Evaluation of Locomotive 470 for possible restoration and operation

There has been a fair amount of interest shown in recent months of restoring the former Maine Central Railroad locomotive number 470. The degree of restoration ranges anywhere from a light cosmetic restoration to a full blown, return to operating condition restoration. I, personally and others would like to see the 470 run, for an operational steam locomotive has an appeal like no other piece of machinery ever built. It would be a wonderful advertising and public relations tool for the City of Waterville and the State of Maine and would preserve a piece of Maine's industrial heritage.

I am preparing this evaluation report to make the City of Waterville, the owners of the 470 and other interested parties aware of the scope of a project like this. There have been some restoration projects like this in other parts of the country that have been started with great enthusiasm. When the members of the group fully realized the costs and labor involved, the project quickly died, or has taken so long to complete that it is difficult to draw enough interest to get it moving again. There have also been other projects like this done successfully. One such example is the City of Portland, Oregon and their locomotives, SP 4449 and SPS 700.

This is why I want to make everyone involved aware of the fact that we have a locomotive that has been exposed to the elements for 50 years with badly rusted and mistreated components. To do a thorough inspection to determine the feasibility of this project, it will require many man hours of labor and probably thousands of dollars depending on who does it and if they are willing to donate their time.

I have broken the locomotive down into 4 catagories. The first and the heart of the locomotive is the boiler. The second is the machinery, the third, the air brake system and the fourth, the tender.

Boiler

A preliminary inspection of the boiler could be done by examining the exterior of the boiler shell and by using a fiber optic scope to do a limited internal examination through the washout plugs. Most all of the boiler jacket and asbestos has already been removed, so there would be little preparation needed for this part of the inspection. Some of the washout plugs and blowdown valves should be removed to inspect inside of the boiler with a fiber optic scope. A few areas of the boiler shell could be spot checked with an ultra sonic tester, also. The firebox and smokebox should be made accessible. It will require the removal of the firebox doors so it may be easily entered. If it is decided to abandon the project in favor of a cosmetic restoration, then minimal time and expense will have been spent in the inspection. If it is decided at this point to go ahead with the project, a more thorough inspection will need to be done. In order to fully evaluate the boiler, the interior must be made completely accessible in order to do an ultrasonic inspection of the entire boiler shell. This is not only necessary to determine the integrity of the boiler, but to also gather data to calculate the working pressure to complete the FRA form 4.

To make the boiler accessible, the dome cover, throttle valve, smokebox cover and firebox doors must first all be removed. Then the superheater units must be removed to make the boiler flues and tubes accessible. The admission pipes leading from the

superheater to the steam chest may also have to be removed. Now the tubes and flues can be removed from the boiler. All the washout plugs should be removed, too.

Once the flues and tubes are removed, the boiler interior should be sandblasted to remove any accumulated scale deposits. This is a nasty, miserable job, depending on what kind of water treatment was done in the past. The interior of the boiler barrel should be painted with a special paint available from the Dampney Corp. to prevent the shell from rusting immediately after sandblasting. Then a grid pattern should be drawn around the exterior of the boiler and numbered so when ultrasonic readings are taken, they may be documented for further calculations. The drypipe should be ultrasonic tested, too and documented. Also, all backhead, throat sheet and front tube sheet braces should be sounded out at this time.

The firebox should be entered and examined at this time, too. The brick arch should be removed and any ash cleaned out as well. A similar grid pattern should be drawn on the firebox sheets and ultrasonic tested and documented. Particular attention should be paid to the knuckle section of the crown sheet. This area sees a lot of expansion and contraction and is prone to cracking. It should be examined from both the firebox side and the boiler barrel side.

The exterior of the boiler should have all the flexible staybolt caps removed and inspected. I know for a fact that there are several flexible staybolt sleeves on the top of the boiler that have rotted through and will have to be replaced. Also, any studs that hold things like the turret valve and turbo generator will have to be inspected for wastage.

All of the boiler inspection work could be done on its current site. Once that it is determined that if the boiler is in generally sound condition, the feasibility of restoring the locomotive to running condition, I would think, would be good. If the decision is made to restore the locomotive to operating condition, then the remaining boiler work should be completed after the machinery and tender are rebuilt. Once the boiler work is done, the clock starts ticking on flue time. This way we can avoid losing any flue time if the rest of the locomotive is done or nearly done.

Machinery

The machinery of the locomotive consists of;

1. Cylinders and steam chest
2. Valves
3. Valve gear
4. Pistons
5. Piston rods
6. Crossheads
7. Main and side rods
8. Lead truck, driving and trailing truck wheels
9. Driving boxes
10. Suspension system
11. Frame
12. Lubrication system
13. Boiler feed water system
14. Stoker
15. Booster engine

It will be difficult to evaluate all of the machinery without complete disassembly of the machinery. The best that can be done is to estimate the number of man hours it will take to move the locomotive to a jobsite where the work will be done, disassemble the key components and either repair the old parts or make new

ones. One can probably assume that a worse case scenario will exist when different components are disassembled because of the long exposure to the elements and vandalism.

On the top of the steam chest there are two peep holes located there so the piston valve can be seen when the valves are being set during an overhaul. The plugs are missing from the peepholes and have been exposed to the weather for several decades. I would expect to find the bushings and spool valves badly rusted from rain water running into them. Some penetrating oil could be poured into them and allowed to set for a time and the holes should be plugged to prevent any further accumulation of water. Once the penetrating oil has set for a sufficient length of time, the heads from the steam chest and cylinders should be removed to inspect the bores. At the very minimum, the valves and pistons will have to be re-ringed, but more than likely the valve and cylinder bores will either need to be re-sleeved or bored oversize and rings fitted to them. It all depends on how badly eroded the machined surfaces are.

To remove the pistons and spool valves from their crossheads, the keys will have to be removed and the rods pressed out of the tapered sockets. This will require heat, a 50 ton hydraulic ram and a special fixture to fit the crosshead pin hole once the main rod is removed.

The main and side rods will have to be removed prior to the previous step. All the rod bearings and crankpin journals will have to be inspected for clearances and surface finish. The rods should be mag particle tested for cracks, too. Here I would expect to find minimal damage, but it's hard to say what kind of shape they were in before the locomotive was retired.

The crossheads and guides will have to be taken down, next. There is a fair amount of rust bulging from the crosshead shoes. The guides have been painted over, but a fair amount of rust was on the surface that will have to be taken care of. The shoes and guides could probably be re machined and shimmed to fit. At the worst the shoes will need to be re babbitted to fit the guides and new fitted bolts made to re hang the guides.

