

Document Information Form

Mine Number: C1015/019

File Name: Incoming

To: DOGM

From:

Person N/A

Company N/A

Date Sent: MARCH 11, 1982

Explanation:

SUGGESTED PRACTICES FOR RAPTOR PROTECTION ON POWER LINES

cc:

File in: C1 015, 019, Incoming

Refer to:

- Confidential
- Shelf
- Expandable

Date _____ For additional information

SUGGESTED PRACTICES FOR RAPTOR PROTECTION

ON POWERLINES

A report prepared in the public interest,

distributed by Raptor Research Foundation, Inc., for Edison Electric Institute

RECEIVED

MAR 11 1982

**DIVISION OF
OIL, GAS & MINING**

File in:

- Confidential
- Shelf
- Expandable

Refer to Record No. 0028 Date _____

In C/ 015, 019, Incoming
For additional information

ACKNOWLEDGEMENT

This report was prepared in the public interest to suggest techniques and procedures to all concerned parties and add to the knowledge for protection of the raptor resources of the nation. The principal author was Mr. Dean Miller, Public Service Company of Colorado, who was assisted by Mr. Erwin L. Boeker, U. S. Fish and Wildlife Service, Mr. Richard S. Thorsell, Edison Electric Institute, and Mr. Richard R. Olendorff, Bureau of Land Management. They wish to acknowledge with grateful appreciation the contributions, reviews and comments by:

<i>Morlan W. Nelson</i>	<i>Birds-of-Prey Consultant</i>
<i>Brian Thomas</i>	<i>California-Pacific Utilities Co.</i>
<i>Gordon Dodge</i>	<i>Idaho Power Company</i>
<i>Boyd Pond</i>	<i>Idaho Power Company</i>
<i>Wayne B. Smith</i>	<i>Idaho Power Company</i>
<i>Wendell Smith</i>	<i>Idaho Power Company</i>
<i>C. E. Knoder</i>	<i>National Audubon Society</i>
<i>R. Turner</i>	<i>National Audubon Society</i>
<i>T. L. Kimball</i>	<i>National Wildlife Federation</i>
<i>Edwin J. Merrick</i>	<i>National Wildlife Federation</i>
<i>John C. McCarthy</i>	<i>Nevada Power Company</i>
<i>Robert C. Miller</i>	<i>Pacific Power & Light Company</i>
<i>Ernest J. Moreland</i>	<i>Rural Electrification Administration</i>
<i>Michael P. Sullivan</i>	<i>Sierra Pacific Power Company</i>
<i>P. R. Nickerson</i>	<i>U. S. Fish & Wildlife Service</i>
<i>David J. Davies</i>	<i>U. S. Forest Service</i>
<i>Dale R. Brown</i>	<i>Utah Power & Light Company</i>
<i>Julie Hoggard</i>	<i>Utah Power & Light Company</i>

The compilation of these suggested practices was accomplished by a concerned ad hoc group of representatives of electric utilities, the conservation community and governmental agencies. The material in this report is an attempt to set forth the state-of-the-art as of June 1975.

SUGGESTED PRACTICES FOR RAPTOR PROTECTION ON POWERLINES

In early 1972, a group of western utilities¹ with the assistance of the Edison Electric Institute, coordinated a workshop with various Federal and State agencies and other interested groups² to study the problems associated with raptor electrocution occurring on powerlines. It was determined that grounding practices on distribution and transmission lines from 4 kV through 69 kV along with certain configurations of transformer banks, fused cutouts, lightning arresters and conductor phase spacings could be a substantial cause of raptor deaths. Subsequent studies have proved that the solution to the problem lies more with engineering expertise than with a biological approach.

The electrocution problem appears to be greater in the western United States — primarily Colorado, Idaho, Nevada, Utah and Wyoming — because the eagle population is greater there. Recent studies also document electrocution losses of egrets, herons, crows, ravens, wild turkeys and other birds of prey, but current evidence shows that 90% of all electrocution victims are golden eagles. This loss of eagles is significant; but pesticide contaminations, loss of habitat, and illegal shooting remain the most threatening problems to raptors in general. The latter two mortality factors, which lead directly from land use patterns and irresponsible use of firearms, are of particular importance to eagle conservation.

The Department of the Interior has coordinated the counting of eagle electrocutions in the United States in cooperation with the electric utility industry and various State and private conservation agencies. Since initiation of this program, approximately 500 raptors, principally golden eagles, have been found at the base of power poles. A number of these deaths can be attributed to other causes including diseases, poisoning and irresponsible use of firearms. The count also showed 98% of the eagles electrocuted were young, inexperienced golden eagles that were just learning to fly. They had not yet attained the skill and precision necessary to negotiate a safe landing or take-off from a powerline pole supporting three or more conductors, transformer banks, fused cutouts or other equipment necessary to transmit or distribute electric energy.

To deal with the factors that contribute to raptor electrocutions, it is necessary to know some things about the birds: how they hunt, where they live and nest, and their art of flying. Eagles and hawks prefer to perch on elevated sites where prey species might be observed over a wide radius and where air currents are more favorable for flight. The preferred power pole perch, for instance, is more often one where the crossarm is perpendicular to the prevailing wind and commands considerable hunting territory. The use of powerline poles as perch sites varies according to topography, season and abundance of prey. Powerlines that traverse steep and broken terrain, where many natural perch sites are available, receive little use compared to those in flat, broad valleys where natural perch sites are absent. Most electrocutions take place during the wintering period when peak populations of eagles and hawks are present. At this time, resident birds, as well as migrants, tend to concentrate in mountain valleys, adjacent foothills and grasslands where food supplies are most abundant and available. During this period, powerline poles receive heavy use as perches, as evidenced by droppings on crossarms and castings beneath the poles. Losses may be expected if lines in these areas are not properly designed or modified.

Through the efforts of many, including Dr. Richard R. Olendorff, Bureau of Land Management (BLM), Washington, D. C., Mr. Erwin L. Boeker, U. S. Fish & Wildlife Service, Denver, Colorado, and Mr. Morlan W. Nelson, recognized authority on birds of prey and Birds-of-Prey Consultant to the Idaho Power Company, more has become known about the eagle's habits and habitats. This information has been used by the electric utility industry to pinpoint and then minimize or eliminate the problem through design changes on certain portions of existing, as well as future, lines.

On March 27, 1972, the Rural Electrification Administration (REA) issued Bulletin 61-10 which was titled "Protection of Bald and Golden Eagles from Powerlines". This bulletin dealt with the causes of raptor electrocutions from certain grounding practices that made it difficult for large birds of prey to fly away from or roost on powerline poles or appurtenances without simultaneously contacting an energized conductor and a ground, thereby causing a completed circuit and electrocution. With this bulletin, the REA specified that all cooperatives would change grounding and construction practices to eliminate the possibility of electrocution. Some of the suggested designs, alterations and additions of special perches can be seen in Exhibits 1 through 4 in the Appendix. Suggestions for increasing phase spacings on pre-1962 standard construction were included. Exhibit No. 2 shows that pole ground wires could be gapped and still provide lightning protection to the powerline. This procedure eliminates a positive ground during normal operation of the line, thus minimizing the possibility of simultaneous contact between an energized conductor and ground. It was not intended that all existing lines be altered, but it was implied that preferred poles would be modified when multiple electrocutions at specific locations could be documented and proved.

¹ Idaho Power Company, Pacific Gas & Electric Company, Pacific Power & Light Company, Public Service Company of Colorado, Tucson Gas & Electric, Utah Power & Light Company.

² Colorado Division of Wildlife, National Audubon Society, National Wildlife Federation, Rural Electrification Administration, U. S. Fish and Wildlife Service.

Concurrent with the action by the REA, certain western investor-owned utilities, such as Idaho Power Company, Utah Power & Light Company, and Pacific Power and Light Company, began detailed research into possible solutions to the problem. Following documentation of raptor electrocutions, these utilities, along with Nevada Power Company and California-Pacific Utilities Company, began formulating procedures and developing designs and methods for modifications and additions to both existing facilities and new construction which would eliminate raptor electrocutions on their powerline structures. The Idaho Power Company engaged the services of Morlan W. Nelson who flew his trained eagles through and perched them on unenergized structures of typical designs and configurations while taking slow motion movies to determine and document whether or not the eagle would actually come in contact with conductors at various spacings and locations on the poles. This research project also established what type perches were acceptable to the eagle and that they do not perch on the smooth, slick surface of an insulator.

The results of all efforts by the electric utility industry have significantly reduced the raptor electrocutions and have resulted in a number of suggested solutions to the problem. These suggested practices could be used by the electric utility industry and land management agencies to assure proper design and precautions in raptor-inhabited areas. Some of the suggested practices are as follows:

1. If possible, adopt armless construction or variations of same on new distribution or subtransmission lines. Due to the physical separation and orientation of the conductors, and lack of suitable perches, this type construction will not present an electrocution hazard to raptors (see Exhibits 11 through 14).
2. Safe crossarm type construction has been designed by lowering the arm which supports the two outside conductors and installing the center conductor on a pole top pin. The vertical separation required is a function of the crossarm length. An eight-foot crossarm should be lowered a minimum of 38 inches below the pole top which results in an effective vertical phase-to-phase dimension of 43 inches because of insulator dimensions and pin attachment positions. An eleven-foot crossarm can be placed a minimum of 30 inches below the pole top (see Exhibits 1, 6, 7 and 16).
3. On existing crossarm construction, a pole top extension may be added to the pole such that the top conductor phase is approximately 43 inches above the pole top when used with an 8'-0" crossarm (see Exhibit 5, note exception).
4. A wood perch, made of 2" x 4" material, can be adequately mounted and oriented several feet above any energized object. It must be properly designed to withstand the landing and take-off forces of large birds (see Exhibit 4). (Idaho Power Company can supply specific designs.)
5. An insulated conductor cover and insulator hood, extending approximately six feet on either side of the insulator, may sometimes be used as a practical solution of modifying existing structures (see Exhibit 3).
6. Use wood braces for stabilizing crossarms. Either gap groundwires to prevent solidly grounding braces and hardware or stop the groundwire approximately 48 inches below the crossarm position (see Exhibits 1, 5, 6, and 7).
7. Where transformer banks and protective equipment are necessary, install all equipment and protective devices on a lower crossarm, which leaves the top crossarm for perching. Use covered jumpers connecting primary transformer bushings. Use bird guards on transformer bushings where possible (see Exhibit 9).
8. Add insulating extension links to primary deadends, which effectively increases phase-to-phase separation and allows safe perching at the pole top or on the crossarm (see Exhibit 8).
9. Use wood or non-conductive braces on top crossarms when crossarm construction is necessary.
10. When grounding is absolutely essential, use of mouldings (wood, plastic, etc.) in critical areas can be employed.

