1968

Economic utilization of Montana's scrapped automobiles; solutions and recommendations

Harold James Schnell

The University of Montana

Follow this and additional works at: https://scholarworks.umt.edu/etd

Let us know how access to this document benefits you.

Recommended Citation
Schnell, Harold James, "Economic utilization of Montana's scrapped automobiles; solutions and recommendations" (1968). Graduate Student Theses, Dissertations, & Professional Papers. 9167. https://scholarworks.umt.edu/etd/9167

This Thesis is brought to you for free and open access by the Graduate School at ScholarWorks at University of Montana. It has been accepted for inclusion in Graduate Student Theses, Dissertations, & Professional Papers by an authorized administrator of ScholarWorks at University of Montana. For more information, please contact scholarworks@mso.umt.edu.
ECONOMIC UTILIZATION OF MONTANA'S SCRAPPED AUTOMOBILES;
SOLUTIONS AND RECOMMENDATIONS

By

H. J. Schnell

B.S. North Dakota State University, 1959

Presented in partial fulfillment of the requirements for the degree of

Master of Science

UNIVERSITY OF MONTANA

1968

Approved by:

Chairman, Board of Examiners

Dean, Graduate School

October 9, 1968

Date
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>LIST OF TABLES</th>
<th>iii</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF FIGURES</td>
<td>iv</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>CHAPTER</td>
<td></td>
</tr>
<tr>
<td>I. THE SCRAP AUTO DISPOSAL PROBLEM; SYMPTOMS AND CAUSES</td>
<td>4</td>
</tr>
<tr>
<td>Manifestation of the Problem</td>
<td>4</td>
</tr>
<tr>
<td>Conditions Which Create the Disposal Problem</td>
<td>9</td>
</tr>
<tr>
<td>II. CURRENT APPROACHES TO SOLVING THE PROBLEM</td>
<td>19</td>
</tr>
<tr>
<td>Present Methods of Scrap Auto Disposal</td>
<td>19</td>
</tr>
<tr>
<td>Regulatory Legislation</td>
<td>27</td>
</tr>
<tr>
<td>Research, Study, and Action Programs</td>
<td>30</td>
</tr>
<tr>
<td>Evaluation of the Current Approaches</td>
<td>37</td>
</tr>
<tr>
<td>III. ECONOMIC SOLUTIONS FOR MONTANA</td>
<td>42</td>
</tr>
<tr>
<td>Operation of the Utilization Method</td>
<td>43</td>
</tr>
<tr>
<td>Cost Analysis of the Utilization Method</td>
<td>51</td>
</tr>
<tr>
<td>Freight Costs</td>
<td>53</td>
</tr>
<tr>
<td>Costs of Conducting Operations</td>
<td>56</td>
</tr>
<tr>
<td>Price Paid by the Shredder Facilities</td>
<td>84</td>
</tr>
<tr>
<td>Production and Shipping Costs and Purchase Price</td>
<td>84</td>
</tr>
<tr>
<td>IV. CONCLUSIONS AND RECOMMENDATIONS</td>
<td>87</td>
</tr>
<tr>
<td>Conclusions</td>
<td>87</td>
</tr>
<tr>
<td>Recommendations</td>
<td>90</td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>93</td>
</tr>
</tbody>
</table>
### LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>III-1. Candidate Operating Locations</td>
<td>44</td>
</tr>
<tr>
<td>III-2. Rail Shipping Costs</td>
<td>54</td>
</tr>
<tr>
<td>III-3. Motor Truck Shipping Costs</td>
<td>56</td>
</tr>
<tr>
<td>III-4. Comparison of Candidate Auto Flattening Machines</td>
<td>60</td>
</tr>
<tr>
<td>III-5. Fork Lift Transporiting Cost</td>
<td>64</td>
</tr>
<tr>
<td>III-6. Flattening Machine Towing Cost</td>
<td>65</td>
</tr>
<tr>
<td>III-7. Equipment and Operating Cost</td>
<td>71</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>FIGURE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-1. Passenger Car Survival Rates</td>
<td>10</td>
</tr>
<tr>
<td>I-2. New Car Sales and Car Scrappage Rate</td>
<td>12</td>
</tr>
<tr>
<td>I-4. Consumption of No. 2 Bundles as a Percentage of Total Purchased Scrap Consumption</td>
<td>17</td>
</tr>
<tr>
<td>I-5. Price of No. 2 Bundles per Gross Ton</td>
<td>18</td>
</tr>
<tr>
<td>III-1. Flow Chart of Operating Systems</td>
<td>50</td>
</tr>
<tr>
<td>III-2. Equipment and Operating Cost</td>
<td>73</td>
</tr>
<tr>
<td>III-3. Total Unit Production Cost</td>
<td>82</td>
</tr>
<tr>
<td>III-4. Billet Production and Rail Shipping Costs</td>
<td>83</td>
</tr>
<tr>
<td>III-5. Total Unit Production and Rail Shipping Costs and Purchase Price</td>
<td>86</td>
</tr>
</tbody>
</table>
INTRODUCTION

Over six million automobiles are scrapped in the United States each year. However, great numbers of them are not re-introduced into the steel-making process as scrap material, but are left as derelicts in an auto wrecking yard or abandoned in some other manner. The accumulation of derelict autos is considered to have reached a crisis level, and no wholly satisfactory solutions have been found, particularly for certain areas of the West such as Montana. In recent years an increasing amount of attention in the form of legislation, research and community action has been devoted to solving the problem, which is rapidly expanding in dimension and seriousness.

Purpose of the Research Study

The purpose of the study was to determine whether the automobiles which are scrapped in the state of Montana can be economically disposed of by utilization, at no cost to the public. The study was limited to economic disposal methods to keep it within manageable limits.

The public reaction to the disposal problem indicated a need for studies directed toward solutions. That the public is concerned is evidenced by the passage of much legislation during recent years to deal with the problem on the federal, state, and local levels.

In addition to the public, the problem of scrap auto disposal is of interest to several industries. The scrap processing and steel making industries are directly affected by the quantity of auto scrap which is
returned as raw material for the making of steel. Auto dismantlers who buy old or wrecked cars for the salvageable parts are faced with the problem of disposal of the hulks after the parts have been sold.

**Study Approach and Method**

The general approach was to attack the study problem in three phases. The first phase was to evaluate the magnitude and effects of the scrap auto disposal problem in the United States, with a separate consideration of the problem in Montana. The second phase was to evaluate the current approaches to solving the problem, in order to formulate and propose a solution for Montana which appeared to be economically feasible and acceptable from the social viewpoint. The third phase was to develop the proposed solution to its conclusion and make constructive recommendations based on study data.

The basic hypothesis which was applied during the course of the study was that a solution for Montana could be formulated from elements of solutions found to be successful elsewhere. Secondarily, it was hypothesized that the solution for Montana would be applicable to other areas of the western states which are similar in terms of population, economic condition, and geography.

The specific techniques used in the study fall into the following categories:

1. Library research of periodicals and newspapers.
2. Research of scrap processing trade and government publications.
3. Letters of inquiry containing questionnaires designed to produce the required data.
4. Personal interviews with various individuals cognizant of certain aspects of the problem.

5. Analysis of data relative to the cost of processing auto bodies, the market price of auto scrap, railroad and motor truck transportation rates, and other pertinent data.
CHAPTER I

THE SCRAP AUTO DISPOSAL PROBLEM: SYMPTOMS AND CAUSES

The heaps of auto hulks and the scattered derelicts which are the symptoms of the problem of disposal of worn-out and wrecked automobiles are highly visible and readily perceived. The cause of the problem, however, has its roots in technology and economics, and is not physically apparent. A degree of investigation and study is required before the cause of the problem can be fully understood.

Manifestation of the Problem

The scrap auto disposal problem is not peculiar to any one state or locality within the country. The symptoms of the problem—country-side and cities sprinkled with overflowing auto wrecking yards and abandoned cars—are to be seen everywhere. The problem exists in the heavily populated sections of the country as well as sparsely populated areas such as the state of Montana.

National Scope

The symptoms of the scrap auto disposal problem assume gigantic proportions when considered in nationwide terms. Estimates of the total number of worn-out or wrecked automobiles scattered throughout the United States vary, but even the minimum estimates are staggering. An official of the Union Carbide Corporation, which has studied the disposition of auto body steel scrap, has estimated that approximately
20 to 30 million auto bodies are strewn about the country. Other sources place the number upwards of 30 million, and as high as 40 million. No matter what the exact number of derelict autos may be, they have created a national problem which has drawn the attention of the highest government agencies and authorities. President Johnson has stated that the millions of rusting auto bodies and piles of scrap that litter the United States are "driving my wife mad."

The existing collection of auto hulks in the country is only one phase of the problem. The collection grows every year because, although we wear out or otherwise remove from the highways about 6 million autos per year, it is estimated that less than half of them make their way through the scrap cycle back into steel furnaces. Also, it is apparent that the number of autos retired from service each year is greater than that of the preceding year. It is estimated that 3.6 million cars were scrapped in this country in 1958. For 1963 the number was estimated to be 5.3 million, and in 1967, 6.6 million autos were taken out of service. It is expected that the number of autos scrapped will keep

---


4 Ibid.


increasing year after year, since motor vehicle scrappage totals in the past have grown as new car sales and registrations have grown.  

The Urban Crisis

The effects of the derelict auto disposal problem are especially severe in the nation's cities. A great many of the country's urban areas share in the problem of abandoned motor vehicles, either on the public roads, or in other areas such as river bottoms, vacant lots, and even the owners' back yards.

An outstanding example is provided by the city of New York. Examination of the statistics shows that during the year 1960, approximately 2,500 autos were abandoned on the city streets, and removed by the Department of Sanitation. By 1962, the yearly number abandoned had increased to 6,299, and in 1964, it was estimated that approximately 25,000 cars were abandoned on the New York City streets. Preliminary estimates indicated that the cost to the city for removal and disposal of the derelicts in 1964 was in excess of $600,000. By 1966, the NYC Police estimated that cars were abandoned at the rate of 110 per night, which amounts to over 40,000 per year. The Sanitation Department tried offering free pick-up service, and ran a campaign by TV, radio, and newspapers, giving the telephone number to call for such service. Over a 2-year period only about 200 people had phoned.

The story is much the same in most of the cities, large and small, throughout the country. In Chicago, auto abandonment rose from

---

7Ibid., p. E-2.  
1,706 cars in 1959 to 21,994 in 1963. In Amsterdam, New York, a city of about 30,000 people, it was found that there were 11 abandoned or dismantled cars for every 1,000 people in the community. In the city of Los Angeles, 2,000 abandoned cars are impounded every month, of which only 30 to 40 per cent are reclaimed. Every year several thousand of them, valued at less than $100 each, are sold for junk to pay the tow charge or storage lien. The California Highway Patrol "harvested" 15,000 abandoned cars in 1965. In the District of Columbia during a 14-month period in 1963 and 1964, the city removed 2,500 abandoned vehicles from the streets. These were vehicles that had been stripped of identification and usually the wheels or engine were missing.

The Rural Problem

In the rural areas of the country, a similar problem exists. Studies have shown that the worst junked car accumulations are small, widely scattered units adjacent to public roads. As an example, consider the results of a study conducted by private economic consultants for the state of New York. The consultants chose Schoharie County as a typical rural area containing practically no medium or large sized


13Institute of Scrap Iron and Steel, op. cit., p. T-1.

cities. Results of the study showed that the county contained over 6,000 automobile hulks for every 1,000 people in the county.\textsuperscript{15}

The nature of the problem in the rural areas differs from that in the cities in one major respect. In the cities, it is necessary to remove the abandoned hulks from the public roadways in order to maintain sanitation and the efficiency of the public thoroughfare system. In the countryside, the autos are most often abandoned off the roadways, along rivers, in gulches and canyons, and in open fields. The rural problem, therefore, becomes one of maintaining the aesthetic values of the countryside, with removal of the auto bodies not being a practical necessity as is the case most of the time in a city.

Symptoms in Montana

It is extremely difficult to obtain an accurate count of the derelict autos in an area the size of the state of Montana. However, some estimates have been made. The past president of the Montana Dismantlers Association has estimated there are about 50,000 auto bodies "lying around Montana." Of those, he estimated that approximately 75 per cent were lying abandoned on public or private property other than in established auto dismantlers' yards. In addition, he estimated that about 30,000 more were expected to be abandoned during that current year (1966).\textsuperscript{16} A casual tour of the state would reveal thousands of

\textsuperscript{15}Institute of Scrap Iron and Steel, \textit{op. cit.}, pp. R-3, R-4.

derelicts abandoned along roadways, in vacant lots and fields, and particularly, along river bottoms. In many of Montana's towns and cities the decrepit, stripped automobile is a typical sight in the backyards of residential neighborhoods.

Conditions Which Create the Disposal Problem

The causes, or the conditions which create the derelict auto disposal problem are complex and interrelated, but they can be separated into three major considerations. These are (a) the pattern of automobile consumption in the United States, (b) the changes, or more accurately, the revolution in the methods of making steel in this country, and (c) the quality of the scrap iron and steel derived from autos, which in turn affects the scrap selling price.

