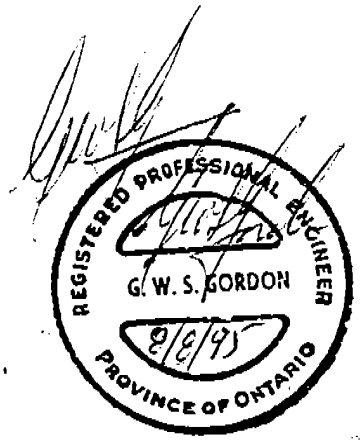
MFG: THRILL SPORT PRODUCTIONS
NAME: BUNGEE LAUNCHER
TYPE: NON-KIDDIE

T H R I L L S P O R T
P R O D U C T I O N S

B U N G E E L A U N C H E R

O P E R A T I N G M A N U A L



CORPORATE OFFICE

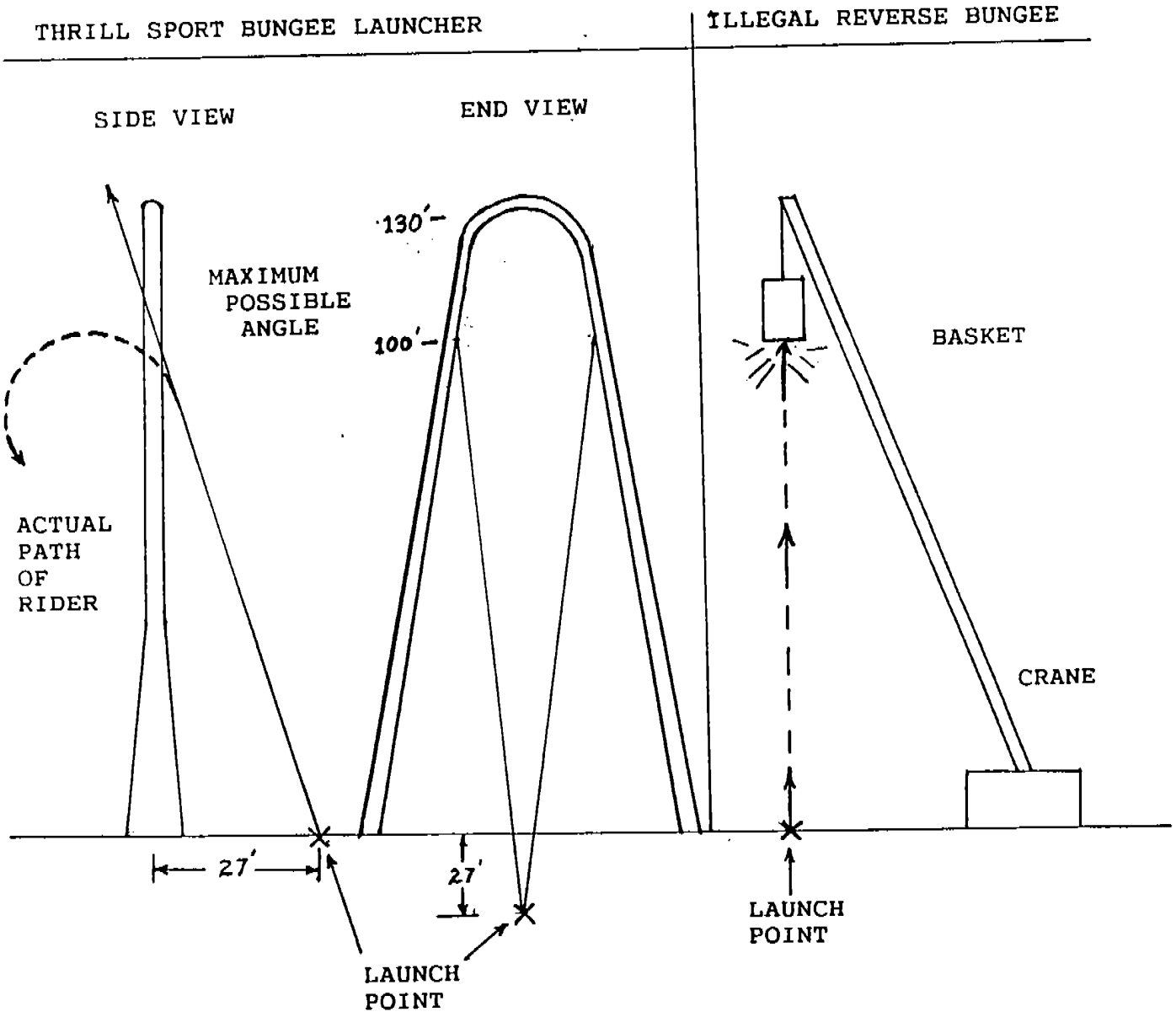
88 A ELM ST.
HOPKINTON, MA 01748
(508) 435-0420

VOICE MAIL PAGER
1 (800)946-4646
PIN # 110-0056

BUNGEE LAUNCHER OPERATIONS - GENERAL DESCRIPTION

THE BASIC OPERATION OF THE BUNGEE LAUNCHER CONSISTS OF SECURING A RIDER IN A FULL BODY HARNESS, ATTACHED TO TWO BUNGEE CORDS, WHICH ARE STRETCHED UP TO 100 FT. ON EACH SIDE OF THE THRILL SPORT BUNGEE ARCH. THE PERSON IS ALSO ANCHORED TO THE GROUND WITH A QUICK-RELEASE MECHANISM. WHEN ALL CONNECTIONS ARE SECURE, THE PERSON IS RELEASED AND WILL ACCELERATE FORWARD AND UPWARD TO A HEIGHT OF APPROXIMATLY 100 FT. THEN THE RIDER WILL DECEND, SWING AND ACCEND APPROXIMATLY FIVE TIMES UNTIL THE BOUNCE AND SWING SUBSIDE. THE RIDER IS THEN LOWERED IN A CONTROLLED DECENT TO THE GROUND AND UNHOOKED FROM THE SYSTEM.

NOTE THIS IS NOT "REVERSE BUNGEE" AS IT IS NOT A SINGLE BUNGEE CORD ATTATCHED TO A BASKET. ALSO THE LAUNCH IS AT AN ANGLE SO THE RIDER IS PROPELLED UPWARD AS WELL AS FORWARD.



OPERATIONAL PROCEDURES AND SAFETY CHECK SYSTEM

WHEN A JUMPER FIRST ARRIVES TO PURCHASE A LAUNCH RIDE, HE/SHE WILL SEE A SIGN POSTED THAT STATES THE FOLLOWING:

WARNING: THIS RIDE IS A HIGH SPEED, PHYSICALLY ACTIVE UNDERTAKING. DO NOT RIDE IF YOU HAVE BACK OR NECK DISORDERS, BROKEN BONES, HIGH BLOOD PRESSURE, HEART PROBLEMS, EPILEPSY, PREGNANCY, OR ANY OTHER PHYSICAL LIMITATIONS.

MINIMUM WEIGHT * 70 LBS. MINIMUM AGE * 10 YRS.
MAXIMUM WEIGHT * 300 LBS.

* THE RIDER'S WEIGHT IS FIRST DETERMINED BY THE DESK CLERK BY TWO SEPARATE SCALES. THE WEIGHT IS THEN WRITTEN ON A WRIST BAND AND PLACED ON THE RIDER.
* THE RIDER IS FITTED INTO A PADDED FULL-BODY HARNESS. SEE FIG. 2
* THE JUMPMASTER SELECTS THE PROPER CORD COLOR AND CALIBRATION PAD ACCORDING TO THE CALIBRATION CHART. (SEE SAMPLE CHART)
* THE SELECTION IS VERIFIED BY A JUMP COORDINATOR.
* THE JUMP COORDINATOR CONNECTES THE CORDS TO THE HOIST CABLES AND THE JUMPMASTER VERIFIES THE CONNECTIONS ARE CHECKED.
* THE JUMPMASTER CONNECTS THE CORDS TO THE CALIBRATION PAD AND THE CALIBRATION PAD TO THE RIDER'S HARNESS.
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* NOTE **** ALL CONNECTIONS ARE VERIFIED TWICE *
* THE RIDER IS CONNECTED TO A QUICK RELEASE DEVICE THAT IS SECURED TO THE GROUND ANCHOR.
* AT THIS POINT ALL CONNECTIONS HAVE BEEN DOUBLE CHECKED AND THE CORDS ARE THEN STRETCHED UP
* DURING THE STRETCH PROCESS THE JUMPMASTER GIVES INSTRUCTIONS TO THE RIDER. THE INSTRUCTIONS ARE:

"WHEN THE CORDS REACH FULL STRETCH I'LL SAY "READY" YOU PUT BOTH ARMS STRAIGHT UP AND LOOK AT YOUR HANDS. I'LL COUNT "3,2,1 LAUNCH" AND PULL THE RELEASE. ENJOY THE RIDE AND DO NOT TRY TO GRAB THE CORDS OR THE PAD. O.K. READY? ARMS UP, 3,2,1, LAUNCH!"

CORD CONSTRUCTION

THERE ARE FIVE SETS OF CORDS USED IN THE SYSTEM. EACH SET OF CORDS HAS A WEIGHT VARIATION RANGE OF APPROXIMATLY 30-50 LBS. THROUGH THE LIFE OF A SET OF CORDS THE RANGE WILL CHANGE AND IS MONITORED WITH THE CALIBRATION CHART. THE COLOR CODES AND THE APPROXIMATE WEIGHT RANGE IS LISTED BELOW.

MAX WIND SPEED 20 MPH CROSS WIND, 35 MPH FORE & AFT.

CORD COLOR	PLY	APPROXIMATE WEIGHT RANGE	F.S.
YELLOW	10	70 - 100 LBS. - 1467	5.1
GREEN	12	105 - 155 LBS. 2090	4.7
RED	16	160 - 205 LBS. - 2350	4.0
BLUE	20	210 - 245 LBS. - 2933	4.2
BLACK	24	250 - 300 LBS. - 4180 lb B.S.	4

ALL CORDS ARE HAND MADE, NEW ZEALAND STYLE, WITH FRESH LATEX RUBBER. THE RUBBER SPECIFICATIONS ARE AS FOLLOWS:

GUAGE OF RUBBER : 22 GUAGE
STRANDS PER PLY : 40 STRANDS
LENGTH OF CORDS : 23 FEET

CORD CONSTRUCTION NOTES

1) CLEAN SURFACE
2) STAKE OFF SPOOL OR SPINDLE AT 23 FEET (OR 22 FEET - SEE P5)
3) LAY WRAPS OR PLYS NEATLY WITH NO TWISTS IN THE RUBBER
4) TIE FIRST AND LAST WRAP TOGETHER IN THREE SEPARATE KNOTS.
   * LEAVE KNOTS VISIBLE ON THE OUTSIDE OF THE CORD FOR EASY INSPECTION
5) TIE SPINDLE WEBBINGS INTO THE SPOOLS WITH A RIBBON KNOT ON EACH SIDE SO THE SPOOL CANNOT TWIST
   * BE SURE TO USE TWO COLORS *
6) STRETCH TO 65 - 70 FT. TO WRAP OR BRAID THE BUNGEE CORD.
7) WRAP WITH 5 STRANDS OF RUBBER WITH THE BRAIDS TWO FINGERS WIDTH BETWEEN WRAPS. PROPER TENSION IS IMPORTANT. TOO LOOSE WILL MAKE THE CORD SLOPPY AND TOO TIGHT WILL BREAK THE BRAIDING DURING THE FIRST FEW JUMPS.
8) LABEL OR TAG THE WEBBINGS WITH THE FOLLOWING INFORMATION:
9) TIE IN STATIC LINE WEBBING IF USED - SEE P5

LENGTH OF CORD	WRAPS OR PLYS	GUAGE OF RUBBER
(ie.) 23	- 20	- 22

ON THE OTHER WEBBING LABEL THE DATE OF MANUFACTURE AND THE COLOR OF THE CORD (ie.) 6-15-95 (R)

Y - YELOW
G - GREEN
R - RED
B - BLUE
BK - BLACK

9) RECORD THE NEWLY CONSTRUCTED BUNGEE CORD IN THE BUNGEE CORD LOG BOOK. THE LOG BOOK SHOULD IDENTIFY THE FOLLOWING INFO:

a) DATE OF MANUFACTURE
b) BUILT BY
c) LABEL INFO
d) DATE CORD IS PUT IN SERVICE

NOTE: STATIC LINE TO BE USED IN THE PROVINCE OF ONTARIO

THE LOG BOOK WILL TRACK THE LIFE OF THE CORD BY A DAILY ENTRY OF THE NUMBER OF USES EACH DAY, KEEPING A RUNNING TOTAL. THE CORDS SHOULD BE RETIRED AFTER THE FOLLOWING:

400 JUMPS ON A CORD OR
5% STRAND BREAKAGE OR
250 HOURS OF LIGHT OR
6 MONTHS IN SERVICE OR
VISIBLE DAMAGE FROM CHEMICALS OR ABUSE

* WHEN A CORD IS RETIRED IT SHOULD BE CUT INTO FIVE FOOT LENGTHS SO IT CAN NOT ACCIDENTLY BE PUT BACK IN SERVICE.

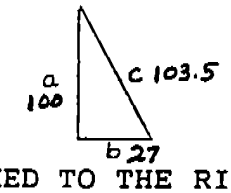
STRETCH FACTORS ON BUNGEE CORDS

THE STRETCH FACTORS OF THE BUNGEE CORDS WILL RANGE BETWEEN 298% AND 315% DEPENDING ON WHICH LENGTH CALIBRATION PAD IS USED. THE CALIBRATION PADS ARE 2, 4, AND 6 FEET LONG. THESE ARE USED TO ADJUST THE STRETCH FACTORS WITHIN THE WEIGHT RANGE OF A CORD, ALLOWING EACH PERSON TO RISE TO APPROXIMATLY THE SAME LEVEL ON THE LAUNCH. A STRETCH FACTOR UNDER 350% IS CONSIDERED VERY SAFE. (SEE CALCULATIONS BELOW)

$$\frac{\text{DISTANCE OF JUMP} - \text{LENGTH OF CORD}}{\text{LENGTH OF CORD}} \text{ EQUALS } \%\text{ OF STRETCH}$$

$$\frac{95.5\text{ FT} - 23\text{ FT}}{23\text{ FT}} \text{ EQUALS } 3.15 \text{ OR } 315\%$$

$a^2 + b^2 = c^2$
$100^2 + 27^2 = 103.5^2$



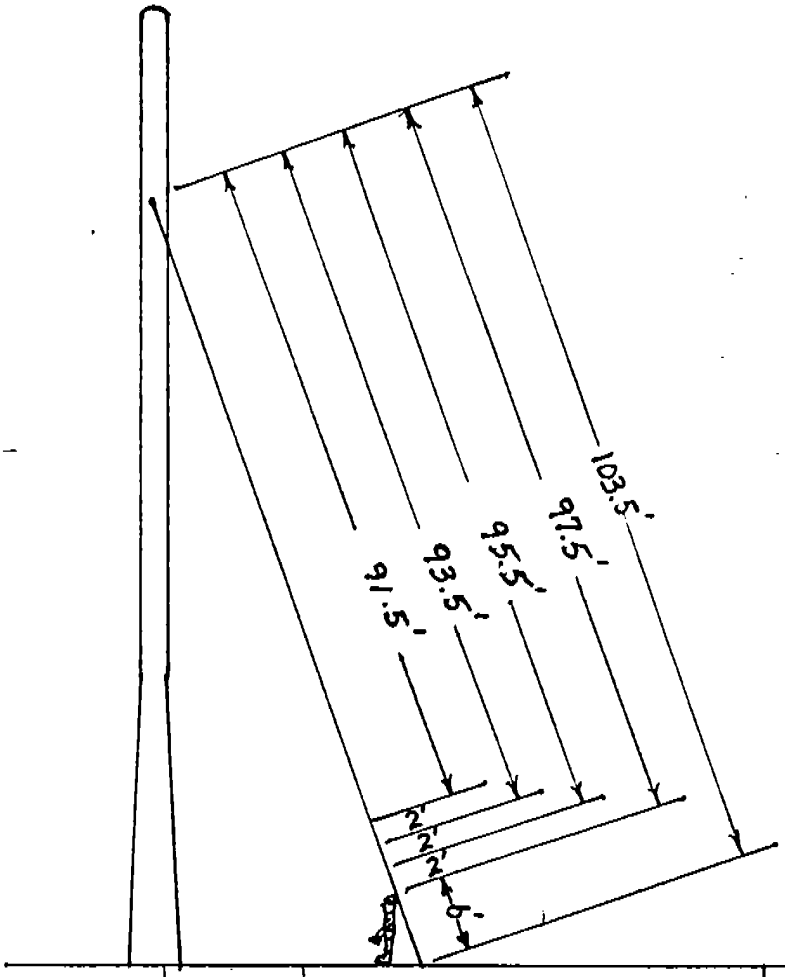
ASSUMING THE CORD IS ATTATCHED TO THE RIDER AT SIX FEET OFF THE GROUND, USING A CALIBRATION PAD A 2FT, 4FT, AND 6FT LONG RESULTS IN THE FOLLOWING STRETCH FACTORS:

2FT PAD * (95.5FT - 23) / 23 315%
4FT PAD * (93.5FT - 23) / 23 307%
6FT PAD * (91.5FT - 23) / 23 298%

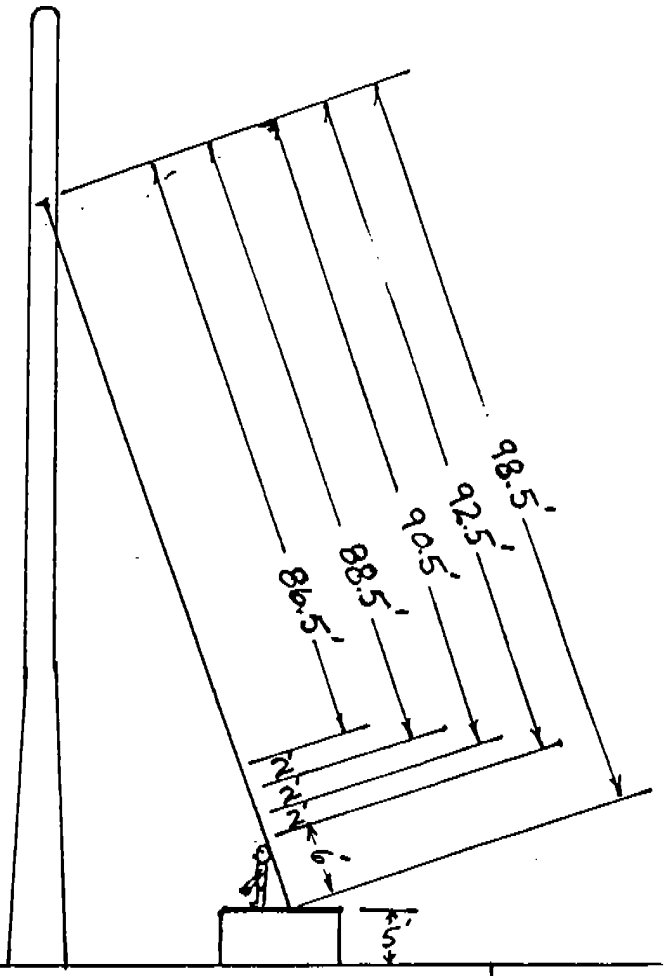
THE ENCLOSED D.S.R.I. REPORT PERFORMED FOR BUNGEE JUMPING USED STRETCH FACTORS OF 306% TO 344% AND KEPT THE PERCENTAGE OF CORD STRENGTH USED UNDER 15%. THE G - FORCES WERE KEPT UNDER 3 G'S AT THE BOTTOM OF THE FIRST STRETCH. SINCE THE BUNGEE LAUNCHER USES STRETCH FACTORS LOWER THAN THOSE USED IN THE STUDY, THE G - FORCE ON THE INITIAL LAUNCH IS LESS THAN 3 G'S ALSO.

THERE IS AN OPTIONAL LAUNCH PLATFORM THAT CAN BE USED IF A STATIC LINE IS BUILT INTO THE BUNGEE CORD. THE OPTIONAL LAUNCH PLATFORM PUTS THE RIDER FIVE FEET UP FROM THE GROUND AND THEREFORE THE CORDS CAN BE BUILT 22 FEET LONG RATHER THAN THE STANDARD 23 FOOT CORDS. THIS WILL MAKE THE STRETCH FACTOR ALMOST THE SAME. SEE THE ILLUSTRATION BELOW.

23 FOOT CORDS
LAUNCH FROM GROUND



22 FOOT CORDS
LAUNCH FROM 5FT PLATFORM



CALIBRATION PAD	STRETCH LENGTH	STRETCH FACTOR
2FT	95.5	315%
4FT	93.5	307%
6FT	91.5	298%

CALIBRATION PAD	STRETCH LENGTH	STRETCH FACTOR
2FT	90.5	311%
4FT	88.5	302%
6FT	86.5	297%

NOTE THE WEEBBING IS INSTALLED IN THE CORD AT 92 FEET LONG WHICH WILL NOT ALLOW THE CORD TO REACH THE GROUND ON FULL STRETCH.

JUMPMASTER QUALIFICATIONS

TRAINEE JUMPMASTER (LEVEL 1)

RESTRICTIONS:

ONLY ALLOWED TO JUMPMASTER UNDER DIRECT
SUPERVISION OF A FULLY QUALIFIED JUMPMASTER (LEVEL 2)

REQUIREMENTS:

A) MUST BE OVER 18
B) MUST HAVE OVER 20 PERSONAL LAUNCHES
C) BE OF GOOD CHARACTER, SHOWING CHARACTERISTICS OF:
   CALMNESS UNDER PRESSURE
   ATTENTION TO DETAIL
   CONSISTENCY
   PERSONABILITY
   WILLINGNESS TO LEARN

D) HAVE A BASIC UNDERSTANDING OF THE DYNAMICS OF LAUNCHING
E) HAVE A GOOD WORKING KNOWLEDGE OF THE LAUNCH PROCEDURES
F) HAVE WORKED OVER 20 HOURS AS A JUMP COORDINATOR FITTING
   HARNESSES AND CONNECTING CORDS

JUMPMASTER CERTIFICATION

QUALIFICATION:

CERTIFIED TO OPERATE A BUNGEE LAUNCHER SITE

REQUIREMENTS:

A) MUST BE OVER 18
B) HAVE OVER 20 PERSONAL LAUNCHES
C) MUST HAVE COMPLETED OVER 40 HOURS AS A TRAINEE JUMPMASTER
   WITHOUT ANY INCIDENTS
D) MUST BE ABLE TO COMPLETE A RESCUE PRODEDURE
E) MUST HAVE A COMPLETE UNDERSTANDING OF THE TOWER OPERATION
   AND THE LAUNCH PROCEDURES

NOTE THE JUMPMASTER MAY BE REQUIRED TO HANDLE COMPLETE SITE OPERATIONS INCLUDING PERSONNEL HIRING AND TRAINING, AS WELL AS REVENUE REPORTS AND RECORD KEEPING.

SAMPLE CALIBRATION CHART / (THIS CHART CAN BE USED TO BRING NEW CORDS INTO SERVICE)

	WEIGHT	PAD LENGTH		WEIGHT	PAD LENGTH
(10 PLY) YELLOW	70	6'	(20 PLY) BLUE	210'	6'
	75	6'		215'	6'
	80	6'		220	6'
	85	4'		225	4'
	90	4'		230	4'
Double	95	2'		235	4'
	100	2'		240	2'
				245	2'
(12 PLY) GREEN	105	6'	(24 PLY) BLACK	250	6'
	110	6'		255	6'
	115	6'		260	6'
	120	4'		265	6'
	125	4'		270	4'
	130	4'		275	4'
	135	4'		280	4'
	140	2'		285	2'
Double	145	2'		290	2'
	150	2'		295	2'
	155	2'		300	2'
(16 PLY) RED	160	6'			
	165	6'			
	170	6			
	175	6'			
	180	4'			
	185	4'			
	190	4'			
	195	2'			
	200	2'			
	205	2'			

* NOTE * AS THE CORDS SOFTEN THE CHART WILL CHANGE OVER THE LIFE OF A SET OF CORDS. IT IS NOT UNUSUAL TO CHANGE TWO OR THREE SETTINGS OVER THE CORD LIFE.

DESCRIPTION OF EQUIPMENT - GLOSSARY OF TERMS

BRAIDING OR TIES	-	RUBBER WRAPS ON THE BUNGEE CORD THAT HOLDS THE CORD TOGETHER. 5 STRANDS WIDE
CARIBEANERS	-	LOCKABLE CLIMBING CLIPS. ALL CARIBEANERS HAVE A MINIMUM STRENGTH OF 6000 LBS.
CLIMBING HARNESS	-	STANDARD ROCK CLIMBING HARNESS FOR RESCUE
CORD COLOR	-	WEIGHT RANGE OF CORD IDENTIFIED BY COLOR
CALIBRATION CHART	-	CHART LISTING THE PROPER CORDS AND PADS
DAILY INSPECTION	-	A CHECKLIST OF DAILY EQUIPMENT CHECK
D.S.R.I. REPORT	-	STUDY OF THE PROPERTIES OF THE RUBBER
HARNESS	-	FULL BODY HARNESS USED FOR LAUNCHING
JUMP COORDINATOR	-	ASSISTANT TO THE JUMPMASTER
JUMPMASTER	-	PERSON IN CHARGE OF THE SITE
PLYS OR WRAPS	-	THE NUMBER OF STRIPS OF RUBBER IN A CORD
SPINDLE OR SPOOL	-	THE SPOOL AT THE END THAT HOLDS THE CORD
SPINDLE WEBBING	-	THE WEBBING THROUGH THE SPOOL THAT A CARIBEANER IS ATTATCHED TO
STRAND	-	A SINGLE STRIP OF RUBBER
TAGGING OR LABEL	-	NUMBERS ON THE SPINDLE WEBBING THAT IDENTIFIES THE CORD

THE FOLLOWING RESCUE GEAR IS NEEDED ON SITE:

2 ROPES - 9/16- 150 FT
2 PETZEL DECENDERS
2 SEAT HARNESSES
2 POUCHES WITH : 2 SCISSORS, 2 WEEBINBG LOOPS, 4 CARIBEANERS GLOVES

RESCUE PROCEDURES

IN THE EVENT OF A HOIST FAILURE THERE ARE TWO POSSIBLE RESCUE SENARIOS.

1) THE RIDER IS SUSPENDED AFTER A LAUNCH AND THE HOIST WILL NOT MOVE DOWN AT ALL. IN THIS SITUATION, TWO RESCUERS WILL CLIMB THE TOWERS TO THE 100 FT LEVEL AND CONNECT A DECENDER TO THE TOWER. A ROPE IS SECURED UNDER THE SPINDLE HARNESS KNOTS AND PUT THROUGH THE DECENDER. THE WEBBINGS ARE CUT ABOVE THE KNOTS SO THE CORD IS NOW HELD BY THE ROPES RATHER THAN THE HOIST CABLES. THE RIDER IS THEN SIMPLY DECENDED DOWN SLOWLY.

2) THE HOIST STOPPED WORKING AFTER LOWERING THE RIDER PART WAY DOWN, AND THE SPINDLE HARNESS TO HOIST CABLE CONNECTION IS TOO FAR AWAY TO REACH FROM THE TOWER. THE RESCUERS WILL THEN CLIMB TO A POINT DIRECTLY ABOVE THE CONNECTION POINT AND ATTACH THEIR ROPE TO THE TOWER. THE RESCUERS WILL DECEND DOWN TO THE CONNECTION POINT AND HOOK A CARIBEANER UNDER THE SPINDLE HARNESS KNOTS AND CONNECT THAT CARIBEANER TO THEIR HARNESS CARIBEANER. THEN THE SPINDLE HARNESS WEBBING IS CUT ABOVE THE KNOTS SO THE CORD IS NOW HELD BY THE RESCUER'S ROPE RATHER THAN THE HOIST CABLES. THE RESCUERS SIMPLY DECEND THEMSELVES AND THE RIDER DOWN SLOWLY.

383

Fax to: (904) 488-9023 (One page only)

December 13, 1995

Mr. Ron Safford
Florida Department of Agriculture
Bureau of Fair Rides
3125 Conner Blvd. Bldg #4
Tallahassee, Florida 32399-1650

Dear Mr. Safford,

I received your letter dated December 7, 1995 declining the use of our amusement device known as the "Rocket Launcher" in the State of Florida. I had been in correspondence with Mr. Lowell Parrish from your department for several weeks and he had requested more information on the ride which I mailed to him. He had been discussing with me how a rule change should be structured to develop safe guidelines for this type of ride. After speaking with Mr. Parrish on December 13, 1995 he informed me that your decline letter was mailed out before the additional information had been received. Mr. Parrish also expressed to me that although our ride and our company as an operator may be safe, the concern of your department is that if a rule change is made to allow this type of ride, it would open the door for other operators that may not be as safe. If our ride is considered safe by other states, inspectors, insurance companies, and even someone in your department, I do not see the arguement that the possibility of other potentially unsafe operators copying our ride a valid justification for not allowing it to operate in the State of Florida.

We have a signed contract with the Florida State Fair to operate the ride February 8 - 19, 1995. If we are not allowed to operate at that event, our company will lose an estimated $100,000 in gross income. Currently this is the only event in Florida that we are interested in operating the ride. I suggested to Mr. Parrish that an exemption or variance be given so your department can see the operation of the ride first hand. At the conclusion of the event, your department can then adjust the rule or decline further operation based on your observations. Although most of my correspondence has been with Mr.Parrish, he informed me that you would be the one that would have to make this decision.

You may respond by fax if you prefer or call me at the home office. The telephone and/or fax number is (970) 949-7978.

Sincerely,

D. Craig Lindell

RECEIVED
DEC 12 1995
BUREAU OF FAIR RIDES INSPECTION

Corporate Office 88 A Elm Street Hopkinton, MA 01748 Tel: (508) 435-0420 Fax: (508) 435-6594
Home Office 2121 N. Frontage Road W. #129 Vail, CO 81657 Tel/Fax: (970) 949-7978

Florida Department of Agriculture & Consumer Services
BOB CRAWFORD, Commissioner

Please Respond To:

December 07, 1995

Mr. Craig Lindell
Thrill Sports Productions
2121 N. Frontage Road W. #129
Vail, CO 81657

Dear Mr. Lindell:

We have reviewed your request concerning the operation of the amusement device known as the "Rocket Launcher." After careful consideration and review of the information and documentation submitted with your request, we must respectfully decline.

Florida Administrative Code 5F-8 (see copy attached) clearly prohibts this type of device unless passengers are protected in a rigid structure and the device is free of any overhead obstructions.

If we may be of further assistance to you please call at (904) 488-9790.

Sincerely,

BOB CRAWFORD
COMMISSIONER OF AGRICULTURE

Ron Safford, Chief
Fair Rides Inspection

RS/rr
Enclosure

Florida Department of Agriculture & Consumer Services
BOB CRAWFORD, Commissioner

Please Respond To:

January 2, 1996

Mr. Craig Lindell
Thrill Sport Productions
2121 N. Frontage Road W. #129
Vail, CO 81657

Dear Mr. Lindell:

I am writing you concerning my letter of December 7, 1995 which stated our decision to decline your request to operate the amusement "Rocket Launcher" in Florida, and your response dated 12/13/95. We have no authority to grant exemptions or variances to existing law or the Florida Administrative Code.

You do, however, have certain rights as provided in Florida Statutes, Chapter 120.57 (see attached).

If I may be of further assistance, please contact me at 904/488-9790.

Sincerely,

BOB CRAWFORD
COMMISSIONER OF AGRICULTURE

Ron Safford, Chief
Bureau of Fair Rides Inspection

RS/sm
Enclosure

cc: Richard Tritschler
Don Farmer
Pat Sucher

Ron -
I don't know if this info. changes our decision on his Bungee Launcher request or not. What do you think. Lowell

P.S. However we may be asked to amend to this Rules.

NO Ron letter has been mailed

RILL SPORT
ODUCTIONS

December 4,1995

State of Florida
Dept. of Agriculture
Bureau of Fair Rides
3125 Conner Blvd. Bldg. #4
Tallahassee, FL 32399

Dear Mr. Lowell Parrish,

Here is the basic manual we spoke about as well as information from the Canada engineer. As we discussed, I will adjust the manual to conform with all the Florida regulations once I get the go ahead from your department that you will approve the ride in your state. If that decision can be made before the Christmas holidays I would greatly appreciate it as that will give me one month to make arrangements for the fair in February. You can contact me at the home office in Colorado if you have any further questions.