The foregoing suggested practices along with the other exhibits included in the Appendix have been effective in reducing electrocution losses and are being used by the electric utility industry. The constantly changing technology of the electric utility industry, along with the inconsistent requirements and locations of new electric loads, does not allow specific designs or dimensions to be dictated for all systems and situations. The design engineer has certain basics with which to work, but is dependent upon Federal, State and Local land management or wildlife conservation agencies to recognize those areas that are not critical, potentially critical, or extremely critical. The land manager must in turn depend upon the design engineer to design the line to protect the raptors as each situation dictates. Since it is not economically feasible to modify all existing lines, and not necessary to have all new lines designed to protect raptors where they do not occur, land managers and engineers must blend their technology and expertise to serve the public effectively with needed energy in the most efficient, most economical way, while simultaneously protecting the environment and its inhabitants. Permit-issuing agencies and the electric utility industry are governed by the following legislation as it relates to the problem of raptor electrocutions:

1. Bald Eagle Protection Act of 1940 (16 U.S.C. 688 et seq.) as amended.

2. *Endangered Species Act of 1973 (87 Stat. 1064).*
3. *Migratory Bird Treaty Act of 1918 (16 U.S.C. 703 et seq.) as amended.*

Wording of the permits issued for the construction of powerlines across public lands should allow the design engineer the latitude which he needs to design a reliable, economic line to serve the load, and yet protect the raptor population within the limitations of the above-listed Acts. The following suggested statement should help clarify, for all agencies and utilities concerned, what would be necessary and sufficient to assure permit-issuing agencies that raptors have been considered during the design phase of the line.

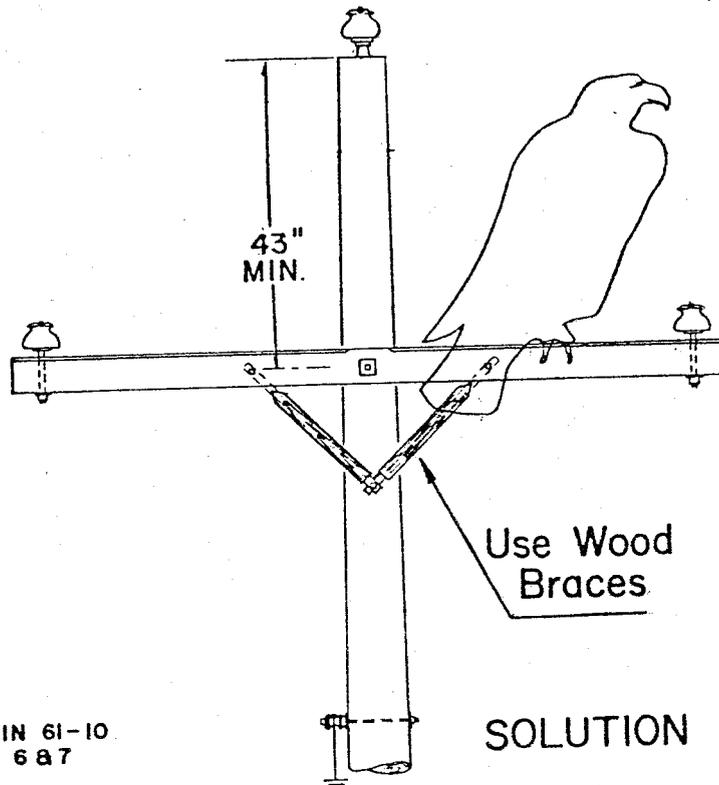
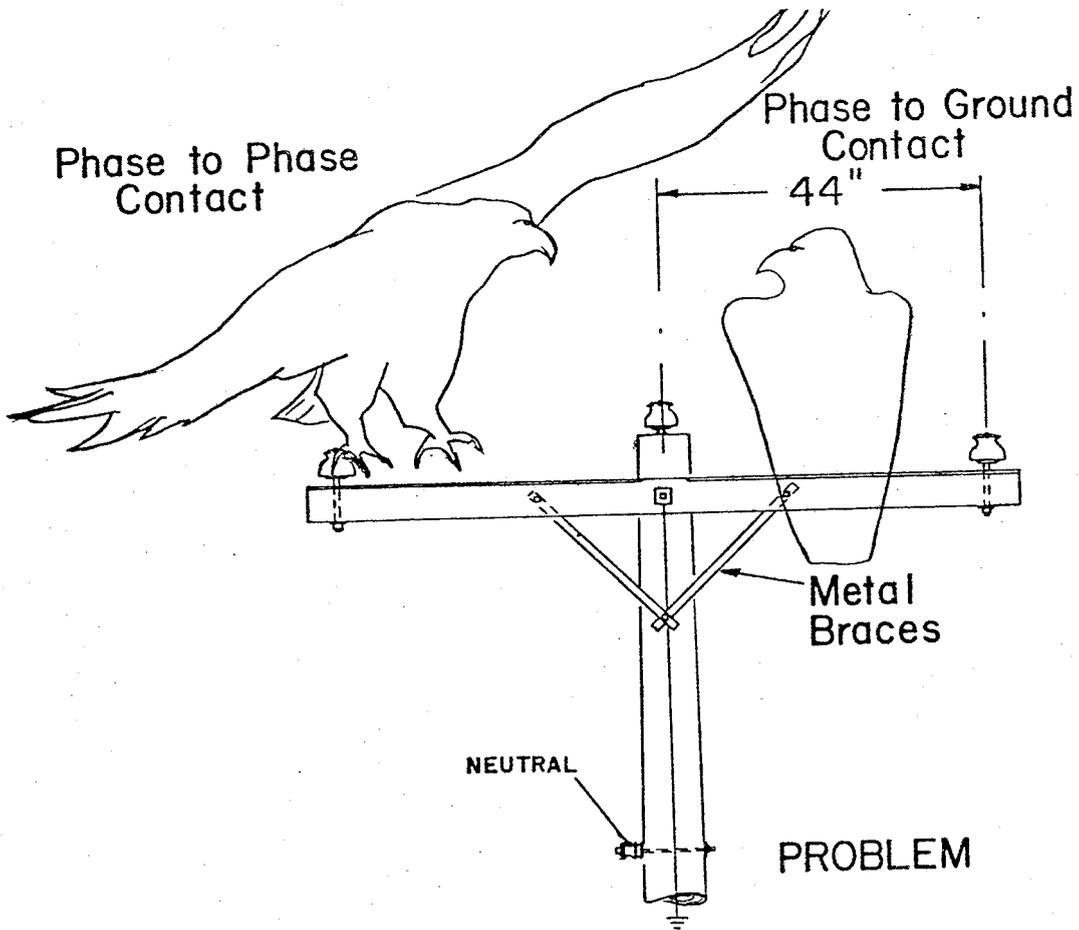
"The applicant, grantee or licensee shall be governed by 'Suggested Practices for Raptor Protection on Powerlines'. Use of this information should be made to design the proposed (name or description of line) kV powerline for designated raptor areas with proper grounding, phase spacing and configuration such that it will prevent, to the best of the design engineer's ability, the electrocution of raptors. The applicant shall provide for the grantor, or licensor, drawings which show phase spacings, configurations and grounding practices of the proposed line, and these shall be made a part of the permit.

The use of designs other than those included herein that are, in the opinion of a raptor expert, raptor safe, shall be permitted on public land rights-of-way. The costs for review of such alternate designs shall be at the applicant's expense.

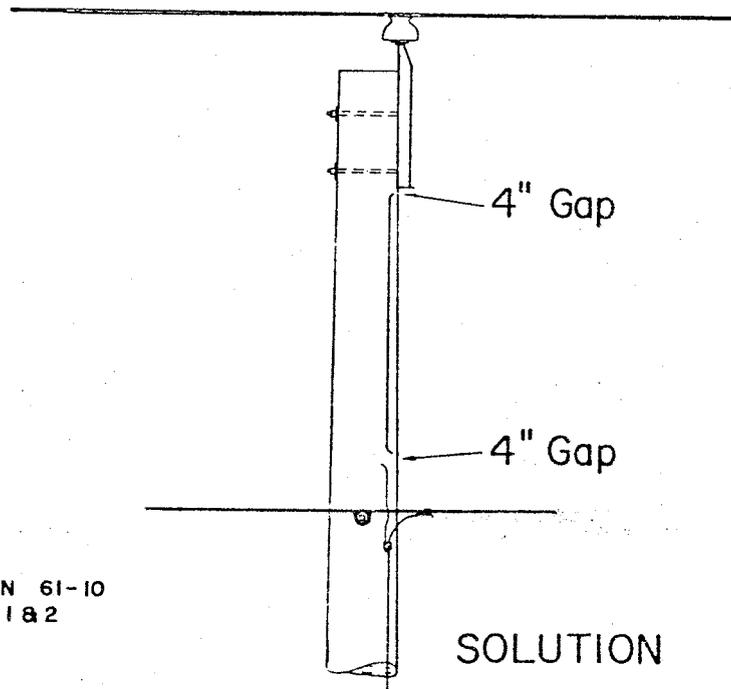
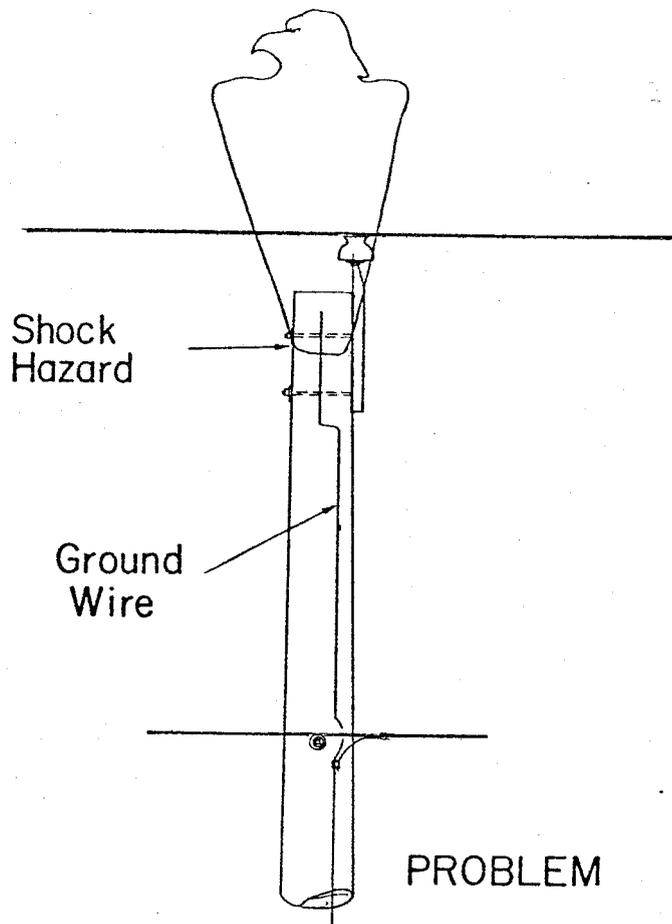
The grantor, or licensor, in issuing this permit, hereby assumes its responsibility to inform the applicant, grantee, or licensee of those areas which are designated habitats or potential habitats of raptors or other birds of prey. Any available biological or land management information in meeting the above-stated goal shall be made available to the engineer."

