A Study of Visual Pollution from Overhead Wires and Associated Structures

Schodorf

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A STUDY OF VISUAL POLLUTION
FROM OVERHEAD WIRES AND
ASSOCIATED STRUCTURES

by
Robert J. Schodorf

A Project Report
Submitted to the
Faculty of The Graduate College
in partial fulfillment
of the
Specialist in Arts Degree

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Robert J. Schodorf
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Percent ranking of six visually offensive stimuli
Offensiveness of overhead wires and associated structures
Residential section with overhead electric facilities
Apartment complex with all utilities placed underground
A high profile substation in a rural setting
Use of natural vegetation as background screening to reduce visual impact from a substation
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Transmission line (138kv) displaying jog in rights-of-way
Transmission line (138kv) rights-of-way through a public golf course
Vegetation permitted to grow under transmission lines thus increasing wildlife habitat.
Transmission line (138kv) rights-of-way used as pasturesland

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CHAPTER 1

THE PROBLEM AND ITS BACKGROUND

Introduction

In recent years there has been a growing public outcry from concerned citizens and environmental groups over the placement of additional overhead lines, particularly power lines. These overhead lines are considered to be visually polluting and a disfigurement of the landscape. Many people view them as examples of the spoils of progress, along with junk yards, litter and trash, billboards and neon signs, superhighways, and congestive living conditions.

The United States is currently experiencing a change from the value systems of the past when conflicts were routinely decided in favor of increased production, to a skepticism of new technology designed mainly for the sake of change. Society according to Nieman and Murray (1972) is requiring that social and environmental costs be evaluated and given their rightful influence in the planning of electrical transmission policy. Investor-owned utilities in response to this pressure have increased their environmental quality expenditures from 1.5 billion dollars in 1971, to 2.1 billion in 1972 (Electric Light and Power 1972). Forward looking utilities have changed their philosophy from what can be installed at the cheapest cost, to what can be installed most cheaply but with due regard for public aesthetic demands (Rom 1971).

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Not all industry spokesmen however, agree that there are serious environmental problems in their respective fields and have all too often responded to environmental concerns in a negative fashion by accusing environmental groups of being "neo Luddites" and blaming them for the impending energy crisis. It can also be pointed out that while some electrical industries have been voicing their concern over the impending energy crisis, they are still advertising the fringe benefits of electrical power (Spinrad 1971). Often a policy of threats such as "brownouts" and job losses is followed to justify forcing people into accepting preconceived plans.

On the other hand some environmentalists have failed to keep in touch with reality in their demands on the power industry for burial of overhead power lines. One group in the state of New York is pushing for the burial of all overhead lines, without apparent thought to the estimated cost to taxpayers of 10 billion dollars (Kihss 1971). Although the United States is an affluent society, the often unfounded accusations and unreasonable demands for action without prior thought to the needs of all segments of our society borders on the irresponsible.

There must be a compromise worked out to the mutual satisfaction of both industry and environmentalists. This project is an attempt to examine the problem objectively and offer possible solutions to existing problems. Although the problem of visual pollution from overhead wires can be traced to both the electrical and telephone companies, the bulk of the problem both now and in the future rests
with the electric power industry and therefore will be the primary concern.

Growth in Energy Consumption

Use of electrical power in the United States throughout this century has doubled approximately every 10 years, with demand growing twice as fast as the gross national product and more than three times as fast as the population (Snowden 1972). Little (1971) states that this growth rate is expected to continue for at least the next 20 years.

According to Anthrop (1970) energy production in the United States increased from 130 billion kilowatt hours (kwh) in 1940 to 1,433 billion (kwh) in 1968, an annual growth rate of 7.41 percent while population growth for the same period averaged only 1.5 percent annually. The National Academy of Engineering (1972) lists a figure of 1,638 billion (kwh) as being used in 1970.

In the present decade the nation's installed generating capacity stands at 300,000 megawatts and may be expected to increase to 600,000 megawatts by 1980. During this same time the annual per capita consumption of electricity is estimated to rise from between 6,000 and 7,000 (kwh) to more than 10,000. In the single year 1980, 25,000 megawatts of new generating capacity with transmission and distribution facilities to match, at an estimated cost of 13 billion dollars, will have to be installed (Snowden 1972). Most of the new electrical capacity in the next 20 years according to Katz (1971) will come from some 250 huge power plants of 2 to 3
million kilowatts each, and transmission rights-of-way from these plants may be as wide as 250 feet.

