Hydraulic Summary

Job

Job Number: S23-90G	Designer: RICHARD M
Job Name: CHC PUYALLUP GARAGE	State Certification/License Number:
Address 1: 111 W. MAIN, PUYALLUP, WA 98371	AHJ:
Address 2:	Job Site/Building:
Address 3:	Drawing Name: S23-90 GARAGE NEW SYSTEM

System

Most Demanding Sprinkler Data
5.6 K-Factor 19.50 at 12.125

Hose Allowance At Source
250.00

Additional Hose Supplies

Node	Flow(gpm)

Total Hose Streams
250.00

System Flow Demand
222.90

Total Water Required (Including Hose Allowance)
472.90

Maximum Pressure Unbalance In Loops
0.000

Maximum Velocity Above Ground
11.46 between nodes 10 and 12

Maximum Velocity Under Ground
2.31 between nodes 18 and 1

Volume capacity of Wet Pipes
1032.57 gal

Volume capacity of Dry Pipes

Remote Area(s)

Occupancy: Ordinary Group I		Job Suffix:
Density: 0.15 gpm/ft²		Area of Application: 900 ft² (Actual 930 ft²)
Number Of Sprinklers Calculated: 11	Number Of Nozzles Calculated: 0	Coverage Per Sprinkler: 130 ft²

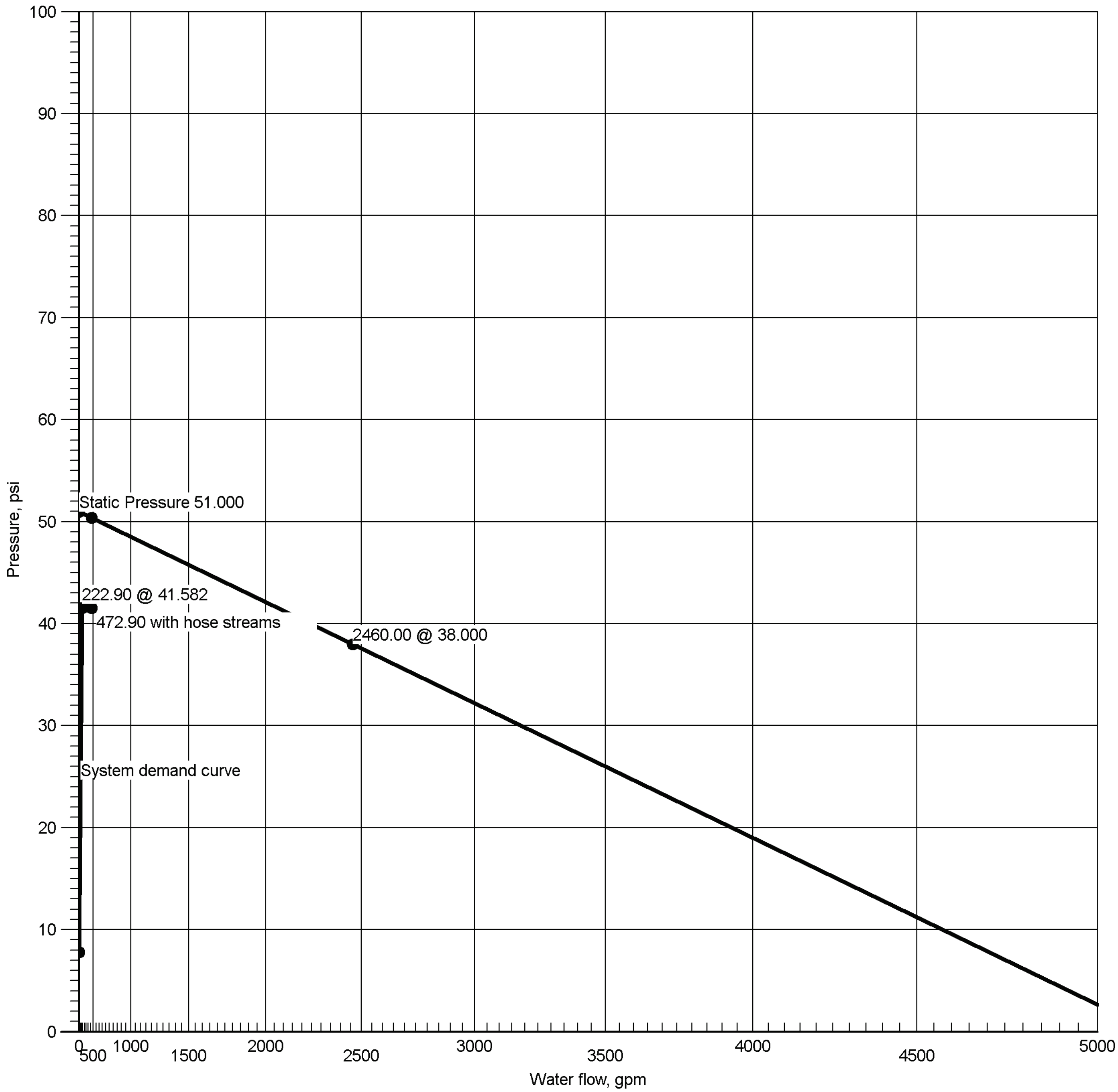
Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
17	Water Supply	250.00	51.000	38.000		2460.00	50.385		472.90	41.582	8.803

Contractor

Contractor Number: 22	Contact Name: ROBERT ARCHER
	Contact Title: OWNER
Name of Contractor: ARCHER CONSTRUCTION	Phone: 253-872-7222
	Extension:
Address 1: 7855 S 206TH ST KENT WA 98032	FAX:
Address 2:	E-mail:
Address 3:	Web-Site:

Water Supply at Node 17



Hydraulic Graph Water Supply at Node 17
Static: Pressure 51.000
Residual: Pressure 38.000 @ 2460.00
Available Pressure at System Demand 50.385 @ 472.90
Required Pressure at System Demand 41.582 @ 222.90
Required Pressure at System Demand (Including Hose Allowance at Source) 41.582 @ 472.90

Summary Of Outflowing Devices

	Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
	Sprinkler	100	21.62	19.50	5.6	14.903			
	Sprinkler	103	19.88	19.50	5.6	12.604			
	Sprinkler	104	19.80	19.50	5.6	12.496			
	Sprinkler	105	20.07	19.50	5.6	12.845			
	Sprinkler	107	20.05	19.50	5.6	12.824			
⇨	**Sprinkler**	**108**	**19.50**	**19.50**	**5.6**	**12.125**			
	Sprinkler	109	19.73	19.50	5.6	12.410			
	Sprinkler	110	19.64	19.50	5.6	12.306			
	Sprinkler	600	21.52	19.50	5.6	14.770			
	Sprinkler	607	21.46	19.50	5.6	14.681			
	Sprinkler	608	19.63	19.50	5.6	12.292			