Additional copies can be obtained from:

*Raptor Research Foundation, Inc.
Department of Zoology - 167 WIBD
Brigham Young University
Provo, Utah 84601*



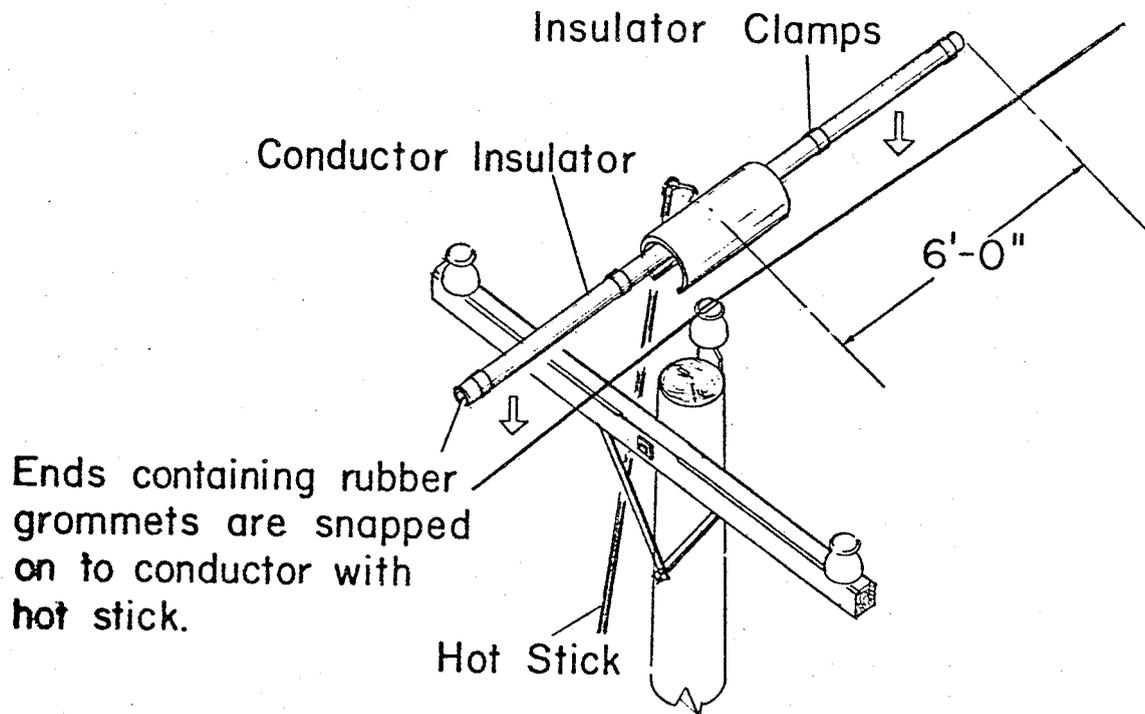
REFERENCE:
 REA BULLETIN 61-10
 FIGURES 6 & 7



REFERENCE:

REA BULLETIN 61-10
FIGURES 1 & 2

TYPICAL INSTALLATION ON SKIRT OR POST-TYPE INSULATOR



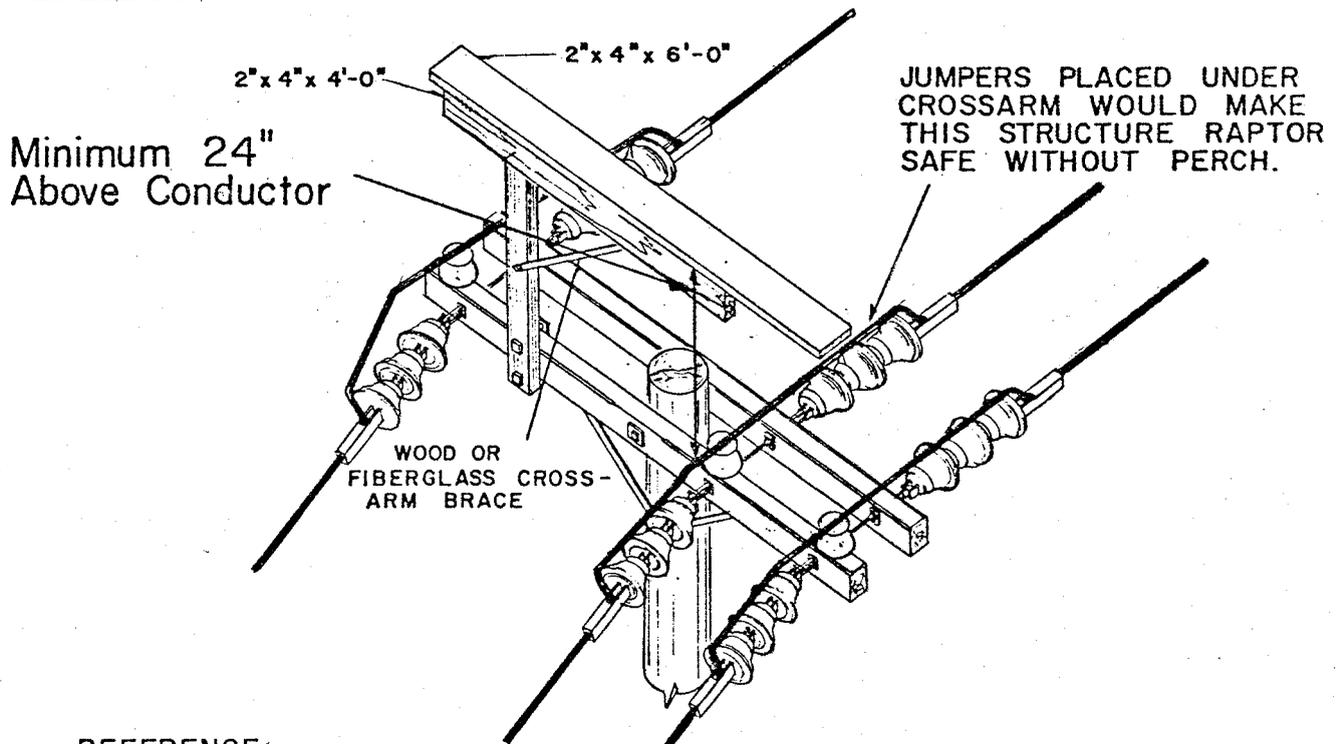
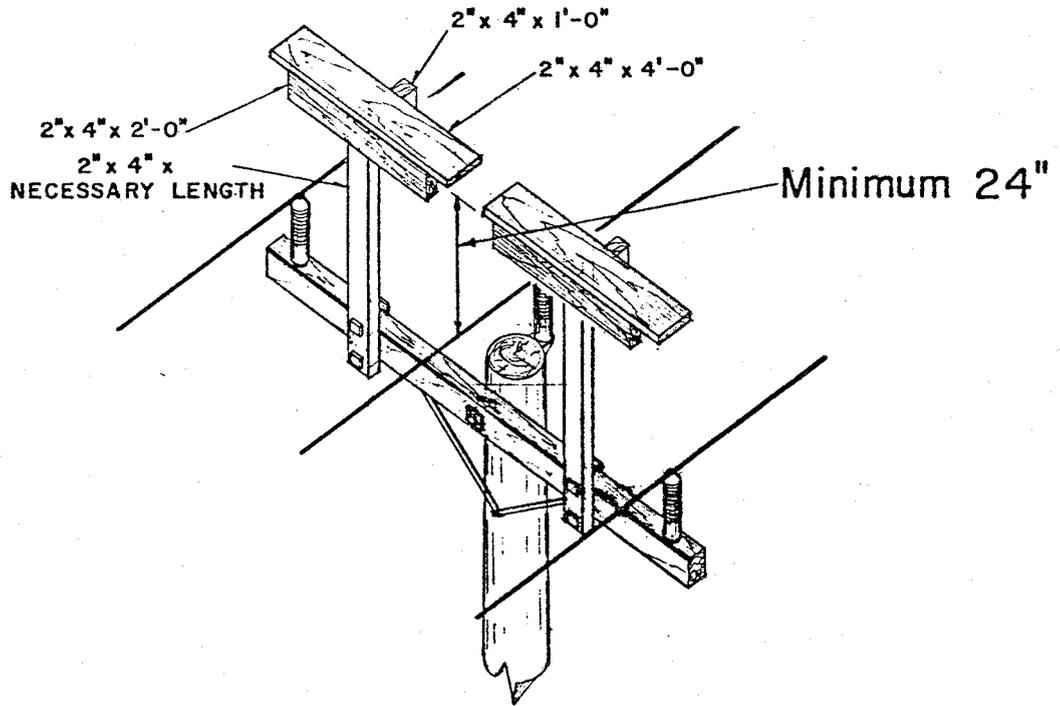
REFERENCE:

IDAHO POWER COMPANY
APPROVED BY: MORLAN W. NELSON
BIRDS-OF-PREY CONSULTANT

ALSO~
REA BULLETIN 61-10 FIGURE 8

EXHIBIT No. 3

ELEVATED PERCH CONSTRUCTION



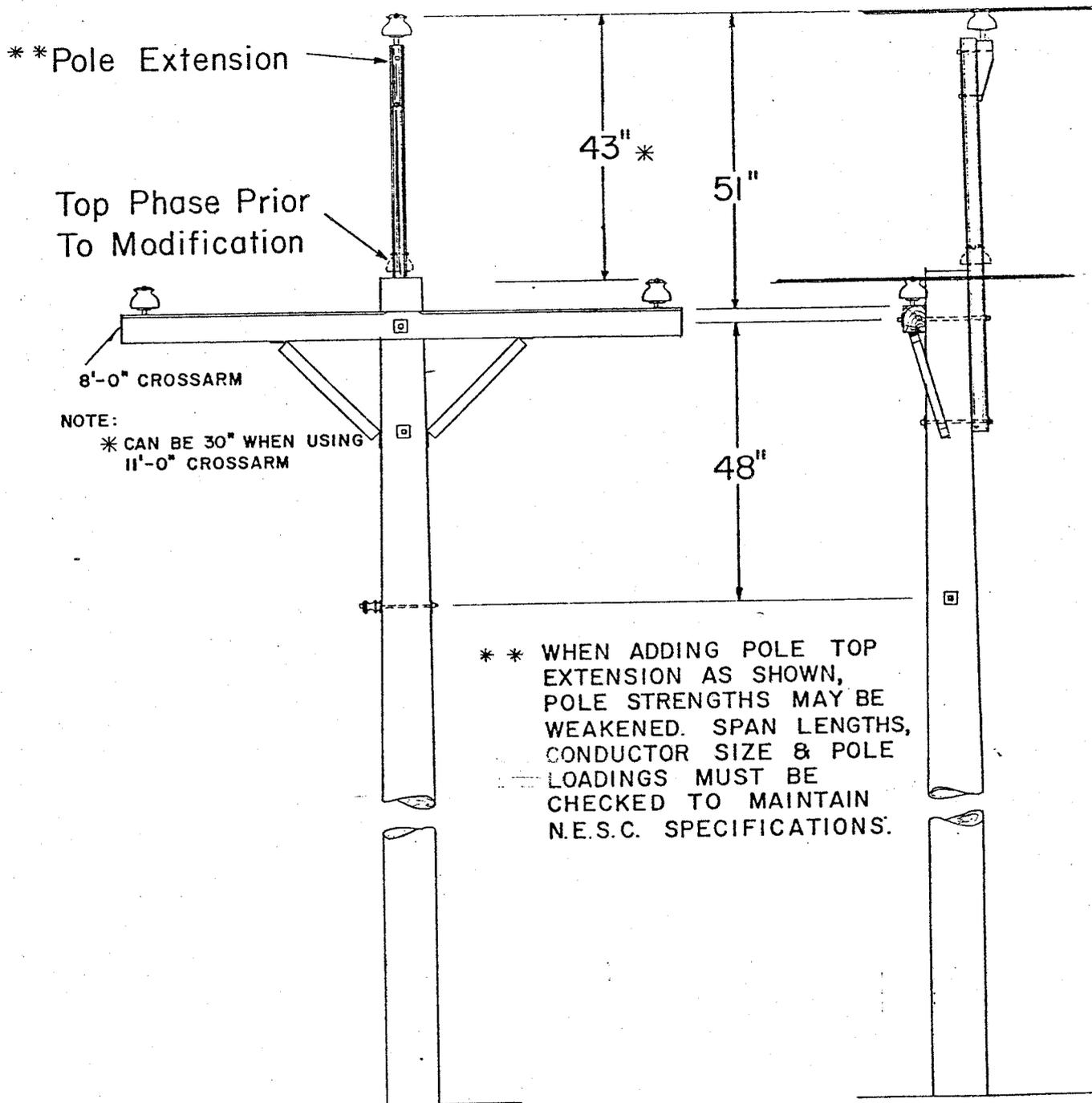
REFERENCE:

IDAHO POWER COMPANY
 APPROVED BY: MORLAN W. NELSON
 BIRDS-OF-PREY CONSULTANT

ALSO ~
 REA BULLETIN 61-10
 FIGURE 5

EXHIBIT No. 4

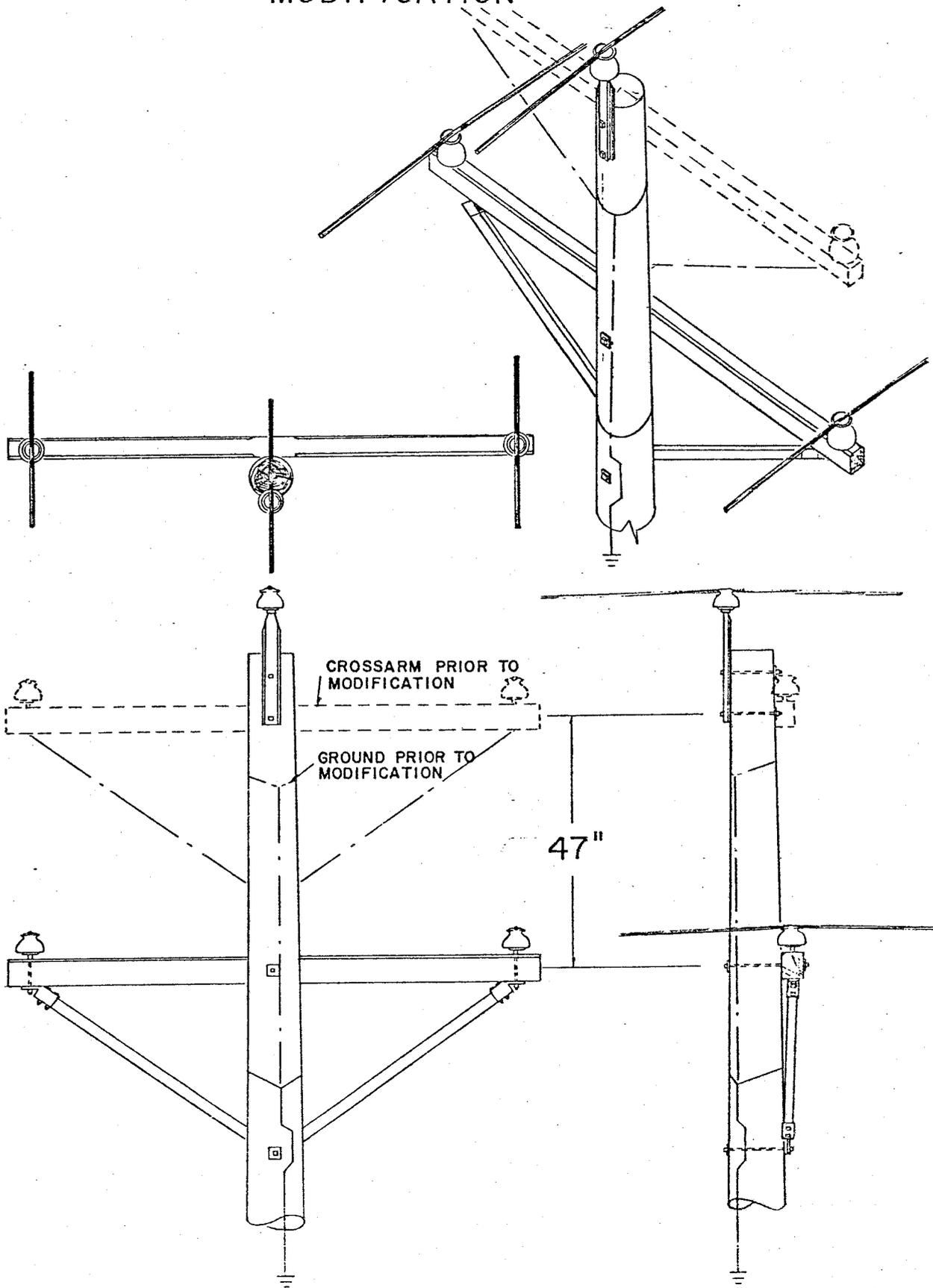
POLE-TOP EXTENSION TO ELEVATE CENTER PHASE ABOVE PLANE OF TWO OUTER CONDUCTORS



REFERENCE:

IDAHO POWER COMPANY
 APPROVED BY: MORLAN W. NELSON
 BIRDS-OF-PREY CONSULTANT

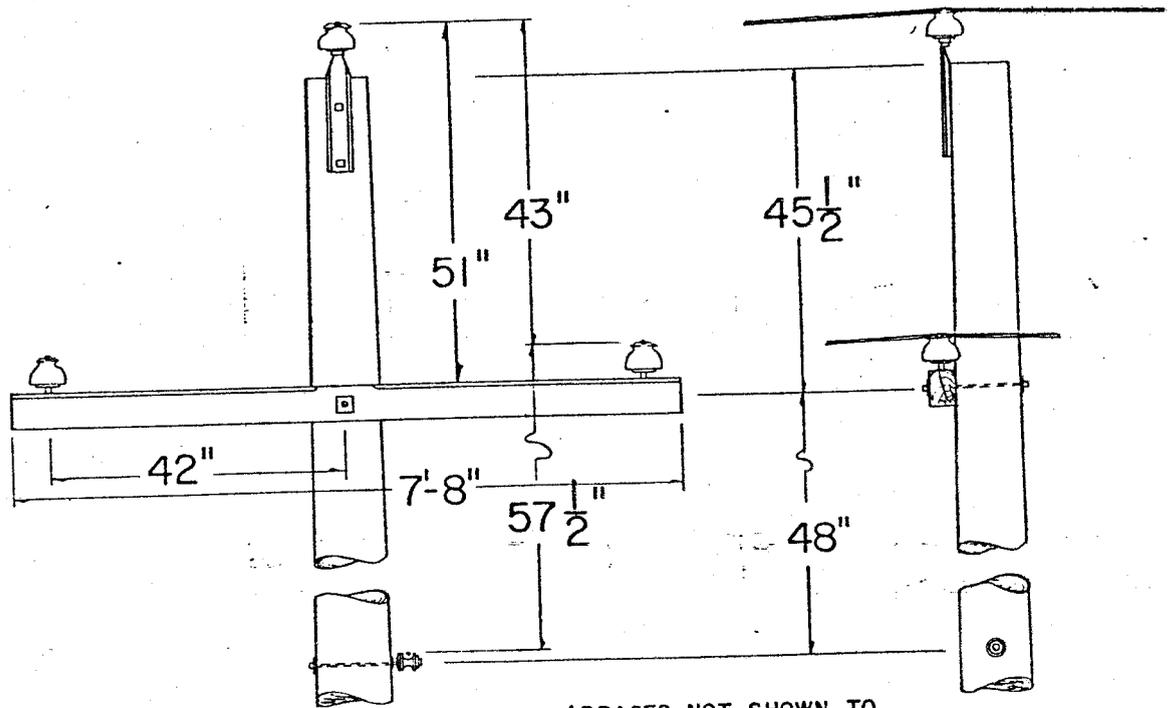
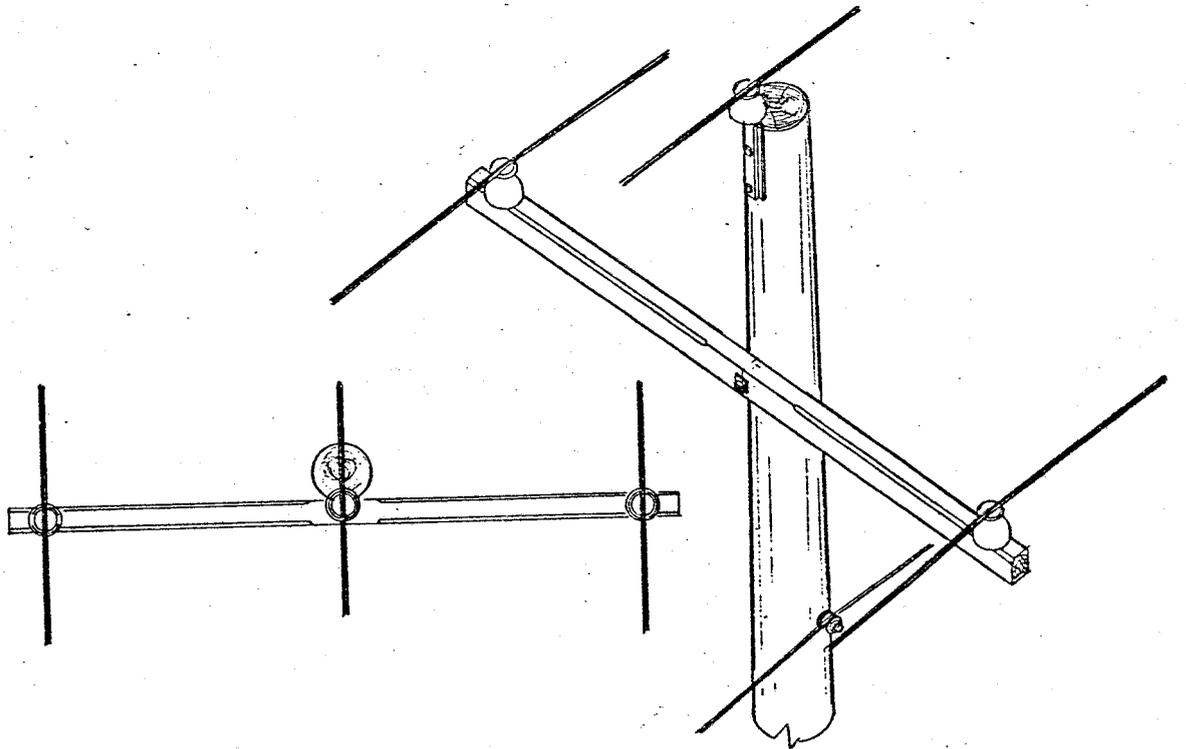
THREE PHASE DELTA LINE MODIFICATION