Estimates of power generation in the year 2,000, range from a high of 12.5 trillion (kwh) to a low of 5.6 trillion (National Academy of Engineering 1972). Putting these figures in perspective; the generating capacity of Boston in 1990 will equal that of Chicago in 1970, while that of Chicago in 1990 will equal that of all of Great Britain in 1970 (Little 1971).

Considering the rate at which power production is doubling, unless something is done, in less than two centuries the land needed for power plants alone would take up all available space in the United States. This is excluding transmission line rights-of-way and transformers (Committee for Environmental Action 1972). The point is that energy growth must stop somewhere, and technology developed to reduce the space needed for power generation, transmission, and distribution.

Transmission Line Growth

In 1968 the United States had 300,000 miles of overhead transmission line with associated rights-of-way totaling 7 million acres. This figure is expected to increase threefold by 1980 (National Academy of Engineering 1972). An additional 20,000 miles of overhead 345 kilovolt (kv), 10,000 miles of overhead 500kv, and 2,500 miles of overhead 765kv transmission lines are scheduled for construction in the United States from January, 1970 through December, 1976 (Rom 1971). Information from Electric Light and Power (1972)
indicates that most of the transmission expansion for the period 1972 to 1976 is expected to be at the 355kv level, with lesser amounts at the 500kv and only 2 regions expecting projects involving 765kv lines.

Transmission towers carrying voltages of 345kv are imposing structures indeed, ranging in height from 50 to 150 feet, and as voltages increase, a corresponding increase in the size of towers and rights-of-way can also be expected (Johnson et al. 1970). Lines carrying 765kv have associated towers 120 to 135 feet high and 90 feet wide (Young 1973). Rom (1971) points out that the ultra high voltage (UHV) tower of the future might be roughly the height of a 17 story building, wider than a 17 story building laid on its side, and require 50 acres of rights-of-way per mile.

With the tremendous rise in generating capacity now taking place and more forecast for the future, a large increase in the number and size of transmission lines and towers can be expected. This will be happening at a time when people are already starting to complain of the unsightly conditions produced by these towers and lines, and the huge amounts of land required for their rights-of-way. The United States is then faced with the task of trying to satisfy increased electric power demands and higher aesthetic values at the same time, a costly and mind challenging proposition. There are, however, possible solutions and compromises available that warrant investigation. Certainly the attitudes and desires of the public should be thoroughly assessed before making any major decisions.
CHAPTER 2

PUBLIC OPINION ON OVERHEAD WIRES AND ASSOCIATED STRUCTURES

Public Attitudes

Although environmentalists have voiced their opposition to the growing number of overhead wires and towers, what is the opinion of the general public? An independent study involving the attitudes of people toward transmission towers and poles was carried out in 1972. Results of this study by Pohlman (1973) indicated that the general public was unaware of transmission structures in their area, and that when its attention was called to these structures they responded with a vague dislike. In a list of unattractive objects including utility structures, Pohlman (1973) found that these structures ranked last. The order from most offensive to least offensive was litter and trash, poorly paved streets, junk yards, billboards and signs, crowded housing, factories, and utility structures.

The investigator attempted to sample the attitudes of college students at Western Michigan University on the issue of visual pollution from overhead wires and associated structures by use of a questionnaire. A group of 92 individuals including both graduates and undergraduates in approximately equal numbers were the subjects. The students were asked to rank a list of unattractive items with the most offensive being listed first. Junk yards, litter and trash, overhead lines, congestive living conditions, billboards
and signs, and superhighways constituted the list to be ranked.
Each individual was then asked to record further the level of
dislike for each item and was given a list of four choices ranging
from not at all offensive to very offensive.

Results of The Survey

Respondents to the survey ranked litter and trash first, followed
by junk yards, congestive living conditions, billboards and signs,
overhead wires and associated structures, and superhighways. Only
3.3 percent listed overhead wires first in order of importance,
while 51.1 percent listed litter and trash as most offensive to
them (Fig. 1). A copy of the questionnaire and additional information
and detailed results appear in the Appendix.

Part two of the questionnaire revealed that the majority of
individuals discerned visual stimuli from overhead wires and associ-
ated structures to be only "a little offensive" (Fig. 2). Of the
people sampled, 51.1 percent viewed overhead wires and associated
structures as a little offensive, 28.3 percent as offensive, 15.2
percent as not at all offensive, and 5.4 percent as very offensive.
These findings closely parallel those of Pohlman (1973) in which he
found a vague dislike of power structures among the respondents.

