THE ELECTRIC INTERURBAN RAILWAY

BY

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THESIS

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THE GRADUATE SCHOOL

I hereby recommend that the thesis prepared by LOUIS ENGELMANN FISCHER, B. S. in M. & S. E., entitled "THE ELECTRIC INTER-URBAN RAILWAY," be accepted as fulfilling this part of the requirements for the degree of Civil Engineer.

[Signature]
Head of Department in charge of Major Work.

Recommendation concurred in:

[Signature]
Committee on Final Examination.
PREFACE.

The writer graduated from the University of Illinois, class of 1898, with the degree of Bachelor of Science, in the Municipal and Sanitary Engineering course. He afterwards became the municipal engineer of an Illinois city, which owned its electric lighting and water plants. This position paved the way for his entrance into the electric traction field, and he subsequently became engaged in the construction and development of electric interurban railways.

Professor A. N. Talbot, who has charge of the Municipal and Sanitary Engineering course at the University of Illinois, because of his profound consideration for the welfare of his graduates, has encouraged the writer to make application for the degree of Master of Science, which degree is granted to graduates with the degree of Bachelor of Science, by the University of Illinois, in recognition of work done or success attained in commercial activities. As the Municipal and Sanitary Engineering course is a branch of the Civil Engineering course, the degree available to the writer is that of C. E.

The writer, in making application for the Degree of Master of Science, has chosen the subject, "The Electric Interurban Railway" for this thesis because of his experience in this field.
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CHAPTER X.

INTRODUCTORY.

Notwithstanding the fact that there are over twenty thousand miles of electric suburban and electric interurban railway now in operation in the United States, of which the operating records are available through the medium of the various State Commission reports, and otherwise, there is little data of actual and proven information so compiled as to be useful to the great number of persons, residing in almost every community, who are promoting, or are encouraging the promotion of, an electric interurban railway.

The fact that, in almost every instance, electric interurban railways have proven to be popular utilities, has caused much development in the construction of such properties, irrespective of the possible or probable economic result incident to their operation, and, in consequence, many of the undertakings have been unprofitable. This condition, which is parallel with that of the early days of steam railroad construction, has caused the investing public to regard electric interurban railway securities with some suspicion.

In view of these existing conditions, it is believed that there is a need for a résumé of the actual economic results from the operation of the existing electric interurban railways, for the purpose of enabling the layman to comprehend the fundamental
conditions essential to an economically successful road, and for the purpose of enabling the investor to discriminate between fundamentally good or bad electric interurban railway securities.
CHAPTER II.

INCEPTION AND DEVELOPMENT OF ELECTRIC TRACTION.

The first authentic record of a well conceived scheme to obtain tractive power by means of electricity, dates from the early '50's, and between that time and the year 1880, when Edison and Field became interested, many attempts were made to work out a feasible scheme, but all of them lacked commercial value.

The real birth of the electrically operated railway as a practical method of transportation, was in 1888, when Frank J. Sprague equipped a short electric railway line in Richmond, Va., which, though crude from the standard of today, was successful. Previous to this, at expositions and elsewhere, electric railways had been built for exhibition and experimentation.

The practicability of the electric railway being quickly demonstrated, there became an immediate demand for this means of traction, and by the year 1890 there had been about two hundred electric railway companies, with a trackage of about 1200 miles, organized in the United States. In England and Germany the work was taken up, and some important installations were commenced. During the next ten years far-reaching improvements were made in the equipment, and by the year 1902 there were over seven hundred electric railways in operation in this country, with an aggregate total of about 22,000 miles of track—a truly remarkable growth.

THE ELECTRIC SUBURBAN RAILWAY.

From the electric railway, operating over and along the streets of a city, it was an easy step to the electric suburban
railway, which originated in the simple extension of a city line to the suburbs of that city. It was speedily recognized that in the electric suburban railway was the solution of the vexing problem of how to remedy the ever increasing congestion of population within a narrow zone around the commercial center of each of the large cities. With the development of the electric suburban railway came the outward development of the growth of the cities for residential purposes, bringing benefits to those working in the cities so great and far-reaching as to be incalculable.

Step by step with the increasing importance of electric traction, improvements in equipment and operation were made, the inventor never lagging behind the constructor.

THE ELECTRIC INTERURBAN RAILWAY.

The next step, the development of the electric interurban railway, was of much greater magnitude than that of the simple evolution of the suburban railway. The problem of the transmission of power over long distances had to be solved, and there were many other questions which the pioneer had to work out. The great minds of the master electricians soon solved the power problem and gave to the world the rotary converter, improved transformers, and the transmission of high potential alternating current to substations.

The earliest attempt at electric interurban railway construction was about the year 1900, and it was not until the year 1902 that the development became general.

The pioneer builders of electric interurban railways were confronted with the problem of deciding whether the tracks of the railway should be built on private right-of-way, or along
the pikes and highways. To build the tracks on private right-of-way, across open country of broken topography, to build bridges over rivers and streams, and in fact, to do all of those things in track construction that the steam railroads had done, appeared to them to necessitate the expenditure of an overwhelming amount of money, and they, unfortunately for operating efficiency, adopted the alternative of utilizing the pikes and highways. The early interurban railway was, therefore, in reality an extension of the suburban railway, made possible by the then recent developments in power transmission.

The pioneer lines having demonstrated the feasibility and practicability of the project, the demand for interurban railways became general, and later builders began to utilize the private right-of-way instead of the pikes and highways for their tracks, and from that time the electric interurban railway became the popular utility it now is.

When carrying passengers between towns it became necessary to carry their baggage, and, from this beginning, the handling of express matter, United States mail, milk and broken freight, was a natural sequence in evolution.

In solving the transportation problems which became more abstruse as the mileage of individual roads increased, the electric interurban railway followed the practice of the steam railroads, and adopted train schedules and dispatching systems, and rules and devices for the safety of its operation. As the traffic increased, trains of cars, under multiple control, were operated, and in some instances dining and sleeping cars were
added to the passenger equipment.

The electric interurban railway policy has always been aggressive in its reach for business, and after acquiring success in the passenger, express and broken freight field, the large earnings to be derived from the handling of bulk freight, and the interchange of traffic with other roads, was sufficient incentive for some of the larger electric railways to enter the field as general freight carriers. This development has been of recent date, and at the present time is restricted to a few of the largest electric railway systems, and these systems are being operated on the same basis as the steam railroads, and are doing identically the same carrying business, including the interchange of traffic and equipment with them.

The growth of the electric suburban and electric interurban railways has been wonderful, as, since the year 1902 there has been constructed, and placed in operation, over twenty thousand miles of track. The development has been especially active in the states of New York, Pennsylvania, Massachusetts, Ohio, Indiana, Illinois and California, as in these states more than thirteen thousand miles, out of the total of about twenty thousand miles, have been constructed.
CHAPTER III.
CLASSIFICATIONS AND DEFINITIONS.

The diversity in the scope of operation of the various electric railways, popularly called electric interurban railways, renders an analysis of their earnings and expenditures, as a whole, unproductive of tangible results. It is therefore first necessary to define what will herein be considered as an electric interurban railway, and to furthermore define the terms used in the subsequent analysis of the fundamental principles governing their operating revenues and expenses, and cost of construction.

CLASSIFICATION OF ELECTRIC RAILWAYS.

Electric railways may be divided into four general classes; Urban, Suburban, Interurban and Commercial.

ELECTRIC INTERURBAN RAILWAY.

An electrically operated railway connecting two or more independent distant communities and organized and operated to carry passengers, baggage, United States mail, express and freight in broken shipments. This railway is distinct from an urban or suburban railway, in that the latter serve only the inhabitants of a city, or of a city and its suburbs, for the purpose of carrying passengers and their ordinary hand baggage. It is also distinct from a commercial railway in that it does not do, or undertake to do, a general bulk and interchange freight business.
CLASSIFICATION OF TYPE OF ELECTRIC INTERURBAN RAILWAYS, AND ALSO OF TERRITORIES SERVED.

In considering the economic results obtained by the various electric interurban railways now operating, it is necessary to classify the types of roads, and also of territories served, into two general classes - the normal and the abnormal.

NORMAL ELECTRIC INTERURBAN RAILWAY - GENERAL CHARACTERISTICS OF,-

- Entrances into cities, towns and villages served, by franchises over city streets.
- Private right-of-way outside of cities and villages.
- Roadbed constructed with reasonable curves and gradients.
- Track laid with 70# or 80# rail and standard ties, 2 ft. centers.
- Power house of ample size and constructed for economical operation.
- Car equipment ample and of modern type.
- Well constructed primary distributing system, and overhead, or Third Rail, secondary distributing system.
- Substantially hourly service, with local trains operating alternately with limited trains. Limited schedule practically equal to the local schedule of the competing steam railway lines.
- One or more broken package freight movements each way per day.
- Rate of fare approximately two cents per mile, with a reduction of from ten to twenty-five per cent when round trip tickets are purchased.

ABNORMAL ELECTRIC INTERURBAN RAILWAY-GENERAL CHARACTERISTICS OF,-

- No entrance into principal cities served.
- Constructed on highways.
Roadbed of such curves and gradients as to constitute barriers to the procurement of a reasonable portion of the available business.

Track construction such as to constitute a barrier to procurement of a reasonable portion of the available business.

Power house inadequate, and unsuited to generate current at reasonable cost.

Car equipment obsolete, insufficient and uncomfortable.

Insufficient primary and secondary distributing systems to maintain reasonable voltage for movement of cars.

Two-hourly, or less frequent, service.

No broken package freight movements.

NORMAL TERRITORY - GENERAL CHARACTERISTICS OF,-

A territory made up of cities, towns and villages which are supported by varied agricultural, manufacturing or mining industries, and which are free from the fluctuating influences of summer, health or amusement resorts, or other similar traffic creating centers, and which are also free from serious business depressions due to local industrial conditions.

ABNORMAL TERRITORY - GENERAL CHARACTERISTICS OF,-

A territory made up of cities, towns, and villages, one, or more, of which is a large pleasure drawing center, or is in a state of industrial decay due to local conditions, or where the principal industries are of such a nature as to be subject to long periods of business depression, or to prolonged strikes.

CLASSIFICATION OF POPULATION SERVED.

The population served by an electric interurban railway,
other than its tributary farming population, may be divided into three general classes, as follows:

Primary Terminal Population,
Secondary Terminal Population,
Intermediate Town and Village Population.

PRIMARY TERMINAL POPULATION.

The population of the principal city into which the railway operates. In other words, the population of that city which is of the greatest commercial importance in the sense that it is a metropolis for the greater portion of the system served.

SECONDARY TERMINAL POPULATION.

The population of the other important terminals, distinct from the principal terminal, which are also of such commercial importance as to attract business from a considerable portion of the territory served, but not to the same extent as the principal terminal.

INTERMEDIATE TOWN AND VILLAGE POPULATION.

The population of cities, towns and villages, served by the line, beyond and between (when there are both primary and secondary terminals), but not including, the primary and secondary terminals.

The tributary farming population residing within the territory served by the line, is excluded from consideration. In a normal farming territory the value of this population from the view-point of its traffic productiveness, is reflected in the size and character of the towns and villages which constitute the intermediate town and village population. There has been
much importance attached to the density of the farming population, and it has been quite customary to approximate its aggregate within arbitrary distances of the line, varying from one mile to four miles. Aside from such estimates being extremely crude, there are such a variety of local conditions influencing the extent of the zone limiting the tributary population, that no uniform principle for considering its value on that basis can be established. On the other hand, the towns and villages, constituting the intermediate town and village population, will reflect all of the characteristics of the farming community that contribute to their support. If such a territory has fertile lands, it will support a greater number of townspeople, if the roads are good in a farming community the sphere of the commercial activities of the town will be increased and it will therefore have a larger population, and so, likewise, will progressive types of farmers have a bearing on the town in which they trade. Even though a town or village may be largely developed because of manufacturing or mining industries, yet to the extent that the town or village has been supported by the tributary farming population it will reflect with reasonable accuracy the value of the farming population as to its traffic productiveness.

CLASSIFICATION OF TRAFFIC SOURCES.
The traffic created by the population served by an Electric Interurban Railway will be consequent to the following general movements;

source 1.

a. The intercommunication of the population of the
primary terminal and the intermediate population served.

b. The intercommunication of the population of the intermediate centers only.

Source 2.

c. The intercommunication of the population of the secondary terminals and the intermediate population served.

d. The intercommunication of the population of the primary terminal and the population of the secondary terminals.

e. The intercommunication of the population of the secondary terminals alone (if more than one).

