

HANDBOOK & EQUIPMENT GUIDE

External Vibration of

- CAST IN PLACE
- WALLS & COLUMNS
- BRIDGE SECTIONS
- TUNNELS, ETC.

CONCRETE
We're The Vibrator Guys.™

VIBCO

www.VIBCO.com

EXTERNAL VIBRATION

VIBCO has supplied the concrete industry with vibrators since 1962. All VIBCO vibrators are made in the United States and are manufactured following one or more of the over 20 VIBCO patents. Highly educated trained engineers and technicians insure top quality as well as the latest innovations in vibration techniques.

WHY USE EXTERNAL VIBRATION:

ECONOMICAL:

- Equipment cost (over the life of the equipment) and labor cost in operating the equipment are much less than that of internal vibrators.
- The new requirements for stronger concrete and the use of more rebars makes it difficult to use internal vibrators.

SAFE:

- The height of columns and walls makes it difficult to use internal vibrators. They do not reach the bottom, get tangled in with the rebars, damage the form sides and do not move the concrete between the rebars causing honeycombing, voids and weak concrete.

LOW MAINTENANCE:

- External vibrators outlast the internals 1:10. They will give years of trouble free service with a minimum of maintenance, as opposed to the high cost of maintenance for internal vibrators.

SAVES LABOR COST:

- The cost for expensive patching crews is virtually eliminated.
- The rebars help to regenerate the vibration throughout the mix insuring no voids and a strong, homogenous concrete.

The following pages will show VIBCO equipment being used successfully on a variety of walls and columns. VIBCO's application engineers are also available to help you select, size and place vibrators on your form.

NOTE: Page numbers under "Equipment Used" refer to pages in VIBCO's "*Handbook & Equipment Guide to External Concrete Vibration*" catalog.

CAST-IN-PLACE WALL SECTIONS

- PROBLEM:** Wall sections were being cast between precast columns. It was impossible to reach the mix so internal vibrator could not be used.
- SOLUTION:** Model US-1600 electric vibrators were used with wood form brackets (page 10 of Concrete Handbook), 2 x 4 wood planks were placed on the Symons form at 4' intervals and the vibrator was clamped to the wood.
- RESULT:** By using high frequency vibrators, the concrete consolidated properly and an excellent almost architectural surface finish was obtained.



Bracket with vibrator clamped to a 2 x 6.



EQUIPMENT USED:

MODEL US-1600

115 Volt - 1 Phase
5 amps - 9000VPM
Modified

MODEL UC-2 Clamp-On Bracket

(Page 11 & 16 Concrete Handbook)



ALTERNATIVE PNEUMATIC EQUIPMENT:

MODEL CCF-2000 or SVRFS-4000

BRACKET CCFC-3

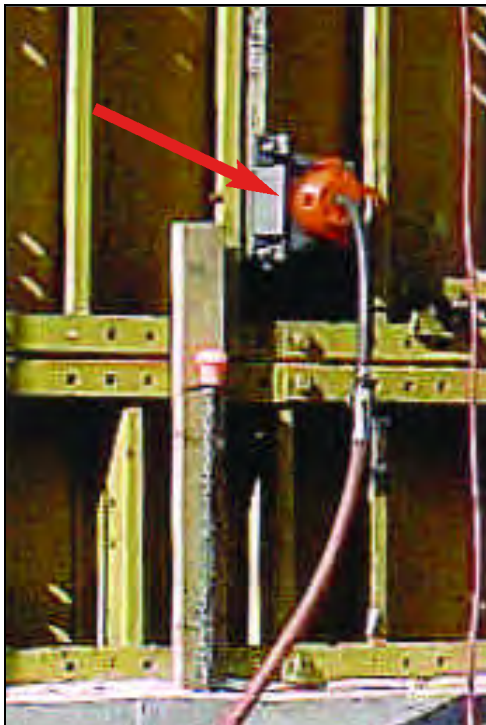
(Page 10 & 14 Concrete Handbook)

WASTE WATER TANKS – LAWRENCE, MA

EFCO-Ready radius forms were used to cast 32' high waste water tanks. The very close steel rebar made it impossible to use internal vibrators. 12 Model SVRFS-4000 VIBCO pneumatic vibrators were staggered on the form starting 2' from the bottom to insure that concrete flowed around rebars. Required density was achieved and contractor saved several days work using external vibrators. 3 tanks were constructed.



Wall section to be cast – notice the tight rebar.



Special vibrator bracket was designed to clamp on to form stiffener.



Close up of vibrator spacing.



EQUIPMENT USED

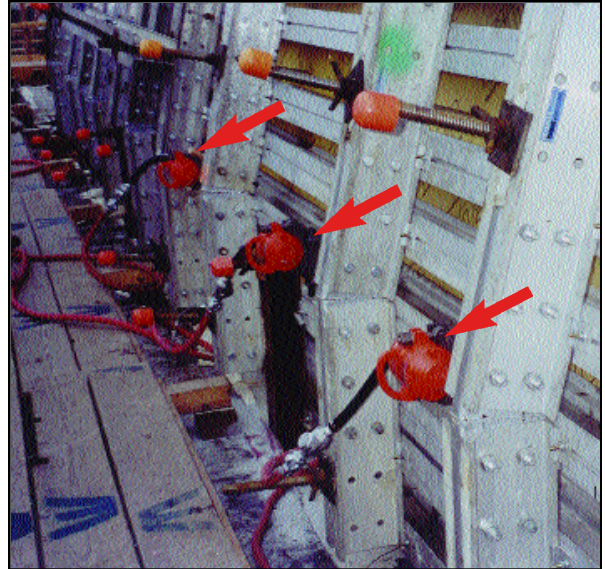
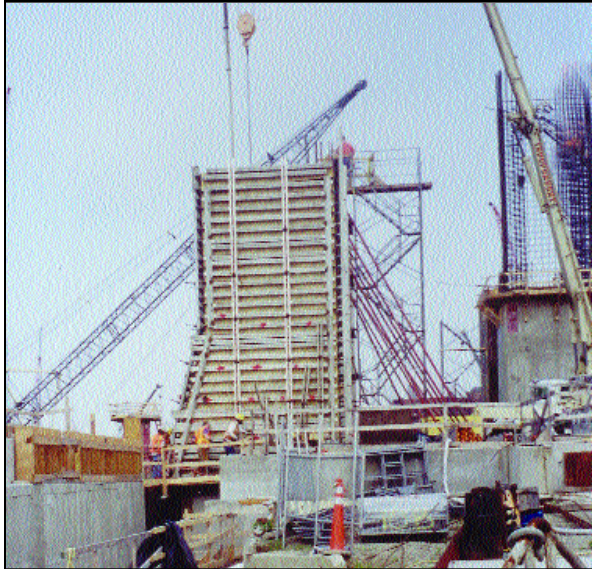
PNEUMATIC:

MODEL SVRFS-4000
(Model CCF-4000 - ALTERNATE EQUIP.)
12000 VPM
40 CFM & 85 dB

(Page 14 Concrete Handbook)

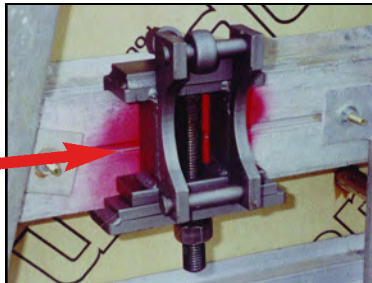
Bracket
specially made by
VIBCO!

