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ENGINEER INTELLIGENCE GUIDE

EIG 21

COLLECTION OF INFORMATION ON HIGHWAYS

A TECHNICAL SERVICE INTELLIGENCE DOCUMENT

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ENGINEER INTELLIGENCE GUIDE 21

COLLECTION OF INFORMATION ON HIGHWAYS

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PREFACE

Engineer Intelligence Guides (EIG's) are the media for the dissemination of intelligence collection, processing, production, and dissemination guidance by the Chief of Engineers to pertinent elements of the Corps of Engineers. EIG's are designed to provide orientation, direction, and instruction in the field of Engineer intelligence. They do not constitute formal Department of the Army collection requirements. Comments on this EIG and suggestions for additional EIG's are solicited from all recipients. Comments and suggestions should be addressed to:

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COLLECTION OF INFORMATION ON HIGHWAYS

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INTRODUCTION

1. Purpose

The purpose of this Engineer Intelligence Guide is to provide guidance to nontechnically trained collectors for the collection of information on highways required by the Chief of Engineers in fulfilling his responsibility to construct, maintain, reconstruct, or demolish highways and their associated structures in a theater of operations and to provide intelligence on highways for both strategic and tactical planning.

2. Scope

This guide outlines in detail the information collection requirements for highways, by relative priorities for collection, and provides essential background material for a thorough understanding of the requirements. It also contains a discussion of the principal sources of highway information and a glossary of highway terms.

3. References

Publication	Title	Date	Classification
FM 5-10	Routes of Communication	August 1948	UNCLASSIFIED
FM 5-36	Route Reconnaissance and Classification	April 1955	UNCLASSIFIED
FM 55-8	Transportation Intelligence	October 1956	UNCLASSIFIED
TM 5-250	Roads and Airfields	August 1957	UNCLASSIFIED
DA PAM 30-104	Intelligence Collection Guide-Transportation	April 1958	UNCLASSIFIED
EIG No. 1	Processing of Engineer Information for Intelligence, Chapter 11, Highways	March 1957	UNCLASSIFIED

CHAPTER 2

BACKGROUND MATERIAL

Section I. PHYSICAL CHARACTERISTICS OF HIGHWAYS

4. General

The term "highway" has a considerably broader meaning for intelligence purposes than for everyday usage. For intelligence purposes, the term includes all types of roads and tracks, from multilane superhighways to ordinary pack trails. Moreover, all associated structures and facilities necessary for the continuity of movement and for protection of the way, such as bridges, ferries, tunnels, fords, snowsheds, and galleries, are considered as integral parts of the highway system. Engineer interests in highway information cover all physical characteristics of the existing road system, as well as the various administration and operational aspects pertaining to development, construction, and maintenance.

5. Importance of highways

The highway system of a country is an indication of its basic economic development. In most countries, highways are the principal means of transportation. In others, they are used as feeders to railroads or inland waterways. From the military point of view, the significance of highways has a direct relationship to their usefulness in the movement of military equipment, supplies, and personnel. Improvement and expansion of the existing highway network may reveal not only hostile intentions of a nation but also potential staging areas and the direction of potential military operations.

6. Design of roads

For all classes of roads, the design includes cross-section elements, horizontal and vertical alinements, and surface types. These data are of military significance for analysts developing intelligence because traffic capacity, load carrying capacity, maintenance, and reconstruction of a road depend on its original design and construction.

a. Cross-section elements. The terms used to describe parts of a road cross section are illustrated in Figures 1 and 2. Typical road design standards are shown in Figure 3. The following cross-section elements are basic for Engineer intelligence.

(1) Subgrade. The subgrade, or subbase, which is the earth foundation for all subsequent layers, is designed to develop sufficient bearing strength to withstand the wheel-load pressure at the surface. The cross-section shape of the subgrade depends on the type of surfacing that is to be used. On earth roads, the subgrade, which is also the surface course, may be shaped to the standard road cross section (Figure 4). Where the road is surfaced, the subgrade usually is graded to the same cross-section profile as the finished surface (Figures 5 and 6), with a crown or, at curves, possibly an angular slope. If the trench method of construction is used, the earth excavated to form a trench is pushed to the side of the road to form retaining shoulders (Figure 7).

(2) Base course. The base course is composed of material placed upon and compacted on the prepared subgrade. The major function of the base course is to distribute wheel load pressures over as large an area of the subgrade as possible. Knowledge of the constituent materials of the base course and its thickness are important in estimating the load-carrying capabilities of the road. Typical materials used in construction of the base course are crushed rock, gravel, sand-clay, stabilized sand mixtures, coral, caliche, tufa, rubble, and bituminous mixtures.

(3) Surface course. The surface course of a road is the top or finishing layer of material covering the base course or subgrade. It is intended to protect the base course from traffic wear, to prevent or lessen damage to the base course and subgrade from water and freezing, and to improve the riding qualities of the road. The surface course is normally used for traffic and is called the traveled way. Information on the type of surfacing is of great significance in determining the traffic and load capacities and the maintenance that may be required if the road is used by heavy military traffic.

(4) Shoulder. A shoulder is that portion of a road between an edge of the traveled way and any parallel ditch, embankment, or cut. Where they are firm enough, they serve as safety strips for emergency use. The surface and width of shoulders may affect the road's traffic capacity.

(5) Drainage system. Road drainage systems include such features as open ditches, covered storm drains, and culverts.

b. Horizontal and vertical alinements. Curves (Figures 8 and 9) and grades (Figure 10) are major considerations in determining the traffic capacity of a road. Design standards for these elements, therefore, provide valuable military data.

c. Road surfaces. Surfaces are included in road design standards because they are basic to the overall usability of a road.

(1) Pavement. The pavement, which has a broader meaning in highway parlance than in general usage, includes both the base course and the surface course. For design purposes, pavements are classified as rigid or flexible.

(a) Rigid pavement. A rigid pavement distributes loads over a wide area of the subgrade, thus reducing stresses. Concrete is the most common type of rigid pavement surface.

(b) Flexible pavement. A flexible pavement is primarily a traffic and weather-resistant medium and not a stress-resistant medium as compared to a rigid concrete pavement; a subgrade with uniform bearing strength is imperative. Roads with flexible pavement are surfaced with bituminous material or with earth material stabilized with oil, cement, or other substances.

(2) Types of road surfaces. Information on road surfaces may indicate the types of subgrade and base course and thus reveal potential maintenance problems. Surfaces usually are of the following types:

(a) Concrete. Concrete is a mixture of cement, sand, gravel or crushed stone, and water. A concrete pavement may be plain or steel reinforced.

(b) Bituminous material. Bituminous material consists of a mixture of asphalt and tar products (bitumens) and aggregate. Bituminous pavement is a compacted mixture of a bitumen and aggregate applied in one or more layers. Bituminous surfaces are classified according to the method of construction and the composition of the mixture into five major categories. Although the different types of bituminous surfaces are virtually impossible to distinguish once they have been laid, the following information is provided to enable an observer to identify a specific type if he sees a surface being laid or reads about a surfacing project.

1. Bituminous surface treatment. A bituminous surface treatment is done by applying a bitumen in liquid form to the base course or an old surface and immediately adding aggregate. The surface mixture may or may not be rolled. If a single application of bituminous material and aggregate is made, the pavement is called a single surface treatment. If more layers are applied, it is called double or triple surface treatment, according to the number of layers.

2. Penetration macadam. Penetration macadam is made by adding a bitumen to an aggregate after the latter has been spread over the base course. The aggregate is spread and rolled, sprayed with a penetration coat of bituminous material, and covered with small stone chips rolled and broomed to fill the voids in the surface.

3. Mixed-in-place bituminous. Mixed-in-place bituminous is constructed by mixing bitumen with aggregate directly on the road base. The pavement may be used as a wearing course for temporary roads or as the first surfacing layer in the construction of higher type roads.

4. Hot-mix bituminous concrete. Hot-mix bituminous concrete is a mixture of course aggregate (35% to 40% of mixture), fine aggregate, mineral filler (finer than sand), and a bitumen that is proportioned and mixed at a central mixing plant. Hot-mix bituminous concrete is mixed, spread, and compacted under heat.

5. Rock asphalt. Rock asphalt is a natural rock impregnated with a bitumen. Rock asphalt may be used for a surface course and forms an excellent base course.

(c) Brick or stone block. Bricks or stone blocks of uniform sizes laid on a good foundation make a stable pavement. The foundation may be composed of a concrete base and a bedding or cushion of 3/4 inch thick sand, granulated slag, or sand-cement. In some areas, natural stones are laid to form cobblestone paving.

(d) Water-bound macadam. Water-bound macadam is made by spreading crushed rock aggregate (up to about $4\frac{1}{2}$ inches in size) in a layer and rolling it in place ; then fine aggregate (generally of stones passing a $2\frac{1}{2}$ inch sieve) is superimposed and rolled and broomed into the coarse aggregate until both are thoroughly keyed in place. The mixture is then "bound" together with water.

(e) Gravel. Gravel surfaces consist of a compacted layer of well-graded gravel (natural gravel or crushed stone). Gravel roads make excellent base courses for later-stage pavings.

(f) Stabilized soil surface. Stabilized soil mixtures are used to provide a base course for the support of a thin bituminous wearing surface. Aggregate is mixed with the soil, and a stabilizing agent (cement, calcium chloride, bitumen) is added.

(g) Sand-clay. Sand-clay surfaces are mechanically stabilized soil surfaces composed of a natural or artificial mixture of sand and clay. They can carry light traffic generally at all times; probably adverse weather conditions will prevent use by heavy vehicles. They withstand wear better than ordinary earth or dirt roads.

(h) Oil-earth. Oil-earth surfaces are made by coating ordinary earth roads with oil in order to reduce dust and, by waterproofing the surface, to lessen the tendency to soften in wet weather.

(i) Earth. An earth surface consists of natural fine-grained soil that is graded to form a surface for carrying traffic. Provisions usually are made for drainage. The use of earth roads is usually limited to dry weather and light traffic.

(j) Heavy expedients. Heavy expedient surfaces are often used in muddy and swampy ground in remote forested areas where timber is abundant. They may be plank roads (Figure 11) used for crossing short sections of loose sand or soft ground; corduroy roads (Figure 12) built over soft ground; and log-tread roads (Figure 13).

7. Critical features

Features along a highway at which it would be relatively easy to block traffic, or that affect the traffic capacity of the road, are considered to be critical. Examples of the former types are structures for which no bypasses are available, mountain passes, terrain gaps (Figure 14), gorges and defiles (Figure 15), deep cuts (Figure 16), steep grades and sharp curves (Figure 17). Examples of the latter types are bridges and tunnels that have fewer lanes than the highways that feed into them, low capacity bridges, places where clearances are restricted, and ferries.

a. Routes through towns. Highways in built-up sections may be blocked, and important consideration is given to bypass routes around populated centers.

b. Bypasses. Bypasses are local detours required to circumvent an obstruction or bottleneck to military vehicles along a route. Bypass possibilities are classified as easy, if a detour can be made by vehicles utilizing alternate routes and off-road movement; difficult, if construction of a bypass or local detour is necessary; and impossible, if terrain prohibits off-road movement, there is no alternate route, and the construction of a bypass or local detour is impractical.

Section II. CONSTRUCTION AND MAINTENANCE

8. General

Maintenance is a continuing operation required to keep a roadway and its structures usable with a minimum of interference to the movement of vehicles. Construction, reconstruction, and maintenance usually depend upon the availability and quality of construction materials, construction equipment, and labor forces, but, locally, construction and maintenance may be hampered by other conditions.

