Investigating & Evaluating Truss Designs

Empowering Structural Engineers to Diagnose, Investigate, and Innovate with Confidence

Presented by John Holland - President/CEO

Learning Objectives:

1

Model Trusses

Assess existing truss designs for new conditions.

2

Understand Assumptions

Identify common loading and analysis practices in wood truss design.

3

Evaluate Modifications

Investigate and identify key controlling information to design effective solutions.

Background & Experience

- 3rd Generation Component Manufacturer
- Founder of Paragon
- Extensive involvement in SBCA
- Visiting lecturer at Virginia Tech
- Guest speaker BCMC

How Structural Engineers Relate to Wood Trusses

Multiple Roles to Solve Complex Structural Challenges

Doctor

Identify weaknesses and recommend solutions.

Detective

Trace root causes and analyze incomplete data.

Designer

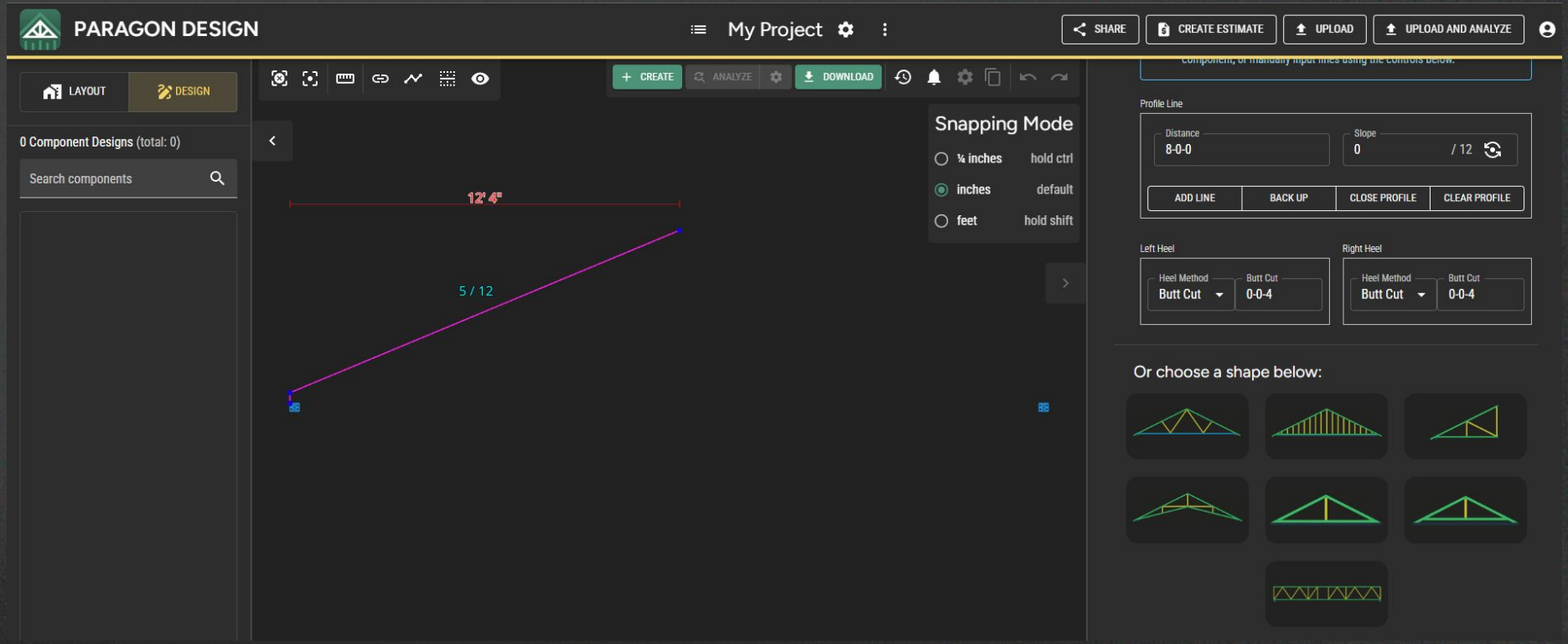
Develop designs to meet customer needs.

Doctor

Prescribing Wood Truss Repairs and Remedies

Problem: truss modifications or damage have compromised the structural integrity,

Use Paragon to Model Truss Stresses



Detective

Forensically Investigating
Wood Truss Failures

https://elcosh.org/document/4231/d001515/Oregon+FACE+Report%25
3A+Collapsed+roof+trusses+kill+carpenter+foreman.html

LUMBER SPECIFICATIONS
TC: 2x4 SP #2
BC: 2x4 SP #2
WEBS: 2x4 SP #3

TC LATERAL SUPPORT 24"OC. UON.
BC LATERAL SUPPORT 24"OC. UON.

M-3x4 where shown; Jts:1,3,5-6,9,11

Unbalanced live loads have been considered for this design.

Connector plates provided by MiTek.

TRUSS SPAN 35'- 4.5"
LOAD DURATION INCREASE = 1.25
SPACED 24.0" O.C.

LOADING
LL(20.0)+DL(10.0) ON TOP CHORD = 30.0 PSF
DL ON BOTTOM CHORD = 10.0 PSF
TOTAL LOAD = 40.0 PSF

BOTTOM CHORD CHECKED FOR A 20 PSF LIMITED STORAGE LIVE LOAD AT LOCATION(S) SPECIFIED BY IBC 2006. THE BOTTOM CHORD DEAD LOAD IS A MINIMUM OF 10 PSF.

IBC 2006 MAX MEMBER FORCES 4WR/DSP/Cg=1.00 PPM

1-	2=(	-483)	353	1-	8=(-221)	355	8-	2=(-2495)	1346	11- 6=(-94) 111
2-	3=(-2119)		821	8-	9=(-697)	1814	2-	9=(-87)	110	6-12=(-2250) 948
3-	4=(-1617)		715	9-	10=(-670)	1738	9-	3=(0)	292	12- 7=(-144) 165
4-	5=(-1611)		712	10-	11=(-673)	1711	3-	10=(-544)	212	
5-	6=(-2109)		829	11-	12=(-719)	1817	10-	4=(-232)	1074	
6-	7=(-89)		134				10-	5=(-533)	229	
							5-	11=(0)	311	

BEARING LOCATIONS	MAX VERT REACTIONS	MAX HORZ REACTIONS	BRG SIZE	REQUIRED BRG LENGTH INCHES (SPECIES)
1'- 8.5"	-141/ 1607V	-186/ 188H	3.50"	1.71 SP (565)
35'- 4.5"	-133/ 1476V	-186/ 188H	3.50"	1.74 SP (565)

BRG @ 1'- 8.5" 1.55 DF/ 2.39 HF/ 2.28 SPF
BRG @ 35'- 4.5" 1.57 DF/ 2.43 HF/ 2.31 SPF

+ Web Member 2x4 Continuous Lateral Restraint (CLR) with Diagonal Bracing (DB) or 2x_ Reinforcement Required. Refer to BCSI-B3 for attachment and additional information, or as specified by the Building Designer.

