

# Line Markers and Signage for Hazardous Liquid Pipelines and Facilities

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## Introduction

Pipelines are, for the most part, buried conduits. As such, they operate safely, quietly, and hidden from view, with little disruption to the public or the surrounding environment. These attributes, which are highly desirable in any mode of transportation, generate the need for an organized system of markers and signs that visually alert the public to the presence of a pipeline and provide a contact number of the Pipeline Operator that can be used in the event of an emergency or before excavating near pipelines. Strategic placement of markers and signs also helps the Pipeline Operator to perform right-of-way surveillance, inspections and other day-to-day activities. Pipeline markers are an integral component of an Operator's operating and maintenance program including damage prevention and public awareness programs.

This recommended practice (RP) was prepared by a committee composed of representatives from pipeline operating companies. Its purpose is to present guidelines concerning the design, fabrication, installation, and maintenance of permanently installed pipeline markers and signs.

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# Marking Liquid Petroleum Pipeline Facilities

## 1 Scope

**1.1** This RP addresses the permanent marking of hazardous liquid pipeline transportation facilities. It covers the design, message, installation, placement, inspection, and maintenance of markers and signs on pipeline facilities located onshore and at inland waterway crossings. Markers and signs indicate the presence of a pipeline facility and warn of the potential hazards associated with its presence and operation. The markers and signs may contain information to be used by the public when reporting emergencies and seeking assistance in determining the location of a buried pipeline.

**1.2** The provisions of this RP cover the minimum signage (markers and signs) requirements for hazardous liquid pipeline facilities. The Pipeline Operator is responsible for determining the type and extent of signage. Consideration should be given to the hazardous characteristics of the commodity being transported; the pipeline's proximity to industrial, commercial, residential, and environmentally sensitive areas; susceptibility to excavation-related damage; consequences of failure; and applicable state and federal laws. Several examples of markers and signs with locations are illustrated in Figure 1, Figure 2, Figure 3, Figure 4, Figure 6, and Figure 8. The pipeline marking programs are integral components of the Pipeline Operator's operations, maintenance and emergency plans, damage prevention programs, and public awareness programs.

## 2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASME B31.4 <sup>1</sup>, Pipeline Transportation Systems for Liquids and Slurries

49 Code of Federal Regulations Part 195 <sup>2</sup>, "Transportation of Hazardous Liquids by Pipeline"

## 3 Terms and Definitions

For the purposes of this document, the following definitions apply.

### 3.1

#### **aerial patrol or air patrol marker**

A marker observable from the air, which is used to identify a pipeline's reference location by the aerial patrol pilot while conducting aerial surveillance of a pipeline right-of-way (ROW).

**NOTE** Information on the marker might consist of distance from a point of reference, usually in miles, name or numbers of above ground facilities, direction of the ROW, a Point of Intersection (PI) where the ROW turns, or other information useful to the pilot.

### 3.2

#### **hazardous liquid**

Petroleum, petroleum products, anhydrous ammonia, ethanol, or carbon dioxide and any substance that may pose an unreasonable risk to life or property if released, when transported by a hazardous liquid pipeline facility in a liquid state.

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<sup>1</sup> ASME International, 3 Park Avenue, New York, NY 10016-5990, [www.asme.org](http://www.asme.org).

<sup>2</sup> The *Code of Federal Regulations* is available from the U.S. Government Printing Office, Washington, DC 20402.

**3.3****line marker or pipeline marker**

Signage used along the pipeline ROW and at above ground pipeline facilities to alert the public and emergency responders of the presence of a pipeline facility.

**3.4****petroleum**

Crude oil, condensate, natural gasoline, natural gas liquids, and liquefied petroleum gas.

**3.5****petroleum product**

Flammable, toxic, or corrosive products obtained from distilling and processing of crude oil, unfinished oils, natural gas liquids, blend stocks, and other miscellaneous hydrocarbon compounds.

**3.6****other markers**

Signage other than aerial patrol, air patrol marker, line marker, or pipeline marker used to identify the presence of a pipeline facility solely for the benefit of a Pipeline Operator or to provide additional information concerning the location or facility.

**3.7****pipeline facility**

New and existing pipe; rights-of-way; and any equipment, facility, or building used in the transportation of hazardous liquids or carbon dioxide.

**3.8****pipeline operator**

Any individual, firm, joint venture, partnership, corporation, association, state, municipality, and cooperative association, including any trustee, receiver, assigned or personal representative thereof, who owns and operates a pipeline system.

**3.9****pipeline system**

All parts of a pipeline facility through which hazardous liquid is transported that includes, but is not limited to, pipe; valves, and other appurtenances connected to the pipe; pumping units, along with the fabricated assemblies associated with the pumping units; metering and delivery stations and fabricated assemblies therein; and breakout tanks.

**3.10****Point of Inflection****PIs**

A change in the pipeline(s) direction or point of intersection.

**3.11****sign**

A publicly displayed or posted notice, board, or other device bearing letters, symbols, and/or designs to convey a designation, name, direction, information, instruction, warning, or other message.

**3.12****signage**

Permanent signs, collectively, including aerial patrol or air patrol markers, line markers, pipeline markers, other markers, and signs, such as those around pump stations and breakout stations used to warn or notify the public or emergency responders regarding the presence of a pipeline facility and telephone number of the Operator.

NOTE Temporary signage, such as flags, stakes, and other markings used to temporarily mark facilities for the purpose of excavation-related work, is not addressed by this RP.

## 4 Conflicting Requirements

If any provisions of this RP present a direct or implied conflict with any statutory regulation, the regulation shall govern. However, if this RP's recommendations are more stringent than the requirements of the regulation, then the recommendations presented herein should be considered.