REFERENCE:
CALIFORNIA-PACIFIC UTILITIES COMPANY

EXHIBIT No. 6

CROSSARM DISTRIBUTION TRIANGULAR CONSTRUCTION



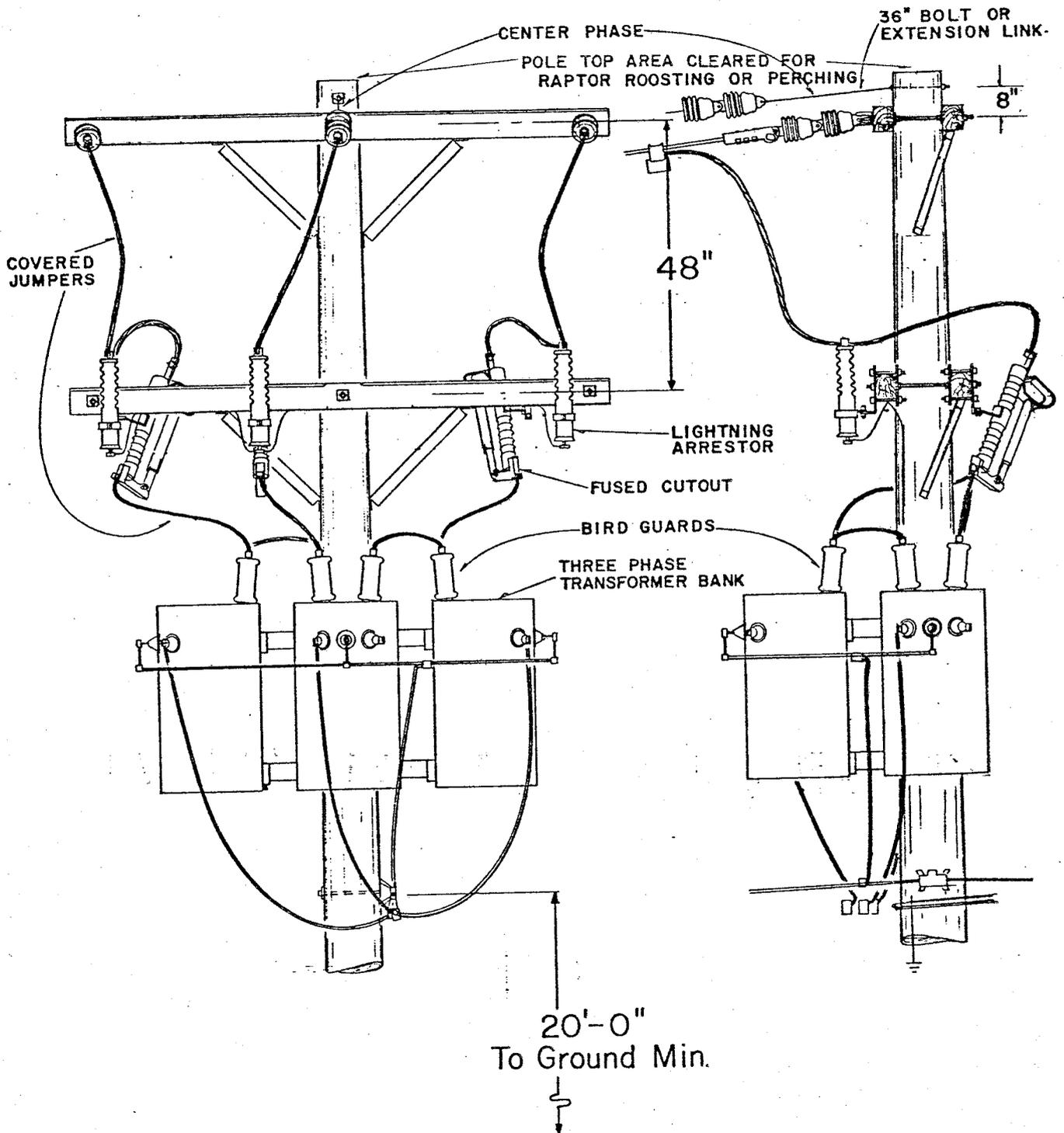
(BRACES NOT SHOWN TO
IMPROVE CLARITY OF
DRAWING.)

REFERENCE:

IDAHO POWER COMPANY
APPROVED FOR CORRECTIONS ON
PREFERRED POLES IN EXISTING LINES
BY: MORLAN W. NELSON
BIRDS-OF-PREY CONSULTANT

EXHIBIT No. 7

LOWERED SECONDARY CROSSARM CONSTRUCTION FOR PROTECTIVE EQUIPMENT

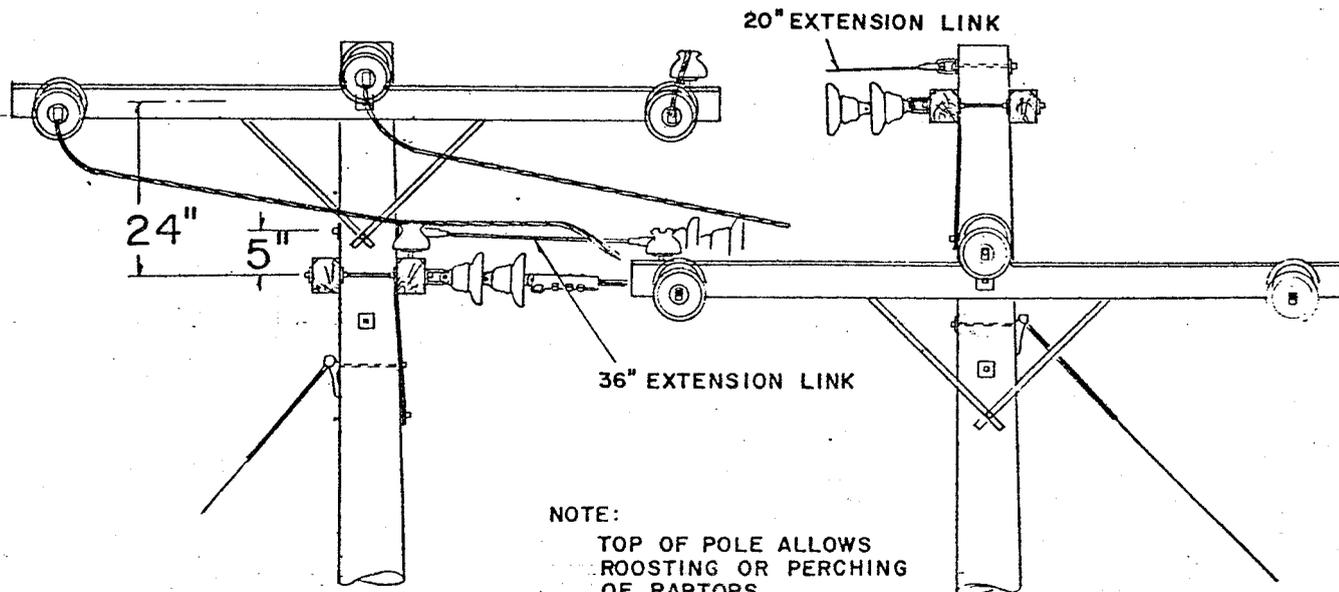
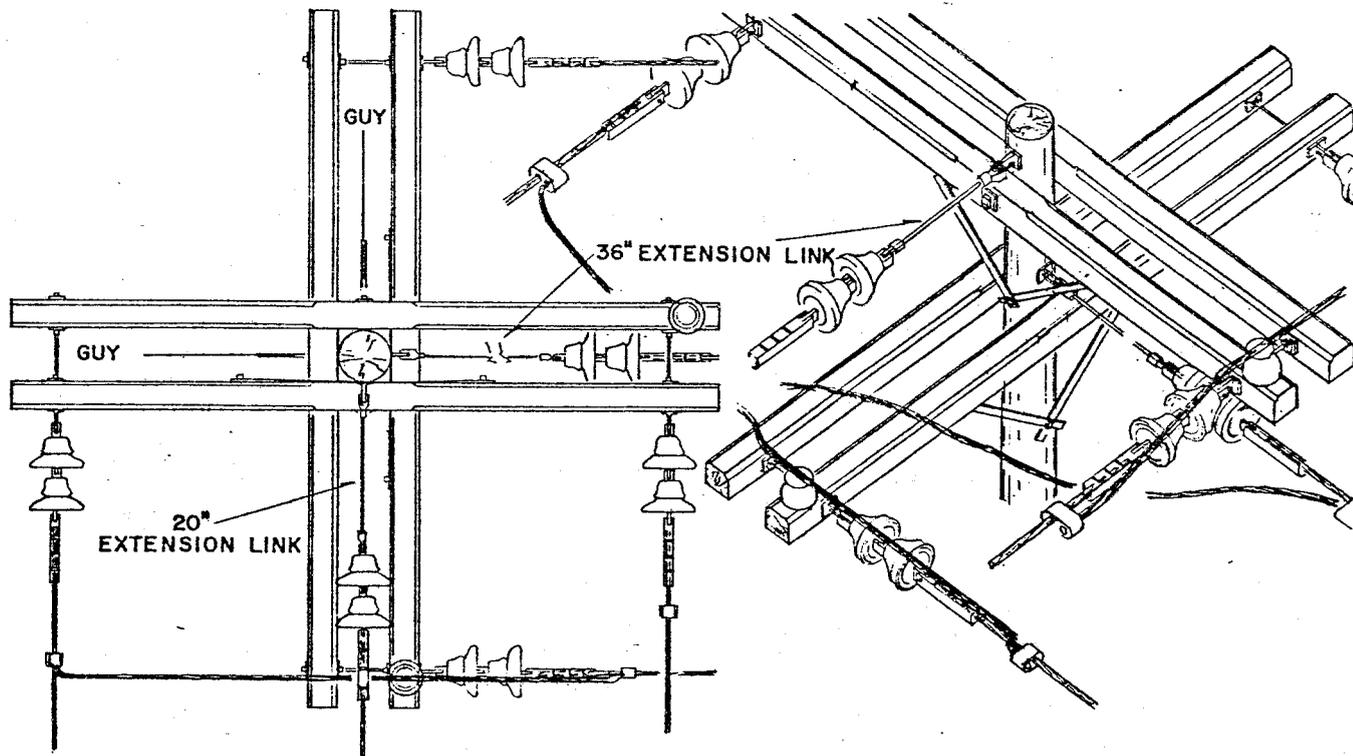