It will be noted that the traffic created by "a" and "b", of Source 1, is consequent to the existence of the primary terminal and the intermediate population, while the traffic created by "c", "d" and "e", of Source 2, is consequent to the existence of the secondary terminal population.
CHAPTER IV.
OPERATING REVENUES.

The Interstate Commerce Commission, in accordance with Section 20 of an Act to Regulate Commerce, has prescribed a classification of the Operating Revenues of electric railways as follows:

General Accounts.

I. Revenue from Transportation.
II. Revenue from operations other than transportation.

Primary Accounts.

I. Revenue from Transportation-
   1. Passenger Revenue.
   2. Baggage Revenue.
   3. Parlor, Chair, and Special Car Revenue.
   4. Mail Revenue.
   5. Express Revenue.
   6. Milk Revenue.
   7. Freight Revenue.
   8. Switching Revenue.
   9. Miscellaneous Transportation Revenue.

II. Revenue from Operations other than Transportation-
   10. Station and Car Privileges.
   11. Parcel-Room Receipts.
   12. Storage.
   15. Rents of Tracks and Terminals.
   17. Rents of Buildings and Other Property.
   18. Power.
   19. Miscellaneous.

RELATION BETWEEN "REVENUE FROM TRANSPORTATION" AND "REVENUE FROM OPERATIONS OTHER THAN TRANSPORTATION".

Very few of the existing electric interurban railways earn an appreciable amount from the sources constituting the Revenue from Operations Other than Transportation, with the exception of Power. It is quite usual for an electric interurban railway to serve a territory from which revenue can be earned by the
sale of Power, and a considerable business can be secured in this
direction, but as the development of this item of earning is much
dependent on the management of the property, and is therefore
not general, it will be eliminated from further consideration
herein.

RELATION BETWEEN PASSENGER REVENUE AND OTHER THAN PASSENGER
REVENUE, AFTER ELIMINATING POWER SALES.

The following cases have been indiscriminately selected from
normal roads serving normal territories;

<table>
<thead>
<tr>
<th>Case</th>
<th>Passenger Revenue</th>
<th>Express, Freight &amp; Other nonpassenger Revenue</th>
<th>Total Gross Revenue</th>
<th>Percentage Express &amp; Freight to Gross Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>$405,979</td>
<td>$5,720</td>
<td>$411,698</td>
<td>1.384</td>
</tr>
<tr>
<td>2.</td>
<td>$1,210,170</td>
<td>$77,992</td>
<td>$1,393,521</td>
<td>5.597</td>
</tr>
<tr>
<td>3.</td>
<td>$570,632</td>
<td>$35,923</td>
<td>$606,555</td>
<td>5.222</td>
</tr>
<tr>
<td>4.</td>
<td>$823,346</td>
<td>$13,977</td>
<td>$858,315</td>
<td>1.618</td>
</tr>
<tr>
<td>5.</td>
<td>$286,185</td>
<td>$28,212</td>
<td>$355,077</td>
<td>9.855</td>
</tr>
<tr>
<td>6.</td>
<td>$872,566</td>
<td>$86,467</td>
<td>$959,033</td>
<td>9.016</td>
</tr>
<tr>
<td>7.</td>
<td>$930,600</td>
<td>$137,613</td>
<td>$1,068,219</td>
<td>12.882</td>
</tr>
<tr>
<td>8.</td>
<td>$346,205</td>
<td>$59,685</td>
<td>$405,890</td>
<td>14.704</td>
</tr>
<tr>
<td>9.</td>
<td>$498,994</td>
<td>$121,574</td>
<td>$620,568</td>
<td>19.580</td>
</tr>
<tr>
<td>10.</td>
<td>$197,405</td>
<td>$37,111</td>
<td>$234,516</td>
<td>15.821</td>
</tr>
</tbody>
</table>

Average, 614,208 60,428 691,321 8.732

Average on 243,229 mi.
steam road in 1911 631,340,776 2,155,338,840 2,786,579,616 77.344

From the typical cases above tabulated it is apparent that
the predominating item is passenger revenue. In the present
stage of development of the Electric Interurban Railway, in fact
from its limited operation in the freight field as has been here-
tofohere defined, all of the other items comprising the subject
of Revenue from Transportation, excepting Passenger Revenue, are
of such little consequence that the subject of revenue will only
be considered from the viewpoint of the total gross revenue.

While the subject here under discussion is the Electric Interurban Railway, which has heretofore been defined as that class of Electric Railway upon which only an express and broken package freight traffic is conducted, in view of the general misapprehension as to the possibilities of Electric Interurban Railways becoming general freight carriers, the fundamental elements essential to engaging in a general freight traffic will be briefly pointed out.

General freight traffic involves the movement of commodities in car-load lots in reasonable numbers, with reasonable frequency, from the producer to the consumer, independently, or jointly with other carriers by interchange agreement. To make such a movement independently both the producer and consumer must be served by the line. Such a movement jointly with other carriers involves interchange relations with these carriers, in the making of which Electric Interurban Railways are handicapped by the fact that they are mostly parasites of the pioneer steam railroads in the sense that they serve the same territories by parallel lines, and compete in a degree for the same traffic. Even though the interchange relations exist, and such freight movements are made possible, the superior facilities of the steam railways make it difficult for the Electric Interurban Railway to procure any material portion of the available business.

Electric Interurban Railways serving large cities, which are either primary or secondary terminals, qualify for the general freight traffic in the sense that they have both the producers and consumers of bulk freight in the territory served by them,
but in view of the fact that they generally enter their terminals over the city streets, the producers and consumers of bulk freight are not served by them except through the medium of transfer wagons, whereas the steam railways generally serve the industries over their own switch tracks, thereby placing the Electric Interurban Railway at a tremendous disadvantage.

Assuming an Electric Interurban Railway has such liberal franchises as will enable it to engage in the general freight traffic, it must be constructed and equipped to handle such. The movement of trains of freight cars involves a far more elaborate power system and diversity of equipment than does the movement of trains of cars of one or two units handling merely passenger, express and light freight traffic. The additional cost of providing the necessary power appliances and freight equipment, together with the handicaps encountered in procuring any great volume of bulk freight traffic, constitute a barrier to engaging in that traffic, which very few of the Electric Interurban Railways have attempted to surmount. The Electric Railways that have developed into Commercial Railways by engaging in the bulk freight traffic, are not procuring such economical results as will lend much encouragement to the promotion of new lines on the theory that the freight traffic revenue can be made a material part of the gross revenue.

RELATIONS EXISTING BETWEEN OPERATING REVENUES AND POPULATION SERVED.

The various phases of traffic movement productive of operating revenues, have heretofore been generally defined as being of two classes, one of which has been described as Source No. 1 and the other as Source No. 2.
STATISTICS OF REVENUE OF LINES PRODUCTIVE OF EARNINGS
FROM SOURCE NO. 1 ONLY.

(Lines serving a Primary Terminal and an Intermediate Town and Village Population, but having no Secondary Terminal.)

The following cases have been indiscriminately selected from the normal roads of this class serving normal territories:

TABLE II.

<table>
<thead>
<tr>
<th>Case</th>
<th>Location</th>
<th>Miles</th>
<th>Primary Track</th>
<th>Intermediate Terminal Town &amp; Village</th>
<th>Gross Operating Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Iowa</td>
<td>76</td>
<td>86,368</td>
<td>12,071</td>
<td>140,120</td>
</tr>
<tr>
<td>2.</td>
<td>Michigan</td>
<td>16</td>
<td>13,194</td>
<td>5,811</td>
<td>64,839</td>
</tr>
<tr>
<td>4.</td>
<td>New Jersey</td>
<td>18</td>
<td>44,461</td>
<td>5,506</td>
<td>92,146</td>
</tr>
<tr>
<td>5.</td>
<td>&quot;</td>
<td>15</td>
<td>8,336</td>
<td>8,173</td>
<td>59,317</td>
</tr>
<tr>
<td>6.</td>
<td>&quot;</td>
<td>17</td>
<td>13,298</td>
<td>11,223</td>
<td>99,346</td>
</tr>
<tr>
<td>7.</td>
<td>New York</td>
<td>17.6</td>
<td>11,504</td>
<td>4,040</td>
<td>75,023</td>
</tr>
<tr>
<td>8.</td>
<td>&quot;</td>
<td>16.5</td>
<td>37,176</td>
<td>5,458</td>
<td>64,958</td>
</tr>
<tr>
<td>9.</td>
<td>&quot;</td>
<td>12.5</td>
<td>6,420</td>
<td>8,651</td>
<td>77,215</td>
</tr>
<tr>
<td>10.</td>
<td>West Virginia</td>
<td>19.3</td>
<td>41,641</td>
<td>4,589</td>
<td>105,394</td>
</tr>
<tr>
<td>11.</td>
<td>Connecticut</td>
<td>13</td>
<td>13,502</td>
<td>7,882</td>
<td>96,869</td>
</tr>
<tr>
<td>12.</td>
<td>&quot;</td>
<td>50</td>
<td>133,605</td>
<td>9,517</td>
<td>52,379</td>
</tr>
<tr>
<td>13.</td>
<td>&quot;</td>
<td>11</td>
<td>19,659</td>
<td>6,213</td>
<td>46,732</td>
</tr>
<tr>
<td>14.</td>
<td>Oklahoma</td>
<td>17</td>
<td>13,000</td>
<td>6,312</td>
<td>66,750</td>
</tr>
<tr>
<td>15.</td>
<td>Illinois</td>
<td>11</td>
<td>14,548</td>
<td>4,955</td>
<td>41,776</td>
</tr>
<tr>
<td>16.</td>
<td>&quot;</td>
<td>19</td>
<td>6,090</td>
<td>3,191</td>
<td>29,516</td>
</tr>
<tr>
<td>17.</td>
<td>&quot;</td>
<td>12.5</td>
<td>22,789</td>
<td>2,700</td>
<td>29,585</td>
</tr>
<tr>
<td>18.</td>
<td>&quot;</td>
<td>14</td>
<td>11,456</td>
<td>5,884</td>
<td>54,300</td>
</tr>
<tr>
<td>19.</td>
<td>&quot;</td>
<td>7</td>
<td>8,102</td>
<td>3,926</td>
<td>29,175</td>
</tr>
<tr>
<td>20.</td>
<td>Indiana</td>
<td>32</td>
<td>24,005</td>
<td>13,953</td>
<td>111,048</td>
</tr>
<tr>
<td>21.</td>
<td>&quot;</td>
<td>23</td>
<td>63,933</td>
<td>4,671</td>
<td>70,618</td>
</tr>
<tr>
<td>22.</td>
<td>&quot;</td>
<td>31</td>
<td>19,359</td>
<td>9,701</td>
<td>99,200</td>
</tr>
<tr>
<td>23.</td>
<td>&quot;</td>
<td>25</td>
<td>69,647</td>
<td>8,300</td>
<td>109,851</td>
</tr>
<tr>
<td>24.</td>
<td>Ohio</td>
<td>25.5</td>
<td>18,266</td>
<td>10,330</td>
<td>121,109</td>
</tr>
<tr>
<td>25.</td>
<td>&quot;</td>
<td>24</td>
<td>5,222</td>
<td>2,227</td>
<td>29,000</td>
</tr>
<tr>
<td>26.</td>
<td>&quot;</td>
<td>53</td>
<td>364,403</td>
<td>10,066</td>
<td>104,000</td>
</tr>
<tr>
<td>27.</td>
<td>&quot;</td>
<td>38</td>
<td>20,387</td>
<td>14,986</td>
<td>142,000</td>
</tr>
<tr>
<td>28.</td>
<td>&quot;</td>
<td>20</td>
<td>46,921</td>
<td>10,136</td>
<td>72,984</td>
</tr>
<tr>
<td>29.</td>
<td>&quot;</td>
<td>18.5</td>
<td>9,076</td>
<td>1,855</td>
<td>20,800</td>
</tr>
<tr>
<td>30.</td>
<td>&quot;</td>
<td>51</td>
<td>116,577</td>
<td>10,034</td>
<td>106,656</td>
</tr>
<tr>
<td>31.</td>
<td>Pennsylvania</td>
<td>19</td>
<td>12,623</td>
<td>4,788</td>
<td>46,376</td>
</tr>
<tr>
<td>32.</td>
<td>&quot;</td>
<td>36</td>
<td>5,749</td>
<td>8,073</td>
<td>91,347</td>
</tr>
<tr>
<td>33.</td>
<td>&quot;</td>
<td>20</td>
<td>1,556,231</td>
<td>10,223</td>
<td>108,186</td>
</tr>
<tr>
<td>34.</td>
<td>&quot;</td>
<td>31</td>
<td>87,411</td>
<td>5,088</td>
<td>58,430</td>
</tr>
<tr>
<td>35.</td>
<td>&quot;</td>
<td>10</td>
<td>5,474</td>
<td>1,640</td>
<td>13,705</td>
</tr>
<tr>
<td>36.</td>
<td>Massachusetts</td>
<td>20</td>
<td>6,740</td>
<td>11,794</td>
<td>58,433</td>
</tr>
</tbody>
</table>
CHART "A"

SHOWING RELATION BETWEEN

REVENUE

AND

INTERMEDIATE TOWN AND VILLAGE POPULATION.
The above statistics indicate:

1. That the length of the road has no relative bearing from which analytical deductions can be made, on the amount of the operating revenues.