## 5 Pipeline Facility Marking Practice

### 5.1 General Description, Use, and Placement of Signage

5.1.1 Signage can be found in various shapes, sizes, and designs. Permanent pipeline facility markers and signs are used to convey the following information to the public and emergency responders:

- a) the presence of a hazardous liquid pipeline facility;
- b) the word "Warning," "Caution," or "Danger" followed by the words "Petroleum (or the name of the hazardous liquid transported) Pipeline" or "Carbon Dioxide Pipeline";
- c) name of Operator and a telephone number (including area code) where the Operator can be reached 24 hours a day to:
  - 1) determine the location of the buried pipeline,
  - 2) receive authorization to cross or occupy the pipeline rights-of-way,
  - 3) report emergencies relating to the pipeline or pipeline right-of-way.

NOTE Before installing line markers, notify local One Call Center in accordance with state One Call laws and regulations.

5.1.2 Pipeline personnel may use pipeline markers, aerial markers and other signs to readily identify pipelines, pipeline right-of-way, or crossings for day-to-day operation and maintenance activities or emergency response.

5.1.3 Regulations require pipeline markers to be located at each public road crossing, at each railroad crossing, and in sufficient number along the remainder of each buried line so that its location is accurately known. Markers should be located along bends or inflection points along the pipeline so that the route of the buried pipeline's location is accurately known. Consideration should also be given to installing signage at each river crossing if permissible.

When installing aerial markers, consideration should be given to terrain, land use adjoining the ROW, flight paths, and physical points along the ROW to be identified, such as PIs and main line-lateral take-offs. When determining the frequency and spacing between markers, consideration should be given to land use, terrain, environment, population density, local ordinances, and other damage prevention considerations such as special excavation activity, One Call law exemptions, and frequency of excavated related near misses.

Line markers should be installed over each pipeline; there are locations where this is impractical, such as when a pipeline runs down the middle of the street, parallels the road under the shoulder, or traverses heavily developed urban areas. Supplemental signage such as curb markers, ground level markers or pavement decals should also be considered.

When determining the frequency and spacing between markers, consideration should be given to land use, terrain, environment, population density, and local ordinances. Damage prevention measures, such as extensive or unusual

excavation activity, areas exempted under One Call laws, and locations where excavation near misses have occurred, may also be examined when considering a location of a marker.

When line markers cannot be placed directly over or adjacent to the pipeline, it is recommended the signage clearly indicate that the pipeline is an offset line marker. Examples of offset markers are shown in Figure 3.

At a minimum, locations should be chosen to meet or exceed the requirements of 49 *CFR* Part 195. Examples of cross country right-of-way line markings are shown in Figure 1 and Figure 2.

## 5.2 Types of Posts

The type of post used will be dependent on the signage used and location. Posts may be made of any materials that will ensure adequate strength, stiffness, visibility, and durability. To maintain structural integrity and appearance, some post materials require surface protection against above- and below-ground corrosion or weathering. A proven coating system that provides a suitable finish and nonfading color should be selected for this purpose. When choosing the post material considerations should be given to the type of environment the post is exposed too. The following criteria should be applied in the selection of marker posts:

- a) metal pipe posts should be straight, sound, and have a nominal diameter of 2 in. or larger.
- b) metal structures designed for use as posts may be used.

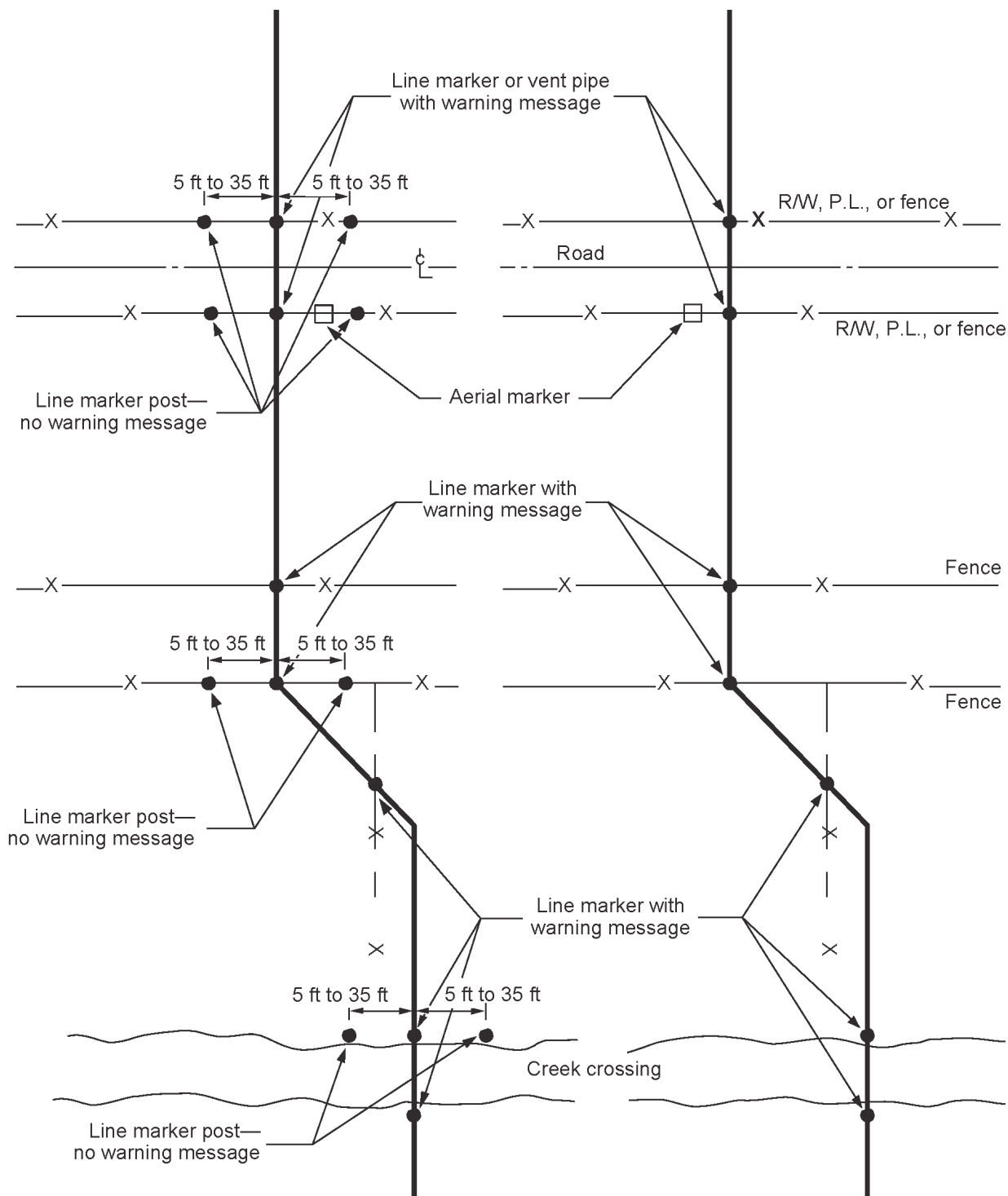
When installing signage with steel posts, there should be a minimum of 12 in. of clearance between the steel post and the outside of the pipe (49 *CFR* Part 195.250). If 12 in. of clearance is impracticable, the clearance may be reduced if adequate provisions are made to protect the pipeline from electrical surges such as lightning strikes and for corrosion control.