The valve gear and related components will have to be removed and inspected next. This locomotive has Baker valve gear which consists of bell cranks, yokes and levers. Other than disassembly, this shouldn't be bad to deal with. Mostly, it should be a case of freeing up frozen joints and making new bushings. The most difficult part is going to be removing and disassembling the reverse gear. This reverse gear is called "Franklin Precision" and is operated by a screw mechanism with an air assist. This will probably be a time consuming component to rebuild.

All of the wheels on the locomotive and tender should be inspected for flange and tread wear. They may well be within acceptable limits and if they are, it will be one thing that we won't have to repair. The axle journals are another matter, however. The locomotive has made two moves since it was placed by the old Waterville station. The first was to move it from the station to the shop yards and the second to where it is now. Who knows what lubrication, if any, was done to the machinery and axle bearings when it was moved. I know that the trailing truck bearing boxes are full of rocks and at least one of the journal box covers are missing. All of the bearing journals will have to be cleaned and inspected before any attempt is made to move the engine. This will be a lengthy job.

The frame should be inspected to make sure that no cracks exist and the cylinder saddle is tight. If a break is found, the frame probably could be welded, but this is a heavy cast steel and would require an expert to properly perform this task. It is probably OK, but should be checked, none the less.

All of the springs on the suspension system should be checked over. If the springs have a good arch to them, they may be OK. Once the locomotive is run for a few trips, they may start to sag.

The lubrication system on the locomotive has three separate systems. In the cab is a Detroit hydrostatic lubricator for the valves and cylinders. Out front by the right cylinder there is a mechanical lubricator for the chassis components. The air pump has its own mechanical lubricator. All of the existing systems could be replaced with new mechanical lubricators to do these functions if the original lubricators could not be rebuilt. They are still available from China.

This component is really part of the boiler, but I chose to address the issues with it here. The current boiler feed water system consists of a Coffin centrifugal pump located on the left side of the boiler with a heat exchanger located in the smokebox. This style feed water system pre heated the water being fed into the boiler by using exhaust steam when it went up the stack, thus saving fuel used to heat the water. I would do away with this arrangement and replace it with a non lifting style injector similar to the one on the right side of the boiler. The right hand side injector uses steam directly from the boiler to operate it which is less efficient, but very effective and much simpler to maintain. There are new reproduction injectors available.

This engine is stoker equipped. It is a Standard HT-1 which uses an auger driven by a small steam engine and a table plate with jets of steam to distribute the coal in the firebox. I believe this feature was added sometime after the MEC purchased the locomotive. To repair it, the jet valves would need new stems and handles made and all new piping. The stoker engine would, no doubt, need to be taken out, stripped and rebuilt. The engine could be hand fired, but it may not be a bad idea to rebuild the stoker, for this engine, from what I heard, was a coal hog and I know personally what hand firing an engine is.

The last piece of machinery is the booster engine. It is a two cylinder engine located on the trailing truck. The purpose of this engine was to give an additional 10,000 pounds of tractive effort to help start the heavy loads. It would also give the engine a faster start from a station stop. This is a fairly complicated piece of machinery. It has flexible piping and air controls to maintain and have been known to be troublesome. I would either remove this component from the engine and save a lot of headaches or leave it there for cosmetic purposes only. I would not rebuild it as a functioning unit. For the kind of service the engine would ever see, it would not require it.

Air Brake System

The air brake system on this locomotive consists of an air pump, two main reservoirs, an auxiliary reservoir, feed valves, distributing valve, independent valve and automatic brake valve. This system is a Westinghouse 6 ET. The air pump is a

cross compound style. It is probably repairable and I think parts can be found for it. The air reservoirs have had patches welded to them and have rust bulging from them and should be replaced with welded reservoirs and safe drilled. This will eliminate maintenance during the annual inspection. The feed valves and distributing valves can either be repaired or replaced along with the independent brake valve. The automatic brake valve is missing, but a suitable replacement could be found for it. Most of the piping, angle cocks and hoses will need to be replaced. The brake gauge clusters will need to be replaced as the originals were vandalized long ago. The original style could probably be found from a collector.

Tender

The tender of this locomotive serves two functions. First of all, it carries the fuel supply and second, it carries the water supply for the boiler. This tender is of a riveted type construction. Many of the sheets have rotted through on the sides and bottom. Repairing a riveted tender presents some problems because to maintain the rivet lines and make a leak proof repair, it requires a skilled worker to do this. Welding can be done to a certain extent, but care must be taken not to warp the steel sheets in the process. Also, the rot is to the point where the tank will probably need to be removed from the frame in order to properly repair it. The tender truck bearing journals will have to be thoroughly cleaned and inspected for damage. The journal boxes on the tender trucks were filled with rocks and sand, as well at the engine trucks. I would not be surprised to find the journals badly rusted and pitted. If they are badly pitted, they will have to be machined down and a new set of brasses made to fit them.

Equipment and tools needed to inspect the boiler

1. Boom truck, 12 ton cap.
2. Oxyacetylene torches, 2
3. Air compressor, 50 cfm
4. Sandblast outfit
5. 2000 pounds black beauty sand
6. needle scalers, 2
7. portable generator, 5KW
8. electric end grinders, 2
9. 5 inch electric angle grinders, 2
10. exhaust fans, 2
11. magnetic base lights, 6
12. 50 ft. tape measure
13. ultrasonic tester
14. water supply, 100 gallons
15. O2 sniffer
16. Fiber optic scope

Man hours to prepare and inspect the boiler

1. Remove dome cover, throttle valve, firebox doors and smokebox cover. 48hrs.
2. Remove superheater units, header and admission pipes 60 hrs.
3. Remove dry pipe, boiler tubes and superheater flues 100 hrs
4. Sandblast interior of boiler barrel 40 hrs.
5. Layout grid pattern and record ultrasonic readings 32 hrs.
6. Sound out boiler bracing and record findings 20 hrs.

Total hrs. 300

Moving the engine from its current location to a work location

1. Engineer pick and transportation plan, transport crane to jobsite 200 hrs
2. Separate the engine from the tender 100 hrs.
3. Load tender and tender trucks on flatbed and off load at jobsite 120 hrs.
4. Separate boiler from frame and transport to jobsite 160 hrs.
5. Load frame and driver assembly and transport to jobsite 120 hrs.