THE "BIG DIG" IN BOSTON – MODEL SVRLS-4000 USED ON FORM FOR VENTILATING SHAFT



The exterior walls needed to be as free from blemishes and bug holes as possible. The form was made up of aluminum stiffeners mounted against a plywood face. For a smooth architectural finish Model SVRLS-4000 Pneumatic Vibrator with 15000 vibrations per minute at 100 PSI was recommended. A special bracket was designed to grip the aluminum form stiffeners. Vibrators were placed on 6' centers and 6' between rows. The contractor marked the vibration locations with spray paint prior to the pour to eliminate any confusion where to place vibrators once the pour was started. Vibrators were started when concrete reached the first row and continued until concrete reached the next row of vibrators. These were then started. The finished wall came out better than expected. No patching necessary.

Special Bracket designed by VIBCO with lug-bracket for vibrator allowing vibrator to be moved from bracket to bracket.



EQUIPMENT USED

PNEUMATIC:

MODEL SVRLS-4000
(CCL-4000 ALTERNATE EQUIPMENT)
15000 VPM at 100 PSI
50 CFM & 85 dB
Special Bracket designed by VIBCO

(Page 6 & 14 in Concrete Handbook)

Bracket
Model CCMC-341
specially made by
VIBCO!

LARGE BASEMENT WALL FORMS

- PROBLEM:** Customer was using internal vibrators on wall form causing a lot of voids and blemishes. Customer spent considerable time after each pour patching and rubbing walls.
- SOLUTION:** Model US-1600 with a special clamp-on bracket was placed and staggered on a 4' radius. Procedure was to pour a layer of concrete, vibrate with internal vibrators and then use the external vibrators. Vibrators were powered by 115 volt field generators.
- RESULT:** A void-free wall was obtained with an almost architectural finish. Minimal patching of joints was the only work contractors had to do after the pour.



EQUIPMENT USED

MODEL US-1600
115 Volt - 1 Phase
5 Amps - 9000 VPM



**MODEL USF-3
WOODFORM BRACKET**
(Page 10 & 16 in Concrete Handbook)



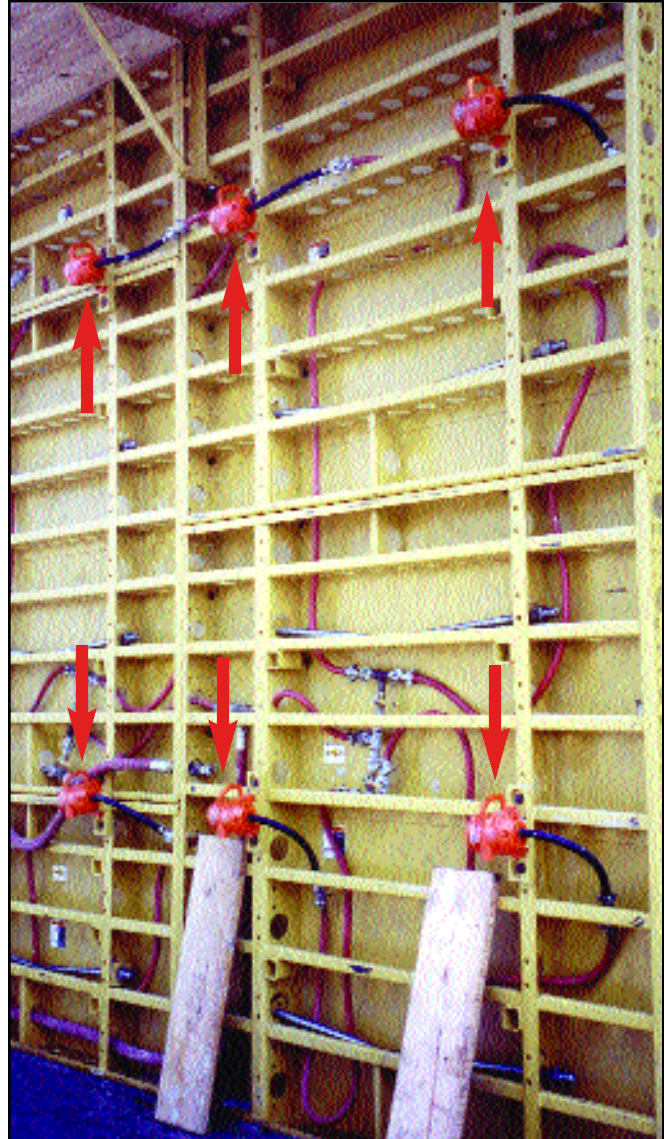
ALTERNATIVE PNEUMATIC EQUIPMENT:

**MODEL CCF-2000 or
SVRFS-4000
BRACKET CCFC-3**

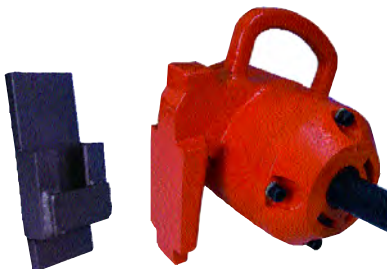


(Page 10 & 14 in Concrete Handbook)

EFCO – 16' HIGH x 12' WIDE WALL FORM



EFCO'S HI-PRO FORM 16' high and two 6' wide wall forms were equipped with 8 Model SVRWS-4000 VIBCO Pneumatic Wedge Type Vibrators. A special bracket was designed by EFCO and VIBCO's engineers. A high capacity concrete pump filled the form in 5 minutes. Due to the fast pour and smooth finish required the vibrators were placed on each vertical stiffener giving additional vibration force to the stiffer form joints. The lower row of vibrators were started when the concrete reached them and continued to vibrate until concrete reached the row of vibrators at 8' high position. These were then started and run until the form was filled and a glistening slick surface appeared. Maximum density was achieved with a glossy, almost architectural finish.