9. Construction equipment

The variety of construction equipment is virtually limitless; details and illustrations of representative equipment used for the construction and maintenance of highways are contained in DA Pam No. 30-26 dated August, 1953. The following information is given for orientation purposes only.

a. Earthworking equipment. This equipment is used for excavating, moving, grading, or compacting earth. The principal items are earth augers, used for boring holes in the earth; bulldozers and angledozers, used as tractor attachments for excavating, moving, and roughgrading earth; ditchers, used for general purpose ditching and trenching; graders, used for shaping road-ways, trimming shoulders, and cutting banks; rooters, used for breaking hard earth surfaces in advance of the use of scrapers and graders; rollers, used for compacting earth subgrades and fills; scrapers, used as self-loading units primarily for excavating and loading; and tractors, used as prime movers for towed construction equipment.

b. Concrete, bituminous, and soil aggregate equipment. This equipment is used for the preparation, placement, and finishing of suitable mixes of cement, bitumen, and clay with selected aggregates. The principal items are concrete mixers, used for mixing cement with sand and aggregates; batching plants, elevated structures with compartments for storing separately and measuring out sand and aggregates; concrete pavers, mixers with a boom and bucket for distributing the concrete after mixing; concrete spreaders, machines that bridge the area being surfaced and uniformly spread the fresh concrete; concrete finishers, which finish the surface of the fresh concrete; bituminous plants, units for mixing bitumen and aggregates and, in some cases, for spreading and finishing the mix (may be a central plant operating at a fixed point, or movable equipment used over the section of paving being surfaced); bituminous distributors, truck-or-trailer mounted tanks equipped for pressure spraying liquid bitumen onto the surface of a roadway; soil-aggregate stabilizers, plants that prepare and proportion clay for mixing with selected aggregates to provide a stable mixture for roadway surfaces.

c. Powered hand tools. Hand tools are tools that are manually supported and guided in their operation. Power for driving the tools may be supplied by electricity, compressed air, or internal combustion engines. The most common hand tools are pneumatic driving tools, such as a jackhammer or pavement breaker, used for breaking up and drilling through paving and rock, cutting into earth and bituminous paving, tamping earth and rock fill, and other similar uses; chain and circular saws, used for felling trees and for cutting logs and lumber; wood and steel drills, used for carpentry and metal work; riveting hammers, used for driving hot or cold rivets in steel construction; and nail drivers.

d. Loading and transportation equipment. This equipment is used for loading material into storage bins or trucks and for transporting material. The principal items are bucket loaders, used for elevating loose material; loading skips (buckets), used as attachments to self-propelled vehicles for the removal and loading of loose materials; conveyors, used in loading material on an inclined plane or in conveying material horizontally to a desired location; cableways, used for transporting material or personnel over varying types of terrain; and the various vehicles used for transporting bulk materials.

e. Gravel pit and quarry equipment. This equipment is used in drilling, crushing, grading, and washing sand and rock aggregate. The principal items are drill-wagons, used for deep-drilling of holes in rock for the placing of explosives; crushers, used to crush stones to the proper sizes for use in concrete, bituminous, or stabilized earth mixes, or for the construction of subgrades; and screens, used for grading stones and sand according to sizes.

f. Miscellaneous equipment. Miscellaneous equipment used for the construction and maintenance of highways includes such items as snow plows and pile drivers.

10. Problems of construction and maintenance

Only extraordinary problems which make highway construction and maintenance abnormally costly and slow or which prevent effective maintenance are of interest. Such problems may be treated countrywide or regionally. Information on those factors that affect construction will indicate the limitations or possibilities for new construction.

a. Terrain. Swamps, bogs, and delta areas may develop special problems of drainage and ditching, necessitate special provisions for support of a roadbed, or possibly require the construction of many bridges. Rugged surfaces might result in steep grades and sharp curves, tunnels, expensive bridges, deep cuts and heavy sidehill construction when developing new roads; sidehill locations and deep cuts could require considerable protection against slides (earth, rock, snow) in the form of retaining walls, cribbing, or snowsheds. Desert terrain might require provisions against sand drifting (sand fences and sand removal). Arctic, subarctic, and high mountainous terrain may require special construction techniques where permafrost, semipermanently frozen ground, or muskeg occur.

b. Weather and climate. Severe winter conditions (sustained periods of freezing, heavy snowfall) can seriously retard construction and maintenance work; protection against drifting snow must be provided and provisions for the repair of damage caused by frost heave and frost boils must be made.

Excessive rainfall may result in washouts and flooding or be the cause of earth and rock slides in rugged terrain. Lack of rainfall in arid areas might present serious problems of water supply. Sustained high temperatures can seriously affect both workers and equipment. Sudden extreme changes of temperatures (including freezing) may cause rock to split off steep slopes and block a road.

c. Lack of regular maintenance. Lack of proper maintenance is evidenced by clogged culverts and ditches; potholed, bumpy, and rutted road surfaces; soft or uneven shoulders; and badly worn or cracked pavements. A minor maintenance job postponed can develop into a major repair job involving sub-grade, base course, and surface.

d. Special geographic phenomena. Earthquakes, volcanic activity, land subsidence, and other special physical phenomena may pose special problems.

e. Sabotage. Guerrilla forces and other agents actively engaged in hostile activities cause special problems for the construction and maintenance of highways in some countries.

Section III. HIGHWAY STRUCTURES AND CROSSINGS

11. General

Highway structures and crossings include bridges, culverts, tunnels, snowsheds, galleries, ferries, and fords. Bridges and culverts are the structures most frequently encountered along roads. A highway bridge or culvert is a structure designed to carry vehicles and pedestrians over an obstacle such as a stream, gully, or gorge; all such structures less than 20-feet long are considered to be culverts, all others are bridges.

12. Bridges

Identification of a bridge or its constituent elements is essential information to the analyst and to the engineer who may be required to repair or restore the structure.

a. Bridge components. A bridge has two main parts -- the substructure and the superstructure. The substructure comprises the foundations and supporting components of a bridge; the superstructure is the assemblage which rests on the substructure and spans the gaps between ground supports.

(1) Substructure. The substructure consists of ground supports at the shore ends of a bridge (abutments) and intermediate ground supports (bents or piers). Material used in substructures includes concrete,

masonry, steel, and wood; concrete and masonry are the most common. Knowledge of foundation conditions, particularly the bearing capacity of the soil on which the footings of the supports rest, is necessary for the engineer, particularly if he has to repair or rebuild a structure; normally, this information cannot be obtained from observation.

(a) Bridge abutments. The construction and design of abutments vary according to the type of bridge superstructure and site conditions. Typical abutments are shown in Figure 18 and 19. Abutments range from elaborate structures where the load-bearing capacity of the soil under the footings is low, to merely a prepared shelf or rock ledge. Lumber may be used for small bridges, particularly where road development tends to be primitive. In some areas demolition chambers are built into the abutments.

(b) Intermediate supports. Intermediate supports for bridges are ground supports between abutments. The following types of intermediate supports are used throughout the world:

1. Pile bents. Pile bents consist of a row of vertical members called piles that are driven into the ground, topped with a cap, and cross braced (Figure 20). Pile bents are used where the stream bottom is soft and uneven, the current swift, or the water deep.

2. Trestle bents. Trestle bents consist of a cap and sill and four or more posts, with transverse bracing across the posts (Figure 21). They are used where the water is shallow, the bottom is fairly firm and even, and the scouring action of water is small. Timber trestle bents are used for spans up to 15 feet.

3. Trestle piers. Two or more bents placed close together and braced to one another form a trestle pier (Figure 22), providing greater lateral and longitudinal stability than a single bent.

4. Pile piers. Pile piers consist of two pile bents braced in the same manner as trestle piers (Figure 23).

5. Crib piers. Crib piers are built of logs, with the bottom of the pier wider than the top (Figure 24). These piers are used only where other types are not suitable because they take more time to build. The center of the crib is filled with ballast to provide weight and stability.

6. Other types of piers. Other types of piers are masonry piers (Figure 25), prefabricated steel trestle piers (Figure 26), open type concrete piers (Figure 27), and solid concrete piers (Figure 28).

(2) Superstructure. Bridge superstructures take many forms, ranging from simple log beams carrying a plank floor to massive complex structures of several thousand feet. Most are made of two basic components -- a set of main supporting members or bridge spans and a floor or deck system that comprise the bridge above the substructure. The principal exception is the reinforced concrete slab design in which the main supporting member also serves as the floor. The type of superstructure depends on the type of load to be carried, length of span, availability of material, manpower, and equipment, and the time available for erection. Structurally, the superstructure is either an independent unit resting on the supporting members, such as steel trusses on concrete or masonry abutments and piers, or integral with the substructure, such as stone masonry arches on stone supports. Usually the roadway paving construction is mounted on or supported by the superstructure and has no structural significance. Based on their superstructures, bridges may be divided into two general classes: fixed and movable.

(a) Fixed bridges. Fixed bridges may have a single superstructure for each span or gap (e.g., as in a through steel truss) or have a continuous superstructure that passes over several gaps (e.g., as in a masonry viaduct or a plate-girder bridge without a structural break at intermediate supports). Some long bridges may be combinations of several types of span design and possibly have both continuous and noncontinuous superstructures. Fixed bridges may be grouped according to structural design into nine basic types: slab, stringer, girder, truss, arch, cantilever, suspension, combined, and ponton (floating).

1. Slab bridges. Slab bridges are short span bridges consisting primarily of a reinforced concrete slab resting directly on the abutments or intermediate supports. A wearing surface of bituminous material is usually laid over the concrete. They may be singlespan or noncontinuous multispan structures. A typical concrete slab bridge is illustrated in Figure 29; this type of bridge can be recognized by the lack of stringers under the slab.

2. Stringer (beam) bridges. Stringer bridges also have short spans, but, unlike slab bridges, they have longitudinal spanning members (stringers) upon which the flooring rests. The most common types of stringers are wooden stringers (Figure 30), steel stringers (Figure 31), and concrete beams (Figure 32). In some instances, a reinforced-concrete slab may be combined with the top flanges of steel beams or with reinforced-concrete stringers. The wearing surface of the roadway may consist of bituminous material or wooden planking laid on top of the concrete slab. When the abutments and deck of a bridge are cast as a unit, the structure is generally called a rigid frame bridge.

3. Girder bridges. Girder bridges, which are composed of girders and a floor system, have longer spans than slab or stringer bridges. The girder is compound steel beam that transmits the roadway load to the piers and abutments. The floor system of a girder bridge is composed of stringers, floor beams, flooring, and a wearing surface. Steel girder bridges are through (Figure 33) or deck types (Figure 34).

4. Truss bridges. Truss bridges are used for spans that are too long for girder bridges (100 feet or more). The truss, which consists of top and bottom cords with an intervening framework of diagonal, vertical, or horizontal elements that are either in compression or in tension, transmits the roadway loads to the substructure. Trusses usually are of steel. Truss types are classified as deck, through, and half-through depending on the position of the roadway. A deck truss is a bridge in which the deck rests on top of the main supporting members (Figure 35). In the through type, the deck is commonly on a level with the lower ledge of the main supporting members, which are joined by lateral bracing over the roadway (Figure 36). The half-through type has the deck at or near the bottom edge of the main supporting members but has no overhead bracing (Figure 37); a truss of this type is often called a pony truss. Many plate girder bridges are half-through types. Common types of bridge trusses are illustrated in Figure 38.

5. Arch bridges. Arch bridges are constructed in many types and variations, but, basically, an arch bridge consists of an arch and a floor system. There are three types: masonry arch (Figure 39); concrete arch, either open spandrel (Figure 40) or filled spandrel (Figure 41), with the roadway supported above the arch; and steel arch, either deck type, with roadway resting on the top member of a trussed steel arch (Figure 42), or through type, with the roadway suspended from the arched member by a series of bars, I-beams, or webbed (latticed) vertical members (Figure 36).

6. Cantilever bridges. Cantilever bridges have two self-supporting beams, or trusses, projecting from piers toward each other, with no intermediate support. These beams are either joined directly to one another or connected by a suspended span. Figure 43 illustrates a cantilever bridge and designates its sections. Cantilever construction frequently is used to cross the widest gap of a multispan bridge.

7. Suspension bridges. Suspension bridges have the roadway suspended by means of vertical cables or ropes from two or more suspension cables, which pass over towers and are anchored at the ends (Figure 44). Suspension spans are usually employed where the construction of intermediate supports is impracticable because of the length of the bridge gap or because vessels must pass under the bridge.

8. Combined bridges. Combined bridges are combinations of different types of spans, adopted because of span length requirements, water depths, current velocity, foundation conditions, or other considerations. Figure 45 shows a combination of deck girder spans on steel trestle bent on concrete pedestal, steel deck trusses, and steel through trusses on concrete piers.

9. Ponton (floating) bridges. Ponton bridges are temporary bridges that are supported by low flatbottomed boats or other floating structures (Figure 46). The major components are the floats, saddle assembly, and the superstructure that carries the roadway. Ponton bridges, because they are anchored to each bank, are classified as fixed bridges, but they may be released at one end to allow vessels to pass.

(b) Movable bridges. A movable bridge has at least one span that can be moved from its normal position to allow vessels to pass. Four general types of movable spans are recognized -- swing, lift, bascule, and retractile.