- c) Straight posts made from debarked trees and treated with a pressure-applied chemical preservative may be used. The post should be sized to provide multiple years of use with consideration for burial type, burial depth, soil condition, etc. Wood posts are not recommended where brush or grass fires may be reasonably expected.
- d) Square precast reinforced-concrete posts having a minimum cross-sectional area of 16 in.<sup>2</sup> may be used. Special conditions, such as spalling during freeze and thaw cycles, should be considered when specifying material for these types of posts.
- e) Posts made of polyvinyl-chloride (PVC), polyethylene, and fiberglass may be used. Materials used should be resistant to ultraviolet exposure and suited to the environment where they are installed (see Figure 3).
- f) Other materials are acceptable provided they meet the general criteria discussed above.

## 5.3 Line Markers

**5.3.1** 49 *CFR* Part 195 requires that certain information be presented on line markers in lettering of a certain size and stroke. The regulations further require that line markers be placed over all buried pipelines at each public road crossing and at each railroad crossing in sufficient numbers along the remainder of each buried pipeline so that its location is accurately known.

**5.3.2** The line marker's message should be presented on strong, durable material finished to resist the effects of exposure and vandalism. The message should state at least the following: "WARNING," "Caution" or "Danger" followed by the words "PETROLEUM [or the name of the liquid petroleum transported] PIPELINE." The lettering should be at least 1 in. high with an approximate stroke of 1/4 in. on a background of sharply contrasting color. It should also contain the name of the Pipeline Operator with a telephone number, including an area code, where the Pipeline Operator can be reached at all times.