EQUIPMENT USED:

PNEUMATIC SVRWS-4000
12000 VPM
40 CFM & 80 dB

UWF3-HP FEMALE BRACKET

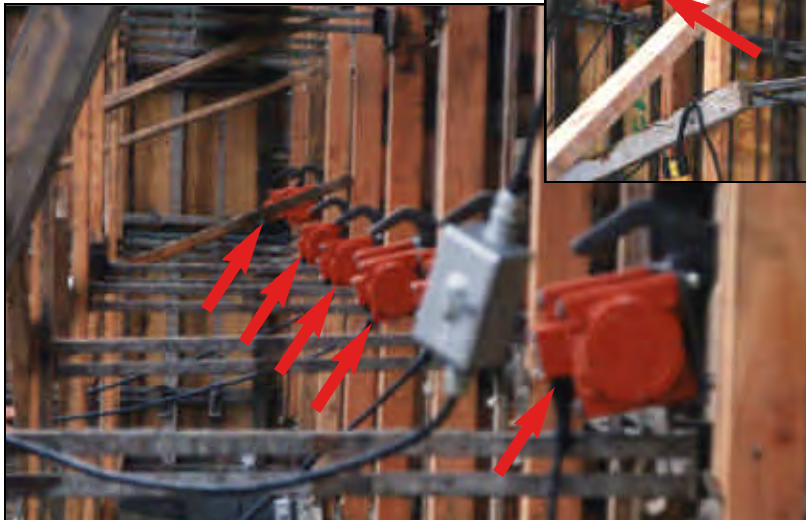
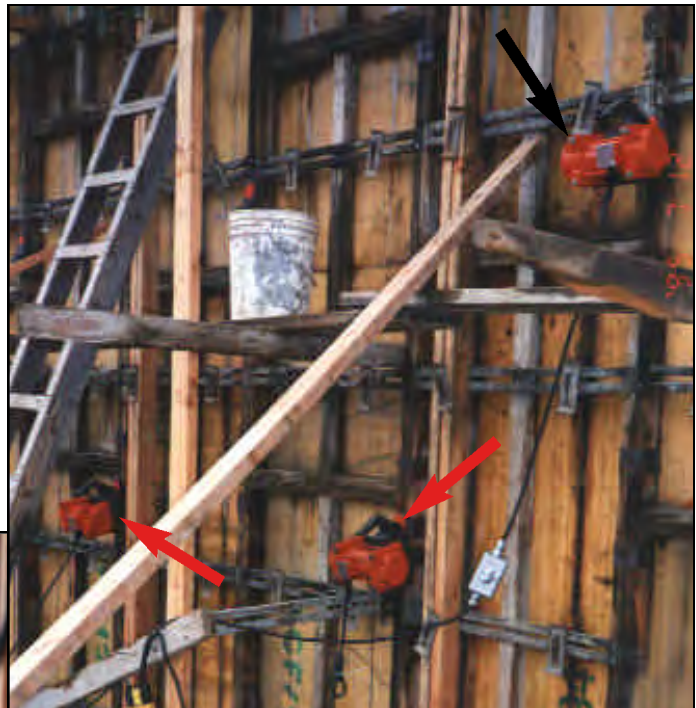
(Page 3 & 14 in Concrete Handbook)

UWF-Bracket was welded onto a flat plate with drilled holes to match existing holes on the form stiffeners for easy removal and repositioning.

IO MODEL US-1600 ELECTRIC VIBRATORS ON 20' HIGH WOODEN FORM SYSTEM

PROBLEM: Workers handling 20' long internal vibrators while standing on ladders became a safety concern. The contractor decided to use external vibrators.

SOLUTION: Working with VIBCO's engineers, a special bracket was designed that could easily be attached and removed from the form when using Model US-1600 vibrators (page 4 of Concrete Handbook). Vibrators were placed 8' apart and staggered on 4' levels. Vibrators were started when concrete reached them and they ran until pour reached next level of vibrators.



COMMENTS: Finish came out perfect. Contractor was very pleased and is now committed to using external vibrators because of safety, ease of handling and product finish.



EQUIPMENT USED:

UWF-1 Bracket
MODEL US-1600
115 Volt - 1 Phase
5 Amps - 9000 VPM

(Page 4, 5 & 16
Concrete Handbook)



ALTERNATIVE PNEUMATIC EQUIPMENT:

**MODEL CCW-2000
or SVRWS-4000**

(Page 3 & 14 Concrete
Handbook)



24 MODEL SVRLS-4000 VIBRATORS ON TALL FORM



PROBLEM: A contractor had a very tall wall where the exposed side had to be blemish free. The rebar spacing was very tight, so it was almost impossible to get an internal vibrator down inside the wall form.

SOLUTION: 24 VIBCO Model SVRLS-4000 combined with specially designed brackets were used. The vibrators were arranged in two rows. The arrangement insured that the pour would not have to stop as the vibrators were moved from row to row. The vibrators were turned on as soon as the concrete reached a vibrator level. Each vibrator on the row continued to operate until the concrete level reached the next row of vibrators. The vibrators were operated only while the concrete was being pumped into the form.

RESULT: The finished concrete had a smooth, void free surface, and the need for touchup was virtually eliminated. Using the external vibrators freed up several men because they did not have to wrestle with the long shaft that was needed for an internal vibrator. Another issue eliminated was the safety factor. Nobody needed to climb up on top of the form to insert a vibrator.



EQUIPMENT USED:
SVRLS-4000

(Page 6 & 14 in
Concrete Handbook)

**SPECIAL BRACKET
CCFF-1 was made
to fit form**

**ALTERNATIVE PNEUMATIC
EQUIPMENT:**

4PL-1600
115/230 Volt
1 Phase 5/2-5A
9000 VPM
(3 Phase Available)

(Page 6 & 16 in Concrete Handbook)



MODEL SVRFS-4000 PNEUMATIC VIBRATORS ON COLUMN FOR BRIDGE BETWEEN SOMERSET & FALL RIVER, MA



Columns had a large amount of rebar. The first pour with internal vibrators came out with large voids and honeycombs. Model SVRFS-4000 high frequency Pneumatic Vibrators were recommended instead of internals. The same portable bracket that was designed for the EFCO-Forms (page 11) was used and straddled 2 form stiffeners. The vibrators were easily moved up the form as the pour progressed. Vibrators were placed on 6' centers around form and next row 6' higher. Vibrating procedure and time followed instructions on page 14. The honeycombs disappeared, the finish was excellent without any need for patching.



**Vibrators placed on 6' centers around form.
Next higher row 6' up.**



**Special Bracket straddling two
form stiffeners.**



EQUIPMENT USED
PNEUMATIC:
MODEL SVRFS-4000
(CCF-4000 ALTERNATE EQUIPMENT)
11500 VPM at 80 PSI
40 CFM & 80 dB

(Page 14 in Concrete Handbook)

Bracket
Model CCEC-3
specially made by
VIBCO!

HUGE STATE UNIVERSITY RESEARCH LAB: 150+ COLUMNS BUILT



PROBLEM: To ensure placement of dense concrete with architectural finish in 24" square x 28 foot tall supporting piers.

