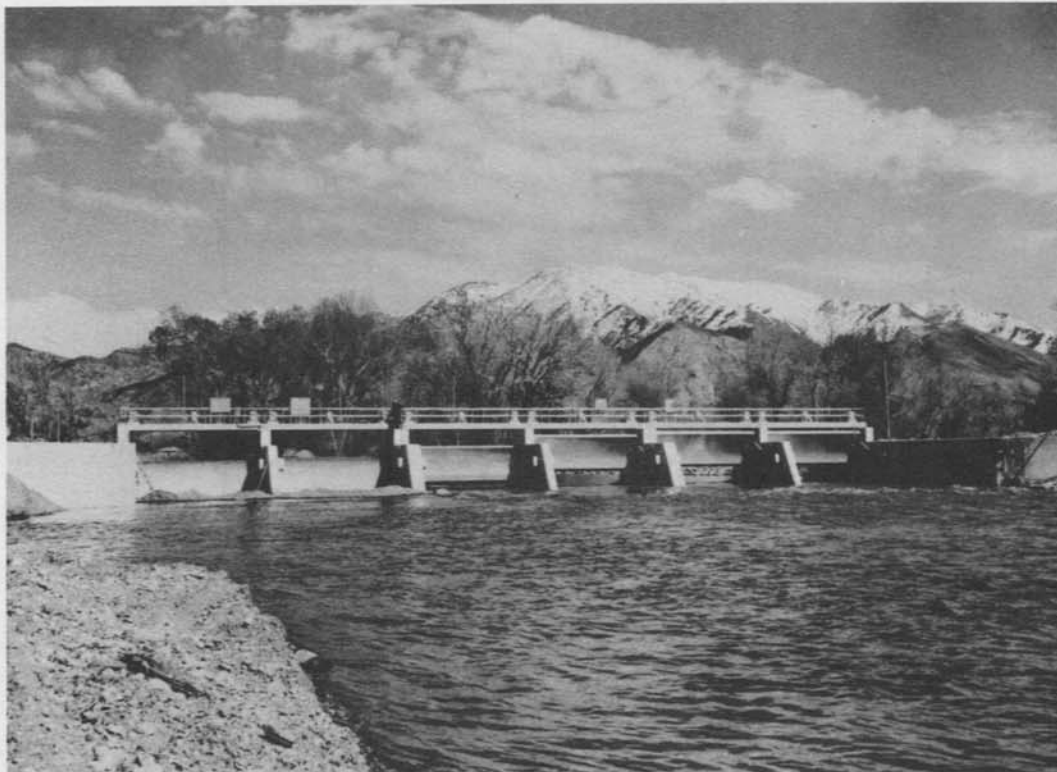


WATER OPERATION AND MAINTENANCE

BULLETIN NO. 84

JUNE 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.

* * * * *

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



COVER PHOTOGRAPH:

Slaterville Diversion Dam, Weber Basin Project, Utah, on the Weber River, looking upstream with the Wasatch Mountains in the background. This structure is operated by the Weber Basin Water Conservancy District. Photo P526-400-3945

UNITED STATES DEPARTMENT OF THE INTERIOR
Rogers C. B. Morton
Secretary

BUREAU OF RECLAMATION
Gilbert G. Stamm
Commissioner

WATER OPERATION AND MAINTENANCE
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INTRODUCTION

Tumbleweeds are a big job to Operation and Maintenance personnel when in an aqueduct or a canal. The maintenance crew of the Southern Field Division in Pearblossom, California, describes how they solved this irritating problem on page 1.

Boating for pleasure can be an increasing source of enjoyment for everyone involved, when the 10 safety rules are sincerely acknowledged as listed on page 4.

Public assistance in providing safety and vandalism control requested and received by the Hooper Irrigation Company is described at the bottom of page 4.

A serious crane accident involving near loss of life and severed limbs is described on page 6.

"Safety Fencing, Net and Cable" is the title of the article on page 7. It describes built in safety precautions for irrigation facilities.

A pickup truck boom attachment is described on page 10.

The unique portable, one-man hoist shown on page 11, could have utility in many situations.

Equipment management is the subject of two articles starting on page 13. The first article entitled "Fleet Purchasing and Disposal Guides," explains why New York City abandoned its 6-year or 60,000-mile replacement plan. The second article entitled "Plan Wisely for Service and Storage," on page 19, outlines the requirements for establishing adequate service centers.

* * * * *

ANOTHER WAY TO DRAG TUMBLEWEEDS OUT OF THE AQUEDUCT¹

If you have ever had bank-to-bank tumbleweeds in the aqueduct you know what a problem they can represent. But, if there happens to be a dragline or similar piece of equipment out in the yard then you may

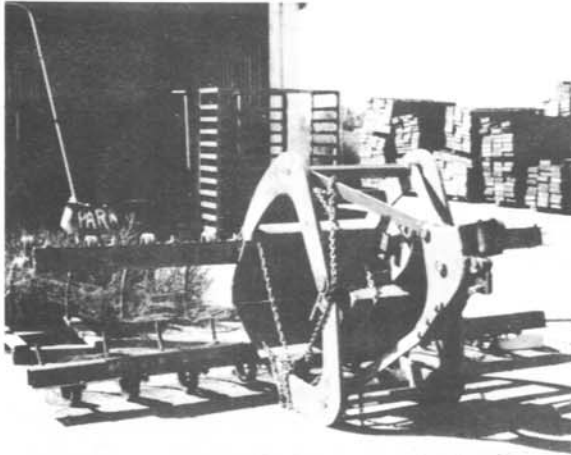


Figure 1

PX-D-73248

have the means of striking back at the problem. Used alone the dragline tends to tear at the weed pack more than remove it. With some modification however this long-necked hoist can drag out tumbleweeds as easily as it drags out earth. The adaptation presented here uses a standard set of log jaws for a dragline as its basis; it was developed by Mr. Carl Capehart and the Civil Maintenance crew in the Southern Field Division, Pearblossom, California.

Description

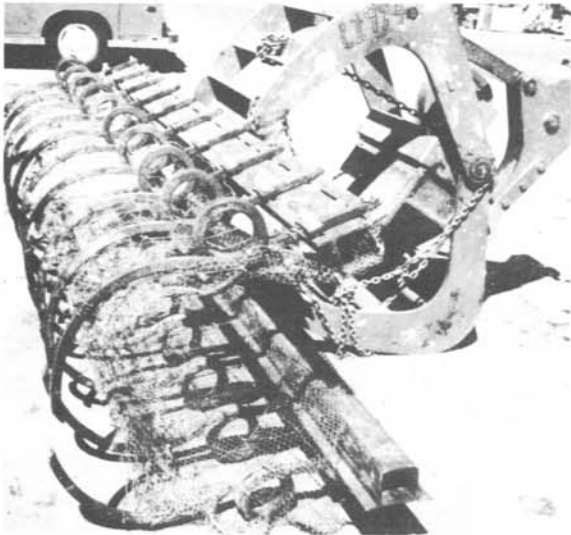


Figure 2

PX-D-73249

Maintenance welders at Palmdale subcenter increased the bite of the log jaws by welding on extensions made of four-inch square steel tubing eleven feet in length and arranged so that they extended equally on both sides of the jaws, as shown in Figure 1 at upper left. The teeth in the new jaws are tines from a heavy-duty spring harrow positioned and bolted in place at approximately one-foot intervals. Figure 2 gives some idea of this arrangement, and also it shows how the harrow teeth are installed to curve inward for a better grip on the weeds.