It would appear from the results of both surveys that few
people are aware of the presence of power lines in their area,
but when their attention is directed to them they find them some-
what offensive. Young (1973) states that acceptance of these struc-
tures has been developed over long periods of time, and has reached
Figure 1. Percent ranking of six visually offensive stimuli.
Figure 2. Offensiveness of overhead wires and associated structures.
the point at which most individuals now do not perceive them in their natural surroundings. Possibly people have been too busy trying to achieve mastery over the environment and in the process have become desensitized (Bourne 1972).

Power industry officials have frequently stated that environmental outcries against the practices of the industry are the work of a minority of the public and do not reflect the opinions of the majority of the populace. This statement is substantiated to a certain extent by the findings of this study. But, to take these findings at face value is somewhat dangerous because they do not take into account the growing awareness of the public on environmental matters. Also, as the demand for energy increases and more structures are added the number of people exposed to the stimuli will also increase.
CHAPTER 3

PLACING UTILITY LINES UNDERGROUND

Introduction

Because of increased pressure from environmentalists both the telephone and electrical companies have made serious efforts toward placing larger portions of their new distribution systems underground. Furthermore, Barrett (1972) lists 15 states as having mandatory underground residential distribution regulations (Table 1). Illustrations readily show how the aesthetic value of a residential area is greatly increased by placing utilities underground (Figures 3&4).

Telephone Companies

Telephone companies in many areas are routinely burying between 80 and 90 percent of all new lines. This is possible, however, because the technology is readily available and in many cases burial of lines is even more economically feasible than an overhead system (Table 2). There are, however, examples when an overhead system would be cheaper such as when large expanses of concrete must be torn up, usually at a cost of at least 12 dollars a foot (Personal Communication 7 May 1973 with Robert Miller, Plant Engineer, Michigan Bell Telephone Company).

Electrical Companies

Problems that exist for electrical companies are more complex
Table 1. States having mandatory underground residential distribution systems as of 1972 (Barrett 1972).

<table>
<thead>
<tr>
<th>Arizona</th>
<th>Hawaii (Oahu only)</th>
<th>Montana</th>
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<tr>
<td>California</td>
<td>Illinois</td>
<td>Nevada</td>
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<tr>
<td>Delaware</td>
<td>Maryland</td>
<td>New Jersey</td>
</tr>
<tr>
<td>District of Columbia</td>
<td>Michigan (LP only)</td>
<td>New York</td>
</tr>
<tr>
<td>Florida</td>
<td>Missouri</td>
<td>Pennsylvania</td>
</tr>
</tbody>
</table>
Figure 3. Residential section with overhead electric facilities.

Figure 4. Apartment complex with all utilities placed underground.
Table 2. Cost relationships between overhead and buried telephone lines in Southwestern Michigan (Personal Communication).

<table>
<thead>
<tr>
<th></th>
<th>Aerial</th>
<th></th>
<th>Buried</th>
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<tbody>
<tr>
<td></td>
<td>Both Urban and Rural</td>
<td>Urban</td>
<td>Rural</td>
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<tr>
<td>24 gauge 50 pair</td>
<td>.59/ft.</td>
<td>.93/ft.</td>
<td>.55/ft.</td>
</tr>
<tr>
<td>24 gauge 200 pair</td>
<td>1.45/ft.</td>
<td>1.70/ft.</td>
<td>1.11/ft.</td>
</tr>
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* additional cost of $110 per pole for aerial installation
because adequate technology does not exist for the burial of all types of power lines. Technology is readily available to transmit electrical current with voltages from 5,000 to 24,900, and also for subtransmission lines carrying approximately 46,000 volts. Greater expense for insulation and increased technical problems, however, make subtransmission lines more difficult to place underground than distribution lines (Personal Communication 8 May 1973 with Max Beech, Plant Engineer, Consumers Power Company). The National Academy of Engineering (1972) states that burial of oil-paper insulated transmission lines carrying voltages of 138kv, 230kv, and 345kv is currently taking place but for only short distances. This solid insulation causes dielectric capacitance which results in limitations of power capacity and permissible length of line. Lines carrying 345kv are not installed underground for spans of more than 15 miles, because the current carrying capacity of the line drops dramatically with distance and is essentially dissipated in a span of 28 miles (Young 1973).