The Pattern of Automobile Consumption

The number of automobiles consumed, or retired from service, increases year after year, with only minor setbacks caused by vagrant economic conditions. According to the Automobile Manufacturers Association, the average age of passenger cars retired from the highways in the United States is fairly stable. In the U.S., it is known that about 50 per cent of a given year model will have disappeared at the end of about ten and one-half years. The rate of disappearance begins to accelerate at the end of about six years. These relationships are shown in Figure I-1.17

From the preceding information, it can be seen that the number of automobiles scrapped during any given year is a function of the number

FIGURE I-1

PASSENGER CAR SURVIVAL RATES

of autos coming into retirement age which were produced during previous years. Figure 1-2 shows the number of automobiles taken out of service for each year from 1956, projected through 1970. The new car production in the United States is also shown from 1956 through 1967.\(^\text{18}\) It is apparent that the autos produced during the high production years of the early 1960's are now starting into the scrap cycle. Since auto production has increased steadily through 1965, and has been maintained at a high level since then, the numbers of autos being scrapped annually will remain high. This production and consumption pattern of autos in the United States is one of the factors which aggravates the already severe disposal problem.

The Changes in Steelmaking

The most important of the conditions which cause the scrap auto disposal problem is undoubtedly the current revolution in steelmaking methods in the United States.

The conventional and most widely used method of producing steel in the U.S. up until recent years has been the open hearth furnace. In 1954, a revolutionary steel making process termed the "oxygen converter" or "basic oxygen furnace" (BOF) was introduced into this country. The process was developed at a steel producing center at Linz, Austria, where years of experimentation resulted in operation of the first commercial scale plant in 1952. By 1962, the BOF accounted for approximately 8 per cent of the steel made in the U.S. By 1966, the figure was

FIGURE I-2
NEW CAR SALES AND CAR SCRAPPAGE RATE

25 per cent, and it is predicted that by 1970, 50 per cent of the steel production in this country will be by BOF.\textsuperscript{19} A comparison of BOF production to open hearth production and other methods is shown in Figure I-3.\textsuperscript{20}

The primary reason for switching to the BOF is that this method offers a cost advantage in manufacturing steel. The BOF will turn out a batch of steel in an hour or less, while the time required by an open hearth furnace is six hours or more. Because of their faster operation, steel can be made by the BOF for two to eight dollars per ton less than with the open hearth.\textsuperscript{21} The result is that about a dozen open hearth furnaces in the U.S. have been scrapped or put on standby.\textsuperscript{22}

Scrap steel is one of the two basic raw materials from which steel is made, the other being pig iron which is produced from iron ore in blast furnaces. The changeover to the BOF from open hearth has had a great effect on the demand for scrap steel, and particularly for automobile scrap. The basic reason is that the oxygen converter can consume not more than 30 per cent scrap in the loading charge, while the open hearth charge generally consists of 35 to 50 per cent scrap, and the furnace can use as much as 60 per cent. The result is that less scrap is consumed by the steel making industry as a whole. The demand

\textsuperscript{19}Institute of Scrap Iron and Steel, \textit{op. cit.}, p. F-2.


FIGURE I-3
U.S. STEEL PRODUCTION BY MAJOR PROCESS
(Estimates indicated by broken lines)

for scrap has therefore lessened, particularly for the low-grade types such as automobile scrap.

The Quality and Price of Auto Scrap

Scrap steel used in the steel production process comes from two major sources. It is produced by the steel companies themselves as a by-product of their production (home scrap), or it is purchased from other sources. The purchased scrap falls into two categories, industrial scrap and obsolete scrap. Industrial scrap is new steel which results from the manufacture of finished products, while obsolete scrap is that which results from demolition of steel structures, and from processing of other articles which contain steel. Old automobiles fall into the latter category.

If the various types of scrap were ranked in order of desirability to the steel industry, the ranking would be as follows: home scrap, industrial scrap, and obsolete scrap. Of the obsolete scrap, the demolition type is preferred, leaving old automobiles in the category of the least preferred scrap.

The reason that old automobiles constitute a poor grade of scrap steel is that they contain a wide variety of non-metallic impurities, such as plastic, rubber, and glass, as well as metallic impurities, such as copper, lead, and chromium. The non-metallic impurities are the more serious, because they are contaminants in the manufacture of steel. As the steel industry reduced the amount of scrap purchased, because of the use of the BOF, it naturally eliminated the poorest grade of scrap.

Institute of Scrap Iron and Steel, op. cit., p. F-1.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
first. Automobile bodies, classified as No. 2 bundles by the steel industry, are included in this category. Figure I-4 shows how the consumption of No. 2 bundles, as a percentage of the total consumption of purchased scrap, has declined in recent years.24

As the demand for auto-body scrap has fallen, so has the price. The scrap processing industry will handle only the scrap that will yield a profit. The price has fallen to a level such that, in many instances, it is no longer profitable to prepare autos for sale as scrap, and to a great extent, the accumulating margin of scrap is uneconomic.25 Thus, at a time when the scrappage rate for old autos is at a peak and still rising, the demand and price for auto scrap is at its lowest. The decline in the price of No. 2 bundles is shown in Figure I-5.26 These circumstances, then, are the central cause of the scrap auto disposal problem in the United States today.

---


26 Data from Proceedings of the National Conference on Auto Salvage, p. B-6, addendum dated May, 1968.
FIGURE I-4

CONSUMPTION OF NO. 2 BUNDLES AS A PERCENTAGE OF TOTAL PURCHASED SCRAP CONSUMPTION


Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
FIGURE I-5
PRICE OF NO. 2 BUNDLES PER GROSS TON

CURRENT APPROACHES TO SOLVING THE PROBLEM

When the causes and effects of the scrap auto disposal problem are recognized, an observer is most likely to ask: What is being done to solve the problem? The approaches or courses of action being taken fall primarily into one of three general categories. These are, (a) the methods now being utilized to dispose of scrap autos, (b) legislation which has been introduced to alleviate the symptoms of the problem, and (c) research programs on the state and federal levels to study new solutions and in some cases establish pilot plants to test them.

Present Methods of Scrap Auto Disposal

The methods which are now employed to dispose of worn-out or wrecked autos range from the simplest and most unsophisticated, such as dumping or burying, to the highly advanced, such as being fed into a gargantuan shredder. There is, of course, the commonplace abandonment of old autos by their owners, which in some cases is disposal of a sort. In cases where the abandoned auto must be removed, such as from a city street, the disposal problem is inherited by the removing person or agency. It was previously explained that a large percentage of the scrapped autos in the United States are not being actively processed through the steel scrap cycle for the manufacture of steel. Autos falling into that category are generally accumulated in areas such as dismantlers' yards, buried or dumped in designated locations, or used
for some purpose such as fish habitat in water bodies, reinforcing along river banks, etc.

**Utilization as Scrap Metal**

It would seem most desirable from an economic standpoint to utilize the metals contained in old autos as scrap material in the production of new steel and other metals. This is now being done with some undetermined percentage of the auto hulks in the country.

The organizations which perform the function of preparing scrap autos for purchase by the steel companies or their brokers are called scrap processors. They are not auto dismantlers, whose business is the stripping of old cars for saleable parts. The auto dismantler, or wrecker, provides the raw material for the scrap processor's use.

Autos utilized for their scrap steel have ordinarily been processed by a number of time consuming and comparatively costly operations. Only in recent years has the scrap industry introduced really high-efficiency processing equipment to lower the time and cost of processing autos for their steel.

**Conventional auto scrapping systems.** After an auto wrecker has stripped an old or wrecked auto for the saleable parts, he sells the remaining hulk to a scrap processor, if he can get a high enough price. Otherwise, the auto will not enter into the scrap processing cycle, because the dismantler will either store it or dispose of it by some means or another. Storing the hulk will only add to the disposal problem.

After receipt of the auto body from a wrecker or other source, the processor prepares it for sale to a steel mill. The greatest
percentage of scrapped automobiles are compressed into bales. The bales usually include the frame, undercarriage, and sheet steel, and are designated as No. 2 bundles.\(^1\) In order to meet the specifications for No. 2 bundles, the auto must be free of nonferrous and nonmetallic materials. A large amount and variety of these are present in the average car. Among these are rubber mats and hoses, glass, seats, upholstery, insulation, copper wire and cables, die cast parts, dashboard, and stainless and chrome steels. The engine block and transmission are removed and sold as other grades of ferrous scrap. The processor may burn the body in the open, or if he has one, in an incinerator. The burning is to eliminate the combustible materials, as well as low-melting temperature metals such as lead and zinc, which are contaminants in steel. Then, again, if the equipment is available, the entire auto body is compressed into a No. 2 bundle. In other cases, the body may be torn up piecemeal by shears and then baled, or it may be cut up by hand with an oxy-acetylene torch. An auto body, after preparation in the foregoing manner, will yield about 1900 to 2000 pounds of No. 2 bundle.\(^2\)

**Recent high-efficiency systems.** It has been recognized for some time by the scrap processing industry that the previously described conventional methods of preparing auto scrap are not satisfactory in many respects. First of all, the methods are time consuming and require


a great deal of hand labor. This results in a processing cost which, in
many parts of the country, is too high to allow a profitable operation.
Secondly, the product of this expensive processing work is the No. 2
bundle, which is a relatively poor grade of scrap steel, for which the
demand and price are low. In order to lower the cost and upgrade the
product, several highly efficient auto scrapping processes have been
recently developed. The development was accomplished by different com-
panies, but the principles used and the end product are essentially
similar. All of the processes under discussion employ gigantic pieces
of equipment capable of accepting a whole auto and shredding it into
small chunks of nearly pure steel. The waste materials and nonferrous
metals are automatically separated, and the steel emerges from the
machine as a raw material ready for use by a steel producer.

The Proler Steel Corporation of Houston, Texas, has developed an
auto scrap processing plant called a Prolerizer. The plant is actually
a series of machines and devices, and the cost of an installation is in
excess of $2 million, depending on the location. At the present time,
Prolerizer plants are located in Houston, Texas; Kansas City, Kansas;
Los Angeles, California; Chicago, Illinois; Jersey City, New Jersey;
and Everett, Massachusetts.

The Prolerizer utilizes a conveyor to transport a car up into its
inner working machinery. It then uses automated cutting tools, hammers,
magnets, and chemicals to shred, separate, and purify the steel. The
main product conveyor carries the purified steel pieces to a mound of
similar steel, while other conveyors carry away rubber, nonferrous
metals, dirt, and other contaminants. A Prolerizer plant can digest
three autos per minute, which is equivalent to over 1400 per 8-hour day, or 350,000 in a year. 3

A similar automatic car shredding device has been developed by Luria Brothers and Company, Inc., of Cleveland, Ohio. Their machine is known as a "fragmentizer" and the shredded steel scrap is trade named Lurmet. In the Lurmet process, the auto bodies are also fed into the machine on a conveyor belt. Inside the machine, the entire automobile is ripped and shredded into small pieces so violently that the nonferrous metals, dirt, rubber, and other undesirable materials are knocked loose, expediting separation at a later stage. The product is then fed into a rotating drum magnet which separates the ferrous particles from the non-magnetic material. Such material drops into a bin for storage and eventual removal. After magnetic separation the Lurmet goes through a second cleaning and a final quality check, from whence it is dropped into a conveyor for transfer to a railroad gondola car. 4

The first "fragmentizer" was a prototype machine installed in Vernon, California. 5 In 1965, after it had been in operation for about two years, Luria Brothers entered into an agreement with Ford Motor Company whereby Ford would purchase substantial quantities of the Lurmet product. 6 Luria then proceeded to build two fragmentizers adjacent to


Ford's foundry plants in Detroit and Cleveland. Each facility is designed to consume 250,000 scrapped autos per year.\footnote{\textsuperscript{7}}

Since the first auto shredding plants were put into operation by Proler and Luria, numerous other shredder plants have been installed in various areas of the country by other concerns. The Institute of Scrap Iron and Steel, Inc., has published a list of such plants operating in the United States. The list, dated May, 1968, is a revision of one originally prepared by \textit{Steel} magazine in December, 1966. A total of 65 shredder facilities are shown to be either in operation or planned.

\textbf{Accumulation}

Although accumulation is not really a method of scrap auto disposal (the hulks are still there and visible), it is in one form or another the most common alternative to utilization of the hulks as scrap metal.

In many areas of the United States, particularly those which are great distances from steel producing facilities, large numbers of derelict autos have been accumulated. The most commonplace accumulations are those which are found in the automobile dismantling yards. Other storage areas are occasionally utilized. Another form of accumulation frequently encountered is burial of auto bodies.

\textit{Designated storage areas.} Accumulation of auto bodies in a dismantler's yard is usually the result of his inability to obtain what he feels is an adequate price for them from a scrap processor. In some

\footnote{\textsuperscript{7}}Thomas, \textit{op. cit.}, sec. I, pp. 1-2.
areas, scrap processors will not even buy the hulks. Rather than spend money to get rid of them, a dismantler will store them in his yard, even though all the saleable parts have been removed. This is a form of accumulation in a designated storage area, the area having been designated by the dismantler himself.

Another form of storage in a designated area is the practice of transferring stripped auto hulks from a dismantler's yard to an area, usually rural, for an indefinite time period of storage. The intent may be to eventually process the hulks for scrap if market conditions warrant, or the area may be intended as a final disposal location.

Economic consultants in New York state discovered, in a study of one typical rural county, that it was common practice for owners of poor farm land to rent or sell acreage to big city auto dismantlers for mass storage of auto hulks. 8

In Missoula County, Montana, one auto wrecking concern is using an area along the Clark Fork River, west of Missoula, as a storage area for hulks. Some of them have been transferred to the area from the wrecker's business locations in another town. 9 The wrecker has no plans for other means of disposal, but intends to "play it by ear" regarding eventual removal or scrap processing of the hulks. 10

Burial. Another commonly found method of scrap auto disposal is

8 Institute of Scrap Iron and Steel, op. cit., p. R-10.
9 Personal interview, Mr. Frank Dures, Frank & Jim's Wrecking, Missoula, July 3, 1968.
10 Personal interview, Mr. Walter Bakke, Bakke Auto Parts, Missoula, July 8, 1968.
burial. The method appears to be the most commonly used among the auto wrecking concerns of Missoula, insofar as disposal of the sheet steel bodies is concerned. One wrecker indicated that he had recently been able to sell the heavy metal (frames, axles, and suspension) at a price which warranted cutting it loose from the body. However, he also stated that he did not even bother to take the heavy metal out at the present time, but buried the whole hulk.  