1. Swing span. A swing span is one that rotates horizontally on a pier at or near its center. It is normal to consider a swing assemblage of two spans because the central pier divides the gap into two parts (Figure 47). Steel trusses or plate girders are normally used.

2. Lift span. A lift span is raised vertically at both ends, with the span remaining in a horizontal position (Figure 48). The usual type has a tower at each end; some have overhead spanning members connecting the tops of the towers. Lift spans are usually constructed of steel truss framing.

3. Bascule span. A bascule span is opened by raising one end (Figure 49). The structure either pivots on a horizontal trunnion at the non-raising end (trunnion type) or rolls back slightly at this point as it is opened (rolling lift)(Figure 50). Bascules may either be single leaf or double leaf, depending on whether one or two movable assemblages are used. In the double leaf type, the raising ends meet in the center of the gap when in closed position. Most bascule type bridges are constructed of steel.

4. Retractile span. Retractile spans open by rolling directly back from the opening along a horizontal track of some type. The type is extremely uncommon and can be used only for very narrow gaps.

(c) Floor systems. For most bridges, the floor system consists of stringers (longitudinal members), floor beams (transverse members), and a roadway (wearing surface). In its simplest form a floor system may consist merely of planking laid across the tops of longitudinal beams that span the gap between substructure supports, as in the stringer bridge. Sometimes flooring is designed to meet the load-bearing capacities of the bridge; in others it is merely a protective or wearing surface. Wood is the most universal bridge flooring, but ribbon tread, concrete, and bituminous wearing surfaces are common.

b. Principal measurements. Measurements of intelligence significance include the length of the bridge and of individual spans, roadway width, vertical and horizontal clearances, underbridge clearance, and certain measurements showing the nature of the site (Figure 51).

(1) Length of bridge. There are several possible measurements for the length of a bridge and for each of its individual spans, depending on what measuring points are selected. The most suitable measuring points are the abutment faces (the sides facing the gap) and the centers of intermediate supports for spans. The desired bridge length is the distance between the two abutment faces, and the span lengths are the distances between successive measuring points (e.g., from center to center of piers). Other bridge lengths that are of value are "superstructure length" or "overall length" including the parts of abutments covered by the ends of spans. With respect to the individual spans of a multispan bridge, the "clear span" dimension may be given; this is the clear distance between adjacent substructure elements.

(2) Width of roadway. Roadway width and horizontal and vertical clearances all pertain to the usable space for the through passage of vehicles. Roadway is the distance between curbings, walks, or the like that bound the space on which vehicles normally move.

(3) Horizontal clearance. Horizontal clearance is a dimension that must be considered to pass loads that extend laterally beyond the vehicle wheels.

(4) Vertical clearance. Vertical clearance is the distance from the crown of the roadway to the lowest overhead cross-member; if less than 14 feet the bridge is considered a bottleneck.

(5) Underbridge clearance. Underbridge clearance is the maximum distance from the normal water level or the ground to the lowest part of the superstructure. For a bridge over a navigable stream, this dimension indicates the height of craft that can pass below the structure.

(6) Site conditions. Measurements indicating the characteristics of the site itself include stream widths and depths and the height and slope of the banks.

c. Bridge capacity. Capacity is the most significant aspect of a bridge because the load-carrying capacity of a route is almost always determined by the capacity of its weakest bridge. The capacity of a bridge is determined by the span with the lowest safe load-carrying capacity (critical span) and is generally the longest span. Without design data it is seldom possible to determine the capacity of a bridge. If the capacity is not posted, it may be estimated from practice (load it has been known to support) or engineer characteristics. Bridge capacity is expressed in two ways: civilian load class and military class.

(1) Civilian load class. Civilian load class (also called "maximum gross load," "maximum capacity," and "load limit") is the most common measure of road bridge capacity. It is expressed in terms of weight in tons (metric or other, depending on the country) of a vehicle that the bridge will support safely. This system assumes all lanes in use and essentially no spacing between vehicles.

(2) Military load class. The military load class may be as much as two or three times the civilian capacity because calculations assume a wider spacing of vehicles and lower speeds.

13. Other structures and crossings

Other structures and crossings include culverts, tunnels, snowsheds, galleries, fords, and ferries.

a. Culverts. Culverts are drains which carry water under a road. They are important structures with respect to the durability of the route and the amount of maintenance necessary to keep it in usable condition. Culverts can be grouped into three main categories -- pipe, box, and arch.

(1) Pipe culverts. Pipe culverts are the most common. They are made of several materials, including corrugated metal, concrete, cast iron, and vitrified clay; are round, elliptical, or flattened on the bottom; and range in diameter from 12 inches to several feet.

(2) Box culverts. Box culverts are used to a great extent on modern roads. They are square or rectangular in cross section and may be made of concrete, saw timber, or logs. A large concrete culvert is similar to a slab bridge.

(3) Arch culverts. Arch culverts were frequently used in the past but are rarely constructed now. An arch culvert, except for size, is structurally similar to a masonry arch bridge.

b. Tunnels. Tunnels are classified by types of bore as semicircular, elliptical, horseshoe, and square with arch ceiling. Interiors may be unlined (Figure 52), masonry lined (Figure 53), or concrete lined (Figure 54). Portals are made of masonry or of concrete. Horizontal clearance is the width of the tunnel bore measured from wall to wall. Vertical clearance is the distance between the top of the road and the tunnel ceiling. Alinement of tunnels may be straight or curved.

c. Snowsheds and galleries. Snowsheds and galleries are protective structures and are not usually encountered as often as other roadway structures. A snowshed affords protection from snowslides for an exposed section of road; it usually is open on one side. A gallery is any sunken or cut passageway covered at the sides as well as overhead; it usually has a series of openings along one side for light and ventilation.

d. Fords.

(1) A ford is a shallow place in a stream where the bottom permits the passage of personnel or vehicles (Figure 55). Fords are classified according to their passability for foot traffic, wheeled vehicles, and tracked vehicles. Most fords are unreliable because they can be made impassable by sudden increases in water levels and by deterioration under heavy traffic. Characteristics of a good ford are a slow current (less than 3 feet per second), low sloping banks with good approaches, uniform depth, and a hard bottom. Trafficability of fords is as follows:

Type of traffic	Fordable depth	Minimum width	Type bottom
Foot	3 1/2'		Firm enough to prevent sinking
Wheeled vehicles	2' - 6'	12'	Firm and smooth
Tanks (light, medium, heavy)	1' - 6'	14'	Firm and smooth

(2) Dips are paved fords used for crossing wide, shallow arroyos or washes in semiarid regions and in other localities where the construction of a bridge is impractical. Both fords and dips require extensive maintenance.

e. Ferries. Ferries are classified as powered ferries (steam, gasoline, or diesel), cable ferries, or current-operated ferries. Ferry slips, or piers, are provided at landing places on the shore to permit easy loading. Floating piers may be adjusted to the height of the ferryboat deck above the stream surface.

CHAPTER 3

OUTLINE OF INFORMATION NEEDS

Section I. GENERAL

14. Purpose

This chapter outlines the scope and type of information on highways that apply to the continuing information needs of the Chief of Engineers. It consists of separate Reporting Guides for highways and for structures and crossings organized into "Priority," "General," and "Detailed" information collection requirements.

15. Information interests

"Priority" information collection requirements are of the first importance in collection because they indicate trends in highway development that may reveal a country's preparations for war. The "General" information grouping represents continuing information requirements that are countrywide or regional in scope. "Detailed" information requirements are the data required on individual highways.

Section II. HIGHWAYS REPORTING GUIDE

16. Priority information collection requirements.

a. Current construction of new highways.

(1) Location, nature and purpose (economic, military, political, other).

(2) Design standards and specifications.

(3) Time schedule for completion, and feasibility; current status.

b. Current reconstruction or improvement of existing highways.

(1) Location, nature and purpose (economic, military, political, other).

(2) Design standards and specifications.

(3) Time schedule for completion, and feasibility; current status.

c. Plans for expansion and/or improvement of existing highway network.

(1) Location, nature and purpose (economic, military, political, other).

(2) Design standards and specifications.

(3) Time schedule for completion, and feasibility.

17. General information collection requirements

a. Importance. Countrywide or regional importance of highway transportation.

(1) Relationship of the highway network to the economy. Statistical comparison (passengers and freight) of highway transportation with the other modes of transportation (railways, inland waterways, airways).

(2) Relationship of the main highways to the secondary road networks.

b. Description. General description of the existing highway network(s) in the country to include:

(1) Geographic distribution (countrywide or regional). Distribution of different types of roads: all-weather, limited all-weather, and fair-weather.

(2) Mileage. Total mileage of highways by type of road and, within each type, by surface. (Tabular presentations, countrywide or regional, are desirable.)

(3) Density. Density of the highway network (countrywide or regional) in miles of road per square mile of the country or region and/or per thousand people.

(4) International connections. Location of connections with neighboring countries.

(5) General conditions. Overall quality (surface, drainage, capacity) and condition of the highway network (countrywide or regional).

(6) Adequacy. The adequacy of the highway network to meet both the peacetime and wartime needs of the country or region, considered in relation to other transportation forms. Potentialities for major improvement or development for military purposes.

(7) Identification system. Highway numbering or other identification system(s) (countrywide or regional) officially adopted or in use. Size, shape, color, frequency, and adequacy of highway identification markers.

(8) Signing system. Size, shape, color, frequency, and adequacy of highway signs: guide signs (used to direct traffic), warning signs and signals (curve, turns, railroad crossing, others), and regulatory signs and signals (speed limit and types of stops, one way, no entry, others).

(9) Vehicles. Types, weight (overall and per wheel) and width of heavy motorized equipment using highways.

c. Development.

(1) Historical development. Brief statement of significant recent development of principal highway networks; data on rehabilitation and restoration of highways damaged by war, floods, earthquakes, landslides, etc.; significance of recent expansion, reconstruction, or new construction of highways.

(2) Terrain effects. Effects of surface configuration, drainage, vegetation, and other physical phenomena on the development of highways; frequency of structures and crossings; severity of grades and curves; susceptibility to interruption from natural causes (snow, floods, landslides, other).

(3) Other factors. Significant economic (industrial and agricultural), political, and military factors in the development of principal highway networks.

d. Organization and administration.

(1) National organizations for control and administration of highways; name, location, major sub-divisions, and functions of the several echelons of the government (national, provincial, district, county).

(2) Number of persons in national organizations, by major subdivisions; quality and quantity of the skilled and unskilled labor force; training and experience; organization of highway personnel.

e. Standards and specifications.

(1) For various types of roads (countrywide or regional): typical cross-section dimensions (see par 6a); horizontal and vertical alinement (see par 6b); characteristics of road surfaces (see par 6c).

(2) Degree to which the standards and specifications are followed in actual practice. (If official standards and specifications have not been established, report common practices).

f. Construction and maintenance.

(1) Construction.

(a) General policy, regulations, and procedures adopted for new construction and reconstruction. Extent of application of the general policy, regulations, and procedures. (If an official statement is not available, report the apparent policy as indicated by construction programs already accomplished or underway).

(b) Governmental construction organizations: name, location, size, capabilities, and efficiency.

(c) Extent of construction by contractors, prisoners, or other non-governmental workers.

(d) Special construction methods used because of a lack of construction materials and machinery, an overabundance of laborers, and the effects of terrain and climate.

(2) Maintenance.

(a) General policy, regulations, and procedures for maintenance, indicating: routine maintenance (patch repairs to the pavement, use of graded gravel, minor improvements, snow removal, repainting of signs); renewals; special repairs necessitated by floods, washouts, erosion, frost heave, and other intermittent causes; frequency of road inspection and repair. Extent of application of the general policy, regulations, and procedures (if an official statement is not available, report the apparent policy as indicated by observed maintenance activities).

(b) Governmental maintenance organizations: name, location, size, capabilities, and efficiency; division of roads into maintenance sections; location of personnel and equipment by sections.

(c) Extent of maintenance by contractors, prisoners, or other non-governmental workers.

(d) Special maintenance methods used because of a lack of construction materials and machinery, an overabundance of laborers, and the effects of local terrain and climatic conditions.

(e) Sections of road closed seasonally because of snow or other weather conditions.

(3) Construction and maintenance materials, equipment, and labor.

(a) Local availability (quantity and accessibility) and quality of principal highway construction materials (aggregate, cement, asphalt, reinforcing rods, steel, timber); degree of dependence upon foreign sources to supply principal highway construction material.