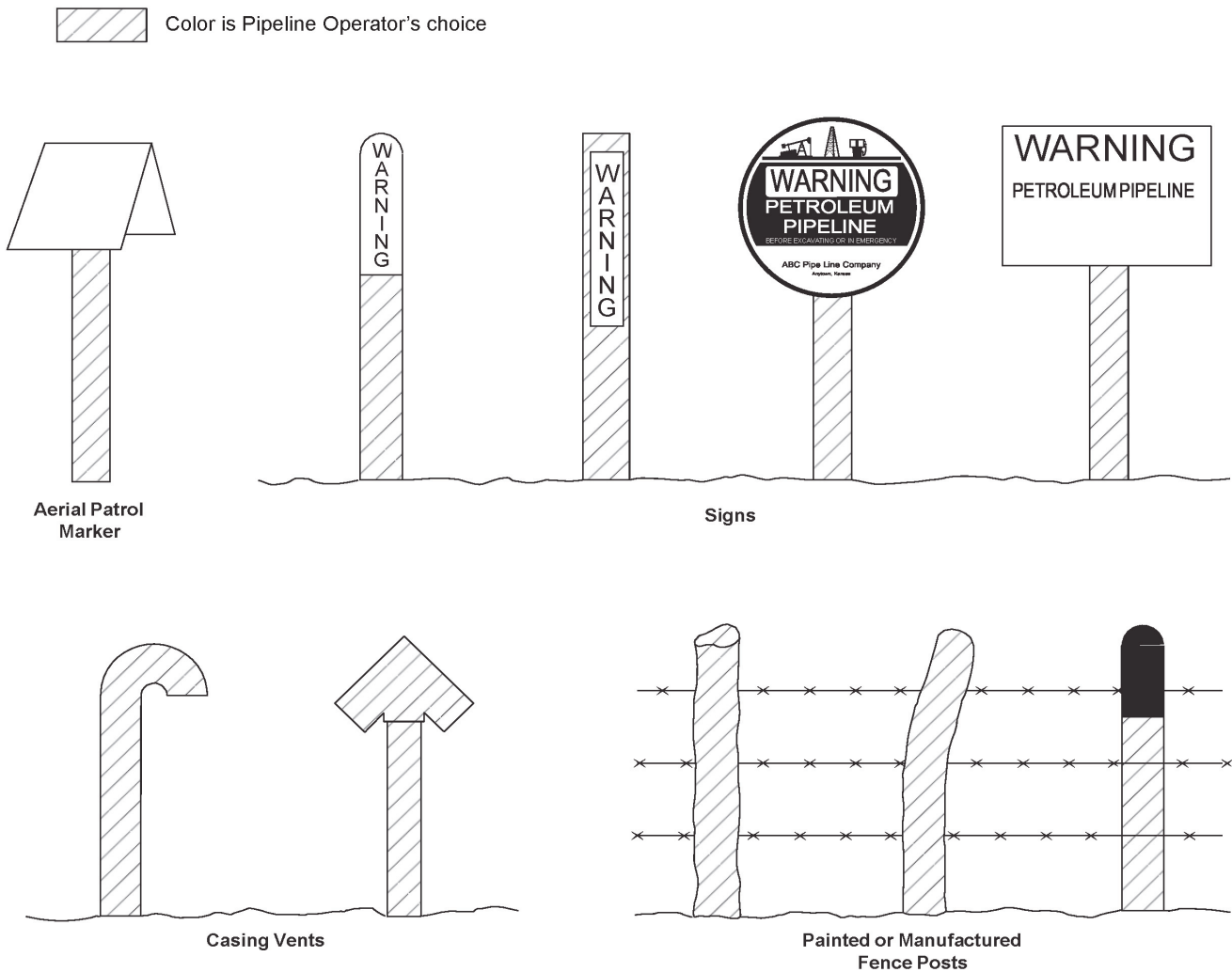


NOTE 1 R/W = right-of-way or ROW  
 NOTE 2 P.L. = property line

**Figure 1—Examples of Cross Country Right-of-Way Marking Locations**

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**Figure 2—Examples of Cross Country Markers and Signs**

**5.3.3** The line markers depicted in Figure 3 and Figure 4 are examples of line markers in general use by the liquid petroleum pipeline industry. The dimensions, wording, colors, and configuration shown on the figures are recommended for good visibility. The size and style of the lettering identifying the Pipeline Operator are optional. A trademark or other identifying symbol may appear as part of the Pipeline Operator's identification.

**5.3.4** Caution should be used when installing a line marker anywhere other than directly over or in proximity to the buried pipeline to avoid any possible misinterpretation as to where the actual pipeline is located. Examples of Offset Markers are shown in Figure 3.

## 5.4 Signage

**5.4.1** The Pipeline Operator may use markers and signs in addition to line markers to aid in determining the location of the pipeline. Examples of additional markers are included:

- a) aerial patrol markers;



Figure 3—Examples of Offset Markers and Signs

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- b) prominently colored posts at fences, and right-of-way limits of roads and railroads;
- c) markers at banks of water crossings;
- d) stenciled markings on the surface of pavements (see Figure 5);
- e) buried tape or warning mesh;
- f) casing vents;
- g) cathodic protection test stations;
- h) any other kind of marker the Operator recognizes as necessary in such locations.

**5.4.2** When signs are used to identify pipeline crossings at navigable waterways they should contain the words "DO NOT ANCHOR OR DREDGE." The sign's lettering should not be less than 12 in. high, with an approximate stroke of 1 <sup>3</sup>/<sub>4</sub> in. on a background of sharply contrasting color. This lettering is in addition to the information recommended in 5.3.1 and 5.3.2. Because government agencies or authorities may share jurisdiction over certain navigable waterways, the specifications for and placement of markers for a particular waterway should satisfy those joint requirements. Many agencies accept or adopt the requirements of the United States Army Corps of Engineers. Figure 7 shows an appropriate navigable waterway sign.

**5.4.3** The Pipeline Operator may elect to place markers of special design in particular locations where current or projected activities may warrant their installation. Consideration should be given to whether the markers are for temporary or permanent service.

**5.4.4** Aerial patrol markers may be used along the routes of pipelines that are patrolled by aircraft. Figure 8 is an example of a typical aerial marker. When used, aerial markers should be placed or positioned at locations where they can easily be identified from the air.

## **5.5 Installation**

**5.5.1** Typically, the message portion of any marker is attached to, or is an integral part of, a post of the type described in 5.2.

**NOTE** Before installing line markers, notify the local One Call Center in accordance with State One Call laws and regulations.

**5.5.2** The following factors should be considered in determining the depth to bury marker posts:

- a) post material;
- b) method of installation;
- c) type of soil;
- d) state of soil consolidation;
- e) depth of frost line and propensity of soil to heave;
- f) size, shape, height, and weight of the pipeline marker assembly;
- g) exposure to external forces such as wind, high water, currents, large livestock, or wildlife;
- h) depth of pipeline to be marked.