The wreckers interviewed who used burial as a disposal method stated that they either hauled the hulks to the burial ground themselves, or that they had them removed and buried for a fee. In either case, the same commercially operated burial ground was used.

Other Disposal Methods

In addition to utilization as scrap steel, storage, and burial, some other scrap auto disposal methods are infrequently employed. One of the methods is to dump the hulks into bodies of water.

When the New York City Sanitation Department cannot sell the abandoned wrecks which they pick up, they bury them at land-fill sites, or dump them into the Atlantic Ocean.  

Several Gulf states have used them as artificial reefs for fish habitat. In the mid-1950's the Alabama State Game and Fish division dumped hundreds of old autos into the sea near the entrance to Mobile Bay. The purpose was to provide artificial reefs of fish "apartments".

---

11 Personal interview, Mr. Douglas Roark, Ace Auto Salvage, Missoula, July 3, 1968.

In 1962, old cars were lowered into the sea near Santa Barbara, California. The objective was to form a reef as part of an artificial island constructed by an oil company for drilling.

Dumping of derelict autos in water may provide a suitable disposal method for limited numbers of hulks in certain areas, but the method is not suitable as a general solution for the millions of existing hulks.

**Regulatory Legislation**

In recent years, the scrap auto disposal problem has become a matter of concern to the general public. The concern is reflected in the quantity and type of legislation which has been introduced on federal, state, and municipal levels. Most legislation has been directed at alleviating the visible problem symptoms, but some of it is aimed at eliminating the root causes of the problem.

**Federal Legislation**

The outstanding piece of federal legislation concerned with the derelict auto problem is Public Law 89-285, the Highway Beautification Act of 1965. This legislation is commonly termed the "Lady Bird Bill." The primary feature of the bill regarding scrap auto disposal is the provision for control of junkyards within 1000 feet of the edge of right-of-way along Interstate and Federal-aid primary highways. Junkyards within 1000 feet of the right-of-way which are in a zoned or unzoned industrial area are not under control of the act. The act provides federal funding for execution of certain provisions, primarily
dealing with screening from view or removal of junkyards.\textsuperscript{13} However, in July, 1968, the U. S. House of Representatives voted to entirely delete all highway beautification funds with the exception of those required for administration expenses.\textsuperscript{14} The financing of the program is unresolved at this writing.

The other principal legislative act affecting disposal of scrap autos is Public Law 272, the combined Clean Air Act and Solid Waste Disposal Act. These also became U.S. law in 1965. According to Section 202b of the act, the purpose is,

\begin{quote}
regular and accelerate a national research and development program for new and improved methods of proper and economic solid-waste disposal, including studies directed toward the conservation of natural resources by reducing the amount of waste and unsalvageable materials and by recovery and utilization of potential resources in solid wastes; and to provide technical and financial assistance to state and local governments and interstate agencies in the planning, development and conduct of solid-waste disposal programs.\textsuperscript{15}
\end{quote}

Other federal legislation has been enacted which is of less importance. In 1966, a Senate subcommittee approved a $400,000 project to build an artificial reef off Sandy Hook, New Jersey, to serve as a fish sanctuary.\textsuperscript{16}

\textbf{Montana Legislation}

The state of Montana also has passed its version of a highway

\textsuperscript{13}"Hearings Set on Standards for Scrap Yard Control," \textit{Waste Trade Journal}, Vol. 69, No. 9 (February 26, 1966), 20.


\textsuperscript{15}J. F. Collins, "Potential Increase in Automobile Scrap Use," \textit{Waste Trade Journal}, Vol. 69, No. 9 (February 26, 1966), 16.

beautification law. Montana Senate Bill No. 17 was signed by the Governor on March 1, 1965, and went into effect on July 1, 1965. The main provision of the law makes it illegal to operate a junkyard within 2000 feet of a county, state, or federal road without a permit from the county sheriff. A junkyard is defined as "a place where 5 or more junked, wrecked, or non-operative automobiles, vehicles, ... are located." The sheriff may require screening of a junkyard when it is within 2000 feet of the center line of a road and is not hidden from the view of motorists by an artificial or natural screen, or by the topography. The permit is effective for two years, and costs $50.00. Penalties for violation of the act are a fine of not less than $100.00 nor more than $1000.00, and each day of violation of the provisions of the act constitutes a separate offense. 17

State and Municipal Legislation Outside Montana

Certain of the states and larger cities in the United States have passed legislation directed primarily toward coping with the problem of the abandoned derelict auto so prevalent in the metropolitan areas.

The Illinois state law was amended in 1961 to allow sales of abandoned junk autos by competitive bid to junk dealers. The law enables police departments to apply to the state for "junking titles" for the abandoned autos impounded by them. The "junking title" is issued to show ownership only for the purpose of scrapping the auto. Any

17 Montana, Chapter No. 136, Montana Session Laws 1965, Senate Bill No. 17.
future issue of a regular title is thus prevented.\textsuperscript{18}

Under the laws of the District of Columbia, a person can be prosecuted for leaving an abandoned vehicle on his property if it remains there long enough to become a health menace. The property owner is subject to a fine of $50.00 per day for every day the vehicle remains on the property after the Health Department gives notice to remove it.\textsuperscript{19}

\textbf{Research, Study, and Action Programs}

It has become obvious to even a casual student of the problem that, for many areas of the country, no really satisfactory methods of scrap auto disposal have been developed. Despite the efforts of private industry and the legislative bodies, the country still abounds with heaps of auto hulks scattered from coast to coast and border to border. Numerous programs of research, study, and action have been initiated by the federal government, city governments, private industry, and various associations to solve the problem.

\textbf{Federal Activities}

The United States Bureau of Mines, by authorization of the Solid Waste Disposal Act, has established two pilot plants to develop new techniques for using auto scrap.

One of the pilot plants is located at Albany, Oregon. It was established to develop a technique for producing high grade scrap from

\textsuperscript{18}G. S. Lloyd and R. McCann, "Waging War on Abandoned Autos," \textit{American City}, Vol. 80 (November, 1965), 98-100.

\textsuperscript{19}Institute of Scrap Iron and Steel, \textit{Proceedings of the National Conference on Auto Salvage}, p. T-1.
auto hulks by means of a selective oxidation process.  

The other Bureau pilot plant is located at Hibbing, Minnesota. It was established for the purpose of developing a process for magnetizing taconite, which is a low-grade non-magnetic iron ore. The process will use auto scrap as a reducing agent by fusing it with the taconite, thus magnetizing the ore and making it susceptible to magnetic separation. Non-magnetic taconite had previously been considered commercially unuseable because of the difficulty of recovery from the parent material.

The President's White House Conference on Natural Beauty met in May, 1965, to consider conservation and extension of the country's natural beauty. Their conclusion with respect to automobile graveyards was that the solution to the junk car problem does not lie in somehow hiding the auto hulks, or burying them, or dumping them into the ocean. Rather, their recommendation was that, 

primary emphasis should be on the recycling process of making auto scrap attractive enough from a quality and price standpoint through operation of the market forces, with whatever Government lubrication might be necessary to effectuate the end.

The recommendation also stated that private industry should be given economic incentives, such as tax credits, for investing in new equipment

22 Collins, op. cit., p. 17.
and technology to make auto scrap more consumable by the steel mills. It also recommended state and federal programs to be financed by taxes on automobile users and manufacturers.

A National Advisory Committee on Highway Beautification has been created to help achieve the goals established by President Johnson with regard to the Highway Beautification Act. The function of the committee is to study proposals and recommend specific courses of action. A Scrap and Salvage subcommittee was formed to consider technical and economic research proposals, as well as the need for revised vehicle titling laws, uniform licensing laws for auto wrecking yards, and government guaranteed loans for financing of scrap processing equipment.²⁴

A detailed study of iron and steel scrap consumption problems has been made by the Business and Defense Services Administration of the Commerce Department. The study research covered structure of the market, a description of the industry, economics of scrap generation and consumption, technological difficulties, and public policy issues. A study report entitled Iron and Steel Scrap Consumption Problems has been published. The most important conclusion with regard to the scrap auto disposal problem was that wider use of the shredding process will in time "make virtually all scrap acceptable and thus practically eliminate the accumulating of supplies of partially acceptable scrap (i.e., stripped junk auto carcasses and similar scrap)."²⁵

²⁴Collins, op. cit., p. 17.
Municipal Activities

Abandonment of worn-out autos on the public streets and in vacant areas is a problem common to a large number of American cities. Many municipalities have developed special programs to prevent the accumulation and facilitate the removal of these derelicts.

**New York City.** A procedure for removing abandoned vehicles from the city streets is in effect, operating within the framework of the city's Administrative Code. After the Police Department has investigated to ascertain that the vehicle has not been stolen, the Sanitation Department removes it from the streets. A sanitation officer inspects the car and evaluates its condition. If it is determined to be a worthless hulk, it is taken to a Marine Transfer Station, loaded onto a scow, and disposed of in a sanitary landfill. If it has scrap value, it is towed to an impounding yard where it must remain for 30 days before it can be sold at auction. The receipts from the sales go into the city's general fund, but the costs to the city for towing, storing, selling, and overhead are far in excess of the sale receipts.26

**Chicago.** The Chicago Police Department has created a special Auto Pounds Section to operate five strategically placed auto impounding areas. The owner of a car abandoned on city property is traced by the engine registration number, and he is given notice to remove the car. If it is not removed within 7 days after notification, the city

contracts with a private towing concern to remove it, and the owner is billed for the tow charges. 27

A vehicle is put up for sale by competitive bid if it is not claimed within 15 days after notification of pick-up. The Auto Pounds Section applies to the state for "junking titles" before the sale to prevent the future issue of a regular title. The vehicles are appraised, and those which are valued at over $100.00 are auctioned by a competent professional auctioneer. They are sold only to licensed auto wreckers or used parts dealers. Those vehicles appraised at less than $100.00 are sold to licensed wreckers by bids. A separate contract is made for each car. Cars that are over 6 years old are sold on a weight basis. The bidders pay by the gross ton, and the price is based on current scrap metal prices. The future of the program is doubtful, because of its dependency on the market price for auto scrap. 28

Los Angeles. In the city of Los Angeles, abandoned cars are towed to one of the 18 impound garages scattered over the metropolitan area. Owners of impounded vehicles are notified immediately by postcard. If a vehicle valued at less than $100.00 goes unclaimed for 20 days, it can be sold for junk, but cannot be registered again. Unclaimed cars with a value of more than $100.00 are required to be sold after being impounded for 90 days, and can be re-registered. Between 30 and 40 per cent of the impounded vehicles are eventually reclaimed. 29

28 Lloyd and McCann, op. cit., pp. 98-100.
29 R. West, "City Seeks Profit in Abandoned Property," Los Angeles Times, February 27, 1967, p. 3.
Washington, D.C. The city of Washington has also initiated a program of impounding abandoned autos. They are held for 60 days, and sold at a public auction if not claimed. The vehicles are sold primarily to auto wreckers and used parts dealers.30

Portland, Maine. The city of Portland recently initiated a program to collect and dispose of all the abandoned and derelict autos located on public and private property outside of established yards. The Junior Chamber of Commerce organized the program, with local contractors donating cranes, trailers, wreckers, and trucks. Residents of the city were enlisted to locate the derelicts and obtain the owners' signatures on legal release forms. During a period of 4 days, 400 cars were collected at an unofficially estimated cost to the city of slightly over $3.00 per car. A company from Freeport, Maine, brought in a portable machine to flatten the car bodies, after which they were hauled to Everett, Massachusetts, for scrap processing.31

Private Association Activities

A wide variety of private associations share an interest in solving the problem of scrap auto disposal. Trade and civic associations both have been actively interested in the subject.

Institute of Scrap Iron and Steel. The Institute has been the most active trade association involved with respect to the problem.


One of the most important of the Institute's activities was the sponsoring of the National Conference on Auto Salvage, held in Washington, D.C., on October 1, 1964. Representatives were present from numerous trade and civic associations, federal agencies, state and municipal agencies, as well as from the scrap processing industry. Presentations were given on all aspects of the auto salvage problem by experts in their respective fields. At the conclusion of the conference, the Institute published a reporting document entitled Proceedings of the National Conference on Auto Salvage, October 1, 1964, and Selected Background Information.

The Institute has taken the position that old autos constitute a valuable resource to the country, because they are a raw material for production of new iron and steel. They contend that the scrap processing industry is capable of handling the current problem. They have recommended that a Task Force be established, including representatives of the scrap, steel, auto manufacturing, and auto wrecking industries, and government officials to study the problem, summarize the existing activities, and recommend steps for relief of the problem. 32

Council of State Governments. In 1967, the Council endorsed a proposal to establish uniform state laws dealing with the problems of old cars, liens, and property rights. 33

Montana Dismantlers Association. The Association adopted an

32 Institute of Scrap Iron and Steel, op. cit., "Statement on the Old Car Disposal Problem."

33 West, op. cit., p. 23.
auto wreckers fencing code at a meeting in Helena in 1965. The fencing code was designed to be compatible with the requirements of both the Federal Highway Beautification Act of 1965 and the Montana law of 1965 relating to regulation of junkyards. The Association has also initiated a clean-up campaign among its members. They have requested state help in finding common burying grounds for old, abandoned cars and in uniform interpretation of the state and federal highway beautification laws.