Total hrs. 700

Equipment required to move locomotive

1. 100 ton lattice boom crane, 100 ft. boom
2. 50 ton cap. Flatbed trailer

Estimated number of man hours to rebuild machinery

1. Un-wheel locomotive frame 160 hrs.
2. Remove main and side rods from drivers 80 hrs.
3. Remove steam chest and cylinder heads and remove spool valves and pistons

80 hrs.

4. Remove valve gear and reverse gear

80 hrs.

5. Remove crossheads and guides

40 hrs.

6. Disassemble lead, trailing and tender trucks and inspect

300 hrs.

7. Disassemble driver boxes from drivers and inspect

80 hrs.

8. Clean bearing journals on drivers and mag particle test

32 hrs.

9. Sandblast frame and mag particle test for cracks

120 hrs.

10. Bore cylinders and valve bushings and machine valves and pistons to fit

1200 hrs.

11. Rebuild reverse gear and valve gear

1200 hrs.

12. Re-babbitt crosshead shoes and machine guides

200 hrs.

13. Rebuild lead, trailing and tender trucks

1000 hrs.

14. Rebuild stoker

200 hrs.

15. Clean, inspect and repair suspension system as required

272 hrs.

16. Re-wheel locomotive frame

72 hrs.

17. Install pistons and valves and line guides

64 hrs.

18. Erect valve gear

40 hrs.

19. Install new chassis lubricator

80 hrs.

Total hours 5300

Estimated number of man hours to rebuild tender

1. Strip stoker machinery from coal box

80hrs.

2. Sandblast entire surface, including underframe and inspect for cracks

40hrs.

3. Cut rotted sections of steel plate from tank and prepare for new plate

320hrs.

4. Rivet in new sections of plate and caulk
200hrs.
5. Rebuild water delivery pipes and shutoffs
150hrs.
6. Paint interior of tank and prime exterior
40hrs.
7. Fill tank with water to check for leaks, repeat until no leaks show
20hrs.
8. Run all new piping for brakes and electrical cable for rear light
110hrs.
9. Mount tank assembly on rebuilt trucks
30hrs.
10. Replace all remaining draft gear, stoker machinery, ect.
160hrs.

Total hours 1150

Estimated number of man hours to rebuild air brake components

1. Remove air pump from boiler, disassemble and inspect
40hrs.
2. Remove air brake distributing valve, disassemble and inspect
32hrs
3. Remove remainder of existing valves and determine feasibility of rebuilding
8hrs.
4. Rebuild air pump by reclaiming old parts and, or by making new parts
300hrs.
5. Rebuild distributing valve
40hrs.
6. Re-install rebuilt equipment on locomotive
80hrs.

Total hours 500

Estimated hours to rebuild boiler

1. Remove all flexible staybolt caps and inspect seats
80hrs
2. Replace all rotted flexible staybolt sleeves
500hrs
3. Repair thermic syphons
500hrs
4. Repair or replace turret valves and studs
500hrs
5. Inspect admission pipes and superheater units for soundness
80hrs

6. Grind in admission pipes and superheater joints
160hrs
7. Replace drypipe in boiler and reinstall superheater header
40hrs
8. Inspect all internal bracing prior to replacing tubes
10hrs
9. Install new sight glasses for boiler water level
40hrs
10. Repair or replace blowdown valves
80hrs
11. Repair boiler feed checkvalves
80hrs
12. Replace tubes and flues in boiler
120hrs
13. Hydro test boiler
20hrs

Total hours 2210

Miscellaneous repairs

1. Repair sheet metal and replace wood trim on cab
400hrs
2. Repair all electrical equipment, including generator, headlight assemblies and wiring.
200hrs
3. Fabricate and fit new boiler jacket
400hrs
4. Research, purchasing materials, misc.
840hrs

Total hours 1840hrs

Grand total
12,000 man hours labor
Time frame
2-3 years

As you can see by the above items listed, this is no small task to accomplish. The amount of hours estimated may even be conservative. Equipment costs and materials will still need to be figured in. To begin with, the funding to support a project like this will have to be sought out and then a contractor hired to do the actual work of restoration. If it is decided to pursue this as a project to have an operational locomotive, then negotiations should begin to secure operating agreements with a party to operate and maintain the locomotive. Negotiations with Guilford Transportation to see if access to their line is possible so the locomotive will have a place to run should be done, too. The FRA should be

contacted at some point so their inspectors can be aware of what we're up to. The operator selected by the 470 committee for the locomotive would be responsible for the insurance, maintenance and costs of running the locomotive and for providing coaches.

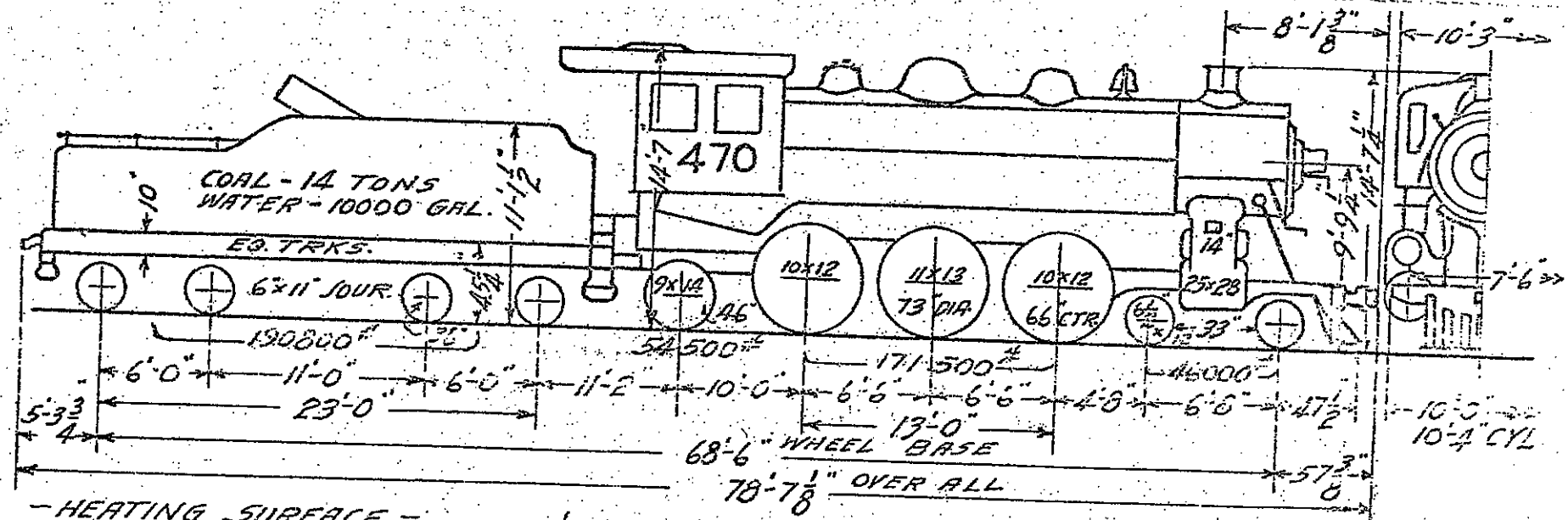
As to where the locomotive is to be housed should be addressed before any work begins. Regardless if the locomotive is restored to operating condition or not, it should be in a location where it can be protected from the elements and vandals or it is pointless to even pursue this project. As I understand it, the 470's current location is too near Guilford's right of way to erect any type of shelter. Maybe there is City owned property near the Guilford right of way where a building could be erected and provide necessary shelter for 470. I think most of the people of Waterville feel it should stay in Waterville and I can understand that. If an enginehouse/museum building could be built to store the engine and an outside operator could run some special trips, let's say four times a year, it could be a good thing for all concerned. During the times the locomotive is not being used, one of us could staff the museum and make the 470 accessible to the public.