2. That the size of the Primary Terminal has no material influence on the amount of operating revenues.

3. That the operating revenue varies approximately directly with the aggregate of the Intermediate Town and Village Population, which is graphically set forth by reference to Chart "A", Page 18.

By reference to Chart "A" it will be noted that out of thirty six roads tabulated twenty-two are within the limits of the lines representing an earning per capita of Intermediate Town and Village Population, of between $8.00 and $12.00, and that all but seven of these cases are within the limits of the lines representing an earning per capita of Town and Village Population of between $7.00 and $13.00. It will be furthermore noted that the relations between the average earnings of the thirty-six cases cited and the Town and Village Population, is approximately represented by the line indicating $10.00 per capita of Intermediate Town and Village Population.

Attention is again directed to the fact that the above deductions are made from the operations of normal roads serving normal territory, and therefore they will be very misleading if applied to abnormal lines or abnormal territories. It is not intended, however, to imply that a normal Electric Interurban Railway serving a normal territory that is productive only of revenue from Source 1, will earn $7.00, or $10.00 or $13.00 per
capita of Intermediate Town and Village Population, as the fact that these limits are exceeded is clearly indicated by Chart "A", but it is also clearly indicated that the earnings will, in all probability, vary between $7.00 and $13.00 per capita of Intermediate Town and Village Population, and that the general average is approximately $10.00 per capita of that population.

STATISTICS OF REVENUE OF LINES PRODUCTIVE OF EARNINGS FROM SOURCES 1 AND 2.
(Lines serving a Primary Terminal, one or more Secondary Terminals, and an Intermediate Town and Village Population.)

The following cases have been indiscriminately selected from normal roads serving normal territories:

TABLE III.

<table>
<thead>
<tr>
<th>Case</th>
<th>Miles</th>
<th>Primary Track</th>
<th>Secondary Terminal</th>
<th>Population of Intermediate Town and Village</th>
<th>Gross Operating Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>28.5</td>
<td>20,367</td>
<td>8,696</td>
<td>2,723 $</td>
<td>84,522 $</td>
</tr>
<tr>
<td>2.</td>
<td>32</td>
<td>25,976</td>
<td>7,353</td>
<td>2,150</td>
<td>118,000 $</td>
</tr>
<tr>
<td>3.</td>
<td>130</td>
<td>2,189,283</td>
<td>55,783</td>
<td>35,400</td>
<td>1,210,170 $</td>
</tr>
<tr>
<td>4.</td>
<td>93</td>
<td>233,650</td>
<td>20,081</td>
<td>26,879</td>
<td>428,456 $</td>
</tr>
<tr>
<td>5.</td>
<td>40</td>
<td>19,359</td>
<td>17,010</td>
<td>2,700</td>
<td>152,535 $</td>
</tr>
<tr>
<td>6.</td>
<td>320</td>
<td>233,650</td>
<td>62,650</td>
<td>112,097</td>
<td>1,899,706 $</td>
</tr>
<tr>
<td>7.</td>
<td>65</td>
<td>63,933</td>
<td>37,655</td>
<td>7,642</td>
<td>257,868 $</td>
</tr>
<tr>
<td>8.</td>
<td>39</td>
<td>12,687</td>
<td>10,480</td>
<td>5,439</td>
<td>135,748 $</td>
</tr>
<tr>
<td>9.</td>
<td>41</td>
<td>223,928</td>
<td>6,305</td>
<td>4,625</td>
<td>123,863 $</td>
</tr>
<tr>
<td>10.</td>
<td>32</td>
<td>8,981</td>
<td>13,650</td>
<td>7,364</td>
<td>306,962 $</td>
</tr>
<tr>
<td>11.</td>
<td>82</td>
<td>31,297</td>
<td>11,080</td>
<td>1,695</td>
<td>91,219 $</td>
</tr>
<tr>
<td>12.</td>
<td>199.5</td>
<td>423,715</td>
<td>31,770</td>
<td>14,711</td>
<td>858,135 $</td>
</tr>
<tr>
<td>13.</td>
<td>67</td>
<td>74,419</td>
<td>9,491</td>
<td>12,443</td>
<td>207,150 $</td>
</tr>
<tr>
<td>14.</td>
<td>36.4</td>
<td>50,217</td>
<td>24,026</td>
<td>4,892</td>
<td>222,110 $</td>
</tr>
<tr>
<td>15.</td>
<td>26</td>
<td>18,266</td>
<td>5,501</td>
<td>6,582</td>
<td>118,292 $</td>
</tr>
<tr>
<td>16.</td>
<td>222</td>
<td>560,663</td>
<td>49,165</td>
<td>74,146</td>
<td>1,068,219 $</td>
</tr>
<tr>
<td>17.</td>
<td>150</td>
<td>560,663</td>
<td>228,194</td>
<td>36,023</td>
<td>1,009,638 $</td>
</tr>
<tr>
<td>18.</td>
<td>122</td>
<td>704,428</td>
<td>51,678</td>
<td>39,006</td>
<td>664,697 $</td>
</tr>
<tr>
<td>19.</td>
<td>95</td>
<td>31,140</td>
<td>33,189</td>
<td>13,163</td>
<td>420,690 $</td>
</tr>
<tr>
<td>20.</td>
<td>40</td>
<td>66,950</td>
<td>25,768</td>
<td>2,477</td>
<td>235,665 $</td>
</tr>
<tr>
<td>21.</td>
<td>40</td>
<td>51,678</td>
<td>31,140</td>
<td>4,853</td>
<td>247,663 $</td>
</tr>
</tbody>
</table>
TABLE IV.

Showing portion of earnings attributable to Source 2 in preceding cases (based on an estimate of earnings from Source 1 at $10.00 per capita of Intermediate Town and Village Population), also showing the per capita revenue of Secondary Population (Source 2), and the average distance between terminals.

<table>
<thead>
<tr>
<th>Case</th>
<th>Average Distance Miles Between Track Terminals</th>
<th>Total Gross Revenue</th>
<th>Estimated Revenue Source 1</th>
<th>Estimated Revenue Source 2</th>
<th>Revenues from Source 2 per Capita of Secondary Terminal Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>28.5</td>
<td>$84,522</td>
<td>$27,230</td>
<td>$57,292</td>
<td>$6.60</td>
</tr>
<tr>
<td>2.</td>
<td>32</td>
<td>118,000</td>
<td>21,500</td>
<td>86,500</td>
<td>12.00</td>
</tr>
<tr>
<td>3.</td>
<td>130</td>
<td>1,210,170</td>
<td>354,000</td>
<td>856,170</td>
<td>15.00</td>
</tr>
<tr>
<td>4.</td>
<td>93</td>
<td>428,456</td>
<td>268,790</td>
<td>159,666</td>
<td>8.00</td>
</tr>
<tr>
<td>5.</td>
<td>40</td>
<td>152,535</td>
<td>27,000</td>
<td>125,535</td>
<td>7.35</td>
</tr>
<tr>
<td>6.</td>
<td>320</td>
<td>1,899,706</td>
<td>1,120,970</td>
<td>768,736</td>
<td>12.30</td>
</tr>
<tr>
<td>7.</td>
<td>65</td>
<td>257,868</td>
<td>76,420</td>
<td>175,448</td>
<td>4.70</td>
</tr>
<tr>
<td>8.</td>
<td>39</td>
<td>135,748</td>
<td>54,390</td>
<td>81,358</td>
<td>8.00</td>
</tr>
<tr>
<td>9.</td>
<td>41</td>
<td>123,863</td>
<td>46,250</td>
<td>79,613</td>
<td>12.30</td>
</tr>
<tr>
<td>10.</td>
<td>32</td>
<td>306,962</td>
<td>73,640</td>
<td>232,320</td>
<td>17.00</td>
</tr>
<tr>
<td>11.</td>
<td>82</td>
<td>91,219</td>
<td>16,950</td>
<td>74,269</td>
<td>6.70</td>
</tr>
<tr>
<td>12.</td>
<td>199.5</td>
<td>858,135</td>
<td>147,110</td>
<td>711,025</td>
<td>22.40</td>
</tr>
<tr>
<td>13.</td>
<td>67</td>
<td>207,150</td>
<td>124,430</td>
<td>82,720</td>
<td>8.70</td>
</tr>
<tr>
<td>14.</td>
<td>36.4</td>
<td>222,110</td>
<td>48,920</td>
<td>171,190</td>
<td>7.12</td>
</tr>
<tr>
<td>15.</td>
<td>26</td>
<td>118,292</td>
<td>65,820</td>
<td>53,532</td>
<td>9.70</td>
</tr>
<tr>
<td>16.</td>
<td>222</td>
<td>1,068,219</td>
<td>741,460</td>
<td>326,759</td>
<td>6.55</td>
</tr>
<tr>
<td>17.</td>
<td>150</td>
<td>1,009,638</td>
<td>360,230</td>
<td>649,408</td>
<td>2.85</td>
</tr>
<tr>
<td>18.</td>
<td>122</td>
<td>664,607</td>
<td>390,006</td>
<td>274,601</td>
<td>5.30</td>
</tr>
<tr>
<td>19.</td>
<td>95</td>
<td>420,690</td>
<td>131,630</td>
<td>289,060</td>
<td>7.60</td>
</tr>
<tr>
<td>20.</td>
<td>40</td>
<td>235,665</td>
<td>24,770</td>
<td>210,895</td>
<td>8.20</td>
</tr>
<tr>
<td>21.</td>
<td>40</td>
<td>247,663</td>
<td>48,530</td>
<td>199,133</td>
<td>6.40</td>
</tr>
</tbody>
</table>

The above statistics indicate -

1. That the length of road has in this case, as in the previous case, no relative bearing from which any conclusions can be drawn, on the amount of operating revenue from Source 2.

2. That the operating revenue from Source 2 is not governed by the population of the Primary Terminal.

3. That the relations existing between revenue from Source 1 and the Intermediate Town and Village Population, heretofore
shown, do not exist as between the revenue from Source 2 and the Intermediate Town and Village Population.

That this is reasonable is shown by the following;-

A road operating between a Primary Terminal and a Secondary Terminal, through an Intermediate Town and Village Population, will not obtain any materially different results insofar as relates to the earnings contributed by the population of the intermediate towns and villages than a road serving merely a Primary Terminal and an Intermediate Town and Village Population, for the reason that the average inhabitant of the intermediate towns and villages, if but one terminal is available to him, will direct his attention to that terminal, whereas if two terminals are available he will divide his attention between the two terminals. The sum total of the revenue derived from his patronage is approximately the same in both instances.

4. Very widely varying results in the revenues from Source 2, per capita of Secondary Terminal Population, are disclosed when considered irrespective of the average distance between terminals. As the earnings from Source 2 are essentially created by the existence of one or more Secondary Terminals it is reasonable that there should exist some proximate relation between the amount of this revenue and the entire population of the Secondary Terminal, or Secondary Terminals, served. When these relations are considered in connection with the average distance between terminals, the following approximate results prevail;-

(a). The greater the average distance between terminals the
less the revenue from Source 2 per capita of Secondary Terminal Population.

That this should be the case is logical from the fact that Electric Interurban Railways paralleling steam railways, will procure, for short distances, say forty miles or under, practically all of the passenger traffic, due to the frequency of service, and the convenience of its operation into the heart of terminals over the city streets. For distances greater than forty miles, the presumed greater hazard incident to the electric lines as compared with the steam lines, results in the proportion of the traffic which the electric lines procure gradually diminishing as the distance increases.