⇨ Most Demanding Sprinkler Data

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
17	-6'-11	S	41.582	222.90	
100	8'-6	Spr(-14.903)	14.903	21.62	
103	10'-9	Spr(-12.604)	12.604	19.88	
104	10'-9	Spr(-12.496)	12.496	19.80	
105	8'-6	Spr(-12.845)	12.845	20.07	
107	8'-6	Spr(-12.824)	12.824	20.05	
108	8'-6	Spr(-12.125)	12.125	19.50	
109	11'-2	Spr(-12.410)	12.410	19.73	
110	11'-2	Spr(-12.306)	12.306	19.64	
600	8'-5	Spr(-14.770)	14.770	21.52	
607	8'-5	Spr(-14.681)	14.681	21.46	
608	8'-5	Spr(-12.292)	12.292	19.63	
1	-6'-11	E(24'-2)	36.123		
2	2'-0	PO(26'-4)	32.134		
3	7'-3	E(9'-5)	23.480		
4	0'-0		33.077		
5	7'-9	mecT(26'-4)	21.728		
6	7'-9	mecT(20'-2)	21.124		
7	10'-4	C(9'-11)	16.740		
8	10'-4	PO(5'-0)	15.984		
9	10'-4	PO(5'-0)	15.857		
10	10'-9	C(9'-11)	16.168		
11	10'-9	PO(5'-0)	12.998		
12	10'-9	PO(5'-0)	13.823		
13	10'-9	PO(5'-0)	15.832		
14	11'-2	PO(5'-0)	13.614		
15	11'-2	PO(5'-0)	12.796		
16	11'-2	T(9'-11)	15.923		
18	-6'-11	T(47'-3)	41.565		

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	
••••• Route 1 •••••								
DR	1.0490	19.50	7.24	120		0.124177	5'-7	Pf 1.807
108	8'-6	19.50	5.6	12.125		Sprinkler,	9'-0	Pe -1.136
15	11'-2			12.796		2E(2'-0), PO(5'-0)	14'-7	Pv
BL	1.6820	58.87	8.50	120		0.096209	8'-6	Pf 0.821
15	11'-2	39.37		12.796		Flow (q) from Route 3		Pe -0.002
14	11'-2			13.614			8'-6	Pv
BL	1.6820	78.93	11.40	120		0.165478	4'-1	Pf 2.310
14	11'-2	20.05		13.614		Flow (q) from Route 5	9'-11	Pe -0.001
16	11'-2			15.923		T(9'-11)	14'-0	Pv
CM	3.2600	78.93	3.03	120		0.006594	10'-10	Pf 0.071
16	11'-2			15.923				Pe 0.173
10	10'-9			16.168			10'-10	Pv
CM	3.2600	179.76	6.91	120		0.030233	12'-8	Pf 0.383
10	10'-9	79.38 + 21.46		16.168		Flow (q) from Route 2 and 7		Pe 0.190
7	10'-4			16.740			12'-8	Pv
CM	3.2600	222.90	8.57	120		0.045009	48'-4	Pf 3.264
7	10'-4	43.14		16.740		Flow (q) from Route 8	24'-2	Pe 1.120
6	7'-9			21.124		Ee1(4'-0), mecT(20'-2)	72'-6	Pv
CM	4.2600	222.90	5.02	120		0.012231	23'-0	Pf 0.604
6	7'-9			21.124			26'-4	Pe
5	7'-9			21.728		mecT(26'-4)	49'-4	Pv
CM	3.2600	222.90	8.57	120		0.045009	24'-9	Pf 1.536
5	7'-9			21.728			9'-5	Pe 0.216
3	7'-3			23.480		E(9'-5)	34'-2	Pv
CM	4.2600	222.90	5.02	120		0.012231	5'-3	Pf 6.386
3	7'-3			23.480			26'-4	Pe 2.268
2	2'-0			32.134		BV(-6.000), PO(26'-4)	31'-7	Pv
CM	6.3570	222.90	2.25	120		0.001741	6'-0	Pf 0.076
2	2'-0			32.134			37'-9	Pe 0.867
4	0'-0			33.077		PO(37'-9)	43'-9	Pv
UG	6.4000	222.90	2.22	140		0.001267	6'-11	Pf 0.039
4	0'-0			33.077			24'-2	Pe 3.006
1	-6'-11			36.123		E(24'-2)	31'-2	Pv
UG	6.2800	222.90	2.31	140		0.001389	204'-10	Pf 5.442
1	-6'-11			36.123			113'-6	Pe
18	-6'-11			41.565		3E(22'-1), BFP(-5.000), T(47'-3)	318'-4	Pv
UG	8.3900	222.90	1.29	140		0.000339	50'-9	Pf 0.017
18	-6'-11			41.565				Pe
17	-6'-11			41.582		Water Supply	50'-9	Pv
		250.00				Hose Allowance At Source		
17		472.90						
••••• Route 2 •••••								
DR	1.0490	19.63	7.29	120		0.125755	4'-7	Pf 1.710
608	8'-5	19.63	5.6	12.292		Sprinkler,	9'-0	Pe -1.003
11	10'-9			12.998		2E(2'-0), PO(5'-0)	13'-7	Pv
BL	1.6820	59.31	8.56	120		0.097538	8'-5	Pf 0.824
11	10'-9	39.68		12.998		Flow (q) from Route 4		Pe
12	10'-9			13.823			8'-5	Pv
BL	1.6820	79.38	11.46	120		0.167246	4'-1	Pf 2.345
12	10'-9	20.07		13.823		Flow (q) from Route 6	9'-11	Pe
10	10'-9			16.168		C(9'-11)	14'-0	Pv
••••• Route 3 •••••								
BL	1.6820	19.64	2.84	120		0.012630	8'-5	Pf 0.106
110	11'-2	19.64	5.6	12.306		Sprinkler		Pe -0.002
109	11'-2			12.410			8'-5	Pv
BL	1.6820	39.37	5.68	120		0.045707	8'-6	Pf 0.389
109	11'-2	19.73	5.6	12.410		Sprinkler		Pe -0.002
15	11'-2			12.796			8'-6	Pv
••••• Route 4 •••••								
BL	1.6820	19.80	2.86	120		0.012810	8'-5	Pf 0.108
104	10'-9	19.80	5.6	12.496		Sprinkler		Pe
103	10'-9			12.604			8'-5	Pv
BL	1.6820	39.68	5.73	120		0.046363	8'-6	Pf 0.395
103	10'-9	19.88	5.6	12.604		Sprinkler		Pe
11	10'-9			12.998			8'-6	Pv
••••• Route 5 •••••								