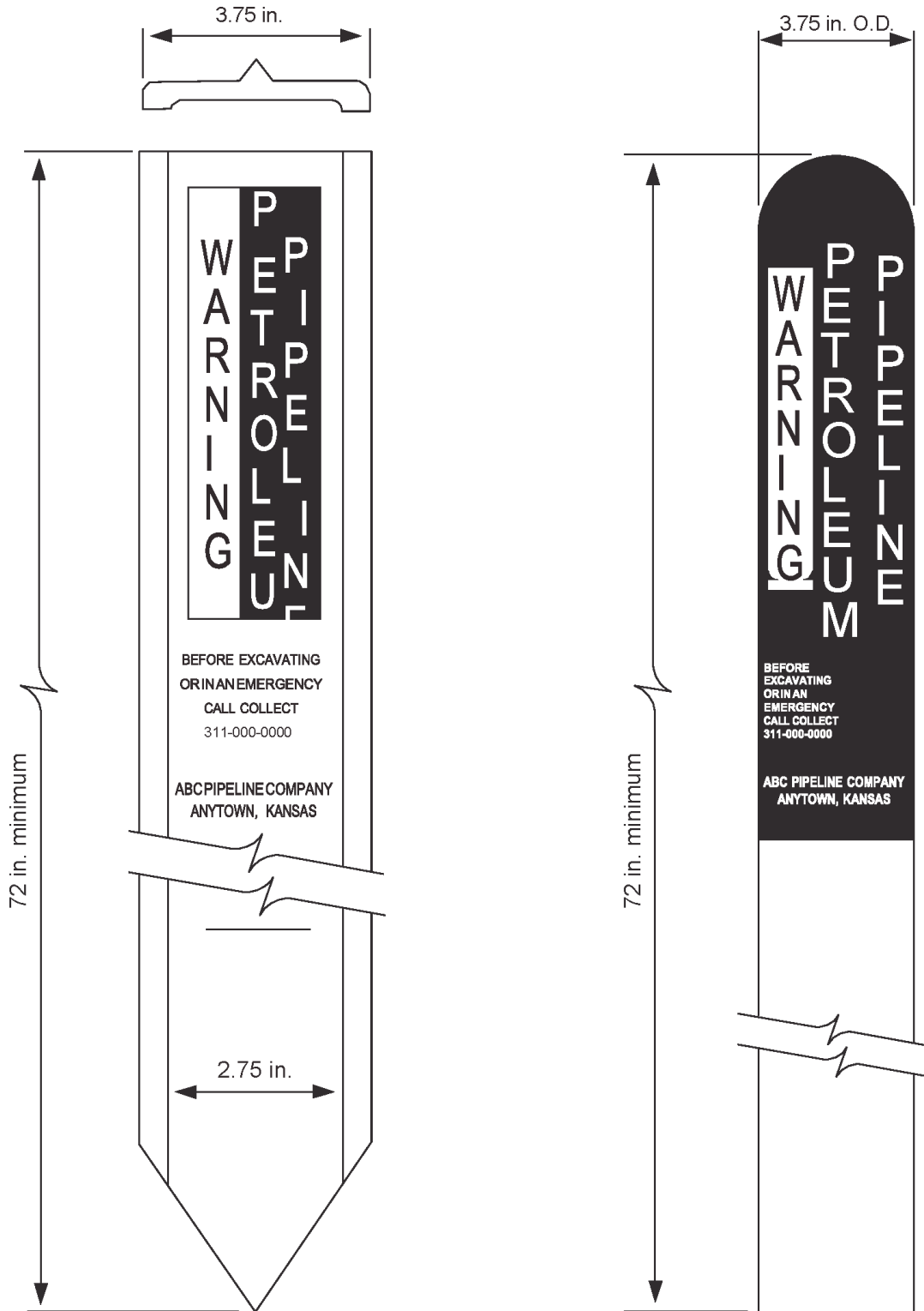


Figure 4—Line Markers

Consideration should also be given to attaching the message portion of any marker to pipeline vent pipes, fences, fence posts, or other existing posts to reduce the overall clutter at the site, provided that in the case of line markers, the requirements noted in 5.3.1 are met.

**5.5.3** Aboveground markers should be sufficiently elevated to allow them to be clearly viewed from a distance, and to allow them to remain visible above normal vegetation or snow accumulation. A minimum height of 4 ft above grade is recommended. The effect that agriculture use and/or type of crops raised has on the visibility of the marker should be considered when determining the location and height of the marker.

**5.5.4** When necessary, the post holes should be backfilled with concrete.

**5.5.5** When installing posts, caution should be exercised to avoid underground structures.

**5.5.6** The bottom of posts may be modified or fitted with transverse members to inhibit unauthorized removal or ejection by frost heaving.

## **6 Aboveground Pipeline Facility Marking and Signage Practice**

### **6.1 Pipelines**

49 *CFR* Part 195 requires that line markers be installed at locations where the pipeline is aboveground in areas that are accessible to the public.

### **6.2 Pipeline Facilities Signs**

Pipeline facilities such as stations, terminals, tank farms, valves, metering, or pipeline junction manifolds should be marked with appropriate signage. Figure 9 shows examples of signs. These signs should contain the name of the Pipeline Operator with a telephone number, including an area code, where the Pipeline Operator can be reached at all times and the name of the facility. Other information, such as the type or name of the facility, a physical address of the location, and how to contact 911 or providing emergency instructions may also be included on signage. Prohibitions and warnings are often included on signage.