MAX LL DEFL = -0.012" (L/1708) @ 0'- 0.0" L/120 = 0.171"
MAX TL DEFL = -0.014" (L/1464) @ 0'- 0.0" L/90 = 0.228"
MAX LL DEFL = 0.120" (L/3308) @ 18'- 6.5" L/240 = 1.654"
MAX TL DEFL = -0.181" (L/2193) @ 18'- 6.5" L/180 = 2.206"

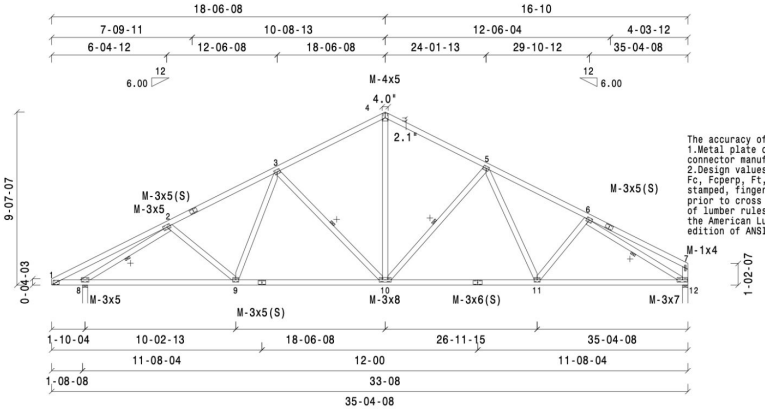
MAX HORIZ. LL DEFL = -0.055" @ 35'- 1.0"
MAX HORIZ. TL DEFL = 0.084" @ 35'- 1.0"

Design conforms to main windforce-resisting system and components and cladding criteria.

Wind: 100 mph, h=15ft, TCDL=6.0,BCDL=6.0, ASCE 7-05, Enclosed, Cat.2, Exp.B, MWFRS, gable end zone, load duration factor=1.6

Max CSI: TC:0.68 BC:0.74 Web:1.00

Design checked for a 300 lb concentrated top chord live load per IBC 2006 due to maintenance workers which is non-concurrent with other live loads.



The accuracy of this Truss Design Drawing relies upon accurate:
1.Metal plate connector design values as published by the plate connector manufacturer.
2.Design values for solid sawn lumber. Design values (E, Emin, Fb, Fc, Fcperp, Ft, and Fv) for solid sawn lumber and approved, grade stamped, finger jointed lumber shall be defined by the grade stamp prior to cross cutting and in accordance with the published values of lumber rules writing agencies approved by the Board of Review of the American Lumber Standards Committee in accordance with the latest edition of ANSI/TPI 1 section 6.3.

JOB NAME: 9441 - MEADOW BROOK - T-10

Scale: 0.1691

Truss: T-10
DES. BY: Jason0
DATE: 11/15/2010
SEQ.: T-10
TRANS ID: 9441

WARNINGS:
1. Builder and erection contractor should be advised of all General Notes and Warnings before construction commences.
2. 2x4 compression web bracing must be installed where shown +.
3. All lateral force resisting elements such as temporary and permanent stability bracing must be designed by designer of complete structure. CompuTrus assumes no responsibility for such bracing.
4. No load should be applied to any component until after all bracing and fasteners are complete and at no time should any loads greater than design loads be applied to any component.
5. CompuTrus has no control over and assumes no responsibility for the fabrication, handling, shipment and installation of components.
6. This design is furnished subject to the limitations set forth by TPI/WTCA in BCSI, copies of which will be furnished upon request.

CompuTrus, Inc. Software +7.5.3.1F(1L)-E

GENERAL NOTES, unless otherwise noted:
1. This truss design is adequate for the design parameters shown. Review and approval is the responsibility of the building designer, not the truss designer or truss engineer.
2. Design assumes the top and bottom chords to be laterally braced at 2' o.c. and at 10' o.c. respectively unless braced throughout their length by continuous sheathing such as plywood sheathing(TC) and/or drywall(BC).
3. 2x Impact bridging or lateral bracing required where shown + +.
4. Installation of truss is the responsibility of the respective contractor.
5. Design assumes trusses are to be used in a non-corrosive environment, and are for "dry condition" of use.
6. Design assumes full bearing at all supports shown. Shim or wedge if necessary.
7. Design assumes adequate drainage is provided.
8. Plates shall be located on both faces of truss, and placed so their center lines coincide with joint center lines.
9. Digits indicate size of plate in inches.
10. For basic connector plate design values see ESR-2529 (CompuTrus) and/or ESR-1311, ESR-1988 (MiTek).

LUMBER SPECIFICATIONS
TC: 2x4 SP #2
BC: 2x4 SP #2
WEBS: 2x4 SP #3

TC LATERAL SUPPORT 24"OC. UON.
BC LATERAL SUPPORT 24"OC. UON.

M-3x4 where shown; Jts:1,3,5-6,9,11

Unbalanced live loads have been considered for this design.

Connector plates provided by MiTek.

TRUSS SPAN 35'- 4.5"
LOAD DURATION INCREASE = 1.25
SPACED 24.0" O.C.

LOADING
LL(20.0)+DL(10.0) ON TOP CHORD = 30.0 PSF
DL ON BOTTOM CHORD = 10.0 PSF
TOTAL LOAD = 40.0 PSF

BOTTOM CHORD CHECKED FOR A 20 PSF LIMITED STORAGE LIVE LOAD AT LOCATION(S) SPECIFIED BY IBC 2006. THE BOTTOM CHORD DEAD LOAD IS A MINIMUM OF 10 PSF.

IBC 2006 MAX MEMBER FORCES 4WR/DSP/Cq=1.00 PPM

1- 2=(-483)	353	1- 8=(-221)	355	8- 2=(-2495)	1346
2- 3=(-2119)	821	8- 9=(-697)	1814	2- 9=(-87)	110
3- 4=(-1617)	715	9-10=(-670)	1738	9- 3=(0)	292
4- 5=(-1611)	712	10-11=(-673)	1711	3-10=(-544)	212
5- 6=(-2109)	829	11-12=(-719)	1817	10- 4=(-232)	1074
6- 7=(-89)	134			10- 5=(-533)	229
				5-11=(0)	311
				11- 6=(-94)	111
				6-12=(-2250)	948
				12- 7=(-144)	165

BEARING LOCATIONS	MAX VERT REACTIONS	MAX HORZ REACTIONS	BRG SIZE	REQUIRED BRG LENGTH INCHES (SPECIES)
1'- 8.5"	-141/ 1607V	-186/ 188H	3.50"	1.71 SP (565)
35'- 4.5"	-133/ 1476V	-186/ 188H	3.50"	1.74 SP (565)