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary	
DR	1.0490	20.05	7.44	120		0.130781	5'-9	**Pf**	1.928
107	8'-6	20.05	5.6	12.824		Sprinkler,	9'-0	**Pe**	-1.138
14	11'-2			13.614		2E(2'-0), PO(5'-0)	14'-9	**Pv**	
• • • • • Route 6 • • • • •									
DR	1.0490	20.07	7.45	120		0.130981	5'-11	**Pf**	1.953
105	8'-6	20.07	5.6	12.845		Sprinkler,	9'-0	**Pe**	-0.975
12	10'-9			13.823		2E(2'-0), PO(5'-0)	14'-11	**Pv**	
• • • • • Route 7 • • • • •									
DR	1.0490	21.46	7.97	120		0.148208	5'-8	**Pf**	2.176
607	8'-5	21.46	5.6	14.681		Sprinkler,	9'-0	**Pe**	-1.025
13	10'-9			15.832		2E(2'-0), PO(5'-0)	14'-8	**Pv**	
BL	1.6820	21.46	3.10	120		0.014869	12'-8	**Pf**	0.336
13	10'-9			15.832			9'-11	**Pe**	
10	10'-9			16.168		Z, C(9'-11)	22'-7	**Pv**	
• • • • • Route 8 • • • • •									
DR	1.0490	21.52	7.99	120		0.149043	3'-10	**Pf**	1.914
600	8'-5	21.52	5.6	14.770		Sprinkler,	9'-0	**Pe**	-0.828
9	10'-4			15.857		2E(2'-0), PO(5'-0)	12'-10	**Pv**	
BL	1.6820	21.52	3.11	120		0.014953	8'-6	**Pf**	0.127
9	10'-4			15.857				**Pe**	0.000
8	10'-4			15.984			8'-6	**Pv**	
BL	1.6820	43.14	6.23	120		0.054127	4'-1	**Pf**	0.756
8	10'-4	21.62		15.984		Flow (q) from Route 9	9'-11	**Pe**	0.000
7	10'-4			16.740		C(9'-11)	14'-0	**Pv**	
• • • • • Route 9 • • • • •									
DR	1.0490	21.62	8.03	120		0.150279	3'-5	**Pf**	1.863
100	8'-6	21.62	5.6	14.903		Sprinkler,	9'-0	**Pe**	-0.782
8	10'-4			15.984		2E(2'-0), PO(5'-0)	12'-5	**Pv**	

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SN	Swing Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PRV	Pressure Reducing Valve
PrV	Pressure Relief Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

PRHM20231549

Gray & Osborne, Inc.
CONSULTING ENGINEERS

MEMORANDUM

TO: BRIAN JOHNSON, WATER SYSTEM SPECIALIST
FROM: KERRI SIDEBOTTOM, P.E.
DATE: NOVEMBER 13, 2023
SUBJECT: 111 – 201 WEST MAIN FIRE FLOW AVAILABILITY
CITY OF PUYALLUP, PIERCE COUNTY, WASHINGTON
G&O #21415.17

Per your request, I have analyzed the available fire flow at two existing hydrants located at 111 and 201 West Main, in the central part of the City's water service area. The setup of the hydraulic model and the assumptions used to determine the static pressure and available fire flow are noted as follows.

- The available fire flows and pressures are measured at Nodes J2228 and J2230, corresponding to existing hydrants NW290 and SW209, respectively, as shown in the attached Figure 1.

- Water system demands are based on projected 2038 demands and reservoirs are depleted of fire suppression and equalizing storage, as established in the *2019 Water System Plan* (WSP) approved by the Department of Health (DOH). The City's water model was updated in 2021 to reflect additional system improvements since the WSP was developed.

- All pump stations are idle, and the Salmon Springs source is operating at 1,100 gpm.

The hydrants are located in Zone 1, which is supplied by Maplewood Springs and the 15th Avenue SE Reservoirs. The system was modeled as-is, with no new piping proposed at this time.

The available pressure under 2038 peak hour demands at the hydrant is included in Table 1.

TABLE 1

Peak Hour Pressure

Node	Hydrant	Elevation, feet	Peak Hour Pressure, psi
J2228	NW290	44	51
J2230	SW209	45	51

Available fire flow was measured at two existing hydrants: Hydrant NW290 (Node J2228) and Hydrant SW209 (Node J2230). The first hydrant is located on an existing 6-inch fire main dead-end within the property, while the other is located on an existing 8-inch main in the street. The results of this modeling are included in Table 2. The modeled fire flow is available at any hydrant individually, but not simultaneously.

TABLE 2

Modeled Fire Flow Availability

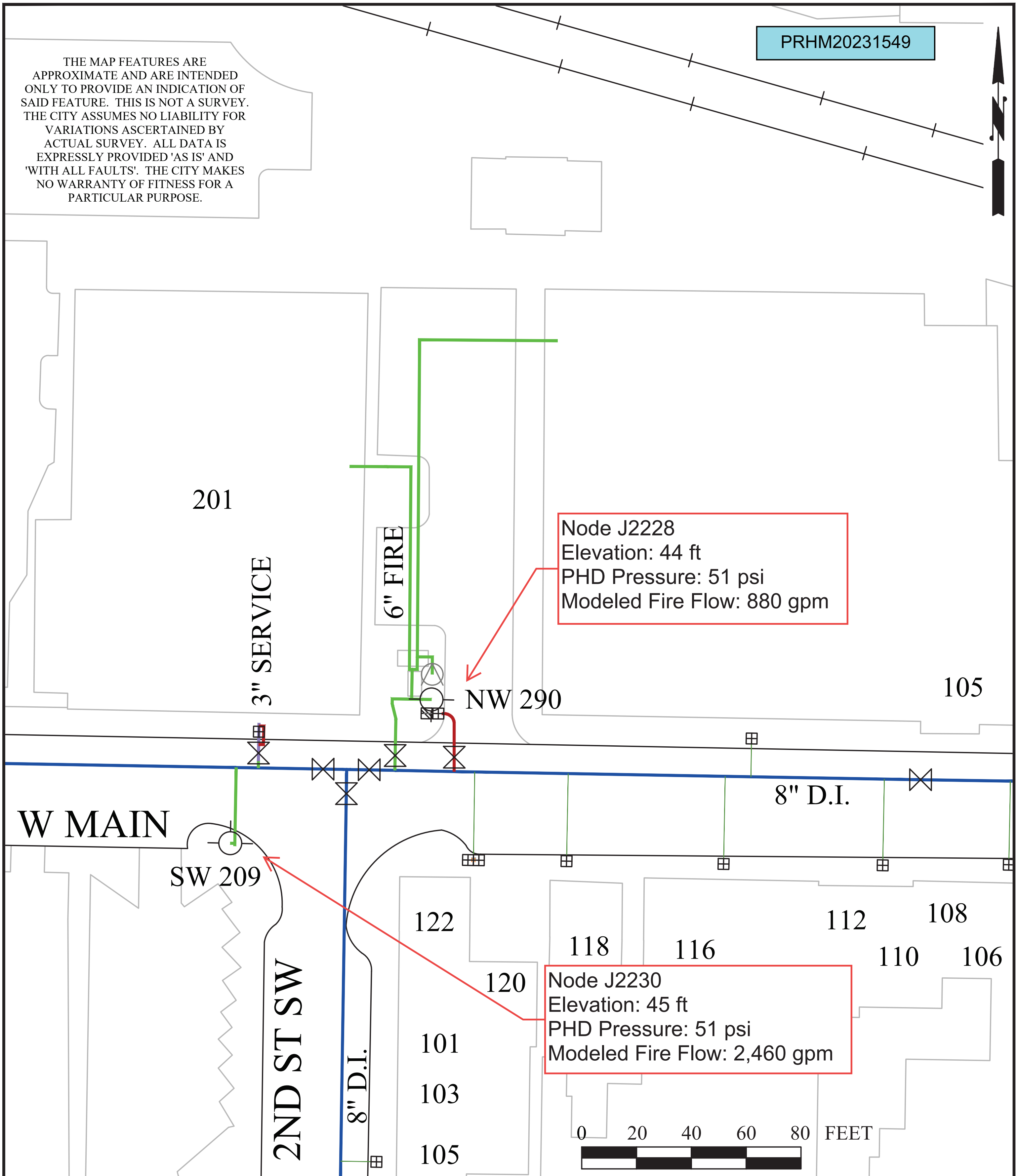
Node	Hydrant	Available Fire Flow, gpm	Residual Pressure at Available Fire Flow, psi	Minimum System Pressure at Available Fire Flow, psi
J2228	NW290	880(1)	42	30
J2230	SW209	2,460(1)	38	30