Thank you for your time. And by the way, as much as it pains me to say this, Congratulations to the Gators in their victory over the Seminoles!

Sincerely,

Craig Lindell

RECEIVED
DEC 12 1995
BUREAU OF
FAIR RIDES INSPECTION

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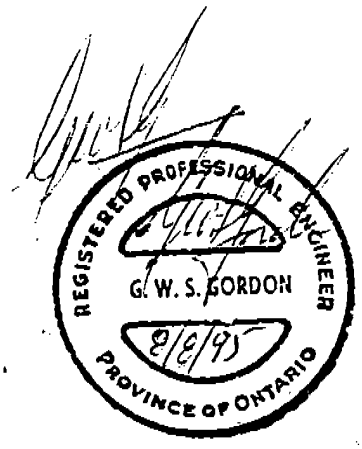
Home Office 2121 N. Frontage Road W. #129 Vail, CO 81657 Tel/Fax: (970) 949-7978

T H R I L L S P O R T

P R O D U C T I O N S

B U N G E E L A U N C H E R

O P E R A T I N G M A N U A L



CORPORATE OFFICE

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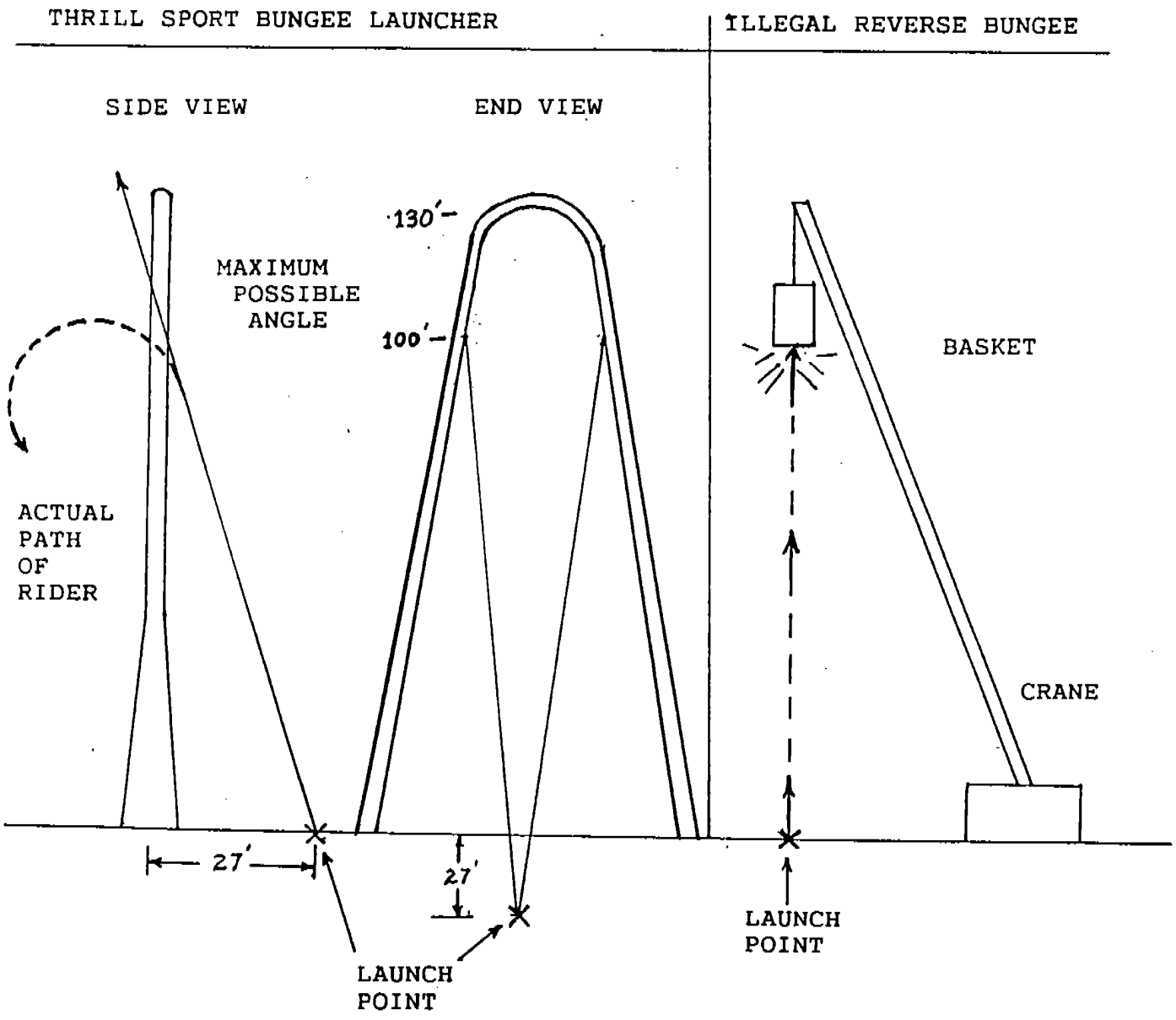

OPERATIONAL PROCEDURES AND SAFETY CHECK SYSTEM

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* AT THIS POINT ALL CONNECTIONS HAVE BEEN DOUBLE CHECKED AND THE CORDS ARE THEN STRETCHED UP
* DURING THE STRETCH PROCESS THE JUMPMASTER GIVES INSTRUCTIONS TO THE RIDER. THE INSTRUCTIONS ARE:
"WHEN THE CORDS REACH FULL STRETCH I'LL SAY "READY" YOU PUT BOTH ARMS STRAIGHT UP AND LOOK AT YOUR HANDS. I'LL COUNT "3,2,1 LAUNCH" AND PULL THE RELEASE. ENJOY THE RIDE AND DO NOT TRY TO GRAB THE CORDS OR THE PAD. O.K. READY? ARMS UP, 3,2,1, LAUNCH!"

CORD CONSTRUCTION

THERE ARE FIVE SETS OF CORDS USED IN THE SYSTEM. EACH SET OF CORDS HAS A WEIGHT VARIATION RANGE OF APPROXIMATLY 30-50 LBS. THROUGH THE LIFE OF A SET OF CORDS THE RANGE WILL CHANGE AND IS MONITORED WITH THE CALIBRATION CHART. THE COLOR CODES AND THE APPROXIMATE WEIGHT RANGE IS LISTED BELOW.

MAX WIND SPEED 20 MPH CROSS WIND, 35 MPH FORE & AFT.

CORD COLOR	PLY	APPROXIMATE WEIGHT RANGE	F.S.
YELLOW	10	70 - 100 LBS. – 1467	5.1
GREEN	12	105 - 155 LBS. 2090	4.7
RED	16	160 - 205 LBS. – 2350	4.0
BLUE	20	210 - 245 LBS. – 2933	4.2
BLACK	24	250 - 300 LBS. – 4180 lb B.S.	4

ALL CORDS ARE HAND MADE, NEW ZEALAND STYLE, WITH FRESH LATEX RUBBER. THE RUBBER SPECIFICATIONS ARE AS FOLLOWS:

GUAGE OF RUBBER : 22 GUAGE
STRANDS PER PLY : 40 STRANDS
LENGTH OF CORDS : 23 FEET

CORD CONSTRUCTION NOTES

1) CLEAN SURFACE
2) STAKE OFF SPOOL OR SPINDLE AT 23 FEET (OR 22 FEET - SEE P5)
3) LAY WRAPS OR PLYS NEATLY WITH NO TWISTS IN THE RUBBER
4) TIE FIRST AND LAST WRAP TOGETHER IN THREE SEPARATE KNOTS.
   * LEAVE KNOTS VISIBLE ON THE OUTSIDE OF THE CORD FOR EASY INSPECTION
5) TIE SPINDLE WEBBINGS INTO THE SPOOLS WITH A RIBBON KNOT ON EACH SIDE SO THE SPOOL CANNOT TWIST
   * BE SURE TO USE TWO COLORS *
6) STRETCH TO 65 - 70 FT. TO WRAP OR BRAID THE BUNGEE CORD.
7) WRAP WITH 5 STRANDS OF RUBBER WITH THE BRAIDS TWO FINGERS WIDTH BETWEEN WRAPS. PROPER TENSION IS IMPORTANT. TOO LOOSE WILL MAKE THE CORD SLOPPY AND TOO TIGHT WILL BREAK THE BRAIDING DURING THE FIRST FEW JUMPS.
8) LABEL OR TAG THE WEBBINGS WITH THE FOLLOWING INFORMATION:
9) TIE IN STATIC LINE WEBBING IF USED – SEE P5

LENGTH OF CORD		WRAPS OR PLYS		GUAGE OF RUBBER
(ie.) 23	-	20	-	22

ON THE OTHER WEBBING LABEL THE DATE OF MANUFACTURE AND THE COLOR OF THE CORD (ie.) 6-15-95 (R)

Y - YELOW
G - GREEN
R - RED
B - BLUE
BK - BLACK

9) RECORD THE NEWLY CONSTRUCTED BUNGEE CORD IN THE BUNGEE CORD LOG BOOK. THE LOG BOOK SHOULD IDENTIFY THE FOLLOWING INFO:

a) DATE OF MANUFACTURE
b) BUILT BY
c) LABEL INFO
d) DATE CORD IS PUT IN SERVICE

NOTE: STATIC LINE TO BE USED IN THE PROVINCE OF ONTARIO

THE LOG BOOK WILL TRACK THE LIFE OF THE CORD BY A DAILY ENTRY OF THE NUMBER OF USES EACH DAY, KEEPING A RUNNING TOTAL. THE CORDS SHOULD BE RETIRED AFTER THE FOLLOWING:

400 JUMPS ON A CORD OR
5% STRAND BREAKAGE OR
250 HOURS OF LIGHT OR
6 MONTHS IN SERVICE OR
VISIBLE DAMAGE FROM CHEMICALS OR ABUSE

* WHEN A CORD IS RETIRED IT SHOULD BE CUT INTO FIVE FOOT LENGTHS SO IT CAN NOT ACCIDENTLY BE PUT BACK IN SERVICE.

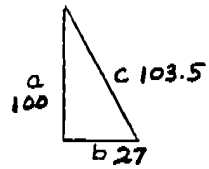
STRETCH FACTORS ON BUNGEE CORDS

THE STRETCH FACTORS OF THE BUNGEE CORDS WILL RANGE BETWEEN 298% AND 315% DEPENDING ON WHICH LENGTH CALIBRATION PAD IS USED. THE CALIBRATION PADS ARE 2, 4, AND 6 FEET LONG. THESE ARE USED TO ADJUST THE STRETCH FACTORS WITHIN THE WEIGHT RANGE OF A CORD, ALLOWING EACH PERSON TO RISE TO APPROXIMATLY THE SAME LEVEL ON THE LAUNCH. A STRETCH FACTOR UNDER 350% IS CONSIDERED VERY SAFE. (SEE CALCULATIONS BELOW)

$$\frac{\text{DISTANCE OF JUMP} - \text{LENGTH OF CORD}}{\text{LENGTH OF CORD}} \text{ EQUALS } \% \text{ OF STRETCH}$$

$$\frac{95.5 \text{ FT} - 23 \text{ FT}}{23 \text{ FT}} \text{ EQUALS } 3.15 \text{ OR } 315\%$$

$a^2 + b^2 = c^2$
$100^2 + 27^2 = 103.5^2$



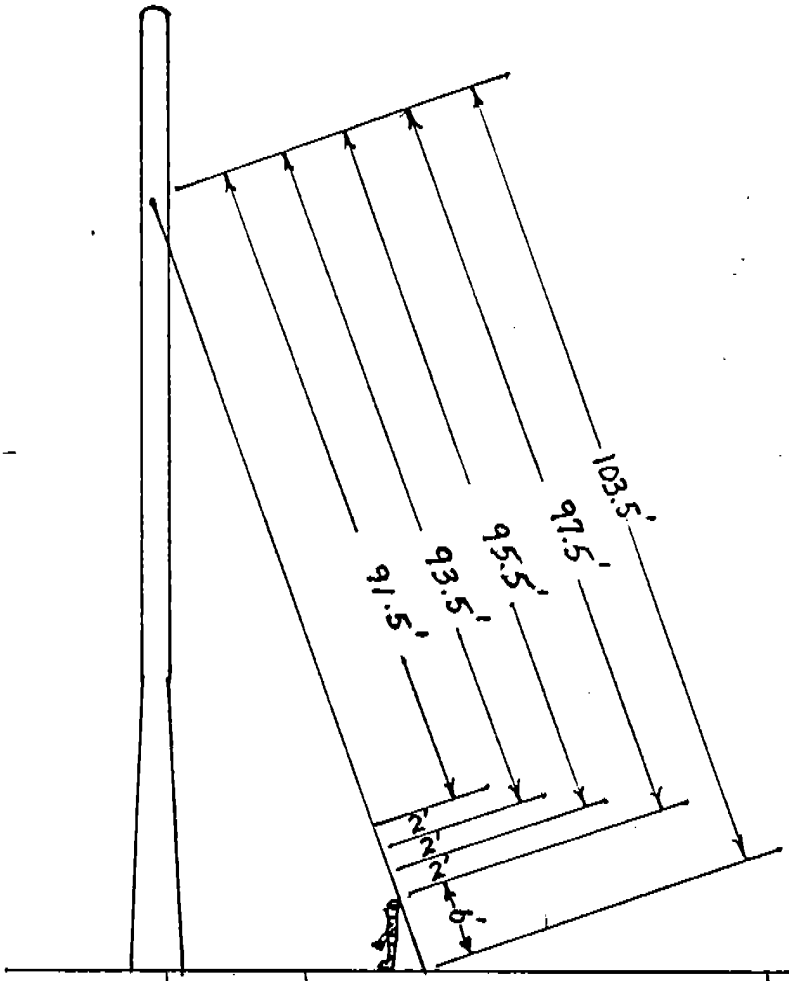
ASSUMING THE CORD IS ATTATCHED TO THE RIDER AT SIX FEET OFF THE GROUND, USING A CALIBRATION PAD A 2FT, 4FT, AND 6FT LONG RESULTS IN THE FOLLOWING STRETCH FACTORS:

2FT PAD * (95.5FT - 23) / 23 315%
4FT PAD * (93.5FT - 23) / 23 307%
6FT PAD * (91.5FT - 23) / 23 298%

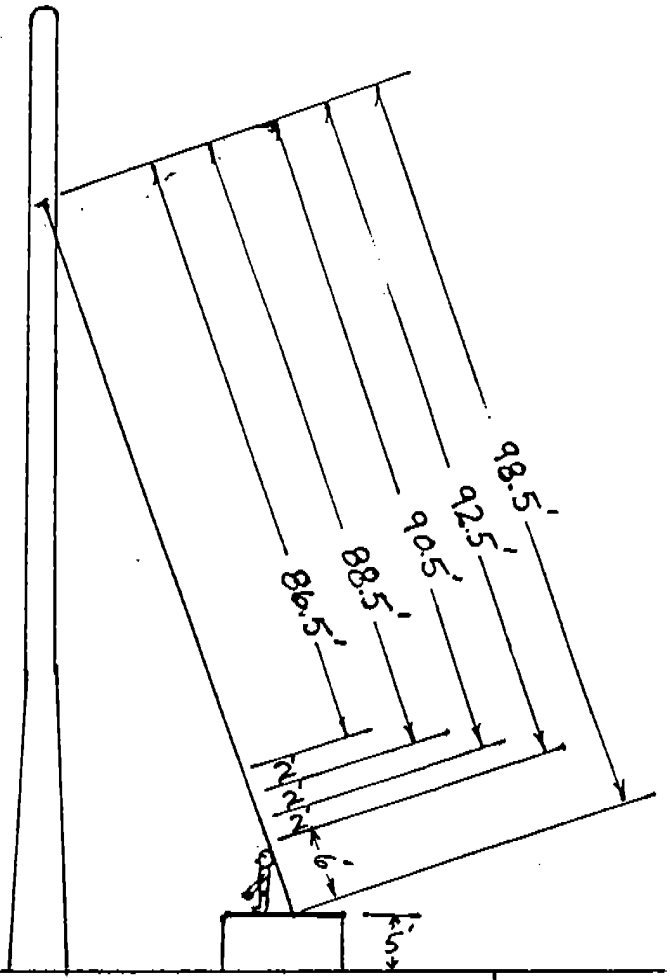
THE ENCLOSED D.S.R.I. REPORT PERFORMED FOR BUNGEE JUMPING USED STRETCH FACTORS OF 306% TO 344% AND KEPT THE PERCENTAGE OF CORD STRENGTH USED UNDER 15%. THE G - FORCES WERE KEPT UNDER 3 G'S AT THE BOTTOM OF THE FIRST STRETCH. SINCE THE BUNGEE LAUNCHER USES STRETCH FACTORS LOWER THAN THOSE USED IN THE STUDY, THE G - FORCE ON THE INITIAL LAUNCH IS LESS THAN 3 G'S ALSO.

THERE IS AN OPTIONAL LAUNCH PLATFORM THAT CAN BE USED IF A STATIC LINE IS BUILT INTO THE BUNGEE CORD. THE OPTIONAL LAUNCH PLATFORM PUTS THE RIDER FIVE FEET UP FROM THE GROUND AND THEREFORE THE CORDS CAN BE BUILT 22 FEET LONG RATHER THAN THE STANDARD 23 FOOT CORDS. THIS WILL MAKE THE STRETCH FACTOR ALMOST THE SAME. SEE THE ILLUSTRATION BELOW.

23 FOOT CORDS
LAUNCH FROM GROUND



22 FOOT CORDS
LAUNCH FROM 5FT PLATFORM



CALIBRATION PAD	STRETCH LENGTH	STRETCH FACTOR
2FT	95.5	315%
4FT	93.5	307%
6FT	91.5	298%

CALIBRATION PAD	STRETCH LENGTH	STRETCH FACTOR
2FT	90.5	311%
4FT	88.5	302%
6FT	86.5	297%

NOTE THE WEEBBING IS INSTALLED IN THE CORD AT 92 FEET LONG WHICH WILL NOT ALLOW THE CORD TO REACH THE GROUND ON FULL STRETCH.

JUMPMASTER QUALIFICATIONS

TRAINEE JUMPMASTER (LEVEL 1)

RESTRICTIONS:

ONLY ALLOWED TO JUMPMASTER UNDER DIRECT
SUPERVISION OF A FULLY QUALIFIED JUMPMASTER (LEVEL 2)

REQUIREMENTS:

A) MUST BE OVER 18
B) MUST HAVE OVER 20 PERSONAL LAUNCHES
C) BE OF GOOD CHARACTER, SHOWING CHARACTERISTICS OF:
   CALMNESS UNDER PRESSURE
   ATTENTION TO DETAIL
   CONSISTENCY
   PERSONABILITY
   WILLINGNESS TO LEARN

D) HAVE A BASIC UNDERSTANDING OF THE DYNAMICS OF LAUNCHING
E) HAVE A GOOD WORKING KNOWLEDGE OF THE LAUNCH PROCEDURES
F) HAVE WORKED OVER 20 HOURS AS A JUMP COORDINATOR FITTING
   HARNESSES AND CONNECTING CORDS

JUMPMASTER CERTIFICATION

QUALIFICATION:

CERTIFIED TO OPERATE A BUNGEE LAUNCHER SITE

REQUIREMENTS:

A) MUST BE OVER 18
B) HAVE OVER 20 PERSONAL LAUNCHES
C) MUST HAVE COMPLETED OVER 40 HOURS AS A TRAINEE JUMPMASTER
   WITHOUT ANY INCIDENTS
D) MUST BE ABLE TO COMPLETE A RESCUE PRODEDURE
E) MUST HAVE A COMPLETE UNDERSTANDING OF THE TOWER OPERATION
   AND THE LAUNCH PROCEDURES

NOTE THE JUMPMASTER MAY BE REQUIRED TO HANDLE COMPLETE SITE OPERATIONS INCLUDING PERSONNEL HIRING AND TRAINING, AS WELL AS REVENUE REPORTS AND RECORD KEEPING.

SAMPLE CALIBRATION CHART / (THIS CHART CAN BE USED TO BRING NEW CORDS INTO SERVICE)

	WEIGHT	PAD LENGTH
(10 PLY) YELLOW	70	6'
	75	6'
	80	6'
	85	4'
	90	4'
Double	95	2'
	100	2'
(12 PLY) GREEN	105	6'
	110	6'
	115	6'
	120	4'
	125	4'
	130	4'
	135	4'
	140	2'
Double	145	2'
	150	2'
	155	2'
(16 PLY) RED	160	6'
	165	6'
	170	6
	175	6'
	180	4'
	185	4'
	190	4'
	195	2'
	200	2'
	205	2'
(20 PLY) BLUE	210'	6'
	215'	6'
	220	6'
	225	4'
	230	4'
	235	4'
	240	2'
	245	2'
(24 PLY) BLACK	250	6'
	255	6'
	260	6'
	265	6'
	270	4'
	275	4'
	280	4'
	285	2'
	290	2'
	295	2'
	300	2'

* NOTE * AS THE CORDS SOFTEN THE CHART WILL CHANGE OVER THE LIFE OF A SET OF CORDS. IT IS NOT UNUSUAL TO CHANGE TWO OR THREE SETTINGS OVER THE CORD LIFE.

DESCRIPTION OF EQUIPMENT - GLOSSARY OF TERMS

BRAIDING OR TIES	-	RUBBER WRAPS ON THE BUNGEE CORD THAT HOLDS THE CORD TOGETHER. 5 STRANDS WIDE
CARIBEANERS	-	LOCKABLE CLIMBING CLIPS. ALL CARIBEANERS HAVE A MINIMUM STRENGTH OF 6000 LBS.
CLIMBING HARNESS	-	STANDARD ROCK CLIMBING HARNESS FOR RESCUE
CORD COLOR	-	WEIGHT RANGE OF CORD IDENTIFIED BY COLOR
CALIBRATION CHART	-	CHART LISTING THE PROPER CORDS AND PADS
DAILY INSPECTION	-	A CHECKLIST OF DAILY EQUIPMENT CHECK
D.S.R.I. REPORT	-	STUDY OF THE PROPERTIES OF THE RUBBER
HARNESS	-	FULL BODY HARNESS USED FOR LAUNCHING
JUMP COORDINATOR	-	ASSISTANT TO THE JUMPMASTER
JUMPMASTER	-	PERSON IN CHARGE OF THE SITE
PLYS OR WRAPS	-	THE NUMBER OF STRIPS OF RUBBER IN A CORD
SPINDLE OR SPOOL	-	THE SPOOL AT THE END THAT HOLDS THE CORD
SPINDLE WEBBING	-	THE WEBBING THROUGH THE SPOOL THAT A CARIBEANER IS ATTATCHED TO
STRAND	-	A SINGLE STRIP OF RUBBER
TAGGING OR LABEL	-	NUMBERS ON THE SPINDLE WEBBING THAT IDENTIFIES THE CORD

THE FOLLOWING RESCUE GEAR IS NEEDED ON SITE:

2 ROPES - 9/16- 150 FT
2 PETZEL DECENDERS
2 SEAT HARNESSES
2 POUCHES WITH : 2 SCISSORS, 2 WEEBINBG LOOPS, 4 CARIBEANERS GLOVES

RESCUE PROCEDURES

IN THE EVENT OF A HOIST FAILURE THERE ARE TWO POSSIBLE RESCUE SENARIOS.

1) THE RIDER IS SUSPENDED AFTER A LAUNCH AND THE HOIST WILL NOT MOVE DOWN AT ALL. IN THIS SITUATION, TWO RESCUERS WILL CLIMB THE TOWERS TO THE 100 FT LEVEL AND CONNECT A DECENDER TO THE TOWER. A ROPE IS SECURED UNDER THE SPINDLE HARNESS KNOTS AND PUT THROUGH THE DECENDER. THE WEBBINGS ARE CUT ABOVE THE KNOTS SO THE CORD IS NOW HELD BY THE ROPES RATHER THAN THE HOIST CABLES. THE RIDER IS THEN SIMPLY DECENDED DOWN SLOWLY.

2) THE HOIST STOPPED WORKING AFTER LOWERING THE RIDER PART WAY DOWN, AND THE SPINDLE HARNESS TO HOIST CABLE CONNECTION IS TOO FAR AWAY TO REACH FROM THE TOWER. THE RESCUERS WILL THEN CLIMB TO A POINT DIRECTLY ABOVE THE CONNECTION POINT AND ATTACH THEIR ROPE TO THE TOWER. THE RESCUERS WILL DECEND DOWN TO THE CONNECTION POINT AND HOOK A CARIBEANER UNDER THE SPINDLE HARNESS KNOTS AND CONNECT THAT CARIBEANER TO THEIR HARNESS CARIBEANER. THEN THE SPINDLE HARNESS WEBBING IS CUT ABOVE THE KNOTS SO THE CORD IS NOW HELD BY THE RESCUER'S ROPE RATHER THAN THE HOIST CABLES. THE RESCUERS SIMPLY DECEND THEMSELVES AND THE RIDER DOWN SLOWLY.

EMERGENCY PLAN

1. Rescue victim if necessary.

2. Stablize victim and assess the condition.

3. Delegate responsiblities to other staff members (ie call 9-1-1 or paramedics, retrieve backboard, etc.)

4. Administer necessary First Aid.

5. Crowd control.

6. Cease operations and close site for major medical emergency or non-compliance for 5F-8.025.

7. Contact necessary authority.

Note: All Thrill Sport staff have been trained and qualified in these prodecures. This Emergency Plan is reviewed by staff during opening procedures.

34C

D. S I. R. R E P O R T

THE FOLLOWING INFORMATION IS A SUMMATION OF THE D.S.I.R. REPORT ON THE PROPERTIES OF THE LATEX RUBBER DURING A BUNGEE JUMP. THESE TEST RESULTS HAVE BEEN APPLIED IN THE STRETCH FACTORS USED FOR THE BUNGEE LAUNCHER.

CALCULATIONS OF BUNGEE STRETCH

14.5 EXAMPLE 1.

IF THE BUNGEE IS PULLED TIGHT UNDER THE CAGE, THEN THE STRETCH FACTOR FOR A JUMP OF 100 FEET IS DONE AS FOLLOWS:

$$\text{STRETCH FACTOR} = \frac{\text{DISTANCE OF JUMP - LENGTH OF BUNGEE}}{\text{LENGTH OF BUNGEE}}$$

BY SUBSTITUTING IN THE VALUES OF A 22.5 FOOT BUNGEE BEING USED FOR A 100 FOOT JUMP, THE FOLLOWING STRETCH FACTOR OF THE BUNGEE IS:

$$\text{STRETCH FACTOR} = \frac{100 - 22.5}{22.5}$$

$$= \frac{77.5}{22.5}$$

$$= \underline{3.444}$$

14.5 EXAMPLE 2.

IF A LIGHTER JUMPER WANTS TO JUMP 100 FEET HE OR SHE MAY HAVE TO LET OUT SAY 4 FEET OF WEBBING LINE. THE STRETCH FACTOR OF THIS BUNGEE JUMP IS:

$$\text{STRETCH FACTOR} = \frac{100 - 22.5 - 4}{22.5}$$

$$= \frac{73.5}{22.5}$$

$$= \underline{3.26}$$

14.6 EXAMPLE 3.

IF EVEN A LIGHTER JUMPER JUMPED 100 FEET AND NEEDED THE WEBBING LINE OUT SAY 8.5 FEET, THE STRETCH FACTOR WILL BE AS FOLLOWS:

$$\text{STRETCH FACTOR} = \frac{100 - 22.5 - 8.5}{22.5}$$

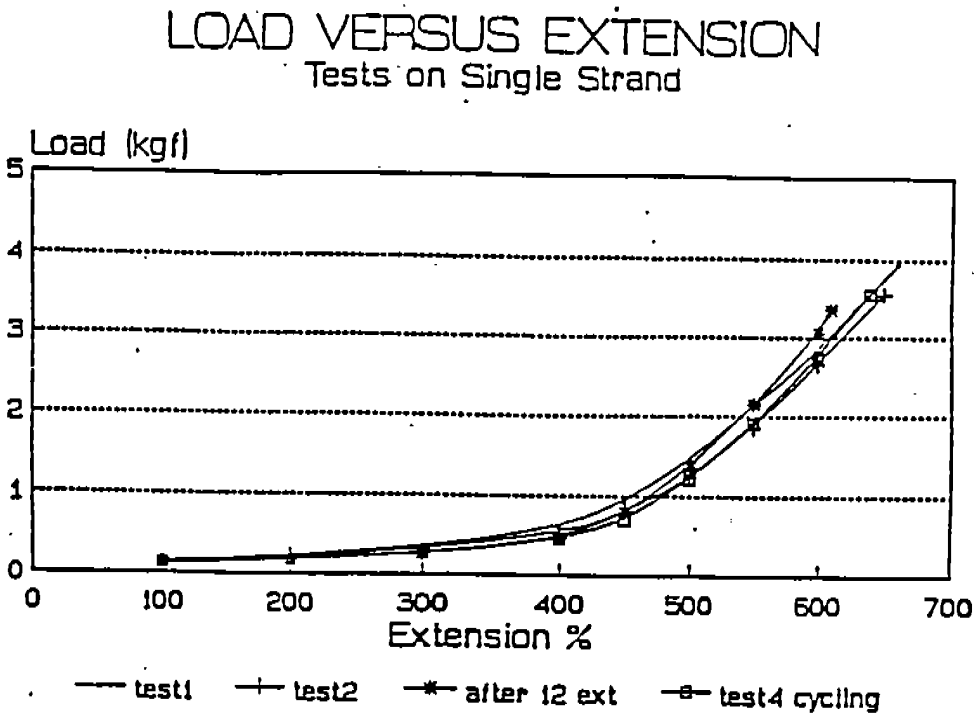
$$= \underline{3.06}$$

DISCUSSION

14.7 THE ONLY SETTING WHERE THE STRETCH FACTOR OF THE BUNGEE IS CLOSE TO 3.5 IS WHEN THE WEBBING LINE IS ON A SETTING OF ZERO.

14.7 YOU CAN SEE FROM THE GRAPH LOAD VERSES EXTENSION THAT IT IS LINEAR UNTIL A STRETCH FACTOR OF 4 1/2 OF 450%. IT THEN CURVES UPWARD AFTER THIS POINT, MEANING THE BUNGEE IS GETTING MUCH STIFFER. THIS IS THE AREA THAT YOU DON'T WANT THE BUNGEE WORKING IN.

14.8 LOAD Vs EXTENSION SINGLE STRAND (DSIR Report Page 5)

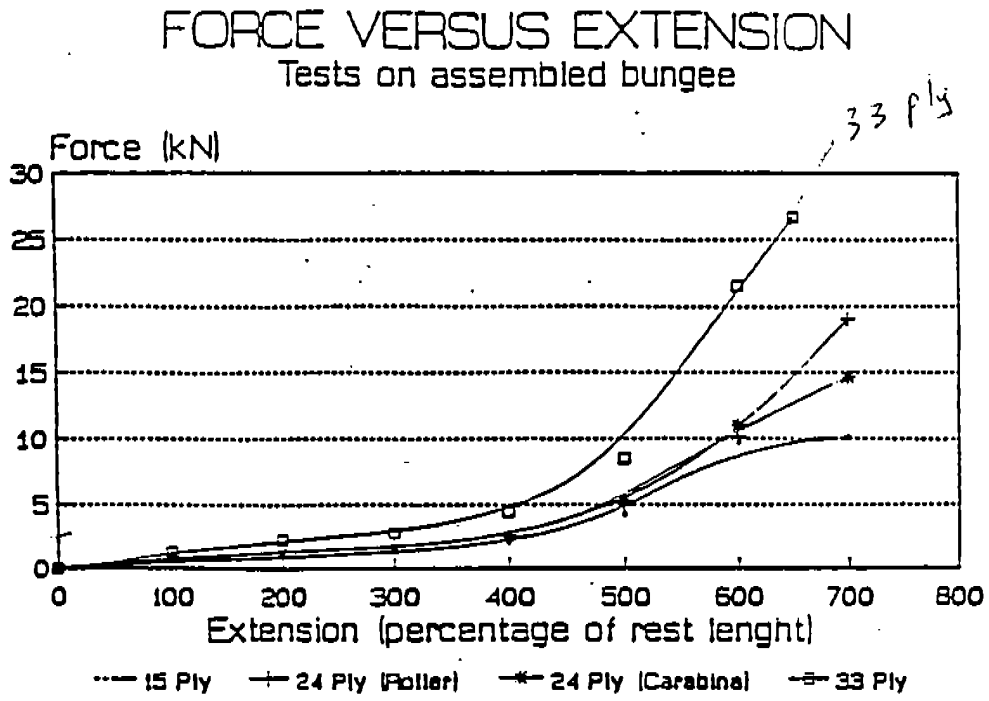


tested Met Lab 10/09/87

14.9 It can been seen from the graph (see 14.8) that LOAD Vs EXTENSION graph is very linear in a nature until a stretch or extension factor of around 450% ie 4 & 1/2 times. After 450% the bungee becomes much stiffer. This is the reason for limiting the stretch of a bungee cord to a max. of 3.5 times.

