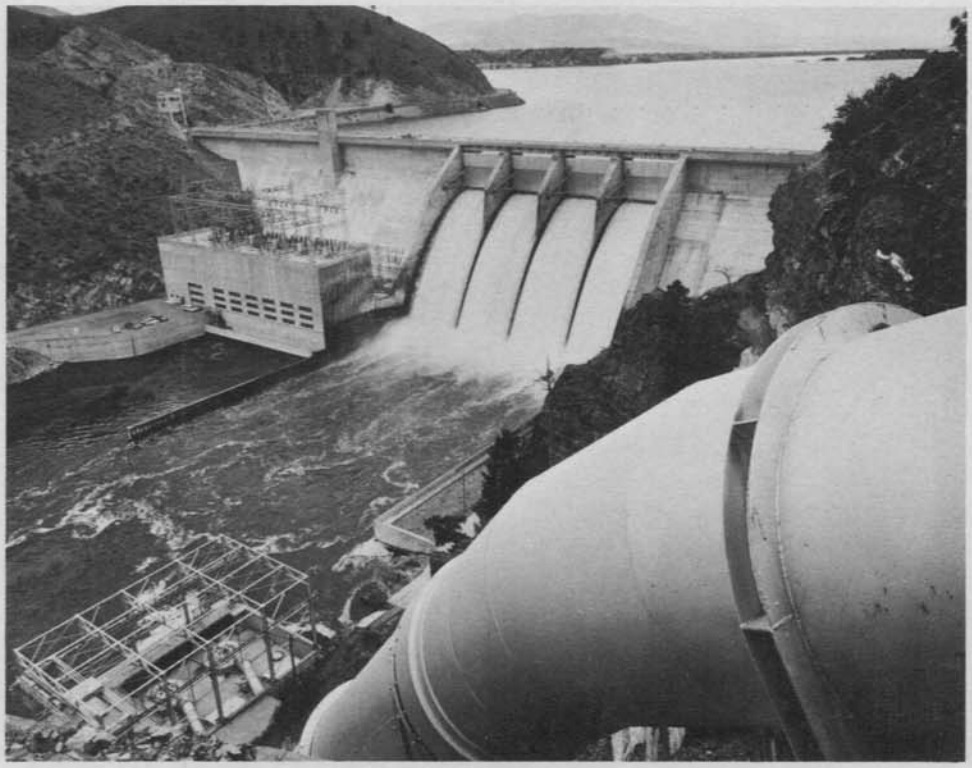
WATER OPERATION AND MAINTENANCE

BULLETIN NO. 86

DECEMBER 1973



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UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF RECLAMATION

The Water Operation and Maintenance Bulletin is published quarterly, for the benefit of those operating water-supply systems. Its principal purpose is to serve as a medium of exchanging operation and maintenance information. It is hoped that the reports herein concerning labor-saving devices and less costly equipment and procedures, will result in improved efficiency and reduced costs of the systems for those operators adapting these ideas to their needs.

To assure proper recognition of those individuals whose suggestions are published in the bulletins, the suggestion number as well as the person's name is given. All Bureau offices are reminded to notify their Suggestions Award Committee when a suggestion is adopted.

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Division of Water Operation
and Maintenance
Engineering and Research Center
Denver, Colorado 80225

COVER PHOTOGRAPH:

Helena Valley Pumping Plant and Canyon Ferry Dam, Montana. The two pumps in the foreground lift water to be discharged into the Helena Valley Canal for delivery to irrigators and municipal users. Photo P296-600-971A

UNITED STATES DEPARTMENT OF THE INTERIOR
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Gilbert G. Stamm
Commissioner

WATER OPERATION AND MAINTENANCE
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INTRODUCTION

Starting on page 1, an article entitled "Unique Pipe Discovery," describes the cooperative effort between Mitchell Irrigation District, Haig, Nebraska, and a Japanese pipe manufacturer which leads to the installation of a revolutionary new type of pipe.

Costly vandalism to equipment at the Arizona Projects Office, has been eliminated by the installation of a chain-link fence, as told in the short article on page 4.

The article on page 5 stresses the importance of taking precautionary measures when climbing fixed ladders.

Two practical methods commonly used for the construction of drop facilities for slipform lined laterals can be found beginning on page 7.

Successful irrigation takes planning as the short article on page 9 indicates.

"Seat Belt Saves Life" is the title of a three page safety article beginning on page 10.

An article on page 13 describes a collapsible stoplog device that permits trash and debris to pass through diversion works during stormflows without endangering the structure.

Fiberglass-reinforced-plastic (FRP) is being molded most successfully by the Salt River Project, for use on radial gate faceplates, as told in the article on page 15.

As the article on page 19 specifies, a little ingenuity payed off when a portable pump commonly used for de-watering in isolated areas of an aqueduct was adapted for use on an extra special job.

UNIQUE PIPE DISCOVERY[1]

Fall opened quietly in the small rural community of Haig, Nebraska, but closed with a bang when Haig became the hub of international activity last November.

