriggers may be used to replace piers below exterior door or window openings less than 48". Adjustable outriggers may only be substituted if local codes permit the use of these devices and they are installed according to the manufacturer's installation instructions. Factory installed outriggers and crossmembers may also replace piers below exterior door or window openings less than 48".

Mark the required point load support locations on the sketch. Supports are not required where the manufacturer has reinforced the floor (such as with additional outriggers or floor joists) and so noted in the documentation provided with the home.

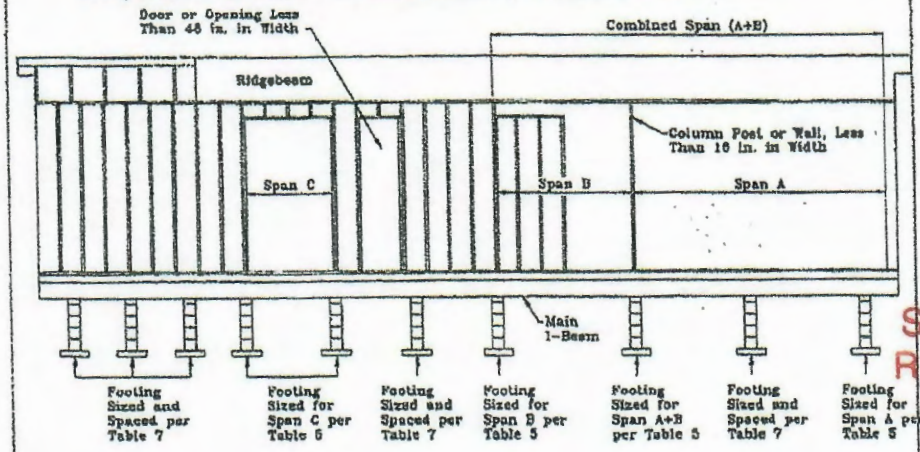


Figure 7. *Typical point-load support locations along the marriage line.*

CALCULATE LOADS

Use **Tables 5-5c** to determine the loads on point load supports (columns). For each support, find the table with the appropriate section width. Then, find the row with the appropriate roof load zone and the column corresponding to the span (see **Figure 7** for guidance on determining spans — If a support is shared by spans on both sides, add the respective loads together to arrive at the total load under that point). The number in the intersecting cell is the load.

SHT 9

Install Footings

Note the required loads next to each point load support on the sketch.

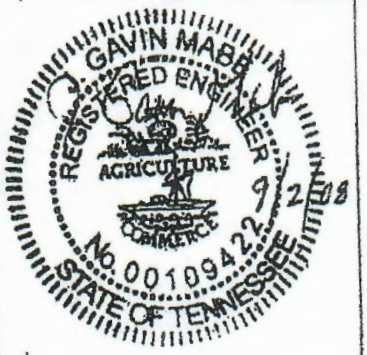


TABLE 5. POINT LOAD ON FOOTINGS AT MARRIAGE LINE OPENINGS (LBS)

20 ft Max. Home Width

Roof Live Load (PSF)	Maximum Opening in Marriage Line (ft)									
	4	8	12	14	16	18	20	24	28	32
20	1000	1600	2200	2500	2800	3100	3400	4000	4600	5200
30	2000	2800	3600	4000	4400	4800	5200	6000	6800	7600
40	2400	3400	4400	4900	5400	5900	6400	7400	8400	9400
60	3200	4600	6000	6700	7400	8100	8800	10200	11600	13000
80	4000	5800	7600	8500	9400	10300	11200	13000	14800	16600
100	4800	7000	9200	10300	11400	12500	13600	15800	18000	20200
120	5600	8200	10800	12100	13400	14700	16000	18600	21200	23800

TABLE 5a. POINT LOAD ON FOOTINGS AT MARRIAGE LINE OPENINGS (LBS)

24/36 ft Max. Home Width

Roof Live Load (PSF)	Maximum Opening in Marriage Line (ft)									
	4	8	12	14	16	18	20	24	28	32
20	1120	1840	2560	2920	3280	3640	4000	4720	5440	6160
30	2320	3280	4240	4720	5200	5680	6160	7120	8080	9040
40	2800	4000	5200	5800	6400	7000	7600	8800	10000	11200
60	3760	5440	7120	7960	8800	9640	10480	12160	13840	15520
80	4720	6880	9040	10120	11200	12280	13360	15520	17680	19840
100	5680	8320	10960	12280	13600	14920	16240	18880	21520	24160
120	6640	9760	12880	14440	16000	17560	19120	22240	25360	28480