Preserving this locomotive as an operating piece of our history will not only preserve the locomotive, but the skills to run and maintain it, too.

LOCO. STOK. CO'S COAL PUSHER
1-8½" AIR PUMP
COMM. C.S. TR. TRK. & CRADLE
CAST STEEL PILOT

BUILT BY ALCO. SCHEN. IN 1924. SHOP # 65554. PACIFIC TYPE. OUR CLASS "C." № 469

BUILT BY ALCO. SCHEN. IN 1924. SHOP # 65555. PACIFIC TYPE. OUR CLASS "C." № 470



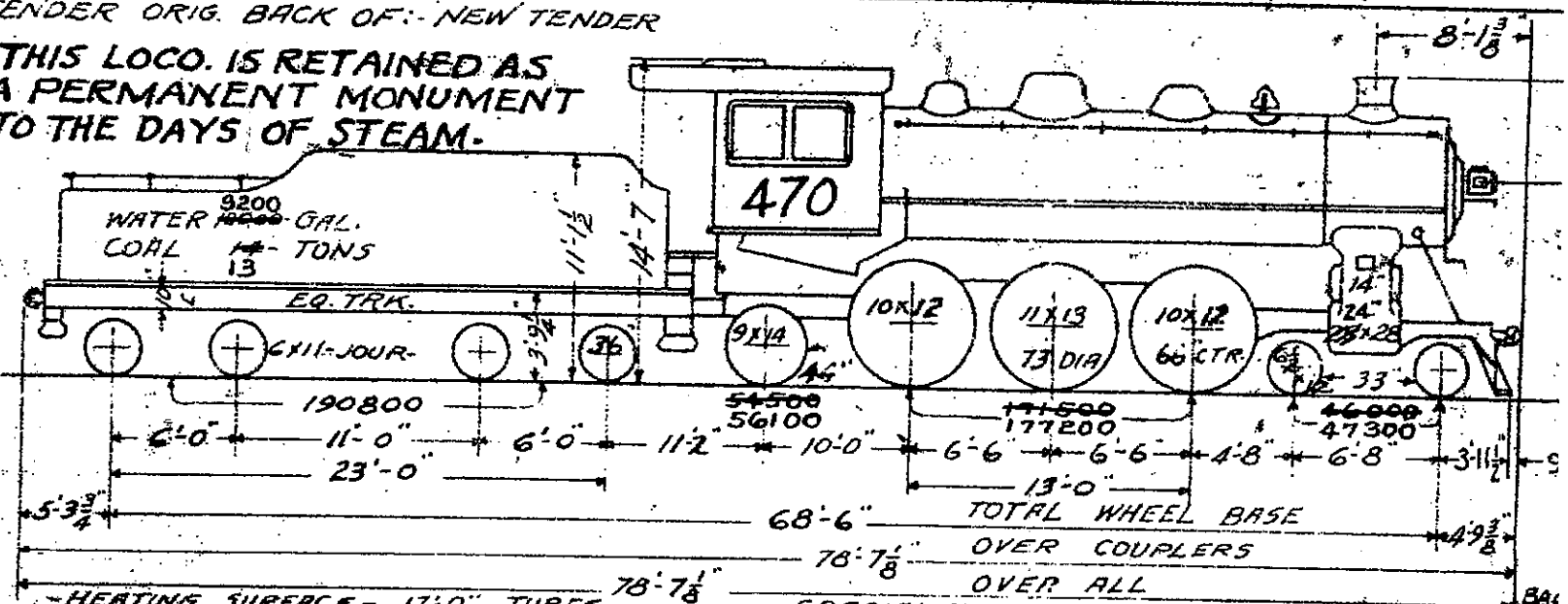
-HEATING SURFACE-		#
TUBES - 218 - 2" 32 - 5⅜"	-	2700
FIREBOX - 108⅛" x 75¼"		248
ARCH TUBES		26
TOTAL		2974
SUP. HEAT		636
GRATE AREA		56.5
STEAM PRESS.		185 LB.
TRAC. POW.	ENGINE	37700 LB.
	WITH BOOSTER	47700 LB.
TONNAGE RATING CLASS - 70-		

-SPECIALTIES-

BAKER VALVE GEAR
PRECISION REVERSE
FR. BUTT FIREDOOR
FR. A-1 RAD. BUFFER
CAST ST. ASH PAN
MINER A-18-S TEN. DR. GR.
TYPE "A" SUPERHEATER
TYPE D-1 SOOT BLOWER
TYPE C-1 BOOSTER
LOCO. ST. CO'S COAL PUSHER
1-8½" AIR PUMP
COMM. TR. TRK. & CR.
CAST ST. PILOT
FR. FLEX. JOINTS
MAD-KIPP LUB.
CHAMBERS THROT.

TENDER ORIG. BACK OF:- NEW TENDER

THIS LOCO. IS RETAINED AS A PERMANENT MONUMENT TO THE DAYS OF STEAM.