The event was the first installation of a unique PVC (polyvinyl chloride) pipe. Approximately 150 representatives of pipe manufacturers, petroleum corporations, plastic companies, consulting engineers, contractors, irrigation districts, and Reclamation representatives from all parts of the United States and Japan traveled to this rural community in western Nebraska to witness the event.

It was not the installing of the PVC pipe per se, but the pipe's unique properties, that made this demonstration of interest to such a large cross section of the United States and Japan.

Soft State

The pipe is manufactured in a soft state that can be coiled or folded for shipment. It is hardened by a heat process at the construction site and, while still warm, is rounded by air pressure. The pipe obtains its design stiffness in a matter of minutes.

Figure 1 PX-700-135

Made in Japan

This unique pipe is a new product developed by a company in Tokyo, Japan. First manufactured 2 years ago, it is now sold in Japan by special order only. The first installation outside Japan was made in Saudi Arabia to test the suitability of the pipe in extremely hot climates.

The United States was chosen by the manufacturer as a second demonstration site. It was chosen because of the current demand for an economical pipe for conveying water and because of the savings obtained through rapid installation of extremely long lengths of pipe.

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[1] Reprinted from the Reclamation Era, Summer 1973, and written by William A. Lidster, Bureau of Reclamation Regional Representative, Open and Closed Conduit Systems Committee, Lower Missouri Region, Denver, Colorado.

With the growing need for irrigation districts to convert their open laterals into closed pipe systems and the increasing number of rural counties forming water districts and constructing potable water systems, what better place could have been selected for this demonstration than rural America?

Installation

The only limitations on the length of this reinforced, jointless pipe is the size of the shipping container and the mode of transportation. For this demonstration, a continuous 3,300-foot length of 16-inch pipe without joints was folded accordion-fashion and shipped from Japan in a 7-foot-wide, 40-foot-long, 15-foot-high container that could be loaded onto a standard flatbed trailer. See Figure 1 on first page.

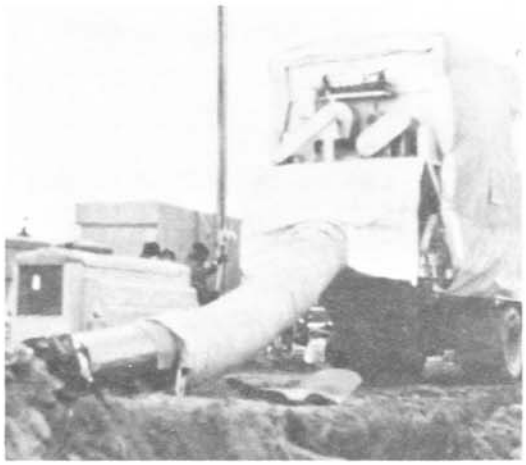

Figure 2 PX-700-137

This container was insulated at the jobsite, covered with a plastic cover, and converted to a heating box to heat the pipe. See Figure 2 at left. The pipe was heated to about 180° F., to fuse the plasticizer and resins which converted the soft pliable pipe into a hardened finished product. The heated, flattened pipe was dispensed through mangles and rounded by inflating the warm pipe by an air compressor supplying air at 5 to 10 pounds per square inch, as shown in Figure 3.

Figure 3 PX-700-138

Onlookers saw the fully inflated pipe come out of the pipe guide and slide directly into the trench. The pipe develops its stiffness as it cools. The cooling time for the pipe depends on the weather. The temperature during this installation was about 30° F. At this temperature the pipe developed its full design stiffness in about 3 minutes.

The pipe was processed and installed at the rate of 20 feet per minute. The maximum speed the pipe can be

processed and installed at the jobsite is 50 feet per minute. At these speeds, the pipe can be laid faster than with conventional trenchers; therefore, the pipe should be ideally suited for use with a high-speed trencher or a mole plow. The manufacturer plans to make the pipe from 1-1/2 inches in diameter to 200 inches in diameter. Presently, the maximum size manufactured is 48 inches. The pipe is manufactured with air vents to evacuate the air as it is folded for shipment. The technician shown in Figure 4 below, is installing plugs as the inflated pipe is being extruded.

Figure 4 PX-700-139

Joint Venture

In our never-ending search to find new products that will benefit irrigation districts in the operation and maintenance of their systems, the Lower Missouri Region discovered this new product with the potential to reduce the cost of converting existing open lateral systems to closed pipe systems.

To highlight the need for new products that could benefit irrigation districts, the Lower Missouri Region sponsored this joint venture between Mitchell Irrigation District, Nebraska, and the Japanese company under the FY 1973 Open and Closed Conduit Systems program. Staking out the line, excavating, and backfilling the trench were accomplished by the Irrigation District. About 30 miles of buried pipe laterals will be installed to replace the open lateral system. The Japanese company supplied the pipe, all equipment for heating and installing it, and a crew of technicians from Japan who assembled the equipment and laid the pipe in the trench.

Who Benefits From Such Demonstrations?

First, this demonstration will benefit irrigation districts by showing industry that equipment and products are needed to provide more economical methods of converting the older, open lateral systems that are expensive to operate and maintain into more efficient closed systems.