BRG @ 1'- 8.5" 1.55 DF/ 2.39 HF/ 2.28 SPF
BRG @ 35'- 4.5" 1.57 DF/ 2.43 HF/ 2.31 SPF

MAX LL DEFL = -0.012" (L/1708) @ 0'- 0.0" L/120 = 0.171"
MAX TL DEFL = -0.014" (L/1464) @ 0'- 0.0" L/90 = 0.228"
MAX LL DEFL = 0.120" (L/3308) @ 18'- 6.5" L/240 = 1.654"
MAX TL DEFL = -0.181" (L/2193) @ 18'- 6.5" L/180 = 2.206"

MAX HORIZ. LL DEFL = -0.055" @ 35'- 1.0"
MAX HORIZ. TL DEFL = 0.084" @ 35'- 1.0"

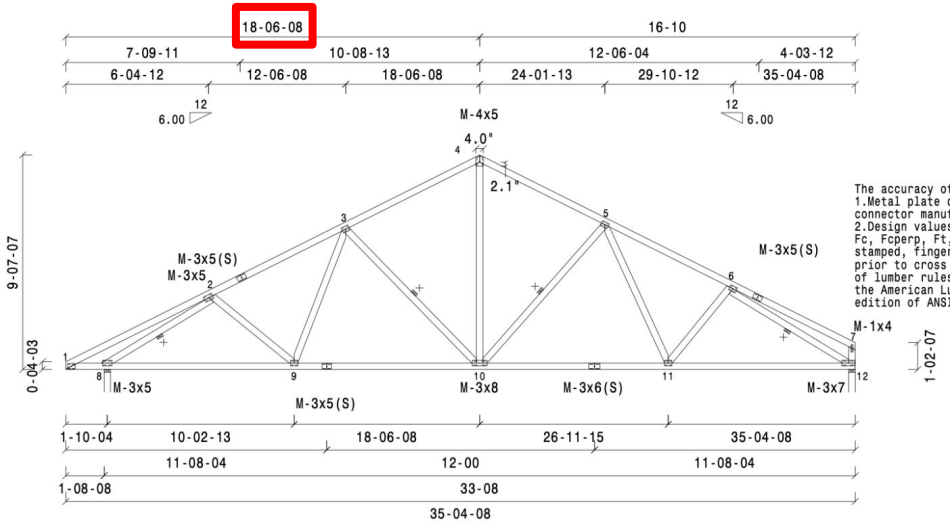
Design conforms to main windforce-resisting system and components and cladding criteria.

Wind: 100 mph, h=15ft, TCDL=6.0,BCDL=6.0, ASCE 7-05, Enclosed, Cat.2, Exp.B, MWFRS, gable end zone, load duration factor=1.6

Max CSI: TC:0.68 BC:0.74 Web:1.00

Design checked for a 300 lb concentrated top chord live load per IBC 2006 due to maintenance workers which is non-concurrent with other live loads.

+ Web Member 2x4 Continuous Lateral Restraint (CLR) with Diagonal Bracing (DB) or 2x_ Reinforcement Required. Refer to BCSI-B3 for attachment and additional information, or as specified by the Building Designer.



The accuracy of this Truss Design Drawing relies upon accurate:
1.Metal plate connector design values as published by the plate connector manufacturer.
2.Design values for solid sawn lumber. Design values (E, Emin, Fb, Fc, Fcperp, Ft, and Fv) for solid sawn lumber and approved, grade stamped, finger jointed lumber shall be defined by the grade stamp prior to cross cutting and in accordance with the published values of lumber rules writing agencies approved by the Board of Review of the American Lumber Standards Committee in accordance with the latest edition of ANSI/TPI 1 section 6.3.

JOB NAME: 9441 - MEADOW BROOK - T-10

Scale: 0.1691

Truss: T-10
DES. BY: JasonO
DATE: 11/15/2010
SEQ.: T-10
TRANS ID: 9441

WARNINGS:
1. Builder and erection contractor should be advised of all General Notes and Warnings before construction commences.
2. 2x4 compression web bracing must be installed where shown +.
3. All lateral force resisting elements such as temporary and permanent stability bracing must be designed by designer of complete structure. CompuTrus assumes no responsibility for such bracing.
4. No load should be applied to any component until after all bracing and fasteners are complete and at no time should any loads greater than design loads be applied to any component.
5. CompuTrus has no control over and assumes no responsibility for the fabrication, handling, shipment and installation of components.
6. This design is furnished subject to the limitations set forth by TPI/WTCA in BCSI, copies of which will be furnished upon request.

CompuTrus, Inc. Software +7.5.3.1F(1L)-E

GENERAL NOTES, unless otherwise noted:
1. This truss design is adequate for the design parameters shown. Review and approval is the responsibility of the building designer, not the truss designer or truss engineer.
2. Design assumes the top and bottom chords to be laterally braced at 2' o.c. and at 10' o.c. respectively unless braced throughout their length by continuous sheathing such as plywood sheathing(TC) and/or drywall(BC).
3. 2x Impact bridging or lateral bracing required where shown + +
4. Installation of truss is the responsibility of the respective contractor.
5. Design assumes trusses are to be used in a non-corrosive environment, and are for "dry condition" of use.
6. Design assumes full bearing at all supports shown. Shim or wedge if necessary.
7. Design assumes adequate drainage is provided.
8. Plates shall be located on both faces of truss, and placed so their center lines coincide with joint center lines.
9. Digits indicate size of plate in inches.
10. For basic connector plate design values see ESR-2529 (CompuTrus) and/or ESR-1311, ESR-1988 (MiTek).

LUMBER SPECIFICATIONS
TC: 2x4 SP #2
BC: 2x4 SP #2
WEBS: 2x4 SP #3

TC LATERAL SUPPORT 24"OC. UON.
BC LATERAL SUPPORT 24"OC. UON.

Unbalanced live loads have been considered for this design.

Connector plates provided by MiTek.

TRUSS SPAN 35'- 4.5"
LOAD DURATION INCREASE = 1.25
SPACED 24.0" O.C.

LOADING
LL(20.0)+DL(10.0) ON TOP CHORD = 30.0 PSF
DL ON BOTTOM CHORD = 10.0 PSF
TOTAL LOAD = 40.0 PSF

BOTTOM CHORD CHECKED FOR A 20 PSF LIMITED STORAGE LIVE LOAD AT LOCATION(S) SPECIFIED BY IBC 2006. THE BOTTOM CHORD DEAD LOAD IS A MINIMUM OF 10 PSF.