- HEATING SURFACE - 17'-0" TUBES

TUBES 218-2" 32-5 3/8"	2700
FIREBOX - 108 1/8 x 75 1/4	248
ARCH TUBES 2-3"	12.7
THER-SYP. NICH.	51.
TOTAL	3032.7
SUPERHEAT	636
GRATE AREA	56.5
STEAM PRESS. 195 ~~190~~	
TR. PWR. ENGINE - 36,500	
WITH BOOST 46,800	
TONN. RATE CLASS.	70

- SPECIALTIES -

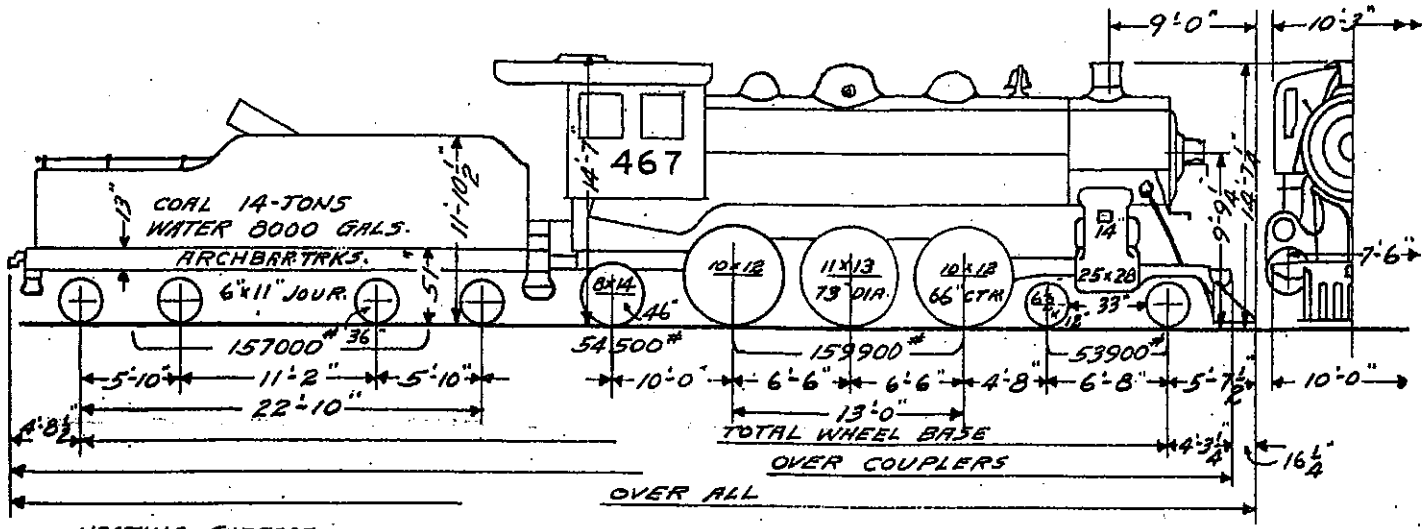
BOOSTER -	FR "C-1"
STOKER -	STD HT-1 ~~NONE~~
SOOT BLOW. -	~~SUP-D-1~~
COAL PUSH -	~~LOCO ST-60~~ COFFIN
FEED HEAT -	~~ALCO~~
SUPERHEATER -	TYPE A
AIR PUMP -	1-8 1/2" CC
B.P. GAGE -	ASHTON ~~ALCO~~
LUBRICATOR -	DETROIT ~~MICHIGAN MFG~~
VALVE GEAR -	BAKER
REVERSE GEAR -	PRECISION

THROTTLE - CHAMBERS
FIREDOOR - BUTT.
ASH PAN - CAST ST.
BUFFER - WEDGE - FR. RAD.
TEN. DR. GEAR. - MINER. ~~A-18-S~~
STEAM HEAT - YES A-79
FLEX. JOINTS - FRANKLIN
BARCO 2" STEAM HEAT JOINT, REAR OF TENDER
- EQUIP ON TEST -
H-S. DUPLEX VALVE RINGS
COMB. DUPLEX CYLINDER RINGS
TEMP. INDICATOR (JOURNAL)

ANNULAR
HULSON G
COFFIN FEED
WHELAN BY-
T-Z. BLOWOF
DETROIT M
FORCE PEE
VALVE PILOT
CHASSIS LUB
F.W.H. STABIL
TANK WATER L
NATHAN LB-2
WELDED BAC
TYPE "E" FEE
BRAKE PIPE REL
REV. GEAR AUXIL

BUILT BY: ALCO. SCHEN. IN. 1924. SHOP NUMBER. 65555 ORDER No. S-1472 PACIFIC TYPE OU

BUILT BY: ALCO. SCHEN. IN. 19---. SHOP NUMBER. ORDER No. S- PACIFIC TYPE OU



- HEATING SURFACE -

TUBES - 218 - 2": 32 - 5⅜"	—	2700 ϕ
FIREBOX - 108⅛" x 75¼"	—	248
ARCH TUBES	—	25
TOTAL	——	2973
SUPERHEAT	——	636
GRATE AREA	——	56.5
STEAM PRESS.	——	185 LB
TRAC. POW. {ENGINE	—	37,700 LB.
TRAC. POW. {WITH BOOSTER	—	47,700 LB.
TONNAGE RATING CLASS - 70 -		

- SPECIALTIES -

BAKER VALVE GEAR
ALCO "G" REVERSE
FR. BUTT FIREDOOR
FR. RAD. BUFFER
CAST ST. ASH PAN
MINER A-18-S TEN. DR. GEAR
TYPE "A" SUPERHEATER
TYPE "D-1" SOOT BLOWER
TYPE "C-2-S." BOOSTER
LOCO. ST. CO'S. COAL PUSHER
2-11" AIR PUMPS
COMM. C.S. TR. TRK. & CRADLE
CAST ST. PILOT
CHAMBERS THROTTLE

October council meeting for Glick package.