Secondly, states such as Nebraska could benefit by having more industry brought into the area. Companies with new products contributing to lower costs in the rehabilitation of existing irrigation systems should investigate the possibility of manufacturing their products where the cost of land is reasonable, availability of manpower is plentiful, and the product need is great. Nebraska is just such a place.

* * * * *

PROTECTIVE FENCE[1]

Drilling equipment of the Arizona Projects Office, Phoenix, Arizona, remaining outside during nonworking hours had been experiencing periodic and costly vandalism. Easily installed portable chain-link fence, as shown in Figure 5 below, was purchased and placed around all equipment. Since initiation of the protective fence, no vandalism has occurred.

Figure 5 PX-D-73759

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[1] Reprinted from the Reclamation Safety News, Second Quarter 1973.

CLIMBING FIXED LADDERS[1]

We'd all agree that a steeplejack's job is dangerous. Those rungs running up a tall smokestack look pretty treacherous, and they are, for any ordinary guy--who has no business climbing them.

But steeplejacks rarely fall. They specialize in climbing safely and in handling themselves safely when they get to the top. They take no chances take nothing for granted--test and check everything their safety depends on.

That's why most of the falls from high ladders are suffered by fellows who don't do much ladder climbing. They don't use enough care.

First of all, no one should climb a high ladder if height bothers him. If it does, he'll be nervous and unsure of himself. A fellow needs steady nerves and a clear head on a high ladder.

Lots of fellows won't admit that they're afraid of height, though, because they've been brought up to think that fear is something to be ashamed of.

Actually, that's the wrong attitude. Fear is a perfectly natural reaction to a dangerous situation or one that seems dangerous. It gives a person the extra strength and energy he needs to meet an emergency. If a person isn't capable of fear, he's abnormal--something is wrong with him.

The thing to be ashamed of is losing your head--losing self-control--from fear. Brave men get scared just like anyone else, but they keep their heads.

What does all this have to do with climbing ladders? PLENTY. If you're afraid of height, have the courage to say so and don't climb high ladders.

If you do climb fixed ladders, there are only a few things to be careful about, but you must never neglect any of them. Remember always, a fall from a high ladder can easily be fatal.

Look the ladder over well before you start up. See anything wrong? Bent or missing rungs? Grease or heavy rust on rungs or rails? Any places where there isn't plenty of clearance? How is the toe clearance behind the rungs? It should be enough to keep the toe of your shoe from touching the structure when your heel is snug against the rung.

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[1] Reprinted by special permission of the Editor from an article in the Industrial Supervisor, dated August 1973.

If a pipeline or anything else cuts the clearance anywhere, don't forget to watch out for it when you get to that place. Lack of clearance has finished off many a man and thrown scares into a lot more because, if you don't allow for it, you're likely to miss a rung.

Be especially careful of wooden ladders. Wooden rungs have a way of rotting and coming loose. Take no chances with them.

Electric wires, unless in pipe conduit, are very dangerous to have within reach of a metal ladder because the ladder is usually well grounded. The insulation on the wire may not be very good since it's exposed to all kinds of weather. In fact, the air around the wires may be all that's keeping the juice in them.

Getting any part of you against or even close to a wire may give the electric current the chance it's always looking for to escape to ground. If it takes off through you, you'll come to on the ground, if at all.

In below freezing weather, check for ice. Sometimes the boys who decide where a ladder is to be put don't reckon with the drip from an overhead platform or an iced-up eaves trough. It's best not even to try to climb an icy ladder. If you must, use a safety belt, be sure to keep it hooked while you work, and knock the ice off as you climb.

After you've checked the ladder, you're ready to start up. Give it a good shake to make sure it's well secured, and look out for any looseness at each point of support as you come to it. In climbing, set your foot on the rung so that your heel is snug against it and close to the rail unless the ladder is too wide for that much spread to be comfortable.

Grasp the rails. If you hold onto the rungs and a loose rung pulls out, you're probably a goner. Even if it turns a little, you may miss your grip. But if you have a good hold on a rail, a rung can let go under your foot and still not throw you.

Always be sure you have a good grip with one hand and are solid with one foot before you take a new hold for the next rung. That goes for climbing either up or down.

Finally, when you hit the top, be sure of your footing when you step across from the ladder to the roof. Unless the setup is right, that's the high hazard point.

If the ladder rails aren't run up at least 42 inches above the roof or platform edge, turn in a good kick about it. The rails should be spread apart above the roof and curved over with the ends made fast (rungs out, of course) so that the climber steps off the ladder between them.

In climbing down, be sure you have your foot placed securely on the rung below before you change your hand hold, and never hurry on a ladder.

* * * * *

SLIPFORM DROP CHUTES[1]

A drop facility is used to gain the most economical method of maintaining proper relationship between the flow line and the ground while retaining a design slope maximum of 0.001 ft/ft. The Bureau of Reclamation approves the use of drop structures on Bureau-financed slipform installations. A closeup view of a drop structure is shown in Figure 6 below.

Drop structures consist of a vertical drop with a stilling basin. A drop structure may be incorporated into a culvert headwall or on the downstream side of turnout structure or measuring weir. They may be constructed of block, but it has been found that concrete is preferable. The floor of the stilling basin should be at least 12 inches below the downstream flow line of the slipform.