For underground lines, the problems are to reduce cost and develop adequate technology for burial of transmission lines carrying high voltages so that line drop is minimized. For example, a 30 mile length of overhead suburban transmission line carrying a voltage of 345kv costs 4.5 dollars per kilowatt. The cost of an underground line of the same length and carrying the same voltage is 72 dollars per kilowatt, 16 times more expensive than comparable overhead line (Rom 1971). Rose (1970) states that except in rare cases an economic defense for underground power transmission over
an overhead system cannot be made. Figures usually quoted show underground systems to be from 9 to 20 times more expensive than comparable overhead systems.

Even with residential distribution lines where technology is readily available for placing lines underground, overhead lines are still cheaper. Increased cost of burial is due to heavier cable insulation (polyethylene), more sophisticated switching and equipment systems, and increased labor costs where quality workmanship is necessary (Personal Communication 20 June 1973 with Max Beech, Plant Engineer, Consumers Power Company).

Burial of already existing overhead facilities which has been proposed by some environmentalists would become an even more expensive proposition. The anticipated life of a new overhead line is from 30 to 40 years, if removed before this period the initial investment is not fulfilled. Added to this cost factor is the labor involved in removing the facility and subsequently placing it underground (Personal Communication 20 June 1973 with Max Beech, Plant Engineer, Consumers Power Company).

Of the nearly 2.3 billion dollars spent on new transmission facilities in 1970, only about 100 million dollars was spent on underground lines (Little 1971). Power companies are receiving pressure from environmentalists to place power lines underground, and at the same time are faced with a public that is unaware of utility structures and the large increase forecast in the future. A policy decision must be made soon as to how best the public interest including environmental concerns can be met.
CHAPTER 4

ENVIRONMENTAL PLANNING FOR SUBSTATIONS, TOWERS, AND TRANSMISSION RIGHTS-OF-WAY

Interim Solutions

In the future, placing power lines above ground may no longer be necessary, but, that time is at least 10 to 20 years away (Kwee and Mullender 1972). An interim solution is needed to this aesthetic problem that will make transmission structures more appealing and less visible to the public. Some power companies have developed programs of selective landscaping and use of natural vegetation for screening. This approach involving adequate preservation of natural areas and selective landscaping holds promise for this environmental problem until all lines can be placed underground. But, it must be emphasized, however, that this environmental protection will not come cheaply. Electric Light and Power (1973) states that annual costs for landscape improvements have risen 18 percent, and the public must be willing to respond to this effort in the form of increased rates.

Substation Selection and Screening

Johnson et al. (1969) list two types of substations. The first is a high profile substation that is easily installed and efficient because of its potential for further expansion (Fig. 5). Because of its height however, this type of substation presents an aesthetic problem. In order to convey a better aesthetic image
Figure 5. A high profile substation in a rural setting.

Figure 6. Use of natural vegetation as background screening to reduce visual impact from a substation.
many companies are erecting lower profile substations that decrease the height by almost 50 percent. These lower profile substations however, are a less efficient use of both the site and structure (Personal Communication 16 June 1973 with Max Beech, Plant Engineer, Consumers Power Company).

The degree of flexibility in choosing a substation site ranges from very flexible in rural areas to minimally flexible in urban areas. In cities and suburbs low profile substations with adequate landscaping will have to be selected at considerably higher costs. In rural areas if adequate background vegetation is present a more economical high profile substation might be selected, and savings in both structure and landscaping can be realized (Fig. 6).

When selecting vegetation for substation sites, economical plants both in terms of initial outlay and maintenance are imperative (Johnson et al. 1969). The selection of ornamental trees and shrubs needing meticulous care are unnecessary and unwarranted. An awareness of the flora surrounding the site is helpful when choosing vegetation. Placing evergreens in an area that has predominantly deciduous trees would only attract attention to the site. Trees and shrubs are available in all shapes and sizes which necessitates insight into selecting harmonious vegetation with adequate screening ability. An example of a tastefully landscaped substation can be seen in Figure 7.

Selection of Towers and Poles

The size of a transmission tower depends on line voltage and
Figure 7. A tastefully landscaped suburban substation.

Figure 8. Newer upswept configuration contrasted with traditional crossarm supports.
the degree of line angle imposed on the tower. Transmission lines carrying 345kv or higher are supported by steel towers. Lower voltages can be carried on steel or wood structures. Heights range from 50 to 150 feet and sometimes greater, depending on voltage, type of tower, and particular situation (Johnson et al. 1970).