TABLE 5b. POINT LOAD ON FOOTINGS AT MARRIAGE LINE OPENINGS (LBS)

28/42 ft Max. Home Width

Roof Live Load (PSF)	Maximum Opening in Marriage Line (ft)									
	4	8	12	14	16	18	20	24	28	32
20	1240	2080	2920	3340	3760	4180	4600	5440	6280	7120
30	2640	3760	4880	5440	6000	6560	7120	8240	9360	10480
40	3200	4600	6000	6700	7400	8100	8800	10200	11600	13000
60	4320	6280	8240	9220	10200	11180	12160	14120	16080	18040
80	5440	7960	10480	11740	13000	14260	15520	18040	20560	23080
100	6560	9640	12720	14260	15800	17340	18880	21960	25040	28120
120	7680	11320	14960	16780	18600	20420	22240	25880	29520	33160

MAX CONCENTRATED LOAD TO SUPPORT = 13,000#

STATE OF ARIZONA
REFER TO SHEET #1

MAY 19 2021

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U-292T

8/13/2008 5:00 PM

SHT 10

STRUCTURAL DESIGN
discussions on design issues for structural engineers

Load-Carrying Capacity

Concrete Slabs-On-Grade Subject To Concentrated Loads

By Victor D. Azzi, Ph.D., P.E., and Ralph H. Laird

The scope of this article is limited to the design of industrial concrete floor slabs on grade for concentrated loads caused by the columns of free-standing work platforms, mezzanines, or mechanical support structures. The concrete floor slab is presumed to be unreinforced. The structure supported by the floor slab is considered to be independent of the building structural system and, therefore, is outside the scope of ACI 318. Further, the spacing of the structural columns supporting these structural platforms is presumed to be sufficiently large, thereby precluding any interactive effects of neighboring columns.

For generations, structural engineers, and those who review their work, have been concerned that there was a lack of understanding of how concrete slabs-on-grade (SOG) behave, particularly under the effects of discrete concentrated loads. This has led to results that in many cases have been unrealistic and overly conservative in their application. With insufficient information, some have speculated about concrete slab-on-grade behavior, including the surmising of failures such as "punching shear," and its dire consequences in applications where none have been observed.

Earlier work done by Westergaard, and Ringo and Anderson, have long been the standard of practice. Standards by the ACI also addressed the design of slabs on grade, and Face and Al-Nasra developed a finite-element basis for the design of SOG. More recently, a definitive research paper by Shentu, Jiang, and Hsu has brought about some rigorous focus to the problem, and their analytical and confirming testing results have allowed a better understanding of the behavior and design of SOG. And even more recently, Higgins has introduced the Shentu method as an approach to a practical design method for slabs-on-grade. The significance of this work is further demonstrated by the City of Los Angeles issuing an Information Bulletin stating that this approach, among others, is an "Acceptable Design and Analysis Method for Use of Slabs-on-Grade as Foundation." The approach developed here is further cited as an acceptable design and analysis method in a recent *Guidance Document*, FEMA 460, by the Building Seismic Safety Council of the Federal Emergency Management Agency, which is focused on issues related to seismic behavior of industrial steel storage racks.

The evolution of SOG design and behavior has allowed both designers and building officials to have a better understanding of, and confidence in, the load-carrying capacities of SOG subjected to large concentrated column loads. These methods are applicable particularly to industrial warehouses and distribution centers where free-standing steel work platforms or mezzanines, typically carrying storage and equipment loads on upper levels, cause large concentrated forces to act at discrete locations on the warehouse floor on which the work platforms have been installed.

The work of Shentu and his colleagues, through a comparison of their analytical predictions and test results, has demonstrated that the load-carrying capacity, as well as settlement behavior, can be well predicted with good results. On that basis, Shentu proceeded to develop a "Simplified Analytical Method" that is the basis for this article. With this method, and the resulting equations presented in that paper, the determination of the load-carrying capacity of a SOG is found to be simple, practical, and reliable.