REFERENCE:

PACIFIC POWER & LIGHT COMPANY
APPROVED BY: WYOMING UTILITY
ENGINEERING COMMITTEE

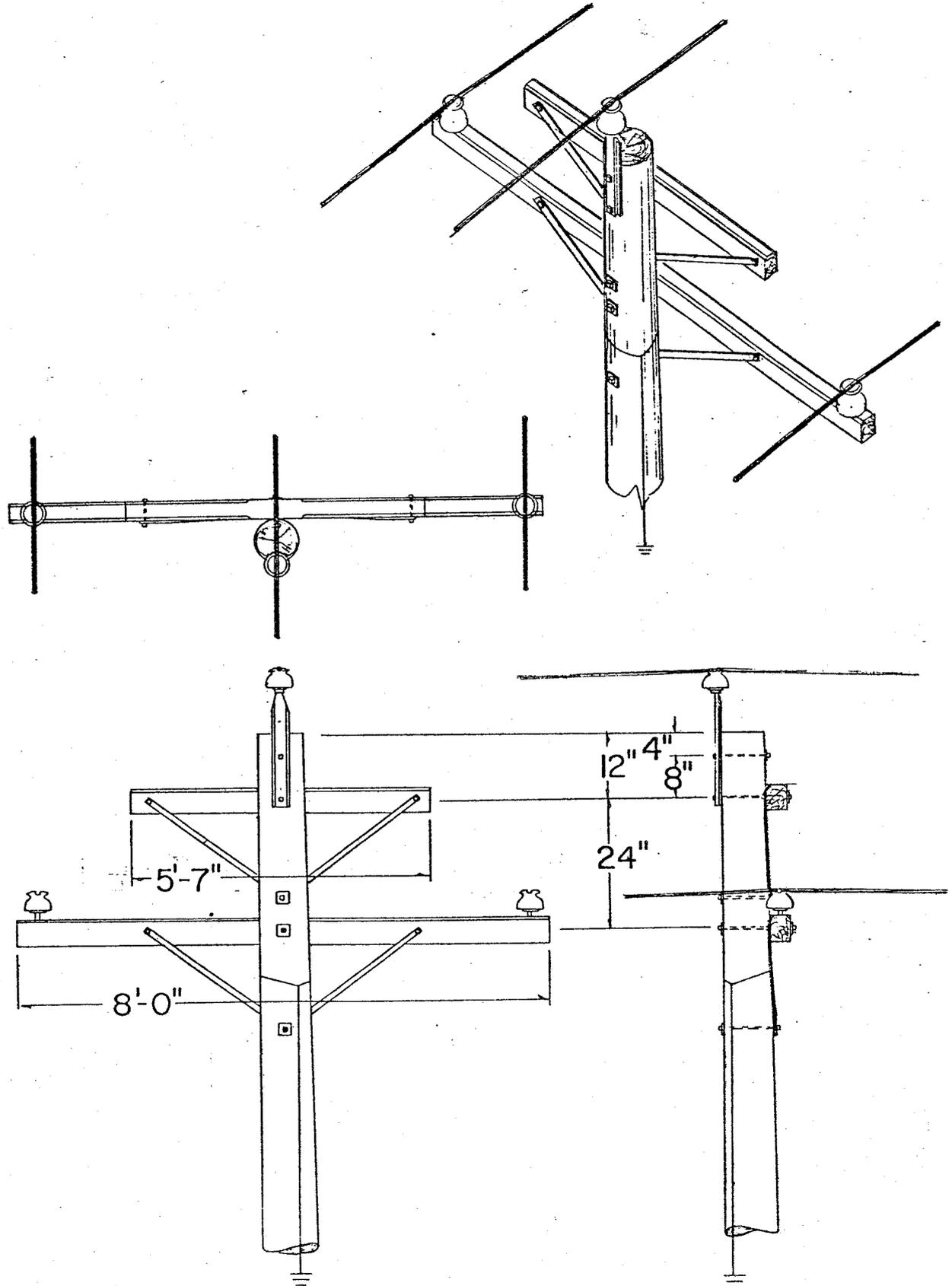
EXHIBIT No. 9

SQUARE CORNER FRAMING PRIMARIES



REFERENCE:
PACIFIC POWER & LIGHT COMPANY
APPROVED BY: WYOMING UTILITY
ENGINEERING COMMITTEE

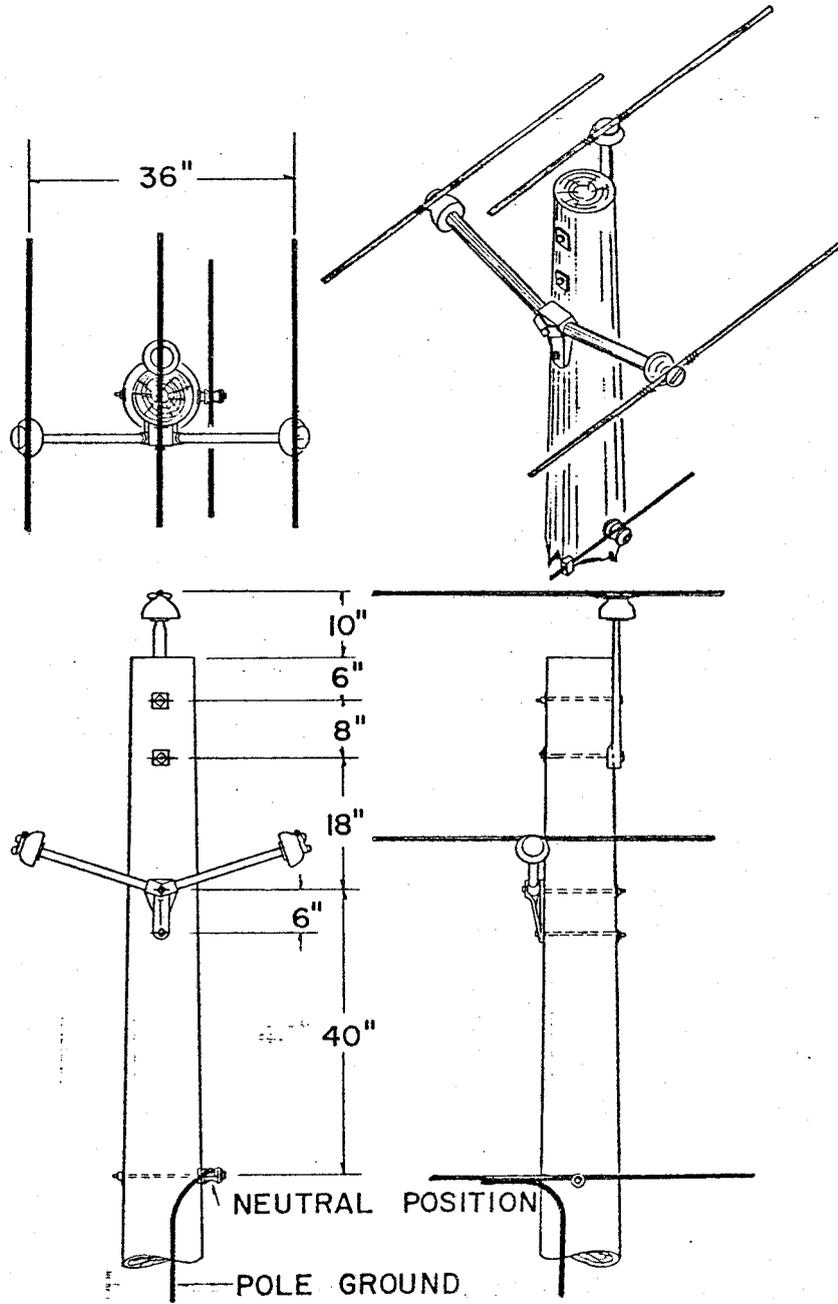
THREE PHASE DELTA LINE AFTER MODIFICATION



REFERENCE:
CALIFORNIA-PACIFIC UTILITIES COMPANY

EXHIBIT No. 10

ARMLESS TRIANGULAR CONSTRUCTION

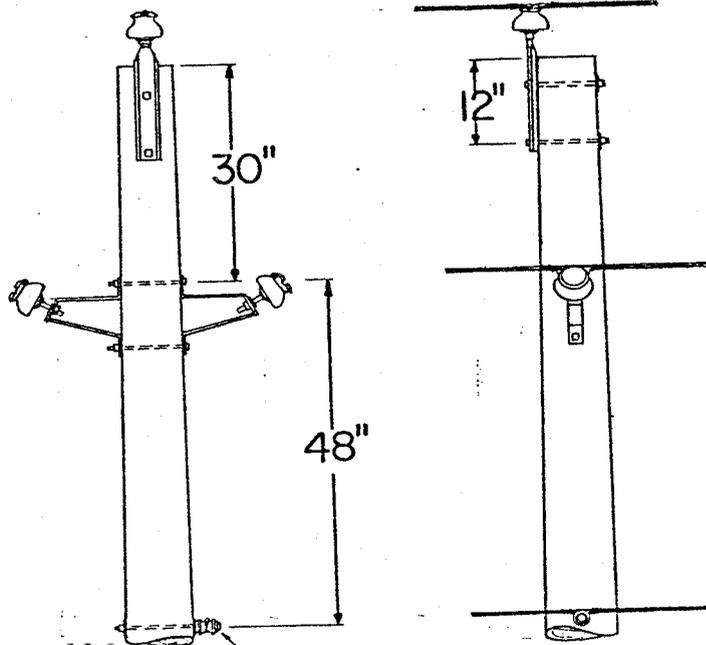