14.10 The graph also shows the consistency of the rubber as regard to it's load vs extension characteristics over successive cycles.

14.11 FORCE Vs EXTENSION OF DIFFERENT PLY BUNGEES
(DSIR Report Page 7)



Tests conducted July 87 air temp 13 C

14.12 From the graph (NOTE 14.11), FORCE Vs EXTENSION it can be seen that an assembled bungee displays the same linear characteristics up to an extension of 450% as a single strand does.

14.13 The graph (NOTE 14.11) shows the each bungee was stretched beyond its breaking point. It can be noted that in every case that the breaking point, of all the individual bungees tested, occurred when the stretch of the bungee was in excess of 6 1/2 times, ie 650 %

14.14 The graph (NOTE 14.11) indicates that using a roller/spindle over the use of a thinner carabiner increases the breaking strain of the bungee significantly.

14.15 The breaking strains of the following bungee as shown in graph 14.11 are as follows:

TYPE OF BUNGEE	BREAKING ~~STRAIN~~ STRENGTH	
	Kilograms	lbs.
15 Ply (Carabiner)	1000	2200
24 Ply (Carabiner)	1500	3300
24 Ply (Roller/ Spindle)	1900	4180
32 Ply (Carabiner)	2600	5720

Rider

200 lb

DYNAMIC LOADING

15.1 This is the extra loading caused by the jumpers deceleration and acceleration during a jump.

15.2 From the DSIR Report, Page 12 it can be seen that the max. deceleration recorded by the load cell at the bottom of the first bounce was 2.87 gs. This load cell study was for a jump of around 70 feet , larger jumps have shown that the jumper is subjected to less deceleration and acceleration, although it occurs over a longer period.

15.3 CALCULATION OF A JUMPER'S DYNAMIC LOADING.

Assuming that the jumper is 200 lbs

FORCE EXERTED BY JUMPER OF 200 lbs = 200 + DYNAMIC LOADING

= 200 + (1.87 * 200)

= 200 + 374

= <u>574 lbs</u>

15.4 This means , at the bottom of the first bounce of the bungee jump the jumper is experiencing an additional gravity pull (deceleration) of 1.87 gs or a total of 2.87 gs. Some roller coaster rides subject the rider to forces in excess of 4 gs

15.5 SAFETY FACTOR OF A BUNGEE.

Weight of jumper = 200 lbs.

Bungee selection (Section 4.11) = Red / 24 Ply

Breaking ~~strain~~ strength of 24 ply spindle bungee (Section 14.15) = 4180 lbs

Weight plus dynamic loading of jumper (Section 15.3) = 574 lbs

Percentage of strength of bungee used = $\frac{574 \times 100}{4180}$

= 13.7 %

15.6 A 200 lb jumper is the largest weight recommended for a Red / 24 Ply bungee (Section 4.11), even so, the safety factor (breaking strain) of the bungee is over 7 times the weight experienced during the jump.

BUNGEE MAINTENANCE

16.1 Bungees must be closely inspected at least 4 times during a normal working day.

16.2 Talcum powder the ends and spindles of the bungee so that the friction between the rubber strands and also the spindle is reduced. It is not necessary when the bungee is wet. Only talc the bungee when it is dry.

16.3 Handling a bungee carefully and keeping it clean are the the major methods of reducing wear.

BUNGEE RETIREMENT

17.1 A bungee is retired if it has over 400 jumps or when 5% of it's strands are broken, which ever are the smaller number of jumps.

17.2 A bungee must be withdrawn from service if it has bee exposed to over 250 hours of sunlight. When a bungee is not in use it must be kept covered.

17.3 If a bungee gets any solvents, accidentally spilt on it, the bungee must be retired.

17.4 A bungee is retired by chopping it up into 3 foot lengths. There is never any chance of the bungee accidentally being put back in service.

P A P E R W O R K

F O R M S

&

R E C O R D S

DAILY BUNGEE OPERATION CHECKLIST

CHECK	MON	TUES	WED	THUR	FRI	SAT	SUN
TOWER ALIGNMENT							
GUY TENSION							
SHACKLES WIRED							
[redacted]							
CABLE CLAMPS							
[redacted]							
WINCH BOLTS							
TRIAL LIFT							
LIMIT SWITCH							
CALIBRATION							
RESCUE GEAR							
SAFETY BELTS							
RADIOS							
HARNESSES							
CORDS							
CARIBEANERS							
WHISKER SWITCH							
WIND METER							

CLOSING CHECKLIST

CHECK							
DECK CLEARED							
EQUIPMENT SECURE							
WIND METER IN							
KEY OUT/POWER OFF							

* NOTES :

THRILL SPORT CORD USE LOG

LOCATION_____

OLOR / CORD #	LABEL #	DATE MFG	MFG BY	TYPE OF THREAD	NOTES *

DATE	YELLOW	GREEN	RED	BLUE	BLACK	COMMENTS

			DATE________________
		THRILL SPORT BUNGEE	
		DAILY JUMP LOG	
JUMP MASTER	**CORD**	**PRINT NAME**	**SIGN NAME**

Daily Cord & Rigging Inspections Log

Date	Insp. #1	#2	#3	#4	#5	Notes.
Time:						
Insp. by:						
Time:						
Insp. by:						
Time:						
Insp. by:						
Time:						
Insp. by:						
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	THRILL SPORT BUNGEE		
WEIGHT OF JUMPER	WEBBING LENGTH	WEIGHT OF JUMPER	WEBBING LENGTH
70 75			
80		205	
85		210	
90		215	
95		220	
100		225	
105		230	
110		235	
115		240	
120		245	
125		250	
130		255	
135		260	
140		265	
145		270	
150		275	
155		280	
160		285	
165		290	
170		295	
175		300	
180		305	
185		310	
190		315	
195		320	
200		325	

SPECIFICATION SHEET
FOR BUNGEE ROCKET AMUSEMENT DEVICE

(1) PROJECTED HEIGHT: 100' (30.5M) above ground level

(2) BUNGEE CORD DATA:

Details of the bungee cords are provided in the operating manual. The cords comply with the requirements of Reference 1, Section 4.3 with the following exceptions.

a) The webbing ends are tied rather than stitched. The cords are built in the field and sewing by machine is not available and hand sewing is not consistent. The knot used to tie the webbing is commonly referred to by the Bungee Jump Industry as a ribbon knot. It is a self tightening non-slip knot.

b) Reference 1 requires the fall arrest system or static line to have a breaking strength of 4000 lb. The three larger cords meet this requirement. However the two smaller cords have two static lines in each having a strength of 500 lb in each line or 1000 lb total per bungee cord. Factors of safety are shown in the following table.

CORD COLOUR	WEIGHT RANGE	BREAKING STRENGTH OF STATIC LINE	LOAD AT BOTTOM OF FALL PER CORD	FACTOR OF SAFETY	LOAD AT TIME OF LAUNCH PER CORD	FACTOR OF SAFETY
YELLOW	70 - 100	1,000	143	7	200	5.0
GREEN	105 - 145	1,000	207	5	290	3.5
RED	150 - 205	4,000	293	14	410	9.8
BLUE	210 - 245	4,000	350	11	490	8.2
BLACK	250 - 300	4,000	429	9	600	6.7

TABLE 1
STATIC LINE FACTORS OF SAFETY

The above factors of safety are calculated as follows.

From the Thrill Sport Manual, the typical acceleration at the bottom of a jump is 2.87g. As there are two cords the force on each will be or 1.43W lb. If the bungee cord were to break at this instant, which is the most likely time for such an occurrence, the fall arrest system would have to resist this force and the FS would be the breaking strength of the static line divided by 1.43W. At the time

of launch, for purposes of calculation of safety factors, the cord tension was increased by 40%.

c) The spool webbing used to attach the bungee cord to the is required to have a strength of two times the ultimate strength of the bungee cord. The spool webbing is 1" tubular nylon having a strength of 4000 lb. (Reference Craig Lindell). The largest cord has a strength of 3520 lb. As the factor of safety is 8.2 and only 5 is required use a value of 3520 x 5/8.2 = 2146 lb. The ratio is 4000/2146 = 1.9 which is close to the required value of 2.

Reference 1, Section 4.3 requires bungee cords to have a factor of safety of 5. Thrill Sport's cords have factors based on 2200/15=1466 lb/ply, (see Operating manual p13, 15 ply cord), as follows.

CORD COLOUR	WEIGHT RANGE	NUMBER OF PLIES	BREAKING STRENGTH BUNGEE CORD	MAXIMUM LOAD AT BOTTOM OF FALL PER CORD	FACTOR OF SAFETY
YELLOW	70 - 100	10	1466	143	10.3
GREEN	105 - 145	12	1760	207	8.5
RED	150 - 205	16	2346	293	8.0
BLUE	210 - 245	20	2933	350	8.4
BLACK	250 - 300	24	3520	429	8.2

TABLE 2
BUNGEE CORD FACTORS OF SAFETY

Retirement of bungee cords is covered in Thrill Sport's Operating Manual. The requirements comply with Reference 1 Section 4.8.1(4).

NOTE: WHEN A BUNGEE CORD IS RETIRED FROM SERVICE FOR ANY REASON, BOTH CORDS MUST BE REPLACED TO ENSURE AN EVEN PULL ON EACH SIDE OF THE RIDER SO THAT THE RIDER IS MAINTAINED ON CENTRE WITHIN +/- 5' OF THE CENTRE LINE OF THE RIDE.

(3) HOISTING EQUIPMENT AND STRUCTURE

The hoisting equipment and structure are shown in Thrill Sports Production Inc.

drawing number 100 sheets 1 to 7 and in Figures 1, 4, and 5 attached. It consists of a tower built from commercially available antenna tower components with a specially constructed arch section at the top. Hoisting is by means of a commercially available drum hoist. The design wind loads are shown in Figure 5 and meet the requirements of the Ontario Building Code.

Name of Manufacturer:Thrill Sports Production Inc.

Year Built:1995

Serial Number: BL100-001

The electric wire rope hoist has a SWL rating of 5,000 lb., (2,275 kg).

There are two (2) 3/8" 6 x 19 IWRC wire rope hoisting cables each having a breaking strength of 13,120 lb. The end of each wire rope has an eye formed using a thimble and two (2) cable clamps.

The electric wire rope hoist is equipped with gear driven limit switches that automatically stop the movement at both the lower and upper terminal points. The hoist control system is designed to slow the hoist prior to the electrical supply to the drive motor being switched off so that the hoist stops smoothly. The hoist system is equipped with a slack rope sensor that, upon detecting slack rope, shuts off the power supply to the hoist. There is only one layer of wire rope on the drum so that an anti-piling sensor is not required.

In addition to the electric wire rope hoist gear driven limit switches, the tower is equipped with an anti-two blocking limit switches on the upper sheaves to prevent over travel in the event that the upper gear driven limit switch fails.

In addition to the tower there is a launch platform constructed from commercial scaffolding approximately 15' square. There shall be no more than two launch personnel and five patrons on the platform at any one time. Spectators are not permitted on the platform.

(4) ATTACHMENT OF PERSON TO BUNGEE CORD

Attachment of the person to the bungee cord is by means of a full body harness. The attachment complies with the requirements of the applicable paragraphs of Reference 1, section 4.2. Details are provided in Figures 2 and 3 and illustrate the required redundancy of the connection.

(5) MINIMUM LAUNCH SITE PERSONNEL:

There are three (3) personnel directly involved in conducting a launch.
(a) Launch Master
(b) Launch Assistant
(c) Electric Wire Rope Hoist Operator

The Launch Assistant also acts as the Retrieval Operator.

(6) WIND SPEED RESTRICTIONS:

Operations are to stop if the cross wind speed exceeds 20 mph or if the fore and aft wind speed exceeds 35 mph at the top of the tower. A cross wind is any wind direction not parallel to the launch direction.

These values and directions are upper limits. Operations shall cease in unusual wind conditions such as gusty and unstable wind directions.

(7) DESIGN CODES AND STANDARDS

In addition to compliance with the Reference 1, (Canadian Bungee Association Code of Safe Practice), the AD complies with:

ELECTRIC WIRE ROPE HOIST:	NEC and CSA Electrical Code AGMA
TOWER:	ANSI/EIA-222-D Antenna Towers
WIRE ROPES:	ANSI Committee of Wire Rope Producers
WELDING:	AWS

(8) CERTIFICATION

8.1 Tower and Hoisting Device are to be certified by an Ontario Professional Engineer on completion of erection at each site.

8.2 Certification of the Bungee Cord is attached.

8.3 Certification of the Body Harness is attached.

(9) SITE LAYOUT

A site layout and general arrangement are shown in Thrill Sports Production Inc. drawing number 100 sheets 1 to 7 and in Figures 1, 4, and 5 attached.A site layout is attached.

(10) OPERATING SPACE

The operating space is shown in Figure 4. It does not comply with the requirements of Reference 1 Section 5.8. The requirements of Reference 1 are for a single bungee cord. The Bungee Rocket has two cords, one on each tower leg, that confine the person to the centre of the tower so there is less chance of moving out of a vertical plane. Further justification for non-compliance is provided in the field test report.

(11) ERECTION AND DISMANTLING INSTRUCTIONS

As the tower is erected by the Manufacturer, there are no specific erection or dismantling instructions provided in this submission. However, it shall be noted that the guy wires are not to be over tightened. Turnbuckles shall be tightened by hand without the use of a cheater bar as tight as possible and then given three full turns using a wrench or cheater bar. Each installation is required to be certified by an Ontario Professional Engineer.

(12) EQUIPMENT AND MAINTENANCE MANUAL

The bungee cord and associated equipment maintenance requirements are included in the Procedures Manual. An inspection and maintenance manual for the tower and associated hoisting equipment is attached.

(13) FIELD TEST REPORT

A field test was conducted prior to operation at Exhibition Place, Toronto. In addition to weight testing, trajectory and off centre movement was investigated. A maximum of 5' movement off centre was used for the acceptance criteria. Riders are not to reach a height of more than 100' so as to maintain a safety zone of 30' above the rider.

(14) REFERENCES

1. Canadian Bungee Association Code of Safe Practice, DRAFT, 4/9/93

SUMMARY OF FACTORS OF SAFETY

The factors of safety for the static line and bungee cords are shown in Table 1 and 2 above. The factors of safety presented below are in some instances based on safe working load and in other instances on breaking strength. Safe working load is generally a load which is not more than 75% of the load that would result in plastic deformation in the structure or component and substantially less than the load that would result in catastrophic failure of the structure or component.

SWL = Safe Working Load

B = Breaking Strength or Collapse Load or Ultimate Strength

FS = Factor of Safety

2-1/2 ton Electric Wire Rope Hoist:

F.S.= 5,000/(2x600) = 4.2 times the SWL (ACCO-Wright)

It is to be expected that commercially available hoist will have a built-in factor of 3 to account for dynamic loading.

Single 3/8" dia. 6x19 Extra Improved Plow Steel IWRC electric hoist wire rope:

B 13,120 lb. (AISI Wire Rope Users Manual)

The bungee cord is stretched to about 600 lb.

FS= 13,120/600 = 21.9 > 10 See Reference 1, Section 4.2.

Calibration Strap

2" tubular webbing

BS = 8000 lb

FS = 8,000/600 = 13 > 10 See Reference 1, Section 4.2.

Main Sheave Axle

ACCO model number 220247M1.

SWL 11,000 lb. (Verbal from Rob Strange, Thrill Sports Productions)

FS = 11,000/600 = 18 times SWL

1" diameter shaft in double shear

SWL = 2 x 0.7854 x 1.0^2 x 10,000 = 15,700 lb

FS = 15,700/600 = 26

Bungee Cord

Factors of safety are shown in Table 2 above.

Static Line

Factors of safety are shown in Table 1 above.

Spool Web

1" Tubular webbing B = 4,000 lb

FS = 4000/600 = 6.7 See Reference 1, Section 4.2.

Karabiners

All karabiners have a minimum breaking strength of 6,500 lb as required by Reference 1. For a total maximum force of 1200 lb, the FS is 5.4. They complies with Reference 1 Section 4.5.1(1),(2), and (4), but not 4.5.1(3) which requires karabiners to have a FS of 10. For this AD, the use of larger karabiners is not practical and an FS of 5.4 in the most highly loaded case is considered adequate and compatible with the bungee cord requirement for a FS of 5.0.

HOIST AND TOWER CERTIFICATION

I, the undersigned, being a Registered Professional Engineer in the Province of Ontario, do hereby certify that to the best of my knowledge and belief the tower and hoisting equipment have been erected and installed in conformance with the specifications contained in the design submission.

CERTIFIED BY:.....

NAME:(print) G.W.S.Gordon

REGISTRATION NO. 16635013

DATE: 18/8/95

HARNESS CERTIFICATION

I, the undersigned, being a Registered Professional Engineer in the Province of Ontario, hereby certify that to the best of my knowledge and belief the Bungee Rocket **Body Harness** shown in Thrill sport Productions Inc. Specification Sheet Figure 2 complies with the requirements of the Canadian Bungee Jumping Association Safe Code of Practice.

CERTIFIED BY:.....

NAME:(print) G.W.S.Gordon

REGISTRATION NO. 16635013

DATE: 18/8/95

BUNGEE CORD

I, the undersigned, being a Registered Professional Engineer in the Province of Ontario, hereby certify that to the best of my knowledge and belief the Bungee Rocket **Bungee Cords** shown in Thrill sport Productions Inc. Procedures manual complies with the requirements of the Canadian Bungee Jumping Association Safe Code of Practice with exceptions described in the Specification Sheet.

CERTIFIED BY:.....

NAME:(print) G.W.S.Gordon

REGISTRATION NO. 16635013

DATE: 18/8/95

BUNGEE ROCKET
FIELD TEST REPORT

This is to certify that the Bungee Rocket successfully under went the following tests.

1. Test launch of a 190 lb rider. The rider was observed to travel in a straight path less than +/- off the centre line of the AD.

2. The upper limit switch on the hoist and tower upper sheave functioned as required, the switch on the hoist stopped the hoist without bottoming out the buffer spring. Similarly the tower upper sheave switch stopped the hoist before bottoming out the buffer spring.

3. A test was conducted to see if the static line would stretch the bungee cord. The test was to simulate a broken bungee cord. Using a 100 lb rated bungee cord, the static line was disconnected from the spool at one end and attached to the hoist cables. The other end attached to a 150 lb weight in the normal manner. The cord was stretched and the static line did not pull out but rather forced the bungee cord to perform as if it had not been disconnected. This is a significant safety feature.

CERTIFIED BY:.....

NAME:(print) G.W.S.Gordon

REGISTRATION NO. 16635013

DATE: 18/8/95

BUNGEE ROCKET TOWER AND HOISTING DEVICE
INSPECTION AND MAINTENANCE

1. Inspect the guy wire anchoring for any movement or ground disturbance daily.

2. Inspect the tower legs at the base daily for any movement. Check that the tower stands vertical.

3. Inspect the guy wires and turnbuckles at the lower end of the guy wires daily.

4. Inspect the tower structural members daily. Check members and bolted connections by hoisting a two man inspection team in the basket to the top of the tower.

5. Inspect the connection of the idler sheaves and main sheaves to the tower daily. Inspect the sheave flanges for wear. Grease the sheave bearings once every two weeks.

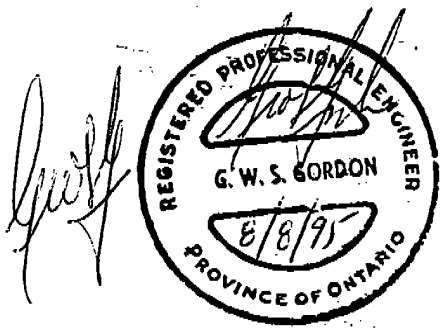
6. Inspect the guy wire connections at the top end of the guys daily. Check to ensure the shackles are moused, (wire locked). Inspect the tower members, (and member attachment), to which the guys are attached.

7. Check the operation of the winch in accordance with the manufacturer's instructions. Details and frequency of inspection and servicing are specified in Wright Inc. document 58975. Daily, check the operation of the upper and lower limit switches and the "anti two block" switch that acts as the backup for the upper limit switch. Check the operation of the pendant dead man switches. Check the function of the key switch. Press the "up" button and while holding the button down, turn the key switch to the off position. The winch should stop immediately. Repeat the process using the "down" button.

8. Check the operation of the slack wire switch daily.

9. Inspect the connection of the wire rope spring to the hoisting cables daily. Check the wire rope clamps for signs of slipping.

10. Insect the hoisting cables daily. Ropes must comply with the requirements of the Amusement Devices Act, paragraph 21.



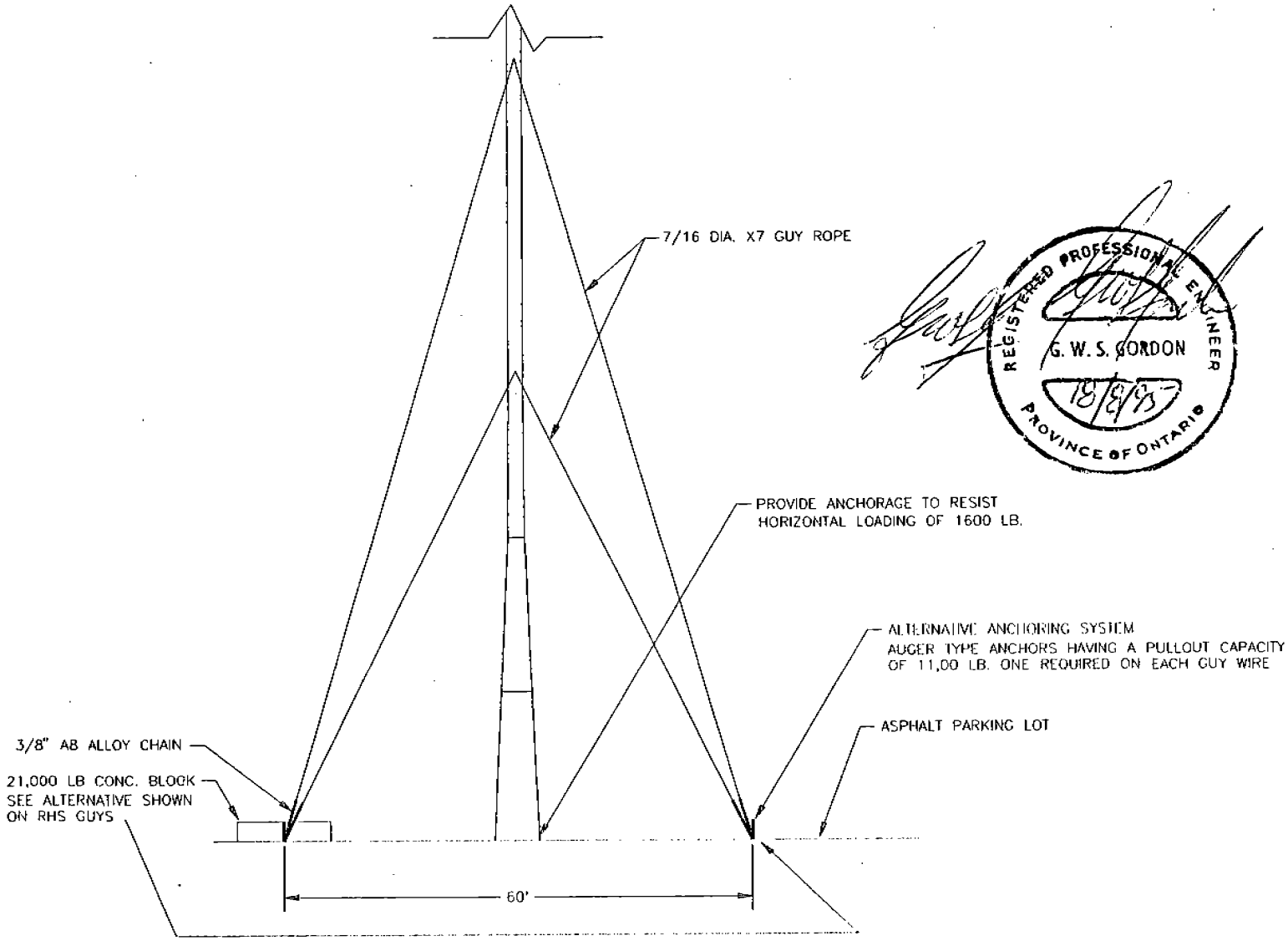
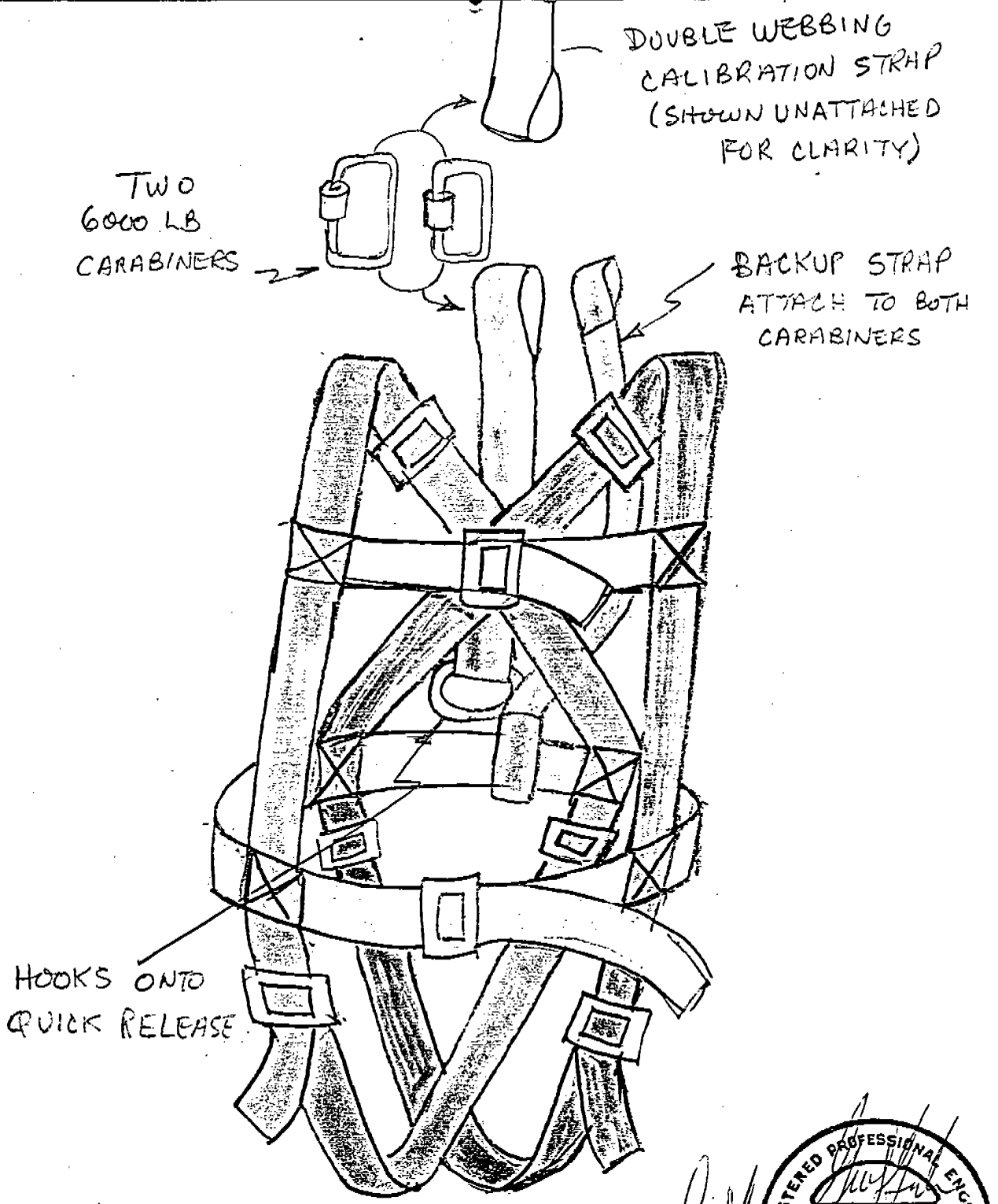


FIGURE 1

TOWER ANCHOR REQUIREMENTS



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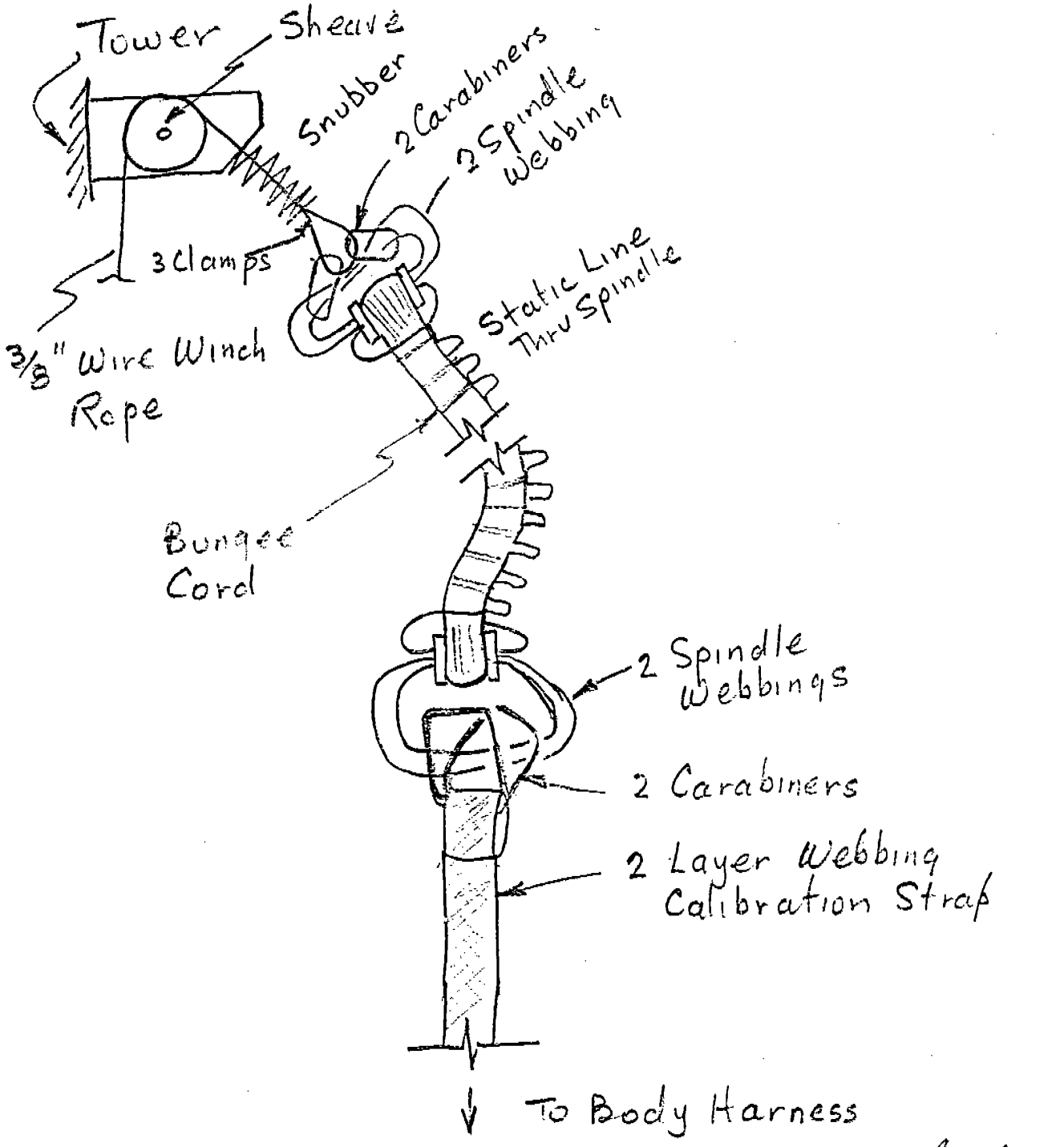
G. W. S. GORDON
18/8/95
PROVINCE OF ONTARIO

FIG. 2

BODY HARNESS



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G. W. S. GORDON
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FIG 3