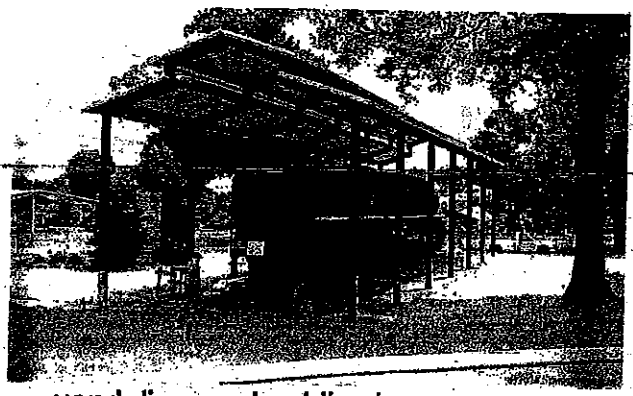
No.	Built By	Year	Tractive Force Lbs.	Weights		Total Wheel Base	Builders Shop No.
				Total Engine	Tender		
466	Amer. Loco. Co. - Sch	1917	*37700	268300	170800	68' - 5½"	57885
467	" " " "	"	"	"	156000	" "	57886
468	" " " "	"	"	"	170800	" "	57887
469	" " " "	1924	"	272000	190800	68' - 6"	65554
**470	" " " "	"	"	~~272000~~ 268300	"	" "	65555
				136 Tons			

*Total Tractive Force w/booster 47700 lbs.
**470 is on permanent display at Waterville, Maine.

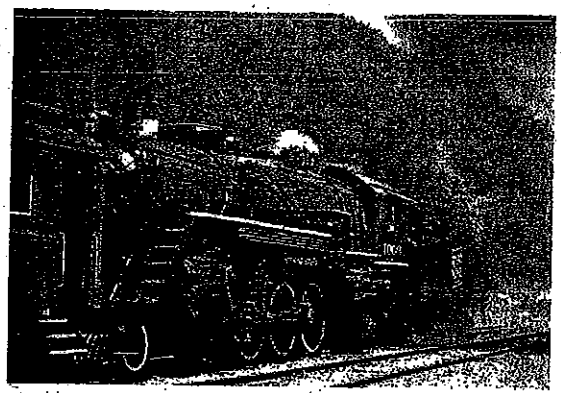
Class C 4-6-2

Attachment 3

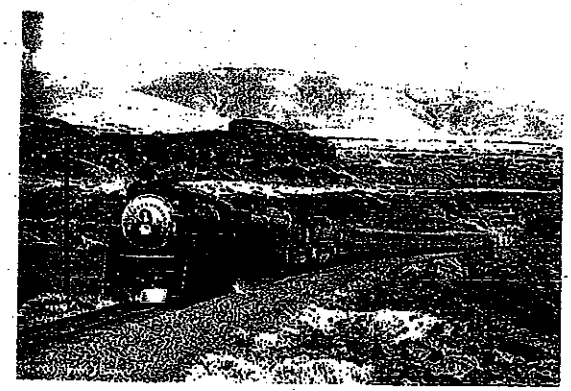
Additional Preservation Successes



Nashville, Chattanooga, and St. Louis Railroad #576, displayed in Nashville, Tennessee, has just received this shelter to protect it from outdoor environmental stresses. This photograph was sent to me for direct comparison with Maine Central #470. Note that this shelter lacks a protective fence. The locomotive, while recently repainted, continues to suffer vandalism and public abuse. Photo: Hussar



Soo Line 2-8-2 no. 1003 is based in the roundhouse in Altoona, WI, but is shown here in Osceola. The occasion was the "Steamfest in the Valley" on the weekend of August 1-2, 1998. Built by ALCO's Schenectady works in 1913, this L-1 class Mikado was donated to the city of Superior, WI after retirement. She was later removed from display for restoration to steam, but the original restoration project fell through. She sat for many years in Fraser Shipyards in Superior, and then was stored next to a warehouse in the shadow of the ore docks in Duluth, before the Wisconsin Railway Preservation Trust stepped in and completed her restoration in 1996.

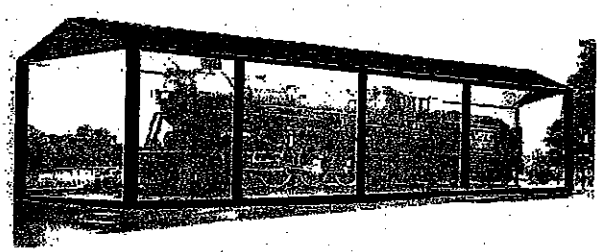


Southern Pacific Daylight locomotive #4449, last of her class, sat in Portland, Oregon's zoo for decades. In 1976, she was removed to pull the "American Freedom Train" and has been running steadily ever since.

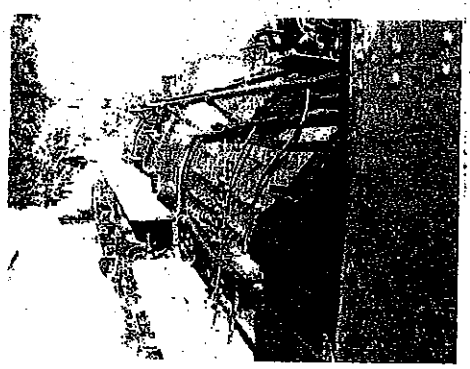
VI. Images

Exposed to the weather, all steam locomotives collect water and ice. Water trickles into tiny recesses, where expansion due to freezing and thawing does severe damage to structural components of the locomotive.

While many citizens bring their families to enjoy the presence of locomotive 470, it should be recognized that the locomotive is a monument, not a playground. Severe injuries and potential public liability can result from people falling from the display. Furthermore, such exploration damages the monument.