(b) Availability and quality of special highway heavy equipment used for construction and maintenance; name, location, and current production of plants producing equipment; degree of dependence on foreign sources; inventory of equipment on hand, countrywide or regional (see par 9).

(c) Availability and skills of labor suitable for construction and maintenance (native, foreign, seasonal workers, prisoners); degree of dependence upon foreign labor sources.

(4) Problems of construction and maintenance applicable to the country or region (see par 10).

18. Detailed information collection requirements for individual highways

a. Description.

(1) Name, number, length.

(2) Termini and important intermediate localities and major junctions.

(3) Bypass routes and detours.

(4) Terrain and climatic conditions of area traversed (surface configuration, vegetation, drainage, soils).

(5) General condition. Alinement (see par 6b), drainage (see par 6a(5)), foundation, and condition of surface.

(6) Type of surface (see par 6c). Prevailing type of surface and type of surface by sections if there are changes in pavement along the route, with the mile station limits of each section.

(7) Roadbed. Width of traveled way and type and width of shoulders; suitability for parking vehicles on the shoulders of the road.

(8) Critical features (location). Gradients in excess of 6%; curves with less than 150-foot radius; defiles, gorges, and significant cuts and fills; narrow or low-capacity bridges (less than 13½ feet horizontal clearances and less than 7½ ton load capacity); interruption factors (slides, washouts, flooding); restrictive city streets (see par 7).

(9) Traffic and load capacity. Wheel or axle load in pounds or tons that the road will bear under constant traffic without excessive maintenance.

(10) Clearances. Minimum vertical clearance (location and nature of restriction); minimum horizontal clearance (location and nature of restriction).

b. Importance. International, national and/or local importance of the route.

c. Standards and specifications. Data that differ from the countrywide or regional standards and specifications.

d. Construction and maintenance. Practices that differ from the general pattern established for the countrywide or regional highway network.

e. Ground photographs.

(1) Roadway: surface type for each section of the route if surfacing changes; section of road that shows conditions favoring or limiting off-road movement.

(2) Critical features.

(3) Unconventional construction equipment (see par 9).

Section III. STRUCTURES AND CROSSINGS REPORTING GUIDE

19. Priority information collection requirements

a. General status. Age, condition, capacity, and clearances in the country or region.

b. Current construction.

(1) Nature and purpose.

(2) Design standards and specifications.

(3) Time schedule for completion, and feasibility; current status.

c. Current reconstruction or improvements.

(1) Nature and purpose.

(2) Design standards and specifications.

(3) Time schedule for completion, and feasibility; current status.

d. Plans for expansion or improvements.

(1) Nature and purpose.

(2) Design standards and specifications.

(3) Time schedule for completion, and feasibility.

20. General information collection requirements

a. Standards and specifications.

(1) Countrywide or regional standards and specifications for each of the various types of structures and crossings (bridges, tunnels, snowsheds, galleries, ferries, fords).

(2) Degree to which the standards and specifications are followed in actual practice. (If official standards and specifications have not been established, report common practices.)

b. Maintenance. Frequency of inspection, and nature and frequency of maintenance.

c. General information requirements on bridges (see par 11 and 12).

(1) Statistics: Total number; total length (feet) of all bridges and most common length (range of feet) of individual bridges; prevailing types of bridges and most common span lengths associated with each type; prevailing load capacities (countrywide, regional, or for various types of roads); prevailing vertical and horizontal clearances.

(2) Conditions: prevailing ages; prevailing states of repair (if poor, indicate reasons); provisions for demolition (common or uncommon).

d. General information requirements on tunnels (see par 13b).

(1) Statistics: total number; total length (feet) of all tunnels and most common length (range of feet) of individual tunnels; prevailing vertical and horizontal clearances.

(2) Conditions: prevailing ages; prevailing states of repair (if poor, indicate reasons); prevailingly lined or unlined, ventilated or unventilated, lighted or unlighted; provisions for demolition (common or uncommon).

e. General information requirements on snowsheds and galleries (see par 13c).

(1) Statistics: total number; total length (feet) of all snowsheds and galleries and most common length (range of feet) of individual structures; prevailing vertical and horizontal clearances.

(2) Conditions: prevailing ages; prevailing states of repair (if poor, indicate reasons); prevailing construction material; prevailingly lighted or unlighted; provisions for demolitions (common or uncommon).

f. General information requirements on vehicle ferries (see par 13e).

(1) Statistics: total number; total length (feet) of crossings and most common length (range of feet) of individual crossings; total number of craft in regular use and most common number at a crossing; prevailing types of ferry craft (motorized, towed, cable-operated) and prevailing capacities (cargo weight and number and type of vehicles).

(2) Condition: prevailing ages; prevailing states of repair (if poor, indicate reasons).

g. General information requirements on fords (see par 21b(5)): extent of dependence on fords.

21. Detailed information collection requirements

Information needs on structures applicable to an individual highway are outlined below.

a. Overall information.

(1) Total number of structures and crossings of each type (bridges, snowsheds, galleries, tunnels, ferries, fords); prevailing types and general condition.

(2) Total length of each type of structure on the individual highway.

b. Information on individual structures and crossings.

(1) Bridges (see par 12).

(a) Bridges less than 100 feet in length (except significant bridges): location (mile station and coordinates), length, material, and bottleneck factors.

(b) Bridges 100 feet or more in length and significant bridges less than 100 feet: location; crossing (name of stream or other feature); water gap (bank to bank at normal water level); total length (from abutment to abutment); spans (material, type, number, length); foundation material; abutment and pier material (concrete, steel, masonry, timber); roadway (width, sidewalks, type of deck); clearances (vertical and horizontal); load capacity (designed, posted, or estimated); chambers for demolition (yes or no); year completed and present state of repair; detours available and distances.

(c) Photographs. Bridges 250 feet or more in length and less than 250 feet if the bridge is typical, unique in design, on a vulnerable site, or unusually important in a road network: one photograph showing side view of the whole bridge including abutments and approaches, the others showing details of component parts of the bridge.

(2) Tunnels (see par 13b). All tunnels regardless of size; location (mile station and coordinates); material through which driven (rock, soil); length (portal to portal); roadway width and surface type; clearances (vertical and horizontal); alinement (straight or curved); ventilation (natural or artificial and adequacy); drainage (type and adequacy); lining (masonry or concrete); chambers for demolition (yes or no); lighting; year completed and condition; detours available around tunnel and distances; photographs of entrances with approaches and surrounding terrain, one of each entrance, and an interior view.

(3) Snowsheds and galleries (see par 3c). All snowsheds and galleries regardless of size; location (mile station and coordinates); length of road covered; material (concrete, masonry, timber); clearances (vertical and horizontal); ventilation (natural or artificial and adequacy); chambers for demolition; lighting; year completed and condition; detours available and distances; photographs of entrances with approaches and surrounding terrain, one of each entrance, and an interior view.

(4) Ferries (see par 13e).

(a) General: name and location of terminals (mile station and coordinates); waterbody name; length of ferry route; alternate routes or crossing points.

(b) Description of terminals: slips (width, depth, capacity); docking facilities (description and state of repair); approach roads (width of traveled way, surface type).

(c) Description of ferryboats: type (motorized, towed, cable-operated); number, motive power, draft, age and state of repair; capacity of each type (maximum cargo weight and number and type of vehicles); vertical and horizontal clearances; round trip crossing time (including crossing of waterbody, mooring, and unmooring, loading and unloading); inoperable periods (dates and reasons).

(d) Photographs: ferryboats; approach road (width, surface); fixed facilities (slips, loading platform, floating stage, other).

(5) Fords (see par 13d); location (mile station and coordinates); waterbody name; width (in feet), depth (in feet), and velocity (in feet per second) of waterbody at maximum, mean, and minimum water levels and dates for each; bottom characteristics (material -- silt, sand, stone, gravel, clay, rocks; firm or soft); bank characteristics (material, firm or soft, slope); approaches (firm or soft, paved); available detours and alternate crossings and distances; photographs of waterbody, banks, approaches, approach road, and a vehicle in the process of crossing.

CHAPTER 4

SOURCES OF INFORMATION

22. Importance of collection

a. Intelligence can be no better than the information from which it is derived. There is a continuing need for the systematic exploitation by field collectors of all available sources of information on highways of a foreign country or region and the reporting of the obtained information to the proper intelligence agencies.

b. To avoid duplication of intelligence collecting and reporting efforts, the collector should, if possible, consult the senior United States official, civilian or military, stationed in the area who is responsible for coordinating all collection and reporting activities.

23. Collection plan

The information needs form the basis for the collector to prepare a collection plan, and he should acquaint himself with these information needs. The background material is designed to enable the collector to recognize significant component parts of a highway and to report them properly. Collection should begin with the "Priority" information requirements for both highways and structures and expand gradually, as time permits, to encompass both "General" and "Detailed" information interests. A collection plan may cover the following items: requirements, suggested source of information, probable location of the source, and collector's comments (items obtained and explanation). Most of the information needs can be met by the collection of highway maps, publications, and aerial and ground photography. The collector is not expected, normally, to evaluate, analyze, summarize, collate, or give opinions on the data he collects. However, specific requirements may include an evaluation of certain information which can best be supplied by an on-the-spot analysis and/or evaluation by the collector.

24. Principal sources

The principal sources of information for highways are highway and other maps, route logs, aerial and ground photographs, publications, direct observation, and friendly natives.

a. Highway and other maps. Maps are one of the principal sources of information. Highway maps, topographic maps, town plans, and atlases contain information on highways including basic road patterns, international connections, types of highways, mileages, number of traffic lanes (or width classifications), and road surfaces. Up-to-date maps may be obtained at civilian and military mapmaking organizations, government agencies in charge of public works and transportation, bookstores, travel bureaus, oil companies, and motor vehicle service stations.

b. Route logs. A route log (Figure 56) is the basic intelligence instrument for highways. It provides detailed route descriptions using mile or kilometer post locations: type, width, and other characteristics of highway or street surfaces, including details on base course and shoulders; bridges, tunnels, fords, ferries, snowsheds, and galleries; bottlenecks of all types; overhead clearances; radius of curves; gradients; sight distances; and repair and servicing facilities. The most complete and current documents of this type are normally available at the government agencies responsible for public works or transportation. Partial information including photographs may be found in various technical and engineering publications available in bookstores and also in folders and pamphlets of tourist agencies, trucking and transit firms, and highway construction organizations.

c. Aerial and ground photography. Photographs, both aerial and ground, are valuable sources for supplementing detailed information on highways, especially for structures. Photographs of highways and structures can be obtained from government highway departments (national or regional), organizations engaged in the construction of highways, and aerial photographic companies, and from technical publications and manufacturing brochures.

d. Publications. Publications are extremely valuable sources of information. The following types of publications are the most readily available to the collector.

(1) Newspapers and popular magazines. News media often contain articles dealing with the construction and maintenance of highways.

(2) Technical publications. Engineer textbooks, training manuals, technical reports, technical booklets, serial periodicals on highways, etc. contain information on highway plans and projects, construction and maintenance, highway design specifications and construction standards, structures, and construction equipment. These publications may be found at government agencies, bookstores, libraries, and professional societies and trade associations concerned with highway transportation, construction, and maintenance.

(3) Traffic laws and regulations. Booklets and pamphlets explaining traffic rules and regulations, illustrating road guidance, warning, and regulatory signs and signals, and other traffic control means may be found at government agencies, bookstores, and libraries.

(4) Statistical yearbooks. Statistical yearbooks contain mileages by types of roads; number of structures; inventories of heavy construction equipment and vehicles by types; data on traffic carried by different modes of transportation; and labor statistics covering administration, construction, and maintenance. They are usually official government publications and may be obtained in bookstores or government agencies.

(5) Bus timetables and guidebooks. Bus timetables, guidebooks, and other tourist literature usually contain information pertaining to highway routes and terminals, as well as photographs. They are easily obtained at bus terminals, tourist travel bureaus, bookstores, and libraries.

(6) Construction plans and projects. Construction plans and projects give data for the development of new highways or describe expansion, reconstruction, and improvement of existing highways. They may contain route logs of individual highways, diagrams showing typical cross-sectional views of the roadway, and drawings of principal structures. Plans may be obtained from publications prepared by both government agencies and private organizations concerned with highway construction.

(7) Manufacturer's catalogs and brochures. Advertising documents cover highway construction equipment and methods, and engineering procedures.

e. Direct observation.

