A PRELIMINARY FEASIBILITY ANALYSIS

OF

ALTERNATIVES

FOR

THE PUBLIC WORKS

SERVICE CENTER

THE DEPARTMENT OF PUBLIC WORKS

CITY OF MARQUETTE

MR. MICHAEL A. ETELAMAKI, P.E.
PUBLIC WORKS DIRECTOR

SUNDBERG, CARLSON AND ASSOCIATES, INC.
101 SOUTH FRONT STREET, SUITE 305
MARQUETTE, MICHIGAN 49855

TABLE OF CONTENTS

TABLE OF CONTENTS	i
INTRODUCTION	1
DISCUSSION OF ALTERNATIVES	2
ECONOMIC DECISION	5
TABLE 1	8
SUMMARY AND RECOMMENDATION	9
REFERENCES	10
APPENDIX	11
ATTACHMENTS	REAR COVER

INTRODUCTION

During recent times, it has become obvious that something needs to be done to improve the Public Works Service Center Facilities.

The existing Public Works Garage-Warehouse Service Center was constructed in about 1962, with various additions through 1976. The useful life at the time of construction was estimated to be 45 years for the 1962 building; and 25 years for the 1973 additions.

The remaining functional life is estimated to be 15 years unless certain major capital improvements are to be made. However, it must be noted here that the building was constructed as a warehouse, and is therefore presently being used to a large part, for functions it was not designed for. Herein lies the problem to be investigated.

Since the facility, as is, is being used for other than for what it was intended, it presents itself as an obstacle to efficient, cost-effective public works. In recognizing this problem, the City of Marquette Public Works Department, has engaged Sundberg, Carlson and Associates, Inc. to analyze various alternatives and to recommend the preliminary feasible alternative for a public works service center. The following alternatives have been analyzed:

(1) Do nothing. Remain at the existing facility as is.

(2) Remodel the existing facility to more adequately function as it's intended to.

(3) Construct a new facility in a more centralized location.

METHOD OF ANALYSIS

This analysis has been made on the basis of uniform annual cost. The reasons for this are several:

(1) The lives of the alternatives are different.

(2) The "benefits" in any of the alternatives are the same. The differences in costs are "benefits" or savings, which can be accounted for more readily as differences in annual costs.

(3) There are many irreducibles associated with replacement comparisons, particularly in the public works sector.

(4) An additional evaluation of energy savings based on an escalation rate of 10%, with the savings applied to an investment at 10% has been done for a comparison.

Other factors considered in this analysis, are the facts that:

(1) Only reducible, known savings estimates were used to evaluate the "improvement" alternatives.

(2) As equipment ages, maintenance increases, and thus, the need for efficient maintenance increases, i.e., a facility being misused presently, will cost more as the misuse increases.

(3) The interest rate used is based upon the fact that this analyst feels that the taxpayer deserves a rate of return better than the cost of money. If bonds are at 8%, 10% seems a fair value to use.

(4) It is assumed that no expansion of services will be required in the future.

Table 1 on page 8 summarizes the uniform annual cost calculations. Appendix 1 contains the calculations used to arrive at the amounts used in the categories for annual costs. Kindly refer to these as you read the following pages.

Discussion of Alternatives

Alternative "A":

Do nothing, remain at the facility.

The existing facility has several deficiencies which manifest themselves as costs, and inefficient operations. The major deficiencies are:

(1) Lack of efficient maintenance areas, traffic flows, storage areas, and work station separation, which manifest themselves in higher labor costs per vehicle or service maintained; higher attrition of materials due to damage; lost time injuries; high cleanup costs; low employee morale; incomplete maintenance, and high supervision costs.

(2) High energy costs. The costs based on 1981 dollars were about $0.92 per square foot. Normal energy costs for a facility of this type range from $0.47 to $0.62 per square foot.

(3) Location. The location is at the far end from where the majority of work is done. This location cost manifests itself in high management costs, high transportation costs, and higher equipment wear and tear, and higher labor costs.

(4) The facility has high maintenance costs. These costs are due to age, the use of the facility for a purpose other than it was designed for, and improper or inadequate building systems, i.e., plumbing, heating, ventilating, etc.

(5) The facility presently needs a new roof.

(6) The facility is probably overstaffed to make up for the loss of efficiency. The decrease in staff has not been taken into account as a savings.

(7) Reduction in life of vehicles, primarily parks and recreation, due to location and methods of salt storage.

Alternate B:

Remodel the existing facility.

Attachment A shows a feasible remodelling schematic. It is felt implementation of this plan would have the following effects:

(1) Reduce vehicle/ equipment maintenance costs due to improved traffic flows maintenance station separation, material flow, and storage areas. It is estimated this will save 4 to 6 percent of the maintenance budget.