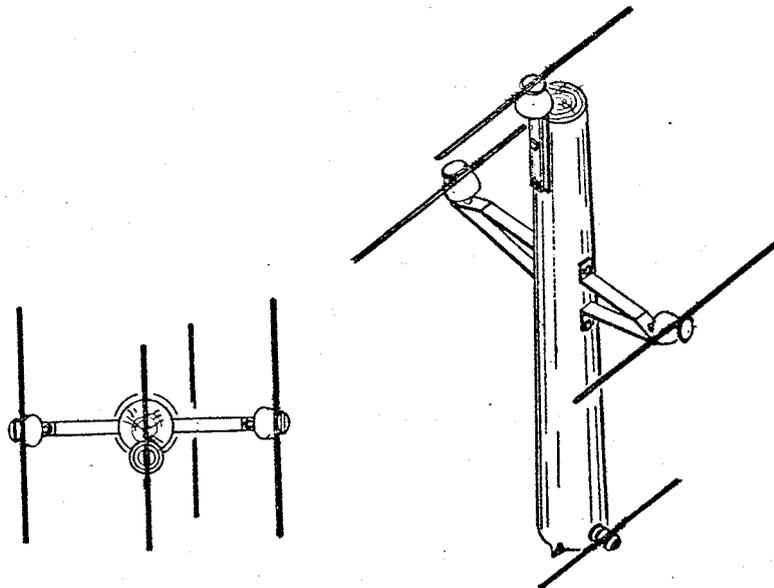


REFERENCE:

UTAH POWER & LIGHT COMPANY

EXHIBIT NO. II

ARMLESS TRIANGULAR CONSTRUCTION



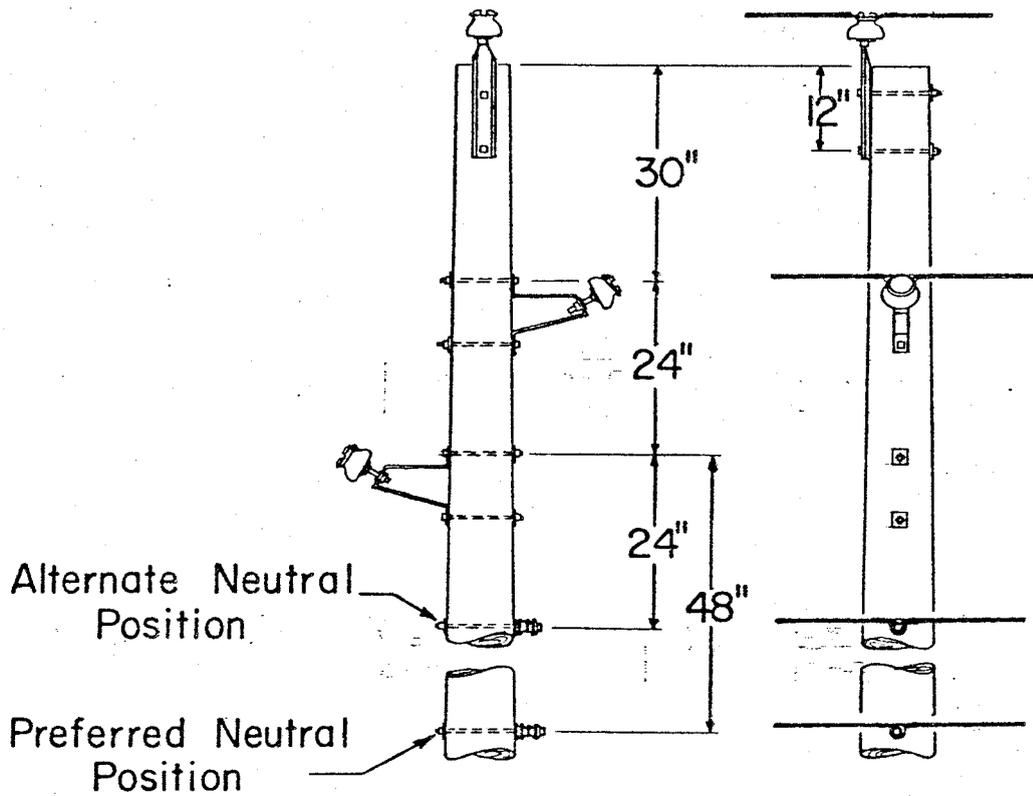
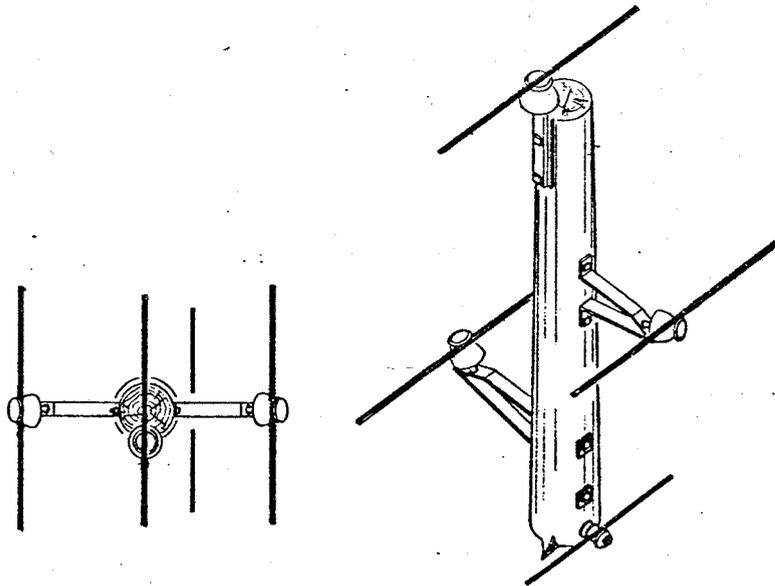
Neutral Position

REFERENCE:

IDAHO POWER COMPANY
APPROVED BY: MORLAN W. NELSON
BIRDS-OF-PREY CONSULTANT

EXHIBIT No. 12

ARMLESS STAGGERED CONSTRUCTION



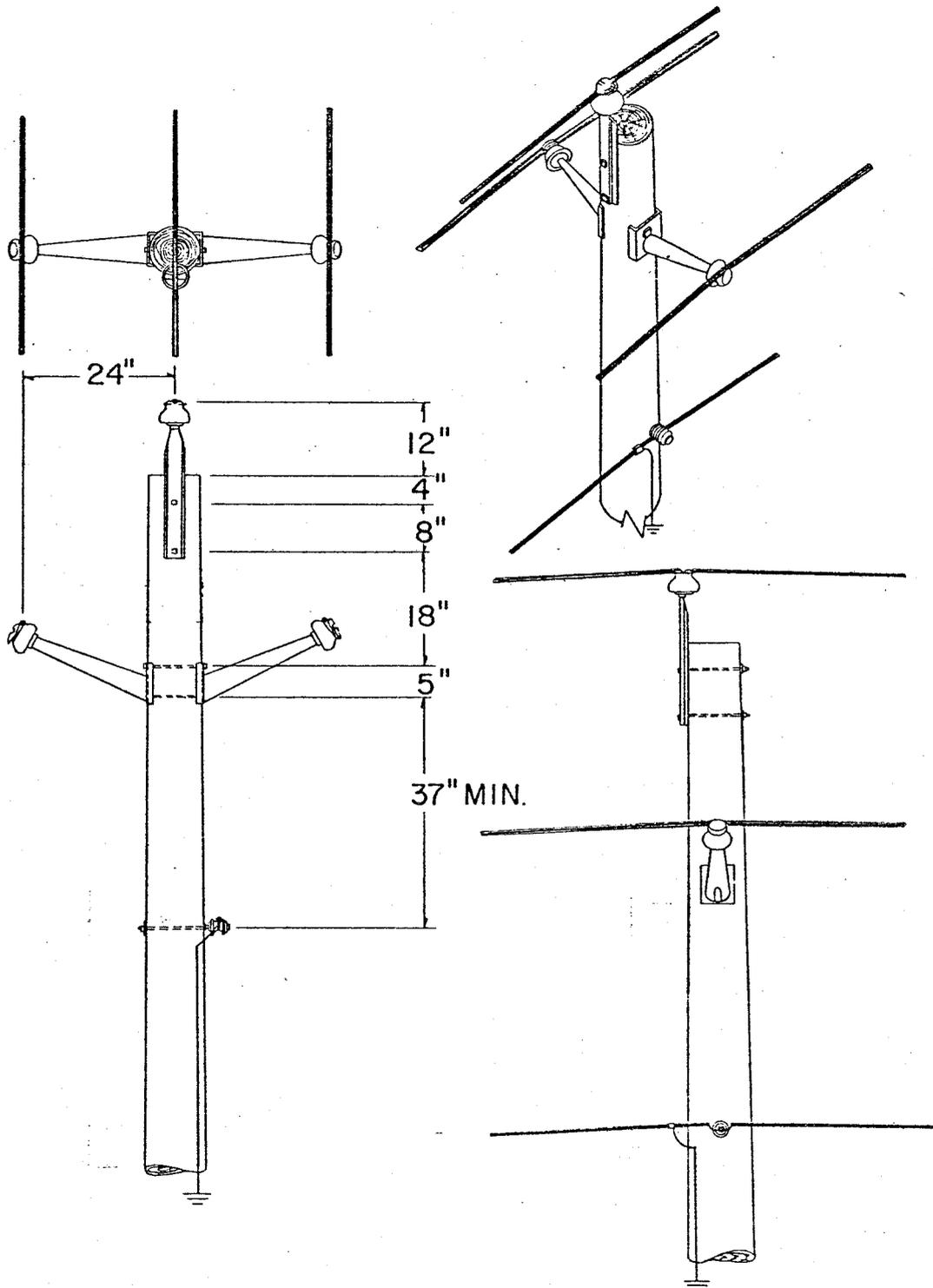
REFERENCE:

IDAHO POWER COMPANY
APPROVED BY: MORLAN W. NELSON
BIRDS-OF-PREY CONSULTANT.