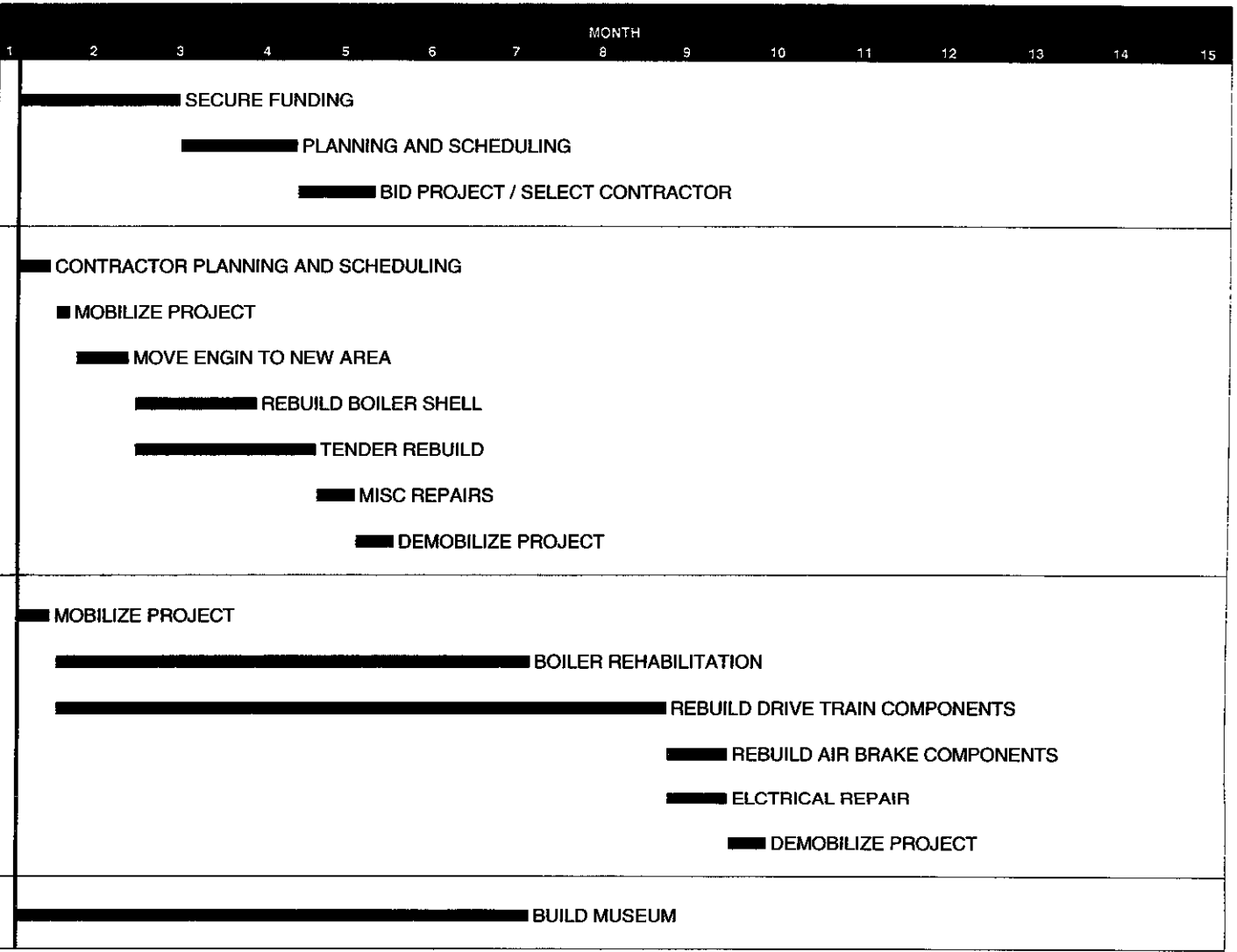


An enclosure, such as the one illustrated here, will allow the community to continue enjoying the monument while preserving the locomotive for future generations. It also eliminates many of the dangers inherent in an open display.



Removal of the boiler jacket has allowed for evaporation of water and better preservation of the boiler shell. It has, however, also exposed the boiler riveting which detracts from the locomotive's historically-accurate appearance. Replacement jacketing with PVC spacers between it and the boiler could be applied.

Description	Orig Dur
CITY OF WATERVILL PLANNING	
SECURE FUNDING	40d
PLANNING AND SCHEDULING	30d
BID PROJECT / SELECT CONTRACTOR	20d
PHASE #1 COSMETIC RESTORATION	
CONTRACTOR PLANNING AND	10d
MOBILIZE PROJECT	5d
MOVE ENGIN TO NEW AREA	15d
REBUILD BOILER SHELL	30d
TENDER REBUILD	45d
MISC REPAIRS	10d
DEMOBILIZE PROJECT	10d
PHASE #2 COMPLETED RESTORATION	
MOBILIZE PROJECT	10d
BOILER REHABILITATION	120d
REBUILD DRIVE TRAIN COMPONENTS	155d
REBUILD AIR BRAKE COMPONENTS	15d
ELCTRICAL REPAIR	15d
DEMOBILIZE PROJECT	10d
PHASE #4 MUSEUM	
BUILD MUSEUM	130d



PRELIMINARY SCHEDULE

CITY OF WATERVILLE 470 RESTORATION BY PHASE

- Early bar
- Progress bar
- Summary bar
- Start milestone point
- Finish milestone point

470 REHAB PROJECT

PHASE # 1 COSMETIC RESTORATION	COST
MOBILIZE / DEMOBILIZE PROJECT	$8,950
RESEARCH AND PURCHASING	$30,200
MOVE ENGIN TO AREA	$60,450
REBUILD BOILER	$117,050
TENDER REBUILD	$187,700
MISC REPAIRS	$59,250
TOTAL BUDGET ESTIMATE	**$463,600**

PHASE # 2 COMPLETED RESTORATION	
MOBILIZE / DEMOBILIZE PROJECT	$6,550
RESEARCH AND PURCHASING	$46,500
BOILER REHABILITATION	$260,800
REBUILD DRIVE TRAIN COMPONENTS	$500,100
REBUILD AIR BRAKE COMPONENTS	$45,700
ELECTRICAL REPAIR	$19,150
TOTAL BUDGET ESTIMATE	**$878,800**

PHASE # 3 MUSEUM	
SITE PREP AND FOUNDATION	$80,000
STRUCTURE AND REQUIRED TRACK	$250,000
PROFESSIONAL SERVICES	$25,000
TOTAL BUDGET ESTIMATE	**$355,000**

TOTAL ALL PHASES	$1,697,400

PHASE II

FILE: ALL_LINK_WITH_SUBTOTALS_V3J

CURRENT 2005 TEMPLATE - REVISED 1/31/2005

PROJECT: 470 REHAB
LOCATION WATERVILLE, MAINE
CLIENT: CITY OF WATERVILLE
EST: MH
DATE/TIME 10/18/06, 6:03 PM
LAST REV. OCT 06 REV1

Bond Required?
(•) YES
( ) NO

PAYROLL & WORKHOUR BURDENS

FIELD PAYROLL BURDEN RATE:	24.00%	OF LABOR
FIELD WKHOUR BURDEN RATE:	$3.25	PER WKHOUR
OFFICE PAYROLL BURDEN RATE:	24.00%	OF LABOR
OFFICE WKHOUR BURDEN RATE:	$3.25	PER WKHOUR

COMMONLY USED WORKER'S COMP RATES:

Specify ____ Specify ____
Specify ____ Specify ____
Specify ____ Specify ____
Specify ____ Specify ____