Missoula Chamber of Commerce. The Chamber has turned its attention to ridding Missoula city and county of wrecked and abandoned vehicles. A subcommittee has been named to confer with city and county officials on the problem.

Evaluation of the Current Approaches

The current approaches to solving the scrap auto disposal problem covered in the preceding review can be evaluated now with respect to solving the existing problem for Montana. One of the hypotheses of this research was that there are elements in solutions found to be successful elsewhere which are applicable in some combination to comprise a solution for Montana. These elements will be considered in the evaluation of the current approaches.


Utilization as Scrap Metal

It is apparent that the conventional auto scrapping systems, as employed in Montana, have largely failed as a means for utilization of the auto bodies as scrap metal. The failure is due principally to the fact that the price of the finished product, No. 2 bundles, is not adequate to cover the labor cost for processing the bodies, and the freight cost for shipping the scrap to a steel mill. The problem is especially severe for Montana because the great distance to the steel mills causes the delivered cost of the No. 2 bundles to be even higher than for many other areas of the country. The conventional auto scrapping methods, then, are discarded as a solution for the problem in Montana.

The recently developed high-efficiency auto shredding systems offer advantages which may overcome some of the factors which now prevent successful economic disposal for this area. The principal advantage of the shredders is that they add value to the raw material (auto bodies) by converting them to another material which is much more valuable on a unit weight basis. To illustrate, a Ford Motor Company official estimated that when baled auto scrap (No. 2 bundles) was worth $20.00 to $25.00 per ton, shredded steel scrap was worth roughly $30.00 per ton. This is an increase in value added ranging from 20 to 50 per cent. In addition, it is probable that the unit cost of processing an auto body by fully automatic methods, with large volume, will be less than the unit cost for hand processing methods. The use of automatic

---

auto body shredding equipment is, therefore, considered as a feature in a successful method for disposal of Montana's auto scrap.

Accumulation

The accumulation of auto bodies, as presently practiced in Montana, does not solve the disposal problem, because the accumulations are found primarily in the auto wrecking yards, or areas procured for the purpose by auto dismantlers. The auto bodies remain, still requiring disposal. However, one aspect of the accumulation method may be a necessary or desirable feature of an economically successful disposal method. Accumulation of bodies in sufficient quantities may produce economies of scale in processing or a premium in selling price great enough to be an important factor. Accumulation in some form will therefore be considered as a feature in a successful disposal method. Burial will not be considered as an acceptable method, because it is not a form of utilization, but only a means of disposal.

Federal Legislation

The Highway Beautification Act of 1965 has a minimum effect with respect to economic solutions of the scrap auto problem in Montana. The provisions of the legislation have no discernable effect on the costs or price of auto scrap, because the law is written primarily to hide the derelicts, or remove them from view. The provisions for control of auto dismantling yards within 1000 feet of federal highways are overshadowed by the Montana law which applies to wrecking yards within 2000 feet of the roadway.
Montana Legislation

The Montana law which regulates auto wrecking yards is designed primarily to hide the derelict autos from public view. Any economic disposal method put into practice would be required to operate within the provisions of the law, and the screening and licensing provisions are pertinent.

State and Municipal Legislation Outside Montana

The Illinois state legislation provides a means for municipal police departments to obtain title to the abandoned autos which they impound, so that they can be sold. The impounding and selling activities remain governed by the price of auto scrap. None of the municipal legislation reviewed is directly applicable to an economic solution for Montana.

Federal Activities

The federal pilot plant programs in Oregon and Minnesota could have an economic bearing on disposal solutions for Montana in that they could ultimately lead to uses for auto scrap which increase the demand, and raise the price. However, this is only an eventuality and not the case at the present time. Any economic disposal solutions will be based on the current demand and price of auto scrap.

Municipal Activities

The municipal activities previously described provide examples of the kind of action programs which could be initiated by Montana cities. However, the success and workability of any such programs are still
dependent upon the market conditions for auto scrap, insofar as economic solutions which utilize the scrap are concerned. These programs have no direct bearing on a solution for Montana.

**Private Association Activities**

The activities of the Institute of Scrap Iron and Steel have had an effect on the auto disposal problem in the United States as a whole. Their National Conference on Auto Salvage served to focus attention of industry and all levels of government on the subject. The Institute has also served as a disseminator of information on the subject of auto salvage, thus performing a service which aids those interested in formulating solutions and putting them into action.

The activities of other associations are not considered to have a direct effect on the formulation of economic solutions for Montana.
CHAPTER III

ECONOMIC SOLUTIONS FOR MONTANA

As discussed in the preceding chapter, an evaluation of the current activities in scrap auto disposal has revealed several methods of operation which, in combination, may prove to comprise a solution for Montana. A proposed method for economic utilization of Montana's auto scrap can now be formulated and stated as follows: Worn-out or wrecked autos in Montana can be economically utilized by collecting them at selected locations within the state, and selling them to an auto body shredding facility.

Sale of the auto bodies to a shredding facility was chosen as the primary operational feature of the proposed disposal method because such a facility can usually offer a higher price for auto hulks than can a scrap processor who produces No. 2 bundles. The higher price is possible because the steel scrap users pay a substantial premium for the shredded product.\(^1\) In addition, as explained in the Chapter II evaluation, the shredder processes auto bodies at a minimum unit cost.

Another feature of the proposed solution which was derived from the Chapter II evaluation is the collection of large quantities of hulks to obtain economies in preparation and shipping, and possibly a premium in buying price from the shredder facility.

---

Operation of the Utilization Method

The proposed method of scrap auto utilization would operate generally as follows. Cities and towns with large concentrations of auto bodies would be selected as operating locations. Scrap autos from the area serviced by these locations would be prepared for shipment and then accumulated at a central location for shipping. When all the available hulks in the area were prepared, they would be shipped by rail or truck to a shredder facility for processing. The proposed method would be employed only if the cost analysis shows that the price of the scrap would be greater than all the costs associated with collection, preparation, and shipping.

Selection of the Operating Locations

The choice of locations in Montana for collection, preparation, and shipment of the auto bodies is somewhat arbitrary, but some criteria for the choice can be established. The following considerations apply to the selection of both the number of locations, and their geographical situation.

The number of locations selected should be adequate to assure that the major concentrations of auto bodies in the state can be economically utilized. If too few locations are selected, some existing accumulations of auto bodies will not be utilized because they are too remote from an operating location. If too many locations are selected, there will be excessive overlap in the geographical area served by the locations, or insufficient derelict autos in each location. Either case will result in operation which is less economic than the ideal. Any
location selected should have an existing supply of auto bodies large enough to facilitate economical preparation and collection. Any of the larger cities in the state would, therefore, be candidates for operating locations, because of the existing derelicts in auto dismantlers' yards.

All the cities in the state with a population of 10,000 or greater, together with the population of the counties in which they are located, are listed in Table III-1. The 1967 auto registration for each of the counties is also listed.

---

**TABLE III-1**

**CANDIDATE OPERATING LOCATIONS**

<table>
<thead>
<tr>
<th>City</th>
<th>Population Rank</th>
<th>County</th>
<th>1967 County Auto Reg.</th>
<th>Auto Reg. Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Falls</td>
<td>1</td>
<td>Cascade</td>
<td>35,474</td>
<td>2</td>
</tr>
<tr>
<td>Billings</td>
<td>2</td>
<td>Yellowstone</td>
<td>29,991</td>
<td>1</td>
</tr>
<tr>
<td>Butte</td>
<td>3</td>
<td>Silver Bow</td>
<td>19,244</td>
<td>4</td>
</tr>
<tr>
<td>Missoula</td>
<td>4</td>
<td>Missoula</td>
<td>25,191</td>
<td>3</td>
</tr>
<tr>
<td>Helena</td>
<td>5</td>
<td>Lewis and Clark</td>
<td>14,640</td>
<td>6</td>
</tr>
<tr>
<td>Bozeman</td>
<td>6</td>
<td>Gallatin</td>
<td>12,159</td>
<td>7</td>
</tr>
<tr>
<td>Anaconda</td>
<td>7</td>
<td>Deer Lodge</td>
<td>6,212</td>
<td>10*</td>
</tr>
<tr>
<td>Havre</td>
<td>8</td>
<td>Hill</td>
<td>6,823</td>
<td>8</td>
</tr>
<tr>
<td>Kalispell</td>
<td>9</td>
<td>Flathead</td>
<td>16,015</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9</strong></td>
<td><strong>346,414</strong></td>
<td><strong>175,749</strong></td>
<td></td>
</tr>
</tbody>
</table>

* Lincoln County ranks No. 9.

---


3Registrar of Motor Vehicles, Deer Lodge, Montana, "Monthly Motor Vehicle Registration Record for each County as of December 29, 1967."
All the cities listed are the largest in population in their respective counties.

The total 1967 auto registration for the state was 298,412. The total auto registration for the nine counties containing the cities of over 10,000 population was 175,749, or 59 per cent of the total state registration. Therefore, over half of the autos in the state are registered in the counties which contain the nine largest cities. It is reasonable to suppose that a large proportion of the derelict autos in the state are within the same counties, and that the largest city in each county would have a sizeable accumulation of derelicts. The nine cities listed would, therefore, be logical operating locations and shipping points for actual operation of the proposed utilization method.

It is not necessary to perform a cost analysis of the operations in each of the designated operating locations in order to test the economic feasibility of the proposed utilization method. There is no reason to suppose that the operating costs at any location should vary greatly from the costs at other locations. However, the costs of shipping the car bodies from the operating locations to the shredding facility will be different for each location because of the variation in shipping distance. Three operating locations chosen to represent shipment from the eastern, central, and western areas of Montana were used in the cost analysis. The locations selected are Billings, Great Falls, and Missoula.

\footnote{Ibid.}
Acquisition of the Auto Bodies

Dismantlers' yards would be the primary source of junk autos, but individual hulks could also be collected from scattered locations, and others could be brought to the operating location by private owners wishing to dispose of them.

It should be recognized that in some instances the collection of derelict autos may be complicated by the requirements to possess legal title to them. This would be especially true in cases where it was attempted to acquire hulks which had apparently been abandoned, and their ownership was undetermined. An attorney for the Montana Highway Commission has stated that there are many legal ramifications involved in removing an abandoned vehicle from a roadside, because a vehicle is considered property, and not merely litter. The attorney also indicated that he would be very reluctant to remove an abandoned car and store or sell it.  

Resolution of the problem of legal ownership of derelict autos with regard to scrapping them is outside the scope of this research project.

Preparation for Shipment

The existing shredder facilities will accept autos only after certain components are removed. For example, the items which must be removed before delivery to a Luria Brothers "fragmentizer" plant are the

---

radiator, battery, tires, seats, engine block, and gas tank. These items would, therefore, be removed before the auto body was flattened for shipment.

Shipment of the whole auto hulks is uneconomic because auto bodies displace a large volume and constitute a small mass, which makes for a low bulk density. The density of an auto body is only 3 to 4 pounds per cubic foot. In the proposed disposal operation, the bodies would be prepared by flattening them in a mobile auto crusher to obtain a higher density. By this process, the auto body would be reduced to a billet which occupies less than one-fourth of its original bulk, and maximum railroad car limits could be approached for shipment.

If shipment of the auto billets to the shredder facility were to be made by rail, two different systems of operation would be logical for preparing the autos.

In one system, the first step in conducting the proposed utilization operations would be to transport the mobile auto body flattener to a site immediately adjacent to a railroad loading siding. Auto hulks would then be transported to the site from auto dismantler's yards and other accumulations of hulks in the area serviced by the operating location. Individual hulks could also be brought to the site by private owners. Those autos which were not in a condition suitable for flattening.

---


8 Harris Press and Shear Corporation, Cordele, Georgia, sales brochure entitled "Harris Carbasher."
would be prepared by removal of the undesirable parts before they were brought to the site. The autos would be fed into the flattening machine by means of suitable handling equipment, and the billets would be removed from the machine, loaded onto a railroad car, and shipped to a shredding facility. In any further discussion, the above described operating system will be referred to as operating system A.

The first step in conducting the disposal operation at any location with the alternate system would be to locate the large concentrations of junk autos in the area. The concentrations would be found primarily in auto wreckers' yards, or other sites used by auto wreckers for storage of junk autos. The mobile auto flattener would be moved into place adjacent to the junk autos. Those autos which were not in a condition suitable for flattening would be prepared by removal of the undesirable parts. The autos would then be fed into the flattening machine by means of suitable handling equipment. The finished auto billets would be removed from the machine, transferred to a truck, hauled to a railroad siding, and loaded onto a railroad car for shipment to the shredding facility. The alternate operating system just described will be referred to hereafter as operating system B.

Operating system A has an advantage compared to operating system B. The flattening machine would be transported and made ready for operation only once at each operating location city. "Down time" and towing expense for moving equipment from one dismantler's yard to another's would therefore be eliminated.

However, operating system B offers an advantage compared to operating system A. Transporting of flattened autos from the wrecking
yard to the railroad loading site could prove to be substantially cheaper than transporting whole hulks. The relative advantages of each system will be considered in the cost analysis of conducting the operations.