Extensive investigations conducted by, and on behalf of, the Storage Equipment Manufacturers Association (SMA) have, for several years, been directed to develop an acceptable and reliable design method for floor slabs on grade. This article is intended to summarize their findings. Included here is a brief description of the design parameters for subgrade properties, concrete tensile properties, and the concept of the radius of relative stiffness and its relevance to this problem. Also included is a representative design table, summarizing recommendations resulting from this work for an example six-inch slab.

Employing an Elastoplastic Model

In earlier years, the determination of the allowable concentrated load applied to an existing concrete floor slab system was solved according to the linear elastic theory of Westergaard. The elastic theory is correct as long as the load is small. However, when the ultimate load-carrying capacity is required, the elastoplastic behavior of concrete should be taken into account.

The more recent research by Shentu and Al-Nasra indicate that there is a substantial difference in the results produced by the methods presented in ACI when compared with those from an elastoplastic analysis. Floor slabs on grade can carry significant additional load after the onset of initial cracking, and it is necessary to take advantage of this additional load-carrying capacity in design procedures for engineering structures.

The inconsistency in designing exclusively in the elastic range is apparent. Most engineering publications acknowledge the existence of shrinkage cracks in concrete floors. To use a design procedure, based on the analytical model of a floor presumed to be uncracked, for a floor slab known to be cracked, is inappropriate. The long-standing use of design methods that presume a crack-free slab, while simplifying the analytical model, has encouraged the use of methods that produce results that may not be applicable for the design of a realistic floor slab-on-grade. The design table presented later in this article is based on research results employing an elastoplastic model of concrete structural behavior.

Analysis

The design of a floor slab-on-grade involves the interaction of a concrete slab and a soil support system. The concrete is a material considered to be heterogeneous and statistically isotropic, becoming orthotropic with the development of micro-cracks. Concrete strength in compression is significantly greater than its strength in tension. Micro-cracks may form in the concrete even before loading. The soil system, in general, is also heterogeneous; its characteristics and mechanical properties may vary within a wide range.

In addition to the concrete slab thickness, the following two properties are critical to the design of a floor slab-on-grade: *subgrade strength* and concrete *tensile strength*.

SHT 11

Table 1: 6-inch slab.

Allowable load in Kips						
Soil	1.5 Rad Rel	Concrete PSI	10-inch baseplate	12-inch baseplate	14-inch baseplate	16-inch baseplate
50 pci	52 inch	3000	36	37	38	39
		4000	41	43	44	45
100 pci	44 inch	3000	41	44	46	48
		4000	48	50	52	55
200 pci	37 inch	3000	52	56	60	65
		4000	60	65	70	75

Example

Consider a 6-inch thick unreinforced slab made of 4000 psi concrete; sitting on a soil whose modulus of subgrade reaction, k_c is 100 pci; and with column loads being applied through 14-inch base plates. Using *Table 1*, the allowable concentrated load, P_a is determined to be 52 kips; and the columns should be no closer than 2x44 inches, or 88 inches, or 7.33 feet.

Soil-bearing capacity, soil compressibility, and modulus of subgrade reaction are properties of the soil system that require understanding. *Soil-bearing capacity* is a measure of soil shear failure. This value is determined by using various standardized soil tests. *Soil compressibility* is a measure of long-term settlement in a soil under load. This value is normally determined using soil consolidation tests.

Modulus of subgrade reaction is the proportionality constant, k_c, in a Winkler subgrade. Its value depends upon the kind of soil, the degree of compaction, and the moisture content. The modulus of subgrade reaction has units of *pci*: it is the pressure in *psi* per inch of soil deformation. The procedure for determining k_c is outlined in ASTM D 1196.

For the general relationship between the soil classifications and the modulus of subgrade reaction, see their depiction in Figure 3.3.5 of ACI R-92. Essentially, soils that have high compressibility and low subgrade strength will have a design k value of about 50 pci. Natural soils of higher subgrade strength have a design k value of about 200 pci.