Connection Of Bungee To Calibration Strap

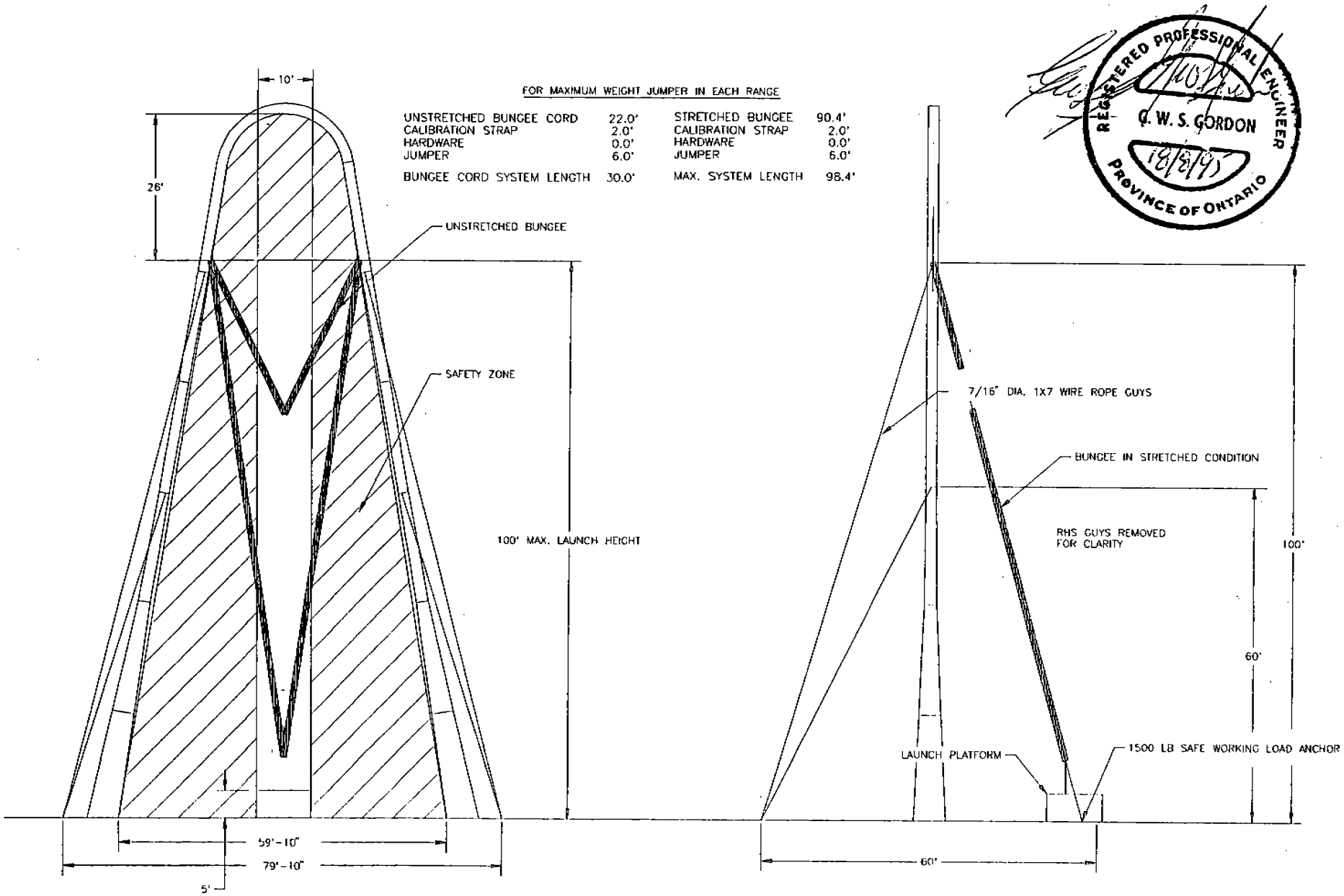


FIGURE 4

SITE LAYOUT AND GENERAL ARRANGEMENT

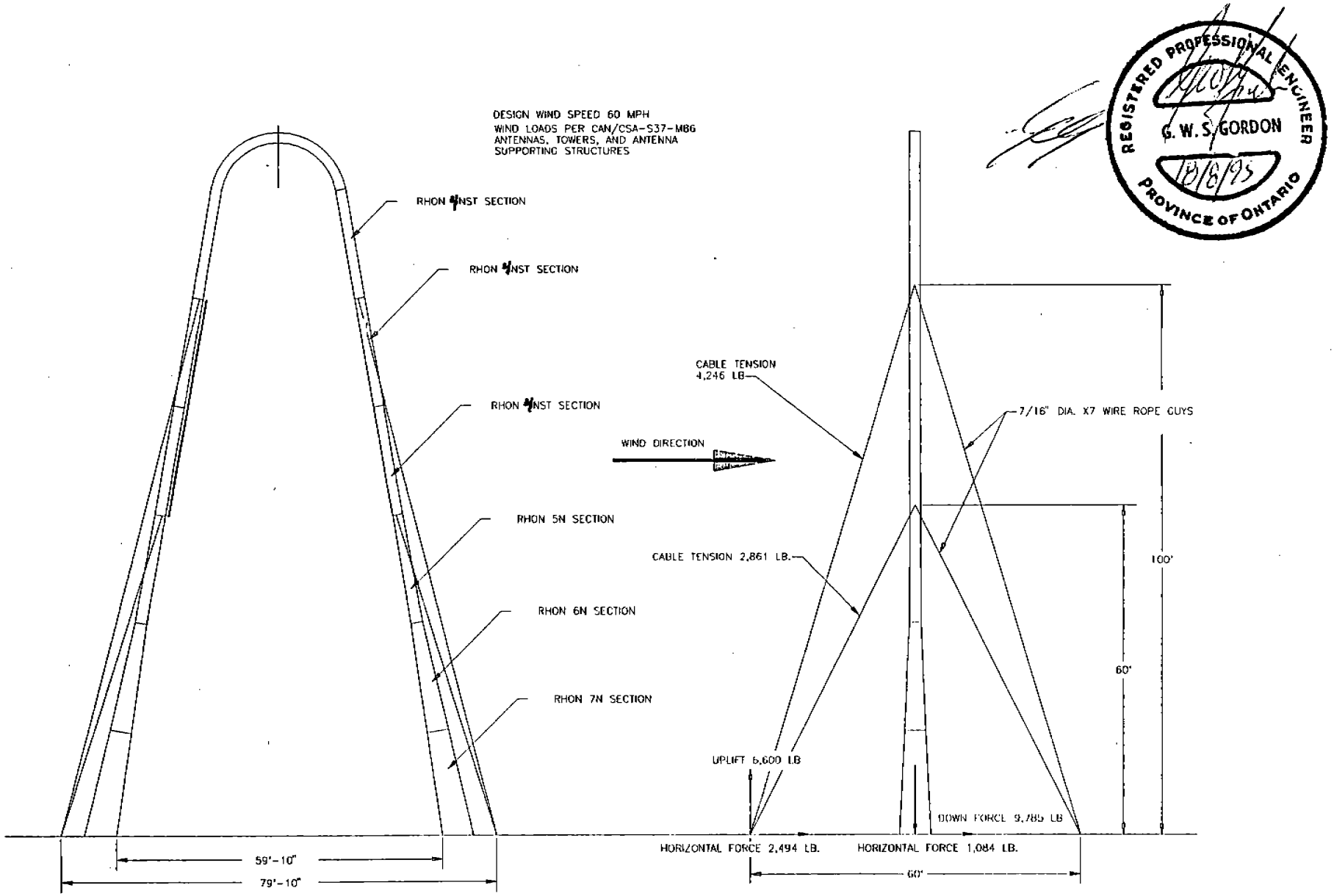
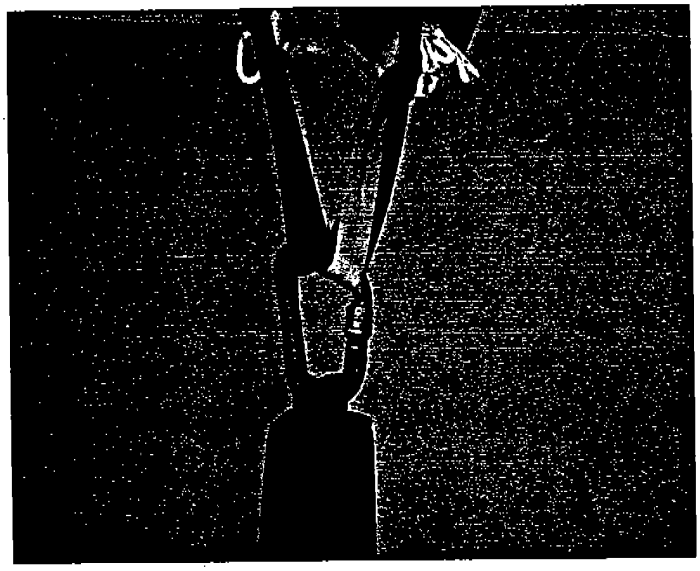


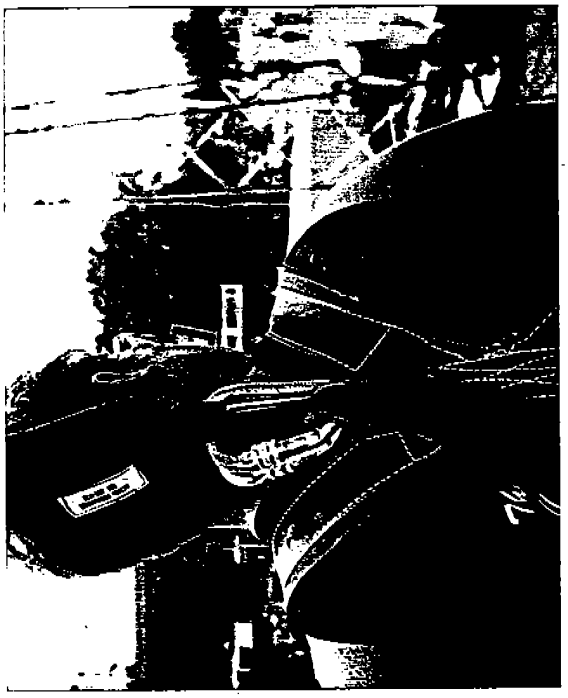
FIGURE 5

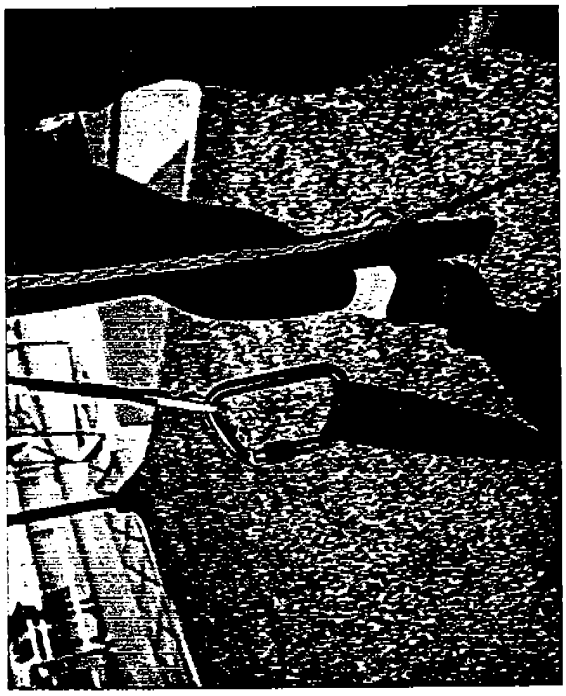
TOWER FOUNDATION LOADING FOR 60 MPH WIND LOAD




BUNGEE
STAFF


G. W. S. GORDON
18/8/75
PROVINCE OF ONTARIO





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entangled in the bungy cord or connecting straps or devices.

(e) Bungy Catapulting or Reverse Bungy Jumping. The sport, activity, or practice whereby a person is attached to a bungy cord which is stretched and then released, thus catapulting or otherwise launching the jumper into the air from a fixed position. This definition does not include the sport, activity, or practice whereby a participant is strapped into a bungy harness on the ground, attached to a bungy cord, and lifted directly from the ground into the air without the use of a catapult, slingshot, or other similar device, nor does it apply to other amusement devices or amusement attractions which may utilize a bungy cord as a component, and the patron or patrons are contained in a rigid structural carrier and no overhead obstruction exists which may impact or otherwise strike the carrier or patron, thereby posing a hazard. "Ground" as used in this paragraph includes the ground, an air bag or air cushion, a launch pad, or other similar object from which the participant is lifted or released.

(f) Bungy Cord. The elastic rope made of rubber, latex, or other elastic-type materials, whether natural or synthetic, to which the jumper is attached. It lengthens and shortens and thus produces a bouncing action.

(g) Bungy Jumping. The sport, activity, or other practice of jumping, diving, stepping out, dropping or otherwise being released into the air while attached to a bungy cord, whereby the cord stops the fall, lengthens and shortens, allows the person to bounce up and down, and is intended to finally bring the person to a stop at a point above the surface. This definition does not include the sport, activity, or other practice whereby a participant is strapped into a bungy harness on the ground, attached to a bungy cord, and lifted directly from the ground into the air without the use of a catapult, slingshot, or other similar device, nor does it apply to other amusement devices or amusement attractions which may utilize a bungy cord as a component, and the patron or patrons are contained in a rigid structural carrier and no overhead obstruction exists which may impact or otherwise strike the carrier or patron, thereby posing a hazard. "Ground" as used in this paragraph includes the ground, an air bag or air cushion, a launch pad, or other similar object from which the participant is lifted or released.

(h) Cord. See Bungy Cord.

(i) Dynamic Loading. The load placed on the rigging and attachments by the initial free fall of the jumper and the bouncing movements of the jumper.

(j) Equipment. Each component which is utilized in bungy jump operation, including power or manually operated devices to raise, lower and hold loads.

(k) Fence. A permanent or temporary structure designed and constructed to retain people, animals and objects within or outside a defined area.

(l) Incident. An event that could or does result in injury to a person, damage to equipment, or the interruption or stopping of bungy jump operations.

(m) Jump Direction. The direction in which a jumper is aimed when jumping from the jump point.

(n) Jump Master. A person who has responsibility for the bungy jumping operation and who takes a jumper through the final stages to the actual jump or release.

(o) Jumper. The person who falls from a height attached to a bungy cord.

(p) Jumper Harness. An assembly to be worn by a jumper and to be attached to a bungy cord. It is designed to prevent the jumper from becoming detached from the bungy cord.

(q) Jump Height. The distance from where the jumper begins to fall to the bottom of the jump zone.

(r) Jump Operator. A person who assists the jump master in preparing a jumper for jumping and who operates the lowering system whereby the jumper is lowered to the landing pad.

(s) Jump Point. The position from which the jumper falls or begins to fall.

(t) Jump Space. The jump zone plus the safety space.

(u) Jump Zone. The space bounded by the maximum designed movements of the jumper or any part of the jumper.

(v) Jumper Weight. The weight of the jumper only.

(w) Karabiner. A shaped metal or alloy device used to connect sections of the jump rigging, equipment or safety gear.

(x) Landing Area. The surface area directly under the jump space, or, where the lifting appliance moves the jumper so that landing occurs away from the jump space, the area covered by the movement of the lifting appliance or part of it, including the area where the jumper lands.

(y) Landing Pad. The padded area on which the jumper is off-loaded after jumping by means of the lowering appliance or equipment.

(z) Lateral Direction. The movement of the jumper measured at 90 degrees to the designed jump direction.

(aa) Launch. A propelled jump.

(bb) Launch Point. The point from which the jumper is launched.

(cc) Loaded Length. The length of the bungy cord when extended to its fullest designed length when jumping.

(dd) Moused. The process of binding around the point and shank of a hook, pin or shackle to prevent any load from slipping off.

(ee) Operating System. The system of processing a jumper through the jump methods used on a particular site. This includes registration, preparation, getting to the jump point, methods of attachment, jumping, the rigging and lowering system and the landing recovery method.

(ff) Operating Manual. The document that contains the procedures and forms for the operation

2. The engineer certifies all safety equipment, including harnesses, connecting straps, safety lines, attachments, karabiners, etc., for use in bungy jump operations;

3. The engineer certifies that the bungy cords to be used in the bungy jump operation, as well as the manufacturing process for the bungy cords, including quality control methods, have been personally examined and reviewed and that the engineer found all types of bungy cords and the manufacturing process to conform in all applicable respects to s. 616.242, Florida Statutes, this rule chapter, and ASTM Committee F-24 Standards. The engineer shall further certify that the bungy cords tested and certified pursuant to subsection (4) of this rule were manufactured by the same manufacturing process as those cords which are to be used in the bungy jumping operations.

4. The engineer certifies the safety air bag for use in bungy jump operations;

5. The engineer certifies the rigging system for use in bungy jump operations;

6. The engineer certifies the jump space, jump zone and jump height are appropriate for the bungy jump operation;

7. The engineer has reviewed the daily operating procedures, jump procedures and close down procedures and certifies them as appropriate for the bungy jump operation;

8. The engineer certifies the bungy jump operation has been inspected and is in compliance with Chapter 616, Florida Statutes, ASTM Committee F-24 standards, and this rule.

9. The engineer certifies the bungy jump operation has undergone some form of nondestructive testing for metal fatigue recognized by the American Society for Non-Destructive Testing, in accordance with Section 616.242, Florida Statutes.

(44) Prohibited Activities.

(a) The practice of sandbagging is hereby prohibited in this state. For purposes of this rule, sandbagging means the practice of holding onto any object (including another person) while bungy jumping, for the purpose of exerting more force on the bungy cord in order to stretch it further, and then releasing the object during the jump causing the jumper to rebound with more force than could be created by the jumper's weight alone.

(b) The practice of bungy catapulting or reverse bungy jumping is hereby prohibited in this state.

(c) The practice of tandem or multiple bungy jumping is hereby prohibited in this state.

(45) Violation of Stop Operation Order or Imminent Danger Order. No person shall operate a bungy jump operation in this state if the Department has issued a stop operation order or imminent danger order prohibiting the operation of that bungy operation. Any person who violates this section shall be subject to the penalties and remedies as provided by law.

(46) Fees. The following fees shall apply to bungy jumping operations:

Annual permit for bungy jump:	$500.00
Annual inspection fee:	50.00

Specific Authority 616.165 FS. Law Implemented 616.242 FS., (as created in Section 13, Chap. 93-168, Laws of Florida). History—New 11-11-92, Amended 6-13-93, 9-21-93, 2-23-94, 4-15-94, 7-5-94.

5F-8.050 Games.

(1) Purpose. This rule specifies and gives guidance for minimum trade standards for the operation of games at public fairs and expositions.

(2) Definitions. The definitions in Sections 616.001 and 616.242, Florida Statutes, Chapter 5F-8, F.A.C. and the following shall apply:

(a) "Agent" means any person who is employed by or otherwise acting on behalf of a concessionaire, whether or not paid in any manner, to work in any game at a public fair or exposition.

(b) "Concessionaire" means any person who owns, operates, or leases a game that has been authorized or permitted by the department.

(c) "Game" means a competitive task or contest in which there is a prize, awarded by skill, for consideration where the skill of the player is the predominant element in the selection of the winner.

(d) "Group games" are those games where the skill of one or more players is pitted against the skills of other players playing the same game simultaneously.

(e) "Person" means any individual, partnership, corporation or agent of the same, acting either individually, or as a group, in any manner covered by this rule.

(f) "Player" means any person who participates in a game.

(g) "Prize or Capital Prize" means any merchandise item won by a player of a game.

(3) General Regulations.

(a) No game shall be operated in a manner which presents a hazard to the safety of any person. No equipment shall be used which is not in good working condition.

(b) Every concessionaire shall be responsible for the actions of his employees or agents as they relate to the operation of the game.

(c) No concession purporting to operate a game may be operated or modified so as to constitute gambling or become a game of chance, in violation of chapters 849, Florida Statutes.

(d) Games may only operate when in compliance with posted rules of play and this rule. All rules of play shall be posted on permanent signs and be readily visible to every player.

(e) No game shall be operated in which hidden numbers, colors, letters or other symbols, conversion charts, score cards, or punch boards are used.

(f) No game shall be operated which includes any mechanical, physical or other devices which directly or indirectly impedes, impairs or thwarts the skill of the player.

(g) No game shall be operated in which cash prizes are awarded.

(h) Concessionaires, their employees or agent shall not buy back for cash any prize from a player.

(i) A game may be played in such a manner that the player may accumulate up to three wins in order to trade up for a larger prize. Each level of

Florida Department of Agriculture & Consumer Services
BOB CRAWFORD, Commissioner

Please Respond To:

January 2, 1996

Mr. Craig Lindell
Thrill Sport Productions
2121 N. Frontage Road W. #129
Vail, CO 81657

Dear Mr. Lindell:

I am writing you concerning my letter of December 7, 1995 which stated our decision to decline your request to operate the amusement "Rocket Launcher" in Florida, and your response dated 12/13/95. We have no authority to grant exemptions or variances to existing law or the Florida Administrative Code.

You do, however, have certain rights as provided in Florida Statutes, Chapter 120.57 (see attached).

If I may be of further assistance, please contact me at 904/488-9790.

Sincerely,

BOB CRAWFORD
COMMISSIONER OF AGRICULTURE

Ron Safford, Chief
Bureau of Fair Rides Inspection

RS/sm
Enclosure

cc: Richard Tritschler
Don Farmer
Pat Sucher

EMERGENCY PLAN

1. Rescue victim if necessary.

2. Stablize victim and assess the condition.

3. Delegate responsiblities to other staff members (ie call 9-1-1 or paramedics, retrieve backboard, etc.)

4. Administer necessary First Aid.

5. Crowd control.

6. Cease operations and close site for major medical emergency or non-compliance for 5F-8.025.

7. Contact necessary authority.

Note: All Thrill Sport staff have been trained and qualified in these prodecures. This Emergency Plan is reviewed by staff during opening procedures.

D. S I. R. R E P O R T

THE FOLLOWING INFORMATION IS A SUMMATION OF THE D.S.I.R. REPORT ON THE PROPERTIES OF THE LATEX RUBBER DURING A BUNGEE JUMP. THESE TEST RESULTS HAVE BEEN APPLIED IN THE STRETCH FACTORS USED FOR THE BUNGEE LAUNCHER.

CALCULATIONS OF BUNGEE STRETCH

14.5 EXAMPLE 1.

IF THE BUNGEE IS PULLED TIGHT UNDER THE CAGE, THEN THE STRETCH FACTOR FOR A JUMP OF 100 FEET IS DONE AS FOLLOWS:

$$\text{STRETCH FACTOR} \quad \frac{\text{DISTANCE OF JUMP - LENGTH OF BUNGEE}}{\text{LENGTH OF BUNGEE}}$$

BY SUBSTITUTING IN THE VALUES OF A 22.5 FOOT BUNGEE BEING USED FOR A 100 FOOT JUMP, THE FOLLOWING STRETCH FACTOR OF THE BUNGEE IS:

$$\text{STRETCH FACTOR} = \frac{100 - 22.5}{22.5}$$

$$= \frac{77.5}{22.5}$$

$$= \underline{3.444}$$

14.5 EXAMPLE 2.

IF A LIGHTER JUMPER WANTS TO JUMP 100 FEET HE OR SHE MAY HAVE TO LET OUT SAY 4 FEET OF WEBBING LINE. THE STRETCH FACTOR OF THIS BUNGEE JUMP IS:

$$\text{STRETCH FACTOR} = \frac{100 - 22.5 - 4}{22.5}$$

$$= \frac{73.5}{22.5}$$

$$= \underline{3.26}$$

14.6 EXAMPLE 3.

IF EVEN A LIGHTER JUMPER JUMPED 100 FEET AND NEEDED THE WEBBING LINE OUT SAY 8.5 FEET, THE STRETCH FACTOR WILL BE AS FOLLOWS:

$$\text{STRETCH FACTOR} = \frac{100 - 22.5 - 8.5}{22.5}$$

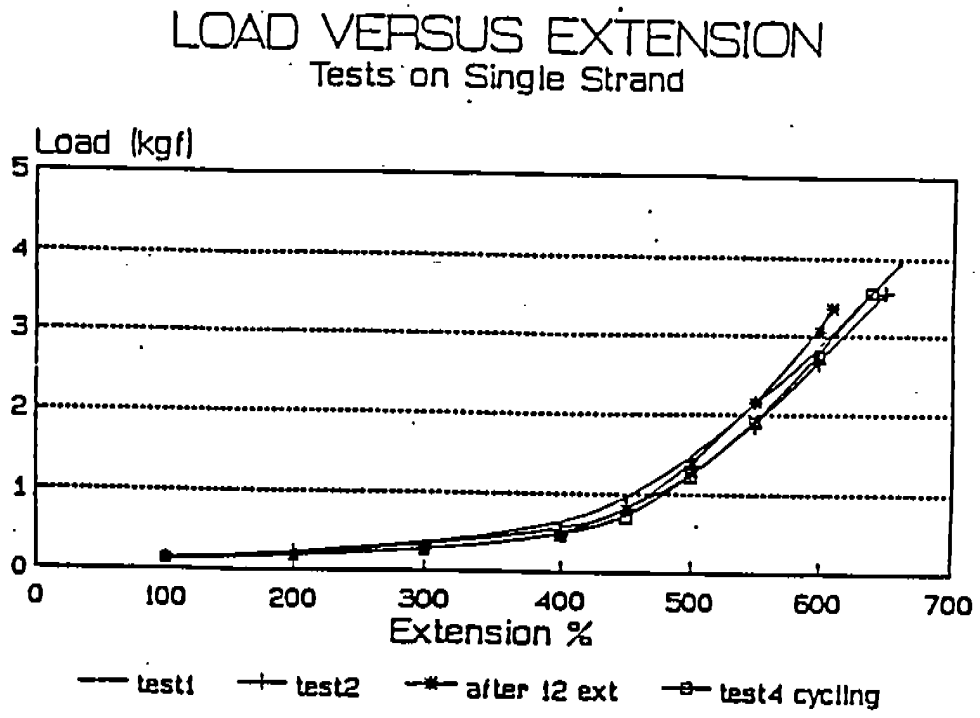
$$= \underline{3.06}$$

DISCUSSION

14.7 THE ONLY SETTING WHERE THE STRETCH FACTOR OF THE BUNGEE IS CLOSE TO 3.5 IS WHEN THE WEBBING LINE IS ON A SETTING OF ZERO.

14.7 YOU CAN SEE FROM THE GRAPH LOAD VERSES EXTENSION THAT IT IS LINEAR UNTIL A STRETCH FACTOR OF 4 1/2 OF 450%. IT THEN CURVES UPWARD AFTER THIS POINT, MEANING THE BUNGEE IS GETTING MUCH STIFFER. THIS IS THE AREA THAT YOU DON'T WANT THE BUNGEE WORKING IN.

14.8 LOAD Vs EXTINSION SINGLE STRAND (DSIR Report Page 5)

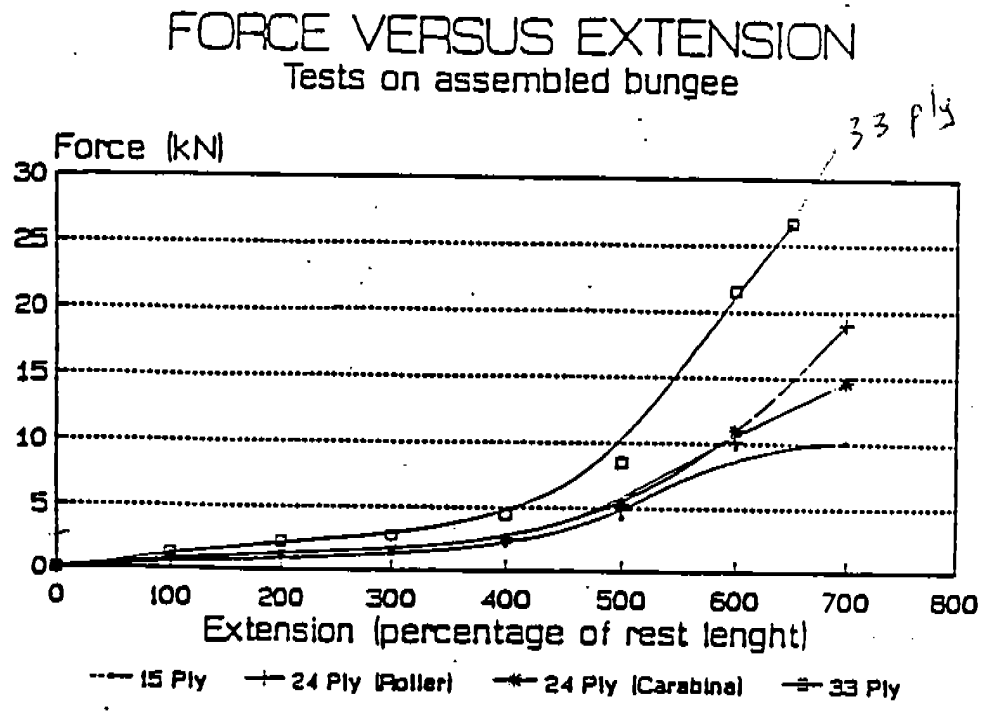


tested Met Lab 10/09/87

14.9 It can been seen from the graph (see 14.8) that LOAD Vs EXTINSION graph is very linear in a nature until a stretch or extension factor of around 450% ie 4 & 1/2 times. After 450% the bungee becomes much stiffer. This is the reason for limiting the stretch of a bungee cord to a max. of 3.5 times.

14.10 The graph also shows the consistency of the rubber as regard to it's load vs extension characteristics over successive cycles.

14.11 FORCE Vs EXTENSION OF DIFFERENT PLY BUNGEES
(DSIR Report Page 7)



Tests conducted July 87 air temp 13 C

14.12 From the graph (NOTE 14.11), FORCE Vs EXTENSION it can be seen that an assembled bungee displays the same linear characteristics up to an extension of 450% as a single strand does.

14.13 The graph (NOTE 14.11) shows the each bungee was stretched beyond its breaking point. It can be noted that in every case that the breaking point, of all the individual bungees tested, occurred when the stretch of the bungee was in excess of 6 1/2 times, ie 650 %

14.14 The graph (NOTE 14.11) indicates that using a roller/spindle over the use of a thinner carabiner increases the breaking strain of the bungee significantly.

14.15 The breaking strains of the following bungee as shown in graph 14.11 are as follows:

TYPE OF BUNGEE	BREAKING ~~STRAIN~~ STRENGTH	
	Kilograms	lbs.
15 Ply (Carabiner)	1000	2200
24 Ply (Carabiner)	1500	3300
24 Ply (Roller/ Spindle)	1900	4180
32 Ply (Carabiner)	2600	5720

Rider 200 lb

DYNAMIC LOADING

15.1 This is the extra loading caused by the jumpers deceleration and acceleration during a jump.

15.2 From the DSIR Report, Page 12 it can be seen that the max. deceleration recorded by the load cell at the bottom of the first bounce was 2.87 gs. This load cell study was for a jump of around 70 feet , larger jumps have shown that the jumper is subjected to less deceleration and acceleration, although it occurs over a longer period.

15.3 CALCULATION OF A JUMPER'S DYNAMIC LOADING.

Assuming that the jumper is 200 lbs

FORCE EXERTED BY JUMPER OF 200 lbs = 200 + DYNAMIC LOADING

= 200 + (1.87 * 200)

= 200 + 374

= <u>574 lbs</u>

15.4 This means at the bottom of the first bounce of the bungee jump the jumper is experiencing an additional gravity pull (deceleration) of 1.87 gs or a total of 2.87 gs. Some roller coaster rides subject the rider to forces in excess of 4 gs

15.5 SAFETY FACTOR OF A BUNGEE.

Weight of jumper = 200 lbs.

Bungee selection (Section 4.11) = Red / 24 Ply

Breaking ~~strain~~ strength of 24 ply spindle bungee (Section 14.15) = 4180 lbs

Weight plus dynamic loading of jumper (Section 15.3) = 574 lbs

Percentage of strength of bungee used = $\frac{574 \times 100}{4180}$

= 13.7 %

15.6 A 200 lb jumper is the largest weight recommended for a Red / 24 Ply bungee (Section 4.11), even so, the safety factor (breaking strain) of the bungee is over 7 times the weight experienced during the jump.

BUNGEE MAINTENANCE

16.1 Bungees must be closely inspected at least 4 times during a normal working day.

16.2 Talcum powder the ends and spindles of the bungee so that the friction between the rubber strands and also the spindle is reduced. It is not necessary when the bungee is wet. Only talc the bungee when it is dry.