(1) Personal route reconnaissance is another means of obtaining information. Direct observation normally should be undertaken only after all other means of gathering data have been exploited. Normally, direct observation should be used to fill specific gaps in information. In countries where security restrictions prohibit or restrict access to published material, direct observation may be the only reliable method of obtaining information. Personnel charged with such collection should prepare detailed collection plans. Reconnaissance trips should be concentrated on roads that carry the heaviest traffic, connect key urban centers, or have other strategic importance. In a backward country, the highways selected may include all existing roads. The collector should select and mark on a map tentative sites and major structures important enough to be photographed.

(2) Direct observation of highways and structures should be reported on a Route Log (Figure 56) or the following U. S. Army reporting forms as applicable: roadway data on DA Form 55-174 (Figure 57); bridge data on

DA Form 55-175 (Figure 58); traffic bottlenecks on DA Form 55-176 (Figure 59); and tunnel data on DA Form 1250 (Figure 60). All these forms are dated 1 June 1956 (FM 55-8, subject: Transport Intelligence).

f. Foreign representatives. Cooperation with representatives of friendly foreign countries and with refugees from unfriendly countries may be very profitable. These people can help the collector either by advising about sources or by supplying the required information. Prior to any such contacts, the collector should consult with the senior U. S. official in the country.

APPENDIX A

GLOSSARY OF HIGHWAY TERMS

---

abutment -- The support at either end of a bridge.

aggregate -- Natural or processed material, such as crushed rock, sand, slag, and shell, used with or without artificial binder as material for the subbase, base, or wearing course of a road. Aggregate in a surface course is often called "road metal".

all-weather road -- Any road which, with reasonable maintenance, is passable throughout the year to a volume of traffic never appreciably less than its dry-weather capacity.

approach span -- A roadway supported on a bridge substructure adjacent to the main bridge spans.

arch bridge -- A bridge that consists of an arch and a floor system.

arch culvert -- A culvert that is similar in design to an arch bridge.

bascule span -- A movable span that is opened by raising one end.

base course -- A layer of material placed upon and compacted on the prepared subgrade of a road.

bitumen -- Any bituminous material (asphalt or tar products).

bituminous pavement -- A wearing surface of a road that is made of a mixture of asphalt and tar products (bitumens) and aggregate.

bituminous surface treatment -- A road surface made by applying a liquid bitumen to the base course, or an old surfacing, and immediately adding aggregate. A course less than 1-inch thick is considered a bituminous surface rather than a pavement.

box culvert -- A culvert with a square or rectangular cross section.

bridge span -- The superstructure that extends over the gap between ground supports.

cantilever bridge -- A bridge that has beams, girders, or trusses that extend toward each other beyond their means of support, and which are joined together either directly or by a suspended span.

causeway -- A section of road raised on an embankment of fill, usually across marshy ground or a shallow body of water.

civilian load class -- Most common measure of road bridge capacity, expressed in tons of a vehicle that the bridge will support safely.

clear span -- The distance between faces of a span's supports (piers or abutments), measured at the top of the support. For concrete or masonry arch bridges, the measuring points are the spring lines of the arch.

combined bridge -- A bridge (usually a long structure) composed of different types of spans.

concrete -- A mixture of cement, coarse and fine aggregate, and water.

continuous span bridge -- A structure that passes over three or more gaps without a structural break at intermediate supports.

corduroy road -- A road built over soft ground and composed of logs or planks laid crosswise or perpendicular to the road directly on the soil or on wood stringers or sleepers.

crib piers -- A bridge support built of logs in the form of a crib with the bottom of the pier wider than the top, sometimes filled with stone.

critical span -- The span which determines the bridge class. It is the span with the lowest safe load-carrying capacity.

cross section -- A vertical cutting of a road at right angles to its axis, showing all structural elements of the road.

crown -- The vertex of the arched surface of a road; also the difference in elevation between the centerline and the edge of the traveled way.

culvert -- A small bridgelike structure serving as a transverse drain under a road. For intelligence purposes, the term is applied to all bridge-like road structures less than 20 feet in length.

dip -- A paved ford used for crossing wide, shallow arroyos or washes in semiarid regions where the construction of bridges is impractical.

earth surface -- Natural soil that has been graded to form a surface for traffic.

fair-weather road -- A road which tends to become impassable in bad weather and which cannot be kept open by normal maintenance. It has a surface of natural or stabilized soil, sand, clay, shell, cinders or disintegrated granite.

ferry (cable) -- A ferry that is attached to a continuous cable that extends across a stream. Power to operate the cable is supplied either by someone on the ferryboat who pulls on the cable or by a motor that operates the cable by means of gears attached to one of the pulleys.

ferry (current-operated) -- A ferry held in the stream by an anchor well upstream from the crossing site; as the ferry moves from shore to shore, it describes an arc of a circle the center of which is the anchor.

ferry (powered) -- A ferryboat that is propelled by its own engine.

fixed bridge -- A bridge with a superstructure that is designed to remain in one position.

flexible pavement -- A pavement made of bituminous or earth stabilized material.

floor system -- Portion of the bridge superstructure that carries the roadway and transmits the load to the main supporting members. It usually consists of stringers, floor beams, and a roadway (wearing surface).

footing -- Part of the substructure of a bridge which rests directly on the ground, spreading the load over a sufficient area of soil so that the structure does not sink into the ground.

ford -- A shallow place in a stream where the bottom permits the passage of personnel or vehicles.

foundation -- The ground beneath the footing of a bridge.

gallery -- Any sunken or cut passageway covered at the sides as well as overhead; it usually has a series of openings along one side for light and ventilation.

girder bridge -- A bridge supported by two or more parallel girders with transverse floor beams.

gravel surface -- A surface composed of a compacted layer of well-graded gravel.

half-through bridge -- A bridge with the deck at or near the bottom edge of the main supporting members; it has no overhead bracing.

heavy expedient road -- A log or plank road used on muddy and swampy ground in areas where timber is abundant.

horizontal alinement -- The horizontal location and direction of the center line of a road; it includes curves and tangents (straight sections).

horizontal clearance -- The distance available to pass a load that extends laterally beyond the wheels of a vehicle.

hot-mix bituminous concrete -- A mixture of coarse aggregate, fine aggregate, mineral filler, and bitumen that is proportioned and mixed at a central mixing plant.

lift span -- A movable span which is opened by raising it vertically at both ends while maintaining it in a horizontal position.

limited all-weather road -- A road which, with reasonable maintenance, can be kept open in bad weather to a volume of traffic which may be considerably less than its dry-weather capacity. This type of road does not have a waterproof surface.

log-tread road -- A road built over soft ground and made by planks, logs, sandbags, mats or brush laid directly on the soil or on wood stringers or sleepers along the wheel track.

metaled road -- A road the surface of which is composed of gravel, broken stone (crushed rock), slag, or shell formed with or without water or artificial binder.

military load class -- Common measure of road bridge capacity, expressed in tons of a military type vehicle that the bridge will support safely.

mixed-in-place bituminous -- A mixture constructed by mixing bitumen with aggregate directly on the road base; it is known as "road mix".

movable bridge -- A bridge with at least one span which can be moved from its normal position to permit the passage of vessels.

oil-earth surface -- A surface made by coating ordinary earth roads with oil in order to reduce dust and to lessen the tendency to soften in wet weather.

overall (superstructure) bridge length -- Length from abutment to abutment, including the parts of abutments covered by the ends of spans.

penetration macadam -- A surface made by adding a penetration coat of bitumen to an aggregate, after the latter has been spread over the base course. It is known as "tar-mac".

pier -- Intermediate ground supports of a bridge between abutments.

pile bent -- Intermediate ground support for a bridge, consisting of a row of four or six vertical members called piles that are driven into the ground, capped and cross braced.

pile pier -- Intermediate ground support for a bridge, consisting of two pile bents braced to one another.

pipe culvert -- A culvert made of corrugated metal, concrete, cast iron, or vitrified clay. Its cross section may be round, elliptical, or flattened on the bottom.

plank road -- Road used in muddy and swampy ground where timber is abundant; it consists of planks laid directly on the soil or on wood stringers or sleepers.

ponton (floating) bridge -- A temporary bridge that is supported by low flat-bottomed boats or other floating structures.

prestressed concrete bridge -- A bridge that has the principal steel reinforcing bars of its main members subjected to tensile stress and, consequently, the enclosing concrete to compressive stress. Prestressing counteracts stresses imposed upon these members by an applied load.

retractile span -- Span that is opened by rolling it directly back from the opening along a horizontal track of some type.

ribbon tread -- Planks of roadway laid diagonally across the stringers to distribute a load longitudinally over the deck and provide both a wearing surface and a smooth bridge surface.

rigid pavement -- Concrete, brick, or stone block pavement that distributes loads over a wide area of the subgrade, thus reducing stresses.

rock asphalt -- Type of bituminous surface consisting of natural rock impregnated with a bitumen.

sand-clay surface -- Mechanically stabilized soil surface in which a natural or artificial mixture of sand and clay is graded and drained.

seal coat -- An application of bitumen and fine aggregate or granular material to the surface of a road to fill voids and prevent the entrance of water.

skew bridge -- A bridge in which the long axis of one or more of the structural elements (piers, abutments) is not perpendicular to the center line of the bridge.

shoulder -- The portion of a roadway between the edge of the traveled way and a bordering ditch or embankment.

slab bridge -- A bridge in which the main members are reinforced or prestressed concrete slabs serving as the floor and resting directly on the abutments or piers; it has no stringers under the slab.

snowsheds -- Structure providing protection from snowslides for an exposed section of road; it usually is open on one side.

span length -- The distance between adjacent substructure elements, the measuring points being the centers of piers and the inner (river) face of abutments.

stabilized-soil surface -- Mixtures of aggregate, soil, and a stabilizing agent (cement, calcium chloride, bitumen) used to provide a base course for the support of a thin bituminous surface.

stone block pavement -- A pavement consisting of stones that are cut or formed into blocks; they generally are laid on a rigid base.

stringer (beam) bridge -- A bridge in which the main supporting members are longitudinal spanning stringers (beams), upon which the flooring rests.

subgrade (subbase) -- The shaped and compacted foundation on which the base course of a road is built.

substructure -- The piers (or bents) and abutments which comprise the ground support for a bridge, including the footing of the supports.

superstructure -- The spanning part of a bridge (bridge span and floor system), including all of the structure resting on the substructure.

surface course (traveled way) --Top layer of material covering the base course or subgrade between the shoulders, used for traffic of vehicles; it is also called traveled way.

suspension bridge -- A bridge which has its roadway suspended from cables or chains that pass over towers and are securely anchored at both ends of the suspended spans.

swing span -- A movable span which is opened by turning it in a horizontal plane on a pivot system usually located at or near its center.

through bridge -- A bridge with the deck on a level with the lower edge of the main supporting members which are connected by lateral bracing over the roadway.

transporter bridge -- A rare type of bridge in which the traffic is carried in a cage or car shuttling across the obstruction, the cage being suspended from an overhead bridging member. Sometimes termed a ferry bridge.

trench method of construction -- Method used in the construction of subgrade; the earth excavated to form a trench is pushed to the side of the road to form retaining shoulders.

trestle bents -- A bent consisting of a cap and sill and four or more posts with transverse bracing across the posts.

trestle piers -- Two or more bents placed close together and braced to one another.

truss bridge -- A bridge consisting of top and bottom cords with an intervening framework of diagonal, vertical, or horizontal elements transmitting the roadway loads to the substructure.

tunnel bore -- The interior of a tunnel; it may be semicircular, elliptical, horseshoe, or square with an arched ceiling.

tunnel liner -- Material (masonry or concrete) lining the interior of a tunnel.

tunnel portal -- Entryway for a tunnel, usually made of masonry or of concrete.

underbridge clearance -- The distance from the water level or the ground to the lowest part of the superstructure.

vertical alinement (profile) -- The longitudinal rate of slope of the center line of a road, expressed in per cent, indicating the vertical rise or fall in feet per 100 feet horizontally.

vertical clearance -- The distance available for the passage of vehicles between the roadway and the lowest overhead obstruction.

water-bound macadam -- Type of road surface made by spreading coarse aggregate in a layer and rolling it in place, superimposing fine aggregate which is rolled and broomed into the coarse aggregate until both are thoroughly keyed in place, and then binding the two types of aggregate together with water.