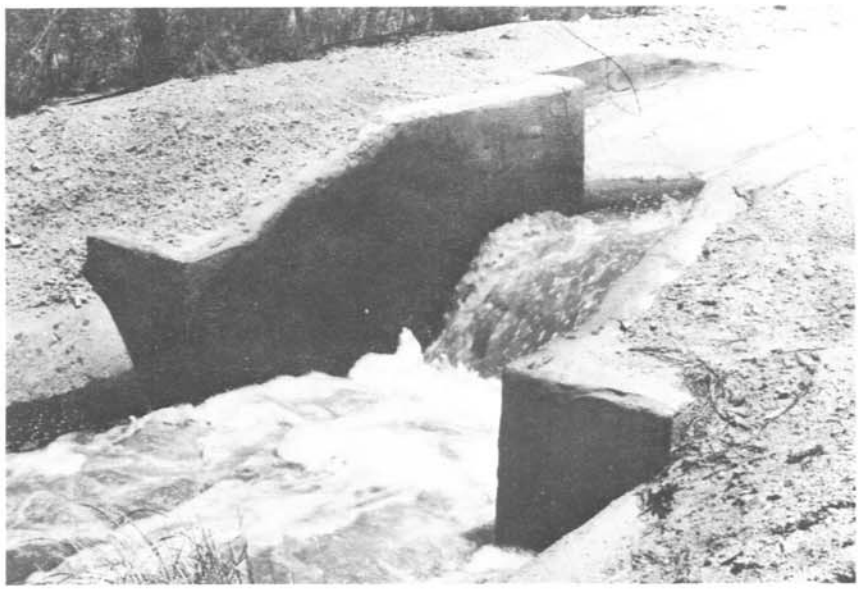

Figure 6 P25-D-73944

An alternative to this type of installation is recommended.

The Salt River Project, in close coordination with the Arizona Projects Office of the USBR, has experimented with the installation of drop chutes on slipform lined laterals. A typical drop chute is shown in Figure 7 on the next page. The drop chutes installed were short sections of slipform at super-critical slopes.

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[1] Prepared especially for this publication by Mr. Ron Merkley, Supervisor of Pump Construction and Maintenance and Field Operations, Salt River Project, Phoenix, Arizona.

The criteria used in placing the chutes were that the slope would be 0.02 ft/ft and would not exceed 50 feet in length. This length allows a 1-foot drop in elevation. Also, chutes were placed a minimum of 300 feet apart (this is sufficient to maintain the proper relationship between the slope of the land in the SRP irrigation district and the associated slipform installation).

Figure 7 P25-D-73939

The chute design slope resulted in hydraulic jump approximately 15 feet below the end of the chute and about 0.3 foot above the normal hydraulic gradient. It was felt that increased freeboard was not required for a jump of this size. The normal design freeboard is 0.5 foot minimum.

The design and placement of drop chutes appears to be a natural with the application of modern techniques used in slipform lining installation. Trenching equipment automatically adjusts for slope changes as they occur; therefore, the chutes are trenched as an integral part of the slipform length. This cannot be accomplished if a significant elevation change is required as in drop structure installations. The trenching equipment must be removed from the trench and maneuvered around the drop location where it can resume trenching of the slipform.

The same is true of slipform placing equipment. It has been observed that the slipform method of placing concrete can be performed without interruption through a drop chute. With a drop structure requirement, the machine must physically be removed from the trench and replaced at the next slipform elevation. Any interruption of the slipform installation process is costly in man-hours, equipment and materials.

A significant cost savings has been realized by the Salt River Project with the substitution of drop chutes for the labor-consuming installation of drop structures. The cost savings presently approaches approximately $600 per structure.

If additional information is desired regarding this type of structure, please write to the Regional Director, Lower Colorado Region, P. O. Box 427, Boulder City, Nevada 89005.

* * * * *

SUCCESSFUL IRRIGATION TAKES PLANNING[1]

Irrigation can put money into the hands of a community. But it takes good cooperation between farmers and business organizations if the entire community is to enjoy the benefits, according to a man who has watched an irrigation project change his town.

An irrigation project came to the dryland farming and ranching area around Ainsworth, Nebraska, in 1960. Clyde Burdick, mayor of Ainsworth, told those attending the Nebraska Water Conference that before that time there was seldom enough moisture to produce a full crop.

Ranchers shipped their cattle elsewhere to be fattened. There were less than half a dozen irrigation wells in the area, and these were powered by farm tractors.

Ainsworth is now surrounded by irrigation wells. It's population is growing in a county where population has been declining for the last twenty years.

The town is a residential and retirement center. It has no tourist attractions, no industry. Yet building permits have jumped from 23 applications in 1960 to 81 applications in 1972.

Corn yields have jumped from about 20 bushels per acre under dryland conditions to over 100 bushels per irrigated acre in 1971.

In the opinion of one banker, the town's growth was due primarily to irrigation. Some of the changes would have occurred without the project, but without irrigation, he said, "Ainsworth could well have been lost."

* * * * *

Don't Count on Spares
by B. L. Garner, Jr.