(1) Limited by maximum system-wide velocity of 10 fps.

Fire flow to both of the hydrants is limited by the 10-fps maximum velocity through the existing 6-inch fire main and the 8-inch pipe on West Main. The dead-end fire main supplying Node J2228 is only 6 inches in diameter and cannot supply more than 880 gpm without exceeding the 10-fps velocity limit. However, Node J2230 is located on an 8-inch diameter main that provides water from two directions, and as such, can sustain a higher flow under the velocity and pressure constraints.

The Department of Health and City Standards for water distribution systems are to meet the peak hourly demand of the system while providing a minimum pressure of 30 psi, system-wide. Under peak daily demand with a fire flow, the system is designed to maintain a minimum pressure of 20 psi, system-wide. Although the peak hourly demand pressure may currently be higher than these standards, the Developer must recognize that the City may not provide pressure higher than 30 psi in the future. The flows and pressures determined in this memo are based on the approximate hydrant elevation at ground level. The Developer may design their sprinkler system for whatever pressure they wish; however, they must recognize and be responsible for conditions when the pressure may be less than currently exists.

KS/sr



CITY OF PUYALLUP PUBLIC WORKS WATER DIVISION	# HYDRAULIC MODEL FOR 111 - 201 W MAIN	SCALE AS SHOWN 11/08/2023 COP\PW\WATER\S_MAINT\PDF\QSEC\PG109\MODEL FOR 111-201 W MAIN

TOLBrace™ Seismic Bracing Calculations

Project Address: CHC Puyallup Garage
201 W. Main St
Puyallup, WA
Job # 23-090

Contractor: Archer Construction
Address: 7855 S. 206th Street
Kent, WA 98032
Phone:
License:

EATON
Powering Business Worldwide

Calculations based on 2016 NFPA Pamphlet #13

Brace Information

Maximum Brace Length	7' 0" (2.134 m)
Diameter of Brace	1" Sch.40
Type of Brace	Sch. 10
Angle of Brace	45° Min.
Least Rad. of Gyration	0.42" (11 mm)
L/R Value	200
Max Horizontal Load	1310 lbs (594 kg)

Fastener Information

Orientation to Connecting Surface NFPA Type B

Fastener

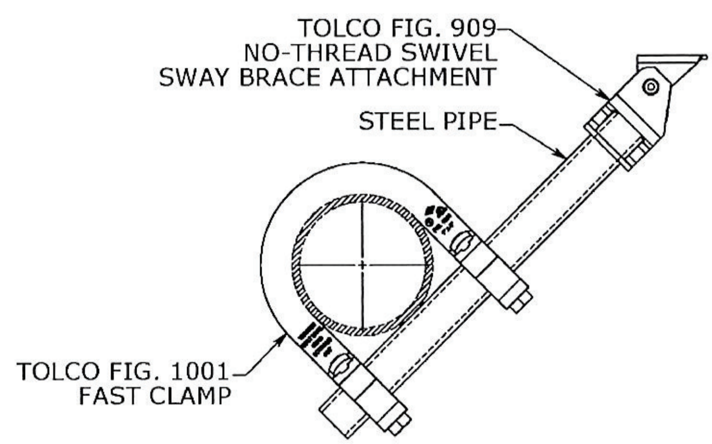
Type	POWERS POWER-STUD +SD2
Diameter	1/2in.
Length	3 1/4in.
Maximum Load	499 lbs (226 kg)
Prying Factor	1.002

TOLCO™ Brace Components

TOLCO™ Component	Listed Load	Adjusted Loa
Fig. 1001 Clamp	2015 lbs (914 kg)	1425 lbs (646 kg)
Fig.909 No-Thread Swivel	2015 lbs (914 kg)	1425 lbs (646 kg)
See Fastener Information		

*Calculation Based on CONCENTRIC Loading
*Please Note: These calculations are for TOLCO™ components only. Use of any other components voids these calculations and the listing of the assembly.

Seismic Brace Assembly Detail



Brace Identification on Plans C1

Brace Type Lateral [X] Longitudinal [ ] 4-Way [ ]

Sprinkler System Load Calculation (Fpw = CpWp)

Cp = 0.67

Diameter	Type	Length	Total Length	Weight Per Unit Length	Total Weight
4" (100 mm)	Sch. 10	40 ft (12.2 m)	40 ft (12.2 m)	11.78 lb/ft (17.53 kg/m)	471 lbs (214 kg)

Subtotal Weight	471 lbs (214 kg)
Wp (incl. 15%)	542 lbs (246 kg)
Total (Fpw)	363 lbs (165 kg)
Maximum Fpw per 9.3.5.5.2 (if applicable)	769 lb (348 kg)

Main Size	Type/Sch.	Spacing (ft)
4"	Sch. 10	40

{TOLBrace™ Version 8}

TOLBrace™ Seismic Calculation

CHC Puyallup Garage | Job # 23-090

201 W. Main St

EATON
Powering Business Worldwide

Brace Identification	C1
Brace Type (Per NFPA#13)	NFPA Type B
Braced Pipe (ft)	4" Sch.10 Steel Pipe
Spacing of Brace	40' 0" (12.19 m)
Orientation of Brace	Lateral
Bracing Material	1" Sch.40
Maximum Brace Length	7' 0" (2.13 m)
Slenderness Ratio used for Load Calculation	200
True Angle of Brace for Calculation	45°
Type of Fastener	POWERS POWER-STUD +SD2 1/2in. x 3 1/4in. (3,000 PSI Light Weig
Length of Fastener	3 1/4in.