The tensile strength of concrete is usually determined by using the split cylinder test in accordance with ASTM C 496. The tensile strength is a more variable property than the compressive strength; it is about 10 to 15 percent of the compressive strength. The tensile strength is between $6(f_c')^{0.5}$ and $7(f_c')^{0.5}$ for normal stone concrete.

The tensile strength in flexure is the modulus of rupture (ASTM C 78). The modulus of rupture is generally accepted as $7.5(f_c')^{0.5}$ for normal concrete. The magnitude of the compressive strength for concrete is generally available for use by the design engineer.

The values presented in *Table 1* are for unreinforced concrete slabs of six-inch thickness. The tabulated values represent the results for the determination of the allowable load-carrying capacities, P_a, for various concrete slabs on grade for a variety of parametric values, based on the application of the following relationship developed by Shentu:

$$P_n = 1.72\ [(k_c R_l / E_c)10^4 + 3.60]\ f_t' d^2 \quad \text{(Equation 1)}$$

and

$$P_a = P_n / FS \quad \text{(Equation 1a)}$$

or, alternatively, solving for the thickness, d, and introducing a Factor of Safety (FS) yields:

$$d = [(FS \times P_a)/(1.72\ [(k_c R_l / E_c)10^4 + 3.60]\ f_t' \beta)]^{0.5} \quad \text{(Equation 2)}$$

where

P_n = nominal load-carrying capacity of the slab on grade, in pounds.
P_a = allowable load-carrying capacity of the slab on grade, in pounds.
k_c = modulus of subgrade reaction, in pci.
R_l = one-half the width or diameter of the column base plate, in inches.
E_c = modulus of elasticity of concrete, in psi.
f_t' = tensile strength in flexure of concrete, in psi.
d = slab thickness, in inches.
FS = factor of safety, here taken as 3.0.
β = load reduction factor, 1.0 for $d < 7.0$ inches; 0.85 for $d \geq 7.0$ inches.

In the analysis on which this article is based, tables were developed for slab thicknesses from four to eight inches; however, the loads for the seven-inch and eight-inch thick floor slabs were reduced by fifteen percent, using a load-reduction factor, β, to compensate for apparent deviation of the results of *Equation 1* from the finite-element results presented in the Shentu paper.

The earlier work of Packard (12), Pickett and Ray (13) and, more recently, by Spears and Panarese (14), and further detailed in ACI 360R-92 (4), treated the area of influence of a single concentrated load. The slab analyzed has a radius of three times the radius of relative stiffness. The radius of relative stiffness, b, is expressed as the fourth root of the result found by dividing the concrete plate stiffness by the modulus of subgrade reaction as follows:

$$b = [E_c d^3/(12\ (1 - \mu^2)\ k_c)]^{0.25} \quad \text{(Equation 3)}$$

where

b = radius of relative stiffness, in inches.
E_c = modulus of elasticity of concrete, taken here as 4,000,000 psi.
d = slab thickness, in inches.
μ = Poisson's ratio, taken here as 0.15.
k_c = modulus of subgrade reaction, in pci.

Additionally, the table shows a value, in inches, which represents a distance of 1.5 times the *radius of relative curvature* for the slab/soil system. From a practical point of view, the radius of relative stiffness is used to determine the distance from the point of an applied concentrated load to a point where the load has virtually no effect on the slab stress. A load that is within a distance of 1.5 times the radius of relative stiffness from another load may have an influence on the slab stresses. Essentially, the loads shown in *Table 1* assume that the load under consideration is the only load within the distance shown on that Table.

Factor of Safety

The primary focus of this article is the analysis and design of concrete floor slabs-on-grade, in warehouses or industrial-type buildings, on which free-standing work platforms or mezzanine structures are built. These structures are normally designed for heavy storage floor or deck loads of 125 psf or more. Further, these free-standing structures are independent of the building structure and, therefore, the floor slabs are outside the scope of ACI 318.