(b). The earnings from Source 2 per capita of Secondary Terminal Population depends largely upon the causes for intercommunication between the various terminals. It is clear that two comparatively small terminals in close proximity - one being a County Seat and the other a manufacturing center - will have far greater intercommunication than if both terminals are County Seats. Again there will be greater intercommunication per capita, in the case of a very large city being connected with a nearby substantially smaller city, than in the case of one comparatively large terminal, sufficient unto itself, being connected by an electric line with another similar large terminal.

GENERAL CONCLUSIONS CONCERNING REVENUE FROM SOURCE 2.

While it is very evident that any attempt to set forth
the approximate relation between revenue from Source 2 and the Secondary Terminal Population is an extremely precarious undertaking, the foregoing statistics and discussions do indicate the following general tendencies, which are submitted as approximate rules governing revenues from Source 2:—

1. That where the Secondary Terminal is removed from the Principal Terminal a distance of forty miles or less, the revenue from Source 2 will vary between $6.00 and $20.00 per capita of that Secondary Terminal, depending upon the causes for intercommunication and the efficiency of the service rendered.

2. That when the Secondary Terminal is removed from the Principal Terminal a distance greater than forty miles, the revenue from Source 2 per capita of that Secondary Terminal will be diminished practically ten per cent for each ten miles of increased distance.

OTHER STATISTICS CONCERNING REVENUE FROM OPERATION, SHOWING RELATION BETWEEN REVENUE AND CAR MILES OPERATED.

TABLE V.

<table>
<thead>
<tr>
<th>Case</th>
<th>Miles</th>
<th>Track</th>
<th>Gross Revenue</th>
<th>Car Miles Operated</th>
<th>Revenue per Car Mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>41</td>
<td>41</td>
<td>$123,863</td>
<td>639,290</td>
<td>.1954</td>
</tr>
<tr>
<td>2.</td>
<td>17</td>
<td>24</td>
<td>66,750</td>
<td>313,498</td>
<td>.2122</td>
</tr>
<tr>
<td>3.</td>
<td>20</td>
<td>51</td>
<td>108,186</td>
<td>572,977</td>
<td>.1886</td>
</tr>
<tr>
<td>4.</td>
<td>25</td>
<td>10</td>
<td>141,085</td>
<td>474,564</td>
<td>.2975</td>
</tr>
<tr>
<td>5.</td>
<td>32</td>
<td>48</td>
<td>107,278</td>
<td>342,542</td>
<td>.3111</td>
</tr>
<tr>
<td>6.</td>
<td>51</td>
<td>31</td>
<td>133,240</td>
<td>558,428</td>
<td>.2385</td>
</tr>
<tr>
<td>7.</td>
<td>38</td>
<td>149</td>
<td>149,304</td>
<td>648,728</td>
<td>.2301</td>
</tr>
<tr>
<td>8.</td>
<td>46</td>
<td>230</td>
<td>230,142</td>
<td>1,052,089</td>
<td>.2166</td>
</tr>
<tr>
<td>9.</td>
<td>23.7</td>
<td>70</td>
<td>70,618</td>
<td>191,674</td>
<td>.3684</td>
</tr>
<tr>
<td>10.</td>
<td>40</td>
<td>145</td>
<td>145,689</td>
<td>638,987</td>
<td>.2284</td>
</tr>
<tr>
<td>11.</td>
<td>320</td>
<td>1,892</td>
<td>1,899,706</td>
<td>5,852,994</td>
<td>.3081</td>
</tr>
<tr>
<td>12.</td>
<td>101</td>
<td>546</td>
<td>546,980</td>
<td>2,294,714</td>
<td>.2383</td>
</tr>
<tr>
<td>13.</td>
<td>62</td>
<td>405</td>
<td>405,890</td>
<td>1,307,924</td>
<td>.3103</td>
</tr>
<tr>
<td>14.</td>
<td>122</td>
<td>620</td>
<td>620,568</td>
<td>2,146,413</td>
<td>.2889</td>
</tr>
<tr>
<td>15.</td>
<td>40</td>
<td>234</td>
<td>234,516</td>
<td>818,425</td>
<td>.2865</td>
</tr>
</tbody>
</table>
TABLE V. (Continued)

<table>
<thead>
<tr>
<th>Case</th>
<th>Miles Track</th>
<th>Gross Revenue</th>
<th>Car Miles Operated</th>
<th>Revenue per Car Mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.</td>
<td>32</td>
<td>$101,993</td>
<td>341,542</td>
<td>.2986</td>
</tr>
<tr>
<td>17.</td>
<td>222</td>
<td>1,068,219</td>
<td>3,818,028</td>
<td>.2965</td>
</tr>
<tr>
<td>18.</td>
<td>30</td>
<td>67,416</td>
<td>367,460</td>
<td>.1985</td>
</tr>
<tr>
<td>19.</td>
<td>170</td>
<td>999,274</td>
<td>3,276,608</td>
<td>.3083</td>
</tr>
<tr>
<td>20.</td>
<td>45</td>
<td>355,469</td>
<td>923,705</td>
<td>.3826</td>
</tr>
</tbody>
</table>

It is customary to use the unit of car mile revenue in considering both the revenue and operating results of operated railways, but the lack of uniformity disclosed by the above table indicates the futility of attempting to estimate revenues on this unit basis.

The revenue per car mile will naturally be dependent upon the frequency of service, which service, on the other hand, depends upon the judgment of the management, and also upon the demands of the local conditions.

Furthermore, the question of multiple unit operation enters into the subject of average earnings per car mile, as does also the nature of the traffic as to its balance from the viewpoint of the equality of movement in opposing directions.

COMPARISON OF ELECTRIC INTERURBAN AND STEAM RAILWAY REVENUES.

The average gross revenue per mile of track on 243,229 miles of steam railway in 1911, according to the statistics of the Interstate Commerce Commission, was $11,588.98, of which $2,708.44 was from Passenger Traffic.

Similar statistics for Electric Interurban Railways are not available, but from the records of typical cases listed in Table V - which may be said to be representative of all roads qualifying as Electric Interurban Railways under the definition
hereinbefore given - the average gross revenue per mile of track is $5,130.00.

While these figures are interesting from the view-point of disclosing the relative earning power of steam railways and Electric Interurban Railways, they are of little importance except as a comparison.

The Electric Interurban Railways, deriving substantially all of their revenue from Passenger Traffic sources, are limited to fields of great density of population, where a large passenger traffic exists. Steam roads, deriving a large per cent of their revenue from freight sources, are not limited to such restricted areas, and have been located more especially primarily for developing freight traffic. Therefore, that the earnings of the Electric Interurban Railway should be considerably higher than the Passenger Revenue of steam roads and considerably less than the gross revenue of steam roads is but a logical result.

Chart "B", page 27, graphically discloses the growth of the average Revenue and Operating Expense per mile of track per year of the steam railway lines as compared to the similar development of Electric Interurban Railways. The statistics of the steam railroads are again taken from the report of the Interstate Commerce Commission, while those of the Electric Interurban Railway have been gathered from the operating statements of a number of typical lines.

From this Chart, it is obvious that the revenue growth per mile of track on Electric Interurban Railways is not keeping pace with that of steam railroads, and that while the growth of operating expense per mile of track on steam railroads has
CHART B.
SHOWING RELATION OF TENDENCY OF GROWTH
OF
OPERATING REVENUE AND EXPENSE
OF
TYPICAL ELECTRIC INTERURBAN RAILWAYS
AS COMPARED TO THAT OF STEAM RAILWAYS.

Note. Solid lines indicate actual
Dashed lines - Approximate
Mean Averages.
not kept pace with the growth of revenue on steam railroads, thereby resulting in a gradual increase in the net revenue per mile of track derived from steam railroad operation, the growth of operating expenses on Electric Interurban Railways has substantially kept pace with the growth of the revenues per mile of track, with the result that the growth of net revenues per mile of track on Electric Railways has been very little.

One of the characteristics of Electric Interurban Railways of which the mileage has not been extended from time to time, is that the available revenue was quickly developed, and that after it was once developed it has increased at a very low rate. This is not especially revealed by Chart "B", page 27, due to the influence which the constantly increased mileage had on the revenue of the typical cases used in preparing the Chart.

**CONCLUDING REMARKS CONCERNING REVENUE.**

The generally accepted, and doubtless the best, method of determining the probable revenues of a projected line, is to apply to determinable units of population of the projected line, the known unit results obtained by operating roads, the type of construction and method of operation of, and general characteristics of territory served by which, are in all respects similar to, and comparable with, like elements on the projected road.

In view of previous discussions as to the relation between the earnings and the population of the territory served, it is obvious that careful consideration must be given to the distribution of the population in that territory, as well as to the amount thereof. While it is also necessary to give careful consideration to the comparable features of the type of con-
struction, and the operating methods, of those roads used for comparison with the similar proposed elements of the projected road, this comparison should be made essentially for the purpose of determining the equality of conditions, and for correction to compensate inequalities productive of variation in the revenue results.

While the final determination of the probable revenues of a projected Electric Interurban Railway should be left to those having expert knowledge of such matters and whose judgment and discriminating discernment of the valuation of varying elements, having bearing upon revenues, is of high character, yet the intelligent application by the layman of rules governing the proximate relations existing between the revenue and population served, as heretofore established, will determine, within reasonable limits, the probable revenues that normal Interurban Railways can obtain in normal territories, and will serve, but in an approximate way only, to determine whether the projected line is fundamentally good or fundamentally bad from a revenue point of view.
CHAPTER V.

OPERATING EXPENSES.

The classification of operating expenses of Electric Railways as prescribed by the Interstate Commerce Commission in accordance with Section 20 of an Act to Regulate Commerce, is as follows:

General Accounts.

I. Way and Structures.
II. Equipment.
III. Traffic.
IV. Conducting Transportation.
V. General and Miscellaneous.

Primary Accounts.

I. Way and Structures-
1. Superintendence of Way and Structures.
   Maintenance of Way.
   Maintenance of Roadway and Track.
   Ballast.
   2. Ties.
   3. Rails.
   4. Rail Fastenings and Joints.
   5. Special Work.
   8. Paving.
  10. Cleaning and Sanding Tracks.
  12. Other Maintenance of Way.
     Tunnels.
  15. Crossings, Fences, Cattle Guards, and Signs.
  17. Telephone and Telegraph Systems.
  18. Other Miscellaneous Way Expenses.
     Maintenance of Electric Lines.
  19. Poles and Fixtures.
  22. Distribution System.
  23. Miscellaneous Electric Line Expenses.
  25. Other Operations - Dr.
  27. Other Operations - Cr.
The above statistics indicate a great variation in the operating expenses under the item of Way and Structures among the several typical roads cited, and also a very great comparative difference to the cost on the steam railway lines. While it is obvious that a steam operated road, moving a great volume of heavy traffic over its rails, requires a greater expenditure of money to maintain the Way and Structures than on the electric road with the lighter equipment and greatly reduced number of car mile movements, on the other hand it does not seem logical that there should be this great difference.

The several primary accounts under the general account of Way and Structures constituting the bulk of the aggregate cost on the average line are the following:

**Ties,**

**Roadway and Track Labor,**
Bridges, Trestles, and Culverts,
Depreciation of Way and Structures,
Sunday items constituting Maintenance of Electric Lines.

The average road has 2600 ties per mile. Assuming the average life of these ties to be ten years, then an average of 260 ties per mile of track per year must be renewed, which at an average expense of 70¢ per tie is equivalent to $182.00 per mile of track per year.

Estimating an average of two men and a foreman to a section of six miles, the least cost of roadway and track labor per mile of track per year is approximately $250.00.

The item of maintenance of bridges, trestles and culverts will naturally vary a great deal on various roads, but will average at least $50.00 per mile of track per year.

Assuming that twenty years use of rail will reduce its value from the cost of new rail to the cost of relayer, then one-twentieth of $10.00 per ton will represent the approximate cost of maintaining the rail. The average electric road uses rail weighing approximately one hundred tons to the mile, which then would be equivalent to a yearly expense of $50.00 per mile for depreciation of rail only. This added to the probable depreciation of bridges and other structures will require at least $100.00 per mile of track per year to offset depreciation.

Sundry items constituting maintenance of electric lines, including also the maintenance of telegraph and telephone lines, will average at least $100.00 per mile of track per year.