### **6.3 Sign Placement**

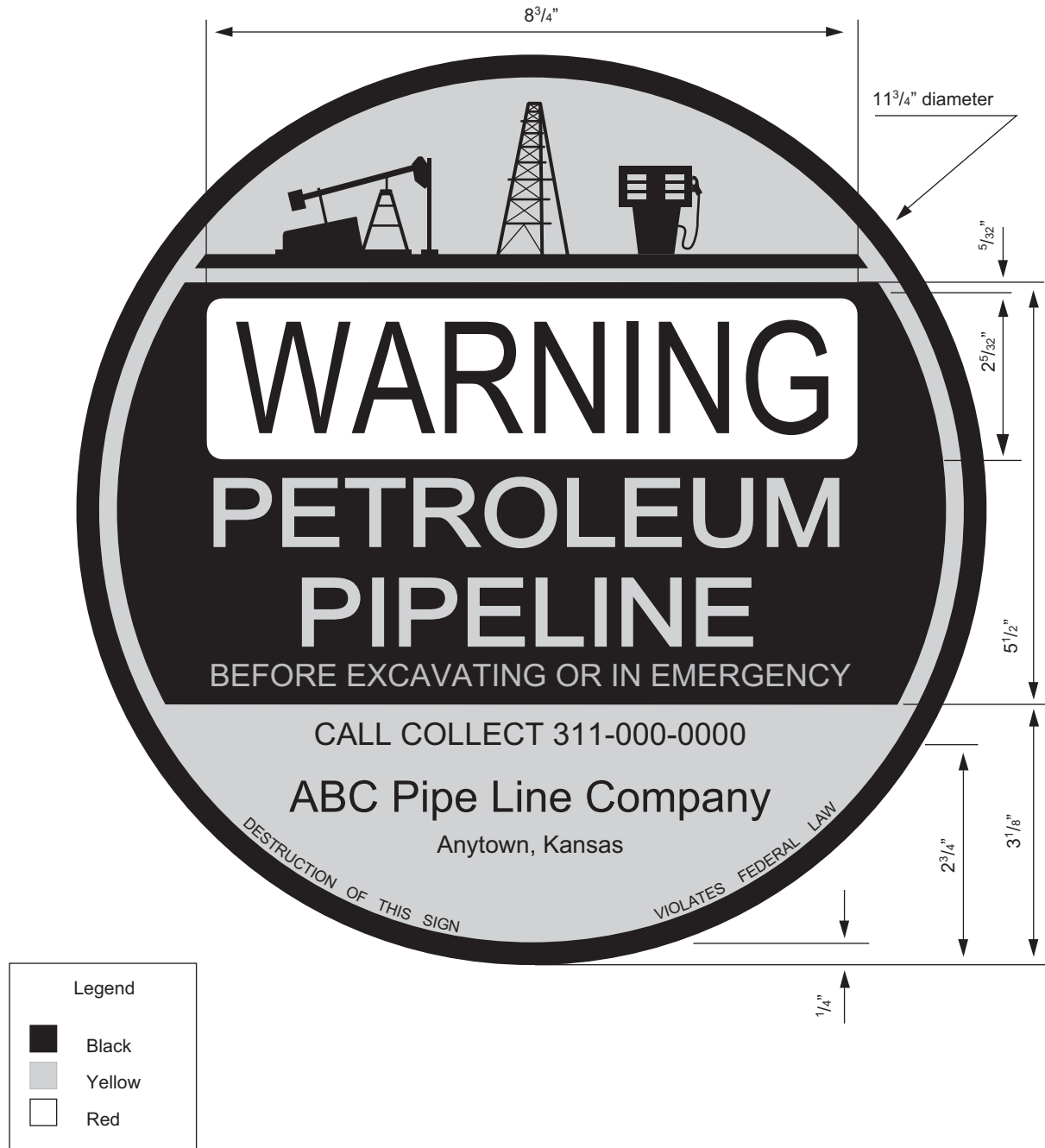
Pipeline facility signs should be placed on all sides of the facility accessible to the public, at the facility entrance or entrances, and in sufficient numbers so that the facility is clearly identified.

## **7 Inspections and Maintenance**

The inspection, maintenance, and replacement of markers and signs should be a part of the Pipeline Operator's regular maintenance procedures. Markers and signs, along with their supporting structures, should be maintained in their original state of effectiveness. Damaged, defaced, or missing markers and signs should be replaced. Markers and signs should not be obscured by vegetation. Markers and signs whose effectiveness has been compromised by construction, damage, or fading should be relocated or replaced to restore effective marking. Pipeline Operators should periodically examine new locations for signage due to changing land use, flooding, re-routing, or other reasons that signage should be added or replaced.

Installation of pipeline markers in rural, farming and ranching areas may require additional precautions. Pipeline Operators should determine whether pipeline markers installed in rural, farming or ranching areas require additional anchoring or barriers to prevent inadvertent removal or damage from livestock.

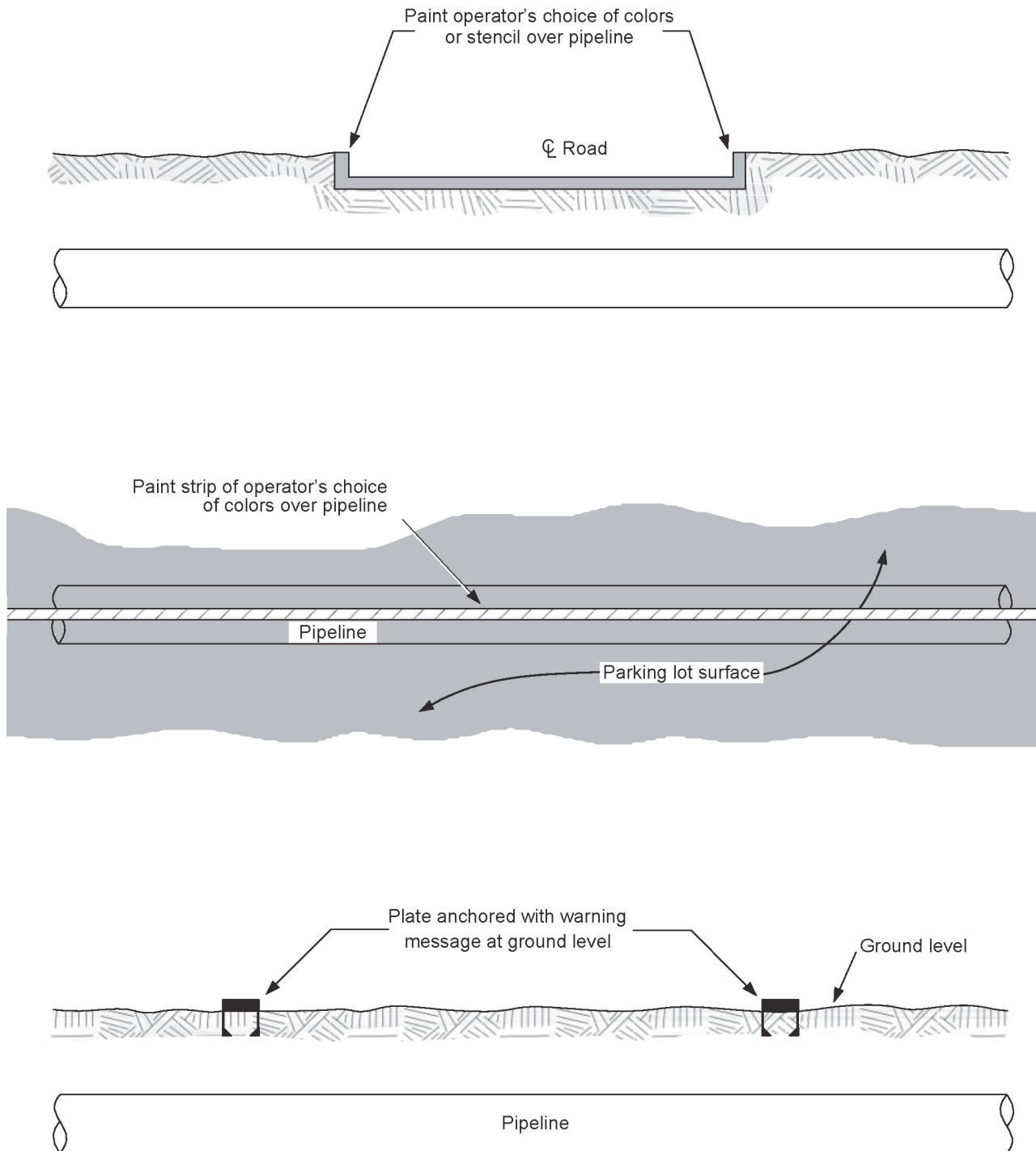
Installation of pipeline markers in highly urbanized areas may pose challenges. Pipeline Operators should research if there are any city ordinances, permit requirements or deed restrictions on installation of pipeline markers.