Summary of Pipe within Zone of Influence

4" Sch.10 Steel Pipe (101.6 mm)	40 ft (12.2 m)

WASHINGTON STATE
CERTIFICATE OF COMPETENCY
FIRE PROTECTION SPRINKLER SYSTEMS
Theodore M. Queen
4930-0205-C Level 3
Archer Construction, Inc.
ARCHEI*219DR
Date 11·27·23
Signature
Expires DEC 31, 23

G-Factor Used 0.67

Allowance for Heads and Fittings	15%

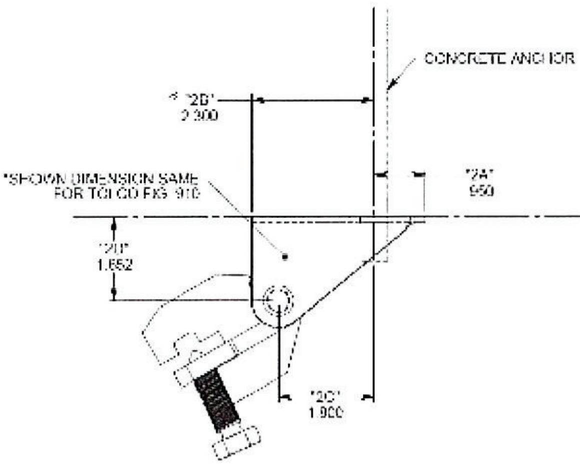
Conclusions

Total Adjusted Load of Pipe in Zone of Influence	363 lbs (165 kg)
Material Capacity	1310 lbs (594 kg)
Fastener Capacity	499 lbs (226 kg)
Fig. 1001 Clamp	1425 lbs (646 kg)
Fig.909 No-Thread Swivel	1425 lbs (646 kg)
Structural Member	Concrete Deck

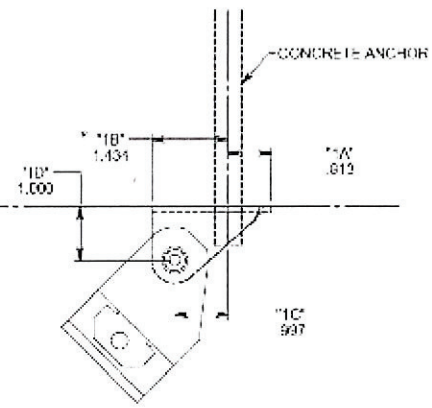
Calculations prepared by Queen

* The description of the Structural Member is for informational purposes only.
TOLBrace™ software calculates the brace assembly only, not the structure it is attached to.
Calculated with TOLBrace™ 8
Visit us at www.tolco.com

DETAIL PER NFPA 13, 2016 FIGURE A9.3.5.12.1(a - c)



TOLCO FIG. 980



TOLCO FIG. 909

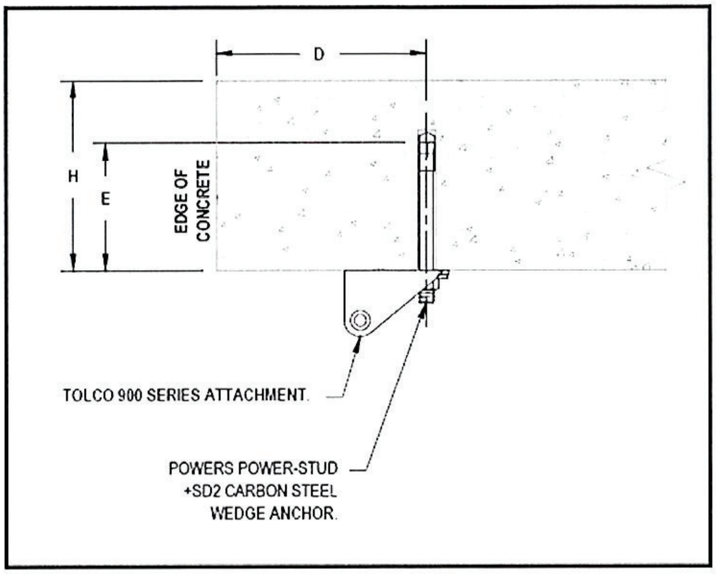
Prying Factors per NFPA 13, 2016 Section 9.3.5.12 when installed in concrete slab decks								
Fig. 980/910								
A	B	C	D	E	F	G	H	I
P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r
3.275	1.156	1.738	1.461	1.830	2.894	3.478	2.459	2.008
Fig. 909								
A	B	C	D	E	F	G	H	I
P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r
2.626	1.002	1.230	1.513	1.487	2.226	2.460	1.740	1.420

Prying Factors per NFPA 13, 2016 Section 9.3.5.12 when installed in concrete metal decks with 1" center offset								
Fig. 980/910								
A	B	C	D	E	F	G	H	I
P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r
3.275	1.156	1.738						
Fig. 909								
A	B	C	D	E	F	G	H	I
P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r
2.626	1.002	1.230	-	-	-	-	-	-

Prying Factors per NFPA 13, 2016 Section 9.3.5.12 when installed in concrete metal decks with 1.125" center offset								
Fig. 980/910								
A	B	C	D	E	F	G	H	I
P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r
3.275	1.156	1.738	-	-	-	-	-	-
Fig. 909								
A	B	C	D	E	F	G	H	I
P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r
2.626	1.003	1.230	-	-	-	-	-	-

*When intsalled in a concrete metal deck (Type W 4 1/2" x 3"), dimension 'B' would be dependent upon the contact area. For SD2 anchors the max offset is 1" so 'B' would be 1.25". For Bang-It and Wood-Knocker II + anchors, the max offset is 1.125" so 'B' would be 1.125".