If shipment of the auto billets were to be made by truck instead of rail, preparation of the auto hulks would be accomplished as described for operating system B, up to the point of transfer to the truck. At this point the billets could be loaded directly onto a flatbed freight truck for shipment to the shredding facility, or stacked nearby for storage until a freight truck was available. An advantage of shipping by truck compared to rail would be that the freight truck could be loaded at the place where the derelict cars were originally accumulated, such as an auto dismantler's yard. Transfer of the junk autos from the dismantler's yard to a railroad siding would thus be eliminated. The operating system which would be used if the billets were shipped by truck will be designated as operating system C.

For purposes of summary and clarification, flow charts of the three proposed operating systems are depicted in Figure III-1.

Selection of the Shredding Locations

Several existing shredding facilities at various locations were selected for analysis of the freight cost for shipping auto billets to their locations and the price paid at the facilities for scrap autos. The location or locations utilized in the disposal method would depend upon the results of such an analysis. Inspection of a list of shredder locations provided by the Institute of Scrap Iron and Steel shows that the shredders nearest to Montana are situated in the state of Washington. These facilities are located at Spokane, Seattle, and Tacoma. Another
FIGURE III-1
FLOW CHART OF OPERATING SYSTEMS

OPERATING SYSTEM A

OPERATING SYSTEM B

OPERATING SYSTEM C

KEY:
- Auto Hulk Accumulation
- Railroad Car
- Flattener Operation
- Freight Truck
facility is located at Portland, Oregon, and the nearest facility to the east is at Council Bluffs, Iowa. Selection of the number of facilities to be used in the cost analysis is somewhat arbitrary, but because of their close proximity to Montana, the locations in Spokane, Seattle, and Tacoma were used for the cost analysis. (Preliminary investigation of the rail freight rates indicates that the cost for shipping scrap from Billings to Council Bluffs would be at least 50 per cent greater than for shipping from Billings to the West Coast.)

Cost Analysis of the Utilization Method

A cost analysis for the utilization of Montana's scrapped autos can now be developed. The utilization operation was separated into two major elements for purposes of the analysis. These elements are: (1) the cost of freight for shipping the auto scrap to the shredding facility, and (2) the costs of conducting all the other operations of the utilization method.

The freight cost for shipment of the auto billets to the shredding facility was the first item considered in the cost analysis because it was judged to be the largest cost and the most important single factor in the proposed method of auto scrap utilization. A statement made by an official of the U. S. Department of Commerce serves to support the judgment. The official stated:

The largest single component of cost in the auto scrap market is the cost of transportation. If somehow, the cost of scrap

---

transport could be lowered 50 percent, all but the smallest, most isolated junked car units could re-enter the commercial scrap cycle. Inventories of car bulks at auto wreckers yards could be greatly reduced.

Therefore, any proposed operating system was eliminated from further consideration if the associated freight costs were so high as to obviously make the system economically unfeasible. The cost of item (1) above would depend upon the point of origin and terminus of the shipment of auto billets. The cost of item (2) would be the same regardless of the collection location at which the operations were conducted.

The purpose of the cost analysis is to test the economic feasibility of the proposed utilization method. It is not intended to be a definitive detailed breakdown of all the costs involved. The costs derived for the various elements of operation are estimates based on the assumptions and "ground rules" which will be presented in the analysis. The assumptions and ground rules were chosen to produce conservative (high) cost estimates. This policy was adopted so that if the results of the analysis showed the proposed utilization method to be economically feasible, a high degree of confidence could be placed in the conclusion.

There were exceptions to the policy of conservatism in instances where the cost element under consideration was judged to be small and the choice of assumptions was limited to either assuming no cost or assuming a small cost on weak or vague substantiation. In such cases a "no cost" assumption was made.
Freight Costs

The cost of shipping the auto billets to the shredding facility would vary depending upon the point of origin of the shipment, and whether shipment was made by rail or truck. For the previously designated three operating locations and three shredding facility locations, there are nine possible combinations of operating location and shredding facility location. In addition, for each combination, the cost of motor truck freight would be different from the cost of rail freight. The nine combinations for which freight costs will be investigated are:

- Billings to Spokane
  - to Seattle
  - to Tacoma
- Great Falls to Spokane
  - to Seattle
  - to Tacoma
- Missoula to Spokane
  - to Seattle
  - to Tacoma

Shipment by Rail

The established railroad freight rates are expressed as a stipulated cost per hundred pounds of cargo. A certain minimum weight of cargo must be loaded on any particular railroad car in order for the stipulated rate to apply. If the minimum weight of cargo is not loaded, the freight cost is determined using the rate stipulated for the commodity, and the minimum required cargo weight.

Auto billets which were shipped to the shredder by rail would be loaded in gondola cars. The dimensions of a gondola car are approximately 42 feet long and 9 feet 6 inches wide x 6 feet 3 inches deep. The size of an auto billet produced by a standard car flattening machine...
is approximately 10 inches thick x 78 inches wide x the original length of the car.\textsuperscript{10} If the auto billets were loaded on end in a gondola car it is calculated that about 52 billets could be accommodated. It is judged that the car could be loaded in this manner without violation of freight limitations.\textsuperscript{11} An average auto billet weighs approximately 1800 lbs.\textsuperscript{12} At an average billet weight of 1800 lbs. a gondola carload of billets would weigh approximately 93,600 lbs., or 46.8 tons.

The railroad freight rates and shipping costs for all the shipping combinations are shown in Table III-2.\textsuperscript{13}

\textbf{TABLE III-2}

\textbf{RAIL SHIPPING COSTS}

For Auto Billets Shipped Between Various Combinations of Operating Locations and Shredder Locations

<table>
<thead>
<tr>
<th>Shipping Combination</th>
<th>Minimum Carloading Required</th>
<th>Freight Rate (per 100 lb.)</th>
<th>Freight Cost (per carload)</th>
<th>Freight Cost (per ton of billet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Billings-Spokane</td>
<td>100,000 lb.</td>
<td>74¢</td>
<td>$740.00</td>
<td>$15.80</td>
</tr>
<tr>
<td>Billings-Seattle</td>
<td>100,000 lb.</td>
<td>74¢</td>
<td>$740.00</td>
<td>15.80</td>
</tr>
<tr>
<td>Billings-Tacoma</td>
<td>100,000 lb.</td>
<td>74¢</td>
<td>$740.00</td>
<td>15.80</td>
</tr>
<tr>
<td>Great Falls-Spokane</td>
<td>80,000 lb.</td>
<td>69¢</td>
<td>$646.00</td>
<td>13.80</td>
</tr>
<tr>
<td>Great Falls-Seattle</td>
<td>80,000 lb.</td>
<td>69¢</td>
<td>$646.00</td>
<td>13.80</td>
</tr>
<tr>
<td>Great Falls-Tacoma</td>
<td>80,000 lb.</td>
<td>69¢</td>
<td>$646.00</td>
<td>13.80</td>
</tr>
<tr>
<td>Missoula-Spokane</td>
<td>80,000 lb.</td>
<td>59¢</td>
<td>$552.00</td>
<td>11.80</td>
</tr>
<tr>
<td>Missoula-Seattle</td>
<td>80,000 lb.</td>
<td>59¢</td>
<td>$552.00</td>
<td>11.80</td>
</tr>
<tr>
<td>Missoula-Tacoma</td>
<td>80,000 lb.</td>
<td>59¢</td>
<td>$552.00</td>
<td>11.80</td>
</tr>
</tbody>
</table>

\textsuperscript{10}Data from Al-Jon, Inc., Ottumwa, Iowa (Manufacturers of portable car-flattening machines).

\textsuperscript{11}Personal interview, Mr. Del Lamb, Northern Pacific Railway Freight Office, Missoula, Montana, August 28, 1968.

\textsuperscript{12}Harris Press and Shear Corporation, "Proposal Specification No. 1158" (July 30, 1968).

\textsuperscript{13}Freight rate data from Northern Pacific Coast Freight Bureau Authority, Freight Tariff h-B.
Inspection of the rail rates reveals that the cost of freight from any one operating location to any of the three shredder locations is the same. Thus, there are effectively only three basic shipping combinations for purposes of cost analysis, and they are determined by the point of origin of the shipment.

**Shipment by Motor Truck**

As in the case of shipment by rail, shippers of steel scrap by truck are charged for a minimum weight of cargo, whether the loading weight is achieved or not. The minimum loading weight required for auto scrap would be 45,000 lb.

Al-Jon, Inc., shows photos "depicting maximum pay loads" of auto billets loaded on a flat-bed semitrailer.¹⁴ The photo shows 17 auto billets, complete with frames and axles. A brochure supplied by Harris Press and Shear Corporation contains a photo of a flat-bed trailer loaded with 19 billets, and the photo caption indicates that "20 or more" billets can be loaded on a standard 40-foot semitrailer. A loading of approximately 20 billets would, therefore, appear to be the maximum number which could be carried by one truck. At an average weight of 1800 lbs. apiece, 20 billets would weigh approximately 36,000 lbs. (18 tons) which is far short of the minimum required loading of 45,000 lbs. The freight cost for shipping the billets by truck would, therefore, be based on the minimum required loading of 45,000 lbs.

The motor truck freight rates and shipping costs for all shipping

¹⁴Al-Jon, Inc., Ottumwa, Iowa, sales brochure entitled "Portable Car Crushers" (Folder No. 2).
combinations are shown in Table III-3.15

### TABLE III-3

**MOTOR TRUCK SHIPPING COSTS**

For Auto Billets Shipped Between Various Combinations of Operating and Shredder Locations

<table>
<thead>
<tr>
<th>Shipping Combination</th>
<th>Freight Rate (per 100 lbs.)</th>
<th>Freight Cost (per shipment)</th>
<th>Freight Cost (per ton of billet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Billings-Spokane</td>
<td>$2.23</td>
<td>$589.50</td>
<td>$32.75</td>
</tr>
<tr>
<td>Billings-Seattle</td>
<td>2.23</td>
<td>1003.50</td>
<td>55.75</td>
</tr>
<tr>
<td>Billings-Tacoma</td>
<td>1.31</td>
<td>1003.50</td>
<td>55.75</td>
</tr>
<tr>
<td>Great Falls-Spokane</td>
<td>2.01</td>
<td>661.50</td>
<td>33.42</td>
</tr>
<tr>
<td>Great Falls-Seattle</td>
<td>2.01</td>
<td>904.50</td>
<td>50.25</td>
</tr>
<tr>
<td>Great Falls-Tacoma</td>
<td>1.47</td>
<td>904.50</td>
<td>50.25</td>
</tr>
<tr>
<td>Missoula-Spokane</td>
<td>1.64</td>
<td>1480.50</td>
<td>41.00</td>
</tr>
<tr>
<td>Missoula-Seattle</td>
<td>1.64</td>
<td>738.00</td>
<td>41.00</td>
</tr>
<tr>
<td>Missoula-Tacoma</td>
<td>1.09</td>
<td>738.00</td>
<td>41.00</td>
</tr>
</tbody>
</table>

A comparison of the rail shipping costs to the motor truck shipping costs shows the truck shipping costs to be a great deal higher. It is clear that shipment of the billets by truck would not be competitive with rail shipment. For that reason, shipment of the billets by motor truck will be excluded from further consideration at this point in the analysis.

#### Costs of Conducting Operations

The costs of conducting the proposed utilization operations were analyzed separately in four major categories. The cost categories are:

15Freight rate data from Pacific Inland Tariff Bureau, Tariff No. 27-A.
(1) acquisition of the auto bodies, (2) preparation of the autos for shipment, (3) indirect or overhead costs, and (4) return on the investment.

Acquisition of the Auto Bodies

As explained in Chapter II, the existing accumulations of auto bodies pose a disposal problem for auto dismantlers. The proprietors of five auto dismantling concerns in the Missoula area were interviewed to determine how they disposed of their auto hulks after all the saleable parts were removed. All of the proprietors stated that such auto hulks were hauled away from their yards and buried. Two of the dismantlers utilized the services of a commercial garbage disposal firm. The dismantlers stated that the disposal firm charged $7.00 per hulk for autos which they removed from dismantlers' yards, or $3.00 per hulk just for burial privileges, if the dismantler hauled the hulk to the burial ground at his own expense. The other proprietors did not state exactly where they buried their auto hulks, or what expenses were involved.  

The economic problem of scrap auto disposal is considered to be primarily a problem of finding a way to dispose of existing auto accumulations and is not concerned with reaching out to collect scattered, abandoned auto bodies. If an economic method of utilizing the dismantlers' supplies of hulks were in operation, junk autos would have scrap value, and those who now abandon old autos would be able to sell them.

---

16 Personal interviews: A & C Auto Wrecking, Mr. Archie Cram, July 8, 1968; Ace Auto Salvage, Mr. Doug Roark, July 3, 1968; Carl's Auto Sales, Mr. Carl Willig, August 16, 1968; Frank and Jim's Wrecking, Mr. Frank Dyes, July 3, 1968; H & I Auto Wrecking Company, Mr. Vern Imboden, July 8, 1968.
to a scrap processor. The problem of the scattered, abandoned autos would then be largely minimized.

For the purpose of cost analysis, acquisition or collection of the auto hulks was considered as a no-cost item, because they have a negative worth to an auto dismantler.

Preparation of the Autos for Shipment

The cost of preparation of the autos for shipment was divided into two separate costs for analytical purposes. They are: (1) the cost of purchasing or renting, and operating the required equipment, and (2) the labor costs to conduct operations. These costs will be considered in order.

Equipment and Operating Costs

The items of equipment which were considered in the cost analysis are the following:

a. Hand tools (cutting torch, wrenches, etc.) for use in removing the undesirable parts from the hulks before flattening.

b. An auto hulk flattening machine.

c. Equipment to load the auto body flattener and remove the billets after the flattening operation.

d. A truck tractor to haul the flattener from one location to another.

e. Trucks to haul the hulks to the flattening site at the rail siding (operation system A), or to haul the billets from the auto dismantler's yard to the rail siding (operation system B).
f. Equipment to unload billets from the flattening machine or truck, and to load billets onto the railroad car.