16.3 Handling a bungee carefully and keeping it clean are the the major methods of reducing wear.

BUNGEE RETIREMENT

17.1 A bungee is retired if it has over 400 jumps or when 5% of it's strands are broken, which ever are the smaller number of jumps.

17.2 A bungee must be withdrawn from service if it has bee exposed to over 250 hours of sunlight. When a bungee is not in use it must be kept covered.

17.3 If a bungee gets any solvents, accidentally spilt on it, the bungee must be retired.

17.4 A bungee is retired by chopping it up into 3 foot lengths. There is never any chance of the bungee accidentally being put back in service.

P A P E R W O R K

F O R M S

&

R E C O R D S

DAILY BUNGEE OPERATION CHECKLIST

CHECK	MON	TUES	WED	THUR	FRI	SAT	SUN
TOWER ALIGNMENT							
GUY TENSION							
SHACKLES WIRED							
[redacted]							
CABLE CLAMPS							
[redacted]							
WINCH BOLTS							
TRIAL LIFT							
LIMIT SWITCH							
CALIBRATION							
RESCUE GEAR							
SAFETY BELTS							
RADIOS							
HARNESSES							
CORDS							
CARIBEANERS							
WHISKER SWITCH							
WIND METER							

CLOSING CHECKLIST

CHECK							
DECK CLEARED							
EQUIPMENT SECURE							
WIND METER IN							
KEY OUT/POWER OFF							

* NOTES :

THRILL SPORT CORD USE LOG

LOCATION_____

COLOR / CORD #	LABEL #	DATE MFG	MFG BY	TYPE OF THREAD	NOTES *

DATE	YELLOW	GREEN	RED	BLUE	BLACK	COMMENTS

			DATE_____
		THRILL SPORT BUNGEE	
		DAILY JUMP LOG	
JUMP	CORD	PRINT NAME	SIGN NAME
MASTER			

Daily Cord & Rigging Inspections Log

Date	Insp. #1	#2	#3	#4	#5	Notes.
Time:						
Insp. by:						
Time:						
Insp. by:						
Time:						
Insp. by:						
Time:						
Insp. by:						
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	THRILL SPORT BUNGEE		
WEIGHT OF JUMPER	WEBBING LENGTH	WEIGHT OF JUMPER	WEBBING LENGTH
70 75			
80		205	
85		210	
90		215	
95		220	
100		225	
105		230	
110		235	
115		240	
120		245	
125		250	
130		255	
135		260	
140		265	
145		270	
150		275	
155		280	
160		285	
165		290	
170		295	
175		300	
180		305	
185		310	
190		315	
195		320	
200		325	

SPECIFICATION SHEET
FOR BUNGEE ROCKET AMUSEMENT DEVICE

(1) PROJECTED HEIGHT: 100' (30.5M) above ground level

(2) BUNGEE CORD DATA:

Details of the bungee cords are provided in the operating manual. The cords comply with the requirements of Reference 1, Section 4.3 with the following exceptions.

a) The webbing ends are tied rather than stitched. The cords are built in the field and sewing by machine is not available and hand sewing is not consistent. The knot used to tie the webbing is commonly referred to by the Bungee Jump Industry as a ribbon knot. It is a self tightening non-slip knot.

b) Reference 1 requires the fall arrest system or static line to have a breaking strength of 4000 lb. The three larger cords meet this requirement. However the two smaller cords have two static lines in each having a strength of 500 lb in each line or 1000 lb total per bungee cord. Factors of safety are shown in the following table.

CORD COLOUR	WEIGHT RANGE	BREAKING STRENGTH OF STATIC LINE	LOAD AT BOTTOM OF FALL PER CORD	FACTOR OF SAFETY	LOAD AT TIME OF LAUNCH PER CORD	FACTOR OF SAFETY
YELLOW	70 - 100	1,000	143	7	200	5.0
GREEN	105 - 145	1,000	207	5	290	3.5
RED	150 - 205	4,000	293	14	410	9.8
BLUE	210 - 245	4,000	350	11	490	8.2
BLACK	250 - 300	4,000	429	9	600	6.7

TABLE 1
STATIC LINE FACTORS OF SAFETY

The above factors of safety are calculated as follows.

From the Thrill Sport Manual, the typical acceleration at the bottom of a jump is 2.87g. As there are two cords the force on each will be or 1.43W lb. If the bungee cord were to break at this instant, which is the most likely time for such an occurrence, the fall arrest system would have to resist this force and the FS would be the breaking strength of the static line divided by 1.43W. At the time

of launch, for purposes of calculation of safety factors, the cord tension was increased by 40%.

c) The spool webbing used to attach the bungee cord to the is required to have a strength of two times the ultimate strength of the bungee cord. The spool webbing is 1" tubular nylon having a strength of 4000 lb. (Reference Craig Lindell). The largest cord has a strength of 3520 lb. As the factor of safety is 8.2 and only 5 is required use a value of 3520 x 5/8.2 = 2146 lb. The ratio is 4000/2146 = 1.9 which is close to the required value of 2.

Reference 1, Section 4.3 requires bungee cords to have a factor of safety of 5. Thrill Sport's cords have factors based on 2200/15=1466 lb/ply, (see Operating manual p13, 15 ply cord), as follows.

CORD COLOUR	WEIGHT RANGE	NUMBER OF PLIES	BREAKING STRENGTH BUNGEE CORD	MAXIMUM LOAD AT BOTTOM OF FALL PER CORD	FACTOR OF SAFETY
YELLOW	70 - 100	10	1466	143	10.3
GREEN	105 - 145	12	1760	207	8.5
RED	150 - 205	16	2346	293	8.0
BLUE	210 - 245	20	2933	350	8.4
BLACK	250 - 300	24	3520	429	8.2

TABLE 2
BUNGEE CORD FACTORS OF SAFETY

Retirement of bungee cords is covered in Thrill Sport's Operating Manual. The requirements comply with Reference 1 Section 4.8.1(4).

NOTE: WHEN A BUNGEE CORD IS RETIRED FROM SERVICE FOR ANY REASON, BOTH CORDS MUST BE REPLACED TO ENSURE AN EVEN PULL ON EACH SIDE OF THE RIDER SO THAT THE RIDER IS MAINTAINED ON CENTRE WITHIN +/- 5' OF THE CENTRE LINE OF THE RIDE.

(3) HOISTING EQUIPMENT AND STRUCTURE

The hoisting equipment and structure are shown in Thrill Sports Production Inc.

drawing number 100 sheets 1 to 7 and in Figures 1, 4, and 5 attached. It consists of a tower built from commercially available antenna tower components with a specially constructed arch section at the top. Hoisting is by means of a commercially available drum hoist. The design wind loads are shown in Figure 5 and meet the requirements of the Ontario Building Code.

Name of Manufacturer:Thrill Sports Production Inc.

Year Built:1995

Serial Number: BL100-001

The electric wire rope hoist has a SWL rating of 5,000 lb., (2,275 kg).

There are two (2) 3/8" 6 x 19 IWRC wire rope hoisting cables each having a breaking strength of 13,120 lb. The end of each wire rope has an eye formed using a thimble and two (2) cable clamps.

The electric wire rope hoist is equipped with gear driven limit switches that automatically stop the movement at both the lower and upper terminal points. The hoist control system is designed to slow the hoist prior to the electrical supply to the drive motor being switched off so that the hoist stops smoothly. The hoist system is equipped with a slack rope sensor that, upon detecting slack rope, shuts off the power supply to the hoist. There is only one layer of wire rope on the drum so that an anti-piling sensor is not required.

In addition to the electric wire rope hoist gear driven limit switches, the tower is equipped with an anti-two blocking limit switches on the upper sheaves to prevent over travel in the event that the upper gear driven limit switch fails.

In addition to the tower there is a launch platform constructed from commercial scaffolding approximately 15' square. There shall be no more than two launch personnel and five patrons on the platform at any one time. Spectators are not permitted on the platform.

(4) ATTACHMENT OF PERSON TO BUNGEE CORD

Attachment of the person to the bungee cord is by means of a full body harness. The attachment complies with the requirements of the applicable paragraphs of Reference 1, section 4.2. Details are provided in Figures 2 and 3 and illustrate the required redundancy of the connection.

(5) MINIMUM LAUNCH SITE PERSONNEL:

There are three (3) personnel directly involved in conducting a launch.
(a) Launch Master
(b) Launch Assistant
(c) Electric Wire Rope Hoist Operator

The Launch Assistant also acts as the Retrieval Operator.

(6) WIND SPEED RESTRICTIONS:

Operations are to stop if the cross wind speed exceeds 20 mph or if the fore and aft wind speed exceeds 35 mph at the top of the tower. A cross wind is any wind direction not parallel to the launch direction.

These values and directions are upper limits. Operations shall cease in unusual wind conditions such as gusty and unstable wind directions.

(7) DESIGN CODES AND STANDARDS

In addition to compliance with the Reference 1, (Canadian Bungee Association Code of Safe Practice), the AD complies with:

ELECTRIC WIRE ROPE HOIST:	NEC and CSA Electrical Code AGMA
TOWER:	ANSI/EIA-222-D Antenna Towers
WIRE ROPES:	ANSI Committee of Wire Rope Producers
WELDING:	AWS

(8) CERTIFICATION

8.1 Tower and Hoisting Device are to be certified by an Ontario Professional Engineer on completion of erection at each site.

8.2 Certification of the Bungee Cord is attached.

8.3 Certification of the Body Harness is attached.

(9) SITE LAYOUT

A site layout and general arrangement are shown in Thrill Sports Production Inc. drawing number 100 sheets 1 to 7 and in Figures 1, 4, and 5 attached.A site layout is attached.

(10) OPERATING SPACE

The operating space is shown in Figure 4. It does not comply with the requirements of Reference 1 Section 5.8. The requirements of Reference 1 are for a single bungee cord. The Bungee Rocket has two cords, one on each tower leg, that confine the person to the centre of the tower so there is less chance of moving out of a vertical plane. Further justification for non-compliance is provided in the field test report.

(11) ERECTION AND DISMANTLING INSTRUCTIONS

As the tower is erected by the Manufacturer, there are no specific erection or dismantling instructions provided in this submission. However, it shall be noted that the guy wires are not to be over tightened. Turnbuckles shall be tightened by hand without the use of a cheater bar as tight as possible and then given three full turns using a wrench or cheater bar. Each installation is required to be certified by an Ontario Professional Engineer.

(12) EQUIPMENT AND MAINTENANCE MANUAL

The bungee cord and associated equipment maintenance requirements are included in the Procedures Manual. An inspection and maintenance manual for the tower and associated hoisting equipment is attached.

(13) FIELD TEST REPORT

A field test was conducted prior to operation at Exhibition Place, Toronto. In addition to weight testing, trajectory and off centre movement was investigated. A maximum of 5' movement off centre was used for the acceptance criteria. Riders are not to reach a height of more than 100' so as to maintain a safety zone of 30' above the rider.

(14) REFERENCES

1. Canadian Bungee Association Code of Safe Practice, DRAFT, 4/9/93

SUMMARY OF FACTORS OF SAFETY

The factors of safety for the static line and bungee cords are shown in Table 1 and 2 above. The factors of safety presented below are in some instances based on safe working load and in other instances on breaking strength. Safe working load is generally a load which is not more than 75% of the load that would result in plastic deformation in the structure or component and substantially less than the load that would result in catastrophic failure of the structure or component.

SWL = Safe Working Load

B = Breaking Strength or Collapse Load or Ultimate Strength

FS = Factor of Safety

2-1/2 ton Electric Wire Rope Hoist:

F.S.= 5,000/(2x600) = 4.2 times the SWL (ACCO-Wright)

It is to be expected that commercially available hoist will have a built-in factor of 3 to account for dynamic loading.

Single 3/8" dia. 6x19 Extra Improved Plow Steel IWRC electric hoist wire rope:

B 13,120 lb. (AISI Wire Rope Users Manual)

The bungee cord is stretched to about 600 lb.

FS= 13,120/600 = 21.9 > 10 See Reference 1, Section 4.2.

Calibration Strap

2" tubular webbing

BS = 8000 lb

FS = 8,000/600 = 13 > 10 See Reference 1, Section 4.2.

Main Sheave Axle

ACCO model number 220247M1.

SWL 11,000 lb. (Verbal from Rob Strange, Thrill Sports Productions)

FS = 11,000/600 = 18 times SWL

1" diameter shaft in double shear

SWL = 2 x 0.7854 x 1.0^2 x 10,000 = 15,700 lb

FS = 15,700/600 = 26

Bungee Cord

Factors of safety are shown in Table 2 above.

Static Line

Factors of safety are shown in Table 1 above.

Spool Web

1" Tubular webbing B = 4,000 lb

FS = 4000/600 = 6.7 See Reference 1, Section 4.2.

Karabiners

All karabiners have a minimum breaking strength of 6,500 lb as required by Reference 1. For a total maximum force of 1200 lb, the FS is 5.4. They complies with Reference 1 Section 4.5.1(1),(2), and (4), but not 4.5.1(3) which requires karabiners to have a FS of 10. For this AD, the use of larger karabiners is not practical and an FS of 5.4 in the most highly loaded case is considered adequate and compatible with the bungee cord requirement for a FS of 5.0.

HOIST AND TOWER CERTIFICATION

I, the undersigned, being a Registered Professional Engineer in the Province of Ontario, do hereby certify that to the best of my knowledge and belief the tower and hoisting equipment have been erected and installed in conformance with the specifications contained in the design submission.

CERTIFIED BY:.....

NAME:(print) G.W.S.Gordon

REGISTRATION NO. 16635013

DATE: .....18/8/95.....

HARNESS CERTIFICATION

I, the undersigned, being a Registered Professional Engineer in the Province of Ontario, hereby certify that to the best of my knowledge and belief the Bungee Rocket **Body Harness** shown in Thrill sport Productions Inc. Specification Sheet Figure 2 complies with the requirements of the Canadian Bungee Jumping Association Safe Code of Practice.

CERTIFIED BY:.....

NAME:(print) G.W.S.Gordon

REGISTRATION NO. 16635013

DATE: 18/8/95

BUNGEE CORD

I, the undersigned, being a Registered Professional Engineer in the Province of Ontario, hereby certify that to the best of my knowledge and belief the Bungee Rocket **Bungee Cords** shown in Thrill sport Productions Inc. Procedures manual complies with the requirements of the Canadian Bungee Jumping Association Safe Code of Practice with exceptions described in the Specification Sheet.

CERTIFIED BY:.....

NAME:(print) G.W.S.Gordon

REGISTRATION NO. 16635013

DATE: 18/8/95

BUNGEE ROCKET
FIELD TEST REPORT

This is to certify that the Bungee Rocket successfully under went the following tests.

1. Test launch of a 190 lb rider. The rider was observed to travel in a straight path less than +/- off the centre line of the AD.

2. The upper limit switch on the hoist and tower upper sheave functioned as required, the switch on the hoist stopped the hoist without bottoming out the buffer spring. Similarly the tower upper sheave switch stopped the hoist before bottoming out the buffer spring.

3. A test was conducted to see if the static line would stretch the bungee cord. The test was to simulate a broken bungee cord. Using a 100 lb rated bungee cord, the static line was disconnected from the spool at one end and attached to the hoist cables. The other end attached to a 150 lb weight in the normal manner. The cord was stretched and the static line did not pull out but rather forced the bungee cord to perform as if it had not been disconnected. This is a significant safety feature.

CERTIFIED BY:.....

NAME:(print) G.W.S.Gordon

REGISTRATION NO. 16635013

DATE: 18/8/95

BUNGEE ROCKET TOWER AND HOISTING DEVICE
INSPECTION AND MAINTENANCE

1. Inspect the guy wire anchoring for any movement or ground disturbance daily.

2. Inspect the tower legs at the base daily for any movement. Check that the tower stands vertical.

3. Inspect the guy wires and turnbuckles at the lower end of the guy wires daily.

4. Inspect the tower structural members daily. Check members and bolted connections by hoisting a two man inspection team in the basket to the top of the tower.

5. Inspect the connection of the idler sheaves and main sheaves to the tower daily. Inspect the sheave flanges for wear. Grease the sheave bearings once every two weeks.

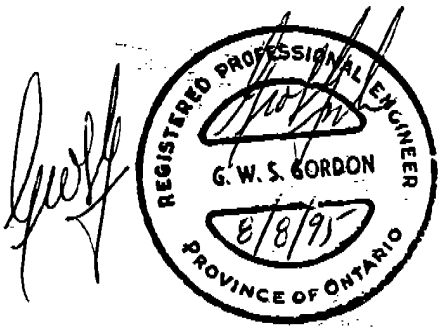
6. Inspect the guy wire connections at the top end of the guys daily. Check to ensure the shackles are moused, (wire locked). Inspect the tower members, (and member attachment), to which the guys are attached.

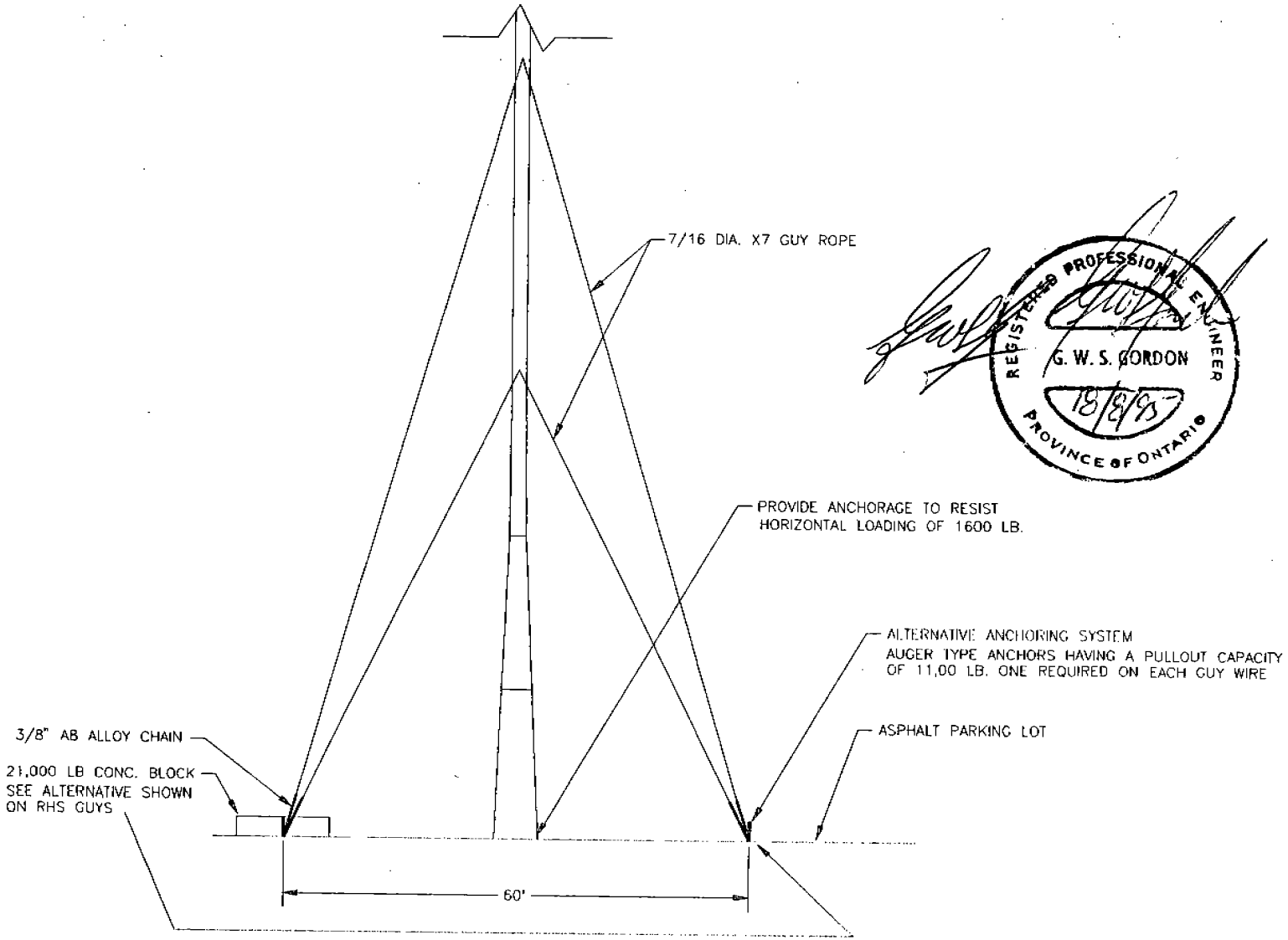
7. Check the operation of the winch in accordance with the manufacturer's instructions. Details and frequency of inspection and servicing are specified in Wright Inc. document 58975. Daily, check the operation of the upper and lower limit switches and the "anti two block" switch that acts as the backup for the upper limit switch. Check the operation of the pendant dead man switches. Check the function of the key switch. Press the "up" button and while holding the button down, turn the key switch to the off position. The winch should stop immediately. Repeat the process using the "down" button.

8. Check the operation of the slack wire switch daily.

9. Inspect the connection of the wire rope spring to the hoisting cables daily. Check the wire rope clamps for signs of slipping.

10. Insect the hoisting cables daily. Ropes must comply with the requirements of the Amusement Devices Act, paragraph 21.





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G. W. S. GORDON
18/2/93
PROVINCE OF ONTARIO

FIGURE 1

TOWER ANCHOR REQUIREMENTS

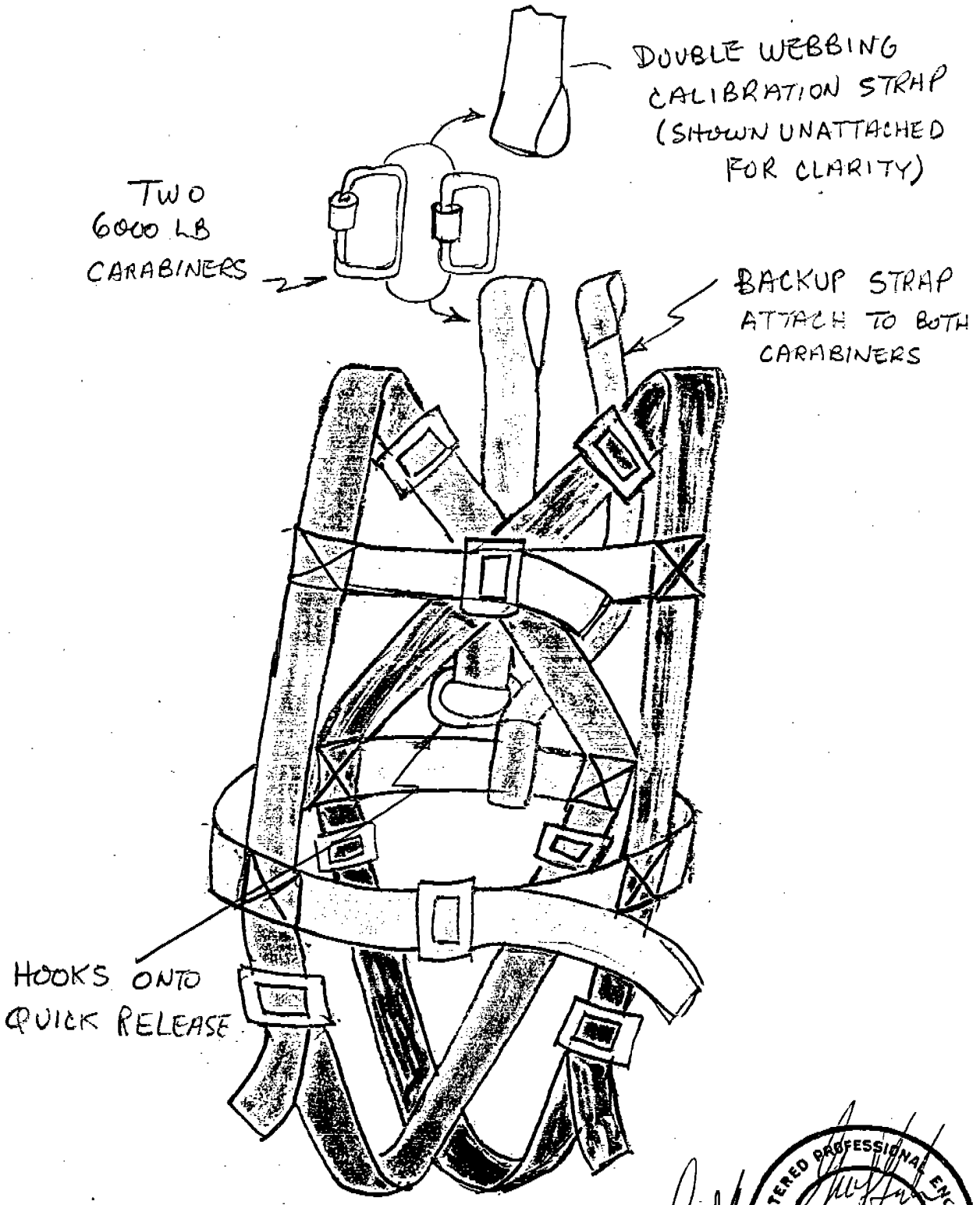

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FIG. 2

BODY HARNESS

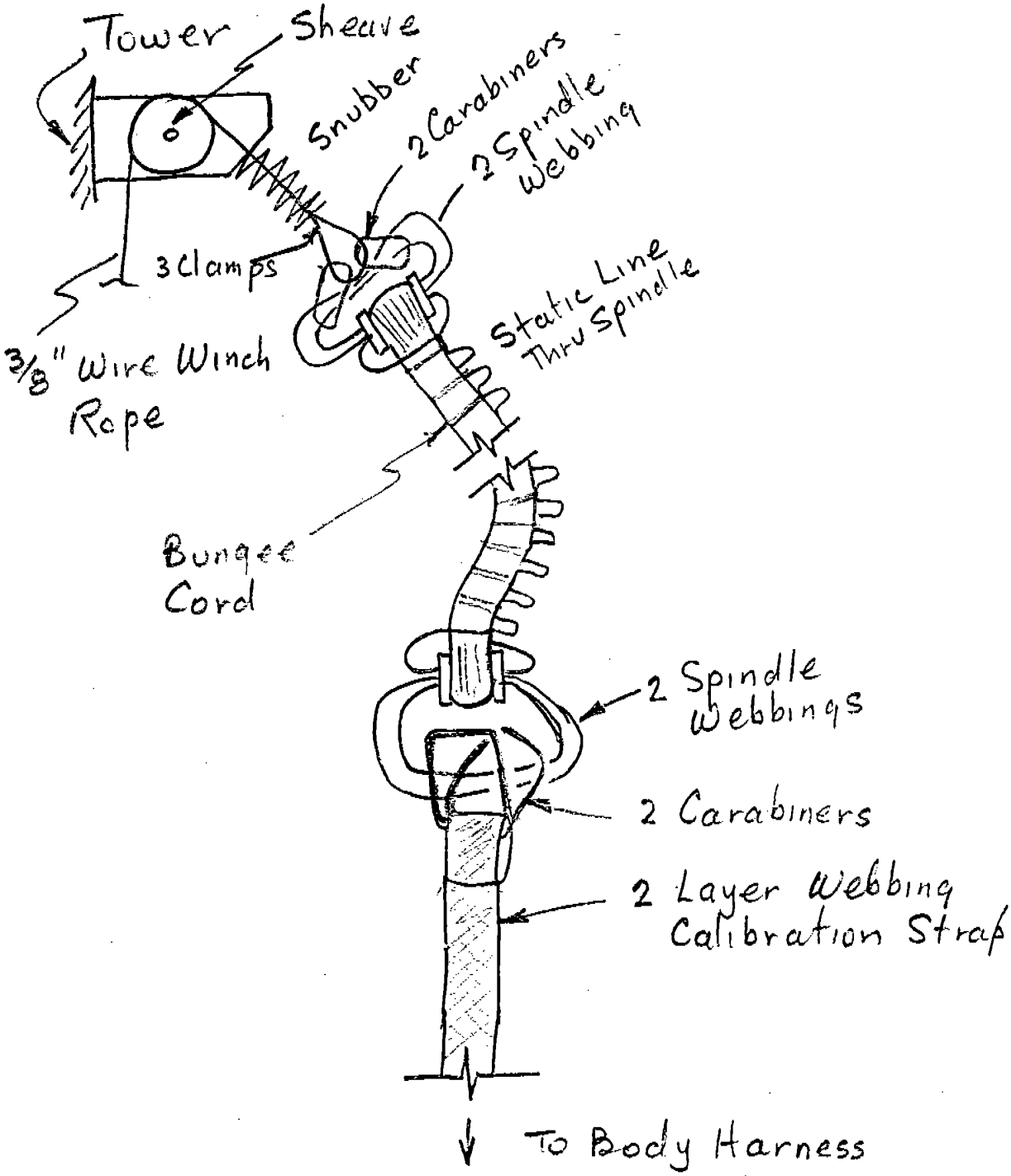

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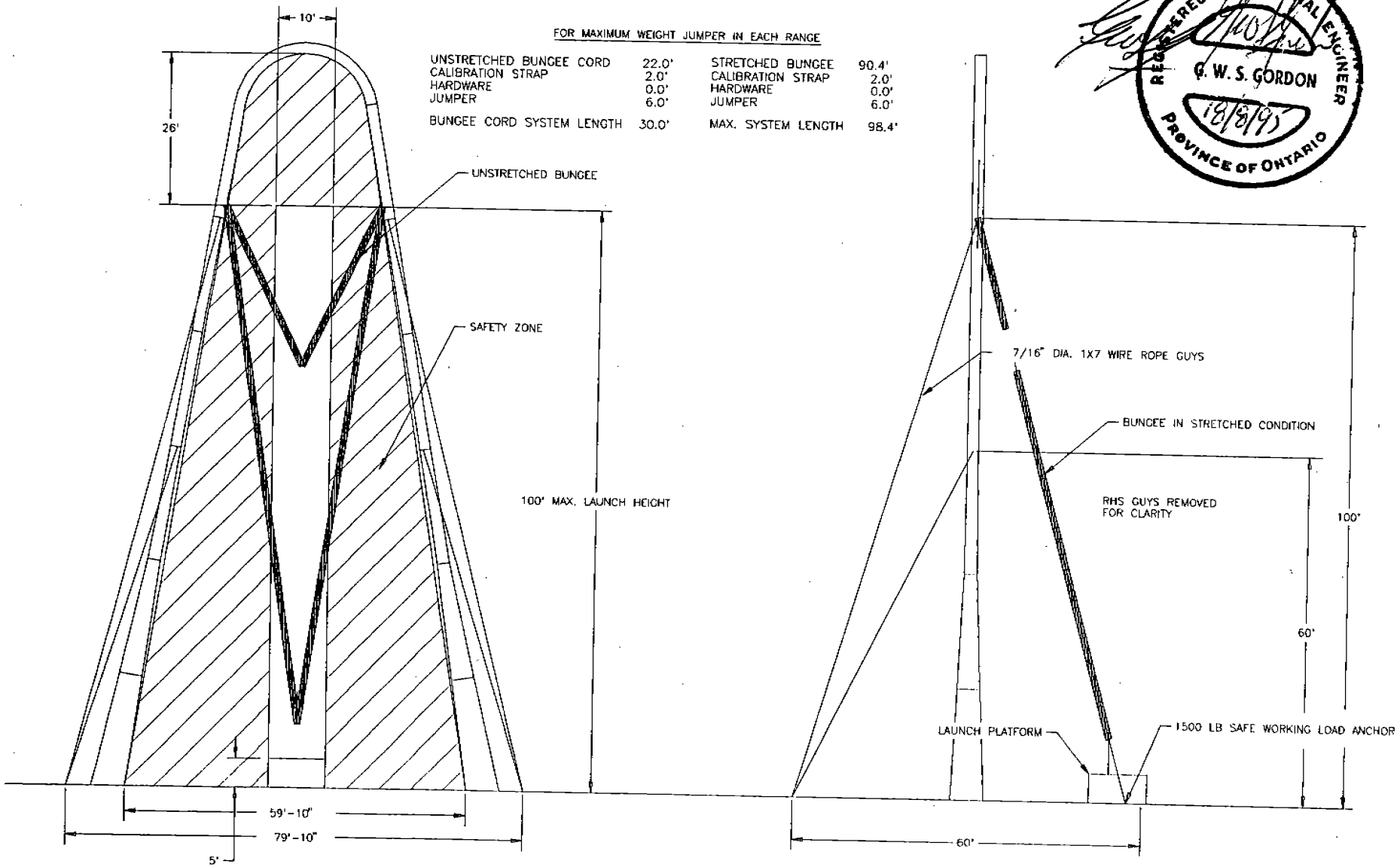
FIG 3