- NOTE 1 Recommended color samples of the red and yellow to be used on this sign are available on loan from the American Petroleum Institute's Manufacturing, Distribution, and Marketing Department.
- NOTE 2 Minor variations in letter style are acceptable provided that the minimum letter size and stroke width recommendations in 5.3.2 are accepted.
- NOTE 3 Sign to have 4 <sup>9</sup>/<sub>32</sub> in. holes on 11 in. b.c. at vertical and horizontal centerlines.

Figure 5—Line Marker

Discussions with state and local agencies as well as neighborhood community associations may be required. Consideration should be given to installing signage along the pipeline so that the route of the pipeline is clearly marked but addresses any ordinances, permit requirements or deed restrictions.

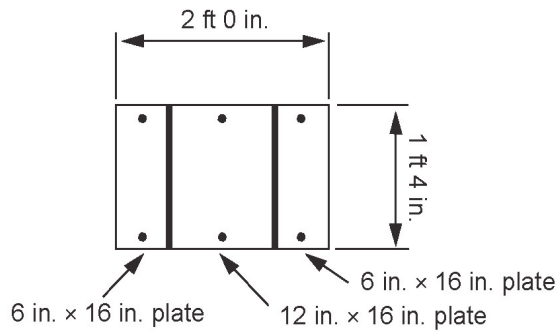


**Figure 6—Examples of Surface Markers**

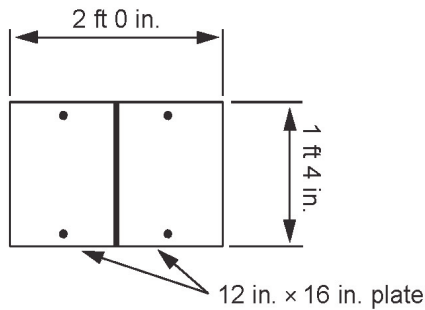


NOTE Use sharply contrasting colors.

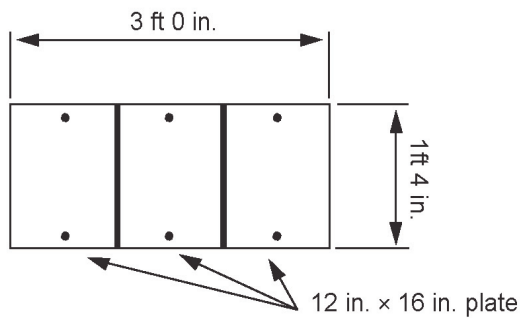
**Figure 7—Pipeline Sign for Navigable Waterways**