$878,777.05

	ITEM & DESCRIPTION	QUAN	UNIT	UNIT WH	TOTL WH	$/WH	TOTL LABR	UNIT COMP	UNIT FRG	TOTL BURD	TYP CON	UNIT CONS	TOTL CONS	TYP EQP	UNIT EQP	TOTL EQP	TOTL FIELD	UNIT FIELD	UNIT MATL	TOTL MATL	UNIT SUB	TOTL SUB	TOTL COST	UNIT COST
1	BOILER REHABILITATION	1	LS	2,670.	2,670	20.50	54,735	3.75%		23,866	2	5378.80	5,379	2			83,980	83,980.26	29500	29,500	7500	7,500	120,980	120,980.26
2		1	LS								2			2										
3	REBUILD OF DRIVE TRAI	1	LS	5,380.	5,380	20.50	110,290	3.75%		48,090	2	8823.20	8,823	2			167,204	167,203.68	46000	46,000	7500	7,500	220,704	220,703.68
4		1	LS								2			2										
5	REBUILD AIR BRAKE COMPONENTS	1	LS	520.	520	20.50	10,660	3.75%		4,648	2	852.80	853	2			16,161	16,160.95	2750	2,750			18,911	18,910.95
6	ELECTRICAL REPAIR	1	LS	200.	200	20.50	4,100	3.75%		1,788	2	328.00	328	2			6,216	6,215.75	2500	2,500			8,716	8,715.75
7	RESEARCH / PURCHASIN	1	LS	500.	500	20.50	10,250	3.75%		4,469	2	820.00	820	2			15,539	15,539.38	5000	5,000			20,539	20,539.38
8	MOBILIZE / DEMOBILIZE I	1	LS	80.	80	20.50	1,640	3.75%		715	2	131.20	131	2			2,486	2,486.30					2,486	2,486.30
9		1	LS								2			2										
10		1	LS								2			2										
	JOB DIRECT COSTS	1	LS		9,350		191,675			83,577			16,334				291,586			85,750		15,000	392,336	
				DIRECT LABOR AVE WAGE=			$20.50	With Burdens =		$29.44						check	291,586					check	392,336	
	PROJECT OVERHEAD	42	WKS	59	2,470	34.52	85,260	3.75%		31,687	2	619.048	26,000	2			142,947	3,403.50					142,947	3403.50
	CREW PER DIEM	9,350	WH								2	1	9,350	3			9,350	1.00					9,350	1.00
	SMALL TOOLS	9,350	WH								2	1.5	14,025	3			14,025	1.50					14,025	1.50
	SAFETY SUPPLIES	9,350	WH								2	0.4	3,740	3			3,740	0.40					3,740	0.40
	EQUIP MAINTENANCE	1	LS	233	233	22.00	5,132	3.75%		2,182	2	9096.20	9,096	2	1103.49	1,103	17,515	17,514.67					17,515	17514.67
	MOBILIZATION	1	LS	1580	1,580	19.00	30,028	3.75%		13,469	2	20099.00	20,099	2	18698.40	18,698	82,295	82,295.18					82,295	82295.18
	EQUIPMENT IDLE	1	LS								3			3	45805	45,805	45,805	45,804.80					45,805	45804.80
	ASSOCIATION DUES		THOS								2	0.7		3										
	CONTINGENCY	1	LS								3			3										
	LABOR COMPONENT OF LIABILITY INSURANCE FOR COMMERCIAL RATE	3120.96	HUN $$							4,213	3			3			4,213	1.35					4,213	1.35
	CUT ADDS	1	LS								3			3										
	CUT ADDS	1	LS								3			3										
	CUT ADDS	1	LS								3			3										
	CUT ADDS	1	LS								3			3										
	MAINE	**S. TAX**		**5.00%**									817				817			4,288			5,104	

$878,777.05

ITEM & DESCRIPTION	QUAN	UNIT	UNIT WH	TOTL WH	$/WH	TOTL LABR	UNIT COMP	UNIT FRG	TOTL BURD	TYP CON	UNIT CONS	TOTL CONS	TYP EQP	UNIT EQP	TOTL EQP	TOTL FIELD	UNIT FIELD	UNIT MATL	TOTL MATL	UNIT SUB	TOTL SUB	TOTL COST	UNIT COST
NON INDUSTRIAL	L. INSUR.			(SEE INSURANCE NOTE AT LEFT FOR TYPE)					3569							3,569						3,569	
NO BOND	BOND	1	MO	(SEE BOND NOTE AT LEFT FOR BOND TYPES)																			
JOB INDIRECT COSTS				4,284		120,421			55122			83,127			65,607	324,276			4,288			328,564	
TOTAL JOB DIRECT AND INDIRECT COSTS				13,634		312,096			138699			99,461			65,607	615,882			90,038		15,000	720,900	
																					check	720,900	

TOTAL JOB AVERAGE WAGE= $22.89
HOURS PER WORK WEEK= 40
AVERAGE CREW SIZE = 6
AVERAGE OVERHEAD SIZE = 3

TOTAL JOB COST = 720,900

% CORPORATE OVERHEAD = 6.00% 43,254

TOTAL JOB COST + CORP OH = 764,154

% MARKUP ON ALL ABOVE COST = 15.00% 114,623

TOTAL COST PLUS MARKUPS **$878,777**

OVHD as % of JOB	16.3%
LABOR as % of JOB	51.3%
CONST. EQUIP. as % of JOB	7.5%
ST&S as % of JOB	11.3%
Consumables $/Wkhr	$1.75
PERM. MATERIAL as % of JOB	10.2%
SUBS as % of JOB	1.7%
EQUIP + MARGIN as % of JOB	25.4%

Total Workers Compensation	$11,704
Payroll Burdens	$74,903
Workhour Burdens	$44,310
Davis Bacon Fringes	
Liability Insurance	$7,783
TOTAL BURDENS	$138,699

TOTAL LABOR PLUS BURDENS : $450,795
TOTAL BURDENS AS % OF LABOR : 44.44%
(Burdens include liability insurance)

TOTAL MARGIN PERCENTAGE - 18.0%
TOTAL MARKUP PERCENTAGE - 21.90%
TOTAL VALUE ALL MARKUPS - $157,877
MARKUP AS % OF LABOR & BURDENS - 35.02%
(Burdens include liability insurance)

RISK FACTOR = 28.88%