Connection Of Bungee To Calibration Strap



FOR MAXIMUM WEIGHT JUMPER IN EACH RANGE

UNSTRETCHED BUNGEE CORD	22.0'	STRETCHED BUNGEE	90.4'
CALIBRATION STRAP	2.0'	CALIBRATION STRAP	2.0'
HARDWARE	0.0'	HARDWARE	0.0'
JUMPER	6.0'	JUMPER	6.0'
BUNGEE CORD SYSTEM LENGTH	30.0'	MAX. SYSTEM LENGTH	98.4'

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FIGURE 4
SITE LAYOUT AND GENERAL ARRANGEMENT

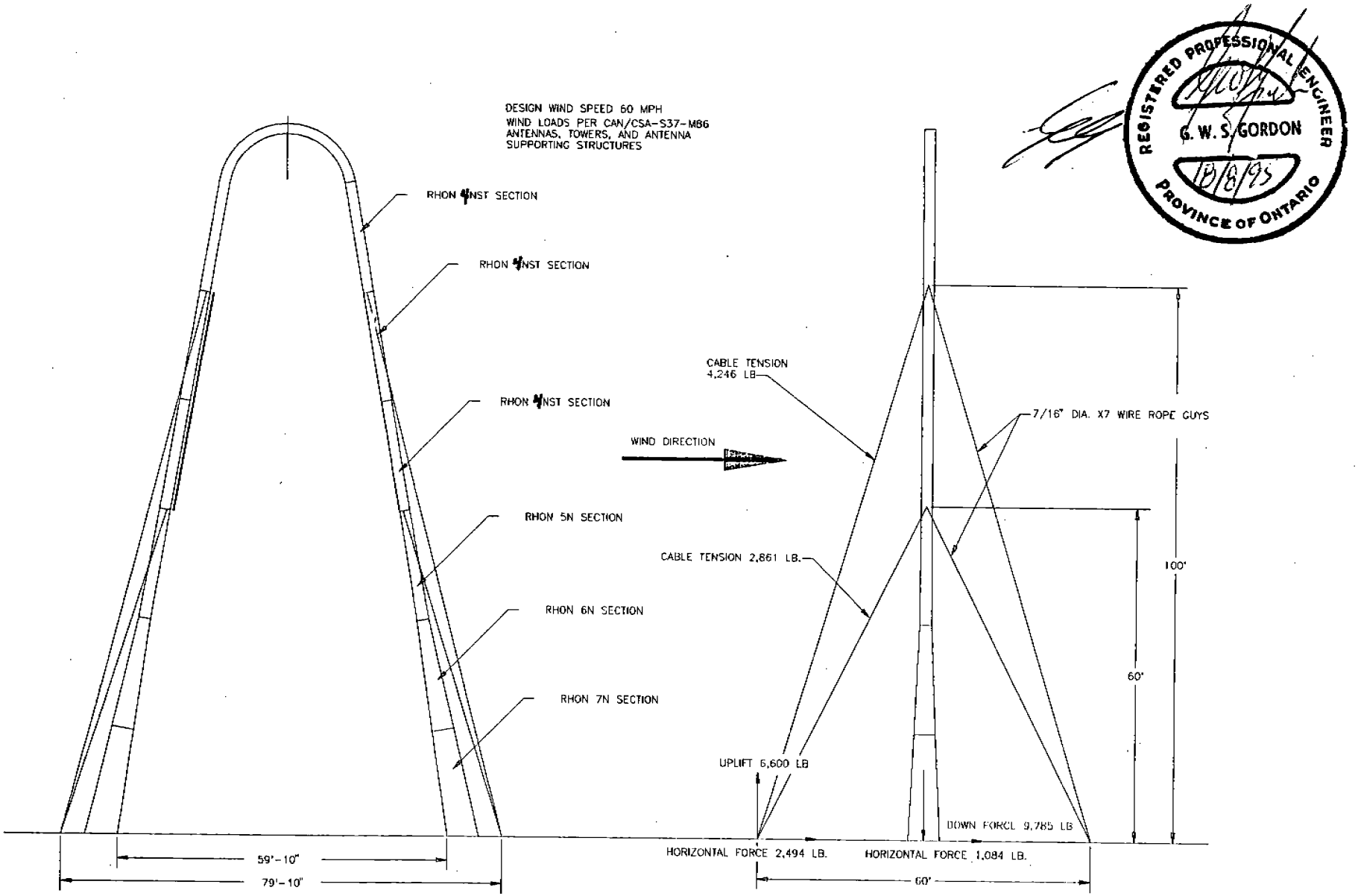
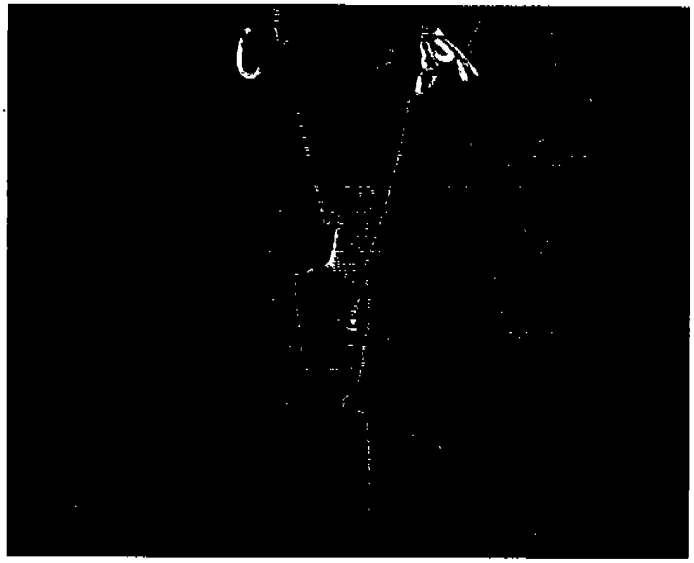
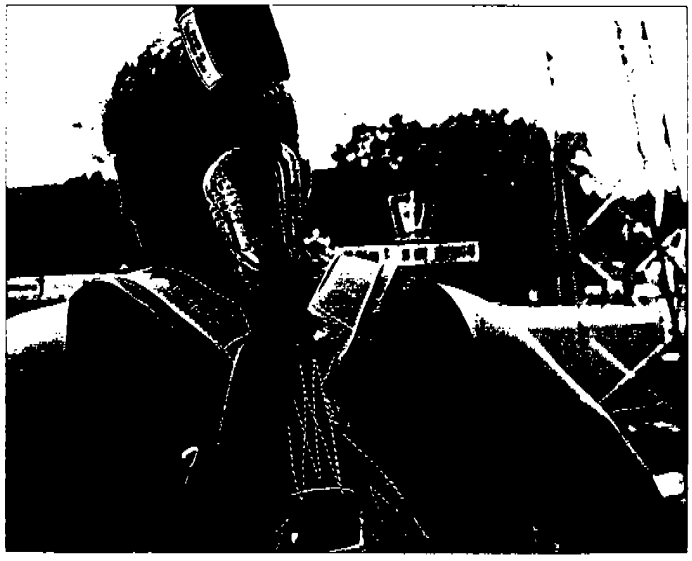


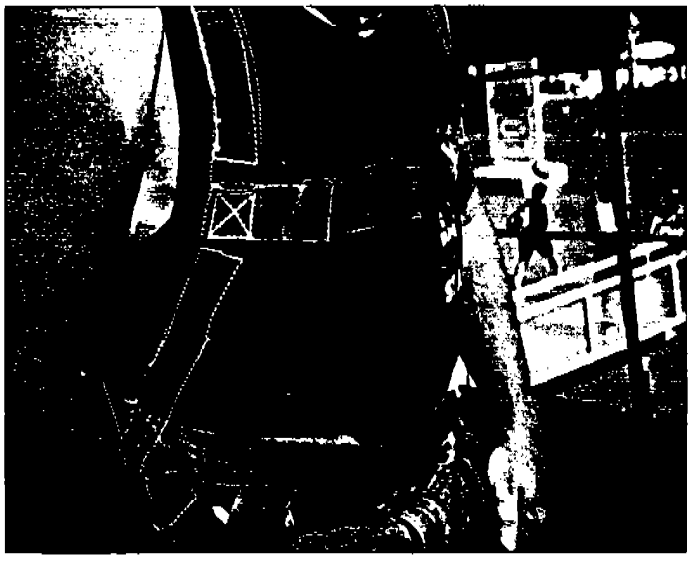
FIGURE 5

TOWER FOUNDATION LOADING FOR 60 MPH WIND LOAD




BUNGEE
STAFF



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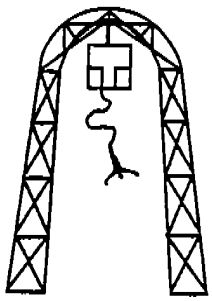
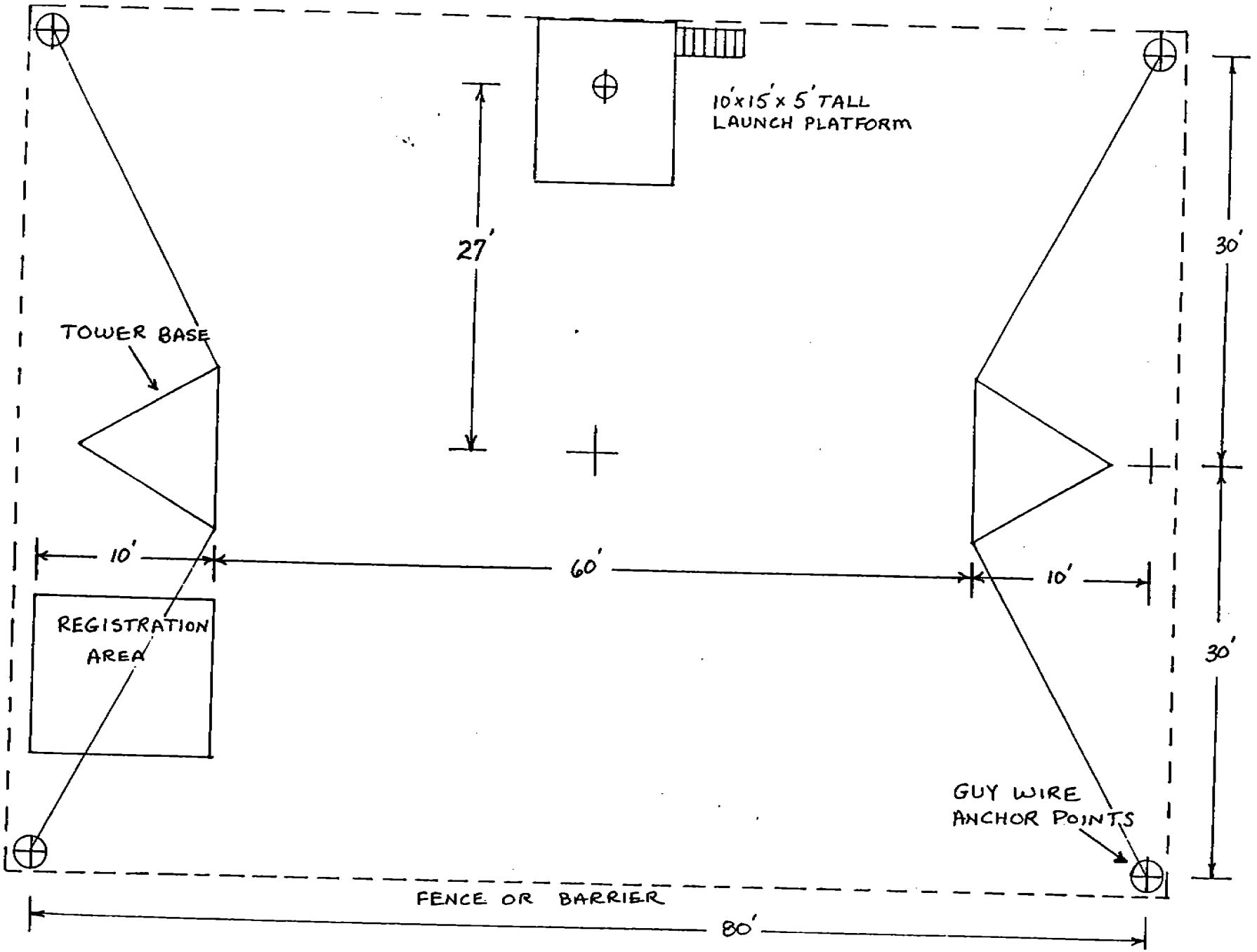


THRILL SPORT
PRODUCTIONS

BUNGEE "ROCKET LAUNCHER"
SITE PLAN



T H R I L L S P O R T

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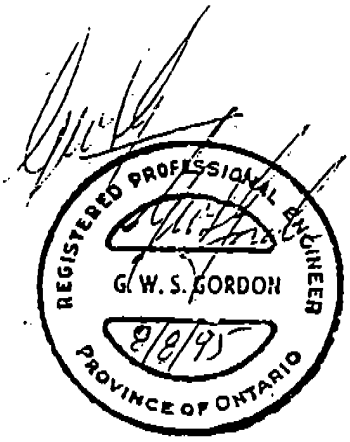


CORPORATE OFFICE

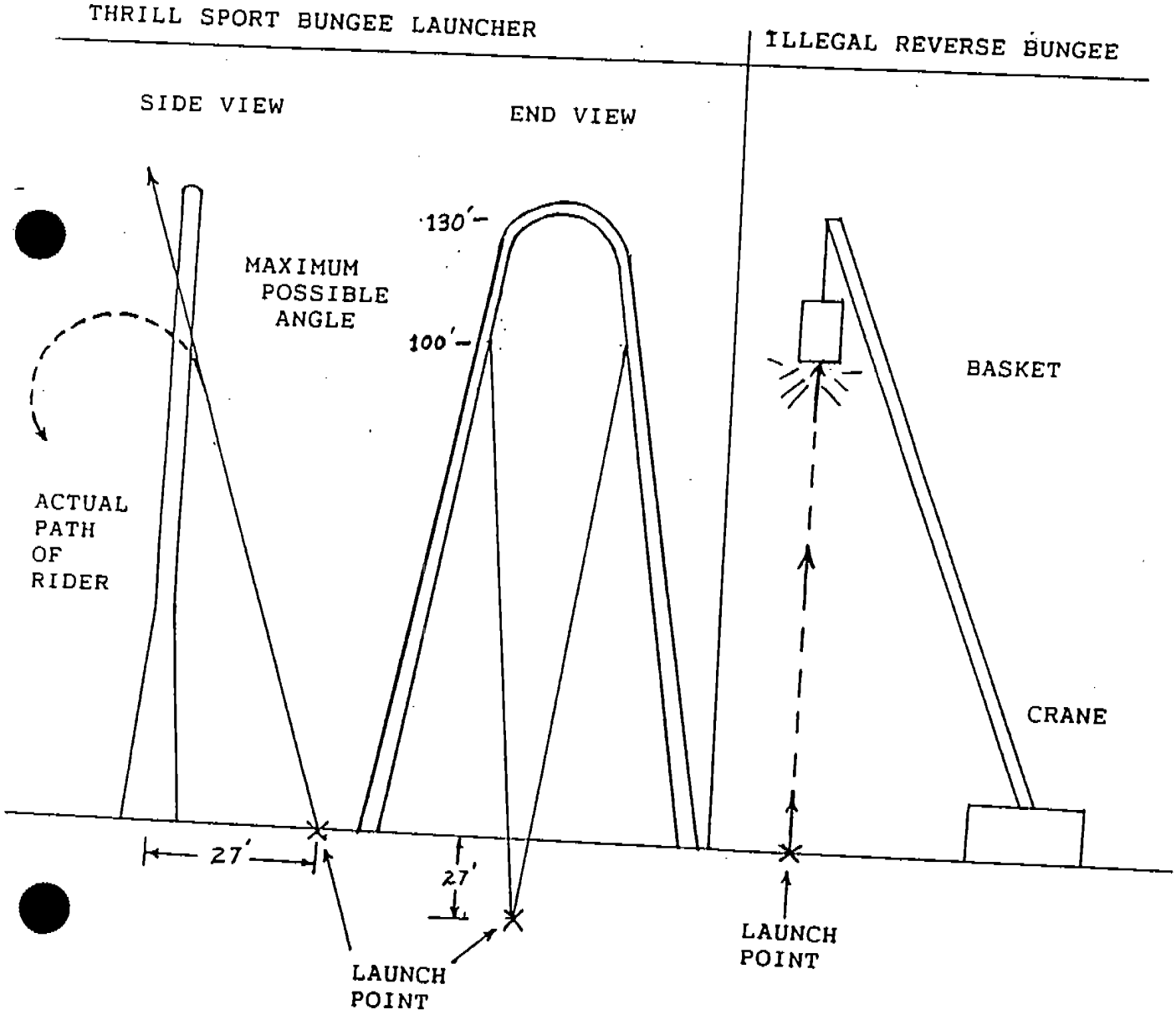
88 A ELM ST.
HOPKINTON, MA 01748
(508) 435-0420

VOICE MAIL PAGER
1 (800)946-4646
PIN # 110-0056

BUNGEE LAUNCHER OPERATIONS - GENERAL DESCRIPTION

THE BASIC OPERATION OF THE BUNGEE LAUNCHER CONSISTS OF SECURING A RIDER IN A FULL BODY HARNESS, ATTACHED TO TWO BUNGEE CORDS, WHICH ARE STRETCHED UP TO 100 FT. ON EACH SIDE OF THE THRILL SPORT BUNGEE ARCH. THE PERSON IS ALSO ANCHORED TO THE GROUND WITH A QUICK-RELEASE MECHANISM. WHEN ALL CONNECTIONS ARE SECURE, THE PERSON IS RELEASED AND WILL ACCELERATE FORWARD AND UPWARD TO A HEIGHT OF APPROXIMATLY 100 FT. THEN THE RIDER WILL DECEND, SWING AND ACCEND APPROXIMATLY FIVE TIMES UNTIL THE BOUNCE AND SWING SUBSIDE. THE RIDER IS THEN LOWERED IN A CONTROLLED DECENT TO THE GROUND AND UNHOOKED FROM THE SYSTEM.

NOTE THIS IS NOT "REVERSE BUNGEE" AS IT IS NOT A SINGLE BUNGEE CORD ATTATCHED TO A BASKET. ALSO THE LAUNCH IS AT AN ANGLE SO THE RIDER IS PROPELLED UPWARD AS WELL AS FORWARD.



OPERATIONAL PROCEDURES AND SAFETY CHECK SYSTEM

WHEN A JUMPER FIRST ARRIVES TO PURCHASE A LAUNCH RIDE, HE/SHE WILL SEE A SIGN POSTED THAT STATES THE FOLLOWING:

WARNING: THIS RIDE IS A HIGH SPEED, PHYSICALLY ACTIVE UNDERTAKING. DO NOT RIDE IF YOU HAVE BACK OR NECK DISORDERS, BROKEN BONES, HIGH BLOOD PRESSURE, HEART PROBLEMS, EPILEPSY, PREGNANCY, OR ANY OTHER PHYSICAL LIMITATIONS.

MINIMUM WEIGHT * 70 LBS. MINIMUM AGE * 10 YRS.
MAXIMUM WEIGHT * 300 LBS.

* THE RIDER'S WEIGHT IS FIRST DETERMINED BY THE DESK CLERK BY TWO SEPARATE SCALES. THE WEIGHT IS THEN WRITTEN ON A WRIST BAND AND PLACED ON THE RIDER.
* THE RIDER IS FITTED INTO A PADDED FULL-BODY HARNESS. SEE FIG. 2
* THE JUMPMASTER SELECTS THE PROPER CORD COLOR AND CALIBRATION PAD ACCORDING TO THE CALIBRATION CHART. (SEE SAMPLE CHART)
* THE SELECTION IS VERIFIED BY A JUMP COORDINATOR.
* THE JUMP COORDINATOR CONNECTES THE CORDS TO THE HOIST CABLES AND THE JUMPMASTER VERIFIES THE CONNECTIONS ARE CHECKED.
* THE JUMPMASTER CONNECTS THE CORDS TO THE CALIBRATION PAD AND THE CALIBRATION PAD TO THE RIDER'S HARNESS.
* THE JUMP COORDINATOR VERIFIES THE THE CONNECTIONS ARE CHECKED.
* NOTE **** ALL CONNECTIONS ARE VERIFIED TWICE *
* THE RIDER IS CONNECTED TO A QUICK RELEASE DEVICE THAT IS SECURED TO THE GROUND ANCHOR.
* AT THIS POINT ALL CONNECTIONS HAVE BEEN DOUBLE CHECKED AND THE CORDS ARE THEN STRETCHED UP
* DURING THE STRETCH PROCESS THE JUMPMASTER GIVES INSTRUCTIONS TO THE RIDER. THE INSTRUCTIONS ARE: "WHEN THE CORDS REACH FULL STRETCH I'LL SAY "READY" YOU PUT BOTH ARMS STRAIGHT UP AND LOOK AT YOUR HANDS. I'LL COUNT "3,2,1 LAUNCH" AND PULL THE RELEASE. ENJOY THE RIDE AND DO NOT TRY TO GRAB THE CORDS OR THE PAD. O.K. READY? ARMS UP, 3,2,1, LAUNCH!"

CORD CONSTRUCTION

THERE ARE FIVE SETS OF CORDS USED IN THE SYSTEM. EACH SET OF CORDS HAS A WEIGHT VARIATION RANGE OF APPROXIMATLY 30-50 LBS. THROUGH THE LIFE OF A SET OF CORDS THE RANGE WILL CHANGE AND IS MONITORED WITH THE CALIBRATION CHART. THE COLOR CODES AND THE APPROXIMATE WEIGHT RANGE IS LISTED BELOW.

MAX WIND SPEED 20 MPH CROSS WIND, 35 MPH FORE & AFT.

CORD COLOR	PLY	APPROXIMATE WEIGHT RANGE	F.S.
YELLOW	10	80 - 100 LBS. - 1467	5.1
GREEN	12	105 - 155 LBS. 2090	4.7
RED	16	160 - 205 LBS. - 2350	4.6
BLUE	20	210 - 245 LBS. - 2933	4.2
BLACK	24	250 - 300 LBS. - 4180 lb B.S.	4

ALL CORDS ARE HAND MADE, NEW ZEALAND STYLE, WITH FRESH LATEX RUBBER. THE RUBBER SPECIFICATIONS ARE AS FOLLOWS:

GUAGE OF RUBBER : 22 GUAGE
STRANDS PER PLY : 40 STRANDS
LENGTH OF CORDS : 23 FEET

CORD CONSTRUCTION NOTES

1) CLEAN SURFACE
2) STAKE OFF SPOOL OR SPINDLE AT 23 FEET (OR 22 FEET - SEE P5)
3) LAY WRAPS OR PLYS NEATLY WITH NO TWISTS IN THE RUBBER
4) TIE FIRST AND LAST WRAP TOGETHER IN THREE SEPARATE KNOTS.
   * LEAVE KNOTS VISIBLE ON THE OUTSIDE OF THE CORD FOR EASY INSPECTION
5) TIE SPINDLE WEBBINGS INTO THE SPOOLS WITH A RIBBON KNOT ON EACH SIDE SO THE SPOOL CANNOT TWIST
   * BE SURE TO USE TWO COLORS *
6) STRETCH TO 65 - 70 FT. TO WRAP OR BRAID THE BUNGEE CORD.
7) WRAP WITH 5 STRANDS OF RUBBER WITH THE BRAIDS TWO FINGERS WIDTH BETWEEN WRAPS. PROPER TENSION IS IMPORTANT. TOO LOOSE WILL MAKE THE CORD SLOPPY AND TOO TIGHT WILL BREAK THE BRAIDING DURING THE FIRST FEW JUMPS.
8) LABEL OR TAG THE WEBBINGS WITH THE FOLLOWING INFORMATION:
9) TIE IN STATIC LINE WEBBING IF USED - SEE P5

	LENGTH OF CORD		WRAPS OR PLYS		GUAGE OF RUBBER
(ie.)	23	-	20	-	22

ON THE OTHER WEBBING LABEL THE DATE OF MANUFACTURE AND THE COLOR OF THE CORD (ie.) 6-15-95 (R)

Y - YELOW
G - GREEN
R - RED
B - BLUE
BK - BLACK

9) RECORD THE NEWLY CONSTRUCTED BUNGEE CORD IN THE BUNGEE CORD LOG BOOK. THE LOG BOOK SHOULD IDENTIFY THE FOLLOWING INFO:

a) DATE OF MANUFACTURE
b) BUILT BY
c) LABEL INFO
d) DATE CORD IS PUT IN SERVICE

NOTE: STATIC LINE TO BE USED IN THE PROVINCE OF ONTARIO

THE LOG BOOK WILL TRACK THE LIFE OF THE CORD BY A DAILY ENTRY OF THE NUMBER OF USES EACH DAY; KEEPING A RUNNING TOTAL. THE CORDS SHOULD BE RETIRED AFTER THE FOLLOWING:

400 JUMPS ON A CORD OR
5% STRAND BREAKAGE OR
250 HOURS OF LIGHT OR
6 MONTHS IN SERVICE OR
VISIBLE DAMAGE FROM CHEMICALS OR ABUSE

* WHEN A CORD IS RETIRED IT SHOULD BE CUT INTO FIVE FOOT LENGTHS SO IT CAN NOT ACCIDENTLY BE PUT BACK IN SERVICE.

STRETCH FACTORS ON BUNGEE CORDS

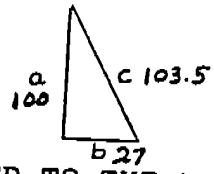
THE STRETCH FACTORS OF THE BUNGEE CORDS WILL RANGE BETWEEN 298% AND 315% DEPENDING ON WHICH LENGTH CALIBRATION PAD IS USED. THE CALIBRATION PADS ARE 2, 4, AND 6 FEET LONG. THESE ARE USED TO ADJUST THE STRETCH FACTORS WITHIN THE WEIGHT RANGE OF A CORD, ALLOWING EACH PERSON TO RISE TO APPROXIMATLY THE SAME LEVEL ON THE LAUNCH. A STRETCH FACTOR UNDER 350% IS CONSIDERED VERY SAFE. (SEE CALCULATIONS BELOW)

$$\frac{\text{DISTANCE OF JUMP} - \text{LENGTH OF CORD}}{\text{LENGTH OF CORD}} \text{ EQUALS } \%\text{ OF STRETCH}$$

$$\frac{95.5\text{ FT} - 23\text{ FT}}{23\text{ FT}} \text{ EQUALS } 3.15 \text{ OR } 315\%$$

$a^2 + b^2 = c^2$

$100^2 + 27^2 = 103.5^2$



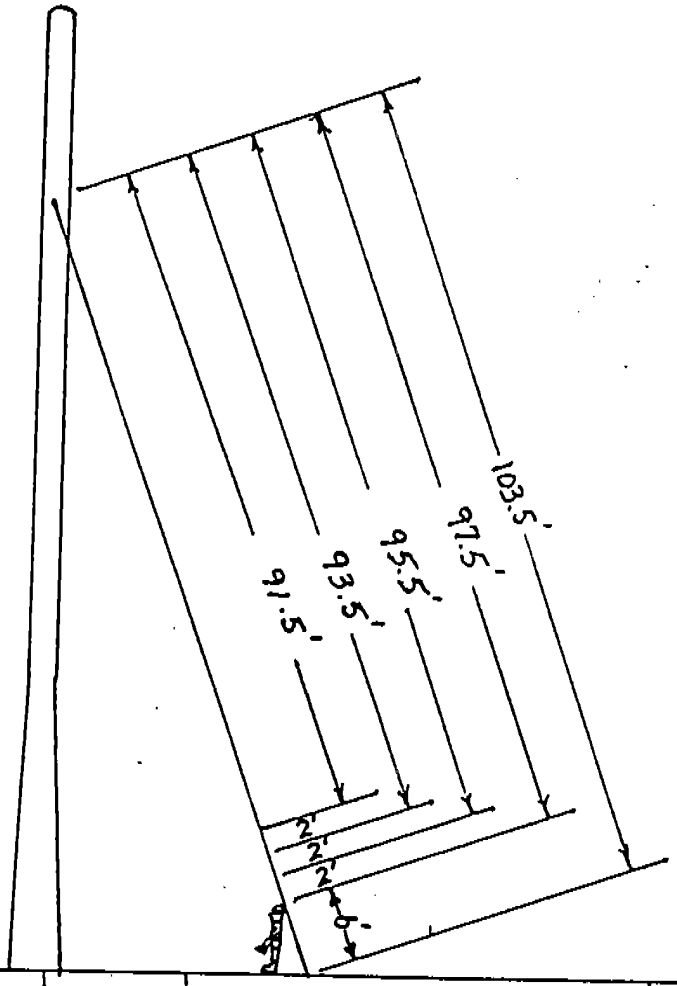
ASSUMING THE CORD IS ATTATCHED TO THE RIDER AT SIX FEET OFF THE GROUND, USING A CALIBRATION PAD A 2FT, 4FT, AND 6FT LONG RESULTS IN THE FOLLOWING STRETCH FACTORS:

2FT PAD * (95.5FT - 23) / 23 315%
4FT PAD * (93.5FT - 23) / 23 307%
6FT PAD * (91.5FT - 23) / 23 298%

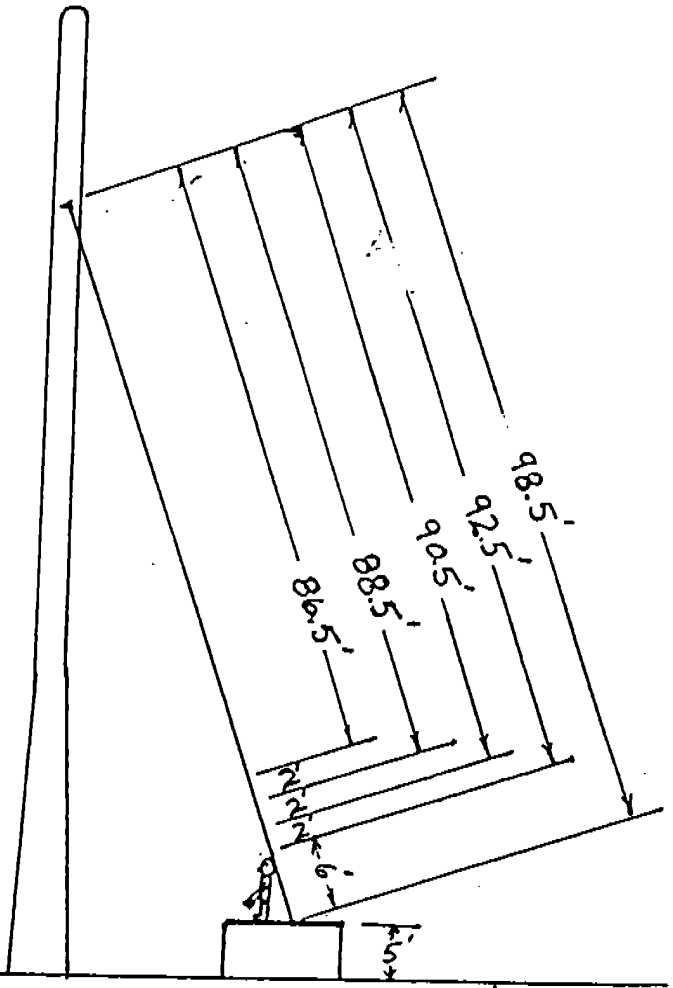
THE ENCLOSED D.S.R.I. REPORT PERFORMED FOR BUNGEE JUMPING USED STRETCH FACTORS OF 306% TO 344% AND KEPT THE PERCENTAGE OF CORD STRENGTH USED UNDER 15%. THE G - FORCES WERE KEPT UNDER 3 G'S AT THE BOTTOM OF THE FIRST STRETCH. SINCE THE BUNGEE LAUNCHER USES STRETCH FACTORS LOWER THAN THOSE USED IN THE STUDY, THE G - FORCE ON THE INITIAL LAUNCH IS LESS THAN 3 G'S ALSO.

THERE IS AN OPTIONAL LAUNCH PLATFORM THAT CAN BE USED IF A STATIC LINE IS BUILT INTO THE BUNGEE CORD. THE OPTIONAL LAUNCH PLATFORM PUTS THE RIDER FIVE FEET UP FROM THE GROUND AND THEREFORE THE CORDS CAN BE BUILT 22 FEET LONG RATHER THAN THE STANDARD 23 FOOT CORDS. THIS WILL MAKE THE STRETCH FACTOR ALMOST THE SAME. SEE THE ILLUSTRATION BELOW.