Spring teeth were chosen for this particular job because of their

¹ Reprinted by special permission of the Editor, from Technical Bulletin No. 15, dated September 1972, published by the State of California, Department of Water Resources, Division of Operations and Maintenance, Sacramento, California.



Figure 3

PX-D-73250

durability and flexibility when clamping and tearing at the water-soaked weeds. Rigid teeth would have broken under the stresses. To prevent smaller weed fragments from escaping back into the water, the insides of the jaws were lined with small mesh wire tacked into place. Figure 2 on the preceding page shows the wire in place as described above.

An added weight of steel plates was welded at the hinging of the jaws to make it easier for the teeth to pound down through the tightly packed weeds. Figure 3 at left shows this weight attached to the pivot bar.

Operation

When a pack of floating weeds lodges on a check gate or pumping plant intake, maintenance crews send for the dragline and the big jaws. Rigged properly on the ropes of a dragline, the jaws can open to a spread of eight feet. The boom is then swung out over the aqueduct in position over the weeds and dropped into the water with the jaws open for a bite. With the jaws full, the load is swung over the bank and dumped into a pile or into a dump truck, to be dried and later destroyed. Figure 4 on next page shows the device being lowered into the water, and in Figure 5 on the same page it shows the jaws clamped shut swinging out of the water with a dripping load of wet weeds.

Here at the present time there is no restriction on burning weeds. However, with the probable future restrictions on burning, other ways of disposal are already being arranged including chopping and burying.

If any additional information is desired regarding this device, please write to Mr. Carl Capehart, Senior Civil Maintenance Foreman, Southern Field Division, Pearblossom Subcenter, Pearblossom, California 93553.

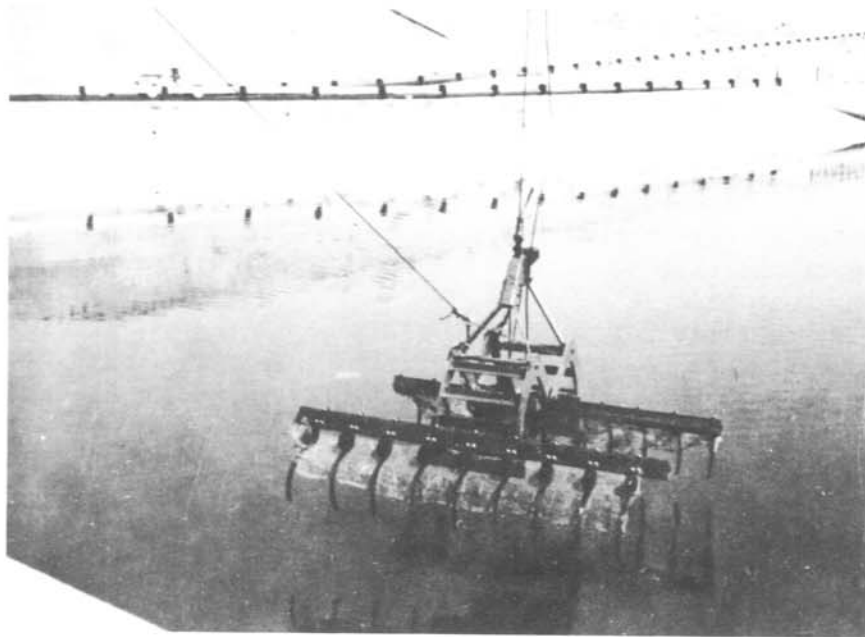


Figure 4

PX-D-73251



Figure 5

PX-D-73252

* * * * *

SAFETY FIRST
BOATING'S GOLDEN RULE

Observe These Safety Rules

- | | |
|---------------------------|------------------------------|
| 1. Know your boat | 6. Take sufficient fuel |
| 2. Don't overload | 7. Keep your boat in shape |
| 3. Keep a good lookout | 8. Carry necessary equipment |
| 4. Operate at safe speeds | 9. Secure your boat properly |
| 5. Respect the weather | 10. Obey the law |
- You are responsible for your wash and wake.
 - Reckless operation is punishable by fine and imprisonment.
 - Boats in your "DANGER ZONE" have right-of-way and should hold course and speed.
 - Learn and exchange proper whistle signals to avoid misunderstanding.
 - An overtaking boat is the burdened vessel.
 - Sailboats have right-of-way except when overtaking. Pass them wide to leeward.
 - Large vessels and tows are not quickly maneuverable. Keep clear - give them room.

The National Safe Boating Week Committee recommends - Be courteous and careful at all times!

* * * * *

PUBLIC SUPPORT FOR SAFETY
AND
VANDALISM CONTROL

Vandalism and safety have always been a source of contention for those who operate water-supply systems. Here is the way one irrigation company handled the situation.

In 1971 the Hooper Irrigation Company, Hooper, Utah, initiated an educational program on swimming and water hazards through letters to the farmers, city officials, the sheriff, and others. The failure of signs, gates, and fencing to keep people away from hazardous sections of the canal prompted this action. Response to the letters has been excellent and the problems with swimmers, structure tampering, and other acts of vandalism have all but disappeared. A copy of the letter cited above signed by the President of the Irrigation Company is printed on the following page.

OFFICERS

JAMES JOHNSTON
President

ARMINA R. WIDDISON
Secretary-Treasurer

HERMAN NEILSON
Vice President

Hooper Irrigation Company

HOOPER, UTAH
Phone 773-1556

DIRECTORS

LEONARD E. BLANCH
HERMAN NEILSON
JAMES JOHNSTON
R. HOWARD COX
J. EUGENE FOWERS
DEAN MANNING
HOWARD WIDDISON

TO INDIVIDUALS AND FAMILY MEMBERS ETC.:

Water and waterways can be hazardous, but tragedy may be avoided! Our irrigation canals and facilities were not constructed as recreation areas; therefore we do not want you or your children to use them as such. The land our system services is flat country, making it necessary in most instances to use open canal to convey the water, wherever possible we have used underground pipeline. We patrol our canal system daily, we also have fenced a large portion of our cement-lined open canals and are willing to do more in our efforts to eliminate a chance of harm. Fencing however, is limited to finances and the desire and cooperation of the landowner. We have posted "No Trespassing" signs along our right-of-ways, but most drownings are of children under the age to read such warnings. If at anytime you chance to see anyone, especially children, along our canal right-of-way. please, as a concerned individual, warn them of the danger and ask them to leave.