IBC 2006 MAX MEMBER FORCES 4WR/DSP/Cq=1.00 PPM

1- 2=(-483)	353	1- 8=(-221)	355	8- 2=(-2495)	1346
2- 3=(-2119)	821	8- 9=(-697)	1814	2- 9=(-87)	110
3- 4=(-1617)	715	9-10=(-670)	1738	9- 3=(0)	292
4- 5=(-1611)	712	10-11=(-673)	1711	3-10=(-544)	212
5- 6=(-2109)	829	11-12=(-719)	1817	10- 4=(-232)	1074
6- 7=(-89)	134			10- 5=(-533)	229
				5-11=(0)	311

BEARING LOCATIONS	MAX VERT REACTIONS	MAX HORZ REACTIONS	BRG SIZE	REQUIRED BRG LENGTH INCHES	(SPECIES)
1'- 8.5"	-141/ 1607V	-186/ 188H	3.50"	1.71	SP (565)
35'- 4.5"	-133/ 1476V	-186/ 188H	3.50"	1.74	SP (565)

BRG @ 1'- 8.5" 1.55 DF/ 2.39 HF/ 2.28 SPF
BRG @ 35'- 4.5" 1.57 DF/ 2.43 HF/ 2.31 SPF

MAX LL DEFL = -0.012" (L/1708) @ 0'- 0.0" L/120 = 0.171"
MAX TL DEFL = -0.014" (L/1464) @ 0'- 0.0" L/90 = 0.228"
MAX LL DEFL = 0.120" (L/3308) @ 18'- 6.5" L/240 = 1.654"
MAX TL DEFL = -0.181" (L/2193) @ 18'- 6.5" L/180 = 2.206"

MAX HORIZ. LL DEFL = -0.055" @ 35'- 1.0"
MAX HORIZ. TL DEFL = 0.084" @ 35'- 1.0"

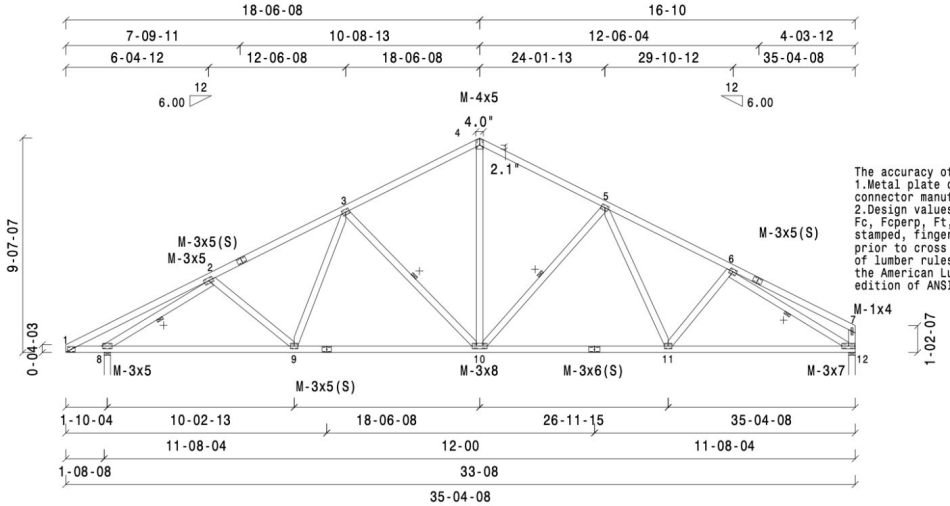
+ Web Member 2x4 Continuous Lateral Restraint (CLR) with Diagonal Bracing (DB) or 2x_ Reinforcement Required. Refer to BCSI-B3 for attachment and additional information, or as specified by the Building Designer.

Design conforms to main windforce-resisting system and components and cladding criteria.

Wind: 100 mph, h=15ft, TCDL=6.0,BCDL=6.0, ASCE 7-05, Enclosed, Cat.2, Exp.B, MWFRS, gable end zone, load duration factor=1.6

Max CSI: TC:0.68 BC:0.74 Web:1.00

Design checked for a 300 lb concentrated top chord live load per IBC 2006 due to maintenance workers which is non-concurrent with other live loads.



The accuracy of this Truss Design Drawing relies upon accurate:
1.Metal plate connector design values as published by the plate connector manufacturer.
2.Design values for solid sawn lumber. Design values (E, Emin, Fb, Fc, Fcperp, Ft, and Fv) for solid sawn lumber and approved, grade stamped, finger jointed lumber shall be defined by the grade stamp prior to cross cutting and in accordance with the published values of lumber rules writing agencies approved by the Board of Review of the American Lumber Standards Committee in accordance with the latest edition of ANSI/TPI 1 section 6.3.

JOB NAME: 9441 - MEADOW BROOK - T-10

Scale: 0.1691

Truss: T-10
DES. BY: JasonO
DATE: 11/15/2010
SEQ.: T-10
TRANS ID: 9441

WARNINGS:
1. Builder and erection contractor should be advised of all General Notes and Warnings before construction commences.
2. 2x4 compression web bracing must be installed where shown +.
3. All lateral force resisting elements such as temporary and permanent stability bracing must be designed by designer of complete structure. CompuTrus assumes no responsibility for such bracing.
4. No load should be applied to any component until after all bracing and fasteners are complete and at no time should any loads greater than design loads be applied to any component.
5. CompuTrus has no control over and assumes no responsibility for the fabrication, handling, shipment and installation of components.
6. This design is furnished subject to the limitations set forth by TPI/WTCA in BCSI, copies of which will be furnished upon request.

CompuTrus, Inc. Software +7.5.3.1F(1L)-E

GENERAL NOTES, unless otherwise noted:
1. This truss design is adequate for the design parameters shown. Review and approval is the responsibility of the building designer, not the truss designer or truss engineer.
2. Design assumes the top and bottom chords to be laterally braced at 2' o.c. and at 10' o.c. respectively unless braced throughout their length by continuous sheathing such as plywood sheathing(TC) and/or drywall(BC).
3. 2x Impact bridging or lateral bracing required where shown + +
4. Installation of truss is the responsibility of the respective contractor.
5. Design assumes trusses are to be used in a non-corrosive environment, and are for "dry condition" of use.
6. Design assumes full bearing at all supports shown. Shim or wedge if necessary.
7. Design assumes adequate drainage is provided.
8. Plates shall be located on both faces of truss, and placed so their center lines coincide with joint center lines.
9. Digits indicate size of plate in inches.
10. For basic connector plate design values see ESR-2529 (CompuTrus) and/or ESR-1311, ESR-1988 (MiTek).

LUMBER SPECIFICATIONS
TC: 2x4 SP #2
BC: 2x4 SP #2
WEBS: 2x4 SP #3

TRUSS SPAN 35'- 4.5"
LOAD DURATION INCREASE = 1.25
SPACED 24.0" O.C.