I saw a man with a leg of wood--
(He hobbled along as best he could)
I saw a man with a hand of steel--
(It helped on the job but could not feel)
I saw a man with an eye of glass--
(He can hear you but he can't see you pass)
I saw two fingers missing from a man's hand--
(He had to give up the career he had planned)
These sights are all grim,
But we may as well face it:
The original's better
Than a part to replace it!

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[1] Reprinted from Reclamation Press Information dated June 15, 1973.

SEAT BELT SAVES LIFE[1]

Mr. Robert D. Mason, Chief of the Tracy Field Division, Bureau of Reclamation, Tracy, California, was seriously injured when the Government vehicle he was driving was struck head-on by a privately-owned panel truck which was out of control. The photograph below (Figure 8) shows the sign placed by the Government vehicle. The wording and placement of the sign was as requested by Mr. Mason.

Figure 8 PX-D-73266

The accident happened when a pickup truck in the southbound traffic lane was slowed down and a panel truck immediately behind veered sharply to avoid a collision. The effort was unsuccessful, and, after striking the pickup, the panel truck careened across the freeway divider and landed atop the northbound Government vehicle, driven by Mr. Mason.

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[1] Reprinted from the Reclamation Safety News, First Quarter 1973.

The private vehicle reportedly was airborne at the time it crashed into the Bureau sedan, as shown in the photograph below (Figure 9). Mr. Mason was on his way to attend a staff meeting at the Mid-Pacific Regional Office in Sacramento at the time of the accident. As can be seen by the photographs, the Government vehicle was a total loss. Be smart - take Mr. Mason's advice and buckle your seat belt.

Figure 9 PX-D-73265

Use of Government Vehicles

The following paragraphs are excerpted from Reclamation Instructions Supplement to Federal Property Management Regulations, Subpart 114S-38.71, Motor Vehicle Management.

114S-38.7106 Transportation of nonofficial passengers.

The sole reason for operating a government-owned or leased motor vehicle is the accomplishment of official business. The official purpose of the use of a vehicle is not voided or changed by the incidental transportation of individuals traveling for personal convenience in available space not needed in the accomplishment of official business. The transportation of nonofficial passengers in vacant space

of a vehicle on official business is permissive. The administrative head of the office having custody of vehicles should use discretion in sanctioning the transportation of nonofficial passengers since in case of accident, a potential liability is created both for the Government and the operator of the vehicle. It also affords opportunity for criticism and allegations of unofficial use. Picking up strangers or "hitchhikers" is prohibited.

114S-38.7107 Operator's liability.

Before an employee is assigned to or permitted to drive or operate any Government-owned or leased motor vehicle, he shall be informed of both his and the Government's liability for any damage to persons or property occurring as a result of such driving or operating. Employee's liability is covered under the provisions of the Tort Claims Act and Public Law 87-258. Civil court actions that may ensue as a result of the employee's actions should be fully explained. All employees will be advised (1) of their personal responsibility for safe driving and operation of equipment, and their compliance with Departmental, Bureau, Federal, State, county and municipal laws and regulations; and (2) that under the provisions of Public Law 87-258, the Attorney General shall defend any civil action or proceeding brought in any court against any employee of the Government or his estate for damage to property, or for personal injury, including death, resulting from the operation by said employee of the Government of a motor vehicle while acting within the scope of his office or employment. Certification as to whether the employee of the Government was acting within the scope of his employment at the time of the incident out of which the suit arose, will be made by the Attorney General. For unconditional liability coverage, it is recommended that the employee provide himself with suitable liability insurance. Administrative disciplinary action may be taken in instances of damage to Government-owned or leased equipment or loss of or damage to property being transported, when the damage or loss is a result of the employee's negligence or failure to properly safeguard the vehicle or property. Further, restitution may be sought by the Government for financial loss or damage so incurred.

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The heights by great men reached and kept, Were not attained by sudden flight, But they, while their companions slept, Were toiling upward in the night.

COLLAPSIBLE STOPLOG STRUCTURE[1]

Personnel of the Chowchilla Water District, Chowchilla, California, located in the Fresno Field Division on the Central Valley Project, designed and built a collapsible stoplog structure as part of the diversion headworks on the Chowchilla River at Berenda Creek and Ash Slough. These hinged metal guides permit trash and debris that collect during heavy storms to pass on through without endangering the structure. The diversion headworks is used as part of the District's distribution facilities during the irrigation season.

When periods of high rainfall occur on the upstream drainage areas there is always a heavy runoff into the Chowchilla River. These high flows into the river deposit large quantities of trash and debris that cause a heavy buildup at the diversion works and possible destruction of the structure. To prevent such a possibility, the district had this collapsible stoplog structure installed. Figure 10 below shows the top part of the structure with the stoplog device in place and ready for an emergency.