POWERS POWER-STUD+SD2 WEDGE ANCHORS IN 3,000 PSI LIGHT WEIGHT CONCRETE



NFPA BRACE ORIENTATIONS A, B, AND C SHOWN ABOVE (MINUS ANGLES), OTHER ORIENTATIONS SIMILAR

Fig. 980/ Fig. 910													
ANCHOR DIA.	NOMINAL EMBED. DEPTH	"E" MIN. EFFECTIVE EMBED. DEPTH	"D" DESIGN EDGE DISTANCE	"H" MIN. BASE MATERIAL THICKNESS	ALLOWABLE STRENGTH DESIGN (ASD)								
					MAX. ALLOWABLE HORIZONTAL LOAD (LBS.)								
					NFPA BRACE ORIENTATION | PRYING FACTOR								
					A	B	C	D	E	F	G	H	I
					3.275	**1.156**	**1.738**	**1.461**	**1.850**	**2.894**	**3.478**	**2.459**	**2.008**
3/8"	2 3/8"	2"	4"	4"	106	218	169	149	162	127	84	119	146
1/2"	3 3/4"	3 1/4"	6"	5 3/4"	222	460	355	315	340	262	177	250	308
5/8"	3 7/8"	3 1/4"	6"	5 3/4"	225	473	363	326	347	262	181	255	314
3/4"	4 1/2"	3 3/4"	8"	7"	287	644	483	453	461	325	241	340	418

VALUES CALCULATED IN ACCORDANCE WITH NFPA 13-16 ANNEX E.7 AND INCLUDE OVER STRENGTH FACTOR Ω = 2.0 AND AMPLIFIED BY 1.2

Fig. 909													
ANCHOR DIA.	NOMINAL EMBED. DEPTH	"E" MIN. EFFECTIVE EMBED. DEPTH	"D" DESIGN EDGE DISTANCE	"H" MIN. BASE MATERIAL THICKNESS	ALLOWABLE STRENGTH DESIGN (ASD)								
					MAX. ALLOWABLE HORIZONTAL LOAD (LBS.)								
					NFPA BRACE ORIENTATION | PRYING FACTOR								
					A	B	C	D	E	F	G	H	I
					2.626	**1.002**	**1.230**	**1.513**	**1.487**	**2.226**	**2.460**	**1.740**	**1.420**
3/8"	2 3/8"	2"	4"	4"	126	236	210	146	187	161	105	147	182
1/2"	3 3/4"	3 1/4"	6"	5 3/4"	264	499	444	310	394	337	221	311	384
5/8"	3 7/8"	3 1/4"	6"	5 3/4"	268	514	455	320	403	341	227	320	394
3/4"	4 1/2"	3 3/4"	8"	7"	350	706	618	443	542	423	309	434	535

VALUES CALCULATED IN ACCORDANCE WITH NFPA 13-16 ANNEX E.7 AND INCLUDE OVER STRENGTH FACTOR Ω = 2.0 AND AMPLIFIED BY 1.2

NOTES:

1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN STONE AGGREGATE CONCRETE HAVING A MIN. COMPRESSIVE STRENTH OF 3,000 PSI AT THE TIME OF INSTALLATION AND DETERMINED PER ICC ESR-2502 FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN CALCULATED IN ACCORDANCE WITH ACI 318-14, CHAPTER 17

2.) PER ICC-ESR, PERIODIC SPECIAL INSPECTIONS ARE REQUIRED IN ACCORDANCE WITH SECTION 1705.1.1 AND TABLE 1705.3 OF THE 2015 AND 2012 IBC. THE SPECIAL INSPECTOR MUST MAKE PERIODIC INSPECTIONS DURING THE ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS CONCRETE TYPE, CONCRETE COMPRESSIVE STRENGTH, HOLE DIMENSIONS, HOLE CLEANING PROCEDURE, ANCHOR SPACING, EDGE DISTANCES, CONCRETE MEMBER THICKNESS, ANCHOR EMBEDMENT, TIGHTENING TORQUE AND ADHERENCE TO THE MANUFACTURER'S INSTALLATION INSTRUCTIONS. CONSULT LOCAL CODES FOR ANY ADDITIONAL SPECIAL INSPECTION REQUIREMENTS.

3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-2502

4.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL

5.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE. LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.

6.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.

7.) TOLCO 900 SERIES ATTACHMENT DIAMETER SHALL BE EQUAL TO THE ANCHOR DIAMETER

8.) IF SUBSTRATE CONDITIONS DIFFER FROM WHAT IS LISTED IN THE ABOVE TABLES, CONTACT EATON B-LINE AT TOLCOSUPPORT@EATON.COM

TOLBrace™ Seismic Bracing Calculations

Project Address: CHC Puyallup Garage

201 W. Main St

Puyallup, WA

Job # 23-090

Contractor: Archer Construction
Address: 7855 S. 206th Street
Kent, WA 98032
Phone:
License:

EATON
Powering Business Worldwide

Calculations based on 2016 NFPA Pamphlet #13

Brace Information

Maximum Brace Length	7' 0" (2.134 m)
Diameter of Brace	1" Sch.40
Type of Brace	Sch. 10
Angle of Brace	45° Min.
Least Rad. of Gyration	0.42" (11 mm)
L/R Value	200
Max Horizontal Load	1310 lbs (594 kg)

Fastener Information

Orientation to Connecting Surface NFPA Type B

Fastener

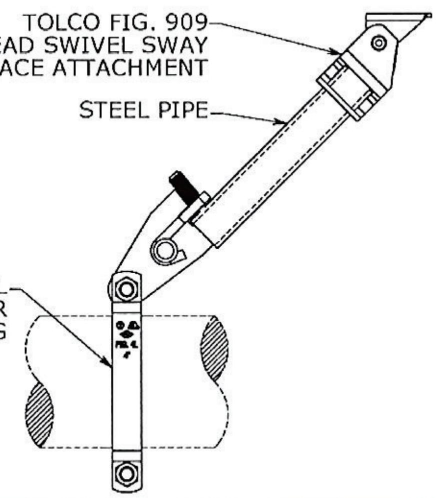
Type	POWERS POWER-STUD +SD2
Diameter	1/2in.
Length	3 1/4in.
Maximum Load	672 lbs (305 kg)
Prying Factor	1.002

TOLCO™ Brace Components

TOLCO™ Component	Listed Load	Adjusted Loa
Fig. 4L Clamp	2015 lbs (914 kg)	1425 lbs (646 kg)
Fig.909 No-Thread Swivel	2015 lbs (914 kg)	1425 lbs (646 kg)
See Fastener Information		

*Calculation Based on CONCENTRIC Loading
*Please Note: These calculations are for TOLCO™ components only. Use of any other components voids these calculations and the listing of the assembly.