LOADING

IBC 2006 MAX MEMBER FORCES 4WR/DSP/Cq=1.00 PPM

1- 2=(-483) 353	1- 8=(-221) 355	8- 2=(-2495) 1346	11- 6=(-94) 111
2- 3=(-2119) 821	8- 9=(-697) 1814	2- 9=(-87) 110	6-12=(-2250) 948
3- 4=(-1617) 715	9-10=(-670) 1738	9- 3=(0) 292	12- 7=(-144) 165
4- 5=(-1611) 712	10-11=(-673) 1711	3-10=(-544) 212	
5- 6=(-2109) 829	11-12=(-719) 1817	10- 4=(-232) 1074	
6- 7=(-89) 134		10- 5=(-533) 229	
		5-11=(0) 311	

BEARING LOCATIONS	MAX VERT REACTIONS	MAX HORZ REACTIONS	BRG SIZE	REQUIRED BRG LENGTH INCHES	(SPECIES)
1'- 8.5"	-141/ 1607V	-186/ 188H	3.50"	1.71	SP (565)
35'- 4.5"	-133/ 1476V	-186/ 188H	3.50"	1.74	SP (565)

BRG @ 1'- 8.5" 1.55 DF/ 2.39 HF/ 2.28 SPF
BRG @ 35'- 4.5" 1.57 DF/ 2.43 HF/ 2.31 SPF

MAX LL DEFL = -0.012" (L/1708) @ 0'- 0.0" L/120 = 0.171"
MAX TL DEFL = -0.014" (L/1464) @ 0'- 0.0" L/90 = 0.228"
MAX LL DEFL = 0.120" (L/3308) @ 18'- 6.5" L/240 = 1.654"
MAX TL DEFL = -0.181" (L/2193) @ 18'- 6.5" L/180 = 2.206"

MAX HORIZ. LL DEFL = -0.055" @ 35'- 1.0"
MAX HORIZ. TL DEFL = 0.084" @ 35'- 1.0"

Design conforms to main windforce-resisting system and components and cladding criteria.

Wind: 100 mph, h=15ft, TCDL=6.0,BCDL=6.0, ASCE 7-05, Enclosed, Cat.2, Exp.B, MWFRS, gable end zone, load duration factor=1.6

Max CSI: TC:0.68 BC:0.74 Web:1.00

Design checked for a 300 lb concentrated top chord live load per IBC 2006 due to maintenance workers which is non-concurrent with other live loads.

SOUTHERN PINE REFERENCE DESIGN VALUES

Based on SPIB Grading Rules and AWC National Design Specification®
Values in pounds per square inch (psi)

Table 1 Dimension Lumber – 2″ to 4″ thick, 2″ and wider

Effective June 1, 2013

Based on Normal Load Duration and Dry Service (MC≤ 19%) — See Tables A-1 thru A-4 for Adjustment Factors

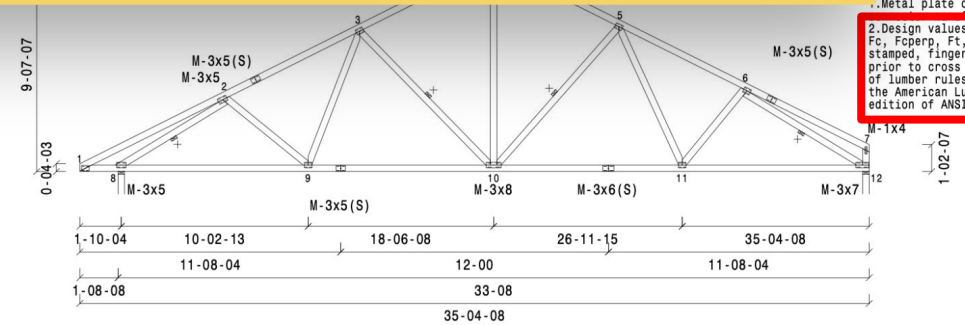
NEW DESIGN VALUES

Size	Grade	Bending F_b	Tension Parallel to Grain F_t	Shear Parallel to Grain F_v	Compression Perpendicular to Grain $F_{c\perp}$	Compression Parallel to Grain F_c	Modulus of Elasticity E	Modulus of Elasticity E_{min}
2″ to 4″ thick, 2″ to 4″ wide	Dense Select Structural	2700	1900	175	660	2050	1,900,000	690,000
Includes: 2x2, 2x3, 2x4	Select Structural	2350	1650	175	565	1900	1,800,000	660,000
	Non-Dense Select Structural	2050	1450	175	480	1800	1,600,000	580,000
	No.1 Dense	1650	1100	175	660	1750	1,800,000	660,000
	No.1	1500	1000	175	565	1650	1,600,000	580,000
	No.1 Non-Dense	1300	875	175	480	1550	1,400,000	510,000
	No.2 Dense	1200	750	175	660	1500	1,600,000	580,000
	No.2	1100	675	175	565	1450	1,400,000	510,000
	No.2 Non-Dense	1050	600	175	480	1450	1,300,000	470,000
	No.3 and Stud	650	400	175	565	850	1,300,000	470,000

13

he accuracy of this Truss Design Drawing relies upon accurate:
.Metal plate connector design values as published by the plate

2.Design values for solid sawn lumber. Design values (E, Emin, Fb, Fc, Fcperp, Ft, and Fv) for solid sawn lumber and approved, grade stamped, finger jointed lumber shall be defined by the grade stamp prior to cross cutting and in accordance with the published values of lumber rules writing agencies approved by the Board of Review of the American Lumber Standards Committee in accordance with the latest edition of ANSI/TPI 1 section 6.3.



JOB NAME: 9441 - MEADOW BROOK - T-10

Scale: 0.1691

Truss: T-10
DES. BY: JasonO
DATE: 11/15/2010
SEQ.: T-10
TRANS ID: 9441

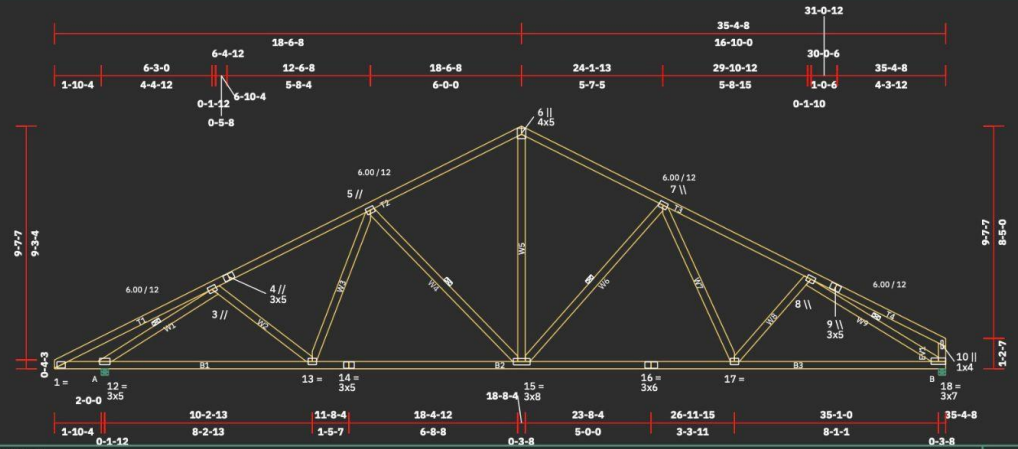
WARNINGS:
1. Builder and erection contractor should be advised of all General Notes and Warnings before construction commences.
2. 2x4 compression web bracing must be installed where shown +.
3. All lateral force resisting elements such as temporary and permanent stability bracing must be designed by designer of complete structure. CompuTrus assumes no responsibility for such bracing.
4. No load should be applied to any component until after all bracing and fasteners are complete and at no time should any loads greater than design loads be applied to any component.
5. CompuTrus has no control over and assumes no responsibility for the fabrication, handling, shipment and installation of components.
6. This design is furnished subject to the limitations set forth by TPI/WTCA in BCSI, copies of which will be furnished upon request.