EQUIPMENT: Concrete supplied by transit-mix truck, to be placed into Symons forms. VIBCO US-1600 Electric External Vibrators fitted with bolt-on brackets. Power available: 115 volt AC from field generators.

SOLUTION: The Symons forms had angle L-iron stiffening frames to which US-1600 bolt-on adapters could be attached. Vibrators mounted to forms in a staggered manner on opposite sides at the 2', 7', 12', 17', 22', and 27' levels. They were operated in succession for about one minute each until concrete reached about 6" above each vibrator. Vibrators were moved to next higher position as pour progressed.

RESULT: No honeycombs! No unsightly holes! No patching up! A good-looking job done quickly and efficiently!

CONTRACTOR COMMENT: The best equipment purchase they ever made!



ELECTRIC EQUIPMENT:

MODEL US-1600

115 Volt - 1 Phase
5 amps - 9000 VPM

MODEL UC-2 Clamp-On Bracket

(Page 11 & 16 in Concrete Handbook)

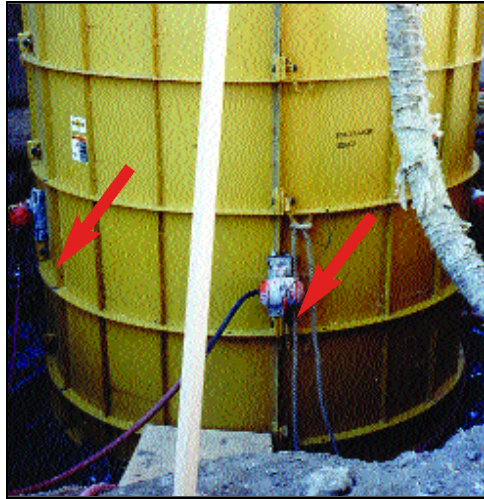


ALTERNATIVE PNEUMATIC EQUIPMENT:

MODEL CCF-2000 or SVRFS-4000

CCFC-3 Clamp-On Bracket
(Page 11 & 14 in Concrete Handbook)

ROUND & SQUARE COLUMN FOR BRIDGE SUPPORTS



**EQUIPMENT USED
PNEUMATIC:**

MODEL SVRFS-4000

11500 VPM at 80 PSI
40 CFM & 80 dB

**CCFC-3 CLAMP-ON
BRACKET**

(Page 11 & 14 in Concrete Handbook)



BRIDGEPORT, CT: A round column form was used for casting support columns for elevated highway thru Bridgeport, Connecticut. Internal vibrators could not be used due to closeness of high tension electrical wires, and close spacing of rebar. VIBCO's Model SVRFS-4000 Pneumatic Vibrators were used with clamp-on brackets. They were placed on 4' centers around the form. Next row 4' up and 45° off first row. Vibrators were started when concrete reached them and continued to vibrate until concrete reached next row. These were then started and the lower row vibrators were moved to next higher position.

Contractor was excited about the ease of using external vibrators and the finish achieved. In his own words: "The column looks just like marble, no patching was necessary."

PROVIDENCE, RI:

JOB SITE: Square bridge support, Providence, RI junction of Rt. 95 & 195

PROBLEM: The rebar spacing was so close internal vibrators could not be used, plus a form liner also reduced the space.

SOLUTION: Four VIBCO Model US-1600 electric vibrators were used in two rows. First row of 2 vibrators 180° apart at 2-1/2' from bottom. Next row 90° from first and 7-1/2' up. First row of vibrators was started when pour reached them and kept running until pour reached next row which was then started. First row was then moved 10' up form. This continued until column was complete. At end of pour top row of vibrators was run until no more air bubbles surfaced and a glossy slick surface appeared.

RESULT: The finish result was beyond expectations. Surface finish was extremely smooth and without blemishes.



EQUIPMENT USED

MODEL US-1600

115 Volt - 1 Phase
5 Amps - 9000 VPM

**MODEL USF-3
WOODFORM BRACKET**

(Page 11 & 16 in Concrete Handbook)



EFCO-FORMS with MODEL SVRLS-4000 HIGH FREQUENCY VIBRATORS – RTE 95 IN CONNECTICUT

JOB SITE: Renovation of bridge columns on Rt. 95 Conn.

PROBLEM: Internal vibrators would not reach bottom of column due to rebar.

SOLUTION: Model SVRLS-4000 (page 6 of Concrete Handbook) was recommended. VIBCO designed a special bracket to be attached to the EFCO form and fit between two horizontal stiffeners. When loosening the clamping bolts it could be removed and moved up as the pour progressed. A total of 8 vibrators were used – one on each side. Vibrators were started when the concrete reached them and continued until it reached the next group of vibrators 6' up. They were then stopped and moved 6' above top row of vibrators. Vibration time approx. 5 min. Concrete was trucked in from local ready mixed plant. (6" slump)

RESULT: Columns came out perfect. The customers word was - "They look just like marble..."



EQUIPMENT USED

PNEUMATIC:

MODEL SVRLS-4000

12000 VPM
40 CFM & 85 dB

(Page 6& 14 in Concrete Handbook)

ALTERNATIVE

PNEUMATIC

EQUIPMENT:

CCL-4000

6000 VPM
35 CFM & 78 dB

Bracket
Model CCEC-3
specially made by

VIBCO!

LARGE APARTMENT COMPLEX

PROBLEM:

Rebar made it difficult to use internal vibrators and the form was too tall for internal vibrators to reach bottom. The columns came out with large voids and unvibrated surfaces.