23 FOOT CORDS
LAUNCH FROM GROUND



22 FOOT CORDS
LAUNCH FROM 5FT PLATFORM



CALIBRATION PAD	STRETCH LENGTH	STRETCH FACTOR
2FT	95.5	315%
4FT	93.5	307%
6FT	91.5	298%

CALIBRATION PAD	STRETCH LENGTH	STRETCH FACTOR
2FT	90.5	311%
4FT	88.5	302%
6FT	86.5	297%

NOTE THE WEEBBING IS INSTALLED IN THE CORD AT 92 FEET LONG WHICH WILL NOT ALLOW THE CORD TO REACH THE GROUND ON FULL STRETCH.

JUMPMASTER QUALIFICATIONS

TRAINEE JUMPMASTER (LEVEL 1)

RESTRICTIONS:

ONLY ALLOWED TO JUMPMASTER UNDER DIRECT SUPERVISION OF A FULLY QUALIFIED JUMPMASTER (LEVEL 2)

REQUIREMENTS:

A) MUST BE OVER 18
B) MUST HAVE OVER 20 PERSONAL LAUNCHES
C) BE OF GOOD CHARACTER, SHOWING CHARACTERISTICS OF:
   CALMNESS UNDER PRESSURE
   ATTENTION TO DETAIL
   CONSISTENCY
   PERSONABILITY
   WILLINGNESS TO LEARN
D) HAVE A BASIC UNDERSTANDING OF THE DYNAMICS OF LAUNCHING
E) HAVE A GOOD WORKING KNOWLEDGE OF THE LAUNCH PROCEDURES
F) HAVE WORKED OVER 20 HOURS AS A JUMP COORDINATOR FITTING HARNESSES AND CONNECTING CORDS

JUMPMASTER CERTIFICATION

QUALIFICATION:

CERTIFIED TO OPERATE A BUNGEE LAUNCHER SITE

REQUIREMENTS:

A) MUST BE OVER 18
B) HAVE OVER 20 PERSONAL LAUNCHES
C) MUST HAVE COMPLETED OVER 40 HOURS AS A TRAINEE JUMPMASTER WITHOUT ANY INCIDENTS
D) MUST BE ABLE TO COMPLETE A RESCUE PRODEDURE
E) MUST HAVE A COMPLETE UNDERSTANDING OF THE TOWER OPERATION AND THE LAUNCH PROCEDURES

NOTE THE JUMPMASTER MAY BE REQUIRED TO HANDLE COMPLETE SITE OPERATIONS INCLUDING PERSONNEL HIRING AND TRAINING, AS WELL AS REVENUE REPORTS AND RECORD KEEPING.

SAMPLE CALIBRATION CHART / (THIS CHART CAN BE USED TO BRING NEW CORDS INTO SERVICE)

	WEIGHT	PAD LENGTH
(10 PLY) YELLOW	70	6'
	75	6'
	80	6'
	85	4'
	90	4'
	95	2'
	100	2'
(12 PLY) GREEN	105	6'
	110	6'
	115	6'
	120	4'
	125	4'
	130	4'
	135	4'
	140	2'
	145	2'
	150	2'
	155	2'
(16 PLY) RED	160	6'
	165	6'
	170	6
	175	6'
	180	4'
	185	4'
	190	4'
	195	2'
	200	2'
	205	2'

	WEIGHT	PAD LENGTH
(20 PLY) BLUE	210'	6'
	215'	6'
	220	6'
	225	4'
	230	4'
	235	4'
	240	2'
	245	2'
(24 PLY) BLACK	250	6'
	255	6'
	260	6'
	265	6'
	270	4'
	275	4'
	280	4'
	285	2'
	290	2'
	295	2'
	300	2'

* NOTE * AS THE CORDS SOFTEN THE CHART WILL CHANGE OVER THE LIFE OF A SET OF CORDS. IT IS NOT UNUSUAL TO CHANGE TWO OR THREE SETTINGS OVER THE CORD LIFE.

DESCRIPTION OF EQUIPMENT - GLOSSARY OF TERMS

BRAIDING OR TIES	-	RUBBER WRAPS ON THE BUNGEE CORD THAT HOLDS THE CORD TOGETHER. 5 STRANDS WIDE
CARIBEANERS	-	LOCKABLE CLIMBING CLIPS. ALL CARIBEANERS HAVE A MINIMUM STRENGTH OF 6000 LBS.
CLIMBING HARNESS	-	STANDARD ROCK CLIMBING HARNESS FOR RESCUE
CORD COLOR	-	WEIGHT RANGE OF CORD IDENTIFIED BY COLOR
CALIBRATION CHART	-	CHART LISTING THE PROPER CORDS AND PADS
DAILY INSPECTION	-	A CHECKLIST OF DAILY EQUIPMENT CHECK
D.S.R.I. REPORT	-	STUDY OF THE PROPERTIES OF THE RUBBER
HARNESS	-	FULL BODY HARNESS USED FOR LAUNCHING
JUMP COORDINATOR	-	ASSISTANT TO THE JUMPMASTER
JUMPMASTER	-	PERSON IN CHARGE OF THE SITE
PLYS OR WRAPS	-	THE NUMBER OF STRIPS OF RUBBER IN A CORD
SPINDLE OR SPOOL	-	THE SPOOL AT THE END THAT HOLDS THE CORD
SPINDLE WEBBING	-	THE WEBBING THROUGH THE SPOOL THAT A CARIBEANER IS ATTATCHED TO
STRAND	-	A SINGLE STRIP OF RUBBER
TAGGING OR LABEL	-	NUMBERS ON THE SPINDLE WEBBING THAT IDENTIFIES THE CORD

THE FOLLOWING RESCUE GEAR IS NEEDED ON SITE:

2 ROPES - 9/16- 150 FT
2 PETZEL DECENDERS
2 SEAT HARNESSES
2 POUCHES WITH : 2 SCISSORS, 2 WEEBINBG LOOPS, 4 CARIBEANERS GLOVES

RESCUE PROCEDURES

IN THE EVENT OF A HOIST FAILURE THERE ARE TWO POSSIBLE RESCUE SENARIOS.

1) THE RIDER IS SUSPENDED AFTER A LAUNCH AND THE HOIST WILL NOT MOVE DOWN AT ALL. IN THIS SITUATION, TWO RESCUERS WILL CLIMB THE TOWERS TO THE 100 FT LEVEL AND CONNECT A DECENDER TO THE TOWER. A ROPE IS SECURED UNDER THE SPINDLE HARNESS KNOTS AND PUT THROUGH THE DECENDER. THE WEBBINGS ARE CUT ABOVE THE KNOTS SO THE CORD IS NOW HELD BY THE ROPES RATHER THAN THE HOIST CABLES. THE RIDER IS THEN SIMPLY DECENDED DOWN SLOWLY.

2) THE HOIST STOPPED WORKING AFTER LOWERING THE RIDER PART WAY DOWN, AND THE SPINDLE HARNESS TO HOIST CABLE CONNECTION IS TOO FAR AWAY TO REACH FROM THE TOWER. THE RESCUERS WILL THEN CLIMB TO A POINT DIRECTLY ABOVE THE CONNECTION POINT AND ATTACH THEIR ROPE TO THE TOWER. THE RESCUERS WILL DECEND DOWN TO THE CONNECTION POINT AND HOOK A CARIBEANER UNDER THE SPINDLE HARNESS KNOTS AND CONNECT THAT CARIBEANER TO THEIR HARNESS CARIBEANER. THEN THE SPINDLE HARNESS WEBBING IS CUT ABOVE THE KNOTS SO THE CORD IS NOW HELD BY THE RESCUER'S ROPE RATHER THAN THE HOIST CABLES. THE RESCUERS SIMPLY DECEND THEMSELVES AND THE RIDER DOWN SLOWLY.

EMERGENCY PLAN

1. Rescue victim if necessary.
2. Stablize victim and assess the condition.
3. Delegate responsiblities to other staff members (ie call 9-1-1 or paramedics, retrieve backboard, etc.)
4. Administer necessary First Aid.
5. Crowd control.
6. Cease operations and close site for major medical emergency or non-compliance for 5F-8.025.
7. Contact necessary authority.

Note: All Thrill Sport staff have been trained and qualified in these prodecures. This Emergency Plan is reviewed by staff during opening procedures.

D. S I. R. R E P O R T

THE FOLLOWING INFORMATION IS A SUMMATION OF THE D.S.I.R. REPORT ON THE PROPERTIES OF THE LATEX RUBBER DURING A BUNGEE JUMP.. THESE TEST RESULTS HAVE BEEN APPLIED IN THE STRETCH FACTORS USED FOR THE BUNGEE LAUNCHER.

CALCULATIONS OF BUNGEE STRETCH

14.5 EXAMPLE 1.

IF THE BUNGEE IS PULLED TIGHT UNDER THE CAGE, THEN THE STRETCH FACTOR FOR A JUMP OF 100 FEET IS DONE AS FOLLOWS:

$$\text{STRETCH FACTOR} = \frac{\text{DISTANCE OF JUMP - LENGTH OF BUNGEE}}{\text{LENGTH OF BUNGEE}}$$

BY SUBSTITUTING IN THE VALUES OF A 22.5 FOOT BUNGEE BEING USED FOR A 100 FOOT JUMP, THE FOLLOWING STRETCH FACTOR OF THE BUNGEE IS:

$$\text{STRETCH FACTOR} = \frac{100 - 22.5}{22.5}$$

$$= \frac{77.5}{22.5}$$

$$= \underline{3.444}$$

14.5 EXAMPLE 2.

IF A LIGHTER JUMPER WANTS TO JUMP 100 FEET HE OR SHE MAY HAVE TO LET OUT SAY 4 FEET OF WEBBING LINE. THE STRETCH FACTOR OF THIS BUNGEE JUMP IS:

$$\text{STRETCH FACTOR} = \frac{100 - 22.5 - 4}{22.5}$$

$$= \frac{73.5}{22.5}$$

$$= \underline{3.26}$$

14.6 EXAMPLE 3.

IF EVEN A LIGHTER JUMPER JUMPED 100 FEET AND NEEDED THE WEBBING LINE OUT SAY 8.5 FEET, THE STRETCH FACTOR WILL BE AS FOLLOWS:

$$\text{STRETCH FACTOR} = \frac{100 - 22.5 - 8.5}{22.5}$$

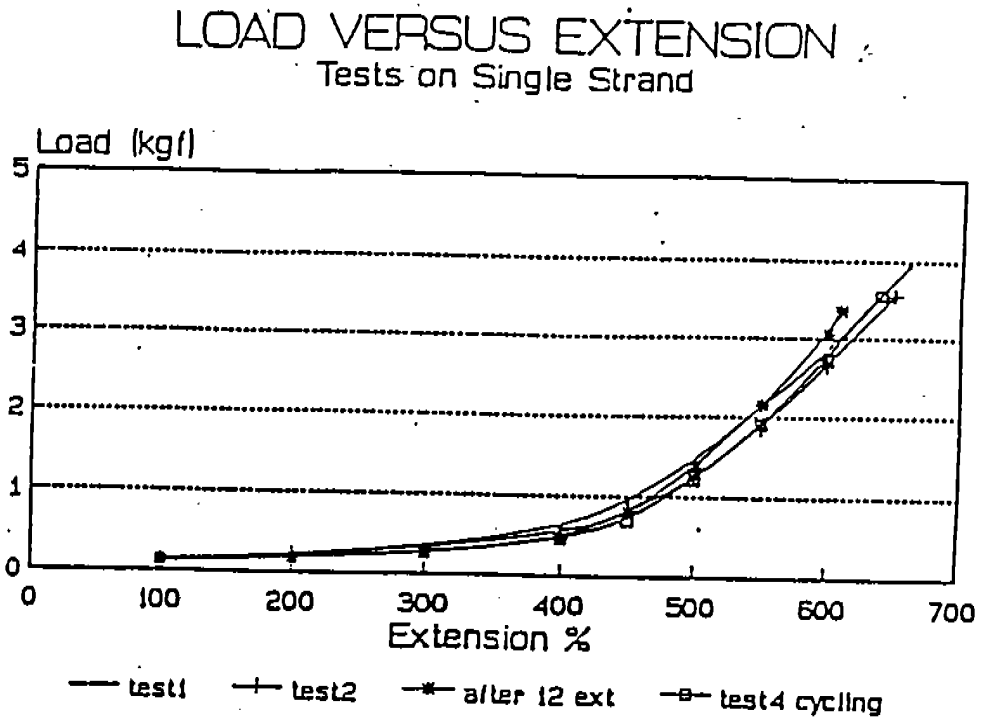
$$= \underline{3.06}$$

DISCUSSION

14.7 THE ONLY SETTING WHERE THE STRETCH FACTOR OF THE BUNGEE IS CLOSE TO 3.5 IS WHEN THE WEBBING LINE IS ON A SETTING OF ZERO.

14.7 YOU CAN SEE FROM THE GRAPH LOAD VERSES EXTENSION THAT IT IS LINEAR UNTIL A STRETCH FACTOR OF 4 1/2 OF 450%. IT THEN CURVES UPWARD AFTER THIS POINT, MEANING THE BUNGEE IS GETTING MUCH STIFFER. THIS IS THE AREA THAT YOU DON'T WANT THE BUNGEE WORKING IN.

14.8 LOAD Vs EXTENSION SINGLE STRAND (DSIR Report Page 5)

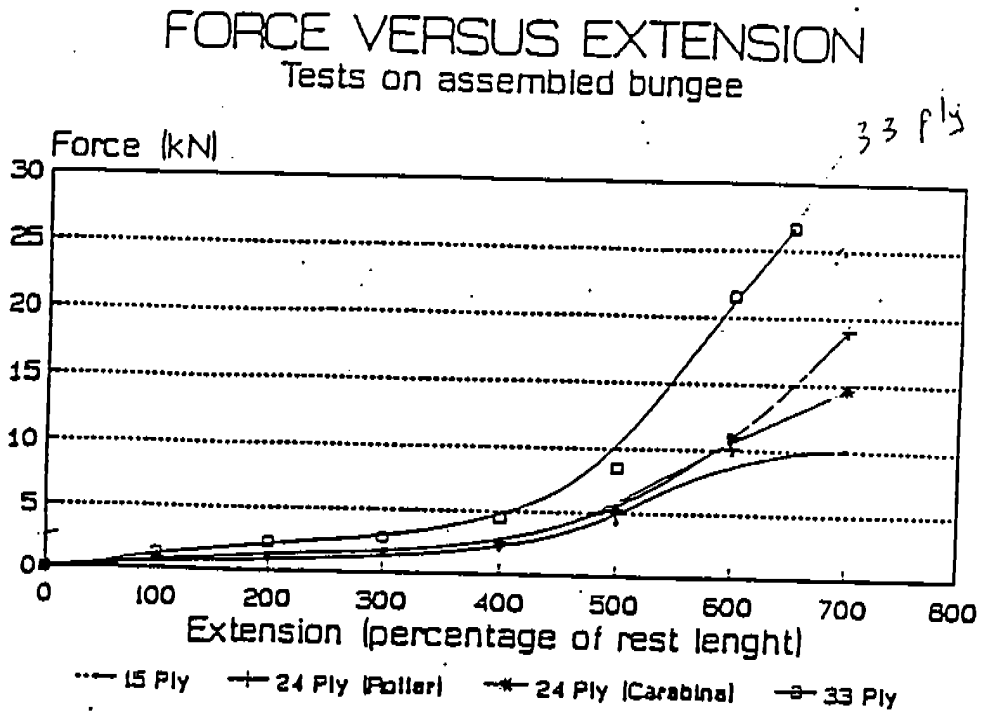


Tested Met Lab 10/09/87

14.9 It can been seen from the graph (see 14.8) that LOAD Vs EXTENSION graph is very linear in a nature until a stretch or extension factor of around 450% ie 4 & 1/2 times. After 450% the bungee becomes much stiffer. This is the reason for limiting the stretch of a bungee cord to a max. of 3.5 times.

14.10 The graph also shows the consistency of the rubber as regard to it's load vs extension characteristics over successive cycles.

14.11 FORCE Vs EXTENSION OF DIFFERENT PLY BUNGEES
(DSIR Report Page 7)



Tests conducted July 87 air temp 13 C

14.12 From the graph (NOTE 14.11), FORCE Vs EXTENSION it can be seen that an assembled bungee displays the same linear characteristics up to an extension of 450% as a single strand does.

14.13 The graph (NOTE 14.11) shows the each bungee was stretched beyond its breaking point. It can be noted that in every case that the breaking point, of all the individual bungees tested, occurred when the stretch of the bungee was in excess of 6 1/2 times, ie 650 %

14.14 The graph (NOTE 14.11) indicates that using a roller/spindle over the use of a thinner carabiner increases the breaking strain of the bungee significantly.

14.13 The breaking strains of the following bungee as shown in graph 14.11 are as follows:

TYPE OF BUNGEE	BREAKING ~~STRAIN~~ STRENGTH	
	Kilograms	lbs.
15 Ply (Carabiner)	1000	2200
24 Ply (Carabiner)	1500	3300
24 Ply (Roller/ Spindle)	1900	4180
32 Ply (Carabiner)	2600	5720

DYNAMIC LOADING

15.1 This is the extra loading caused by the jumpers deceleration and acceleration during a jump.

15.2 From the DSIR Report, Page 12 it can be seen that the max. deceleration recorded by the load cell at the bottom of the first bounce was 2.87 gs. This load cell study was for a jump of around 70 feet , larger jumps have shown that the jumper is subjected to less deceleration and acceleration, although it occurs over a longer period.

15.3 CALCULATION OF A JUMPER'S DYNAMIC LOADING.

Assuming that the jumper is 200 lbs

FORCE EXERTED BY JUMPER OF 200 lbs = 200 + DYNAMIC LOADING

= 200 + (1.87 * 200)

= 200 + 374

= <u>574 lbs</u>

15.4 This means at the bottom of the first bounce of the bungee jump the jumper is experiencing an additional gravity pull (deceleration) of 1.87 gs or a total of 2.87 gs. Some roller coaster rides subject the rider to forces in excess of 4 gs

15.5 SAFETY FACTOR OF A BUNGEE.

Weight of jumper = 200 lbs.

Bungee selection (Section 4.11) = Red / 24 Ply

Breaking ~~strain~~ strength of 24 ply spindle bungee (Section 14.15) = 4180 lbs

Weight plus dynamic loading of jumper (Section 15.3) = 574 lbs

Percentage of strength of bungee used = $\frac{574 \times 100}{4180}$

= 13.7 %

15.6 A 200 lb jumper is the largest weight recommended for a Red / 24 Ply bungee (Section 4.11), even so, the safety factor (breaking strain) of the bungee is over 7 times the weight experienced during the jump.

BUNGEE MAINTENANCE

16.1 Bungees must be closely inspected at least 4 times during a normal working day.

16.2 Talcum powder the ends and spindles of the bungee so that the friction between the rubber strands and also the spindle is reduced. It is not necessary when the bungee is wet. Only talc the bungee when it is dry.

16.3 Handling a bungee carefully and keeping it clean are the the major methods of reducing wear.

BUNGEE RETIREMENT

17.1 A bungee is retired if it has over 400 jumps or when 5% of it's strands are broken, which ever are the smaller number of jumps.

17.2 A bungee must be withdrawn from service if it has been exposed to over 250 hours of sunlight. When a bungee is not in use it must be kept covered.

17.3 If a bungee gets any solvents, accidentally spilt on it, the bungee must be retired.

17.4 A bungee is retired by chopping it up into 3 foot lengths. There is never any chance of the bungee accidentally being put back in service.

P A P E R W O R K

F O R M S

&

R E C O R D S

DAILY BUNGEE OPERATION CHECKLIST

CHECK	MON	TUES	WED	THUR	FRI	SAT	SUN
TOWER ALIGNMENT							
GUY TENSION							
SHACKLES WIRED							
CABLE WEAR							
CABLE CLAMPS							
WINCH BOLTS							
TRIAL LIFT							
LIMIT SWITCH							
CALIBRATION							
RESCUE GEAR							
SAFETY BELTS							
RADIOS							
HARNESSES							
CORDS							
CARIBEANERS							
WHISKER SWITCH							
WIND METER (oft.)							

CLOSING CHECKLIST

CHECK							
DECK CLEARED							
EQUIPMENT SECURE							
WIND METER IN							
KEY OUT/POWER OFF							

NOTES :

WEEKLY INSPECTIONS

THESE ITEMS SHOULD BE CHECKED ONCE A WEEK ON A DESIGNATED DAY. THE INSPECTIONS AND MAINTAINANCE SHALL BE PERFORMED BY KNOWLEDGABLE AND TRAINED PERSONNEL ONLY. IT IS NECESSARY TO CLIMB THE TOWER TO PERFORM SOME OF THIS WORK. PROPER SAFETY BELTS SHALL BE USED AT ALL TIMES WHEN ON THE TOWER. INITIAL AND RECORD ANY MAINTENANCE PERFORMED BELOW EACH ITEM.

1) GREASE SHEAVE WHEELS

_____

2) CHECK ALL SHEAVE BRACKET BOLTS

_____

3) CHECK ALL FLANGE BOLTS

_____

4) VISUAL CHECK OF CROSS MEMBER BOLTS

_____

5) INSPECT ELECTRIC BRAKE FOR ALIGNMENT AND WEAR

_____

6) CHECK RELEASE ANCHOR HARDWARE FOR WEAR

_____

7) CHECK STAIRS AND HANDRAILS FOR TIGHTNESS

_____

8) CHECK AND PERFORM ANY DECK MAINTENANCE

_____

9) INSPECT COMPLETE LENGTH OF CABLES

_____

THRILL SPORT CORD USE LOG

LOCATION_____

OLOR / CORD #	LABEL #	DATE MFG	MFG BY	TYPE OF THREAD	NOTES *

DATE	YELLOW	GREEN	RED	BLUE	BLACK	COMMENTS

DATE________________

THRILL SPORT BUNGEE

DAILY JUMP LOG

JUMP MASTER	CORD	PRINT NAME	SIGN NAME

Daily Cord & Rigging Inspections Log

Date	Insp. #1	#2	#3	#4	#5	Notes.
Time:						
Insp. by:						
Time:						
Insp. by:						
Time:						
Insp. by:						
Time:						
Insp. by:						
Time:						
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Time:						
Insp. by:						
Time:						
Insp. by:						
Time:						
Insp. by:						

	THRILL SPORT BUNGEE		
WEIGHT OF JUMPER	WEBBING LENGTH	WEIGHT OF JUMPER	WEBBING LENGTH
70 75			
80		205	
85		210	
90		215	
95		220	
100		225	
105		230	
110		235	
115		240	
120		245	
125		250	
130		255	
135		260	
140		265	
145		270	
150		275	
155		280	
160		285	
165		290	
170		295	
175		300	
180		305	
185		310	
190		315	
195		320	
200		325	

SPECIFICATION SHEET
FOR BUNGEE ROCKET AMUSEMENT DEVICE

(1) **PROJECTED HEIGHT:** 100' (30.5M) above ground level

(2) **BUNGEE CORD DATA:**

Details of the bungee cords are provided in the operating manual. The cords comply with the requirements of Reference 1, Section 4.3 with the following exceptions.

a) The webbing ends are tied rather than stitched. The cords are built in the field and sewing by machine is not available and hand sewing is not consistent. The knot used to tie the webbing is commonly referred to by the Bungee Jump Industry as a ribbon knot. It is a self tightening non-slip knot.

b) Reference 1 requires the fall arrest system or static line to have a breaking strength of 4000 lb. The three larger cords meet this requirement. However the two smaller cords have two static lines in each having a strength of 500 lb in each line or 1000 lb total per bungee cord. Factors of safety are shown in the following table.

CORD COLOUR	WEIGHT RANGE	BREAKING STRENGTH OF STATIC LINE	LOAD AT BOTTOM OF FALL PER CORD	FACTOR OF SAFETY	LOAD AT TIME OF LAUNCH PER CORD	FACTOR OF SAFETY
YELLOW	70 - 100	1,000	143	7	200	5.0
GREEN	105 - 145	1,000	207	5	290	3.5
RED	150 - 205	4,000	293	14	410	9.8
BLUE	210 - 245	4,000	350	11	490	8.2
BLACK	250 - 300	4,000	429	9	600	6.7

TABLE 1
STATIC LINE FACTORS OF SAFETY

The above factors of safety are calculated as follows.

From the Thrill Sport Manual, the typical acceleration at the bottom of a jump is 2.87g. As there are two cords the force on each will be or 1.43W lb. If the bungee cord were to break at this instant, which is the most likely time for such an occurrence, the fall arrest system would have to resist this force and the FS would be the breaking strength of the static line divided by 1.43W. At the time

of launch, for purposes of calculation of safety factors, the cord tension was increased by 40%.

c) The spool webbing used to attach the bungee cord to the is required to have a strength of two times the ultimate strength of the bungee cord. The spool webbing is 1" tubular nylon having a strength of 4000 lb. (Reference Craig Lindell). The largest cord has a strength of 3520 lb. As the factor of safety is 8.2 and only 5 is required use a value of 3520 x 5/8.2 = 2146 lb. The ratio is 4000/2146 = 1.9 which is close to the required value of 2.

Reference 1, Section 4.3 requires bungee cords to have a factor of safety of 5. Thrill Sport's cords have factors based on 2200/15=1466 lb/ply, (see Operating manual p13, 15 ply cord), as follows.

CORD COLOUR	WEIGHT RANGE	NUMBER OF PLIES	BREAKING STRENGTH BUNGEE CORD	MAXIMUM LOAD AT BOTTOM OF FALL PER CORD	FACTOR OF SAFETY
YELLOW	70 - 100	10	1466	143	10.3
GREEN	105 - 145	12	1760	207	8.5
RED	150 - 205	16	2346	293	8.0
BLUE	210 - 245	20	2933	350	8.4
BLACK	250 - 300	24	3520	429	8.2

TABLE 2
BUNGEE CORD FACTORS OF SAFETY

Retirement of bungee cords is covered in Thrill Sport's Operating Manual. The requirements comply with Reference 1 Section 4.8.1(4).

NOTE: WHEN A BUNGEE CORD IS RETIRED FROM SERVICE FOR ANY REASON, BOTH CORDS MUST BE REPLACED TO ENSURE AN EVEN PULL ON EACH SIDE OF THE RIDER SO THAT THE RIDER IS MAINTAINED ON CENTRE WITHIN +/- 5' OF THE CENTRE LINE OF THE RIDE.

(3) HOISTING EQUIPMENT AND STRUCTURE

The hoisting equipment and structure are shown in Thrill Sports Production Inc.

drawing number 100 sheets 1 to 7 and in Figures 1, 4, and 5 attached. It consists of a tower built from commercially available antenna tower components with a specially constructed arch section at the top. Hoisting is by means of a commercially available drum hoist. The design wind loads are shown in Figure 5 and meet the requirements of the Ontario Building Code.

Name of Manufacturer:Thrill Sports Production Inc.

Year Built:1995

Serial Number: BL100-001

The electric wire rope hoist has a SWL rating of 5,000 lb., (2,275 kg).

There are two (2) 3/8" 6 x 19 IWRC wire rope hoisting cables each having a breaking strength of 13,120 lb. The end of each wire rope has an eye formed using a thimble and two (2) cable clamps.

The electric wire rope hoist is equipped with gear driven limit switches that automatically stop the movement at both the lower and upper terminal points. The hoist control system is designed to slow the hoist prior to the electrical supply to the drive motor being switched off so that the hoist stops smoothly. The hoist system is equipped with a slack rope sensor that, upon detecting slack rope, shuts off the power supply to the hoist. There is only one layer of wire rope on the drum so that an anti-piling sensor is not required.

In addition to the electric wire rope hoist gear driven limit switches, the tower is equipped with an anti-two blocking limit switches on the upper sheaves to prevent over travel in the event that the upper gear driven limit switch fails.

In addition to the tower there is a launch platform constructed from commercial scaffolding approximately 15' square. There shall be no more than two launch personnel and five patrons on the platform at any one time. Spectators are not permitted on the platform.

(4) ATTACHMENT OF PERSON TO BUNGEE CORD

Attachment of the person to the bungee cord is by means of a full body harness. The attachment complies with the requirements of the applicable paragraphs of Reference 1, section 4.2. Details are provided in Figures 2 and 3 and illustrate the required redundancy of the connection.

(5) MINIMUM LAUNCH SITE PERSONNEL:

There are three (3) personnel directly involved in conducting a launch.
(a) Launch Master
(b) Launch Assistant
(c) Electric Wire Rope Hoist Operator

The Launch Assistant also acts as the Retrieval Operator.

(6) WIND SPEED RESTRICTIONS:

Operations are to stop if the cross wind speed exceeds 20 mph or if the fore and aft wind speed exceeds 35 mph at the top of the tower. A cross wind is any wind direction not parallel to the launch direction.

These values and directions are upper limits. Operations shall cease in unusual wind conditions such as gusty and unstable wind directions.

(7) DESIGN CODES AND STANDARDS

In addition to compliance with the Reference 1, (Canadian Bungee Association Code of Safe Practice), the AD complies with:

ELECTRIC WIRE ROPE HOIST:	NEC and CSA Electrical Code AGMA
TOWER:	ANSI/EIA-222-D Antenna Towers
WIRE ROPES:	ANSI Committee of Wire Rope Producers
WELDING:	AWS

(8) CERTIFICATION

8.1 Tower and Hoisting Device are to be certified by an Ontario Professional Engineer on completion of erection at each site.

8.2 Certification of the Bungee Cord is attached.

8.3 Certification of the Body Harness is attached.

(9) SITE LAYOUT

A site layout and general arrangement are shown in Thrill Sports Production Inc. drawing number 100 sheets 1 to 7 and in Figures 1, 4, and 5 attached.A site layout is attached.

(10) OPERATING SPACE

The operating space is shown in Figure 4. It does not comply with the requirements of Reference 1 Section 5.8. The requirements of Reference 1 are for a single bungee cord. The Bungee Rocket has two cords, one on each tower leg, that confine the person to the centre of the tower so there is less chance of moving out of a vertical plane. Further justification for non-compliance is provided in the field test report.

(11) ERECTION AND DISMANTLING INSTRUCTIONS

As the tower is erected by the Manufacturer, there are no specific erection or dismantling instructions provided in this submission. However, it shall be noted that the guy wires are not to be over tightened. Turnbuckles shall be tightened by hand without the use of a cheater bar as tight as possible and then given three full turns using a wrench or cheater bar. Each installation is required to be certified by an Ontario Professional Engineer.

(12) EQUIPMENT AND MAINTENANCE MANUAL

The bungee cord and associated equipment maintenance requirements are included in the Procedures Manual. An inspection and maintenance manual for the tower and associated hoisting equipment is attached.

(13) FIELD TEST REPORT

A field test was conducted prior to operation at Exhibition Place, Toronto. In addition to weight testing, trajectory and off centre movement was investigated. A maximum of 5' movement off centre was used for the acceptance criteria. Riders are not to reach a height of more than 100' so as to maintain a safety zone of 30' above the rider.

(14) REFERENCES

1. Canadian Bungee Association Code of Safe Practice, DRAFT, 4/9/93

SUMMARY OF FACTORS OF SAFETY

The factors of safety for the static line and bungee cords are shown in Table 1 and 2 above. The factors of safety presented below are in some instances based on safe working load and in other instances on breaking strength. Safe working load is generally a load which is not more than 75% of the load that would result in plastic deformation in the structure or component and substantially less than the load that would result in catastrophic failure of the structure or component.

SWL = Safe Working Load

B = Breaking Strength or Collapse Load or Ultimate Strength

FS = Factor of Safety

2-1/2 ton Electric Wire Rope Hoist:

F.S.= 5,000/(2x600) = 4.2 times the SWL (ACCO-Wright)

It is to be expected that commercially available hoist will have a built-in factor of 3 to account for dynamic loading.

Single 3/8" dia. 6x19 Extra Improved Plow Steel IWRC electric hoist wire rope:

B 13,120 lb. (AISI Wire Rope Users Manual)

The bungee cord is stretched to about 600 lb.

FS= 13,120/600 = 21.9 > 10 See Reference 1, Section 4.2.

Calibration Strap

2" tubular webbing

BS = 8000 lb

FS = 8,000/600 = 13 > 10 See Reference 1, Section 4.2.

Main Sheave Axle

ACCO model number 220247M1.

SWL 11,000 lb. (Verbal from Rob Strange, Thrill Sports Productions)

FS = 11,000/600 = 18 times SWL

1" diameter shaft in double shear

SWL = 2 x 0.7854 x 1.0^2 x 10,000 = 15,700 lb

FS = 15,700/600 = 26

Bungee Cord

Factors of safety are shown in Table 2 above.