SHT 12

Table 1: 4-inch Slab

Allowable load in Kips

Soil	1.5 Rad Rel	Concrete PSI	10" baseplate	12" Baseplate	14" Baseplate	16" Baseplate
50 pci	39 inch	3000	16	17	17	17
		4000	19	19	20	20
100 pci	33 inch	3000	19	19	20	21
		4000	21	22	23	24
200 pci	27 inch	3000	23	25	27	29
		4000	27	29	31	33

Table 2: 5-inch Slab

25,000# ALLOWABLE

Allowable load in Kips

Soil	1.5 Rad Rel	Concrete PSI	10" baseplate	12" Baseplate	14" Baseplate	16" Baseplate
50 pci	46 inch	3000	25	26	26	27
		4000	29	30	31	31
100 pci	38 inch	3000	29	30	32	33
		4000	33	35	36	38
200 pci	32 inch	3000	36	39	42	45
		4000	41	45	48	52

Table 3: 6-inch Slab

Allowable load in Kips

Soil	1.5 Rad Rel	Concrete PSI	10" baseplate	12" Baseplate	14" Baseplate	16" Baseplate
50 pci	52 inch	3000	36	37	38	39
		4000	41	43	44	45
100 pci	44 inch	3000	41	44	46	48
		4000	48	50	52	55
200 pci	37 inch	3000	52	56	60	65
		4000	60	65	70	75

Table 4: 7-inch Slab

Allowable load in Kips

Soil	1.5 Rad Rel	Concrete PSI	10" baseplate	12" Baseplate	14" Baseplate	16" Baseplate
50 pci	59 inch	3000	41	43	44	45
		4000	48	49	51	52
100 pci	49 inch	3000	48	50	53	55
		4000	55	58	61	63
200 pci	42 inch	3000	60	65	70	75
		4000	69	75	80	86

When selecting a factor of safety (FS), the following factors should be considered:

a) Will the design load be applied to the entire deck surface simultaneously? The likelihood of the design load being applied over the entire deck surface may be unlikely.
b) Will any slab failure lead to a catastrophic result?
c) Will excessive settlement under load cause problems of function or inconvenience, e.g., will windows break, will doors stick, will stored goods become unstable or dislodged, and will roofs leak due to the floor-slab settlement?
d) Will slab failure lead to costly repair?

Good engineering judgment should be exercised in the selection of any factor of safety. The tables developed in this study, such as the example presented here, in general use a factor of safety of three versus the predicted nominal load, P_n, of Equation (1). While this is considered to be very conservative, a factor of three was chosen, pending any further research results on the effects of control joints and the effects of other possibly-neighboring loads on the overall behavior and load-carrying capacity of the floor-slab system. Further, as stated earlier, the loads for seven-inch-thick-eight-inch-thick floor slabs have been reduced by approximately fifteen percent to compensate for the apparent deviation of the results of *Equation 1* from the finite-element results presented in the Shentu paper.■

SHT 13

Table 5: 8-inch Slab

Allowable load in Kips

Soil	1.5 Rad Rel	Concrete PSI	10" baseplate	12" Baseplate	14" Baseplate	16" Baseplate
50 pci	65 inch	3000	55	56	57	59
		4000	62	64	66	68
100 pci	55 inch	3000	62	65	69	72
		4000	72	75	79	83
200 pci	46 inch	3000	78	85	91	97
		4000	90	98	105	112

Victor D. Azzi, Ph.D., P.E. is a consulting structural engineer who, among other areas of his practice, serves as a consultant to various groups of the material handling industry. He was a long-time Professor of Engineering at the University of New Hampshire, from which he is now retired, and continues to serve on committees of the BSSC-NEHRP, ASCE 7, and AISI dealing with the seismic behavior of non-building structures. Victor can be reached at victorazzi@comcast.net.

Ralph H. Laird, served as president of Wildeck, Inc. from 2002 until his retirement in 2008. He was a registered P.E. until that retirement. Because of the apparent lack of design information for floor slab-on-grade, he worked with the MHI (Material Handling Institute) to assist in the development of a more comprehensive and realistic approach to the SOG design.