Seismic Brace Assembly Detail



Brace Identification on Plans C2

Brace Type Lateral [ ] Longitudinal [X] 4-Way [ ]

Sprinkler System Load Calculation (Fpw = CpWp)

Cp = 0.67

Diameter	Type	Length	Total Length	Weight Per Unit Length	Total Weight
4" (100 mm)	Sch. 10	70 ft (21.3 m)	70 ft (21.3 m)	11.78 lb/ft (17.53 kg/m)	825 lbs (374 kg)
				Subtotal Weight	825 lbs (374 kg)
				Wp (incl. 15%)	949 lbs (430 kg)
Main Size	**Type/Sch.**	**Spacing (ft)**		**Total (Fpw)**	636 lbs (288 kg)
4"	Sch. 10	70		**Maximum Fpw per 9.3.5.5.2 (if applicable)**	N/A

TOLBrace™ Seismic Calculation

CHC Puyallup Garage — Job # 23-090

201 W. Main St

Brace Identification	C2
Brace Type (Per NFPA#13)	NFPA Type B
Braced Pipe (ft)	4" Sch.10 Steel Pipe
Spacing of Brace	70' 0" (21.34 m)
Orientation of Brace	Longitudinal
Bracing Material	1" Sch.40
Maximum Brace Length	7' 0" (2.13 m)
Slenderness Ratio used for Load Calculation	200
True Angle of Brace for Calculation	45°
Type of Fastener	POWERS POWER-STUD +SD2 1/2in. x 3 1/4in. (3,000 PSI Normal W
Length of Fastener	3 1/4in.

Summary of Pipe within Zone of Influence

4" Sch.10 Steel Pipe (101.6 mm)	70 ft (21.3 m)

WASHINGTON STATE
CERTIFICATE OF COMPETENCY
FIRE PROTECTION SPRINKLER SYSTEMS
Theodore M. Queen
4930-0205-C Level 3
Archer Construction, Inc.
ARCHEI*219DR
Date 11·27·23
Signature
Expires DEC 31, 23

G-Factor Used 0.67

Allowance for Heads and Fittings	15%

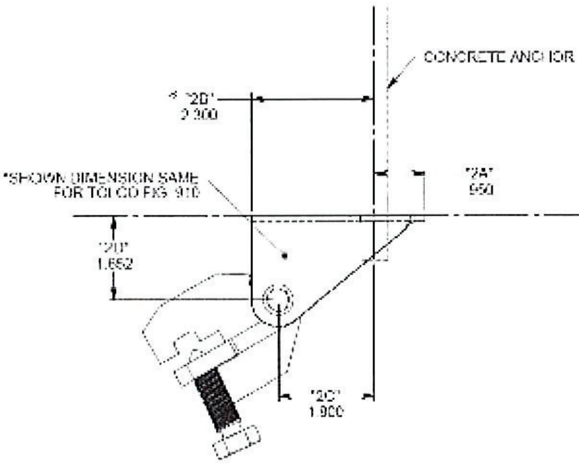
Conclusions

Total Adjusted Load of Pipe in Zone of Influence	635 lbs (288 kg)
Material Capacity	1310 lbs (594 kg)
Fastener Capacity	672 lbs (305 kg)
Fig. 4L Clamp	1425 lbs (646 kg)
Fig.909 No-Thread Swivel	1425 lbs (646 kg)
Structural Member	Concrete Deck

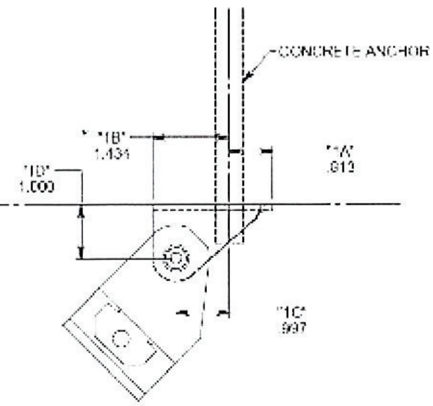
Calculations prepared by Queen

* The description of the Structural Member is for informational purposes only.
TOLBrace™ software calculates the brace assembly only, not the structure it is attached to.

DETAIL PER NFPA 13, 2016 FIGURE A9.3.5.12.1(a - c)



TOLCO FIG. 980



TOLCO FIG. 909

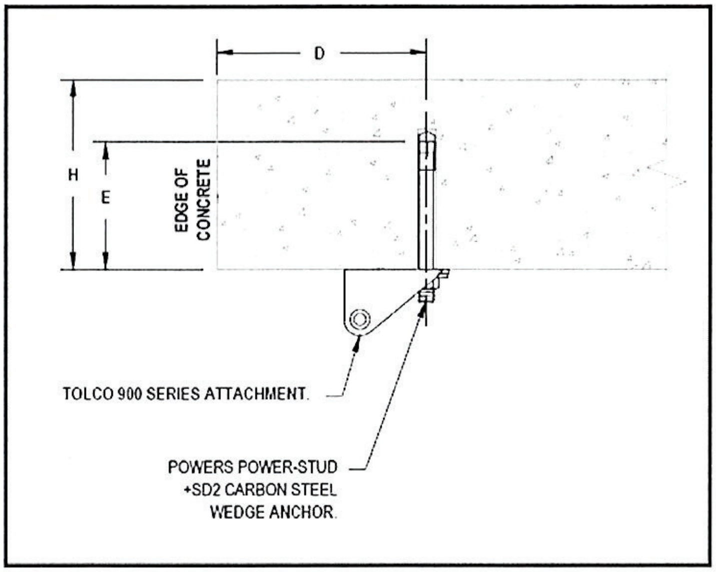
Prying Factors per NFPA 13, 2016 Section 9.3.5.12 when installed in concrete slab decks								
Fig. 980/910								
A	B	C	D	E	F	G	H	I
P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r
3.275	1.156	1.738	1.461	1.830	2.894	3.478	2.459	2.008
Fig. 909								
A	B	C	D	E	F	G	H	I
P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r
2.626	1.002	1.230	1.513	1.487	2.226	2.460	1.740	1.420

Prying Factors per NFPA 13, 2016 Section 9.3.5.12 when installed in concrete metal decks with 1" center offset								
Fig. 980/910								
A	B	C	D	E	F	G	H	I
P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r
3.275	1.156	1.738						
Fig. 909								
A	B	C	D	E	F	G	H	I
P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r
2.626	1.002	1.230	-	-	-	-	-	-

Prying Factors per NFPA 13, 2016 Section 9.3.5.12 when installed in concrete metal decks with 1.125" center offset								
Fig. 980/910								
A	B	C	D	E	F	G	H	I
P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r
3.275	1.156	1.738	-	-	-	-	-	-
Fig. 909								
A	B	C	D	E	F	G	H	I
P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r	P_r
2.626	1.003	1.230	-	-	-	-	-	-

*When intsalled in a concrete metal deck (Type W 4 1/2" x 3"), dimension 'B' would be dependent upon the contact area. For SD2 anchors the max offset is 1" so 'B' would be 1.25". For Bang-It and Wood-Knocker II + anchors, the max offset is 1.125" so 'B' would be 1.125".