Estimating all the other items not specifically enumerated above at a very low minimum of $150.00 per mile of track per year, the least total cost logical and reasonable for the item of
Way and Structures is $832.00 per mile of track a year, which is considerably above the average of $555.00 for the typical lines herein cited, and only about one-half of the similar expense on steam railroads.

CONCLUSIONS.

First; That the Electric Interurban Railways are not now bearing the burden of operating costs under this head that they will ultimately have to bear, this condition being due to the fact that the average age of the existing roads is but about five or six years, and that they therefore have not reached their maximum expense of operation in this particular, and that a sufficiently high standard of maintenance has not been generally adopted.

Second; That the actual maintenance expense of Way and Structures on the average electric road will vary between $800.00 and $1000.00 per mile of track per year.

EQUIPMENT.

Schedule of Primary Accounts.

29. Superintendence of Equipment.
   Maintenance of Power Equipment.
30. Power-Plant Equipment.
31. Substation Equipment.
   Maintenance of Cars and Locomotives.
32. Passenger and Combination Cars.
33. Freight, Express, and Mail Cars.
34. Locomotives.
35. Service Cars.
   Maintenance of Electric Equipment of Cars and Locomotives.
37. Electric Equipment of Locomotives.
   Miscellaneous Equipment Expenses.
38. Shop Machinery and Tools.
40. Horses and Vehicles.
41. Other Miscellaneous Equipment Expenses.
42. Depreciation of Equipment.
43. Other Operations - Dr.
44. Other Operations - Cr.
The statistics of the expense of maintaining equipment on steam roads are in no wise comparable with those of Electric Interurban Railways, and the comparison is only made to show the approximate relations existing.

The statistics of the expense of maintaining equipment on Electric Interurban Railways indicate that 2¢ per car mile is the minimum, and 3¢ per car mile is the maximum. The expense per car mile of track will, of course, depend wholly on the number of car mile movements. The ordinary Electric Interurban Railway, rendering an hourly passenger service for the greater part of nineteen hours a day, with its additional movements in the way of trail cars, express, mail, freight and work cars, will operate between 15,000 and 20,000 car miles per mile of track per year; the result for roads rendering half hourly service is approximately double that.
The Electric Interurban Railways are in a somewhat different position in reference to the maintenance of equipment than with reference to maintenance of way and structures, in that the maximum expense of maintaining equipment in operative condition is reached in a year or two after the equipment is put in service. Therefore the well managed lines are now bearing approximately the maximum burden of expense of maintaining equipment. On the other hand the item of depreciation of equipment is not being provided for, although the question is receiving serious consideration. Generally speaking, a passenger motor car, costing approximately $10,000.00, will operate an average of about 50,000 miles a year. Assuming that such a motor car after operating twenty years will have depreciated to one-third of its original value, then the annual depreciation will be approximately 3\(\frac{1}{2}\)%, or $350.00 per year, which is equivalent to seven-tenths of a cent per car mile.

CONCLUSION.

That the average expense of maintaining equipment of Electric Interurban Railways, if proper allowance is made for the depreciation of equipment, is approximately 3% per car mile per year, which is equivalent in the case of basic hourly service to from $450.00 to $600.00 per mile of track per year.

TRAFFIC.

Schedule of Primary Accounts.

Traffic Expenses.

45. Superintendence and Solicitation.
46. Advertising.
47. Miscellaneous Traffic Expenses.
STATISTICS OF ACTUAL OPERATING EXPENSES FOR TRAFFIC ON TYPICAL ELECTRIC INTERURBAN RAILWAYS.

TABLE VIII.

<table>
<thead>
<tr>
<th>Case</th>
<th>Cost per Mile of Track per Annum.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>$10.00</td>
</tr>
<tr>
<td>2.</td>
<td>46.00</td>
</tr>
<tr>
<td>3.</td>
<td>38.00</td>
</tr>
<tr>
<td>4.</td>
<td>64.00</td>
</tr>
<tr>
<td>5.</td>
<td>53.00</td>
</tr>
<tr>
<td>6.</td>
<td>61.00</td>
</tr>
<tr>
<td>7.</td>
<td>20.00</td>
</tr>
<tr>
<td>8.</td>
<td>89.00</td>
</tr>
<tr>
<td>9.</td>
<td>114.00</td>
</tr>
<tr>
<td>10.</td>
<td>94.00</td>
</tr>
</tbody>
</table>

Average, 48.00

Average on 243,229 miles of steam road in 1911, 234.00

The above statistics indicate that as yet the Electric Interurban Railways have not employed extensive organizations for the purpose of developing traffic. As the Electric Interurban Railway develops into a Commercial Electric Railway, the traffic expense will be increased. The question of the proper extent of such an organization from an economic point of view, depends much on local conditions, but generally speaking Electric Interurban Railways should maintain more extensive departments for the development of traffic than is now the practice.

CONCLUSION.

That an Electric Interurban Railway should expend from $50.00 to $150.00 per mile of track per year, for the purpose of maintaining an active traffic organization to secure the available business as rapidly as is possible.
CONDUCTING TRANSPORTATION.

Schedule of Primary Accounts.

48. Superintendence of Transportation.

Group I. Power.

49. Power-Plant Employees.
50. Substation Employees.
51. Fuel for Power.
    Other Power Supplies and Expenses.
52. Water for Power.
53. Lubricants for Power.
54. Miscellaneous Power-Plant Supplies and Expenses.
55. Substation Supplies and Expenses.
56. Power Purchased.
57. Power Exchanged - Balance.
58. Other Operations - Dr.
59. Other Operations - Cr.

GROUP II. Operation of Cars.

Conductors, Motormen, and Trainmen.

60. Passenger Conductors, Motormen, and Trainmen.
61. Freight and Express Conductors, Motormen and Trainmen.
    Miscellaneous Transportation Expenses.
    Miscellaneous Car-Service Employees and Expenses.
62. Miscellaneous Car Service Employees.
63. Miscellaneous Car Service Expenses.
    Station Employees and Expenses.
64. Station Employees.
65. Station Expenses.
    Carhouse Employees and Expenses.
66. Carhouse Employees.
67. Carhouse Expenses.
    Signal, Interlocking, Telephone, and Telegraph Systems.
68. Operation of Signal and Interlocking Systems.
69. Operation of Telephone and Telegraph Systems.
70. Express and Freight Collections and Delivery.
71. Loss and Damage.
72. Other Transportation Expenses.

STATISTICS OF ACTUAL OPERATING EXPENSES FOR CONDUCTING TRANSPORTATION ON TYPICAL ELECTRIC INTRURBAN RAILWAYS.

TABLE IX.

<table>
<thead>
<tr>
<th>Case</th>
<th>Car Miles Operated Per Mile of Track</th>
<th>Expense per Car Mile</th>
<th>Expense per Mile of Track Per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>33,756</td>
<td>.0855</td>
<td>$ 2,672.00</td>
</tr>
<tr>
<td>2.</td>
<td>41,066</td>
<td>.0793</td>
<td>3,242.00</td>
</tr>
<tr>
<td>3.</td>
<td>25,478</td>
<td>.1011</td>
<td>2,564.00</td>
</tr>
<tr>
<td>4.</td>
<td>22,149</td>
<td>.0895</td>
<td>1,978.00</td>
</tr>
</tbody>
</table>
TABLE IX. (Continued)

<table>
<thead>
<tr>
<th>Case</th>
<th>Car Miles Operated Per Mile of Track Per Year.</th>
<th>Expense per Car Mile.</th>
<th>Expense per Mile of Track Per Year.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td>20,527</td>
<td>.0841</td>
<td>$1,702.00</td>
</tr>
<tr>
<td>6.</td>
<td>19,274</td>
<td>.0821</td>
<td>1,562.00</td>
</tr>
<tr>
<td>7.</td>
<td>15,856</td>
<td>.1057</td>
<td>1,676.00</td>
</tr>
<tr>
<td>8.</td>
<td>21,095</td>
<td>.0893</td>
<td>1,884.00</td>
</tr>
<tr>
<td>9.</td>
<td>18,593</td>
<td>.1059</td>
<td>1,977.00</td>
</tr>
<tr>
<td>10.</td>
<td>20,460</td>
<td>.0845</td>
<td>1,727.00</td>
</tr>
</tbody>
</table>

Average, 22,490 .0901 2,049.00

Average on 243,229 miles of steam road in 1911, 3,887.00

The results shown by the above roads per car mile are surprisingly uniform. The expense per mile of track per year will naturally vary directly with the frequency of service.

The character of the items constituting the schedule of expense of conducting transportation, and from the fact that there is no depreciation charge, indicates that the operating lines are now carrying the approximate maximum burdens under this charge.

The principal items making up the aggregate expense of conducting transportation are:

First. The group constituting power. This expense, with the improvement of the art of generating electricity, and with the increase in the volume of power generated, has a downward tendency.

Second. The wages of employees engaged in conducting transportation. This expense has a slowly upward tendency, due to the gradual increase in wages, which possibly compensates the downward tendency in the expense
of the power group.

The higher expense of this item on steam roads is due to the fact that one of the greatest savings effected by electric operation, over steam operation, is in the lower wage paid the train crews of electric trains as compared with train crews on steam trains. A motorman or conductor of an electric train gets approximately 1 1/2¢ per train mile operated, while an engineer or conductor of a steam train gets about 3¢ per train mile operated.

CONCLUSION.

That the Electric Interurban Railways are amply meeting the burden of the expense of conducting transportation and that it averages approximately 9¢ a car mile, which is equivalent to from $1,350.00 to $1,800.00 per mile of track a year on roads maintaining a basic hourly schedule.

GENERAL AND MISCELLANEOUS.

Schedule of Primary Accounts.

General Expenses.
Salaries and Expenses of General Officers and
General Office Clerks.
73. Salaries and Expenses of General Officers.
74. Salaries and Expenses of General Office Clerks.
75. General Office Supplies and Expenses.
76. Law Expenses.
77. Relief Department Expenses.
78. Pensions.
79. Miscellaneous General Expenses.
80. Other Operations - Dr.
81. Other Operations - Cr.
82. Injuries and Damages.
83. Insurance.
84. Stationery and Printing.
  Store and Stable Expenses.
85. Store Expenses.
86. Stable Expenses.
87. Rent of Tracks and Terminals.
88. Rent of Equipment.
STATISTICS OF ACTUAL OPERATING EXPENSES FOR GENERAL AND MISCELLANEOUS ON TYPICAL ELECTRIC INTERURBAN RAILWAYS.

TABLE X.

<table>
<thead>
<tr>
<th>Case</th>
<th>Car Miles Operated</th>
<th>Expense per Car Mile.</th>
<th>Expense per Mile of Track Per Year.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>33,756</td>
<td>.0169</td>
<td>$ 561.00</td>
</tr>
<tr>
<td>2.</td>
<td>41,066</td>
<td>.0461</td>
<td>1,893.00</td>
</tr>
<tr>
<td>3.</td>
<td>25,478</td>
<td>.0403</td>
<td>1,022.00</td>
</tr>
<tr>
<td>4.</td>
<td>22,149</td>
<td>.0172</td>
<td>379.00</td>
</tr>
<tr>
<td>5.</td>
<td>20,527</td>
<td>.0479</td>
<td>887.00</td>
</tr>
<tr>
<td>6.</td>
<td>19,274</td>
<td>.0392</td>
<td>750.00</td>
</tr>
<tr>
<td>7.</td>
<td>15,856</td>
<td>.0199</td>
<td>315.00</td>
</tr>
<tr>
<td>8.</td>
<td>21,095</td>
<td>.0268</td>
<td>565.00</td>
</tr>
<tr>
<td>9.</td>
<td>18,593</td>
<td>.0393</td>
<td>718.00</td>
</tr>
<tr>
<td>10.</td>
<td>20,460</td>
<td>.0286</td>
<td>585.00</td>
</tr>
<tr>
<td>Average,</td>
<td>22,490</td>
<td>.0321</td>
<td>730.00</td>
</tr>
</tbody>
</table>

Average on 243,229 miles of steam road in 1911, 287.00

Reference to the individual items of the schedule of general and miscellaneous expenses will disclose the cause for much of the variation in this branch of operating expense in the above cases. It will be noted that it is the only item of operating expense in which the electric roads exceed the steam roads. This latter condition is probably due to the fact that this account is divisible into much greater mileages on steam roads than on electric roads.

The item of rental of tracks and terminals must of necessity introduce a very indeterminate quantity, and likewise the other items are readily seen to be subject to large variations.

CONCLUSION.