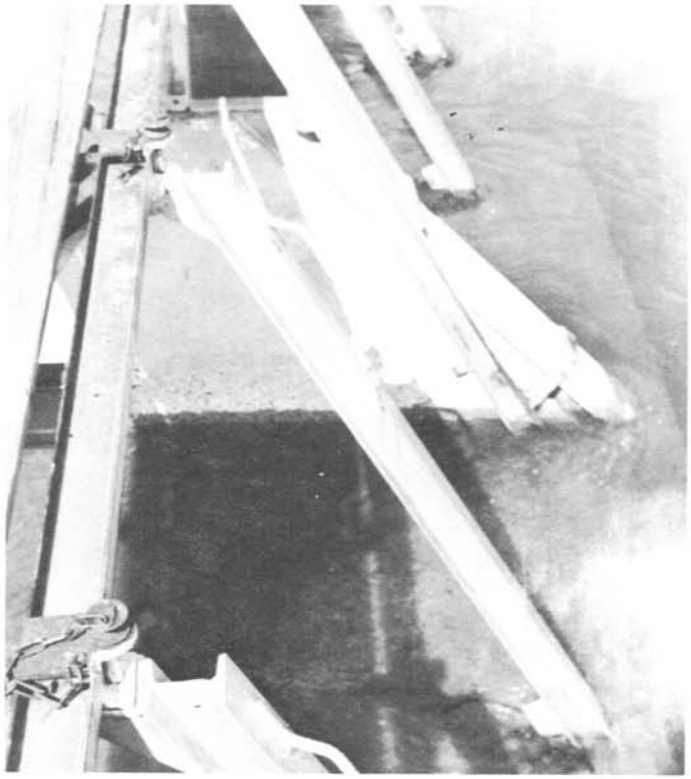

Figure 10 P885-D-73945

[1] The material for this article was furnished by the Fresno Field Division, Fresno, California.

Stoplog Construction

"H" beams for the collapsible stoplog supports are hinged at the floor of the structure, pinned in place to the "I" beam at the top. (See Figure 10). The 4" x 8" stoplogs are lowered into the slots between adjacent "H" beams. When the structure becomes endangered by heavy flows in the river, district personnel pull the pins on top and the force of the water against the stoplogs collapses the supports. The stoplogs are then carried downstream and new ones have to be set in their place.

During the February 1973 runoff, the high flows in the river did not cause any damage to the present structure as shown in Figure 11 below. However, during the same high runoff, a similar structure upstream that did not have the collapsible stoplog features was completely destroyed and had to be replaced at considerable expense to the district.

Figure 11 P885-D-73946

If additional information is desired concerning this collapsible stoplog structure, please write to: Regional Director, Bureau of Reclamation, Mid-Pacific Region, 2800 Cottage Way, Sacramento, CA 95825.

* * * * *

RADIAL GATE FIBERGLASS FACEPLATES[1]

The evolution of free-form fiberglass-reinforced-plastic (FRP) has been a recent boon to manufacturers and users of water associated products and applications. Its excellent corrosion resistent properties has made it an ideal material to be used in and around water. Applying this characteristic of FRP to the diversified needs of an irrigation district, the Salt River Project is finding ever increasing uses available for fiberglass.

Development of One of These Uses

The placement of corrugated metal facings on steel framed radial gates has been an accepted practice in industry for many years. Figure 12 below, shows a typical steel framed radial gate with a corrugated metal faceplate. Degradation from corrosion due to constant immersion in water has resulted in continual maintenance on the relatively thin corrugated steel facings. Replacement of the facings in our facilities varied from 2 to 7 years, depending on water quality and degree of immersion. Due to the high maintenance costs experienced, an exhaustive search was begun with a resultant testing program to find the most economical and practical material that could be used for this purpose.

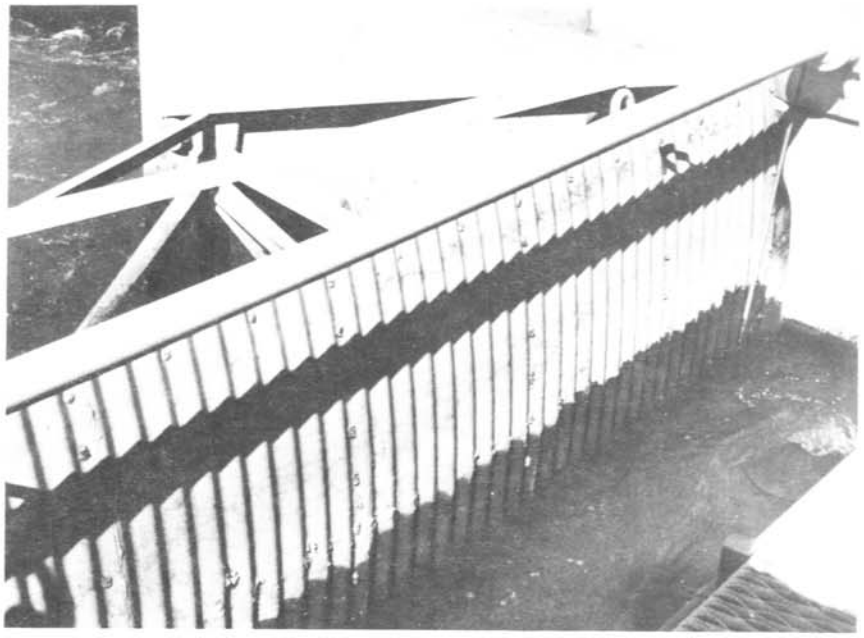

Figure 12 P25-D-73938

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[1] Prepared especially for this publication by Mr. Ron Merkley, Supervisor of Pump Construction and Maintenance and Field Operations, Salt River Project, Phoenix, Arizona.