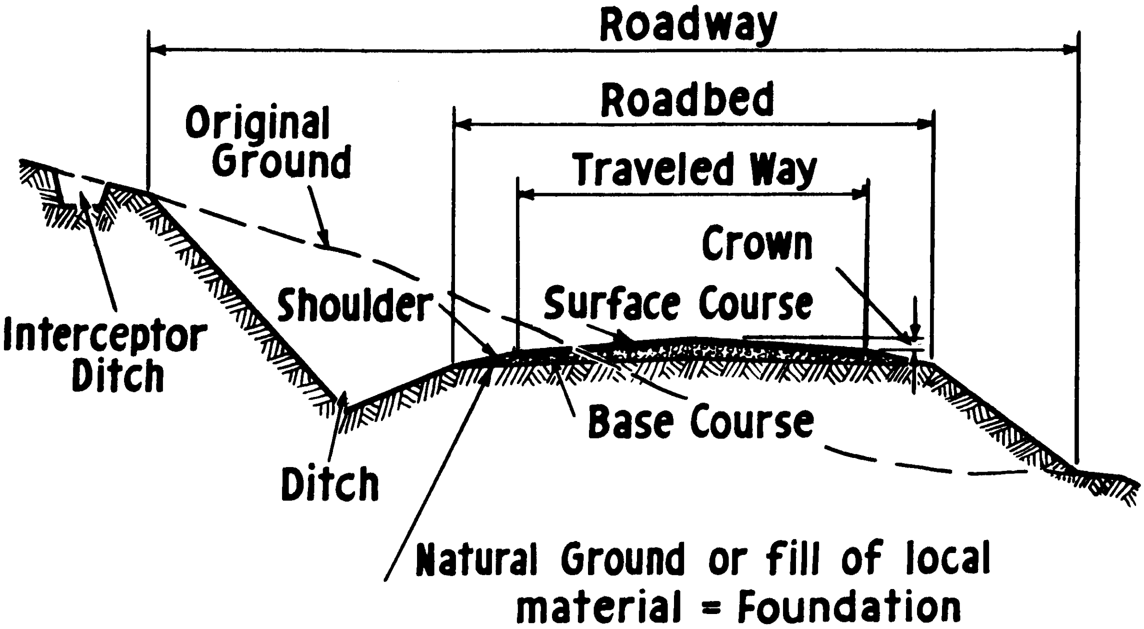


Figure 1. Typical cross-section illustrating road nomenclature.

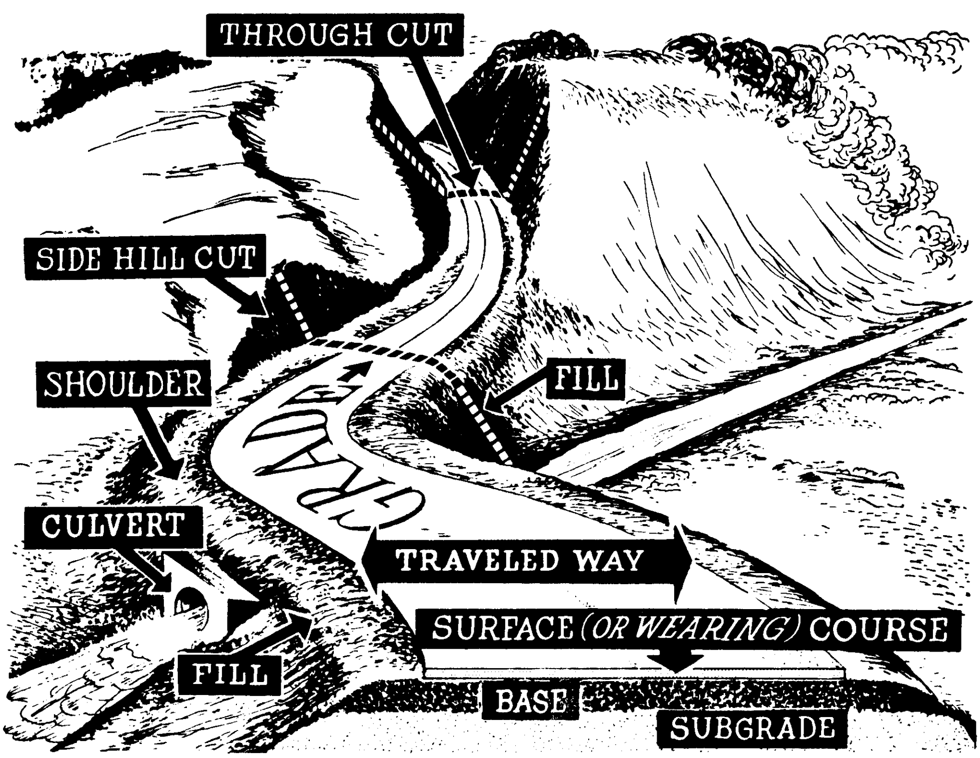


Figure 2. Perspective of road illustrating nomenclature.

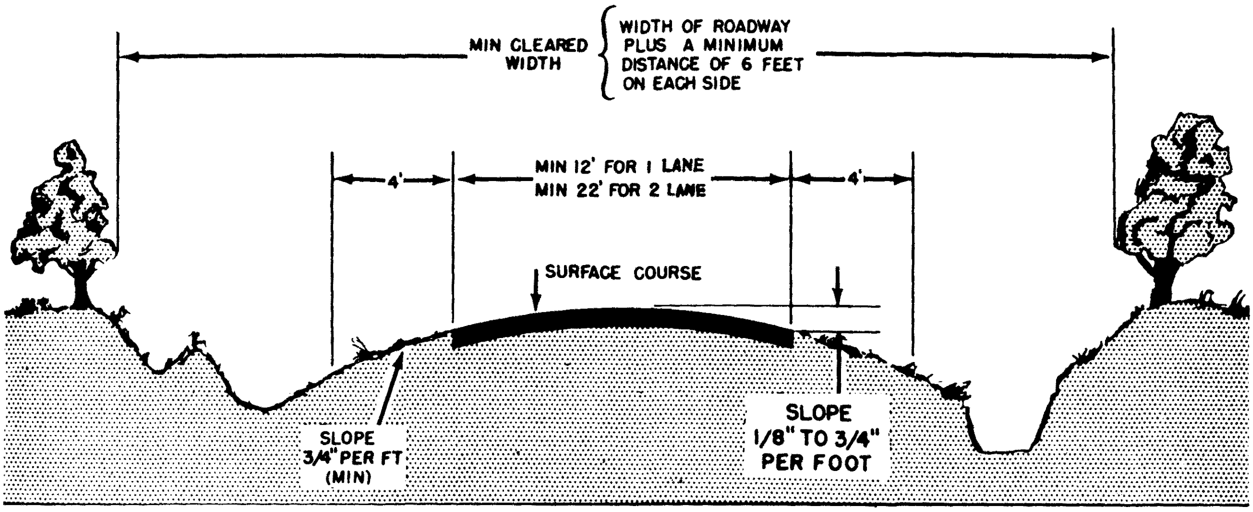


Figure 3. Typical cross-section illustrating road design standards.

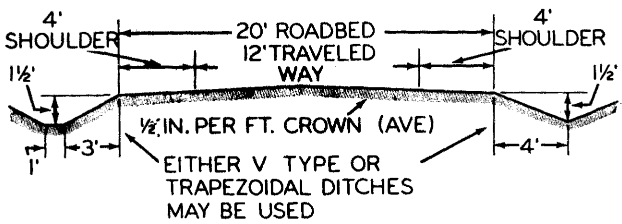


Figure 4. Cross-section design for one-way earth road.

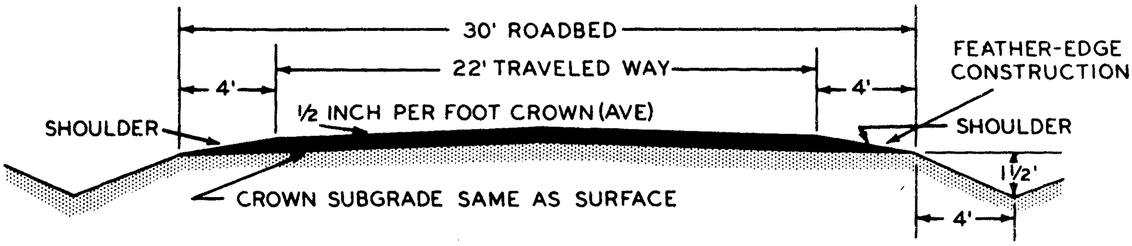


Figure 5. Cross-section design for one-way road using double-course construction.

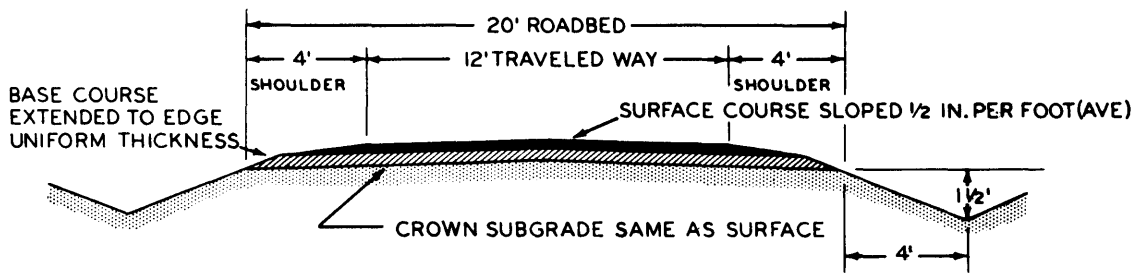


Figure 6. Cross-section design for two-way road using single-course construction.

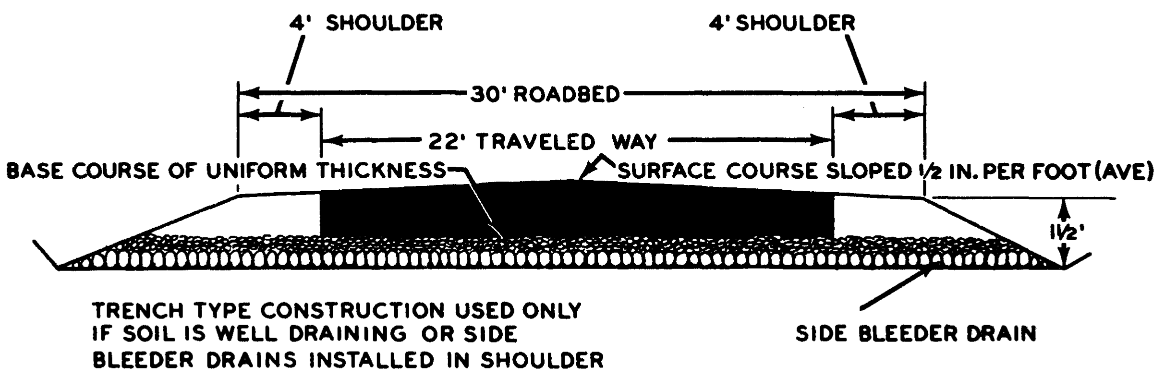


Figure 7. Cross-section design for two-way road using double-course, trench-type construction.