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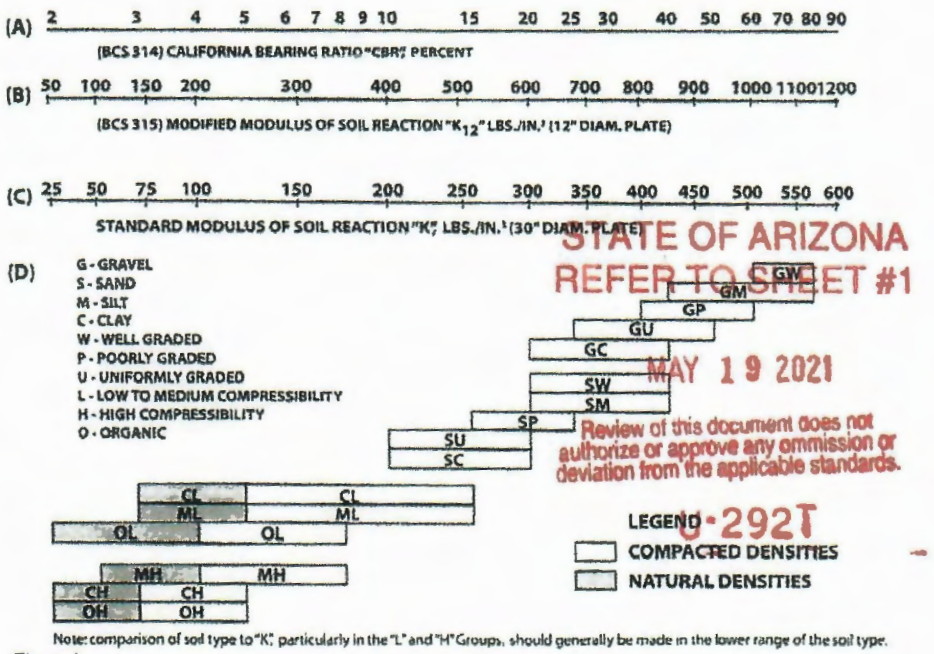
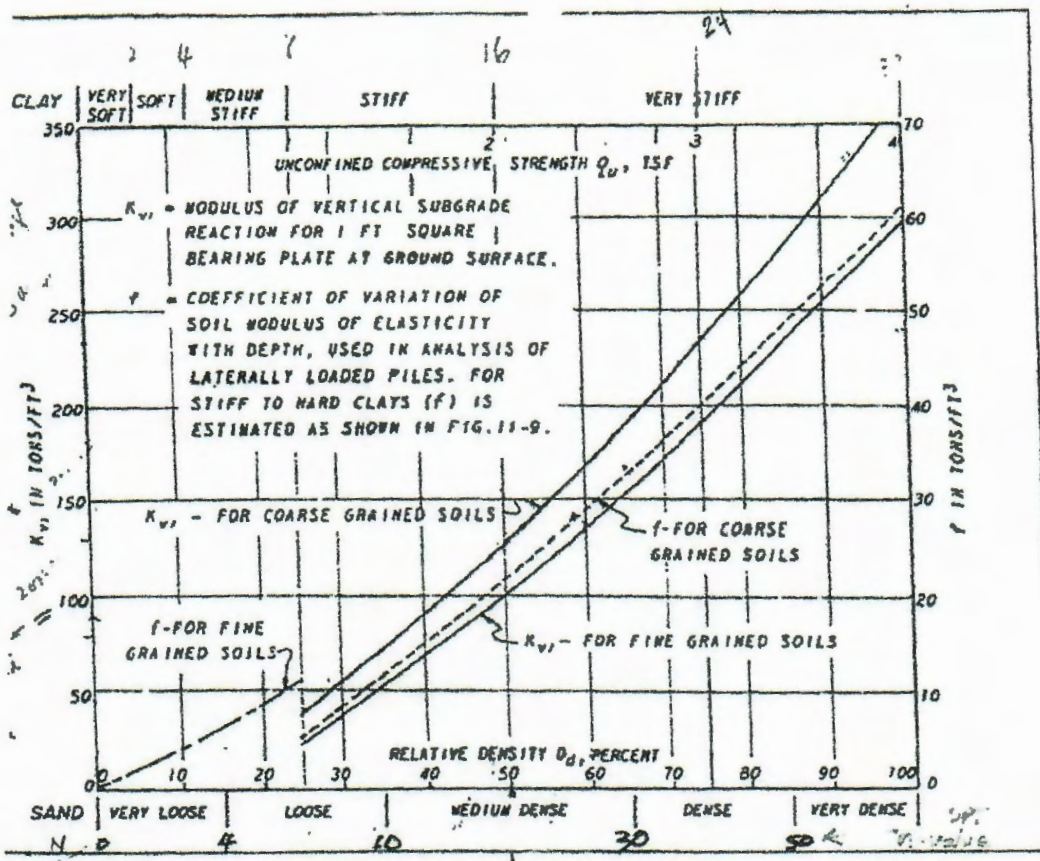


Note: comparison of soil type to "K," particularly in the "L" and "H" Groups, should generally be made in the lower range of the soil type.