That while no fixed costs can be determined as applicable to all Electric Interurban Railways, yet from the above statistics it is evident that an allowance of from 3% to 4% per car...
mile is adequate for the average electric road, which is equivalent to from $450.00 to $800.00 per mile of track per year for roads operating on a basic hourly schedule and using the tracks of other roads in entering terminals.

**TOTAL OPERATING EXPENSES.**

**SUMMARY OF STATISTICS OF CASES ALREADY CITED.**

**TABLE XI.**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. $999</td>
<td>$699</td>
<td>$10</td>
<td>$2,672</td>
<td>$561</td>
<td>$4,950</td>
<td>33,756</td>
</tr>
<tr>
<td>2. 558</td>
<td>790</td>
<td>46</td>
<td>3,242</td>
<td>1,893</td>
<td>6,521</td>
<td>41,056</td>
</tr>
<tr>
<td>3. 792</td>
<td>567</td>
<td>38</td>
<td>2,564</td>
<td>1,022</td>
<td>4,984</td>
<td>25,478</td>
</tr>
<tr>
<td>4. 430</td>
<td>471</td>
<td>64</td>
<td>1,978</td>
<td>379</td>
<td>3,322</td>
<td>22,149</td>
</tr>
<tr>
<td>5. 774</td>
<td>476</td>
<td>53</td>
<td>1,702</td>
<td>887</td>
<td>3,892</td>
<td>20,527</td>
</tr>
<tr>
<td>6. 474</td>
<td>402</td>
<td>61</td>
<td>1,562</td>
<td>750</td>
<td>3,249</td>
<td>19,274</td>
</tr>
<tr>
<td>7. 519</td>
<td>357</td>
<td>20</td>
<td>1,676</td>
<td>315</td>
<td>2,887</td>
<td>15,856</td>
</tr>
<tr>
<td>8. 760</td>
<td>428</td>
<td>89</td>
<td>1,884</td>
<td>565</td>
<td>3,726</td>
<td>21,095</td>
</tr>
<tr>
<td>9. 426</td>
<td>379</td>
<td>114</td>
<td>1,977</td>
<td>718</td>
<td>3,614</td>
<td>18,593</td>
</tr>
<tr>
<td>10. 661</td>
<td>582</td>
<td>94</td>
<td>1,727</td>
<td>585</td>
<td>3,649</td>
<td>20,460</td>
</tr>
<tr>
<td><strong>Average, 562</strong></td>
<td><strong>482</strong></td>
<td><strong>48</strong></td>
<td><strong>2,049</strong></td>
<td><strong>730</strong></td>
<td><strong>3,872</strong></td>
<td><strong>1702</strong></td>
</tr>
</tbody>
</table>

Average on 243,229 miles of steam road in 1911, $7,957

The above statistics indicate that the approximate average expense per mile of track for electric operation is one-half that for steam railroad operation. These statistics also show that the average expense of operating the roads represented by the above cases, under the system of accounting now in vogue, is approximately 17½% per car mile.

**GENERAL CONCLUSIONS CONCERNING THE COST OF OPERATING ELECTRIC INTERURBAN RAILWAYS.**

From the preceding discussion of the operating expenses of existing Electric Interurban Railways, and the discussion of
elements of operating expenses not now properly taken into account, the following general summary of the approximate operating expenses of an Electric Interurban Railway operating a basic schedule of hourly service is presented:

<table>
<thead>
<tr>
<th>Operating Account</th>
<th>Expense per Mile of Track per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Way and Structures,</td>
<td>$800.00 to $1,000.00</td>
</tr>
<tr>
<td>Equipment,</td>
<td>450.00 to 600.00</td>
</tr>
<tr>
<td>Traffic,</td>
<td>50.00 to 150.00</td>
</tr>
<tr>
<td>Conducting Transportation,</td>
<td>1,350.00 to 1,800.00</td>
</tr>
<tr>
<td>General and Miscellaneous,</td>
<td>450.00 to 800.00</td>
</tr>
<tr>
<td>Total,</td>
<td>$3,100.00 to $4,350.00</td>
</tr>
</tbody>
</table>

**T A X E S .**

The item of Taxes, which is not included in the operating expenses, varies widely on different roads in different States, as indicated by the following table:

**TABLE XII.**

<table>
<thead>
<tr>
<th>Case.</th>
<th>State</th>
<th>Miles Track</th>
<th>Total Taxes</th>
<th>Taxes per Mile of Track.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Indiana</td>
<td>58.7</td>
<td>$11,729.00</td>
<td>$199.00</td>
</tr>
<tr>
<td>2.</td>
<td>&quot;</td>
<td>32</td>
<td>3,870.00</td>
<td>121.00</td>
</tr>
<tr>
<td>3.</td>
<td>Illinois</td>
<td>406</td>
<td>117,147.00</td>
<td>288.00</td>
</tr>
<tr>
<td>4.</td>
<td>&quot;</td>
<td>160</td>
<td>51,000.00</td>
<td>318.00</td>
</tr>
<tr>
<td>5.</td>
<td>Iowa</td>
<td>74</td>
<td>9,525.00</td>
<td>128.00</td>
</tr>
<tr>
<td>6.</td>
<td>Ohio</td>
<td>222</td>
<td>41,312.00</td>
<td>186.00</td>
</tr>
<tr>
<td>7.</td>
<td>&quot;</td>
<td>41</td>
<td>6,122.00</td>
<td>149.00</td>
</tr>
<tr>
<td>8.</td>
<td>New York</td>
<td>180</td>
<td>29,289.00</td>
<td>162.00</td>
</tr>
<tr>
<td>9.</td>
<td>Connecticut</td>
<td>21</td>
<td>7,511.00</td>
<td>357.00</td>
</tr>
<tr>
<td>10.</td>
<td>Massachusetts</td>
<td>21</td>
<td>2,016.00</td>
<td>96.00</td>
</tr>
</tbody>
</table>

Average taxes per mile of track, 156.00

Average on 243,229 miles of steam road in 1911, 448.58

The variation in taxes per mile of road is largely due to
the fact that the Electric Interurban Railway being of modern date, no uniform valuation for the assessment of these properties has been established in the various States.

The fact that the taxes on Electric Interurban Railways are considerably below those on steam railway lines, indicates that the former are likely to have a general upward tendency, until they approximately equal those of the steam railways.

CONCLUSION.

That taxes on Electric Interurban Railways will be increased, and that $250.00 per mile of track per year is the minimum amount that can be safely used for estimating this item.
CHAPTER VI.

COST OF CONSTRUCTION.

The classification for expenditures for Road and Equipment of Electric Railways, as prescribed by the Interstate Commerce Commission in accordance with Section 20 of an Act to Regulate Commerce, is as follows:

General Accounts.

I. Road.
II. Equipment.
III. General Expenditures.

Primary Accounts.

I. Road -
1. Engineering and Superintendence.
2. Right of Way.
3. Other Land used in Electric Railway Operation.
4. Grading.
5. Ballast.
6. Ties.
7. Rails, Rail Fastenings, and Joints.
8. Special Work.
10. Paving.
11. Track Laying and Surfacing.
13. Tunnels.
15. Bridges, Trestles, and Culverts.
17. Interlocking and Other Signal Apparatus.
18. Telegraph and Telephone Lines.
19. Poles and Fixtures.
22. Distribution System.
27. Shops and Carhouses.
29. Docks and Wharves.
30. Power-Plant Equipment.
31. Substation Equipment.
32. Shop Equipment.
33. Park and Resort Property.
Primary Accounts. (Continued).

I. Road - (Continued)

34. Cost of Road Purchased.

II. Equipment.
35. Cars.
36. Locomotives.
37. Electric Equipment of Cars.
38. Other Rail Equipment.

III. General Expenditures.
40. Law Expenses.
41. Interest.
42. Injuries and Damages.
43. Taxes.
44. Miscellaneous.

I. ROAD.

1. Engineering and Superintendence.

Covers expenditures for services of engineers, draftsmen, and superintendents employed on preliminary and construction work, and all expenses incident to the work.

This item will run approximately 5% of the cost of the work and will vary between $1,000.00 and $2,000.00 per mile of single track.

2. Right-of-Way.

Covers cost of land acquired for roadbed, including all expenses incident thereto, such as cost of condemnation proceedings, abutting property damages, etc.

The cost of procuring right-of-way is entirely dependent on local conditions, and no set rule can be established. The right-of-way will measure two acres per mile for each rod in width, and a well constructed line should be four to five rods in width, making a total of from eight to ten acres per mile. It may be roughly estimated that the acreage cost
of right-of-way will be twice the prevailing acreage price for the adjacent land, therefore on a line constructed through a farming country in which the land is worth $100.00 an acre, the right-of-way will probably cost $200.00 an acre, or $2,000.00 per mile for five rods in width. Similarly where land is worth $200.00 an acre, a right-of-way five rods in width is likely to cost approximately $4,000.00 per mile.

3. Other Land Used in Electric Railway Operations.

This covers the cost of land acquired for use in operating the road, other than for roadbed purposes.

Generally speaking this item of cost is small, and is made up almost wholly of the cost of the ground for power house and car barn purposes, and may be roughly estimated at from $100.00 to $500.00 per mile of track.

4. Grading.

Covers the cost of grading the roadbed, and includes all things incident to the making of such roadbed, such as retaining walls, riprap, ditches for waterway, etc.

The amount of grading is entirely dependent upon the topography of the country traversed, and the maximum gradient under which the line is built. For a well constructed line, it may be generally estimated that the grading will vary between 10,000 yards and 20,000 yards per mile, at an average cost of from 25% to 30% a yard, making the approximate limits from $2,500.00 to $6,000.00 per mile of track.

5. Ballast.

Covers the cost of material used, including that of loading, hauling and unloading alongside of track, and of
all transportation.

Quantities will vary from 2,000 yards to 3,000 yards per mile, and the cost will vary, with the availability of the material, from 75¢ to $1.50 a yard, making the approximate cost per mile of track vary between $1,500.00 and $4,500.00.

6. Ties.

Covers the cost of cross, switch, bridge, and other ties, including transportation, inspection, handling, and preservation, but not the final distribution.

Ties will run approximately 2,600 to the mile, and will vary in cost from 70¢ to $1.00, making the cost from $1,820.00 to $2,600.00 per mile.

7. Rails, Rail Fastenings, and Joints.

Covers the cost of rail, rail fastenings and joints, including transportation, inspection and handling, but not of the final distribution.

The quantity will vary with the weight of the rail used. 80# rail weighs 126 tons per mile, and 70# rail weighs 110 tons per mile. The price of the rail will be about $30.00 per ton. The cost of rail fastenings and joints will be about eleven percent of the cost of the rail, so that the cost per mile for 70# rail, with fastenings and joints, will be approximately $3,700.00, and for 80# rail it will be approximately $4,200.00.

8. Special Work.

Covers the cost of special work, including steam and street railway crossings, switches, turn-outs, etc., including transportation, inspection and handling, but not of final distribution.
The special work expense will vary with local conditions, but will usually amount to between $400.00 and $600.00 per mile of track.


Refers only to railways operated by underground electric contacts, and therefore does not apply to Electric Interurban Railways.

10. Paving.

Covers cost of labor and material for paving between rails and outside thereof, as may be required by City ordinances.

As, generally speaking, interurban railways operate over leased tracks into cities with paved streets, this item does not usually enter into the cost of constructing roads. If it does enter into the construction expense, the expense will vary in proportion to the amount of paving required.

11. Track Laying and Surfacing.

Covers the cost of distributing the track materials, and of constructing the track, together with the cost of spreading the ballast and placing it under the track.

This cost will vary from $800.00 to $1,200.00 per mile of track.


Covers the cost of the first outfit of tools necessary to equip the maintenance of way and structures gangs for properly maintaining and repairing the property when it is opened for the handling of commercial traffic, and may be roughly estimated at $50.00 per mile.
13. Tunnels.
Covers the cost of tunneling, material used and labor expended in the construction of tunnels.
As, however, tunnels are rare on Electric Interurban Railways, this item will not be further considered.

Refers only to Companies operating elevated railway systems, and does not apply to Electric Interurban Railways.

15. Bridges, Trestles, and Culverts.
Covers the cost of materials used and labor expended in the construction of bridges and trestles, both substructure and superstructure, erected to carry tracks over streams, ravines, or the tracks of other railways, and of culverts.
This cost will depend absolutely and wholly upon the local conditions, and will show a great variation on different roads. For the general purpose of showing the approximate cost to Electric Interurban Railways, it may be assumed to vary between $2,000.00 and $4,000.00 per mile of track.