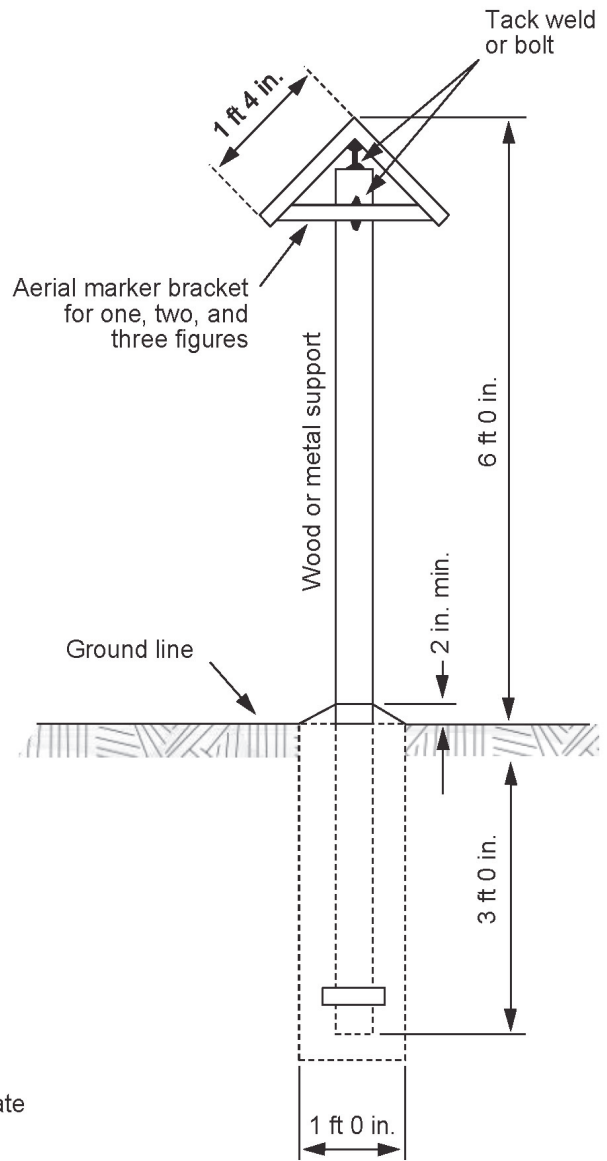
1 — Figure Marker



2 — Figure Marker

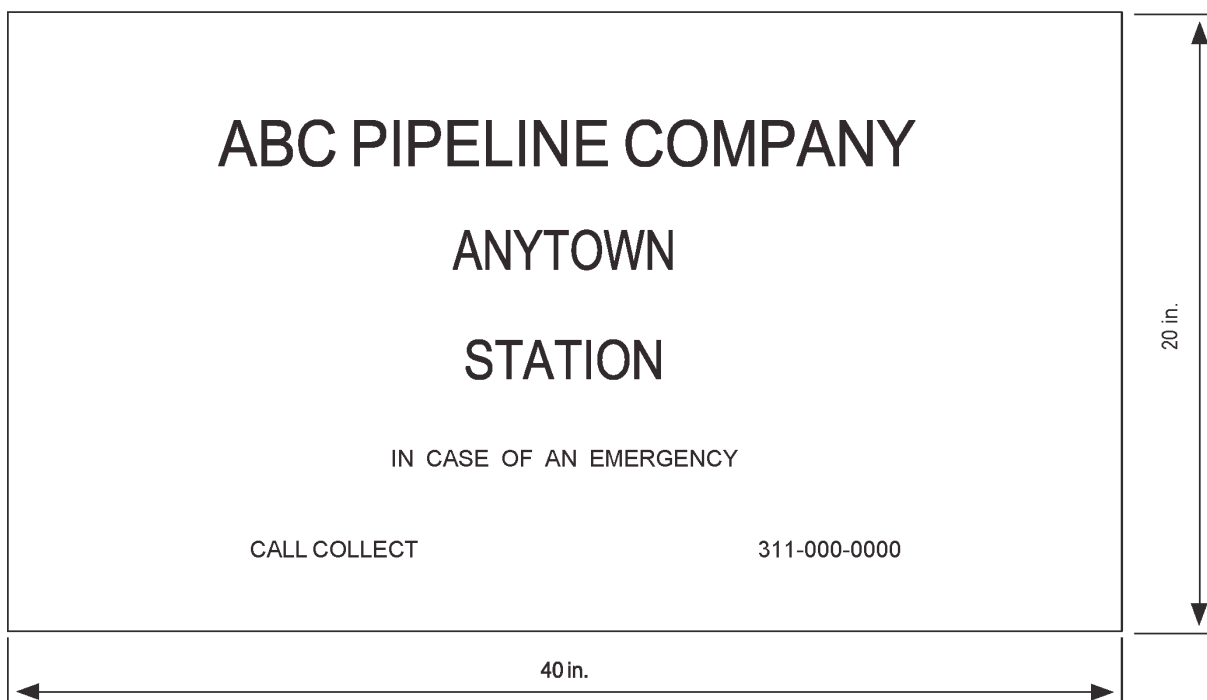
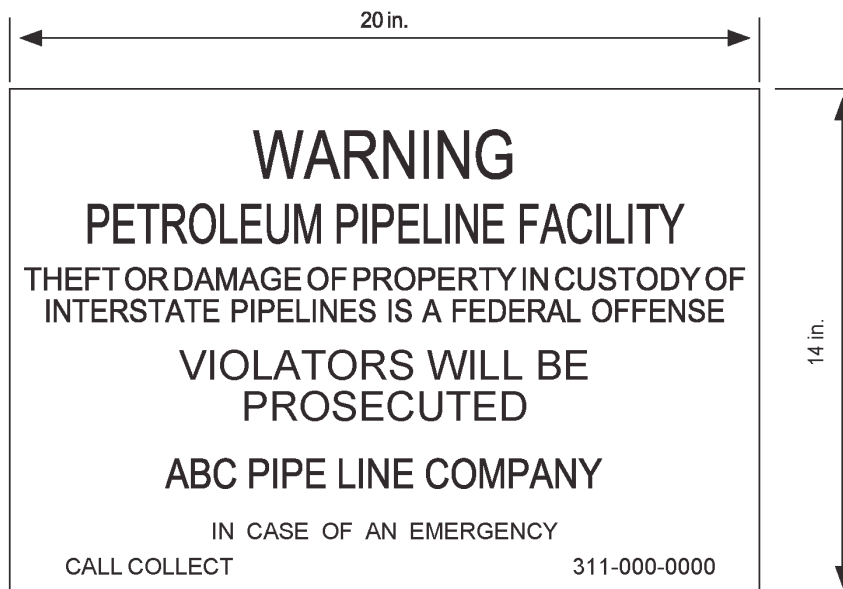


3 — Figure Marker



NOTE Use sharply contrasting colors

Figure 8—Typical Aerial Markers



**Figure 9—Typical Pipeline Facility Signs**

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