(2) Reduce utility/energy costs by approximately 10%, unless the existing structure envelope is remodelled significantly more than included in the remodelling cost.

(3) Reduce attrition costs of materials and parts due to damage/losses. This amount is included in the savings in item 1 above.

(4) Improve employee morale to the extent of improved working conditions and facilities.

(5) A reduction in facilities maintenance costs, if the new roof is put on the existing structure, and if the drainage systems are improved.

However, the remodelled facilities would have the following disadvantages:

(1) Higher than required management/administration costs due to distance from City Hall and Engineering, and the separate facility for Administration and Engineering.

(2) Higher than required transportation, utilities maintenance, snow removal and supervision costs due to distance from the major work areas.

(3) Higher than normal energy costs, due to existing structure deficiencies which are unrepairable without a complete new envelope.

(4) Deterioration of parks/recs vehicles due to salt storage building proximity to theirs..

(5) It would require a substantial outlay of capital.

(6) Disruption of ongoing maintenance during construction, and the cost of moving, removing, and relocating existing equipment, tools, materials, parts, and furnishings.

Alternative C

Construct and relocate to a new, centrally located facility.

Attachments B&C show schematic layouts for potential new facilities on a suggested site. Implementation of either of these plans would have the following effects:

(1) Reduce of vehicle/equipment maintenance costs to a minimum standard which could be set by providing the most efficient layout possible for traffic flows, vehicle upkeep, storage, materials/parts storage and work station separation.

(2) Reduce energy costs to a minimum, within current energy code requirements by using the most energy efficient materials and equipment for building systems.

(3) Reduce of lost time accidents due to lack of adequate lighting and personnel mobility paths.

(4) Reduce transportation costs, utility and street maintenance costs, snow removal costs, and supervision costs due to location nearer higher maintenance work area.

(5) Reduce management/administration costs due to location of management/engineering in same facility.

(6) Increase employee morale greatly, since new facilities can be fit to employee's needs in the conception, and due to new equipment and tools.

(7) Reduce facilities maintenance costs to a minimum by using materials most suited for the use and environment.

(8) Reduce materials/parts attrition due to loss and damage.

(9) Reduce overtime requirements by increasing efficiency to the optimum.

(10) Provide location for snow removal dump site, at a central location.

(11) Provide potential for reduction in work force personnel, by one maintenance worker and by one clerical worker.

The construction of and relocation to a new facility would have the following disadvantages:

(1) A large initial capital outlay fund would be required.

(2) Moving of existing tools, equipment, vehicles, materials, parts, and furniture from the existing facility.

Discussion of Economic Decision

As shown in Table 1, the uniform annual costs indicate that the do nothing alternative is economically the thing to do. However, a large number of factors which must be considered are the "irreducibles", i.e., those factors which cannot be reduced to soundly estimated monetary terms at this time. These are factors which must be evaluated on judgement and applied to decisions which might have marginal economic differences. The following factors are considered "irreducibles", in the case of "A" and "B" versus "C", and "A" versus "B".

(1) The potential for reduction in employees due to centralized effort.

(2) The potential for substantial reduction in vehicle/equipment maintenance costs.

(3) The potential for a reduction in supervisory personnel.

(4) The potential for better control of operations.

(5) The potential for better communications up and down the chain of command; including City Hall.

(6) The capability to meet the need for increased maintenance capacity, say in the case of increased road/water/sewer maintenance miles due to the annexing of another area to the City.

(7) The fact that the current facility does not now and will not, without major expenditures, effectively meet the needs of a public works service center.

Our experience with these factors indicates, the following:

(1) The centralized location of an organized maintenance facility tends to eliminate duplicated effort due to

reductions in "non-productive" travel times. This, in combination, with a more organized vehicle service area reduces maintenance time requirements and allows more even scheduling of preventative maintenance. The fact that the new facility idea above combines the management, engineering and supervision in one location suggests that secretarial/clerk skills could be combined. We feel that "C" would reduce personnel by one clerical and one maintenance II worker or mechanic, assuming maintenance needs are not expanded.

(2) Whenever road mileage is evened-out or reduced and preventative maintenance is increased, vehicle maintenance costs are reduced. In most cases, several small improvements will snowball into a larger improvement, than expected. It is estimated herein that vehicle maintenance costs will be reduced by approximately 12%, where in reality this figure could optimistically, due to the compounding effects of organized parts, a central maintenance manual library, better supervision, etc., be 25%.

(3) The centralization of management, engineering, and production operations will increase communications and control, and thus reducing the response times, misunderstandings, and erroneous decisions. This is a difficult item to put a number on but Niebel (4) indicates savings in "production" can vary from 2 to 6 percent of production costs. Better communications result from the line to upper management and vice-versa. This can have a very productive effect in the generation of ideas, improving morale, and increasing productivity.