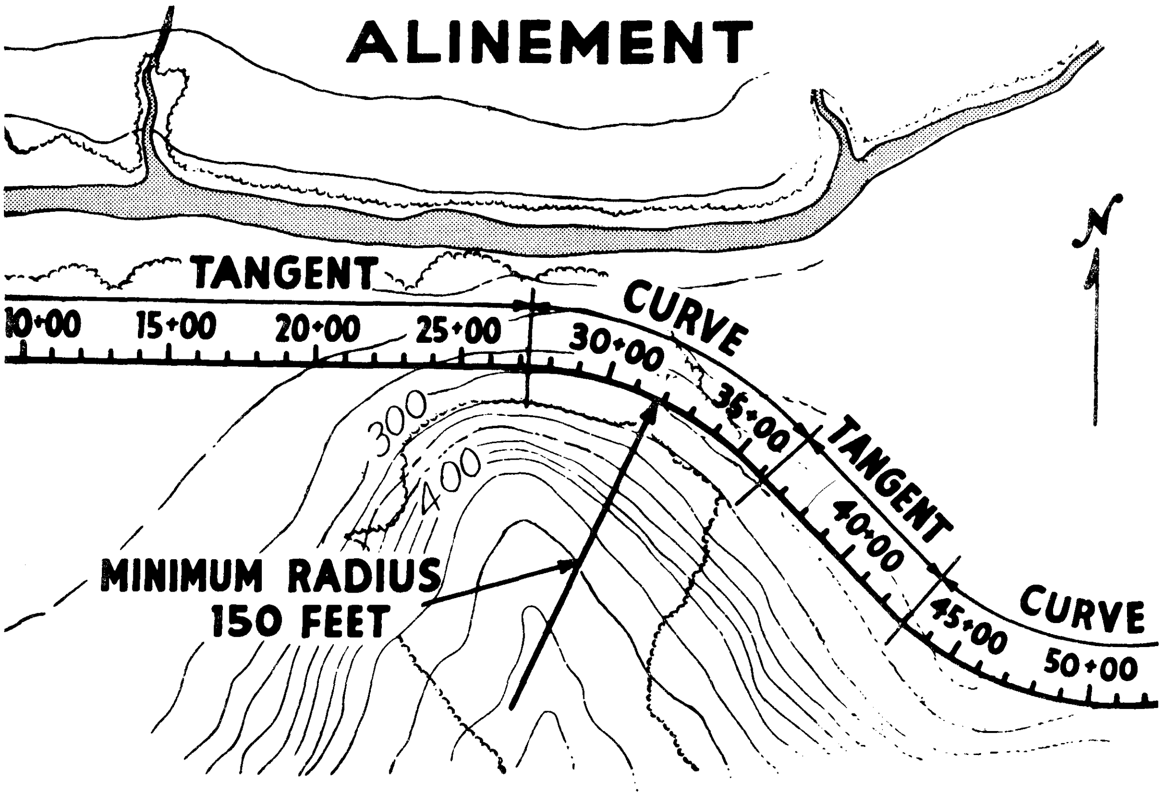
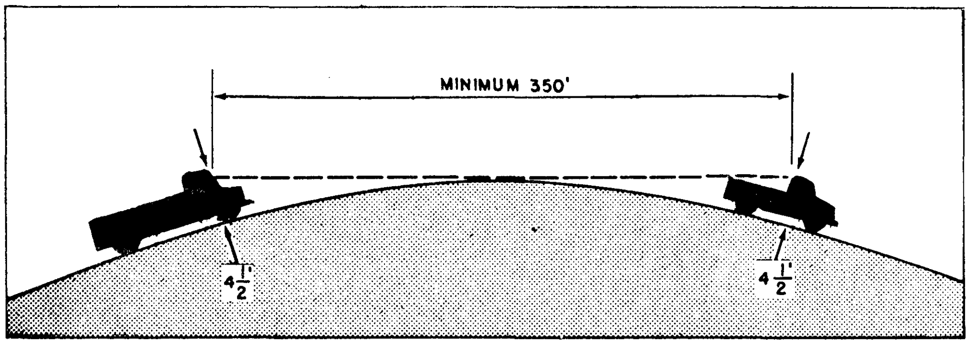
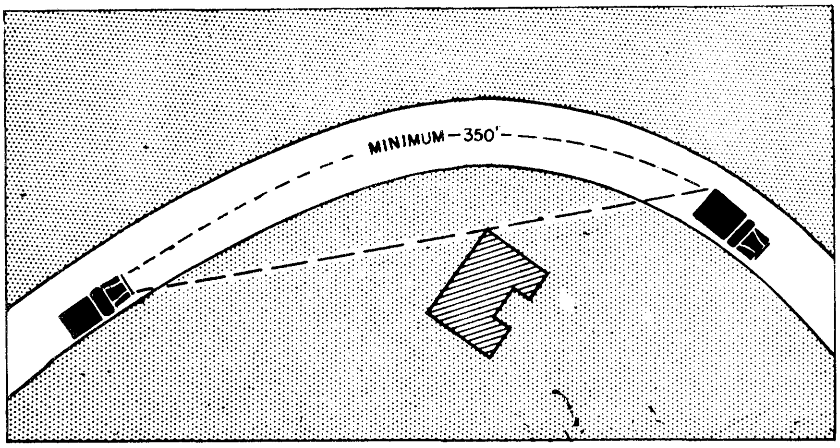


Figure 8. Alinement showing tangents and curves. The numbers, which indicate thousands of feet from a zero point, represent survey stations used in the construction of a highway. Construction standards and specifications designate the minimum allowable radius for curves.



VERTICAL CURVE



HORIZONTAL CURVE

Figure 9. Minimum passing sight distances for vertical and horizontal curves.

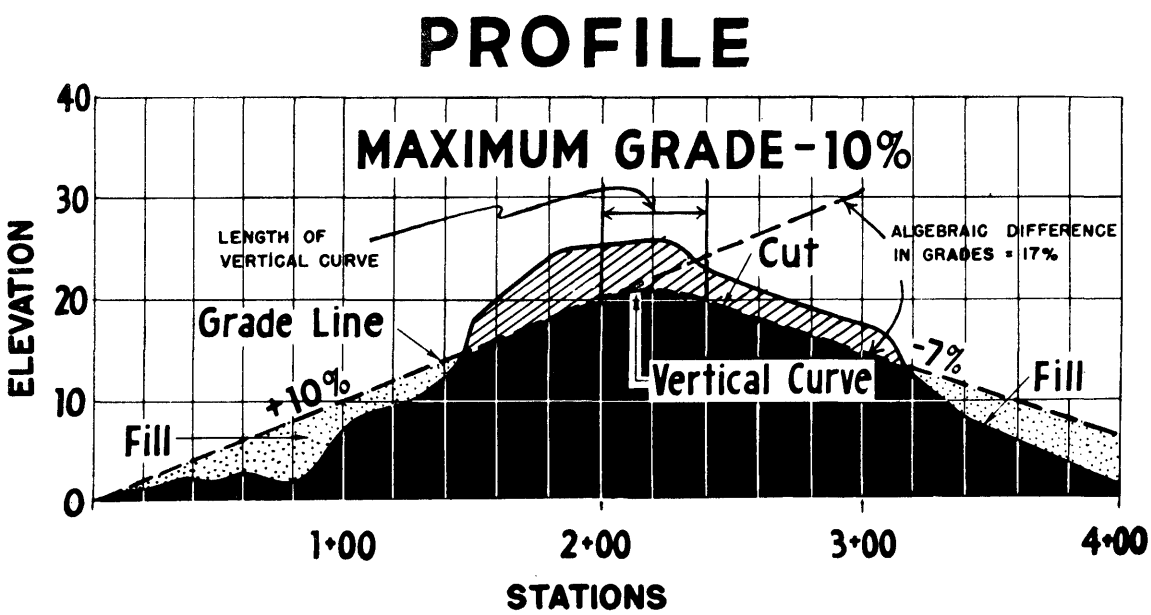
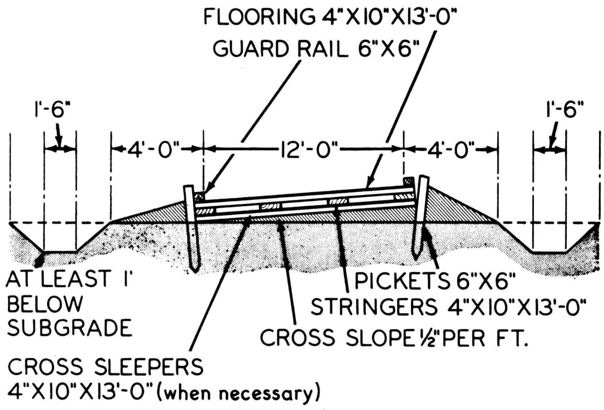


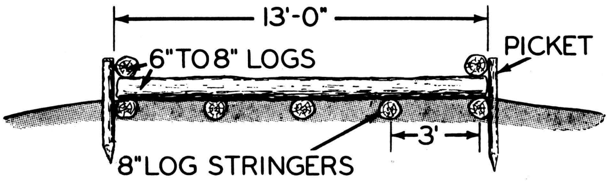
Figure 10. Profile of road.



a. Construction details for a plank road.

b. Plank road with a drainage ditch.

Figure 11. Diagram and photo of a plank road.



a. Construction details for a corduroy road.

b. Corduroy road being covered with an earth wearing surface.

Figure 12. Diagram and photo of a corduroy road.

Figure 13. Log-tread road.

Figure 14. Road through a terrain gap.

Figure 15. Road through a defile.

Figure 16. Road through a deep cut.

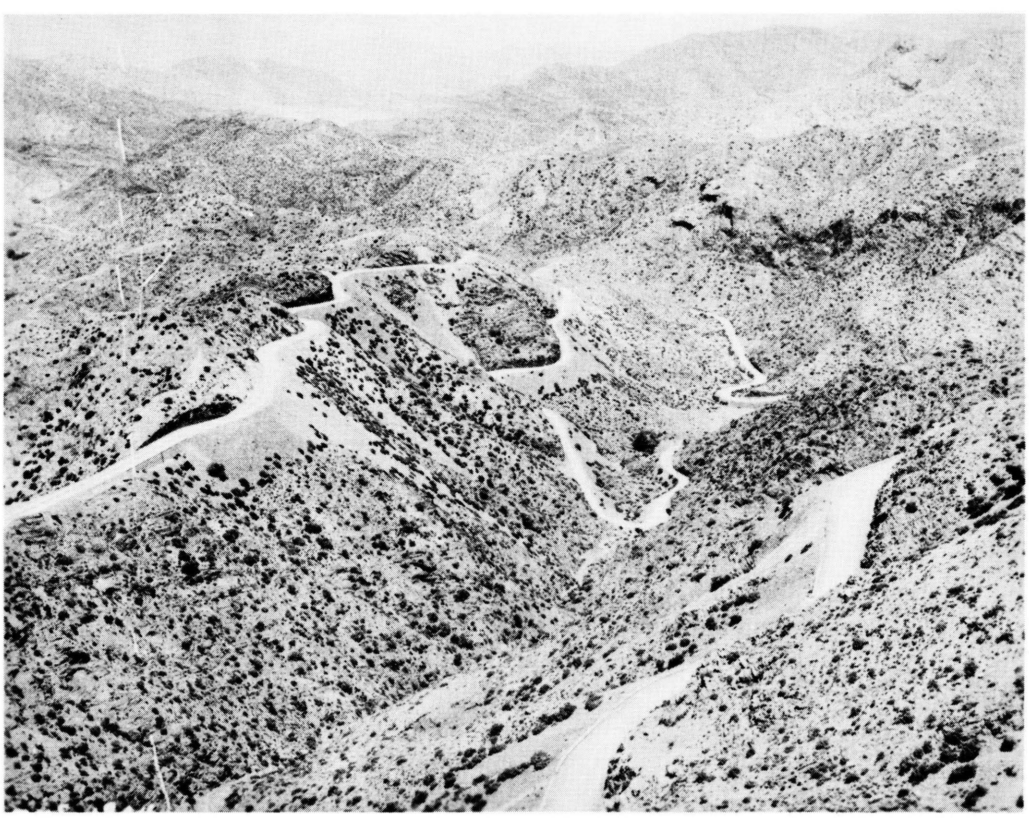


Figure 17. Road with steep grades and sharp curves.

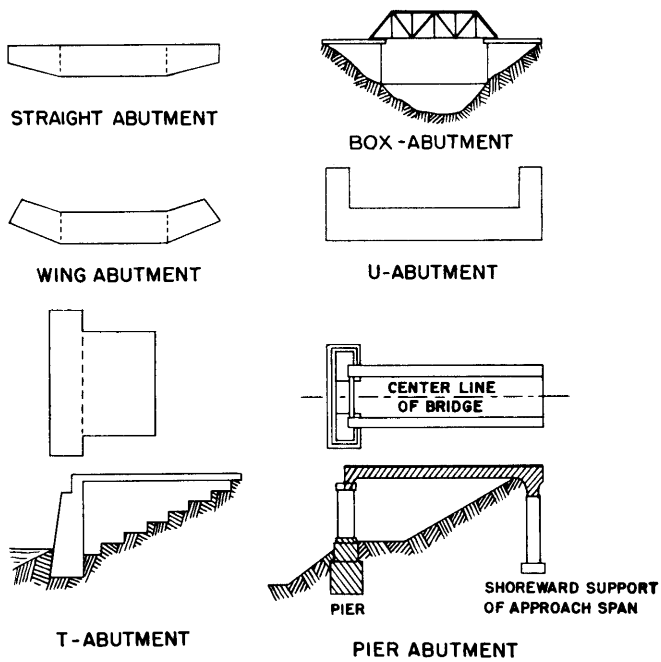


Figure 18. Types of common abutments.