Structures most visually acceptable are often of the simplest forms, because efforts to make them more appealing often only attract more attention (Johnson et al. 1970). According to Barthold and Pfeiffer (1964) towers of simpler design also represent a savings by using less material.

Responding to recent outcries against the offensiveness of towers and poles, companies have begun to market newer and more attractive structures. These newer forms include poles of various materials such as laminated wood, concrete, fiberglass, reinforced plastic, and steel. Structures of this nature can be color blended to fit into almost any situation and help make it more aesthetically pleasing. Another recent advance appearing on utility poles is the new upswept line (Fig. 8). This has the feature of reducing the length and size that traditional crossarms occupied. As a word of caution, however, modern structures are not always environmentally compatible.

Planning and Development of Rights-Of-Way

When discussing rights-of-way through private land most property owners immediately become interested. Some are happy because this means additional income. Recently however, a growing number of
individuals have been fighting the efforts of power companies to obtain rights-of-way through their land. Young (1973) believes that power companies have been using the "right of eminent domain" to distribute visual and audible pollution to rural areas for the benefit of large industrial centers. There is a conflict of interest between urban dwellers who want the visually offensive structures removed from their area and into the country, and rural individuals who see their land disfigured at the expense of satisfying the city dweller. Experts cannot even agree in their approach to this problem. Rom (1971) states that in selecting transmission line rights-of-way, the "backwoods" approach should be used thus avoiding major transportation arteries. Johnson et al. (1970) believe that in forested areas transmission lines should parallel existing roads since this will cause the least environmental disruption. The power industry is then faced with making an environmental decision in an area where even the environmentalists cannot agree.

There are however, several ideas which can make the presence of rights-of-way more palatable to all concerned. As in other areas of power transmission, the use of screening techniques can be most useful. By placing jogs in the transmission line rights-of-way these structures can be shielded from the public view. This type of situation works well in scenic areas and where transmission lines cross major highways (Fig. 9). Allowing vegetation to grow to permissible heights under transmission lines would also help in screening them from view. A deep understanding of the ecosystems operating within the area will also aid in the selection
Figure 9. Transmission line (135kv) displaying jog in rights-of-way.

Figure 10. Transmission line (138kv) rights-of-way through a public golf course.
and maintenance of rights-of-way. The use of hills and forests as background screens whenever possible is advantageous. Johnson et al. (1970) state that land elevations should be crossed obliquely instead of at right angles, and that lines should not be placed on the floor of valleys or on hilltops because this makes them conspicuous.

Once rights-of-way have been carefully selected, then a plan of multiple use can be implemented. For instance, in urban areas rights-of-way may be used as riding trails, hiking trails, parks, playgrounds, picnic areas, golf courses, or simple extensions of personal backyards (Fig. 10). In rural areas these rights-of-way might best serve as a continuation of cropland or pasture, riding and hiking trails, or whenever possible an extension of wildlife habitat (Figures 11&12). Another important consideration according to Brown (1969) is the selection of "energy corridors" in which as many industries as possible can participate. This type of planning would save considerable land and help protect the future of our environment.
Figure 11. Vegetation permitted to grow under transmission lines thus increasing wildlife habitat.

Figure 12. Transmission line (138kv) rights-of-way used as pastureland.
CHAPTER 5

RECOMMENDATIONS

After investigating the problem of visual pollution from overhead wires and associated structures, the investigator wishes to make the following suggestions:

1. Actions of the power industry should be closely scrutinized by environmentalists to insure protection of the environment. But, in the role of protector, environmentalists have a moral obligation to substantiate their claims against industry and must not rely on making irresponsible allegations.

2. Power companies have the responsibility of informing the public about the future of additional transmission structures. Public surveys indicate that people are naive and unaware of the tremendous increase in power structures needed for the future.

3. New environmental programs should be initiated and highly publicized by power companies. These new aesthetic programs will mean added cost, and the public must be informed of possible rate increases. There are however, many safeguards that cost little and require only a little concern and foresight.

4. An educational program that can be used in areas where rights-of-way are to be purchased is badly needed. Using the right of eminent domain as a weapon to force people into selling, without first listening to their fears and objections, is unwarranted. Bad publicity can be avoided if a program using public meetings and educational literature to show industry's concern for the environment is first instituted.

5. Cooperation among industries in the planning of future energy corridors should be started immediately. In this way the senseless disruption and disfigurement of the landscape can be avoided. Industry must take the initiative in this area, because thus far state governments have appeared reluctant to do so.