The factors discussed above are difficult to place a monetary value on, but are known to have varying degrees of positive production effects, when acted upon.

Another factor which needs consideration is the escalation of energy costs. Government estimates indicate a doubling of energy costs by the year 1996, based on 1974 prices.

based on 1982 data and increases of the past two years, an escalation rate of 10% is a realistic number. Applying this escalation rate to the savings over the 55 year life, the present worth of those savings for "B" over "A" is $200,000.00; similarily for "C" over "A" that savings is $400,000.00. This means a considerable savings in money and energy over the life of the capital invested. If we apply the present worth of these savings to the capital being invested now, the equivalent annual costs of "C" as compared to "A" is $696,938.00 versus $704,946.00, respectively.

ANNUAL COSTS/SAVINGS					TOTAL EQUIVALENT ANNUAL COSTS $
MAINT./ OP'NS. $	ENERGY/ UTILITIES $	OUTSIDE MAINT. CONTR. $	MANAGEMENT SEPARATION $	(SALVAGE) $	
605,229	40,000	21,000	20,000	0	704,946
575,229	36,000	21,000	30,000	(4365)	764,829
504,000	28,000	0	5,150.00	(1060)	737,150

NOTE: If we consider the salvage value of the existing facility as a present credit towards initial capital outlay, the equivalent annual cost of "C" becomes $700,959.00.

TABLE I

ANNUAL COST ESTIMATES

SUMMARY AND RECOMMENDATION

Three alternatives were analyzed. Alternative "A" was the "status-quo" alternative; alternative "B" was to remodel the existing facility, and alternative "C" was to construct and relocate to a new centrally located facility. A fourth alternative, a combination of alternatives "B" and "C" was considered initially, but is was considered economically unfeasible due to the large estimated cost of remodelling just a portion of the existing facility, and due to the split operations costs.

Initial economic evaluation, based on equivalent annual costs, rendered the following:

"A" = $744,946.00 for a 15 year life

"B" = $764,829.00 for a 33 year life

"C" = $737,959.00 for a 55 year life

Consideration of the equivalent present worth of future escalated energy savings, using at a 10% interest rate and a 10% escalation rate for energy costs, yields an equivalent annual cost for "C", as compared to "A", of $696,938.00.

It was found that the many irreducible factors involved weigh heavily in favor of a new facility, and it is estimated that these will lead to an economic savings of 5% of the operating costs.

It is recommended that further detailed study and preliminary design be done for Alternative "C", construction of, and relocation to, a new centrally located Public Works Service Center.

References

1. Grant, Ireson, and leavenworth, "Principles of Engineering Economy", 6th Edition; New York: The ronald Press Co., 1970

2. Apple, J.M.: "Plant Layout and Materials Handling", 3rd Edition; New York: The Ronald Press Co., 1976

3. Bovay; H.E., Jr.; "Handbook of Mechanical and Electrical Systems for Buildings", New York: McGraw Hill Book Co. 1971

4. Niebel, B.W.; "Industrial Economics and Management", 4th Edition; New York: McGraw-Hill Book Co., 1967

APPENDIX

Sundberg, Carlson And Associates, Inc.

Consulting Engineers, Land Surveyors & Construction Managers

101 S. Front St. • Marquette MI 49855

CALCULATION SHEET

1500 Breitung Ave. • Kingsford MI 49801

CLIENT CITY OF MARQUETTE PUBLIC WORKS DEPT.		CLIENT PROJ. NO.
		SCA JOB. NO. 212-124
CALCULATED BY	SCALE	SHEET 1 OF
CHECKED BY	DATE 2-02-83	FIELD BOOK NO.

EXISTING FACILITIES COSTS CURRENTLY - DO NOTHING ALT.

FACILITY
OPERATING COSTS:
ENERGY = (GAS & ELECTRICITY) = $26,700.00 1981 & 82
GAS: $18,000.00 → INCREASE ~ 25%
ELECTRICITY: $8,700.00 → INCREASE @ 4%
ESCALATION AVE ≈ 10%

MAINTENANCE OUTSIDE CONTRACTS ≈ $5,000.00 FROM DPW

MISCELLANEOUS MAINTENANCE ≈ $42,000.00 FROM DPW.

Vehicle Mile Cost. = $\frac{205,000 + 818,000}{880,000}$ = $1.163 per mile

LSP/MQT

Sundberg, Carlson And Associates, Inc.

Consulting Engineers, Land Surveyors & Construction Managers
101 S. Front St. • Marquette MI 49855 CALCULATION SHEET 1500 Breitung Ave. • Kingsford MI 49801

CLIENT CITY OF MARQUETTE PUBLIC WORKS DEPT.		CLIENT PROJ. NO.
		SCA JOB. NO. 212-124
CALCULATED BY	SCALE	SHEET 3 OF
CHECKED BY	DATE	FIELD BOOK NO.