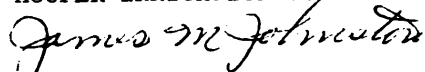
Throwing trash in the canals, dumping debris along the roadways, opening and closing headgates without authority, damaging property, or any unsafe practice cannot be tolerated and if necessary forceful measures will be taken to stop all such activities.

This letter is being sent to all known families residing in the vicinity of the area served by the Hooper Irrigation Company canal system.

We sincerely ask for your cooperation.

Respectfully,

BOARD OF DIRECTORS of
HOOPER IRRIGATION COMPANY



JAMES M. JOHNSTON, President

CRANE HAZARDS¹

An Army contractor employee was attempting to move a crawler crane to a different site on the job. He attempted to move it under communication lines, but he found there was not enough clearance. He then backed the crane and lowered the boom to the ground. The operator and the oiler were to remove the pins at the rear of the crane to allow the gantry to fold over the crane and be low enough to proceed under the communication lines. At the time they started this procedure the boom lines were slack. The operator's manual states that the boom be lowered to the ground and boom hoist tension be slightly reduced. The gantry is then lowered by slowly increasing slack in the boom hoist line. When the operator removed his pin on the right side the gantry still held until the pin on the left was removed. The moment the pins on both sides were out the gantry collapsed in a scissor-like action. The operator, on the right, received a glancing blow on his hard hat. The oiler, on the left, was caught in the fold of the gantry. His left arm and leg were crushed and subsequently amputated, the leg above the knee and the arm above the elbow.

The operator was experienced in crane operation, although not with this new machine. The oiler had helped move this crane under the same lines four times previously. Both men were standing on the counterweight when the gantry collapsed. The operator was hit a glancing blow on the head by the gantry when it collapsed and knocked off the counterweight. Evidently his reflex action made him move out of the way at the right moment so that he was not caught. He credits his hard hat with saving his life.

The slack in the cables allowed the gantry to collapse. Standard Operating Procedures direct the boom will touch the ground with slightly reduced boom hoist tension. The boom was touching the ground at the time of the accident.

To prevent this sort of accident in the future the manufacturer was requested to incorporate a safety device which would prohibit collapse of the gantry in the event of excess slack cable. Suggested possible devices included a positive drive gear train for up and down motion of the gantry, or a ratchet type holding device. Another suggestion was to install a buzzer and light that would react when tension was off the boom.

So far the manufacturer has not come up with a positive safety device. They have had warning plates printed, and they are distributing them to owners of these cranes and similar equipment. The plates read,

"WARNING. STAND CLEAR OF GANTRY, OUTSIDE OF GANTRY
AREA WHEN REMOVING LOCKING PINS AND WHILE RAISING OR
LOWERING. FOLLOW OPERATING INSTRUCTIONS."

¹ Reprinted from the Reclamation Safety News, Third Quarter 1972.

SAFETY FENCING, NET AND CABLE¹

Safety fencing was installed at check structures on the South Gila Canal, during construction of the system. The construction is part of the South Gila Valley Unit, Gila Project, Yuma Projects Office, Yuma, Arizona.

One of the check structures shown in Figure 6 below, is part of the original construction and shows the fencing and the safety cable suspended across the canal between the end post of the fence enclosure. This type of installation exists at locations where a pipe siphon is immediately downstream from the check. A detailed drawing of the safety net and cable is shown on the next page (Figure 7).

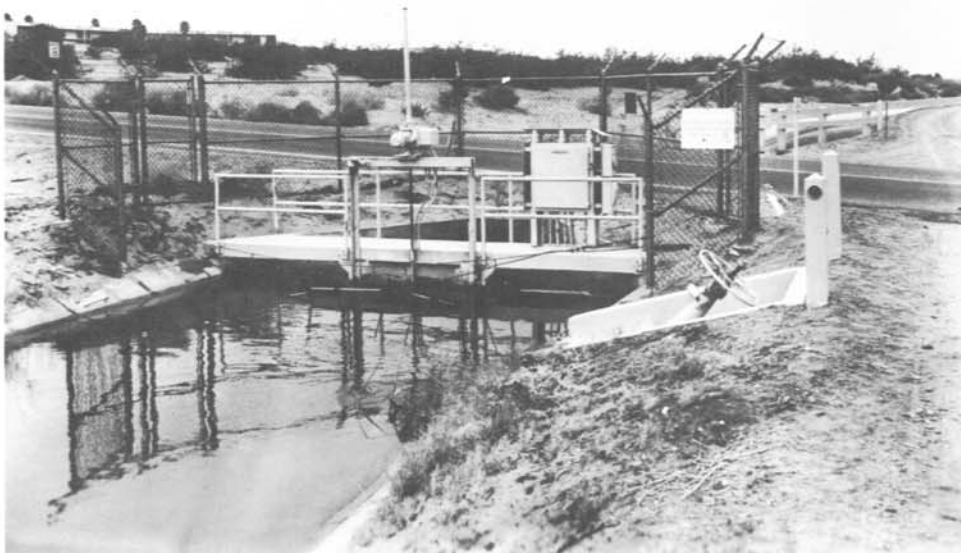


Figure 6

PX-D-73253

At Check SG-4.0, a "people or animal" rack was installed. A full view of this particular rack can be seen in Figure 8 on page 9. This type of rack eliminates the need for the safety cable and chains. The rack also permits small trash and pondweed to pass through without clogging the rack and retains large tumbleweeds and other debris.

¹ Material for this article was furnished by the Yuma Projects Office, Yuma, Arizona.