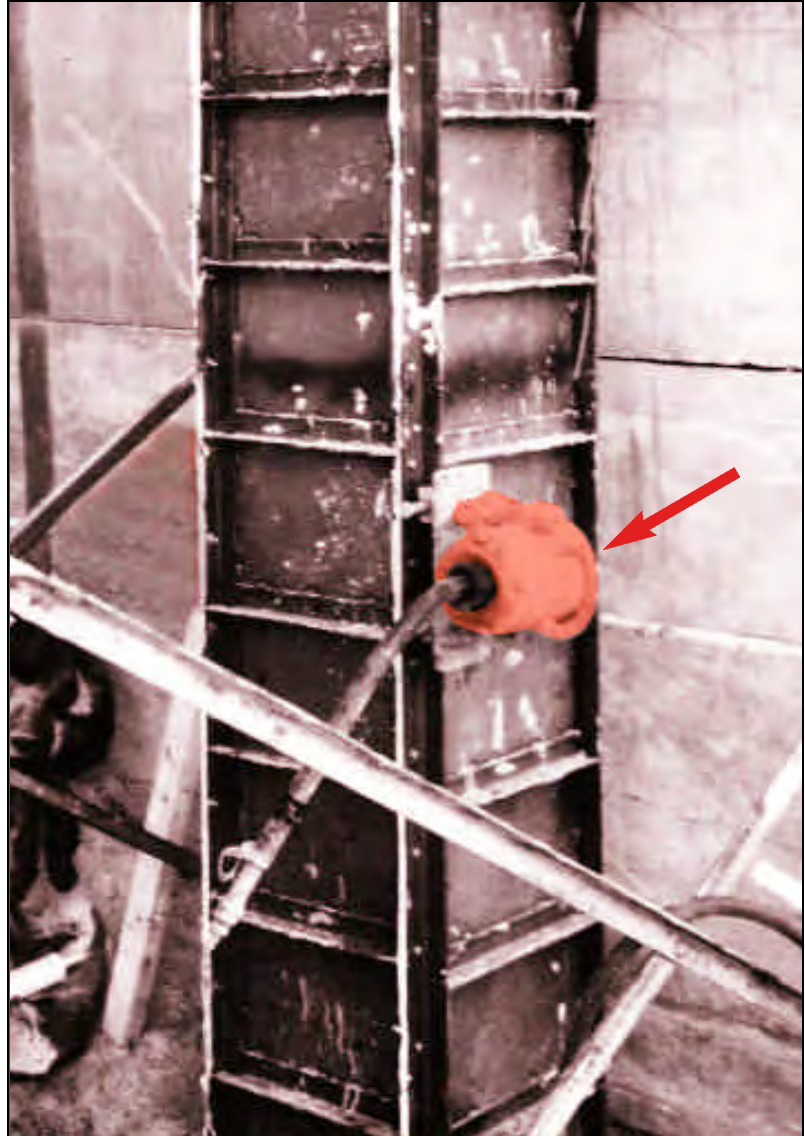
SOLUTION:

Contractor had large compressor on job site and 2 Pneumatic Model SVRLS 4000 High Frequency Vibrators mounted on a clamp-on bracket with a lug bracket were recommended (Page 6 of Concrete Handbook).

The lug-bracket was chosen so the contractor could move the vibrators to other permanently mounted lug brackets on his wall forms. Vibrators were mounted 2' from bottom and 7' from bottom then moved 5' each time. Vibrators were started when concrete reached them and stopped when concrete reached the opposite higher vibrator, which then was started.

RESULT:

Excellent surface finish was achieved without any rework needed. Concrete completely consolidated.



EQUIPMENT USED

PNEUMATIC:

MODEL SVRLS-4000

12000 VPM
40 CFM & 80 dB
with Clamp-On Bracket

(Page 6 & 14 in Concrete Handbook)



ALTERNATIVE

ELECTRIC

EQUIPMENT:

MODEL US-1600

115 Volt - 1 Phase
5 amps - 9000 VPM

**MODEL UC-2
Clamp-On Bracket**

(Page 11 & 16 in Concrete Handbook)

BRIDGE SECTIONS CAST IN PLACE RTE. 95, BALDWIN BRIDGE BRIDGE OVER CONNECTICUT RIVER



BRIDGE SECTIONS CAST ON SITE

PROBLEM: Bridge sections were being cast in place on site at a bridge replacement construction site on Interstate 95 (crossing the Connecticut River) in Connecticut. They were having problems with blemishes, imperfections and honeycombing throughout the finished product.

VIBCO Model SVRF vibrators were selected to eliminate the finishing problem. The concrete was pumped into steel forms where a matrix of rebar was placed. The mix was a 3" slump.

SOLUTION: Five Model SVRF-5500 High Frequency Vibrators were installed on each bridge section form. They totally eliminated the honeycombing and imperfections. The vibrators were operated with 90 PSI air. (See page 14 in Concrete Handbook.)



EQUIPMENT USE PNEUMATIC:

MODEL SVRF-5500
9000 VPM AT 80 PSI
56 CFM - 98 dB

(Page 14 in Concrete Handbook)



ALTERNATIVE PNEUMATIC EQUIPMENT:

MODEL CCF-5000
7000 VPM AT 80 PSI
50 CFM - 78 dB

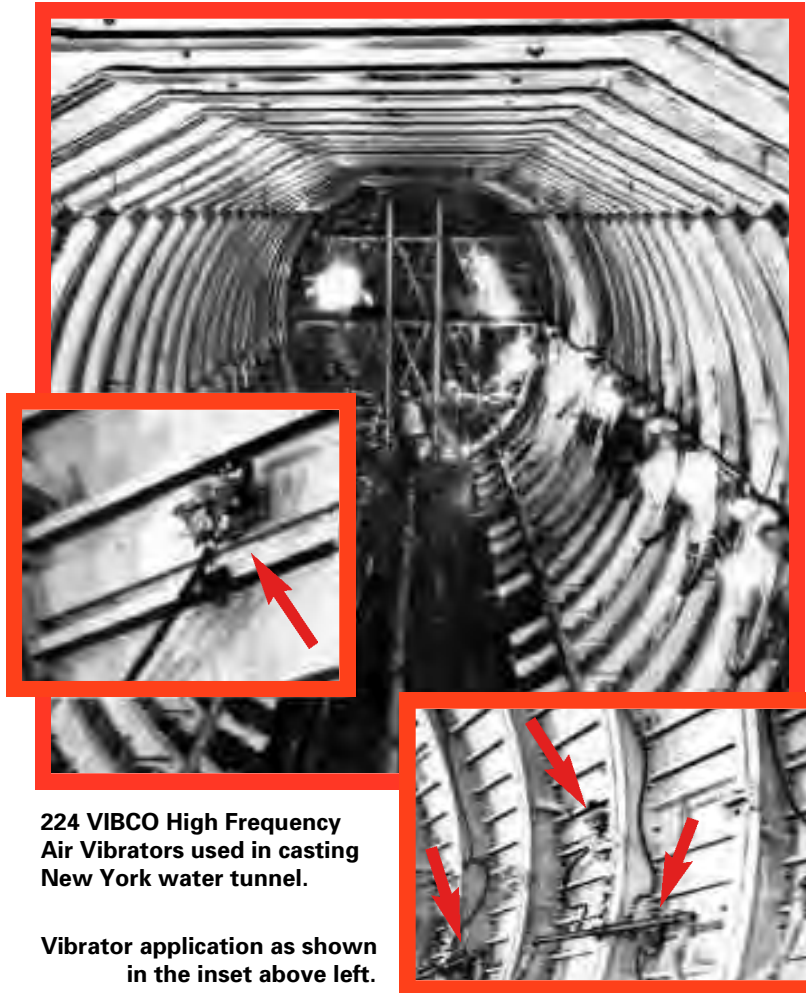
(Page 14 in Concrete Handbook)

13.2 MILE LONG CONCRETE WATER TUNNEL PROJECT USES VIBCO'S HIGH FREQUENCY AIR VIBRATORS

VIBCO'S MODEL SVRF-5500 GETS THE JOB DONE.