ALSO ~
NEVADA POWER COMPANY

EXHIBIT No. 13

FOR TANGENTS AND LIGHT ANGLES
WITH LIGHT CONDUCTORS



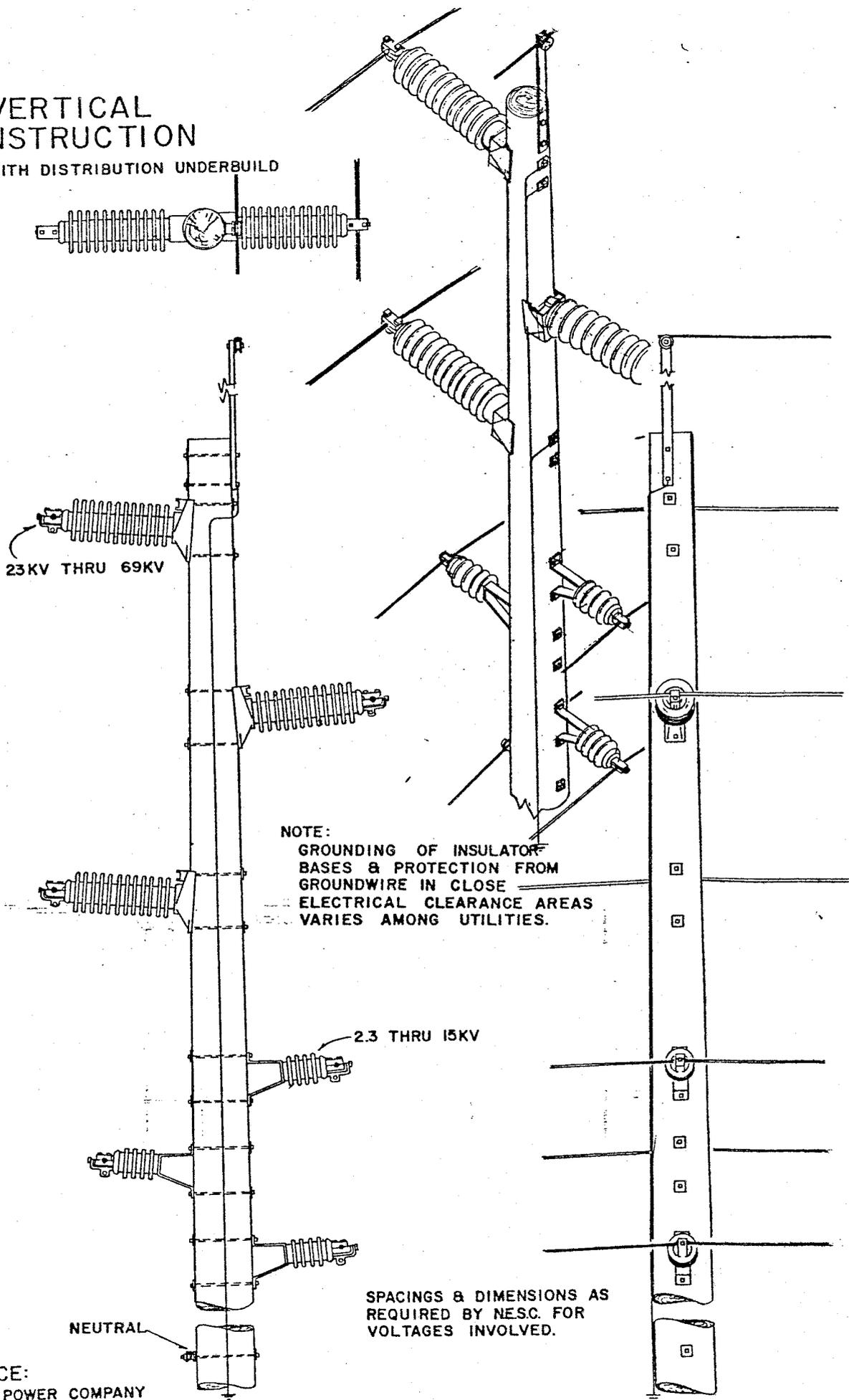
REFERENCE:

CALIFORNIA-PACIFIC UTILITIES COMPANY

EXHIBIT NO. 14

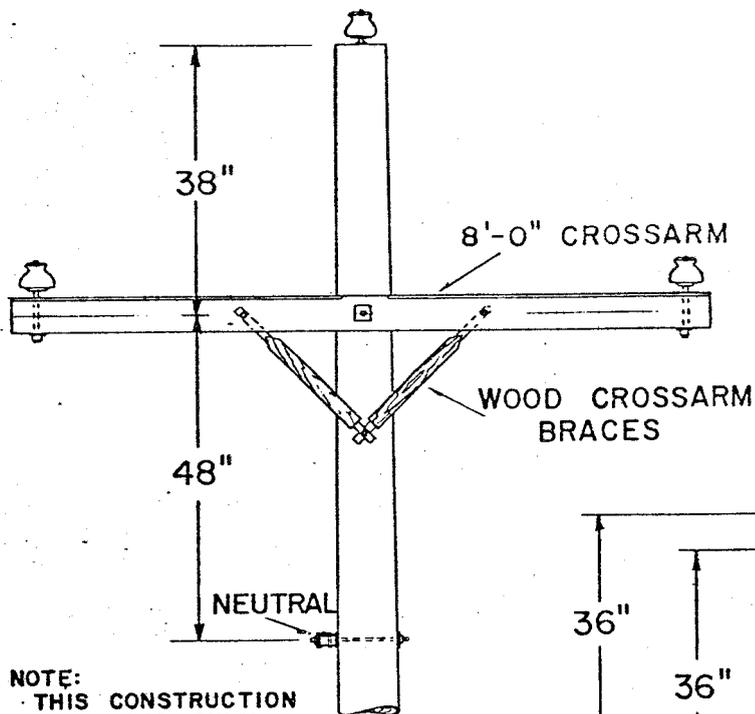
VERTICAL CONSTRUCTION

TRANSMISSION WITH DISTRIBUTION UNDERBUILD



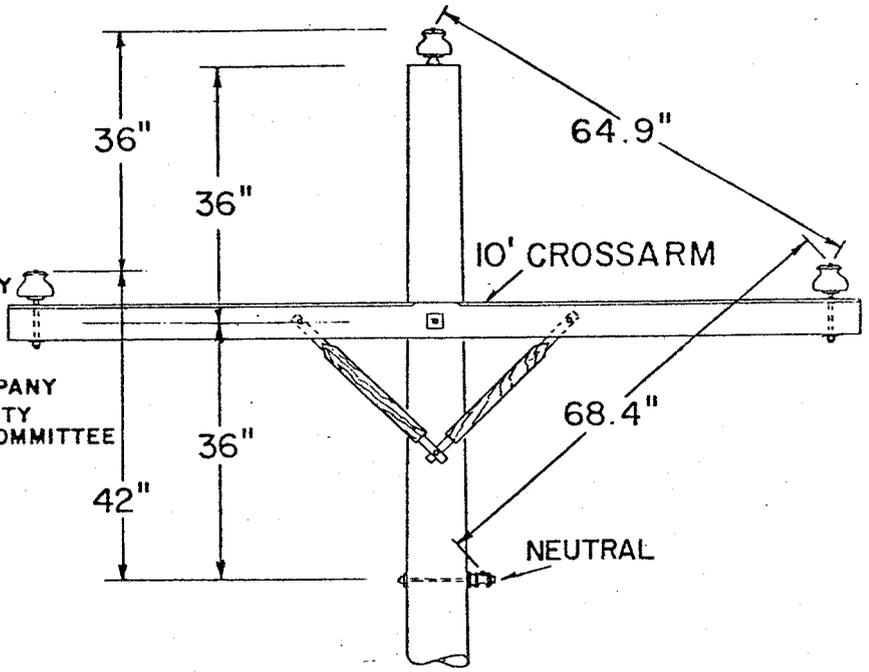
REFERENCE:

IDAHO POWER COMPANY
APPROVED BY: MORLAN W. NELSON
BIRDS-OF-PREY CONSULTANT

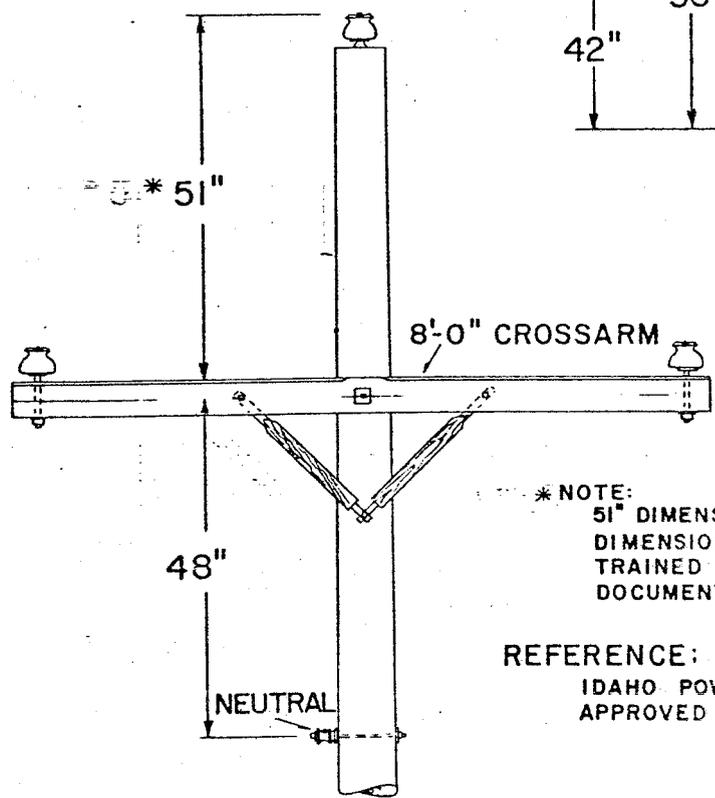


NOTE:
 THIS CONSTRUCTION
 TO BE USED ONLY IN
 AREAS WITH A KNOWN RAPTOR
 POPULATION OR WHEN SPECIFICALLY
 REQUIRED BY GOVERNMENTAL
 AGENCIES OR PROPERTY OWNERS.
 REFERENCE:

PACIFIC POWER & LIGHT COMPANY
 APPROVED BY: WYOMING UTILITY
 ENGINEERING COMMITTEE



REFERENCE:
 SIERRA PACIFIC POWER COMPANY
 24.9 KV CROSSARM - RAPTOR
 PROTECTION CONSTRUCTION



* NOTE:
 51" DIMENSION IS THE ONLY
 DIMENSION CHECKED WITH
 TRAINED EAGLES &
 DOCUMENTED ON FILM.

REFERENCE:
 IDAHO POWER COMPANY
 APPROVED BY: MORLAN W. NELSON
 BIRDS-OF-PREY
 CONSULTANT