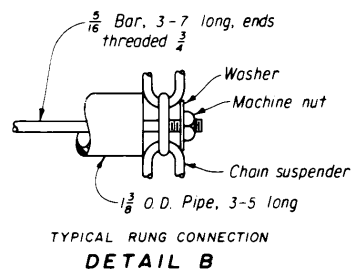
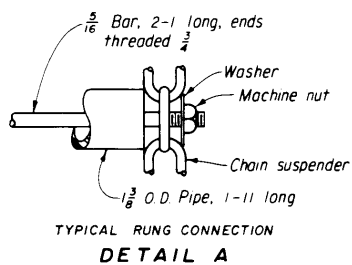
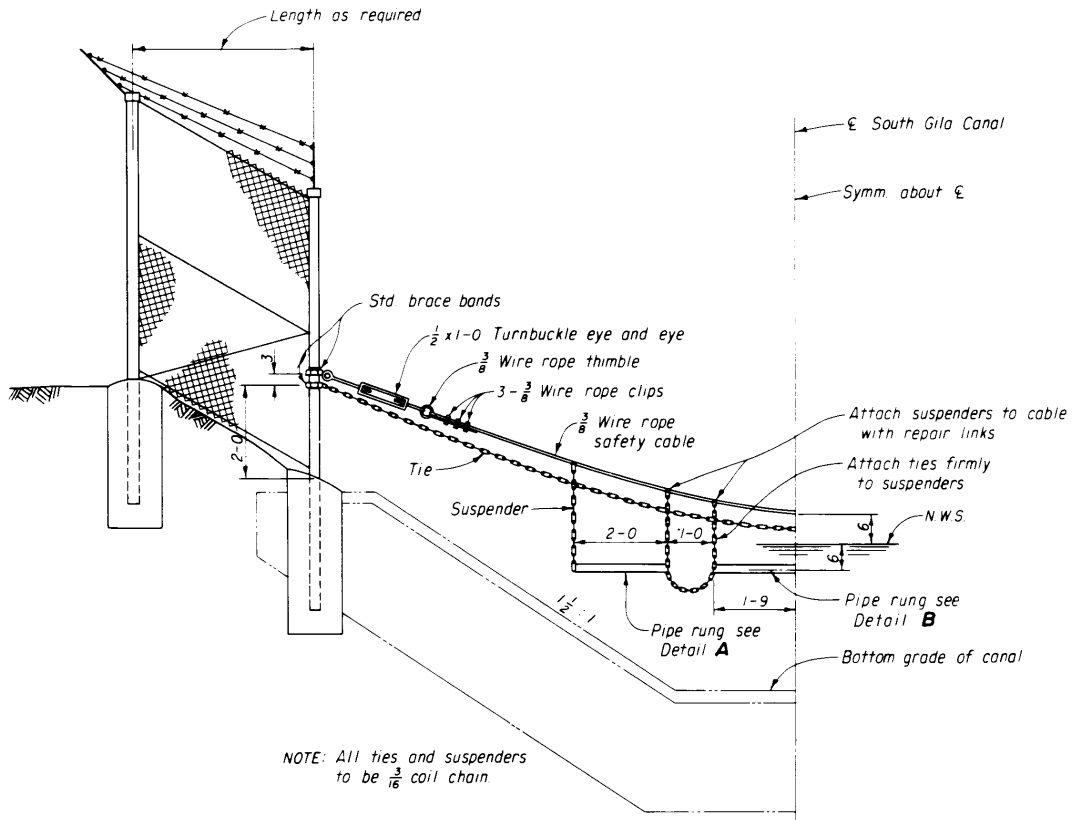


Figure 7

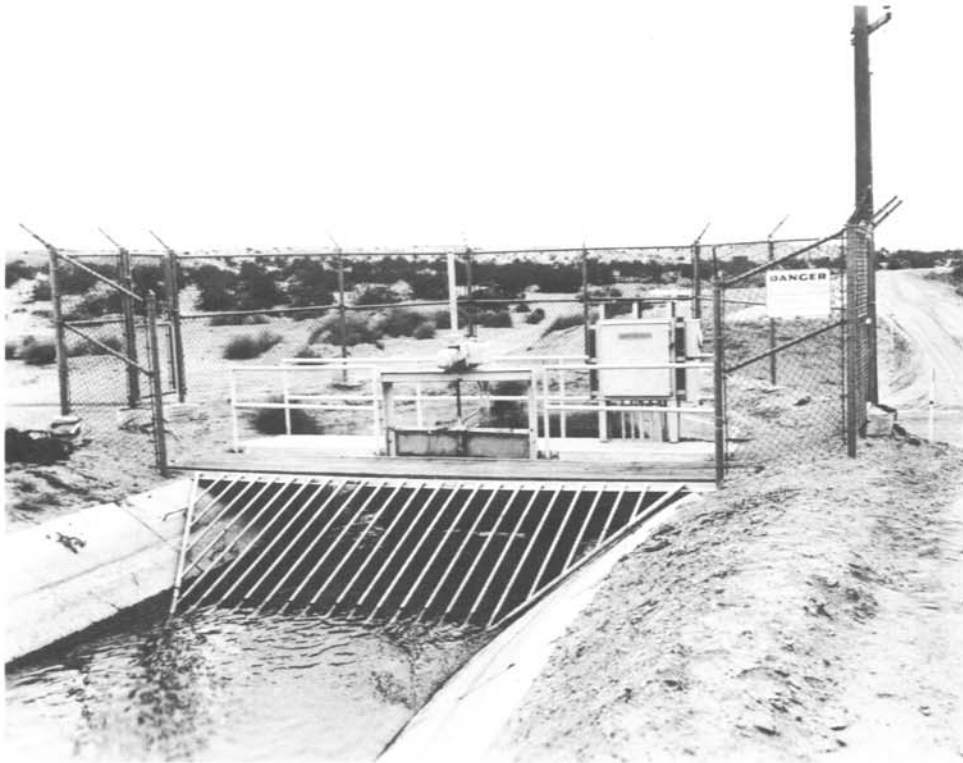


Figure 8

PX-D-73254

The trash rack shown in Figure 8 above, was designed and fabricated by shop personnel. It was reported to be easy to install and very easy to clean.

Materials used for construction:

- a. 3-inch by 3-inch by 1/4-inch angle iron.
- b. 1-inch galvanized pipe.
- c. 1/4-inch by 3-inch flat bar stock.

The pipe is welded to flat bars on 8-inch centers, and other dimensions would vary with size of canal or lateral. Installation of the pipe on a flat slope causes most of the trash to collect near the top of the rack that permits the easier cleaning previously mentioned, and also eliminates the need for cross bracing between the pipes in most installations. Larger pipe can be used where flow velocity causes vibration damage to pipe.

* * * * *

BOOM ATTACHMENT FOR PICKUP TRUCK¹

The following vehicle modification was not made by shop personnel but was done by a commercial firm in Oakland. Specifications for the type of vehicle required was drawn-up by maintenance men in the shop and forwarded to the Company, however. All modifications were made, and vehicles procured, with the full consent of the Mobile Equipment Branch, and this truck will fill a specific role in the maintenance of the Field Division.

Modification consists of two steel boom-arms attached to pivots fixed in the bed of a 3/4-ton truck. The arms can be canted back over the tailgate and secured together at their tops to form a crane. A hand-operated winch complete with cable makes it a very useful hoisting tool. When not in use the boom-arms can be laid back over the edge of the cab and secured in specially-built rests. Most of these features are visible in Figure 9, shown below.

This truck can go into places where a larger hoist could not go. It can provide lift in many field situations, and objects can also be hoisted and placed in the back of the truck for transportation.

If further information is desired regarding this Pick-up truck modification please write to: Chief Technical Development Section, Plant Operations Branch, State of California, Department of Water Resources, 1416 Ninth Street, Sacramento, CA 95814.