The costs associated with all the items of equipment were derived in terms of dollars per ton of flattened auto scrap.

The cost of the required hand tools would be so small compared to the cost of the major equipment items required for flattening and handling the scrap autos that the hand tool costs were ignored in the analysis of equipment costs.

Auto flattener. Before the cost of the auto flattener and handling equipment could be analyzed, the type and model of machine which would be used had to be determined.

A survey of the manufacturers of scrap processing machinery was conducted to select an auto flattening machine suitable for use in the proposed utilization method. The manufacturers were located primarily through advertisements in various issues of the Waste Trade Journal. (The magazine bills itself as "the market authority on secondary raw materials," and carries advertising from numerous scrap processing machinery companies.) Other companies were located by means of an inquiry to the National Auto and Truck Wreckers Association, Inc., San Mateo, California. The survey of manufacturers revealed only two mobile machines capable of flattening an auto body into a billet which can be processed by an auto shredder. One machine is the Harris Carbasher II, manufactured by the Harris Press and Shear Corporation, Cordele, Georgia. The other machine is the Al-Jon Car Crusher, manufactured by Al-Jon, Inc., Ottumwa, Iowa. A comparison of important characteristics of the machines is given in Table III-4.
TABLE III-4

COMPARISON OF CANDIDATE AUTO FLATTENING MACHINES*

<table>
<thead>
<tr>
<th></th>
<th>Al-Jon</th>
<th>Harris</th>
</tr>
</thead>
<tbody>
<tr>
<td>Means of transport</td>
<td>truck tractor</td>
<td>truck tractor</td>
</tr>
<tr>
<td>Operating crew</td>
<td>1 man</td>
<td>2 men</td>
</tr>
<tr>
<td>Power source</td>
<td>gasoline engine (60 HP)</td>
<td>diesel engine (60 HP)</td>
</tr>
<tr>
<td>Capacity autos/hour</td>
<td>15 (max.)</td>
<td>15 (max.)</td>
</tr>
<tr>
<td>Package size</td>
<td>10&quot; x 78&quot; x original car length</td>
<td>14'0&quot; x 80&quot; x (average)</td>
</tr>
<tr>
<td>Weight of machine</td>
<td>app. 30,000 lb.</td>
<td>app. 48,700 lb.</td>
</tr>
<tr>
<td>Rail freight (manufacturer to Missoula)</td>
<td>app. $1200</td>
<td>app. $1948</td>
</tr>
<tr>
<td>Purchase price</td>
<td>$29,580 FOB plant</td>
<td>$29,000 FOB plant</td>
</tr>
</tbody>
</table>

* Information shown in the table is derived from data furnished by the respective manufacturers.

Either car flattening machine requires the use of a fork lift end loader to load the hulk into it, and to remove the finished billet. A radio control device which can be operated from the crane or fork lift is offered as an option for operation of the Car Crusher. One man can thus operate both the fork lift and the Car Crusher. The analysis of the flattening machine cost was based on use of the Al-Jon Car Crusher with radio control device. The costs associated with the employment of a second operator were thereby avoided.
Although both manufacturers were queried as to the possibility of leasing or renting their machines, their replies were presented in terms of purchase only. Al-Jon required a down payment of one-third of the purchase price with the order, and the balance on delivery, or in 24 equal payments with 5 per cent "add-on" interest. The terms quoted by Harris were 20 per cent cash with the order, and the balance upon delivery to the purchaser's authorized carrier. Since the manufacturers indicated by their terms that they would consider only outright sale of their machines, the cost was analyzed in terms of depreciation. The depreciation cost of the flattening machine is expressed in dollars per ton of auto billet production.

The machine would be depreciated using the straight line method, and the cost would be amortized over a 5-year period. It will be assumed that the machine is worn out at the end of that time, and its worth is the salvage value based on the weight and the current price of that grade of steel scrap. The Car Crusher is constructed primarily of heavy steel plate and angles, which would be classified as No. 1 heavy melting scrap. The recent price in Chicago for No. 1 heavy melting steel was $23.00 per gross ton (2,240 lb.). The weight of the Car Crusher given by the manufacturer and shown in Table III-4 is equivalent to \( \frac{20,000}{2,240} \) or 13.4 gross tons. The scrap value would then be 13.4 tons x $23.00 per ton, or $308.00. Since the residual scrap value of the machine is so small compared to the initial purchase price (1.04 per cent of the price), the scrap value was ignored in the cost analysis, and the entire purchase

---

price of the machine is amortized over a 5-year period. Computation of
depreciation expense over a 5-year period instead of some longer time
span has the advantage of producing a conservative estimate of depre-
ciation expense.

The cost of the rail freight would be amortized in 5 years and
was considered as part of the purchase price for cost analysis. The
purchase price of $30,780 amortized over a 5-year period yields a depre-
ciation expense of $6,156 per year.

The machine will flatten 15 autos per hour, or 120 autos in an
8-hour day. Production on a yearly basis would therefore be 120 autos/
day x 5 days/week x 50 weeks/year = 30,000 autos/year. Al-Jon indicated
in their inquiry response that operating costs for the Car Crusher
should be calculated using an "efficiency factor" of 60 per cent of
total capacity.18 (An efficiency factor is commonly used in computation
of machine production to allow for contingencies such as "down time" for
repairs and maintenance, training of operators, moving of machinery to
a new location, operator absenteeism, inclement weather, and others.)
When the efficiency factor is applied, the yearly production becomes
30,000 autos/year x 60%, or 18,000 autos/year. The average auto, less
engine, and ready for flattening, weighs approximately 1800 lbs.19 The
production can therefore be expressed as 18,000 autos/year x 1800 lbs./
auto, or 32,400,000 lbs./year. The production is equivalent to 16,200
tons/year. Depreciation was previously calculated at $6,156 per year.

1158" (July 30, 1968).
The cost of the machine on a unit-ton basis is therefore the annual depreciation expense of $6,156 divided by the yearly production of 16,200 tons, or $.38 per ton of billet production.

**Fork lift truck.** The fork lift truck which is required for feeding the auto flattener and removing the billets is a common item of equipment that can be readily rented. The rental cost is included in the operating cost estimate provided by Al-Jon for the Car Crusher. The Al-Jon estimate of operating cost for the Car Crusher also includes fuel, maintenance, and wages for one full-time operator. The total operating cost which includes all the items listed is estimated by Al-Jon to be $2.00/ton of production. The estimate is based on operation at 60 percent of total capacity.\(^2\)

When the disposal operations were moved from one operating location to another, the fork lift truck would also be moved. Such a vehicle is not designed for long distance highway travel. The truck would therefore be hauled from one location to another by a commercial hauler.

Inspection of a highway map of Montana shows that the transfer of operations from Billings to Bozeman might be considered a typical move. The distance is approximately 142 miles. A price quotation for hauling a fork lift truck was obtained from a hauling company in Missoula. The company quoted a rate of $1.25 per "loaded mile" for any distance up to 150 miles.\(^2\) The cost of hauling the fork lift truck between Billings and Bozeman would therefore amount to approximately 142 miles x $1.25/
mile, or approximately $178.00. The hauling cost in dollars per ton of auto billets would vary with the tonnage of billets produced at any one location, and would decrease as tonnage increased. The relationship for a wide range of billet production tonnage is shown in Table III-5.

### TABLE III-5

**Fork Lift Transporting Cost**

<table>
<thead>
<tr>
<th>Tons of billet</th>
<th>200</th>
<th>400</th>
<th>600</th>
<th>800</th>
<th>1000</th>
<th>1200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dollars/ton</td>
<td>$.89</td>
<td>.45</td>
<td>.30</td>
<td>.22</td>
<td>.18</td>
<td>.15</td>
</tr>
</tbody>
</table>

Flattener transport. A third major item of equipment is required to conduct the operation of the proposed utilization method. The Car Crusher is mobile, and may be towed from one operating location to another. According to Al-Jon, a standard truck tractor is required for the purpose. For purposes of cost analysis, it was assumed that the Car Crusher is moved once for each location in which operations are conducted. The transfer of operations from Billings to Bozeman will again be considered a typical move.

A rate of $1.50 per "loaded mile" was quoted by a heavy equipment hauling company in Missoula for towing the Car Crusher. The cost for transfer between the aforementioned cities would therefore be approximately 142 miles x $1.50/mile or approximately $213.00. As was the case

---

22 Hauling rate obtained from Hughes Hauling Company, Missoula, Montana, August 13, 1968.
for hauling the fork lift, the transfer cost in dollars per ton of auto
billetts would vary with the tonnage of billets produced at any one loca-
tion. The relationship is shown in Table III-6.

TABLE III-6

<table>
<thead>
<tr>
<th>Tons of billet</th>
<th>200</th>
<th>400</th>
<th>600</th>
<th>800</th>
<th>1000</th>
<th>1200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dollars/ton</td>
<td>$1.07</td>
<td>.53</td>
<td>.36</td>
<td>.27</td>
<td>.21</td>
<td>.18</td>
</tr>
</tbody>
</table>

If operating system B were employed for preparing the auto bodies,
it would be required to move the car flattener from one accumulation of
auto bodies to another, within a given operating location. The rate
quoted by a heavy equipment hauling company in Missoula was $17.50 per
hour for intra-city towing. It is impossible to determine how many such
moves would be required within any location without performing a de-
tailed inspection of the accumulations of hulks within the area serviced
by each location. Rather than assume a number of moves which cannot be
soundly justified, the requirement for the additional concurrent expense
will be noted here, and considered later in the evaluation of the costs
for the two operating systems under discussion.

Auto scrap transfer. An additional major item of equipment would
be required to transfer the whole auto hulks, or the auto billets. If
operating system A were employed, a truck or trucks would be required to
transfer the hulks from the dismantler's yard (or other accumulations)
to the site at the railroad siding where the flattening machine was operating. If operating system B were employed, the auto billets would have to be transferred from the site where the flattener was in operation to the railroad siding for loading onto the rail car.

Determination of the cost of transferring the auto scrap in either of the operating systems under discussion poses a peculiar problem for several reasons. One reason is that the cost is dependent upon the determination of some fine points of the utilization system operation. If operating system A were employed, the hulks could logically be hauled to the flattening site with a rented truck, or the operator of the dismantling yard could haul his hulks to the site using his own equipment. If operating system B were employed, the auto billets could be hauled to the rail loading site by means of a rented truck, or again, the wrecking yard operator could haul the billets with his own equipment. If the billets produced by operating system B were hauled using rented equipment, either one truck or two trucks could be used. It would be logical to use two trucks, loading one of them with the billets as they came directly off the auto flattener, while the other truck transported a load of billets to the loading site and returned to be loaded again. However, one truck could be utilized if the billets which were produced while the truck was on a run to the loading site were stockpiled and loaded onto the truck when it returned. The choice of whether to use one or two trucks would depend upon the amount of "slack time" in operation of the lift truck, the time required for the hauling truck to deliver a load and return, and other factors which could probably not be determined until operations were begun.
Another factor complicates the determination of the transfer cost of the auto scrap. As previously described, auto dismantlers have been bearing the cost of removing unwanted hulks from their yards, and disposing of them by burial. That the practice has become recognized by dismantlers as a solution to their disposal problem is evidenced by the previously mentioned efforts of the Dismantlers Association to find burial grounds for junk autos. The practice of disposal by burial has been accepted by the dismantlers as one of the costs of doing business.

The proprietors of four of the major auto wrecking concerns in the Missoula area were asked if they would take advantage of an opportunity to haul their stripped auto hulks to an area designated for the purpose, if the area were furnished free of charge to the dismantlers. All of the proprietors stated enthusiastically that they would be happy to utilize such a disposal area. They were unanimous in the opinion that such a disposal area would be of great benefit to them.23

Although the dismantlers would still incur the cost of transporting their hulks from their property to the disposal site, they would save the cost of burying the hulks. For purposes of the cost analysis, it will be assumed that the auto dismantler and others who wish to get rid of derelict autos will haul the hulks to the auto flattening site at their own expense. If operating system B were employed, the dismantlers would transport the billets to the railroad loading siding at their expense. The cost to the dismantler of transporting billets

23 Personal interviews, August 16, 1968: A & C Auto Wrecking, Mr. Archie Cram; Ace Auto Salvage, Mr. Doug Roark; Carl's Auto Sales, Mr. Carl Willig; H & I Auto Wrecking, Mr. Vern Imboden.
should be less per ton than the cost of transporting whole hulks because more billets than hulks can be loaded on a truck.

As a result of the above considerations, transporting the auto hulks or billets to the flattening machine or rail loading site was not considered to be a cost in the proposed utilization method.

**Loading crane.** The last major item of equipment which would be required to conduct operations is a crane for loading the auto billets into the railroad gondola car. The crane is also an item of equipment which can be rented or leased. The rental rates for a crane capable of performing the required function were investigated with heavy equipment rental companies in Missoula.

The authority used for the cost estimates showed a rental cost of $1,065 per month for a suitable crane.\(^2\) The machine chosen for cost analysis is gasoline powered and truck mounted so as to eliminate the need for additional transporting equipment. It has a maximum lifting capacity of 12½ tons. A general purpose clamshell bucket attachment would be required, at additional cost of $282.00 per month. The total rental cost of the crane and bucket is therefore $1,347.00 per month.