224 VIBCO Model SVRF-5500 High Frequency Vibrators, were used on the steel form for casting the New York City water tunnel #3. Each 40' steel form section contained 28 VIBCO vibrators. Lining operations were carried on in a 24 hour, five day work schedule. An average of 700 yards a day were placed. VIBCO High Frequency Air Vibrators create 5000 lbs. of force at 80 PSI of pressure. They are bearingless, and the unique air chambers and spring steel wear plates make the unit virtually maintenance free. Ask for free descriptive literature. Other places the VIBCO air vibrators were used are the sewage tunnel around Chicago, New York and the Boston subway tunnels.

VIBCO engineers, with their decades of experience on many successful tunnel jobs will, at no charge, figure out how many vibrators to use on your form, where and how to place them, locate manifolds and size them, figure air consumption, lubricators needed, vibration sequence, etc.



**224 VIBCO High Frequency
Air Vibrators used in casting
New York water tunnel.**

**Vibrator application as shown
in the inset above left.**



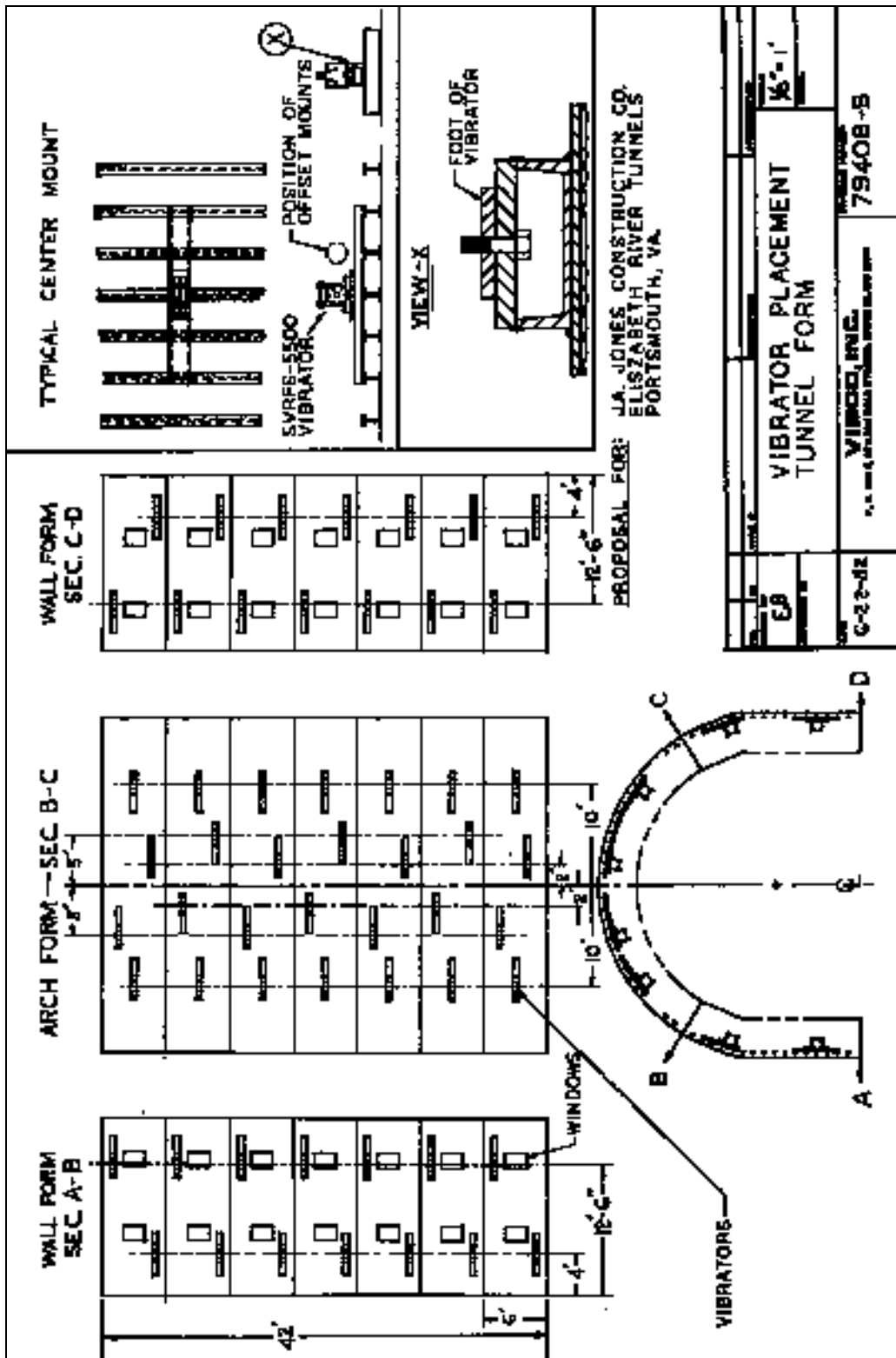
EQUIPMENT:
MODEL SVRF-5500
9000 VPM AT 80 PSI
56 CFM - 98 dB

(Page 14 in Concrete Handbook)



EQUIPMENT:
MODEL CCF-5000
7000 VPM AT 80 PSI
50 CFM - 78 dB

(Page 14 in Concrete Handbook)



General Rules for Selecting, Sizing and Placing External Vibrators

For the successful use of external vibrators you must determine:

- 1. VIBRATION PENETRATION**
- 2. EFFECTIVE VIBRATION AREA**
- 3. SIZING AND PLACING OF VIBRATORS**
- 4. VIBRATION PROCEDURE & VIBRATION TIME**

1. VIBRATION PENETRATION: As a general rule, when the thickness of the concrete in the form exceeds 6 inches, use vibrators (staggered) on both sides of the form. In columns the reinforcement steel will aid in vibration transfer to the center of the column.

2. EFFECTIVE VIBRATION AREA: Vibration waves are strongest at the vibrator and diminish as they move away in a circular pattern (like the waves when a stone is thrown into water) Reaching a 3-5 foot radius. Generally figure a 3 foot radius from the vibrator as an effective vibration area. Some of the vibration will travel to a 5 foot radius. At the 5 foot radius the vibration from the next vibrator should overlap the first.

3. SIZING AND PLACING OF VIBRATORS

(A) SIZING: There are many ways to select and size vibrators. We list the most commonly used ones below. (For other selections consult a VIBCO applications engineer.)

ELECTRIC VIBRATORS:

Model US-900: 115 volt single phase - 4.5 amps
10,000 vibrations per minute

Model US-1600: 115 volt single phase - 5 amps
9,000 vibrations per minute

(Both can be run off field generators.)

PNEUMATIC VIBRATORS:

**Model CCF, CCW
or CCL-2000:** 80-100 PSI - 40 CFM
6,000 vibrations per minute

**Model CCF, CCW
or CCL-4000:** 80-100 PSI - 45 CFM
7,000 vibrations per minute

GENERAL RULES FOR SELECTING, SIZING & PLACING EXTERNAL VIBRATORS, cont'd.