6. More money must be appropriated for research into newer methods of underground power transmission. Exceedingly small portions of current budgets are now being used for this purpose. This research could possibly be financed by government appropriations, or even a tax on electricity if needed.
CHAPTER 6

SUMMARY

Environmentalists are currently voicing opposition to the placement of additional overhead power lines and towers. These structures are viewed as a disfigurement of the landscape. As demand for electrical energy continues to grow, an increase in the number of power structures is imminent. The statements below summarize some of the more important aspects of the controversies that arise.

1. A literature search reveals that power demand in the United States is doubling approximately every 10 years. The number of new generating and transmission facilities needed to meet this demand will mean an increase in visually offensive structures.

2. Public surveys indicate that the public is inattentive to present transmission structures and unaware of the large increase needed for the future. When their attention was called to these structures they responded with a vague dislike.

3. Technology is currently unavailable to bury all power lines and still maintain integrity of conductivity. Lower voltage distribution and subtransmission lines for which technology is available are being placed underground in increasing numbers and at higher costs. Voltage lines carrying 138kv or greater can be buried only in special instances and for short distances.

4. Interim solutions are suggested until all power lines can be routinely buried. The use of selective landscaping and natural
vegetation to screen substations and transmission structures is recommended. A planned public and private usage of rights-of-way through rural and urban areas which is environmentally compatible is suggested.

5. Recommendations to power companies and environmentalists include a responsible approach to the problem by environmentalists, initiation of new environmental and educational programs by power companies, public information on the future increase in power structures and possible rate increases, cooperation among industries in planning future energy corridors, and expenditure of more money to speed up research on underground power transmission.
LITERATURE CITED


APPENDIX
VISUAL POLLUTION QUESTIONNAIRE

Listed below are 6 items usually considered to be visually polluting. Please rank them in order by placing a 1 next to that which is most visually offensive to you, and a 6 next to that which is least visually offensive to you.

_____ Junk Yards
_____ Litter and Trash
_____ Overhead Power Lines, Poles, and Transmission Towers
_____ Building Congestion, Housing, Factories, Shopping Centers etc.
_____ Billboards and Signs
_____ Highways, Expressways, and Superhighways

Please circle the selection below for each question, which most closely fits with your attitude concerning the subject.

I find the visual stimuli of Junk Yards to be:
\(\begin{align*}
&\text{a) very offensive} \\
&\text{b) offensive} \\
&\text{c) a little offensive} \\
&\text{d) not at all offensive}
\end{align*}\)

I find the visual stimuli of Litter and Trash to be:
\(\begin{align*}
&\text{a) very offensive} \\
&\text{b) offensive} \\
&\text{c) a little offensive} \\
&\text{d) not at all offensive}
\end{align*}\)

I find the visual stimuli of Overhead Wires and Associated Structures to be:
\(\begin{align*}
&\text{a) very offensive} \\
&\text{b) offensive} \\
&\text{c) a little offensive} \\
&\text{d) not at all offensive}
\end{align*}\)

I find the visual stimuli of Crowded Congestive Conditions to be:
\(\begin{align*}
&\text{a) very offensive} \\
&\text{b) offensive} \\
&\text{c) a little offensive} \\
&\text{d) not at all offensive}
\end{align*}\)

I find the visual stimuli of Billboards and Signs to be:
\(\begin{align*}
&\text{a) very offensive} \\
&\text{b) offensive} \\
&\text{c) a little offensive} \\
&\text{d) not at all offensive}
\end{align*}\)

I find the visual stimuli of Superhighways to be:
\(\begin{align*}
&\text{a) very offensive} \\
&\text{b) offensive} \\
&\text{c) a little offensive} \\
&\text{d) not at all offensive}
\end{align*}\)

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<table>
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<th>Item</th>
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<th>3</th>
<th>4</th>
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Table 3. Individual scoring of each item sampled.
Table 4. Percentage of people ranking item first in offensiveness.

<table>
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<tr>
<th>Item</th>
<th>Percentage</th>
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<td>Junk Yards</td>
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<tr>
<td>Superhighways</td>
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Table 5. Offensiveness of overhead lines to people surveyed.

<table>
<thead>
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<th>Category</th>
<th>Percentage</th>
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<tr>
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<tr>
<td>Offensive</td>
<td>28.3</td>
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<tr>
<td>A Little Offensive</td>
<td>51.1</td>
</tr>
<tr>
<td>Not At All Offensive</td>
<td>15.2</td>
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</table>