The list of possible materials was reduced to four products as follows:

1. Hot-dipped galvanized corrugated metal

2. Hot-dipped galvanized corrugated metal encapsulated in various epoxies or rust inhibitors

3. One-fourth-inch steel plate coated with zinc metal spray

4. One-half-inch FRP (chopper gun spray up)

After establishing that the above materials were acceptable to our construction and maintenance techniques, each was placed on a zinc spray coated steel radial gate frame. The gates were placed in the canal system at various locations and service life tested to determine which was the superior product. Here are the results we experienced:

Product 1 and 2 were essentially the same. No life increase or reduction of maintenance was noted by the application of epoxies and inhibitors. Expected life without maintenance is between 2 and 7 years.

Product 3 has been a very successful material to use for this purpose, but construction costs were considerably higher than any of the other three products. This was due to the time required to form and splice one-fourth-inch plates to conform to an exact radius of the gate frames. Expected life has not been determined, but it has surpassed that of products 1 and 2.

Product 4 has been determined to be the superior product as no degradation has been observed in the approximate seven years since installation of the first unit. There has been no maintenance required on the FRP faceplates. Expected life is not known, but it is anticipated that they will be in service until its associated canal structure is removed.

The FRP radial gate plates are fabricated at the Salt River Project fiberglass shop. Chopper gun spray up is used. Glass content is 30%. A general purpose polyester resin makes up the remaining 70%. The gel coat is molded directly into the FRP. Molds have been constructed for all sizes of radial gates in service at our project. This allows the correct radius to be formed with a minimum of internal stresses directly into the finished product. Figure 13 on the following page shows a full view of one of these Fiberglass Faceplate Molds, and Figure 14 also on the following page shows a completed Fiberglass Faceplate that is ready to install on the facing of a radial gate.