Covers the cost of material used and labor expended in constructing street, road, and farm crossings at grade, overhead bridges, viaducts, etc. Also fences, cattle-guards, etc.
This cost may be roughly stated at varying between $500.00 and $1,000.00 per mile.

17. Interlocking and Other Signal Apparatus.
Covers the cost of material used, and labor expended, in constructing interlocking, and other signal apparatus, complete.
The cost per mile will depend entirely upon the amount
of signaling installed. As most roads have been constructed without the installation of any signal system, it may be said to vary from a nominal sum to $2,500.00 per mile.

18. Telegraph and Telephone Lines.
Covers the cost of material used, and labor expended, in constructing telegraph and telephone lines, for use in dispatching, and other business of the railway.

This item will vary in cost from $100.00 to $500.00 per mile.

19. Poles and Fixtures.
Covers the cost of poles, cross-arms, insulating pins, brackets, and other pole fixtures, also other structures for supporting overhead transmission lines, and all labor expended in connection with the construction of pole lines or structures.

This cost will vary from $500.00 to $1,500.00 per mile.

Covers the cost of material and labor expended in constructing conduits required for underground wires and cables.

This item does not usually enter into construction of Electric Interurban Railways and will not be considered as a probable cost of construction.

Covers the cost of material used and labor expended in the construction of high-tension transmission system, including cables, wires, insulators, and insulating material.

This cost will vary between $500.00 and $1,200.00 per mile of track.
22. Distribution System.

Covers the cost of material used and labor expended in constructing the distributing system for transmission of low tension power, including insulators and connections, also track bonding and all labor incident to same; overhead trolley lines, including cost of trolley, guard, span, strain and other wires. Also cost of third rail, and all materials used and labor expended incident to laying third rail.

This item of cost will vary in the case of overhead lines from $1,500.00 per mile, to, in the case of third rail, $5,000.00 per mile.


Has reference primarily to dams and canals, etc., for the utilization of water power, which, not being a usual feature in the construction of Electric Interurban Railways, will not be considered in this discussion.


Covers the cost of material used, and labor expended, in erecting buildings to be used for power generating plants. Includes also the excavations, gas and water pipe connections, etc., incidental thereto.

This will vary between $15.00 and $20.00 per kilowatt of station capacity, which capacity will range from 40 kilowatts to 60 kilowatts per mile of track, making the cost of the power house buildings vary between $600.00 and $1,200.00 per mile of track.


Covers the cost of material used, and labor expended, in
erecting buildings for use as power substations.

This cost will vary from between $300.00 and $500.00 per mile of track.


As it is unusual for Electric Interurban Railways to own a general office building in fee, this cost will be eliminated from this discussion.

27. Shops and Carhouses.

Covers the cost of material used, and labor expended, on buildings to be used as shops, car sheds or car houses, and includes plants for furnishing power for heating and lighting; also oil houses, sand houses and store houses.

This cost will vary between $400.00 and $600.00 per mile of road.


Covers the cost of material used, and labor expended, in the erection of stations, waiting rooms and other buildings not heretofore classified. Includes also the furniture and fixtures used to complete these buildings.

This cost will vary from $100.00 to $200.00 per mile.

29. Docks and Wharves.

As this item is not usual in Electric Interurban Railway construction, it will be eliminated from this discussion.


Covers the cost of material and labor expended in equipping plants for generating power. Includes also the cost of engines, boilers, pumps, condensers, and all equipment for generating electric current. Also foundations for any of the
foregoing equipment; switch-boards and all fixtures and appliances connected therewith.

This cost will vary between $50.00 and $75.00 per kilowatt of capacity, and as the power requirements will vary between 40 kilowatts and 60 kilowatts per mile of track, the cost will vary between $2,000.00 and $4,500.00 per mile of track.

31. Substation Equipment.

Covers the cost of material used, and labor expended, in equipping power substations. Includes also the cost of storage batteries, transformers, rotary converters, switchboard and foundations therefor.

This cost will vary between $750.00 and $1,500.00 per mile of track.

32. Shop Equipment.

Covers the cost of machinery and tools used in shops and car houses, including also boilers, engines, motors and all appliances and tools necessary to first equip the shops.

This cost will vary from $150.00 to $300.00 per mile of track.

33. Park and Resort Property.

Covers the cost of property for amusement parks or resorts.

As this is not an essential to the construction, it will not be considered in this discussion.

34. Cost of Road Purchased.

For obvious reasons this item will also not be considered in this discussion.
II. EQUIPMENT.

35. Cars.

Covers all expenditures for passenger, baggage, express, freight, mail and other cars, from the operation of which revenue is to be derived. Covers car bodies, trucks, and all fixtures or appliances inside of, or attached to, the car bodies or trucks except the electric equipment of the cars.

Electric Interurban Railways require from one car for every five miles operated, to one car for every three miles operated. Cars will vary in cost from $4,000.00 to $8,000.00, and therefore the cost of this item will vary from $800.00 a mile to $2,600.00 a mile.

36. Locomotives.

Covers all expenditures for locomotives, including all appurtenances, furniture, fixtures, and electric equipment, necessary to fit them for service.

As locomotives are not essential to the service rendered by an Electric Interurban Railway, this item will not be considered as a necessary construction cost.

37. Electric Equipment of Cars.

Covers all expenditures for electrical equipment, and wiring, of all cars of whatsoever nature.

This cost will vary from $3,000.00 to $5,000.00 per car, and will vary between $600.00 and $1,600.00 per mile of track.

38. Other Rail Equipment.

Covers expenditures for water cars, sprinkling cars, sand cars, salt cars, supply cars, and other work cars; also snow plows, sweepers and scrapers.
This cost will vary between $200.00 and $500.00 per mile.


Covers expenditures for horses, wagons, harness, automobiles, and other road equipment.

As the expenditures under this item are relatively small, the cost is considered negligible, and is therefore eliminated.

III. GENERAL EXPENDITURES.

40. Law Expenses.

Covers expenditures for counsel, solicitors and attorneys, their clerks and attendants, and expenses of their offices, together with all incidental legal expenses during the construction of the road.

This cost will vary from $200.00 to $500.00 per mile of track.

41. Interest.

Covers the interest on the moneys used incidental to, and during the period of, construction, but does not include discounts and commissions on securities issued for construction purposes.

This cost will vary between $1,000.00 and $2,000.00 per mile of track.

42. Injuries and Damages.

Covers all expenses incident to injuries to persons, or damage to property, caused directly in connection with the construction of the road and equipment.

This cost will vary between $100.00 and $200.00 per mile.

43. Taxes.

Covers taxes and assessments levied and paid on property
belonging to the Company while under construction.

This cost usually amounts to very little, and is estimated at from $50.00 to $100.00 per mile of track.

44. Miscellaneous.

Covers the cost of organization expenses, including the payment of all organization fees; the cost of preparing certificates of stocks and bonds; payment of trustees’ fees; expenses incurred in the disposal of securities; salaries and expenses of executive and general officers of a road under construction, and general office clerks; rent of office space; all items of special and incidental nature which can not properly be charged to any other account in this classification.

This cost will vary from $500.00 to $1,000.00 per mile of track.

**SUMMARY.**

<table>
<thead>
<tr>
<th>Account</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Engineering and Superintendence,</td>
<td>$1,000</td>
<td>$2,000</td>
</tr>
<tr>
<td>2. Right of Way,</td>
<td>2,000</td>
<td>4,000</td>
</tr>
<tr>
<td>3. Other land used in Electric Railway</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation,</td>
<td>100</td>
<td>500</td>
</tr>
<tr>
<td>4. Grading,</td>
<td>2,500</td>
<td>6,000</td>
</tr>
<tr>
<td>5. Ballast,</td>
<td>1,500</td>
<td>4,500</td>
</tr>
<tr>
<td>6. Ties,</td>
<td>1,820</td>
<td>2,600</td>
</tr>
<tr>
<td>7. Rails, Rail Fastenings, and Joints,</td>
<td>3,700</td>
<td>4,200</td>
</tr>
<tr>
<td>8. Special Work,</td>
<td>400</td>
<td>600</td>
</tr>
<tr>
<td>9. Underground Construction,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Paving,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Track Laying and Surfacing,</td>
<td>800</td>
<td>1,200</td>
</tr>
<tr>
<td>12. Roadway Tools,</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>13. Tunnels,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Elevated Structures and Foundations,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Bridges, Trestles, and Culverts,</td>
<td>2,000</td>
<td>4,000</td>
</tr>
<tr>
<td>16. Crossings, Fences, Cattle Guards, and Signs,</td>
<td>500</td>
<td>1,000</td>
</tr>
<tr>
<td>17. Interlocking and Other Signal Apparatus,</td>
<td>0</td>
<td>2,500</td>
</tr>
<tr>
<td>18. Telegraph and Telephone Lines,</td>
<td>100</td>
<td>500</td>
</tr>
<tr>
<td>19. Poles and Fixtures,</td>
<td>500</td>
<td>1,500</td>
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<tr>
<td>20. Underground Conduits,</td>
<td></td>
<td></td>
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<tr>
<td>Totals forward,</td>
<td>$16,970</td>
<td>$35,150</td>
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### SUMMARY. (Continued)

<table>
<thead>
<tr>
<th>Account</th>
<th>Cost Per Mile of Track.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>Brought forward,</td>
<td>$16,970</td>
</tr>
<tr>
<td>23. Dams, Canals, and Pipe Lines,</td>
<td></td>
</tr>
<tr>
<td>24. Power-Plant Buildings,</td>
<td>600</td>
</tr>
<tr>
<td>25. Substation Buildings,</td>
<td>300</td>
</tr>
<tr>
<td>26. General Office Buildings,</td>
<td></td>
</tr>
<tr>
<td>27. Shops and Carhouses,</td>
<td>400</td>
</tr>
<tr>
<td>28. Stations, Waiting Rooms, and Miscellaneous Buildings,</td>
<td>100</td>
</tr>
<tr>
<td>29. Docks and Wharves,</td>
<td></td>
</tr>
<tr>
<td>30. Power-Plant Equipment,</td>
<td>2,000</td>
</tr>
<tr>
<td>31. Substation Equipment,</td>
<td>750</td>
</tr>
<tr>
<td>32. Shop Equipment,</td>
<td>150</td>
</tr>
<tr>
<td>33. Park and Resort Property,</td>
<td></td>
</tr>
<tr>
<td>34. Cost of Road Purchased,</td>
<td></td>
</tr>
<tr>
<td>35. Cars,</td>
<td>800</td>
</tr>
<tr>
<td>36. Locomotives,</td>
<td></td>
</tr>
<tr>
<td>37. Electric Equipment of Cars,</td>
<td>600</td>
</tr>
<tr>
<td>38. Other Rail Equipment,</td>
<td>200</td>
</tr>
<tr>
<td>39. Miscellaneous Equipment,</td>
<td></td>
</tr>
<tr>
<td>40. Law Expenses,</td>
<td>200</td>
</tr>
<tr>
<td>41. Interest,</td>
<td>1,000</td>
</tr>
<tr>
<td>42. Injuries and Damages,</td>
<td>100</td>
</tr>
<tr>
<td>43. Taxes,</td>
<td>50</td>
</tr>
<tr>
<td>44. Miscellaneous,</td>
<td>500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$26,720</strong></td>
</tr>
</tbody>
</table>

It is very obvious that the cost of building Electric Interurban Railways can be made to vary, as can the cost of building houses or automobiles. It is also obvious that no approximate statement can be made with regard to the cost of building an Electric Interurban Railway, unless a full knowledge has been obtained of the constructional elements entering therein, and of the requirements for power and car equipment.

The summary of the probable limits of cost for normal lines heretofore given, is merely indicative of their possible wide variation. However, this summary will necessarily serve to disillusionize those who are laboring under the erroneous impress-
ion that Electric Interurban Railways can be built for insignificant amounts.

The approximate average cost of constructing Electric Interurban Railways now operating, and which are in the category of what are herein called normal Electric Interurban Railways, is about $35,000.00 per mile. On the other hand, there are a number of roads, which also qualify as normal roads, which cost less than the minimum shown in the summary on page 57, due perhaps to the lack of sufficient car equipment, the lack of power plant buildings or equipment, or of any other constructional element; also due, perhaps, to having been subsidized by monetary subscriptions or free right-of-way, or other benefits.