CompuTrus, Inc. Software +7.5.3.1F(1L)-E

GENERAL NOTES, unless otherwise noted:
1. This truss design is adequate for the design parameters shown. Review and approval is the responsibility of the building designer, not the truss designer or truss engineer.
2. Design assumes the top and bottom chords to be laterally braced at 2' o.c. and at 10' o.c. respectively unless braced throughout their length by continuous sheathing such as plywood sheathing(TC) and/or drywall(BC).
3. 2x Impact bridging or lateral bracing required where shown + +
4. Installation of truss is the responsibility of the respective contractor.
5. Design assumes trusses are to be used in a non-corrosive environment, and are for "dry condition" of use.
6. Design assumes full bearing at all supports shown. Shim or wedge if necessary.
7. Design assumes adequate drainage is provided.
8. Plates shall be located on both faces of truss, and placed so their center lines coincide with joint center lines.
9. Digits indicate size of plate in inches.
10. For basic connector plate design values see ESR-2529 (CompuTrus) and/or ESR-1311, ESR-1988 (MiTek).

COMPONENT	JOB	CODE	LENGTH	CAMBER	PLIES	SPACING	WEIGHT	
IBC2021	NCSEA Example Updated Code	IBC2021 TPI2014	35-4-8	0-0-2	1	2-0-0 o.c.	173 lb	PARAGON

SCALE 1 in.:68.99 in.



LOADING (psf)

TCLL	20
TCDL	10
BCLL	0
BCDL	10

PLATE TYPES
MiTek - MT20

LUMBER

TC 2x4 SP No. 2 | BC 2x4 SP No. 2 | WEB 2x4 SP No. 3 | OTHER 2x4 SP No. 3

PERMANENT BRACING:

TC= Structural sheathing (or purlins at max 3-11-6 o.c.)
BC= Rigid ceiling applied (or purlins at max 10-0-0 o.c.)
WEB= 1 row of lateral restraint at midpoints: 12-3, 5-15, 15-7, 8-18
JOINT= None specified

design.paragontruss.com/KMB34ZIDWX

BID BUILD EXPLORE

DESIGN VALUE MODIFIERS

USE WET SERVICE (Cm)= No
USE REP. MEMBER (Cr)= No
USE BENDING MOD. (Km)= Yes
TEMPERATURE (Ct)= T < 100°F
INCISING (Ci)= 1

WIND DESIGN CRITERIA

DESIGN METHOD= Wind ASCE Hybrid Directional (7-16)
WIND SPEED (V)= 110.00 mph
EXPOSURE CATEGORY= B
OCCUPANCY CATEGORY= II
ENCLOSURE TYPE= Enclosed
MEAN ROOF HEIGHT (h)= 25'
BLDG WIDTH (B)= 24'
BLDG LENGTH (L)= 50'
TCDL= 6.0 psf
BCDL= 6.0 psf
MWFRS METHOD= Directional
C-C ZONE= Varies

SNOW DESIGN CRITERIA

DESIGN METHOD= N/A
TERRAIN CATEGORY= N/A
EXPOSURE CATEGORY= N/A
OCCUPANCY CATEGORY= N/A
GROUND SNOW (Pg)= N/A
EAVE TO RIDGE (W)= N/A
THERMAL FACTOR (Ct)= N/A

MAXIMUM CSI

	LINK	CSI (LC)
TC	1-3	0.51 (2)
BC	12-13	0.77 (1)
WEB	12-3	0.47 (1)
EV	18-10	0.71 (1)

MAXIMUM JSI

JOINT= 10
JSI (LC)= 4.72 (1)
FABRICATION TOLERANCE= 20%

EXPOSURE CRITERIA

	LEFT	RIGHT
CANTILEVER	-	-
PORCH	-	-
END VERTICAL	x	x

BC MAXIMUM DEFLECTIONS Kcr= 2

LOADING	DIRECTION	LOCATION	In. DEFLECTION	L/d	L/d LIMIT
Live + Creep	Vertical	15-17	-0.239	>999	180
Live	Vertical	13-15	-0.092	>999	240
Live + Creep	Horizontal	18	0.085		

MAXIMUM BEARING FORCES

JOINT (BEARING)	lbs (LC) DOWN	lbs (LC) UPLIFT	lbs (LC) HORIZONTAL	In. ACTUAL LENGTH	In. REQUIRED LENGTH
12 (A)	-1494 (1)	0	123 (6)	3.5	1.59
18 (B)	-1324 (1)	0	0	3.5	1.56

MAX AXIAL FORCES

Only showing forces of 250 lbs or more

PANEL	TENSION lbs	COMP. lbs
12-3	277	-1997
7-8	251	-1877
3-5	242	-1844
8-18	182	-1665
17-18	1651	-135
12-13	1555	-143
13-15	1529	-90
15-17	1526	-88
5-6	273	-1432
6-7	275	-1426
15-6	885	-85
15-7	127	-523
5-15	124	-505
8-10	61	-383
18-10	63	-300
7-17	259	0

NOTES

1. This Truss Design Drawing is not to be used for any purposes unless stamped by a competent professional engineer.
2. Do not erect truss backwards or upside down.
3. Building stability bracing is the responsibility of the building designer. Purlins and lateral restraint must be braced. Refer to BCSI-B3 and construction drawings by building designer for additional information.
4. 0.7 scaling factor is used for wind loads in CC load cases.
5. C-C for members and forces & MWFRS for reactions shown.
6. Designed for dry service conditions only. All lumber should be seasoned to 19% or less moisture content prior to truss fabrication.
7. All plates are of type MT20 and of size 3x4 unless otherwise indicated.
8. Plates have been designed with a rotation tolerance of 10 degrees except where limited by the truss profile or inferred chase openings.
9. The following plates are offset (X, Y) in.: plate 6 (0, 0.38), plate 3 (-0.59, -0.25), plate 5 (-0.12, -0.12), plate 7 (0.19, -0.06), plate 8 (0.29, -0.23), plate 18 (0, 0.12), plate 15 (0.11, -0.11)