Figure 9

PX-D-73255

¹ Reprinted by special permission of the Editor, from Technical Bulletin No. 13, of March 1972, published by the State of California, Department of Water Resources, Division of Operations and Maintenance, Sacramento, California.

A PORTABLE "JIB-BOOM" HOIST¹

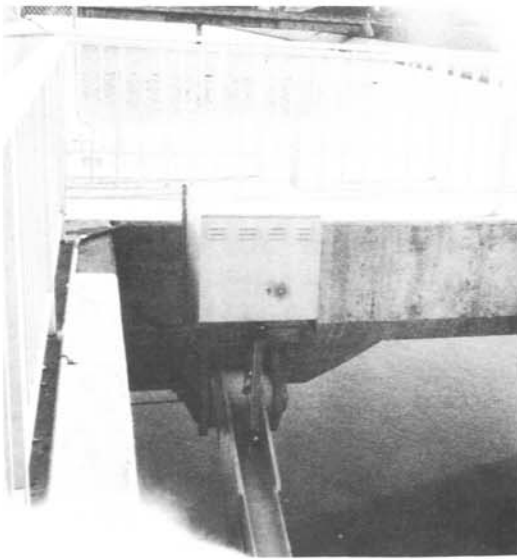


Figure 10 PX-D-73256



Figure 11 PX-D-73257

Occasionally, the "four-bar linkage" and the gate positioning encoder at each of the radial gate locations needs service and adjustment. This is one of the duties of a Control Systems Technician. The linkage and encoder equipment is located down at the pivot-point of one arm of the gate and is protected by a heavy, box-like, steel cover, as shown in Figure 10 at left. Before any adjustment or other work can be done the cover has to be removed, which involves a man standing on the gate arm and struggling to lift the awkward, heavy cover up over the guard railing. Because of the unnatural position and the weight and size of the cover, the job presents a very real safety hazard. On at least one occasion the cover accidentally slipped and was dropped into the aqueduct. Men at the Delta Operation and Maintenance Center have developed a device to eliminate the danger while speeding-up and simplifying the job.

Description

Everything about lifting and removing the heavy cover was dangerous and difficult, so the answer was to get a reliable crane or other lifting device. The tool had to be inexpensive and easily portable, preferably by one man. This is exactly what was turned out. Bud Byron, Maintenance Foreman, designed it and Dick Carlton, Maintenance Mechanic, built it. The hoist they produced is made of ordinary steel tubing, reinforced and braced at

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Figure 12 PX-D-73259

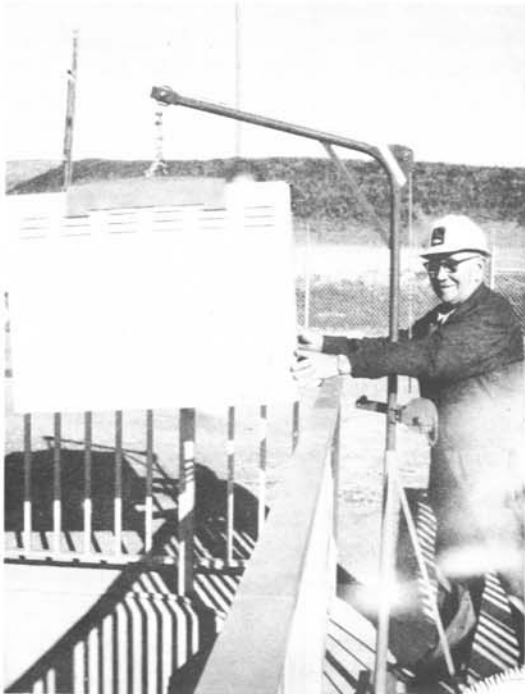


Figure 13 PX-D-73258

please write to the Department of Water Resources, same address as shown at bottom of preceding page.

* * * * *

the angle-bend, and fitted with two pulleys and a small boat-type winch. The bottom of the hoist fits into a steel-pipe base braced by a tripod of steel strap and welded to a T-shaped base of metal channel. The only thing needed then was to fasten a wire rope to the winch, thread this over the pulleys, and attach it to some sort of lifting hook. All of this is shown in Figure 11 on the preceding page, where the hoist is on display held by builder Dick Carlton.

Operation

The lifting hoist is completely portable in a van or pickup and is set up in approximately one minute by anchoring the base in position on the walkway adjacent to the cover by means of one, 5/8-inch bolt and a Red-Head concrete anchor, which is now provided at each location. A pair of lifting jaws made of a piece of chain with flat bar plates at either end is used to engage the cover. Figure 12 above, shows how the bar plates slip into the louver openings on the cover sides. This attaching can be done easily from the gate walkway. With the two bar plates engaged into the louvers, the hoist is cranked to lift the cover up clear of the guard rail, the ratchet of the winch is then "pinned" to hold the load secure, and the cover is swung over the railing and let down onto the walkway. It is a very simple, safe, one-man operation. Figure 13 at left, shows the hoist in action. The technicians charged with adjusting the equipment are glad to have the hoist available.

If further information is desired regarding this "Jib-Boom" hoist,

FLEET PURCHASING AND DISPOSAL
GUIDES by
Marvin Gersten¹

The subjects of this paper represent a high priority concern of the New York City administration. Motor vehicles and their operation play a major role in supplying vital services and represent a sizable portion of our city expense and capital budgets. Success demands centralized control, computerized records, budget and cost study, and constant liaison administration.

To give you some concept of the size of our vehicle operation, consider Table 1:

TABLE 1

total population	7,867,760
total area of city	320 sq. miles
total agencies & departments	100
total vehicle fleet	13,380
a)cars, scooters & motorcycles	4,186
b)trucks	9,194
average number city vehicles per sq. mile on two-shift operation-- sanitation of three-shift operation--police	42

Purchase Department automotive and heavy equipment purchase awards average 30 million dollars annually and represent 22% of our total Purchase Department dollar awards.

City of New York replacement cycle for passenger cars prior to the 1968 model year was six years or 60,000 miles--whichever came first. Disposal was by sealed bid. In 1967, our fleet was a mixed one of compacts, a few intermediates, the highest percentage being standard models, with medium class models for executive use. All units were bottom-of-the line 6-cylinder stripped, the only extra equipment being an automatic transmission except the executive cars which had 8-cylinder engines and power steering. All were black in color with standard upholstery. Under the program Bureau of Budget figures showed a vehicle depreciation over the six-year period of \$275 a year. On the same basis, maintenance costs were estimated to be \$460 a year for a total of \$735 a car. Disposal of used units by sealed bid resulted in a salvage recovery on an average of \$50 per unit.

¹ Commissioner, Purchasing Department City of New York, presented at the American Public Works Association Congress and Equipment Show, Philadelphia, Pennsylvania.