As in the case of determining revenues, it should be left to a competent expert, of good judgment, to estimate the cost of building a projected Electric Interurban Railway, yet the figures showing the maximum and minimum costs (See Summary, page 57) will indicate the probable limits for normal roads, fully equipped with the necessary power station and cars, to operate in normal territory.

It must be distinctly borne in mind, however, that these conclusions do not refer to abnormal lines serving abnormal territory. In fact, many short electric roads have been constructed with light rail and equipment for astonishingly low costs, but usually the advantage of the low cost of construction has been offset by the high cost of operation.
CHAPTER VII.

ECONOMIC RELATIONS. OPERATING REVENUES, OPERATING EXPENSES, AND COST OF CONSTRUCTION.

The prevailing rates of interest, demanded by the investing public, on the securities of Electric Interurban Railways, range from six per cent to seven per cent, which high rates have been largely brought about by the construction of so many unprofitable roads through ignorance of the fundamentally essential elements entering into such an undertaking. In order to borrow from the investing public the necessary funds with which to construct an interurban railway, the project must show an earning power of a net revenue, after paying operating expenses and taxes, of from one and one-half to two times the amount of the interest on the construction cost, to be computed on a basis of from six per cent to seven per cent.

HYPOTHETICAL APPLICATION OF THE HERETOFORE ESTABLISHED PRINCIPLES GOVERNING OPERATING REVENUES, OPERATING EXPENSES, CONSTRUCTION COSTS.

CASE 1.

It is proposed to construct a normal road, from a city of 50,000 population, constituting what is herein called a Primary Terminal, to extend through a normal territory, to a town of 5,000 population, ten miles distant, thence to another town of the same population also ten miles distant, and thence to a third similar town ten miles distant.

This line will be thirty miles long, and will have an Intermediate Town and Village Population of 15,000 (Source 1). It will have no Secondary Terminal. The revenue will be
approximately $10.00 per capita of Intermediate Town and Village Population, or a total of $150,000.00 per annum.

Because of it being a short line, the Operating Expenses will be estimated at the minimum of the heretofore determined limits of Operating Expenses for normal roads, or $3,100.00 per mile of track per year, which aggregates $93,000.00 per year.

The taxes will be approximately the minimum of $250.00 per mile of track, or $7,500.00 per year.

The cost of construction will also be approximately the minimum of the limits heretofore determined, or $26,550.00 per mile, which is a total of $801,600.00.

The surplus earning, after deducting the operating expenses and taxes, will be $49,500.00.

The interest on the cost of construction, at 6½ per cent per annum, will amount to $51,772.00.

This road will therefore fail to earn its interest by $2,604.00, and will fall short of making its securities negotiable by approximately $50,000.00. The project, therefore, fails as an economic success.

SUMMARY OF ABOVE -

Operating Revenues, 15,000 Intermediate Town and Village Population, @ $10.00 per capita, $150,000.00
Operating Expenses, 30 miles @ $3,100.00 per mile per annum, 93,000.00
Net Revenue, 57,000.00
Taxes, 30 miles @ $250.00 per mile, 7,500.00
Surplus Applicable to Fixed Charges, 49,500.00
Interest on $801,600.00 @ 6½%, 52,104.00
Deficit, 2,604.00
**MODIFICATION OF CASE 1.**

Estimating that the total aggregate of the Intermediate Town and Village Population is 18,000 instead of 15,000, the results will be as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Revenues, 18,000 Intermediate Town</td>
<td>$180,000.00</td>
</tr>
<tr>
<td>and Village Population, @ $10.00 per capita</td>
<td></td>
</tr>
<tr>
<td>Operating Expenses, 30 miles @ $3,100.00 per</td>
<td>$93,000.00</td>
</tr>
<tr>
<td>mile per annum</td>
<td></td>
</tr>
<tr>
<td>Net Revenue</td>
<td>$87,000.00</td>
</tr>
<tr>
<td>Taxes, 30 miles @ $250.00 per mile</td>
<td>$7,500.00</td>
</tr>
<tr>
<td>Surplus Applicable to Fixed Charges</td>
<td>$79,500.00</td>
</tr>
<tr>
<td>Interest on $801,600.00 @ 6½%</td>
<td>$52,104.00</td>
</tr>
<tr>
<td>Surplus, Applicable to Dividends</td>
<td>$27,396.00</td>
</tr>
</tbody>
</table>

From the estimated results of the above modification of Case 1, it will be noted that the surplus earnings, after deducting operating expenses and taxes, will approximately equal one and one-half times the interest charges computed on the basis of 6½% of the cost of construction. The Intermediate Town and Village Population of this hypothetical road is 600 per mile of track, and therefore it may be concluded, in a general way, that such a projected road, serving a Primary Terminal and Intermediate Town and Village Population only, should have not less than an average of 600 of Intermediate Town and Village population per mile of track.

As, however, in the above case the operating expenses and cost of construction were computed at the minimum of the deductions heretofore made, it is apparent that should the elements of construction or operation indicate costs higher than the minimum, a proportionately greater Intermediate
Town and Village Population per mile of track must prevail to make such a road a financial success.

CASE 2.

The conditions as above recited for Case 1, with the extension of the same road ten miles further to a city with a population of 20,000, qualifying as a Secondary Terminal, (Source 2) under the definition heretofore given. The Intermediate Town and Village Population (Source 1) will be 15,000 as in the previous case. The total miles of track will be 40, and the distance between terminals 40 miles.

SUMMARY OF THE OPERATING RESULTS:

Revenue from Source 1.
15,000 Intermediate Town and Village Population @ $10.00 per capita, ............... $ 150,000.00

Revenue from Source 2.
As the conditions conducive to intercommunication between the Primary and Secondary Terminals will have a bearing on the revenue from Source 2, it is here estimated that the Primary Terminal is the Capital of a State, and the Secondary Terminal the County Seat of the adjacent County, and in this instance there is the average cause for intercommunication, and the average earning under these conditions can be properly estimated, viz; $8.00 per capita of Secondary Terminal Population.
20,000 population @ $8.00 per capita, ........ 160,000.00

Total Gross Revenue, ................. 310,000.00

Operating Expenses.
The conditions of service in this instance would entail a greater number of car movements than in Case 1, and the operating expenses would be approximately the maximum of the deductions heretofore made, viz; $4,350.00 per mile of track.
40 miles @ $4,350.00 per mile, ............ 174,000.00

Net Earnings, ......................... 136,000.00

Taxes. 40 miles @ $250.00 per mile, .......... 10,000.00

Net Earnings Applicable to Fixed Charges, .... 126,000.00

Construction Cost, in this case, would be higher than in Case 1, and is herein estimated to be $35,000.00 per mile, or for 40 miles, $1,440,000.00.
Interest on $1,440,000.00 @ 6%, ............ 86,400.00

Surplus Earnings Applicable to Dividends, .... $ 39,600.00
This road would fall a little short of producing such economical results as would qualify it as a commercially feasible project, but if the population of the Secondary Terminal was 22,000 it would just about so qualify.

DISCUSSION OF MODIFICATIONS OF CASE 2.

If the Primary Terminal were merely the County Seat of one County, and the Secondary Terminal the County Seat of the adjacent County, it is not believed that the revenue from Source 2 could be safely estimated as high as $8.00 per capita.

If, on the other hand, the Primary Terminal was a city of one million population, and therefore exercised a predominating commercial influence over the Secondary Terminal, the estimate of earnings due to Source 2 may be increased to $15.00, and in extreme cases to $20.00 per capita of Secondary Terminal Population.

Again, if the Secondary Terminal population were removed a greater distance from the Primary Terminal, the intercommunication would be reduced, and a reduction of the revenues from Source 2 should be made to the extent of approximately $1.00 per capita for every ten miles of increased distance between the terminals.

CASE 3.

The conditions existing in Case 2, with a further extension of the line of ten miles to a town of 5,000 population, and another extension to a city of 20,000 population of sufficient importance to be classed as an additional Secondary Terminal. (The latter extension being also 10 miles)

The Intermediate Town and Village Population is 20,000; the Secondary Terminal Population 40,000, and the entire length of line 60 miles.

Distance between Terminals. The Primary Terminal is
40 miles distant from the first Secondary Terminal, and 60 miles from the second Primary Terminal, and the Secondary Terminals are 20 miles distant from each other.

Revenue from Source 1.
20,000 population @ $10.00 per capita, ... $200,000.00

Revenue from Source 2.
First, the population of the first Secondary Terminal, viz; 20,000 @ $8.00 per capita, ... 160,000.00
Second, the Second Secondary Terminal, being 60 miles from the Primary Terminal, will be entitled to an estimate of approximately $6.00 per capita from the viewpoint of its relations with the Primary Terminal, and being 20 miles from the first Secondary Terminal it will be entitled to an estimate of $8.00 per capita, making an average of $7.00 per capita.
20,000 population @ $7.00 per capita, ... 140,000.00

Total Gross Revenue, ....... ....... ....... ....... 500,000.00

Operating Expenses.
60 miles @ $4,350.00 per mile, ........ ... 261,000.00

Net Earning Applicable to Taxes and Fixed Charges, 239,000.00

Taxes, 60 miles @ $250.00 per mile, ... , ....... 15,000.00

Net Earnings Applicable to Fixed Charges, ... 224,000.00

Cost of Construction; Estimated at $35,000.00 per mile. $2,100,000.00 @ 6½%, ........ ... 136,500.00

Surplus Earnings Applicable to Dividends, ... $87,500.00

This road will also qualify as a financially feasible project.

MODIFICATION OF CASE 3.

The judgment of the expert must again be carefully exercised in determining the intercommunication between the Primary and Secondary Terminals and between the two Secondary Terminals. The same general reasoning should be followed as in the Modification of Case 2.

If the second Secondary Terminal is a city of 40,000 inhabitants, then it will be far less dependent on the Primary Terminal, and the intercommunication between these terminals will be greatly reduced, while, on the other hand, the intercommunication between the two Secondary Terminals will be increased. In such a case, the value of the first Secondary Terminal for revenue from Source 2, should be increased to perhaps $10.00 per capita of its population, and the value of
the second Secondary Terminal should be decreased to perhaps $4.00 per capita in estimating the revenues from Source 2. Where this condition prevails the results will be substantially as follows:

Revenue from Source 1.
20,000 population @ $10.00 per capita, .... $200,000.00

Revenue from Source 2.
First; 20,000 population of first Secondary Terminal @ $10.00 per capita, .... 200,000.00
Second; 40,000 population of second Secondary Terminal at $4.00 per capita, .... 160,000.00

Total Gross Revenue, ...................... 560,000.00

Operating Expenses, ...................... 261,000.00

Net Earnings Applicable to Taxes and Fixed Charges 299,000.00

Taxes, ........................................ 15,000.00

Net Earnings Applicable to Fixed Charges, ... 284,000.00

Cost of Construction; Because of the importance of the second Secondary Terminal, and its influence on the cost of construction of the road by entering a larger city, the estimate for this case will be $40,000.00 per mile of track, or $240,000.00 for the 60 miles.
$2,400,000.00 @ 6½%, ......................... 156,000.00

Surplus, Applicable to Dividends, ........... $ 128,000.00

This hypothetical case represents ideal conditions for an Electric Interurban project. It indicates, in a general way, the territory necessary to the production of satisfactory economic results.
CHAPTER VIII.

CONCLUDING REMARKS.

In the preceding pages, the general principles governing the Operating Revenues, Operating Expenses, and Construction Costs of Electric Interurban Railways, have been pointed out and discussed.

Especial attention has been directed to the lack of uniformity of results on properties now in operation, and to the causes therefor.

While the fundamental elements necessary to an economically feasible road have been determined within approximate limits for normal roads operating in normal territory, it is believed that the hazard of indiscriminately applying these limits to all cases, will be fully realized, and that the necessity of employing expert talent, of mature discriminating judgment, to estimate the probable performances of a projected road, is fully appreciated. It is also believed that projected Electric Interurban Railways, that, to the intelligent layman, do not qualify as economically feasible propositions, as herein defined, under the limits set forth, had better be left unconstructed.

From the statements herein made, the conclusion may be drawn that a great number of the Electric Interurban Railways now in operation, are not the commercial successes they are generally considered to be, and this conclusion is fully concurred in. This does not mean that there are not many profitable Electric Interurban Railways, as in fact there are many such. It is also
believed that there are now territories susceptible of developing profitable Electric Interurban Railways, and, as the Town and Village Population continues to increase, there will be many more such.