POWERS POWER-STUD+SD2 WEDGE ANCHORS IN 3,000 PSI NORMAL WEIGHT CONCRETE



NFPA BRACE ORIENTATIONS A, B, AND C SHOWN ABOVE (MINUS ANGLES), OTHER ORIENTATIONS SIMILAR

Fig. 980/ Fig. 910

ANCHOR DIA.	NOMINAL EMBED. DEPTH	"E" MIN. EFFECTIVE EMBED. DEPTH	"D" DESIGN EDGE DISTANCE	"H" MIN. BASE MATERIAL THICKNESS	ALLOWABLE STRENGTH DESIGN (ASD) MAX. ALLOWABLE HORIZONTAL LOAD (LBS.) NFPA BRACE ORIENTATION | PRYING FACTOR								
					A	B	C	D	E	F	G	H	I
					3.275	**1.156**	**1.738**	**1.461**	**1.850**	**2.894**	**3.478**	**2.459**	**2.008**
3/8"	2 3/8"	2"	4"	4"	140	296	227	204	217	163	113	159	196
1/2"	3 3/4"	3 1/4"	6"	5 3/4"	292	618	473	427	453	339	236	332	409
5/8"	3 7/8"	3 1/4"	6"	5 3/4"	331	696	534	479	511	386	267	375	462
3/4"	4 1/2"	3 3/4"	8"	7"	422	929	700	650	669	478	350	493	606

VALUES CALCULATED IN ACCORDANCE WITH NFPA 13-16 ANNEX E.7 AND INCLUDE OVER STRENGTH FACTOR Ω = 2.0 AND AMPLIFIED BY 1.2

Fig. 909

ANCHOR DIA.	NOMINAL EMBED. DEPTH	"E" MIN. EFFECTIVE EMBED. DEPTH	"D" DESIGN EDGE DISTANCE	"H" MIN. BASE MATERIAL THICKNESS	ALLOWABLE STRENGTH DESIGN (ASD) MAX. ALLOWABLE HORIZONTAL LOAD (LBS.) NFPA BRACE ORIENTATION | PRYING FACTOR								
					A	B	C	D	E	F	G	H	I
					2.626	**1.002**	**1.230**	**1.513**	**1.487**	**2.226**	**2.460**	**1.740**	**1.420**
3/8"	2 3/8"	2"	4"	4"	167	322	285	201	252	211	142	200	247
1/2"	3 3/4"	3 1/4"	6"	5 3/4"	348	672	595	419	526	440	297	417	515
5/8"	3 7/8"	3 1/4"	6"	5 3/4"	394	756	670	471	594	501	335	470	580
3/4"	4 1/2"	3 3/4"	8"	7"	509	1017	892	637	784	621	446	627	773

VALUES CALCULATED IN ACCORDANCE WITH NFPA 13-16 ANNEX E.7 AND INCLUDE OVER STRENGTH FACTOR Ω = 2.0 AND AMPLIFIED BY 1.2

NOTES:

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6.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.

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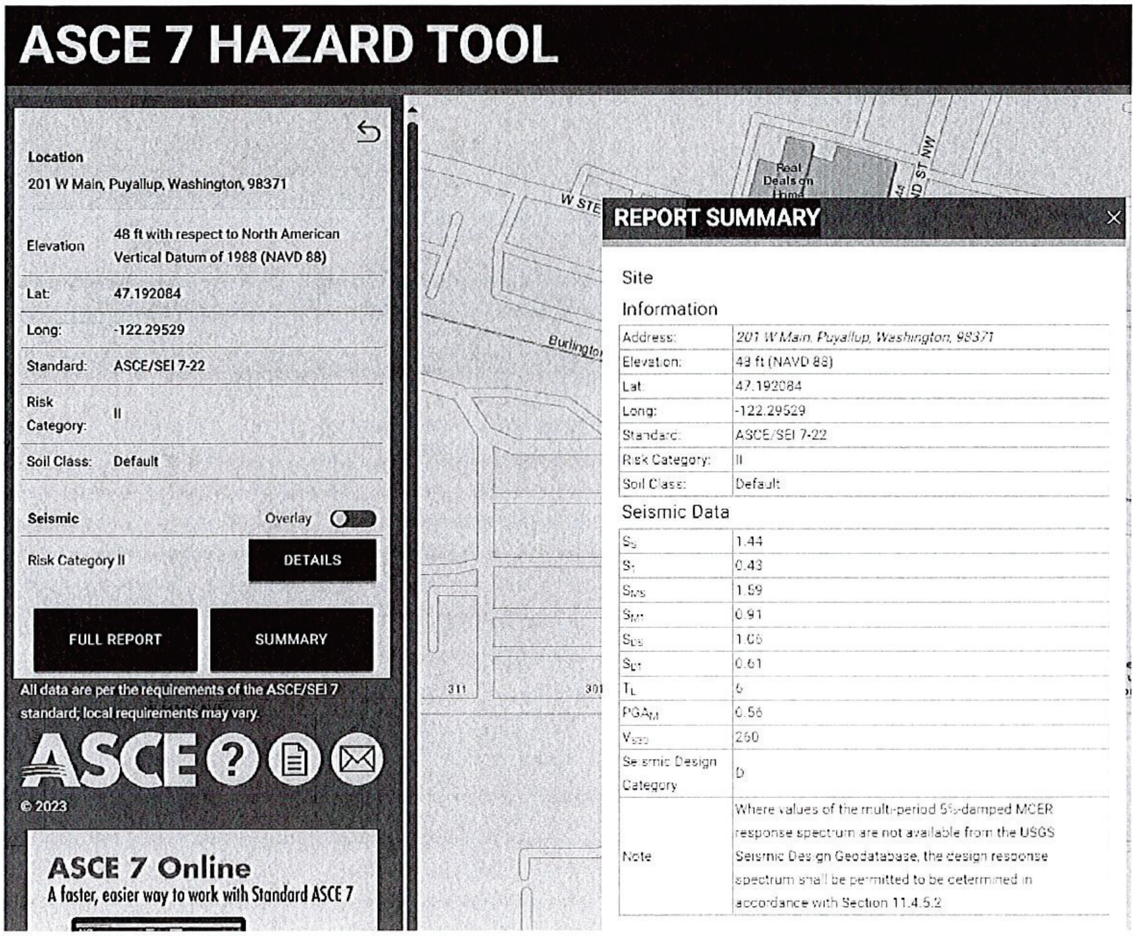
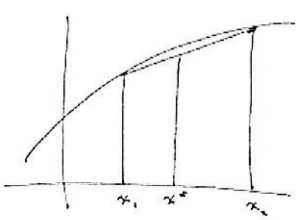


Linear interpolator



Fill in five values and leave one blank. Click the Calculate button, and the blank value will be filled in by linear interpolation. (Help and details)

x	y
1.4	.65
1.44	0.67
1.5	.7

Calculate