Obviously, this was a wasteful and costly program considering the economic advantages enjoyed by government agencies at that time:

1. Excise Tax Exemption, worth \$150 to \$200 advantage in the used car market.
2. Vehicle manufacturers' competitive government price subsidies that averaged as high as \$800 a car below dealer wholesale cost, on large quantity bids.
3. Manufacturers' warranty of two years or 24,000 miles plus a 5-year or 50,000 mile warranty against defects on major components.

Two-Year Replacement

In 1967, the decision was made to change to a two-year replacement cycle regardless of mileage for the purpose of reducing maintenance costs; also to upgrade on model car and related equipment in order to increase the value as a used car when removed from service. When specifying the approved cars, in addition to the normal considerations, we added the idea that we were manufacturing a used car for sale to the public that must be readily salable and bring top dollar on the car market two years down the road.

To inaugurate our new program we decided on types, models, equipment, color and upholstery as follows:

ADMINISTRATIVE CARS--Intermediate model top-of-the-line, 4-dr. sedan, 6-cylinder engine, automatic transmission, power steering, AM Radio, heavy duty alternator and battery, snow tires on rear, color-mfgs., assorted standard colors (no blacks) with black vinyl upholstery.

STATION WAGONS--Standard model equipment same as the intermediates with an engine option of 6 or 8 cylinder and of two or three seats.

EXECUTIVE CARS--Medium class top-of-line, 4-dr. hardtop sedan, 8-cylinder automatic transmission, power brakes and steering, AM Radio, air-conditioning, tinted glass, rear window defogger, heavy duty alternator and battery. Colors--assorted manufacturers' standard, black vinyl upholstery.

POLICE AND FIRE UNITS--Standard model bottom-of-line, 4-dr., sedans, 6 and 8 cylinder engine, with automatic transmission only but loaded with specially engineered equipment and special paint.

Our decision as to method of disposal was to change from sealed bids to public auction.

Public Auction

Auctions are held at a centrally located City garage by a public auctioneer. Auctioneer's fee is paid by the purchaser. All units are

sold "as is"; no conditioning is performed. Our only expense is one dollar for a wash and \$300 for newspaper advertising for each auction.

The result of the sale of our 1968 model cars in terms of average dollar depreciation or cost of use--whichever term you prefer--is in Table 2.

Table 2

intermediate model	\$500 or \$250 a year
station wagons	\$480 or \$240 a year
medium 4-dr. hard-tops	\$600 or \$300 a year

Since most cars auctioned were in the 20,000 to 30,000 mile range, the 24-month, 24,000 mile warranty made maintenance expense minimal--mostly oil-change, lubrication, inspection, adjustment and tune-up. Budget Bureau figures showed 2-year maintenance to average \$300 or \$150 a year. Total depreciation and maintenance was \$400 a year, resulting in a saving of \$335 per year per car. When you multiply this by 1,500 administrative cars, the savings are large.

With the discontinuance of substantial manufacturers competitive government price subsidies in the 1971 model year plus a City of New York austerity budget, a moratorium was placed on the purchase of all cars other than police units. At the moment we are in the process of making a decision on future policy. One thing is certain; we will not return to the old 6-year or 60,000 mile cycle.

For trucks, our replacement program has some degree of flexibility. It is charted in Table 3. Actually, any truck not permitting economical operation may be replaced at any time.

Table 3

light trucks--5 years or 50/60,000 miles
medium --6 or 7 years or 70/80,000 miles
heavy duty --8 to 10 years or 90/100,000 miles

So much for our replacement and disposal policies. I would now like to address myself to the larger problem of total fleet operation.

Increasing Costs

Government automotive purchase and fleet operations are today caught up in an unsurpassed economic squeeze. Increased costs are represented by general inflation, increased vehicle and equipment acquisition costs, including normal annual price increases, and cost of anti-pollution safety devices (A leading auto manufacturer estimates that 1975 model Federal goals will cost the public an additional \$300 per car). Also discontinuance by major vehicle manufacturers of competitive government sales subsidies add to our costs. Subsidies have gone

as high as \$800 below dealer wholesale on an intermediate model 4-dr. sedan and as high as \$1,500 on a heavy duty truck. As of today, only two leading manufacturers are extending subsidies on passenger cars and then in vastly reduced amounts. Look at what this change in government sales policy on the part of the vehicle manufacturers represents in terms of 1970 vs. 1971 model passenger car prices: (see Table 4 to see how subsidy removal has raised prices.)

TABLE 4

	<u>1970</u> <u>Price</u>	<u>1971</u> <u>Bid</u>	<u>Dollar</u> <u>Increase</u>	<u>Percent</u> <u>Increase</u>
intermediate - 4 dr. sedan	\$1,739.00	\$2,352.79	\$586.79	33.8%
station wagon - 2 seat	2,096.18	2,834.01	737.83	35.2%
station wagon - 3 seat	2,224.77	2,919.31	694.54	31.2%
medium - 4 dr. hard top	2,824.53	3,699.00	874.47	30.9%

Increased maintenance costs stem from manufacturers' warranty "cutback" to 12 months or 12,000 miles. Proposed legislation to cancel the Federal excise tax to the public will cost the \$150 to \$200 advantage previously enjoyed in the disposal of used vehicles. Labor shortage of skilled mechanics results in wage competition. City of New York pays \$6.50 an hour. Shortage of qualified automotive technical and administrative management personnel, due to failure of civil service to establish attractive competitive compensation, adds to salary costs. Since most 1970-1971 vehicle and equipment budgets were based on the previous years' awards without consideration of subsidy discontinuance budget limitations are built in.

Our 1971-1972 will be on an austerity basis. In view of these largely uncontrollable increased cost factors, what options have we to eliminate or reduce the dollar squeeze? Let's look at passenger cars, trucks and fleet operations in that order:

Passenger Car Options

We can proceed with original budgeted purchase compensating for increased unit price by reducing number of units and fit quantity to available funds, replacing only high-mileage cars, or we can try to secure additional budget allocation.

If the fleet has been operating on a one or two-year replacement program with no cars in service longer than two or three years an accumulated mileage is not in excess of 40,000 miles, we can declare a moratorium until the next model year.

Extending vehicle service life is possible. It would require an in-depth study of cost implication on vehicle depreciation, disposal value and maintenance cost.

The downgrading of approved models and equipment to match available budget and quantity requirement is possible with choice of sub-compacts, full compacts, intermediate or standard model cars. Implications on depreciation, disposal value, maintenance and safety must be considered.

Truck Purchase Options

In this category initially we had no options. Light and medium class trucks were tied to the passenger car no-subsidy policy, with only one exception and in mid-year one other manufacturer reversed their policy to supply subsidies only on medium and heavy duty trucks. These subsidies have proven to be minimal; for light and medium trucks not more than \$50 to \$100 below dealer wholesale. Only in the area of heavy duty trucks can we look forward to normal government price levels and then only from the exclusive truck manufacturers.