It was assumed that the crane, stationed at the railroad loading siding, is capable of loading the billets into the railroad car at the same rate that they are produced by the flattener. The cost of the crane rental, in dollars per ton of loaded billets was therefore derived from the amount of rental per month and the tonnage of billets loaded

per month. The auto flattener's rate of production of 16,200 tons per year is equivalent to 1,350 tons per month. The cost of the crane rental in dollars per ton of loaded auto billets is therefore $\frac{1347}{1350}$ month, divided by 1350 tons, or approximately $1.00 per ton.

In addition to the rental cost, other operating costs for the crane were considered. Fuel, maintenance, repairs, and the cost of transferring the crane from one operating location to the other are the major items.

Fuel consumption for operation of an average sized gasoline engine powered crane is estimated to be between 3 and 5 gallons per hour.25 The crane under consideration is smaller than the average. To obtain a conservative fuel cost estimate, a consumption rate of 4 gallons/hour was used in the cost analysis. The current price of regular gasoline in Missoula, less state road taxes, is approximately 30 cents per gallon. Fuel cost for an hour of crane operation was therefore estimated to be $4 \text{ gal./hour} \times 30\text{¢/gal.}$, or $1.20. The previously estimated rail car loading rate of 1350 tons per month is equivalent to 7.8 tons per hour. The fuel cost per ton of loaded auto billets is therefore $1.20$ divided by 7.8 tons, or approximately 15 cents per ton.

The cost of maintenance and repairs to the crane will depend upon the care and skill with which the equipment is operated, the initial condition of the equipment, and other conditions which cannot be foreseen, such as accident. No attempt was made to estimate the cost because the basic information required for a good estimate is unavailable. It

---

will be recognized here that the additional costs exist, and they are considered in the evaluation of the equipment cost analysis.

When the utilization operations were moved from one operating location to another, the crane would also have to be moved. The crane would be mounted on a truck suitable for long distance highway travel. It was estimated by a representative of a heavy equipment rental company that a diesel truck of the type ordinarily used as a platform for mobile cranes would obtain an average of 5 to 6 miles per gallon of diesel fuel when operated on the highway.²⁶ The current price of diesel fuel in Missoula is 30.1 cents per gallon. The transfer of operations from Billings to Bozeman was again considered a typical move for the cost analysis.

The quantity of fuel required to drive 142 miles at a consumption rate of 5 miles per gallon would be approximately 28 gallons, and the cost of the fuel would be approximately $8.40 for a typical move. The cost of transporting the crane is so small compared to other operating expenses that it was ignored in the cost analysis.

**Total equipment and operating costs.** The cost of equipment for operation of the proposed auto body utilization method can now be summarized. Table III-7 shows the costs for various items of equipment in terms of dollars-per-ton of auto billets loaded on a railroad car. The costs are applicable for production by operating systems A or B, at any operating location.

²⁶ Estimate obtained from Ace Equipment Company, Missoula, Montana, August 19, 1968.
### TABLE III-7

**EQUIPMENT AND OPERATING COST**  
**Dollars Per Ton**

<table>
<thead>
<tr>
<th>Equipment Item</th>
<th>Tons of Auto Billets (loaded on rail car)</th>
<th>200</th>
<th>400</th>
<th>600</th>
<th>800</th>
<th>1000</th>
<th>1200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto flattener (purchase costs)</td>
<td></td>
<td>.38</td>
<td>.38</td>
<td>.38</td>
<td>.38</td>
<td>.38</td>
<td>.38</td>
</tr>
<tr>
<td>Fork lift rental (includes operation of flattener and fork lift)</td>
<td></td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Towing of flattener</td>
<td></td>
<td>1.07</td>
<td>.53</td>
<td>.36</td>
<td>.27</td>
<td>.21</td>
<td>.18</td>
</tr>
<tr>
<td>Transporting fork lift</td>
<td></td>
<td>.89</td>
<td>.45</td>
<td>.30</td>
<td>.22</td>
<td>.18</td>
<td>.15</td>
</tr>
<tr>
<td>Crane rental</td>
<td></td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Crane fuel</td>
<td></td>
<td>.15</td>
<td>.15</td>
<td>.15</td>
<td>.15</td>
<td>.15</td>
<td>.15</td>
</tr>
<tr>
<td>Total Equipment Cost</td>
<td></td>
<td>5.49</td>
<td>4.51</td>
<td>4.19</td>
<td>4.02</td>
<td>3.92</td>
<td>3.86</td>
</tr>
</tbody>
</table>

Note that some cost items are constant on a unit ton of production basis, while other items decrease per unit ton as production increases. The costs which remain the same on a unit ton basis do so because the operations are paced by the output of the auto flattener, operating at 60 per cent of maximum rated capacity. The cost of towing the flattener and transporting the fork lift occur only once at each location, and the cost per ton decreases as production at any operating location increases.

The equipment operating costs for operating systems A or B can also be illustrated by a cost curve which allows approximate total costs to be determined graphically for any production tonnages between the
limits of 200 and 1200 tons at any operating location. Such a cost curve is presented in Figure III-2.

The costs which were shown in Table III-7 are considered to be the major identifiable costs. As they were developed, it was explained that certain other costs would not be included on a unit ton basis because they were minor or the data required to make a good estimate of them were not available.

One of the costs not included in the foregoing tables or curves is the cost of towing the flattening machine from one accumulation of auto hulks to another, but within the coverage area of any one operating location. A standard truck tractor would be required to tow the machine. The same hauling company which furnished the estimate for towing the flattener between cities quoted a towing fee of $17.50 per hour for intra-city transfer. The hourly rate is calculated portal to portal, and is applicable for any towing distance less than 50 miles.\(^{27}\) Although it cannot be foreseen how many intra-city moves might be required at any operating location, the tow cost must be recognized as an additional cost to those shown in the tables and curves if operating system B were employed.

Another cost which is not reflected in the tables or curves is the cost of maintenance and repairs to the crane.

It was pointed out in previous discussion that one cost advantage of operating system B compared to operating system A may be the lower cost of transporting auto billets to the loading site compared to the

\(^{27}\)Towing rate from Hughes Hauling Company, Missoula, Montana, August 19, 1968.
FIGURE III-2

EQUIPMENT AND OPERATING COST

Dollars per ton of billet loaded for shipment

BILLET PRODUCTION AT ANY OPERATING LOCATION, TONS
cost of transporting whole auto hulks to the flattening site. These transfer operations, however, were determined in the cost analysis to be "no cost" items because they are presently incurred by the auto dismantlers, and the cost of such transfer would remain as one of the dismantlers' operating costs. Therefore, operating systems A and B are considered to be equal in cost in terms of the intra-operating location transport of auto scran.

In summary, it would be recommended that operating system A be utilized if the billets were to be shipped to the shredding facility by rail, because of the cost saving compared to operating system B for towing the auto flattener from one accumulation of hulks to another.

Cost of Labor

The cost of labor required for operation of the proposed utilization method was analyzed in terms of the level of manpower required. The manpower which would be needed to accomplish the operations is envisioned as follows:

a. One man to operate the fork lift. The same man would operate the flattening machine by remote radio control.

b. Two men to load the auto billets onto the rail car with the crane. A crane operator and an oiler would be required.

c. Some undetermined level of manpower to prepare the cars for flattening by removing undesirable parts.

Operation of the fork lift. In the previously developed analysis of equipment and operating costs, it was noted that the estimate of $2.00 per ton for running the flattening machine included the wages of
the fork lift driver. The labor cost for operation of the fork lift, therefore, need not be developed separately for purposes of addition to the other labor costs. However, a separate examination of the cost is in order so as to determine its compatibility with the $2.00 per ton cost figure.

The union pay scale in Montana for a fork lift operator is $4.64 per hour, or $37.12 for an 8-hour day. It was previously calculated that the production rate of the flattening machine was 64.8 tons of auto billets in 8 hours. The labor cost for the fork lift operator per ton of auto billets produced would therefore be $37.12 divided by 64.8 tons, or approximately 57 cents per ton. The remaining $1.43 per ton of the $2.00 per ton estimate would be available to cover the cost of fork lift rental, as well as fuel and maintenance for the flattener and fork lift. The separately estimated labor cost for operation of the fork lift appears to be compatible with the overall cost estimate for operation of both machines, including fuel, maintenance, fork lift rental, and one operator.

Operation of the crane. The current agreement between the Montana Contractor's Association and the International Union of Operating Engineers stipulates that an oiler is required in addition to the operator when a clamshell or any other attachment is used with a crane. The union pay scale for a crane operator is $4.98 per hour, and the rate for an oiler-driver is $4.42 per hour. The total hourly cost of labor for

---

operating the crane would therefore be $7.40 per hour, or $75.20 for an 8-hour day. At the previously estimated production rate of 64.8 tons of auto billet per day, the labor cost for crane operation would be approximately $1.16 per ton of auto billet produced.

Preparation of the hulks. It is extremely difficult to arrive at an accurate estimate of the level of manpower which would be required to remove the undesirable parts from the auto hulks before flattening. It was previously determined that removal of the engine block, battery, tires, radiator, seats, and fuel tank would be required.

Auto dismantlers in the Missoula area are readily able to dispose of the engine blocks from the cars which they acquire. The engine of a worn-out or wrecked auto is ordinarily one of the saleable parts, particularly if the auto is a recent model. If an engine cannot be sold as a used part, the scrap value of the cast iron which it contains is great enough so that the dismantler will remove the engine and sell it separately. It was therefore assumed that the engines will have been removed from the hulks obtained from auto dismantlers' yards.

The battery, tires, and radiator are invariably removed from an auto bulk by the dismantler and are sold either as used parts, or as special categories of scrap. None of the parts present a disposal problem to the auto dismantler, and it will be assumed that all of the hulks obtained for flattening from a dismantler or other source will have been stripped of the aforementioned parts.

The seats from a junk auto have no reliable resale value, and are generally left in the auto and disposed of with the auto bulk. Two dismantlers were asked if they would remove the seats from their auto
hulks if it were a prerequisite to their use of a free disposal site. Both dismantlers gave affirmative answers.\textsuperscript{29}

The fuel tanks are sometimes removed from the hulks by the dismantlers and sold as used parts. One dismantler stated that he sold about 90 per cent of the fuel tanks from the autos which he acquired, and he considered disposal of fuel tanks to be no problem.\textsuperscript{30} If for some reason the tanks were not saleable, a dismantler would ordinarily leave them attached to the derelict auto.

There is a good basis for eliminating the cost of stripping the auto hulks as a cost element in the analysis of the proposed disposal method. The only parts which the dismantler does not separate from the auto hulks in the normal operation of his business are the seats and the fuel tank. The marginal cost to the dismantler of removing the two additional components from the hulks before disposal would be minor. The advantage to the dismantler of free disposal of the hulks would probably more than compensate for the slight additional cost of removing the seats and fuel tanks. Rather than assume some minor cost for occasional removal of unwanted parts, it was assumed that the hulks will have been stripped of all the undesirable components by the dismantler.

Because of the aforementioned considerations, any labor cost for removal of unwanted components from the auto hulks before flattening was eliminated as a factor in the cost analysis of the proposed utilization method.

\textsuperscript{29} Personal interviews, August 16, 1968: H & I Auto Wrecking, Mr. Vern Imboden; A & C Auto Wrecking, Mr. Archie Cram.

\textsuperscript{30} Personal interview, August 16, 1968: H & I Auto Wrecking, Mr. Vern Imboden.
**Total cost of labor.** The total labor cost for operation of the proposed utilization method would consist of wages for the fork lift operator, crane operator, and oiler-driver. The wages for the fork lift operator were included in the previously developed equipment operating costs. The additional labor cost which must be accounted for in the analysis is the cost of wages for the two-man crane crew. The additional labor cost would be $1.16 per ton of auto billet production.

**Indirect and Overhead Costs**

Only the major identifiable items of indirect cost were considered in the cost analysis. The major cost items are identified as salary for management, the employer's contribution for Old Age and Survivor's Insurance (O.A.S.I.), and the employer's payment for Workmen's Compensation Insurance premiums. The cost of payments for Unemployment Compensation are comparatively minor (2.7 per cent of the first $3,000 of wages), and were ignored in the cost analysis.

**Manager's salary.** The major item of indirect or overhead cost would be salary for the project manager who would direct the implementation of the proposed utilization method. The manager would be required to perform a wide variety of organizational and supervisory tasks. He would be responsible for selecting the operating locations, obtaining authorization from auto dismantlers and others for preparation and shipment of the hulks, on-the-job supervision, arranging for shipment of slabs, and sale of the slabs to the shredding facility. It was assumed that a manager capable of performing all the required functions would be an experienced person who would require a minimum salary of $12,000
per year. At the production rate of 16,200 tons of auto slab per year, the overhead cost for management would be 7½ cents per ton of billet production.

O.A.S.I. payments. Another item of overhead cost would be the employer's O.A.S.I. contribution for the employees on the payroll. The employer's contribution would also be required for the project manager. The rate of contribution is 4.4 per cent of the first $7800 of wages, or approximately $315.00 for each employee per year. If operating system A or B were utilized, a total of four employees, including the manager, would be required. The total employee contribution for O.A.S.I. would then be $1260.00 per year. The cost of the tax would be approximately 8 cents per ton of billet production.

Workmen's Compensation Insurance. The employer's payments for Workmen's Compensation Insurance would be another item of overhead cost. According to a Missoula insurance firm, the insurance premiums for the type of work under consideration would cost approximately $5.00 per $100.00 of wages. The cost would therefore be approximately 5 per cent of the direct labor cost. The direct labor cost for the fork lift operator was calculated to be approximately 57 cents per ton of auto billet production, and the combined labor cost for the crane operators was calculated to be approximately $1.16 per ton. The total direct labor cost for operating systems A or B was therefore $1.73 per ton. The approximate cost of Workmen's Compensation would be 5 per cent of $1.73, or 9 cents per ton of auto billet.