Figure 1

SHT 14/14



DEFINITIONS

σ_v = FOOTING SETTLEMENT
q = FOOTING UNIT LOAD IN ksf
B = FOOTING WIDTH
L = FOOTING LENGTH
D = DEPTH OF FOOTING BELOW GROUND SURFACE
E_s = MODULUS OF ELASTICITY OF SOIL
C_s = SHAPE COEFFICIENT OF LOADED AREA

FOR COARSE GRAINED SOILS AND VERY SOFT TO MEDIUM STIFF FINE GRAINED SOILS, E_s IS ASSUMED TO INCREASE LINEARLY WITH DEPTH ($E_s = fz$)

FOR STIFF TO HARD CLAYS E_s IS ASSUMED TO BE CONSTANT WITH DEPTH.

COARSE GRAIN SOILS

(MODULUS OF ELASTICITY INCREASING LINEARLY WITH DEPTH)

SHALLOW FOOTINGS $D \leq B$

FOR $B \leq$ 2FT:

$$\sigma_v = \frac{2\,q\,B^2}{K_{v1}\,(B+1)^2}$$

FOR $B \geq$ 4FT:

$$\sigma_v = \frac{2\,q\,B^2}{K_{v1}\,(B+1)^2}$$

INTERPOLATE FOR INTERMEDIATE VALUES OF B

DEEP FOUNDATION $D \geq 5B$

FOR $B \leq$ 2FT:

$$\sigma_v = \frac{2\,q\,B^2}{K_{v1}\,(B+1)^2}$$

NOTES: 1. NONPLASTIC SILT IS ANALYZED AS COARSE GRAINED SOIL WITH MODULUS OF ELASTICITY INCREASING LINEARLY WITH DEPTH.

2. VALUES OF K_{v1} SHOWN FOR COARSE GRAINED SOILS APPLY TO DRY OR MOIST MATERIAL WITH THE GROUND WATER LEVEL AT A DEPTH OF AT LEAST 1.5B BELOW BASE OF FOOTING. IF GROUND WATER IS AT BASE OF FOOTING, USE $K_{v1}/2$ IN COMPUTING SETTLEMENT.

FIGURE 11-8
Immediate Settlement of Isolated Footings on Coarse Grained Soils

From: Tony Lugo
Subject: Re: Showlow Pines Unit 10, Lot#102
Date: Dec 12, 2022 at 10:02:34 PM
To: M A
Bcc: Tony Lugo

Hi manny, thank you for your response. Hopefully we will be able to meet in the future. Next time you're up there if you see us working please come over and say hi. Thanks Tony and Angi

Sent from my iPhone

> On Dec 12, 2022, at 4:43 PM, M A wrote:
>
> Dec 12, 2022
>
> Tony my name is Manny Arriola I received a letter from you dated December 9, 2022. Our lot is located behind yours on Leighton Dr
> We are not permanent residents we live in Tucson Az. we go up to the cabin about 4 times a year we will not be going up until sometime next year so we will not be able to attend your meeting. Let me know if you have any questions or concerns.
>
> Thank You
>
> Manny & Cecilia
> Arriola

Citizen Participation Plan Report #2 for Anthony & Annjanette Lugo (21 County Road 8307)
for Additional Neighbors Requiring Notifiation.
Dated 6/21/2023

Name & Mailing Info. of Neighbor	Date Letter Sent (Letters Attached)	Response from Neighbor
Mr. Charles Ballantyne	June 5, 2023	Charles called and wanted to discuss the area. He hadn't been up there for many years and wanted to know how the area was developing. Asked about availability of utilities and water in the area. No specific questions about our plan.
Mr. Timothy W. Davis	June 5, 2023	Letter returned as undeliverable (see attached copy)
Mr. Norman V. or Colleen Y. Elsworth	June 5, 2023	Received an email from Colleen & Norman expressing support of our plan. Email Attached.
Mr. Harvey Whiteman	June 5, 2023	Harvey called and wanted to discuss the area. He inherited his land from an uncle and has not ever been to the property. He wanted to know how the area was developing. Asked about availability of utilities and water in the area. No specific questions about our plan
Mr. Gary Kendrick	June 5, 2023	No response from Gary.