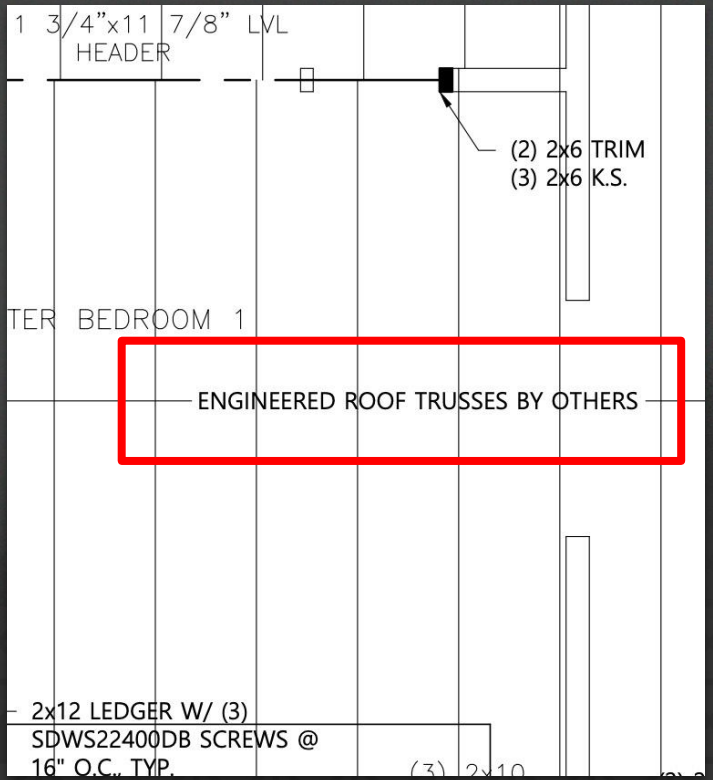
LOAD CASES (Lumber DOL, Plate Grip DOL)

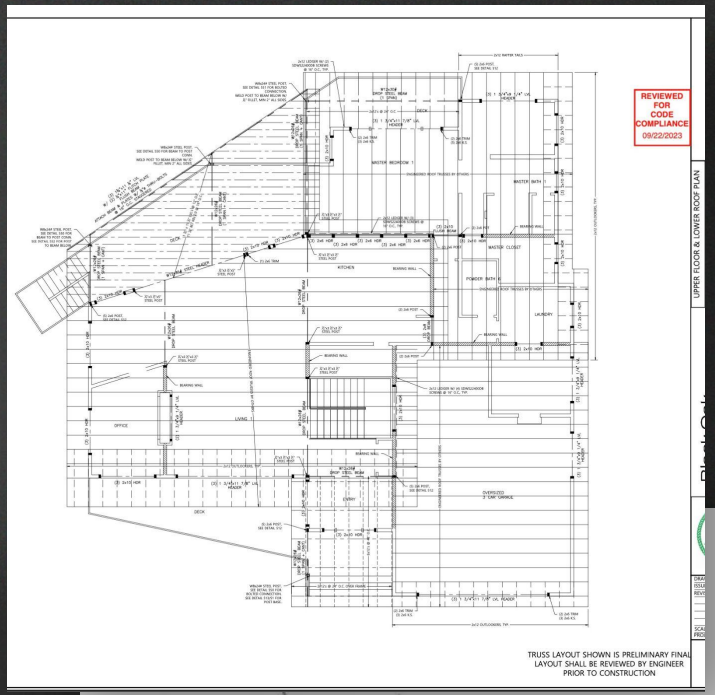
1. D + Lr (1.25, 1.25)
2. D + 1 Lr (Unbalanced) (1.25, 1.25)
3. D + 2 Lr (Unbalanced) (1.25, 1.25)
4. D (0.90, 0.90)
5. D + 0.6 MWFRS Negative Internal W From Left (1.60, 1.60)
6. D + 0.6 MWFRS Negative Internal W From Right (1.60, 1.60)
7. D + 0.6 MWFRS 1st Parallel Negative Internal (1.60, 1.60)
8. D + 0.6 MWFRS 2nd Parallel Negative Internal (1.60, 1.60)
9. D + 0.6 CC Negative Internal Case 1 (1.60, 1.60)
10. 0.6 D + 0.6 MWFRS Positive Internal W From Left (1.60, 1.60)
11. 0.6 D + 0.6 MWFRS Positive Internal W From Right (1.60, 1.60)
12. 0.6 D + 0.6 MWFRS 1st Parallel Positive Internal (1.60, 1.60)
13. 0.6 D + 0.6 MWFRS 2nd Parallel Positive Internal (1.60, 1.60)
14. 0.6 D + 0.6 CC Positive Internal Case 1 (1.60, 1.60)
15. D + 0.75 Lr + 0.75(0.6 MWFRS Negative Internal W From Left) (1.60, 1.60)
16. D + 0.75 Lr + 0.75(0.6 MWFRS Negative Internal W From Right) (1.60, 1.60)
17. D + 0.75 Lr + 0.75(0.6 MWFRS 1st Parallel Negative Internal) (1.60, 1.60)
18. D + 0.75 Lr + 0.75(0.6 MWFRS 2nd Parallel Negative Internal) (1.60, 1.60)
19. D + 0.75 Lr + 0.75(0.6 CC Negative Internal Case 1) (1.60, 1.60)