Increased truck depreciation is inescapable since most fleets operate under the universally accepted replacement periods of light and medium trucks at six years or 60/70,000 miles; heavy duty trucks at seven to ten years or 70/100,000 miles and others under the old formula of replacement when lifetime total maintenance costs exceeds the original purchase cost.

Fleet Operations

It follows that only in the area of fleet operations is there a possibility of economies. We believe this can be accomplished by the establishment of a Fleet Management Bureau with authority to acquire, lease, manage, maintain, store and operate vehicles and other automotive equipment for the use of other agencies and to operate shops, yards, fuel depots, and other facilities required for the effective and economical use and maintenance of such equipment. The establishment of central management and operating control will put a fleet on a commercially sound operational basis. We know of several state governments and cities operating with excellent results on this basis for a period of years. The economies to be achieved are elimination of duplication of facilities and personnel; maximum utilization of equipment, facilities and personnel; reduction of department and agency-head involvement in automotive equipment and maintenance problems freeing their time for primary department responsibility; permitting the establishment of a passenger car revolving fund for the purchase of replacement vehicles, with funds to come from rental fee revenue; and maximum used car disposal dollar recovery. Only in the area of heavy duty trucks can we look forward to normal government price levels and then only from the exclusive truck manufacturers.

The Director's Job

The Director of Fleet Management Bureau must establish vehicle replacement cycle policy; passenger car and truck specifications; vehicle

equipment policy; vehicle acquisition in liaison with Purchase Department and vehicle disposal policy, including public and wholesale auction, sealed bid and trade-in.

He must also dispose of used vehicles in liaison with the salvage division of Purchase Department; establish mileage and use standards to assure efficient vehicle utilization; establish the monthly, weekly, and daily use rate with mileage, (after establishment of revolving fund). He establishes, operates, and maintains a central vehicle pool of passenger cars and station wagons, (also subpools in other areas where required and justified). Echelons of maintenance and repair are needed including practices and standards in lubrication; preventive maintenance; accident repair, mechanical, sheet metal and painting.

He approves shop layouts, equipment and special shop tools. A "Parts Common" is required (spark plugs, ignition parts, etc.) as well as motor oil and lubrication specifications in liaison with vehicle, Purchase Department and its engineering department, to help insure efficient parts distribution through all echelons of maintenance and repair.

Engineering liaison must be maintained with vehicle manufacturers' engineering representatives; also, warranty liaison with vehicle manufacturers' service personnel.

Vehicle records should include inventory control, parts control, and operations and cost control. The computerized control of records is the ultimate objective.

A vehicle safety program will contain driver training and accident report procedures.

A program for the reconditioning of relinquished passenger cars and trucks should employ prison labor, youth rehabilitation training program, your own shop and an outside contractor. The director must conduct constant studies and surveys to improve operations and effect economies.

I have never seen a decentralized government fleet operation that was not wasteful and inefficient to the degree that it could not be vastly improved by centralized control. In conclusion, it must be obvious that to fill the position of administrator or director of your fleet that you select a man who is a professional, qualified experienced automotive man, and who combines automotive technical and maintenance knowledge with real management skill.

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PLAN WISELY FOR SERVICE AND STORAGE¹

Construction of service and storage facilities is a major investment for any city and should be undertaken only after an in-depth review of characteristics and needs. For a small city a single garage and storage yard are probably the most economical. Where property is not zoned for industrial development, new buildings will demand good architectural design, larger side yards, and require more landscaping and general maintenance.

The large city has a problem of different dimension. With expanding services and a growing geographical area, running time for vehicles and employee travel increase, and operations become uneconomical. The solution is often a systematic decentralization of facilities.

One of the first steps in planning a city-wide system of service facilities is to study existing operations. The basic purpose of our plan in Nashville, was to create a few strategically located service centers for the joint use of our different divisions. Prior to our present system we had a central shop that was headquarters for five divisions of the Public Works Department. The site was on a dead-end street. This street also served the Nashville Transit Company busses. This created terrific congestion.

Nashville and Davidson County is a growing community of 450,000 people, covering 533 square miles of rolling hill country. In performing its duties, the Public Works Department utilizes over \$6 million worth of equipment, varying from power saws to a quarry crusher and a ferry. Passenger automobiles used by the department are leased from the General Services Division. The Equipment Division services and maintains all equipment, including 550 pieces of rolling stock.

Careful consideration should be given to the planning, design, and location of the facilities. Adequate land for outside storage of materials should be available near a railroad siding. The terminal point for large equipment-user operations is another factor to be considered. Some cities have constructed garage facilities adjacent to municipal incinerators since a sizable number of vehicles are used in this operation. They can be serviced and stored immediately after use with only a short run from the incinerator. Dispersal of equipment storage facilities is obviously necessary in large cities to minimize nonproductive vehicle mileage.

It may be uneconomical to provide storage facilities for all types of equipment, since some units will wear out and need replacing in a relatively short period of time. Part-time protection against weathering

¹ Written for the American Public Works Association Reporter, dated February 1972 by Mr. Wm. Lamb, Jr., Director of Public Works Metropolitan Nashville and Davidson County, Tennessee.

may not lengthen the useful life of such equipment sufficiently to justify the expense. Figure 14 below shows a typical storage area. Note plows parked in readiness for mounting. The area has over 73,000 square feet of floor space, and will allow the storage of 130 pieces of equipment.



Figure 14

PX-D-73260

Location Is Vital

The overall efficiency of an outlying service center is determined to a large degree by its location. Therefore, site selection should be given careful consideration. A service center should be near the center of an area producing the heaviest, most consistent service demands. Land and landscaping cost will usually be lower in industrially-zoned areas. Where property is not zoned for industrial development, new buildings will demand good architectural design, larger side yards, and require more landscaping and general maintenance.

The site should be large enough for both present and future needs. The facility should be near an Interstate, Expressway, or major arterial street. With frequent and somewhat slow ingress and egress of trucks, direct access to yards should be from a service road, not from the thoroughfare. For internal circulation at least two entrances should be provided.

Many employees depend upon public transportation to get to work. Therefore, the facility should be easily accessible to personnel and

vehicles. This is an important consideration. Before finally accepting a particular site, a thorough investigation of the availability of utilities, (water, sewers, power, gas, etc.), should be made. Topographic conditions that make for low development cost are important. Make every effort to achieve optimum land utilization, and to minimize the disturbances of natural surroundings. Soil conditions should be investigated to avoid unnecessary foundation problems.

In Nashville, we have four service centers; one in East Nashville, one in West Nashville, and two downtown. The East Nashville site, containing 14 acres, zoned industrial, and adjacent to the railroad, was purchased in 1961 for \$90,000. The West Nashville site was approximately 5 acres, was established in an abandoned quarry that belongs to the city.