We notified 100% of the additional five (5) neighbors that we were told were not informed on our first report. Three (3) responded to the letter sixty percent (60%), one (1) response indicatied 100% support of our plan, and the two (2) others were mor interested in finding out about the area and property values for the area. They were not at all concerned with our plan.

We have not received any concerns with our plan from either this list of the first list of citizens we notified and held a meeting for on 12/30/2022.

From: Colleen Elsworth
Sent: Thursday, June 8, 2023 3:43 PM
To: Toni Lugo
Subject: Anthony & Annjanette LugoShow Low Pines, Unit 10, Lot #102, 1995 Schult 3/2 manufacture home

To whom it may concern (Apache County Building Permit):

My husband & myself, Norman V & Colleen Y Elsworth both agree to have their 1995 Schult placed on property to live in. I feel that the laws you have made to stop older homes from coming in has cause more problems then allowing this to happen. They are trying to make difference, & do it the right way. So bottom line, please let them do it & change that law. It might even discourage other types (meaning that ones just want to put a hole in the ground for waste). More good people, more good people to watch the area. Not everybody can go new, but there are alot of good older homes that can be placed & still have a lot of good use.

Anyway, thank you for taking the time to listen. Let them do it please.

Norman & Colleen Elsworth

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The Apache County Planning and Zoning Commission
will hold a meeting on Thursday July 6, 2023 at 1:00 p.m. in the Board of Supervisors Room, located in the Apache County Annex at 75 W. Cleveland, St. Johns, Arizona, at which the Commission will hold a public hearing to consider and possibly approve the following items:

PUBLIC HEARING, consideration, and possible recommendation for approval of a Conditional Use Permit to allow Tony and Angi Lugo to place a 1995 Schult Manufactured Home on their 1.17-acre parcel. The property is located in the Show Low Pines Subdivision unit 10 on county road 8307 Concho, AZ. A.P.N. 201-04-102.

*Pursuant to the Americans with Disabilities Act, the Apache County Planning & Zoning endeavors to ensure the accessibility of its meetings to all persons with disabilities. If you need an accommodation for a meeting, please contact Shanna at (928) 337-7526, TDD (928)-337-4402 at least 48 hours prior to the meeting (not including weekends or holidays) so that an accommodation can be arranged. One or more members of the Commission may participate telephonically or through video communication.

*These items are available on the county Web site at www.co.apache.az.us at least 24 hours prior to the scheduled meeting. Those wishing to comment on any of these items may do so in writing, by e-mail, or in person. Mail comments to Apache County Community Development, P.O. Box 238, St. Johns, AZ 85936, or e-mail planning@co.apache.az.us.

***If you plan to attend the public meeting, please call (928) 337-7526 the day of the meeting to ensure that the meeting has not been cancelled or postponed.

Published in the White Mountain Independent: #172868, F, June 16, 2023

Posted 6/21/23

NOTICE

THE APACHE COUNTY

PLANNING & ZONING COMMISSION

WILL HOLD A PUBLIC MEETING

75 W. Cleveland Street,

County Annex Board of Supervisors Room

Thursday July 6, 2023

AT **1 p.m.**

FOR THE PURPOSE OF

CONDITIONAL USE PERMIT

Allowing Tony and Angi Lugo to install a 1995 Schult Manufactured Home on their 1.17-acre parcel.

Apache County Ordinance Article 7 Section 730.

FOR THE PROPERTY DESCRIBED AS FOLLOWS:

Parcel/Reference Number: 201-04-102

Location/Legal Description: Show Low Pines Subdiv. Unit 10

Township: 12N, Range: 24E, Section: 29

All interested persons are encouraged to attend the public meeting.

HEARING