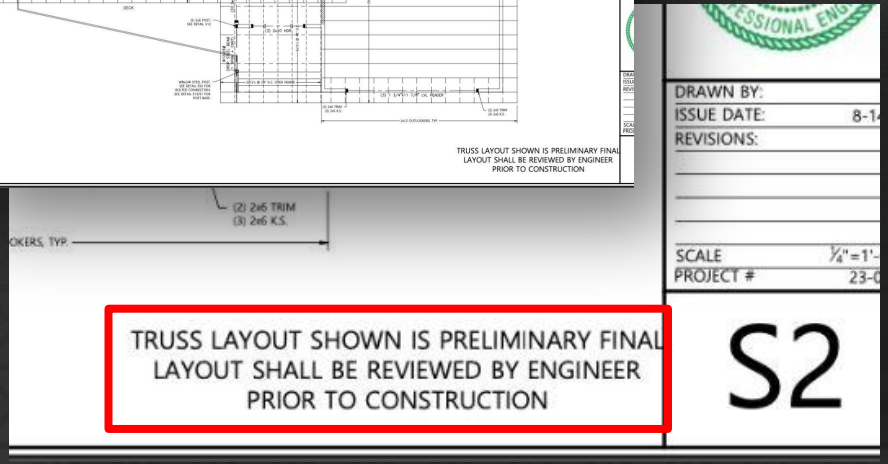
Designer

Evaluating Truss Design Feasibility for New Construction Projects

Typical Process: Delegated Design

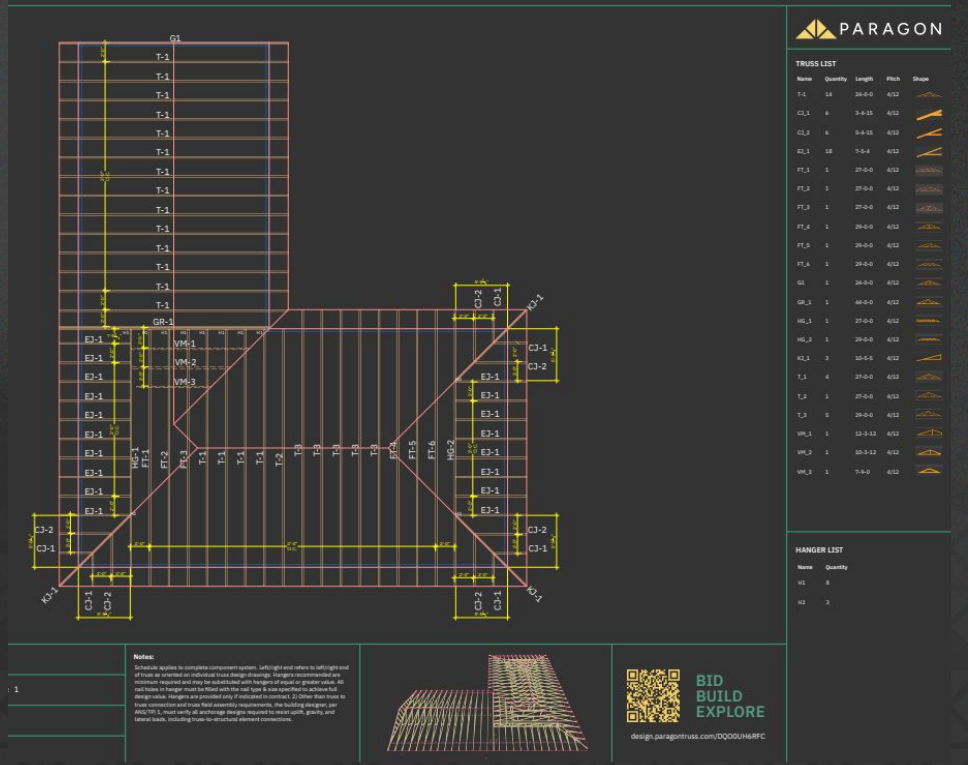






As a Designer, use Paragon to:

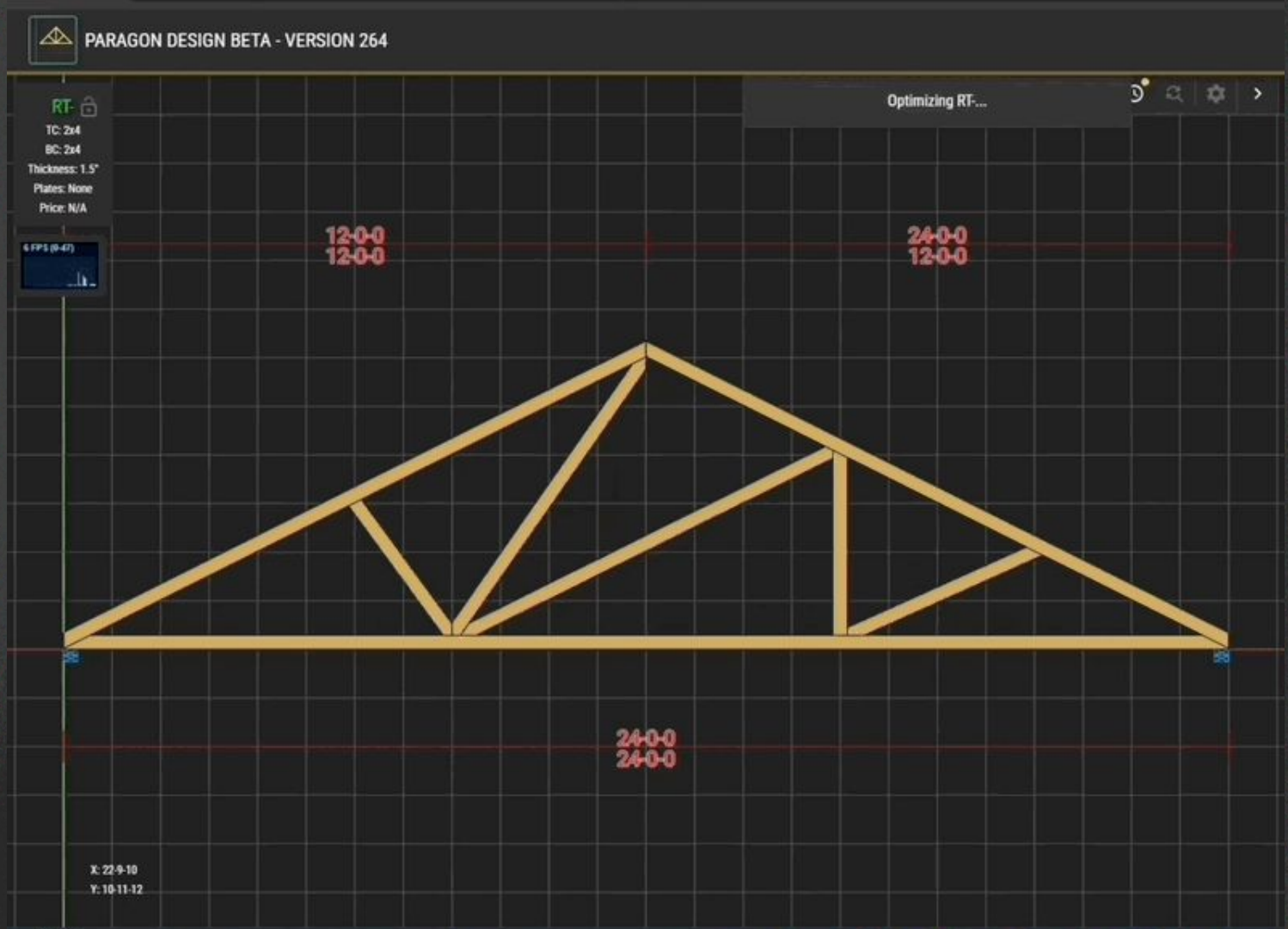
- Evaluate Conceptual Structural Questions
- Design Uplift Connections
- Coordinate MEP
- Communicate Design Intent



Designer (Bonus!)

Value Engineering
Truss Designs

Use Generative Artificial Intelligence to explore Feasibility and Tradeoffs


PARAGON DESIGN BETA - VERSION 264
RT-
TC: 2x4
BC: 2x4
Thickness: 1.5"
Plates: None
Price: N/A
Optimizing RT-...
12-0-0
12-0-0
24-0-0
12-0-0
24-0-0
24-0-0
X: 22-9-10
Y: 10-11-12

Conclusion

Conclusion

Structural Engineers have hard jobs

Paragon can make them easier when it comes to Wood Trusses

Doctor

Detective

Designer

PARAGON

Sign up for a free account today.

If you have any additional questions feel free to email us at info@paragontruss.com.

paragontruss.com/engineers