Another important step includes the determination of the sizes and layout of districts that each center will service. In Nashville it was determined by analyzing travel time and similar factors. With a range of standards relating to district size it is possible to vary standards as a city grows. A single service center might handle newly annexed areas. When these areas become large enough, each could support a service district and center. The older district would then revert to its former size, and the new district would absorb subsequent growth.

The East and West Nashville Centers were designed ten years ago after the annexation of 50 square miles. However, soon after completion, Nashville and Davidson County formed a metropolitan form of government, under which an additional 400 square miles were added to be served by these centers.

They have adapted to this increased work load with only minor difficulty.

Use Expressways

In determining the boundaries of districts, we found expressway location to be the most significant factor. Although an expressway is a barrier to vehicles crossing it, it can also greatly increase the distance that a vehicle can travel in a given time. Ultimately the service center operation would gain maximum benefit from having access to the expressways; thus each district should have an expressway through it or as near to its median as possible.

After a district plan is formulated, size estimates for the service centers can be made. These can be obtained by making a detailed survey of each department slated for decentralization. Each department should complete a questionnaire on estimates of space required by both employees and equipment.

The detailed planning of a garage site and its interior is largely an architectural problem that must be worked out with the architect and

division heads. The mechanics are going to use these facilities, so it is extremely important to consult them in the planning stage.

Parking lots should be provided for employees and visitors. They should be lighted, paved and fenced, and located to keep private vehicles out of the services and storage areas.

It may also be advisable to provide an assembly room, kitchen, locker rooms, showers and restroom facilities for employees. Both of our new centers have these facilities. They help maintain good morale.

Steel buildings are practical for garage and shop facilities, particularly storage buildings. Such structures can be erected quickly, using pre-fabricated elements, at relatively low cost. They can also be developed economically with room for expansion and with door arrangements so that the vehicle storage area can be relatively open during the warm weather but closed and heated in winter.

Shops Need Tools

A shop should be almost self-sufficient with all necessary tools and shop equipment to take care of ordinary repairs. Manufacturers and local dealers will advise in setting up maintenance programs. The centers should include lifts or pits, motor analyzers, spark plug testing and cleaning machine, wheel alignment machine, heavy-duty battery chargers, portable electric and gas welding equipment, and an overhead crane designed for at least five ton capacity. See Figure 15 below, hydraulic floor lifts replace pits in this modern shop. Larger

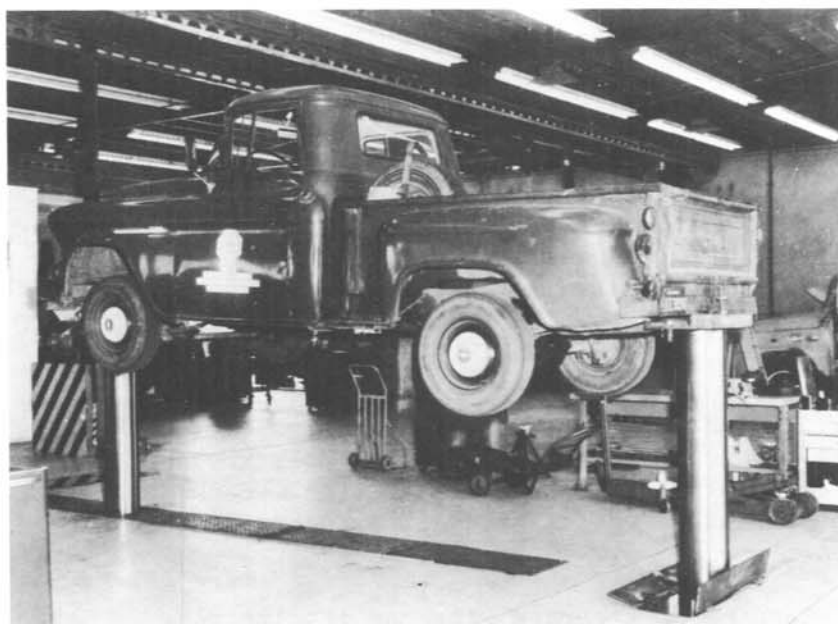


Figure 15

PX-D-73261

garages may also have brake testing machines, piston grinders, pin-reaming machines, line reamers, brake drum grinders, and other modern equipment. See Figure 16 below, this clean well equipped shop is practically self sufficient with all necessary tools and shop equipment to take care of ordinary repairs.



Figure 16

PX-D-73262

The service centers should also be equipped with modern washing equipment located in a separate service bay. This equipment should have facilities for steam generation with disinfectant added.

Other types of repair shop operations might also be performed at a well designed center. Facilities might be included for repairing water meters and parking meters, or for painting and repairing signs and signals. It may be economical to provide a complete paint and body shop at one center. Tire repair equipment, including power wrenches, mounting and demounting equipment, is a necessity at one central location. Completely equipped service trucks should also be provided.

Some shop facilities employ loud speakers to issue instructions particularly for dispatching. This system is often supplemented with a blackboard arrangement.

Service Centers

To buy gasoline in quantities a city should have storage tanks, with capacities of at least 10,000 gallons. Three of our four service centers have 12,000-gallon tanks. One has a 20,000-gallon unit. The cost of installing such tanks can usually be more than offset by

bulk-purchase savings. Care should be taken to install such tanks in accordance with the standards developed by the National Board of Fire Underwriters. The dispensing device should be located in an area of fire resistant construction, well away from vehicle storage and repair areas. It should be well ventilated. It should also be protected against damage by mounting it on a concrete island and should be located where it cannot be struck by a vehicle descending a ramp out of control. A convenient remote emergency shut-off for electric power to the dispensing unit and the pump supplying it should also be provided.

Limiting the number of points at which gasoline, oil and diesel fuel may be dispensed has some inventory control advantage but it results in considerable non-productive mileage. The use of additional tanks and pumps may prove advantageous if adequate records are maintained. Some large cities supply gasoline, diesel fuel, and oil to vehicles in the field through the use of tank trucks. Fuel is available at each of our four locations. It can also be obtained in the field from one of our service trucks.

Establishing design criteria for a system of maintenance and storage facilities is an involved process involving many factors that often appear to be unrelated. The planning of service facilities is well suited to the team design approach, utilizing the knowledge and abilities of engineers, architects, city planners, and other department heads. A city's needs and jobs should be reviewed in the effort to determine the exact function of each service center.

One of the primary objectives is low construction cost and low, long range maintenance cost. Proper briefing of the architectural and engineering firm should be done at a pre-design conference. The design should be simple.

In the planning stage don't overlook the mechanics and other personnel who will use the facilities. Their comments and ideas constitute a valuable source of information. A review of the operation of other cities can prove valuable, if properly interpreted. However, their needs may not be your needs, so don't blindly copy their plans.

The basic concept of decentralization of maintenance and storage facilities is to achieve maximum service with efficiency and economy. The time spent in planning may prove to be the best investment your city can possibly make.

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