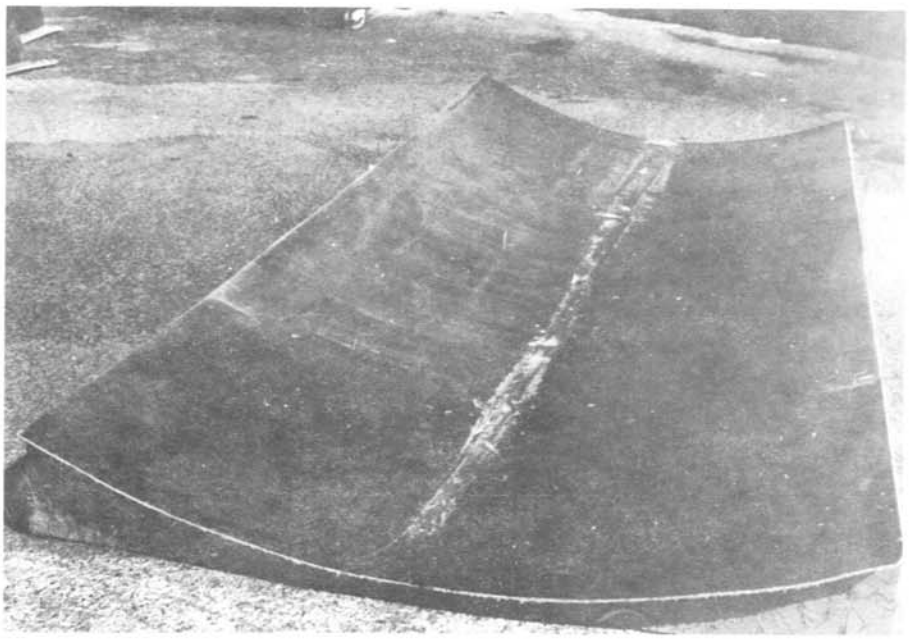

Figure 13 P25-D-73940

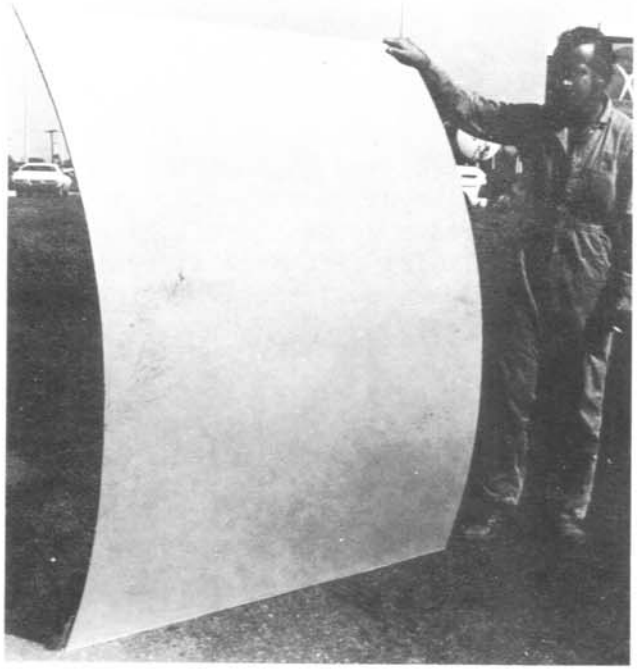

Figure 14 P25-D-73941

In conjunction with the above testing; zinc plated, cadmium plated, hot-dipped galvanized, and stainless steel bolts were placed into service to determine the bolts most suited to our specific needs. The zinc and cadmium plated bolts deteriorated from corrosion immediately after placement into service. Stainless steel bolts were determined to be the superior fasteners in terms of service life but the expense of these bolts made them a less desirable item. Hot-dipped galvanized bolts showed excellent corrosive resistant properties and exceeded the life expectancy of the rubber seals used on the radial gates. Since periodic replacement of the gate seals is required, it was determined that replacement of the galvanized bolts could be done with less labor costs than that of stainless steel bolts at the time of seal replacement. This is due to the fact we could remove the galvanized bolts by shear rather than the time-consuming unscrewing procedure required to save the stainless steel bolts for reuse. Therefore, the hot-dipped galvanized bolts were chosen as being the most practical fastener for our use.

The knowledge that was gained about fiberglass-reinforced-plastic with its use as radial gate faceplates is enabling the Salt River Project to continue developing additional uses for FRP in our irrigation district.

* * * * *

Even in antiquity, ground water played an important role where surface water was scarce or absent. Without pumps, water was withdrawn in buckets, using winches and various devices operated by draft animals. Because the yield was too small for extensive irrigation, khanats were evolved. Khanats are subterranean galleries, serving as conduits to lead ground water to the surface.

Many khanats are 15 miles long; some are as long as 95 miles. It is said that about 40,000 khanats existed at one time in Iran, which still has about 20,000. Khanats apparently originated in Armenia before 700 BC, then spread through the Near East, North Africa, and China.

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ADAPTING A SUBMERSIBLE PUMP[1]
for
A SPECIAL PURPOSE

The May 1973 dedication of Perris Dam, near Riverside, California, was looked upon as something more than the end of another job. The finish of this facility marked the completion of Phase 1 of the State Water Project, and those in charge of the dedication ceremonies wanted the official introduction of water into Perris Dam to be impressive enough to emphasize the event. The line leading into the reservoir would be filled and water would be running in, but the desire was for an obvious display when the Governor "turned on the pumps". Providing such a display became one of the "other" duties of the maintenance personnel at Southern O&M Center at Castaic. The success with which these men carried out their rather unique assignment can be seen in the Film Featurette of the Director's monthly staff film for May 1973, and here is how they did it.

Figure 15 PX-D-73947

Description

After considering one or two methods, the maintenance men chose a 5400-gpm submersible pump as the "delivery" means because it was portable, powerful--and available. The pump, used for quick de-watering of isolated reaches of the aqueduct, has a 10-inch discharge pipe. To provide for a maximum safe pressure for the "display" they decided to reduce this to four inches. Figure 15 at left shows the pump arrangement used. With the pump submerged near the main pipeline inlet and only a portion of the discharge above water, this four-inch pipe could shoot up quite a geyser. There might be so much pressure, in fact, that it would be a problem to prevent the reducer from being blown off. There were some other problems. For instance, how to support the pump at the correct angle while resting on the 2-to-1 sloped side of the reservoir at the pipe outlet? And how to prevent starting torque from whipping and banging the pump around like a garden hose? Figure 15 shows how they arranged to position the pump on the sloping footing.

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It required careful calculating to get the proper angles for the pump base. The base itself was made out of steel channel designed, cut, and welded by the men at Castaic. When they were finished they had a platform which would accommodate the sloping side and still maintain the pump in an upright attitude. Four short lengths of channel were welded in a roughly-circular pattern to the base platform. The pump would fit in between these, and so would not slide or bounce off during transportation or startup. To further secure the pump at these times, loops of steel rod were welded to the support platform and wire cables passed through them, wrapped around the pump, and then shackeled securely. Some of this can be seen in Figure 15 also. All of it was to position the pump and to hold it during use.

Figure 16 PX-D-73942

Figure 17 PX-D-73943

Figures 16 and 17 above show two views of the reducer and the system by which it was attached to the pump discharge pipe. The reducer was welded-up out of two steel flanges; there is a 10-inch pipe portion on one end and a domed reduction to the four-inch discharge nozzle on the other. The 10-inch pipe is then double-clamped to a length of 10-inch flexible hose, which is double-clamped to the pump discharge. This affords a certain amount of "give" when the pump comes on. To make sure that the thing does not give too far, the men welded two rings, one on each side, to the reducer above the flexible joint and then attached the rings to two steel rods which were secured to the base platform. The rings can be seen in Figure 16, and the securing rods can be seen in Figure 17.

The pump was lifted onto the transportation trailer, and later positioned near the reservoir intake by power crane operated by Castaic personnel. All of this effort, from start to finish, was done by a few volunteers in a total of roughly 12 hours. This made it possible to test the pump to make sure of performance before the dedication. When the switch was closed, an impressive spout of water shot up into the air for nearly 60 feet. Just another routine job for Operation and Maintenance personnel.

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