3 SIZING AND PLACING OF VIBRATORS (cont'd.)

PNEUMATIC VIBRATORS cont'd:

Model SVRLS,	80-100 PSI - 40-50 CFM
SVRFS-4000,	11,500 to 15,000 vibrations per minute
SVRWS-4000	(For architectural finish)
CCF, CCL-5000 & 7000:	

COMPARABLE VIBRATORS:

US-900 & CCF, CCL, CCW-2000's: Used on smaller forms for low production with effective vibration area of 2.5 to 3' radius

US 1600 & CCF, CCL, CCW-4000's & SVRL, SVRF, SVRW-4000: Used on high production, larger forms with an effective vibration area of 3' plus.

(B) PLACING OF VIBRATORS:

STEP 1. For walls, make a dimensional drawing of the form, if 6 inch thick concrete, draw up front only. If over 6 inches, make a drawing of both sides (see *Figure 1 A & B*). For columns, make a drawing of all 4 sides (see *Figure 2 A & B*).

STEP 2. Draw in circles of 3' radius and 5' radius. The 5' radius should overlap, one circle for each vibrator position. (see *Figure 2 A & B*)

TIP: A good idea is to start first row of vibrators 2' up from the bottom of the form. Since all the form weight rests here, some of the vibration will also travel under the form.

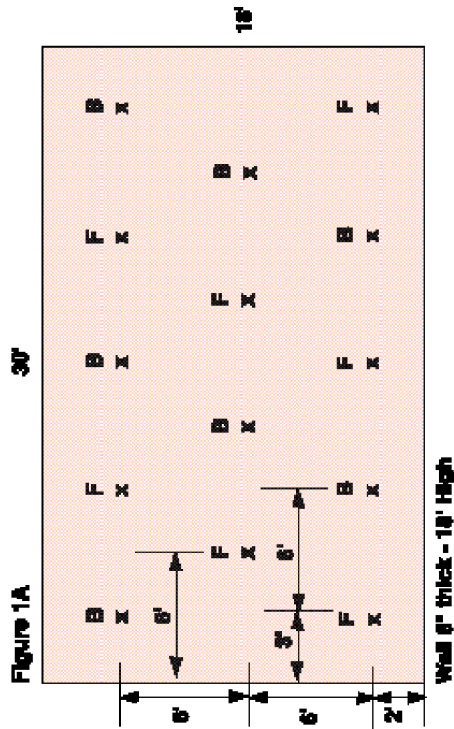
You can make your own decisions as to where to place the vibrators on the form – just remember the simple rule that the effective vibration area has a 3' radius (5' max.) and the adjacent vibrator area should overlap.

When you have drawn up your form and placed the vibrators, you will know how many vibration positions you have. Now you will have to decide how many vibrators you need. A good rule of thumb is to have enough for the first row of vibrators. Remember the bottom row of vibrators must be moved to the next row up and started when the concrete reaches that row. If this is too much climbing and rushing while the pour is going on, you might want to get additional vibrators.

When using electric vibrators, keep in mind that the US-900 and US-1600 high frequency vibrators have a 50% duty cycle – in an hour you can only use them for 30 minutes. These 30 minutes can be 30 minutes continuous running or 1, 2, 3, etc. minimum minutes "on" with the same or longer "off" time. But never exceeding a total running time of 30 minutes in one hour. The pneumatic units have a 100% duty cycle and can be operated continuously.

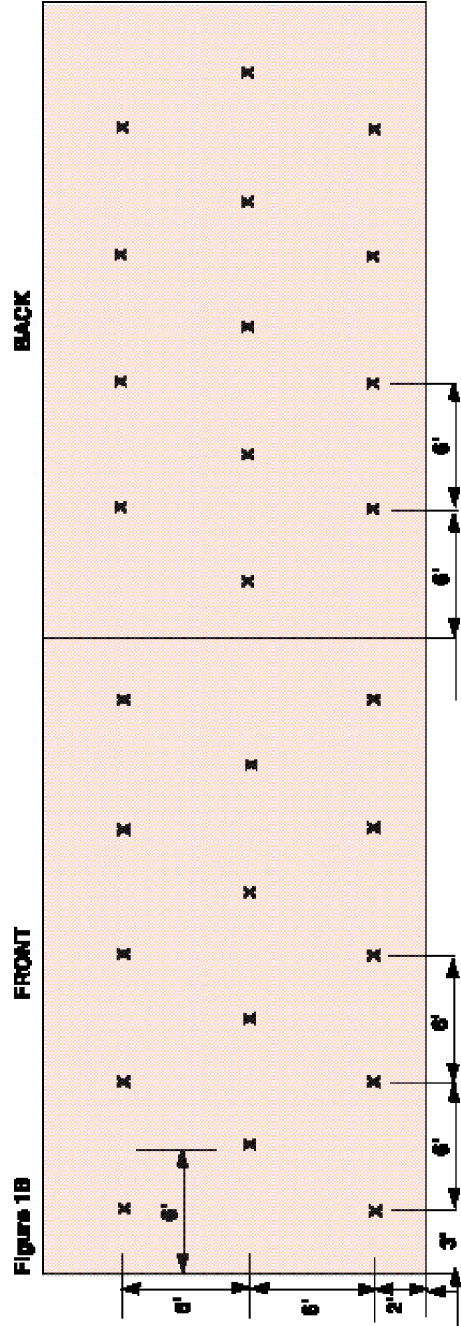
GENERAL RULES FOR SELECTING, SIZING & PLACING EXTERNAL VIBRATORS, cont'd.

WALL 6" THICK 18' HIGH



WALL 6" THICK: It is only necessary to vibrate one side. Front side will have the best finish. If opposite side also has to have a better finish, stagger vibrators on both sides. Shown in Figure (1B).

WALL 6" THICK 18' HIGH - BOTH SIDES NEED TO BE VIBRATED IN STAGGERED ROWS.



GENERAL RULES FOR SELECTING, SIZING & PLACING EXTERNAL VIBRATORS, cont'd.