Moves/vehicle while maintaining : daily moves/vehicle $/yr.
Lost time @ 15 minutes per move

3 moves per day - presently 3 vehicles need to be moved to relocate 1 for alternate servicing

$ × 3 people × 15 minutes / 60 × 250 × $8.60 ave/hr × 1.22 $P/R = $5,902.00

1600 tons × 2000 / 135 = 23,300 FT.³ SALT.

LSP/MQT

Costs for new building

Capital Cost
2,000,000 @ 8%

Operating & maintenance costs:

Energy costs for facility are estimated at:

New facilities of this type are estimated to use ≈ 30-50% less energy than pre 1973 structures

∴ for new facility $40,000 x .60 = $24,000 per year

upkeep costs ≈ 1% of new bldg value = $20,000/year

Benefits

① Management time ≈ ($30,000/yr)

② Better downtown maintenance

③ Faster by-pass maintenance

④ Less total distances for maintence vehicles to travel.
Assume 3.5 miles saved/per vehicle mile/day estimated
vehicle miles = 880,000 per year ÷ 250 days
$\frac{3520 \text{ veh mi}}{3.5 \text{ veh day}}$ = 100 $\frac{\text{miles}}{\text{day}}$ at an average cost of

100 x 365 x 1.163 = ($42,449.50)/year - normal maint.

(1.) 2-25-83 0826

Steve Lawry - Cleaning up - 2 free people + 8 hrs. →

Sweeping, Cleaning drains, cleaning floors; High pressure,

Lose aggregates - waste factor 2%-5%
$500-1000

Extra handling

Pipe, Valves, + Fittings → Service Boxes, etc

Lost time due → $1000.00

Enterprise St. to - former school bus garage
Corner McLellen/West Ridge - Former UPS

Presque Isle/Hawley - probably be condemned

Division St. - Quarry Pond - needs new roof
$14,000.00

Lower Harbor - essentially useless, except for evidence storage
Parks - winter storage

Problem w/ that bldg - no adequate drainage
+ floor waste gets into san. sewer, plugged
+ needs regular sand traps
+ 4-5 times year clean out w/ vacuum trucks
1/2 hr + 1/2 hr x 2 x 4.5 hrs.
+ pressure rodder/vacuum truck - rental.

Biggest problem: lack of adequate work stations, fluids, lighting

Parks Dep't

Salt storage w/ respect to parks equipt - takes a toll → city ends up doing body -
vehicle life - 4 pu - 2 yrs from life
Body: 1 person - 3-4 times/year x 2 days + materials 200/vehicle

Energy Cost Estimates

Current value = $40,000.00

Since we can go to better distribution on lighting in a more efficient system, lighting (electrical costs) can be reduced by approximately 21% or $900.00

Energy costs of the current facility can be reduced by approximately 20% with a new addition by going to a different system in the shop area or approx. $3600
$4500.00

In a new facility energy costs will be approximately : warehouse & repair .30 / # x 35,000 = 10,500
office .45 / # x 8000 # = $3600
14,100
Assume we can reduce other utilities by 15% $14,535
28,635.00

Existing Facility

Sand = 50 x 20 x 15 = 300 yd³ ÷ 7 = 43 truck loads of sand.

43 x 1.25 x 2 x 1.163 = $125.00 per year, saved on sanding.

Time saved - labor - assume ½ of trips would be 10 minutes less trip 1 way

43 + 69 = 112 x .50 x 8.57 hr x 1.22 = $586.00 per year.

Additional morale improvements

1. less lost time due to illness, absenteism, etc.
2. Enthusiasm due to more facilities, better, positive work attitude
3. Savings in 1 job at 9.21 per hour since lost time, moves, etc, would save that in 1 day = 9.21 x 2080 x 1.22 = 23,3[illegible]
4. Savings to taxpayers of 1 free job @ 4.75/hr.
   4.75 x 2080 x 1.22 = $12,054.
5. Eliminate ½ of overtime for maintenance or ¼ of $41,000.00, $10,250.00 = extra hours due to time lost in maintenance during shift.
6. $42,000 in misc maintenance around bldgs.
7. $30,000 in mgmt expense/per year.

ALTERNATE 1

Remodel Existing Bldg.

New Life

Additions = 40 years (due to attachment to existing) 3000 + 9600 = 12,600

Existing Bldg Shop = .75* 8200 FT.² 8,200

Warehouse = 60 − 25 = 35 8060 FT.² + 6912 FT.² 14,972

35,772

TOTAL SERVICE LIFE (WGTD) = 33 years.

New Facility Life = 55 years

*Existing Facility as is w/new roof

*As maintenance facility - ~~less~~ than adequate presently.