31 Rate obtained from Glacier General Assurance Company, Missoula, Montana, August 23, 1968.
Total indirect cost. The total indirect cost per ton of auto billet production would be 91 cents for operating systems A or B.

Cost of Return on Investment

The only major item of investment required in order to conduct the proposed utilization operations would be purchase of the mobile auto hulk flattener. A purchase price of $30,780 including freight was quoted by Al-Jon for their Car Crusher.

The percentage of return that could reasonably be expected on an investment of the type under discussion is not exactly determinable. The investment would certainly be considered a relatively high-risk proposition because of the many uncertainties involved. Among these are the future prices of shredded steel scrap, availability and accessibility of accumulations of auto hulks, and availability and cost of rented equipment and manpower. A somewhat high rate of return would therefore be expected on the investment. For purposes of analysis, it was assumed that a 20 per cent annual rate of return is required to attract an investor. Since the cost of the machine would be completely amortized over its working lifetime, the average amount of the investment during that time period would be one-half of the purchase price, including freight, or $15,390. The yearly return expected would then be 20 per cent of $15,390, or $3,078. On a production basis of 16,200 tons of auto slabs per year, the cost of return on the investment would be approximately 19 cents per ton.
Summary of Production Costs

It is now in order to review and summarize the costs for production of auto billets which have been developed so far.

The costs for equipment, including all operating expenses except labor, were found to vary over a given range of auto billet production tonnages at any operating location. The total equipment cost would decrease as the tonnage produced increased. The relationship was shown by a curve in Figure III-2.

The cost of labor for operation of the equipment was found to be constant on a unit ton of production basis, because the costs were computed for a single, constant rate of auto billet production. For operating systems A or B the total labor costs would amount to $1.16 per ton of auto billet production, excluding wages for the fork lift operator.

Indirect and overhead costs were calculated to include a project manager's salary as well as Social Security taxes, and Workmen's Compensation Insurance. The total indirect costs were calculated to be 91 cents per ton of auto billet production. The cost of return on the average investment in equipment was calculated to be 19 cents per ton of production.

The total of all the costs of scrap auto billet production for a range of production tonnages at any given operating location is shown in Figure III-3.

The total billet production costs can be added to the previously derived costs of rail freight, and the total of production and shipping costs are illustrated in Figure III-4.
FIGURE III-3
TOTAL UNIT PRODUCTION COST
Dollars Per Ton of Billet Loaded for Rail Shipment

TOTAL UNIT PRODUCTION COST

EQUIPMENT AND OPERATING (VARIABLE)

LABOR ($1.16)

INDIRECT COSTS (91¢)

RETURN ON INVESTMENT (19¢)

BILLETS PRODUCTION AT ANY OPERATING LOCATION, TONS

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
FIGURE III-4
AUTO BILLET PRODUCTION AND RAIL SHIPPING COSTS

(a) Total Unit Costs, Billings to Spokane, Seattle, or Tacoma.
(b) Total Unit Costs, Great Falls to Spokane, Seattle, or Tacoma.
(c) Total Unit Costs, Missoula to Spokane, Seattle, or Tacoma.
(d) Unit Shipping Costs, Billings to Any Shredder ($14.80/ton).
(e) Unit Shipping Costs, Great Falls to Any Shredder ($13.50/ton).
(f) Unit Shipping Costs, Missoula to Any Shredder ($11.80/ton).
Price Paid by the Shredder Facilities

The price paid for junk autos by the three shredder facilities varies considerably. The facilities which supplied price quotations for the purchase of junk autos were:


The buying prices quoted by the facilities for auto billets were as follows:

a. American, $9.00 per ton\(^{32}\)
b. Sternoff Metals, $11.00 per ton\(^{33}\)
c. General Metals, $14.50 per ton\(^{34}\)

It was emphasized in the letter from General Metals that "the price indicated is regardless of quantity, and . . . does vary almost monthly as the scrap market varies."\(^{35}\) Both American and Sternoff also indicated that they could offer no quantity buying price premiums.

Production and Shipping Costs and Purchase Price

The shredding facilities purchase price for auto billets can be shown on the same type of curves which were previously constructed to

\(^{32}\)Personal interview, Mr. George Montague, Executive Vice President, August 27, 1968.

\(^{33}\)Telephone interview, Mr. Resnick, General Manager, August 26, 1968.

\(^{34}\)Letter from Martin H. Brashem, General Metals, to H. J. Schnell, August 12, 1968.

\(^{35}\)Ibid.
show the total costs for billet production and shipping. The resulting
cost and price relationships are illustrated in Figure III-5.

Inspection of Figure III-5 shows that for every combination of
operating location and shredder location, there is a gap between the
curve which represents the total costs and the line which represents
the purchase price paid for the billets. In all cases, the line repre-
senting purchase price falls below the curve representing total cost.
There is no cost-price combination which represents economic utilization
of junk autos, because there is no case in which the market price of the
auto scrap is adequate to cover the costs of production and shipping.
FIGURE III-5

TOTAL UNIT PRODUCTION AND RAIL SHIPPING COSTS
AND PURCHASE PRICE

(a) Total Unit Costs, Billings to Spokane, Seattle, or Tacoma.
(b) Total Unit Costs, Great Falls to Spokane, Seattle, or Tacoma.
(c) Total Unit Costs, Missoula to Spokane, Seattle, or Tacoma.
(d) Billet Purchase Price at Tacoma.
(e) Billet Purchase Price at Seattle.
(f) Billet Purchase Price at Spokane.
CHAPTER IV

CONCLUSIONS AND RECOMMENDATIONS

Evaluation of the cost and price data developed in the preceding chapter gives rise to a number of conclusions regarding both the application of the proposed utilization method and the general problem of junk auto disposal in Montana. Evaluation of the conditions which cause the proposed utilization method to be uneconomical leads to several recommendations with regard to solving the utilization problem.

Conclusions

The basic conclusion to be derived from the cost analysis is that it is not possible at this time to utilize Montana's scrapped automobiles economically by collecting, preparing, selling, and shipping them to a shredding facility. For any combination of operating and shredder location, the combined costs of billet production and shipping would be in excess of the current market value of the auto scrap.

The cost of shipping the scrap to a shredder facility by rail or truck is greater than the total of all the production costs, for any operating system or shredder location. For shipments originating from Billings or Great Falls, the freight cost alone, for either rail or truck, is greater than the market value of the scrap. It is therefore apparent that for those operating locations, economic utilization of the auto scrap would be impossible even if the cost of preparation for shipment were eliminated. If the assumptions which were employed for
development of the billet production cost analysis are well founded, it
would be impossible to greatly reduce the cost of preparing the junk
autos for shipment, short of utilizing a radically different method of
flattening the hulks, or another form of preparation as yet unknown.

The factors which determine the rail and truck freight rates,
however, are not so much the economic cost of shipping the material as
they are considerations of how shipment of the general type of material
(scrap steel) fits into the overall transportation picture for the applica-
able geographic area. The existing rail and motor truck freight
rates do not necessarily represent the actual economic cost of trans-
porting the commodities. The rates are in effect by virtue of their
approval by the respective regulatory authorities. This is evident by
the fact that the cost of rail freight for shipping auto scrap from any
of the operating locations in Montana to Spokane would be the same as
for shipping from the same locations to Seattle or Tacoma. Since the
cost of freight is by far the greatest single cost item of the utiliza-
tion method, and the rates are established by considerations in addition
to the economic cost of transporting the material, it may be economically
possible to reduce the rates. It would be absolutely necessary to do so
if Montana's auto scrap were to be economically transported to the noted
shredder facilities.

Examination of Figure III-5 shows that shipping combination
Missoula-Tacoma is the combination which would most closely approach
the regime of economic utilization. For a production of 200 tons of
billet at a single location, the total production cost would be $7.75
per ton, which when added to the rail freight of $11.80 per ton amounts
to a total cost of $19.55 per ton. The purchase price paid by the shredder at Tacoma is $14.50 per ton, leaving a loss of $5.05 per ton. If 1200 tons of billets were produced, the production cost would be $6.12 per ton, and the freight cost and purchase price would remain at $11.80 and $14.50, respectively. The total cost would be $17.92 per ton, and the loss would therefore be reduced to $5.42 per ton.

If the rail freight rates were reduced by $5.05 per ton, a reduction of 43 per cent, economic utilization of junk auto accumulations in the Missoula area as small as 200 tons would be possible. Two hundred tons of billets represents about 220 junk autos, a quantity which could be found in most average-sized dismantler's yards. A rail freight rate reduction of $3.42 per ton, or about 29 per cent, would make possible the economic utilization of any collection of derelicts in excess of 1200 tons, or about 1340 junk autos.

The percentage of rail freight cost reduction which would be required to allow economic operation at the other two operating locations can be calculated in the same manner. For an operating location at Billings, freight rate reductions of 57 per cent and 46 per cent would be required to allow profitable utilization of junk car tonnages of 200 and 1200 tons, respectively. For economic utilization when operating at Great Falls, the corresponding rate reductions required would be 51 per cent and 39 per cent.

The previously quoted statement made by James F. Collins of the U. S. Department of Commerce serves to give support to the above conclusions. The statement is repeated here for convenience:
The largest single component of cost in the auto scrap market is the cost of transportation. If somehow, the cost of scrap transport could be lowered 50 per cent, all but the smallest, most isolated junk car units could re-enter the commercial scrap cycle. Inventories of car hulks at auto wreckers yards could be greatly reduced.

Officials of the A American By Products Company have made application with the Northern Pacific Coast Freight Bureau for a reduction in the rail freight rates for steel scrap. The requested reduction would lower the rates for shipment of scrap to Spokane from as far east as Baker, Montana. It is not known what percentage of reduction in the rates is expected, nor exactly when the lower rates would go into effect if approved.

The A American Company has also made application with the Inland Freight Traffic Service for a reduction in the motor truck rates for shipment of steel scrap.¹

**Recommendations**

The major economic obstacle to utilization of Montana's junk autos, given the current market value of steel scrap, is the high cost of freight for transporting the raw scrap to a scrap processor, or scrap user. The primary recommendation is, therefore, that effort be continued in the direction of achieving a lowering of both rail and truck rates to a level which would allow future utilization of a much greater percentage of auto scrap than can be economically utilized now.

In addition, it is recommended that attention be given to the possibility of establishing a truck transportation system created

expressly for long-distance hauling of auto scrap. It should be possible to establish a system not subject to the regulatory agencies which now set the rates at levels such that the long-distance transport of steel scrap is economically unfeasible. The system could be operated by new private concerns, or it could be operated by existing scrap processors as a backward-integrated extension of their business operations.

Volunteer organizations or service clubs could adopt the disposal of junk autos in their communities as a club project. The autos would not have to be flattened, and the hulks could be hauled to shredder facilities by donated transportation, circumventing the high freight costs. By this means these organizations could raise money and at the same time perform a valuable public service.

Although the purpose of this research study was to find economic methods of utilizing Montana's auto scrap, the results of the study suggest that solutions may lie in other realms of activity. The economic unfeasibility of disposing of derelict autos results in a social cost which is now borne by the general public. It is possible to shift the social cost to those who buy and use automobiles so as to make it a direct cost borne by them. Through legislative action, a disposal tax of some sort might be levied on automobile owners. If levied, the tax could be applied to the purchase price of a new car, or made applicable each time a car changed ownership. The revenue from the tax, however it was administered, could be used for final disposal of the car at the end of its useful life.

There is a subject associated with the problem of scrap auto disposal that deserves further study. Auto body shredder facilities are
being put into operation in the United States at an increasing rate.

The current list supplied by the Institute of Scrap Iron and Steel shows a total of 65 shredders in operation or being planned as of May, 1968.

As the technology of designing shredder facilities becomes mature, it may become practical to develop portable or mobile units which could be moved from one accumulation of hulks to another. The advantage would lie in the fact that it would be more economical to ship the shredded material than whole hulks or billets because the density of the shredded scrap is far greater, and maximum rail car loadings could be achieved.

By the use of a portable shredder, junk car accumulations which are now too small or remote to be utilized could be economically processed. It is, therefore, recommended that further study be performed regarding the economic feasibility of developing portable auto body shredders.
BIBLIOGRAPHY
BIBLIOGRAPHY

Articles and Periodicals


"Death in the Streets," Time, Vol. 87 (June 17, 1966), 52.


Public Documents


Harris Press and Shear Corporation. "Harris Carbasher," sales brochure, Cordele, Georgia.


Northern Pacific Coast Freight Bureau Authority, Freight Tariff U-B.

Pacific Inland Tariff Bureau, Tariff No. 27-A.


Other Sources

Letters:


Personal Interviews:

Mr. Walter Bakke, Bakke Auto Parts, Missoula, July 8, 1968.


Mr. Frank Dures, Frank & Jim's Wrecking, Missoula, July 3, 1968.


Mr. Del Lamb, Northern Pacific Railway Freight Office, Missoula, August 28, 1968.

Mr. George Montague, Executive Vice President, A American By Products Company, Spokane, Washington, August 27, 1968.
Mr. Douglas Roark, Ace Auto Salvage, Missoula, July 3, 1968.

Mr. Carl Willig, Carl's Auto Sales, East Missoula, August 16, 1968.

Telephone Interview:

Mr. Resnick, General Manager, Sternoff Metals Corporation, Seattle Washington, August 26, 1968.