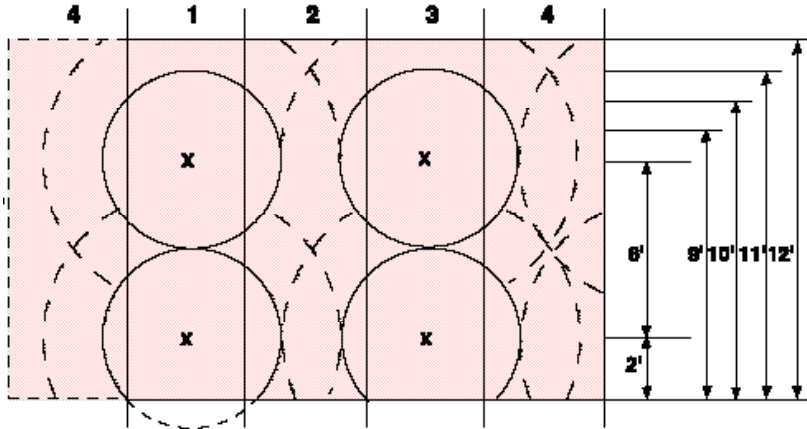
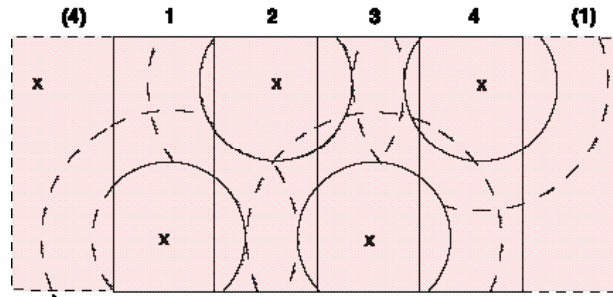


Figure I



Dotted line shows side 4 = 1. Moved to show vibration coverage

Figure II

FIGURE 2A

4' x 4' COLUMN

Figure I: 3' radius circles "Primary Vibration" cover two sides; with the "Secondary 5'R-Vibration" all sides are covered. The X indicates vibrator position. 4 vibrators will cover A 9', 10', 11' or 12' high columns.

Figure II: Show an alternative staggered vibrator mounting

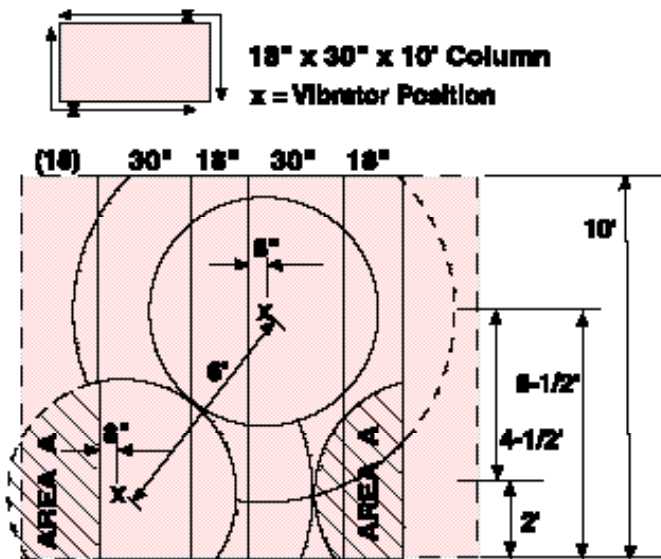


FIGURE 2B

When sides are small 15", 18", 20", put the vibrator close to a corner. The other vibrator close to opposite corner of the 30" side (a corner will always resist vibration more than a flat wall).

When placing the vibrators as shown the primary and secondary vibration will cover the form sides.

The top vibrator can be moved so that the vertical distance between the vibrators is 6' and then a taller column can be vibrated.

GENERAL RULES FOR SELECTING, SIZING & PLACING EXTERNAL VIBRATORS, cont'd.

3. SIZING AND PLACING OF VIBRATORS (cont'd.)

- (C) **BRACKETS:** The bracket to be selected can be one of the standard models shown on the preceding applications or you can design your own in conjunction with VIBCO's application engineers.

4. VIBRATION PROCEDURE AND VIBRATION TIME

- (A) **VIBRATION PROCEDURE:** Place vibrators to be used in their lowest position. It's a good idea to pre-mark the vibrator positions. Do not start vibrators until the concrete reaches them or is about 6" above them.

TIP: If internal vibrators are used, do not start the external ones until the internals have stopped or moved to a higher position. Internal vibrators throw air bubbles away from the vibrator head against form side leaving air holes and pockets on surface. External vibrators throw air bubbles into the mix, up and out, leaving surface against form smooth and blemish free.

- (B) **HOW LONG TO VIBRATE:** The time you need to vibrate varies depending on concrete slump, additives, stiffness of form, vibrator force, etc.

To determine the vibration time needed, it is advisable to make a test run. For example: On a column, take the time from the start of the vibrators to when the concrete reaches the 1/2 way mark to the next higher row, look at the concrete surface. When no more air bubbles are breaking on the surface, and a glistening surface appears on top of the concrete, you have vibrated enough. The time this took is your vibration time for the vibrators in each position for all the columns of that size.

If you do not want to measure the time, you will have to watch the concrete surface for bubbles breaking and the glistening slick surface each time, before moving the vibrators.

NOTE: If the walls or columns are too high to determine the vibration time by observing air bubbles breaking on the surface you can elect to run the vibrators until the concrete reaches the next higher row (like the contractors on page 8 and 13). The lower vibrators are stopped, moved up and restarted. Caution should be taken if the concrete mix has a high slump with large aggregates.

TIP: "Over-vibration" is something every contractor is afraid of (when the aggregate and sand separate and all the aggregate ends up in lumps or at the bottom of the form). The concern is well founded, but it takes a long vibration time and a lot of vibration force to reach this point. Our experience has been to see "under-vibration" rather than "over-vibration," too little vibration time or force to get a homogenous mix free of air bubbles.

GENERAL RULES FOR SELECTING, SIZING & PLACING EXTERNAL VIBRATORS, cont'd.

5. **HELPFUL HINTS AND CORRECTIONS AFTER THE FORM IS STRIPPED**

- (A) For bleeding of cement and water: tighten seals in form or use less water or lower slump concrete.
- (B) For honeycombing: often from bleeding, but if not, increase vibration time. If honeycombing on lower surface, move vibrators close to bottom of form.
- (C) For small pin holes in finish: usually from too wet mix; additives or form oil; air entering when form wall flexes too much during vibration, sucking in air. Large pin holes: if all over, try to reduce water content, vibrate longer after pour, add additional vibrators or re-vibrate before initial set.
- (D) Separation of aggregates: vibration time too long or too much water in mix.

**IF YOU HAVE ANY QUESTIONS
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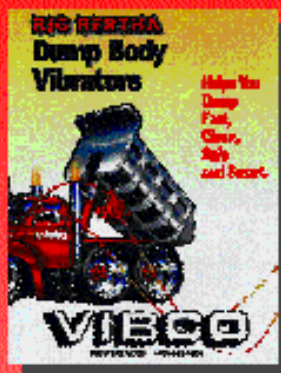


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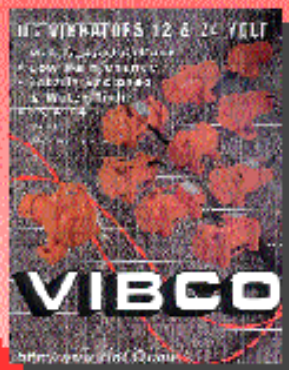
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HANDBOOK & EQUIPMENT GUIDE EXTERNAL CONCRETE VIBRATION

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