Static Line

Factors of safety are shown in Table 1 above.

Spool Web

1" Tubular webbing B = 4,000 lb

FS = 4000/600 = 6.7 See Reference 1, Section 4.2.

Karabiners

All karabiners have a minimum breaking strength of 6,500 lb as required by Reference 1. For a total maximum force of 1200 lb, the FS is 5.4. They complies with Reference 1 Section 4.5.1(1),(2), and (4), but not 4.5.1(3) which requires karabiners to have a FS of 10. For this AD, the use of larger karabiners is not practical and an FS of 5.4 in the most highly loaded case is considered adequate and compatible with the bungee cord requirement for a FS of 5.0.

HOIST AND TOWER CERTIFICATION

I, the undersigned, being a Registered Professional Engineer in the Province of Ontario, do hereby certify that to the best of my knowledge and belief the tower and hoisting equipment have been erected and installed in conformance with the specifications contained in the design submission.

CERTIFIED BY:.....

NAME:(print) G.W.S.Gordon

REGISTRATION NO. 16635013

DATE: 18/8/95

HARNESS CERTIFICATION

I, the undersigned, being a Registered Professional Engineer in the Province of Ontario, hereby certify that to the best of my knowledge and belief the Bungee Rocket **Body Harness** shown in Thrill sport Productions Inc. Specification Sheet Figure 2 complies with the requirements of the Canadian Bungee Jumping Association Safe Code of Practice.

CERTIFIED BY:.....

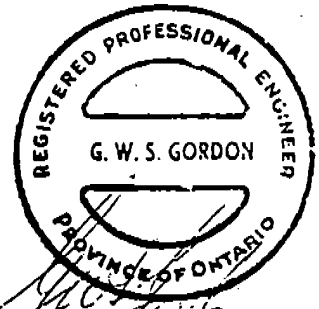
NAME:(print) G.W.S.Gordon

REGISTRATION NO. 16635013

DATE: 16/6/95

BUNGEE CORD

I, the undersigned, being a Registered Professional Engineer in the Province of Ontario, hereby certify that to the best of my knowledge and belief the Bungee Rocket **Bungee Cords** shown in Thrill sport Productions Inc. Procedures manual complies with the requirements of the Canadian Bungee Jumping Association Safe Code of Practice with exceptions described in the Specification Sheet.



CERTIFIED BY:.....

NAME:(print) G.W.S.Gordon

REGISTRATION NO. 16635013

DATE: 18/2/95

BUNGEE ROCKET
FIELD TEST REPORT

This is to certify that the Bungee Rocket successfully under went the following tests.

1. Test launch of a 190 lb rider. The rider was observed to travel in a straight path less than +/- off the centre line of the AD.

2. The upper limit switch on the hoist and tower upper sheave functioned as required, the switch on the hoist stopped the hoist without bottoming out the buffer spring. Similarly the tower upper sheave switch stopped the hoist before bottoming out the buffer spring.

3. A test was conducted to see if the static line would stretch the bungee cord. The test was to simulate a broken bungee cord. Using a 100 lb rated bungee cord, the static line was disconnected from the spool at one end and attached to the hoist cables. The other end attached to a 150 lb weight in the normal manner. The cord was stretched and the static line did not pull out but rather forced the bungee cord to perform as if it had not been disconnected. This is a significant safety feature.

CERTIFIED BY:.....

NAME:(print) G.W.S.Gordon

REGISTRATION NO. 16635013

DATE: .....

BUNGEE ROCKET TOWER AND HOISTING DEVICE
INSPECTION AND MAINTENANCE

1. Inspect the guy wire anchoring for any movement or ground disturbance daily.

2. Inspect the tower legs at the base daily for any movement. Check that the tower stands vertical.

3. Inspect the guy wires and turnbuckles at the lower end of the guy wires daily.

4. Inspect the tower structural members daily. Check members and bolted connections by hoisting a two man inspection team in the basket to the top of the tower.

5. Inspect the connection of the idler sheaves and main sheaves to the tower daily. Inspect the sheave flanges for wear. Grease the sheave bearings once every two weeks.

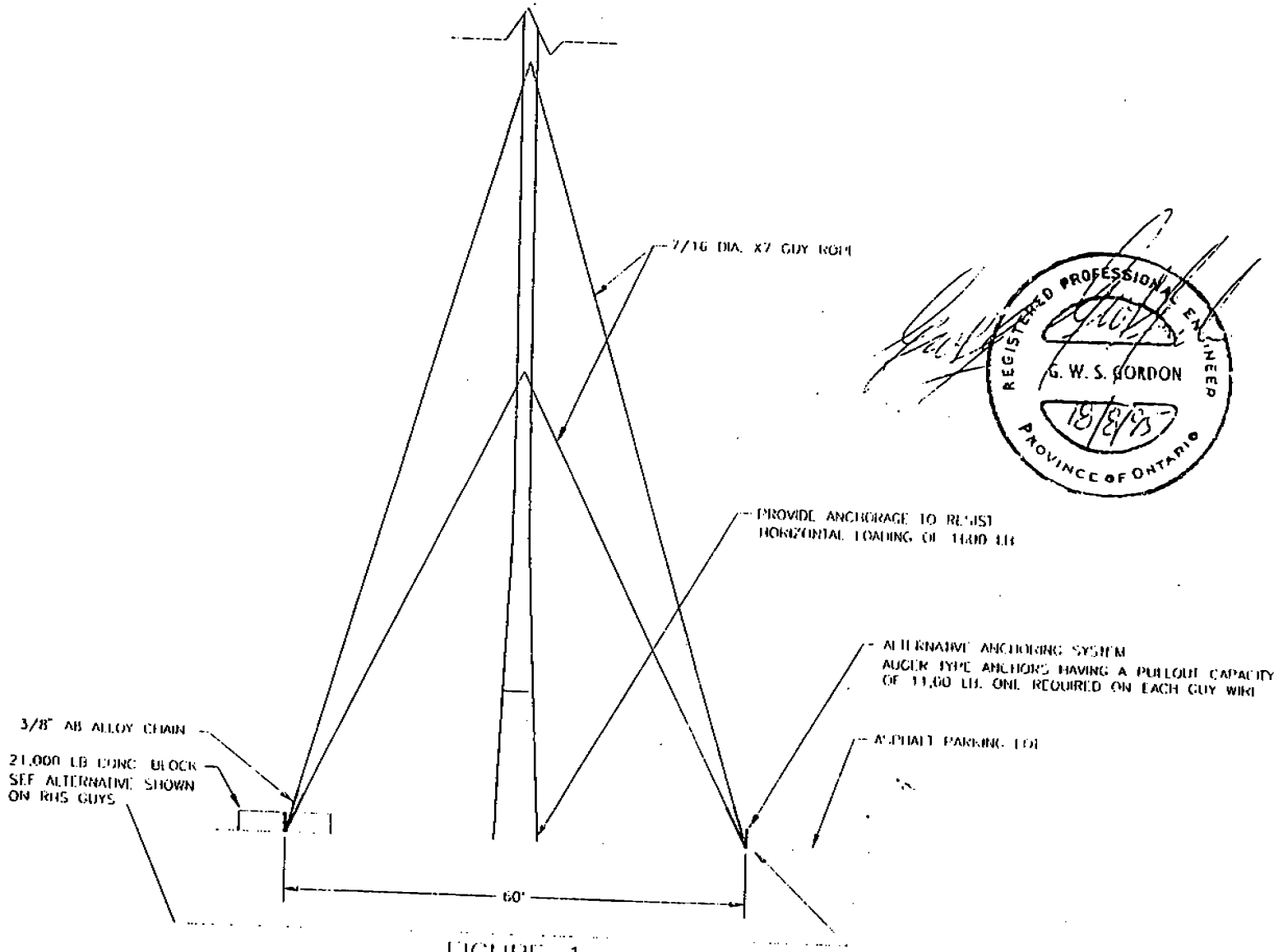
6. Inspect the guy wire connections at the top end of the guys daily. Check to ensure the shackles are moused, (wire locked). Inspect the tower members, (and member attachment), to which the guys are attached.

7. Check the operation of the winch in accordance with the manufacturer's instructions. Details and frequency of inspection and servicing are specified in Wright Inc. document 58975. Daily, check the operation of the upper and lower limit switches and the "anti two block" switch that acts as the backup for the upper limit switch. Check the operation of the pendant dead man switches. Check the function of the key switch. Press the "up" button and while holding the button down, turn the key switch to the off position. The winch should stop immediately. Repeat the process using the "down" button.

8. Check the operation of the slack wire switch daily.

9. Inspect the connection of the wire rope spring to the hoisting cables daily. Check the wire rope clamps for signs of slipping.

10. Insect the hoisting cables daily. Ropes must comply with the requirements of the Amusement Devices Act, paragraph 21.



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G. W. S. GORDON
18/8/93
PROVINCE OF ONTARIO

FIGURE 1

TOWER ANCHOR REQUIREMENTS

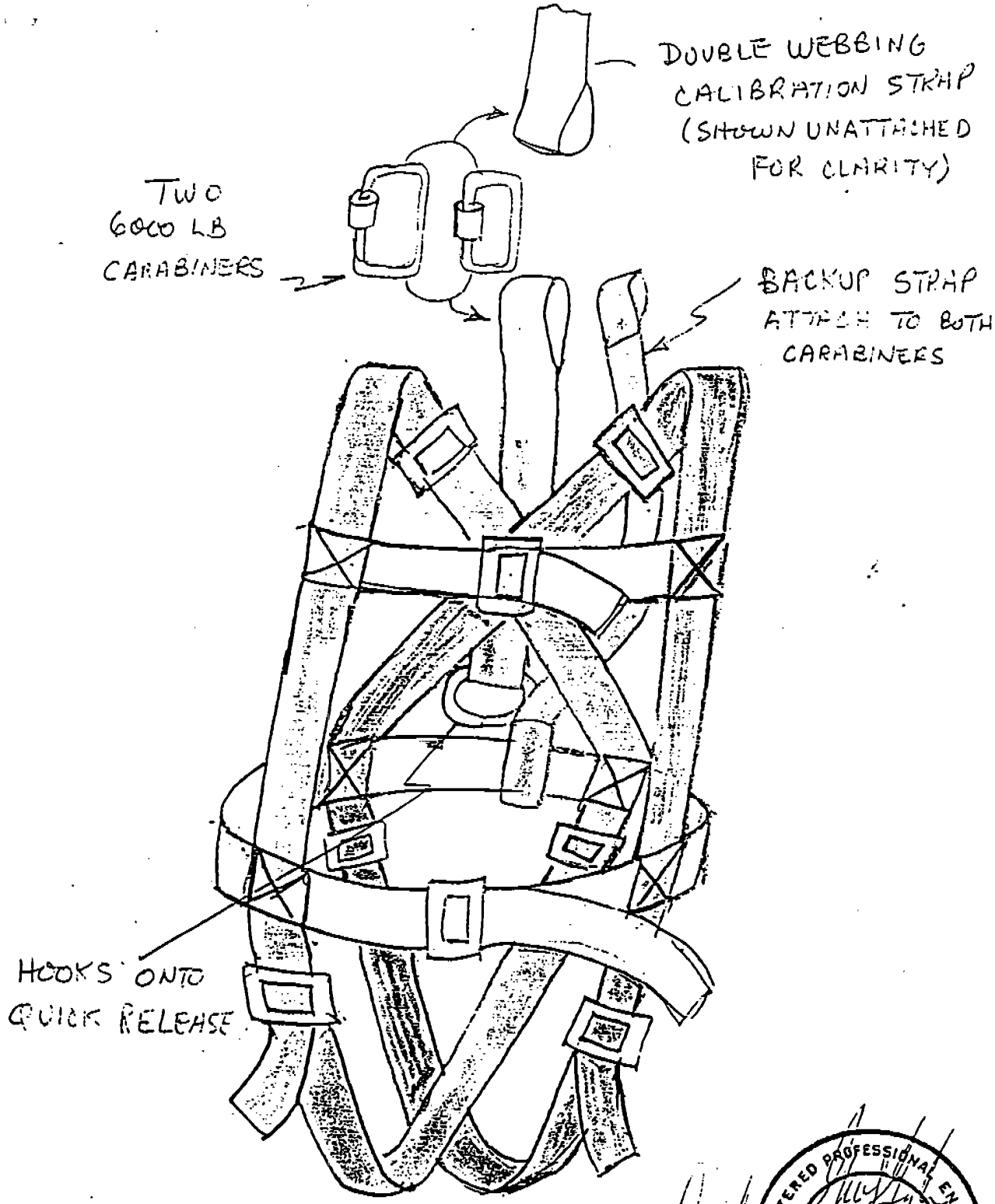

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FIG. 2

BODY HARNESS

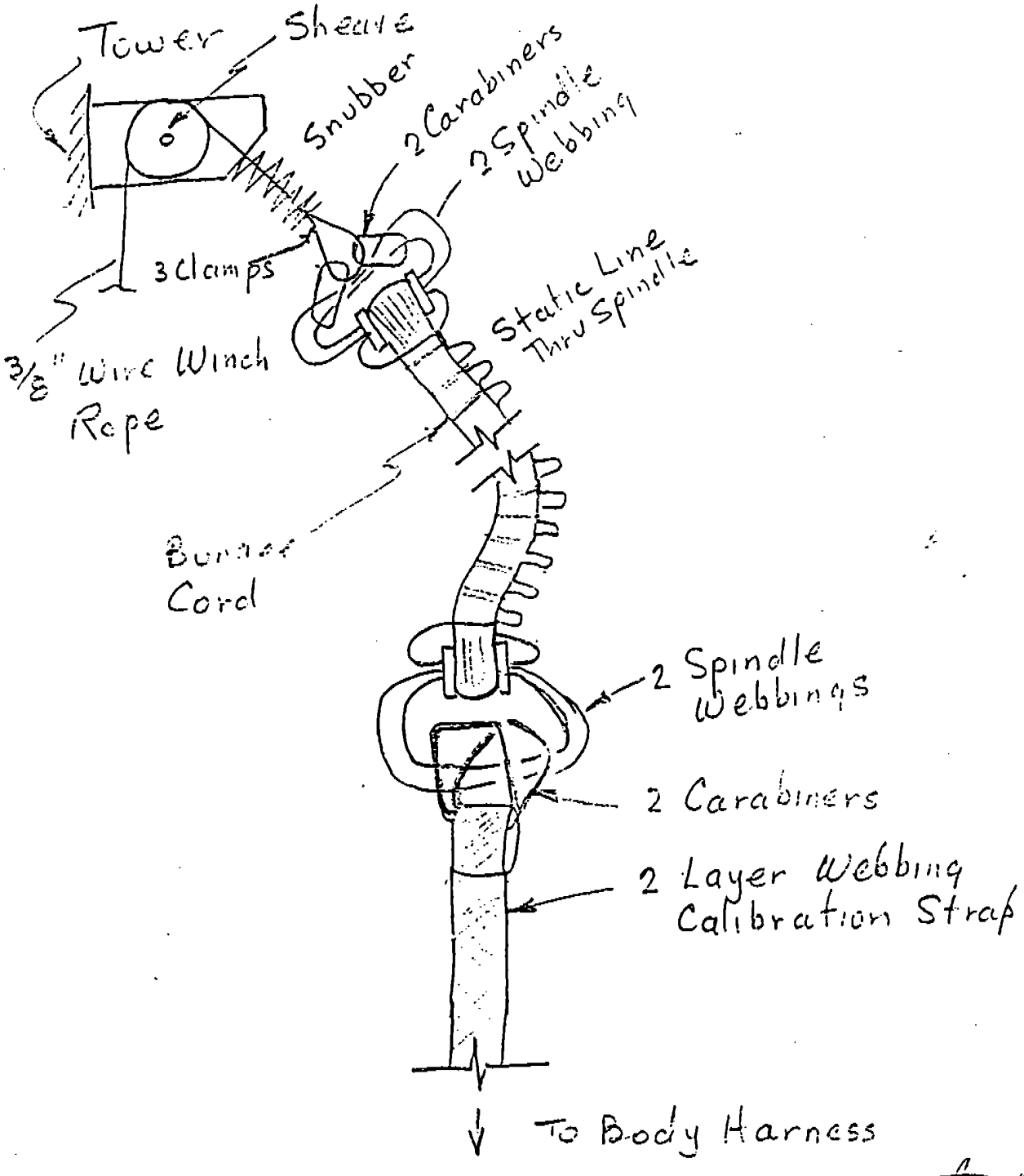

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FIG 3

Connection Of Bungee To Calibration Strap

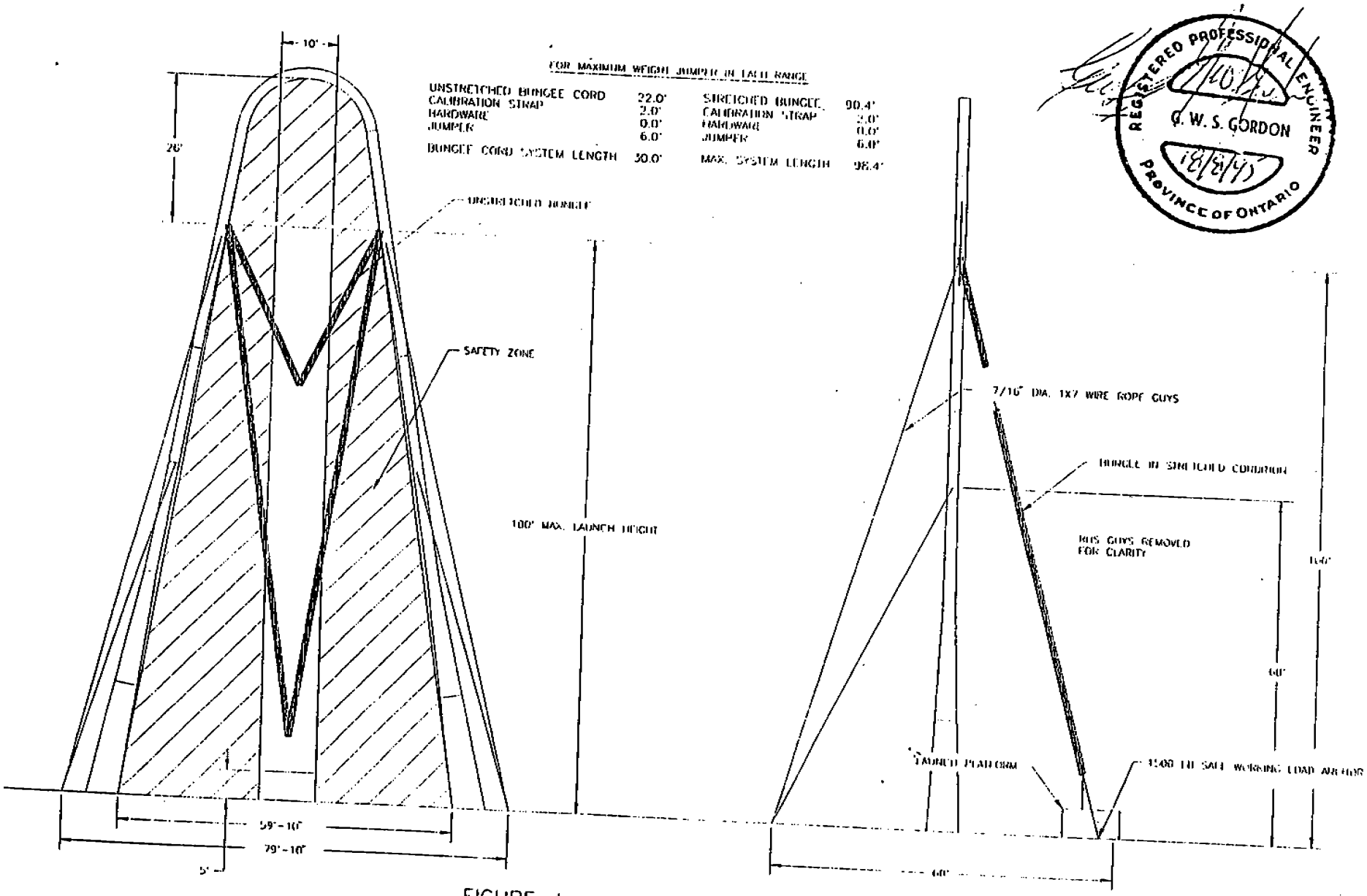

FIGURE 4

SITE LAYOUT AND GENERAL ARRANGEMENT

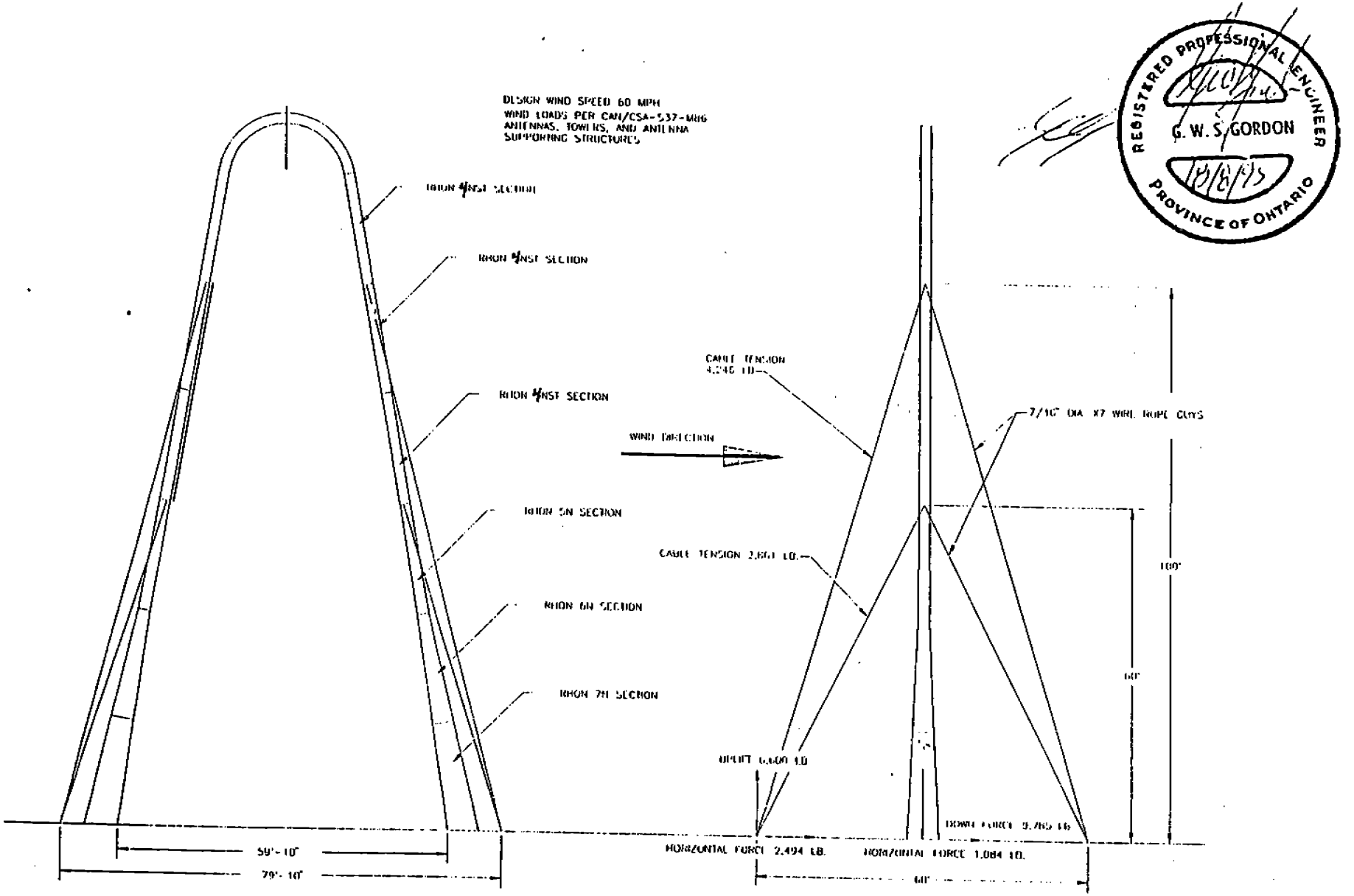

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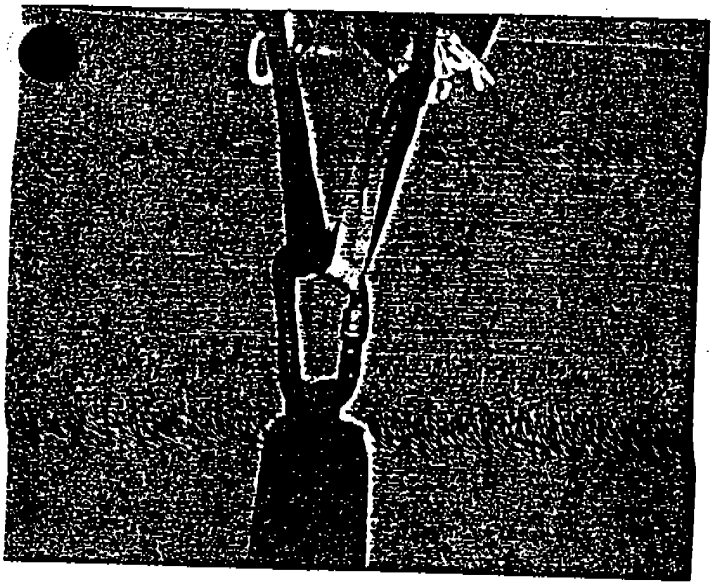
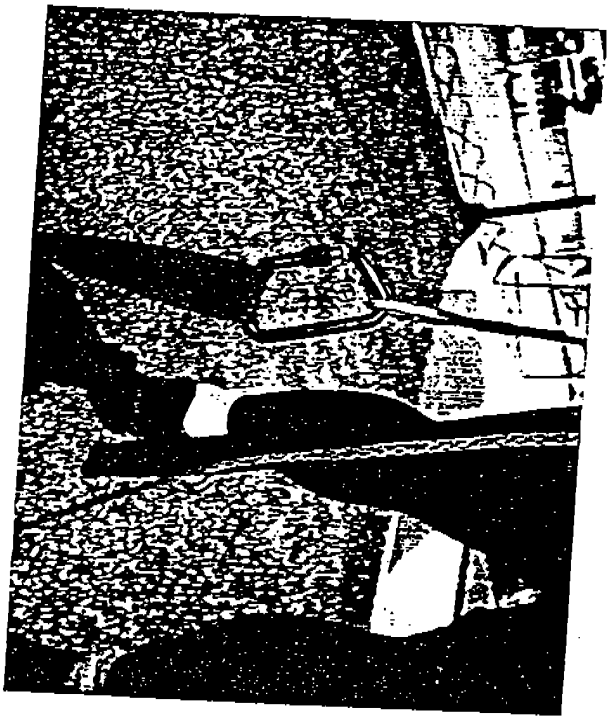
FIGURE 5

TOWER FOUNDATION LOADING FOR 60 MPH WIND LOAD




STAFF


G. W. S. GORDON
18/8/75
PROVINCE OF ONTARIO



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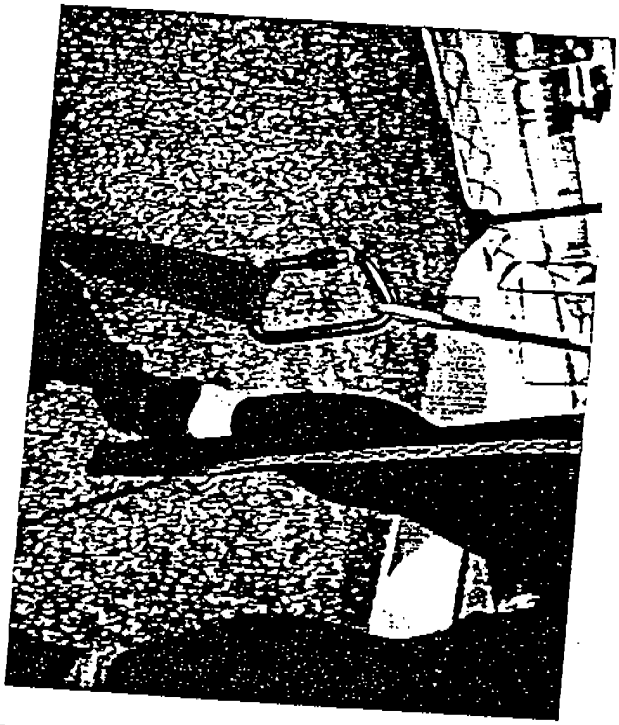

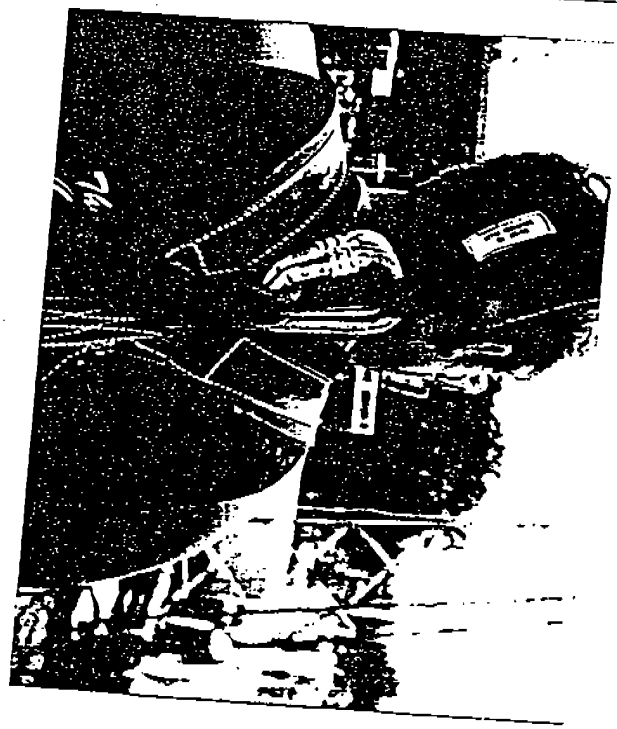

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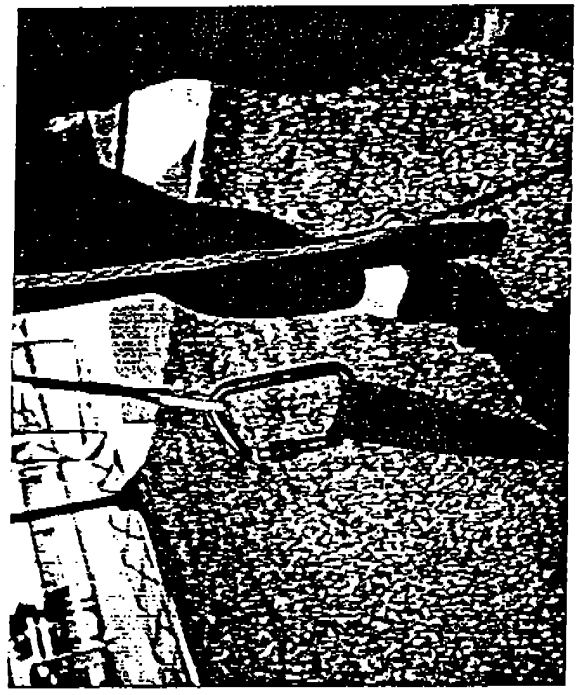

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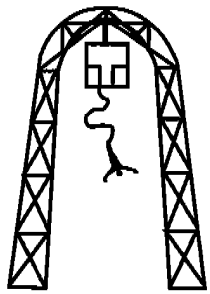

THRILL SPORT PRODUCTIONS

December 4,1995

State of Florida
Dept. of Agriculture
Bureau of Fair Rides
3125 Conner Blvd. Bldg. #4
Tallahassee, FL 32399

Dear Mr. Lowell Parrish,

Here is the basic manual we spoke about as well as information from the Canada engineer. As we discussed, I will adjust the manual to conform with all the Florida regulations once I get the go ahead from your department that you will approve the ride in your state. If that decision can be made before the Christmas holidays I would greatly appreciate it as that will give me one month to make arrangements for the fair in February. You can contact me at the home office in Colorado if you have any further questions.

Thank you for your time. And by the way, as much as it pains me to say this, Congratulations to the Gators in their victory over the Seminoles!

Sincerely,

Craig Lindell

RECEIVED
DEC 12 1995
BUREAU OF
FAIR RIDES INSPECTION

Corporate Office 88 A Elm Street Hopkinton, MA 01748 Tel: (508) 435-0420 Fax: (508) 435-6594
Home Office 2121 N. Frontage Road W. #129 Vail, CO 81657 Tel/Fax: (970) 949-7978