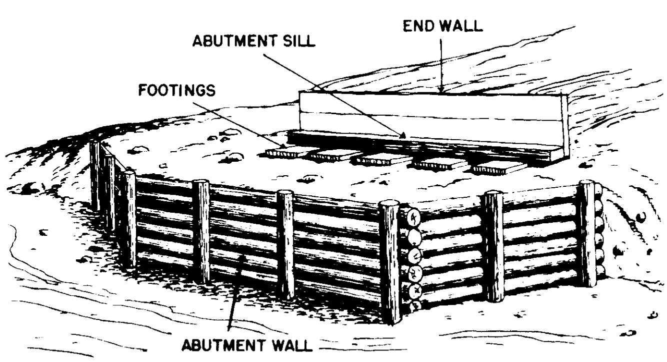


Figure 19.

Earth abutment, with timber abutment sill and end wall.

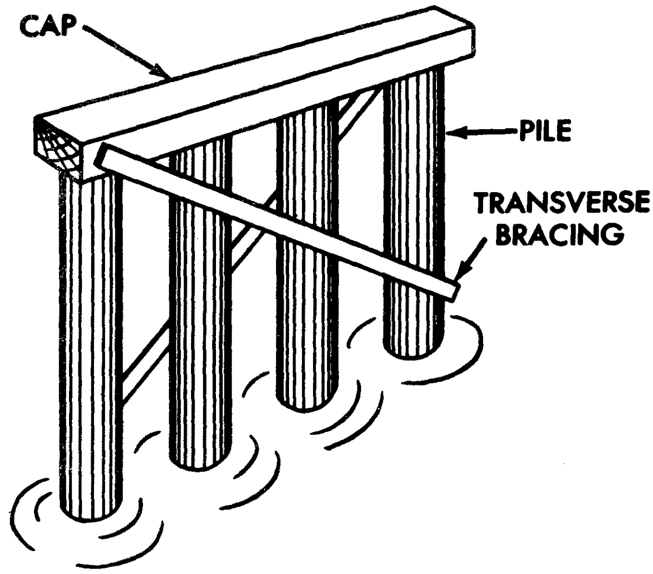
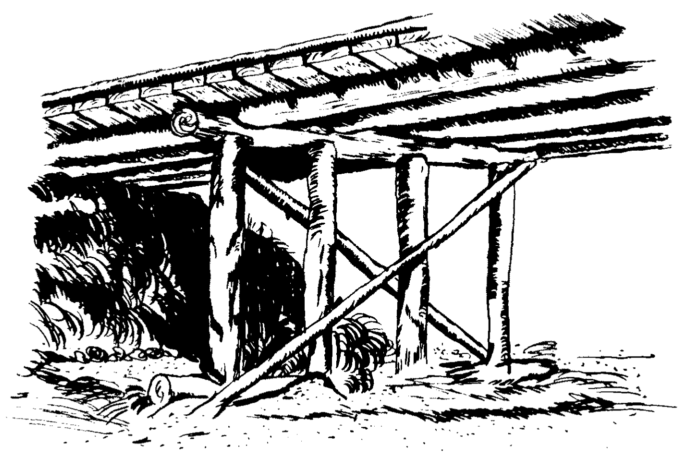
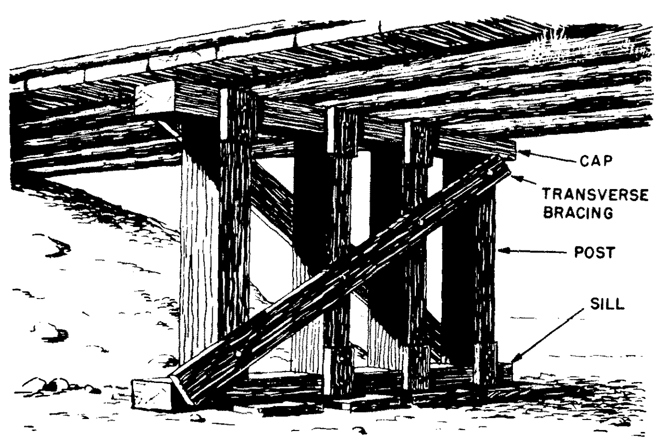


Figure 20. Pile bent.



a. Log trestle bent.



b. Shaped timber trestle bent.

Figure 21. Trestle bents.

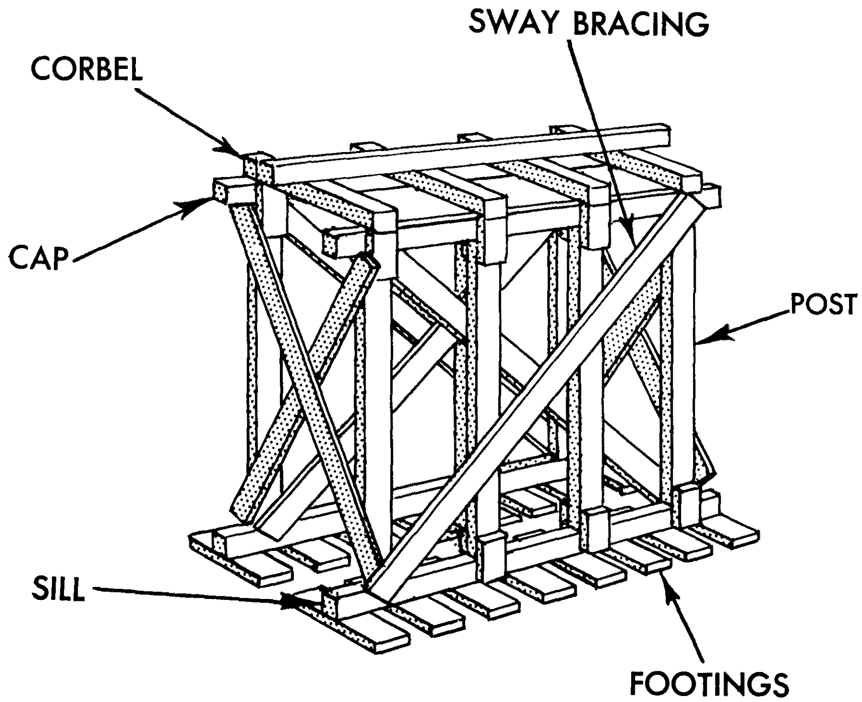


Figure 22. Timber trestle pier.

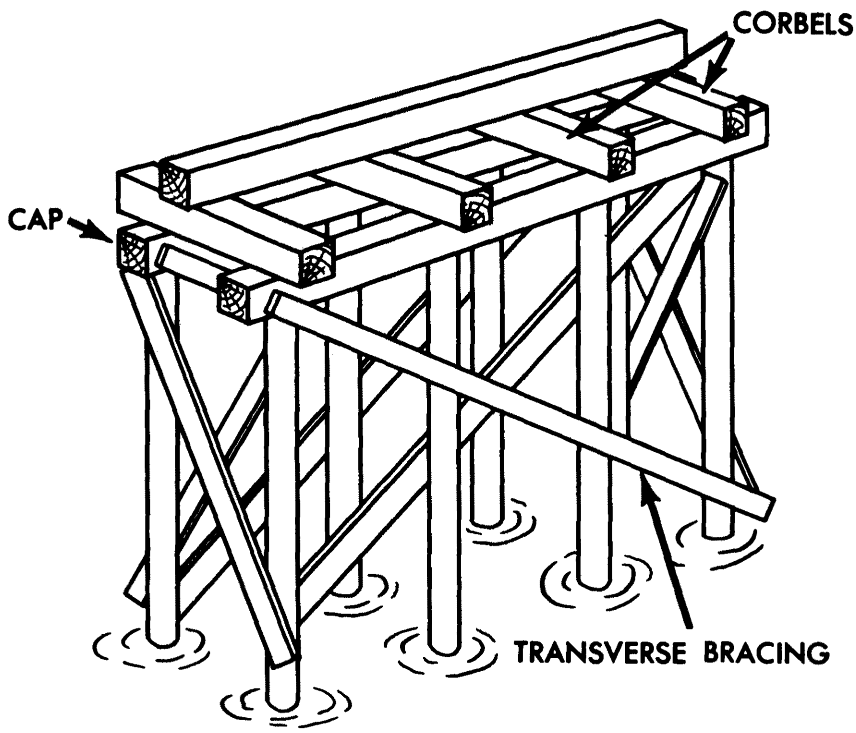


Figure 23. Timber pile pier.

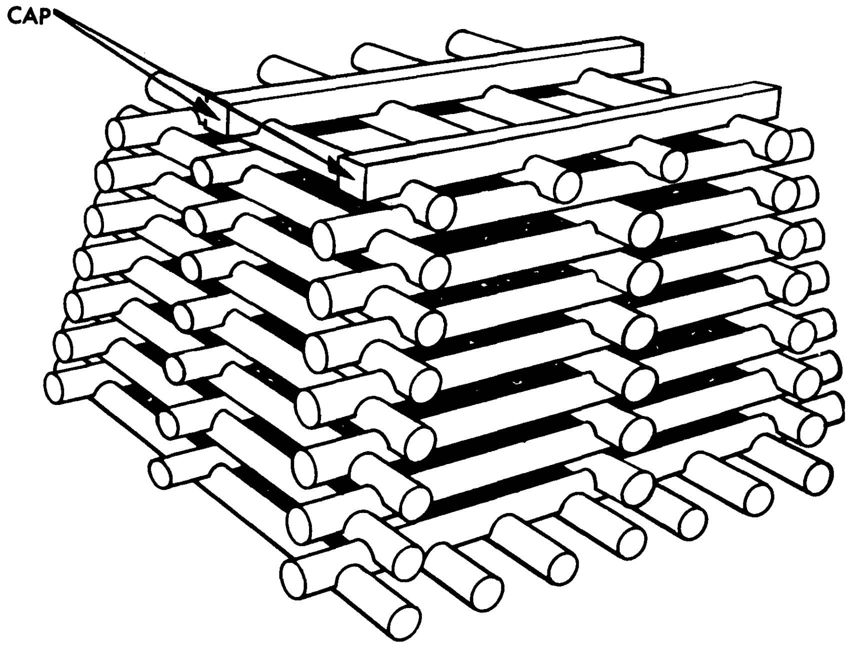


Figure 24. Crib pier.

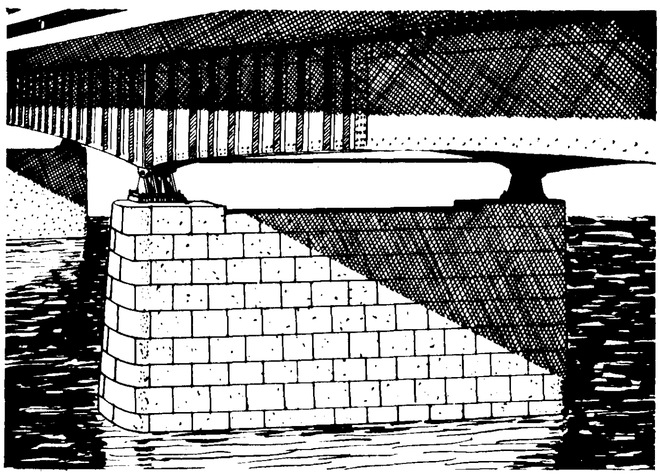


Figure 25. Masonry pier.

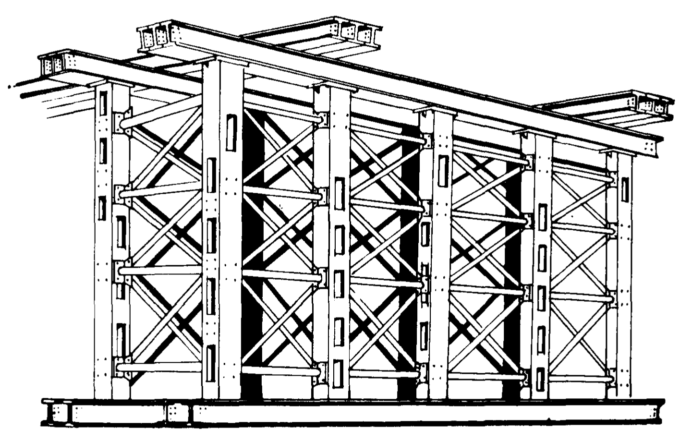


Figure 26. Prefabricated steel trestle pier.

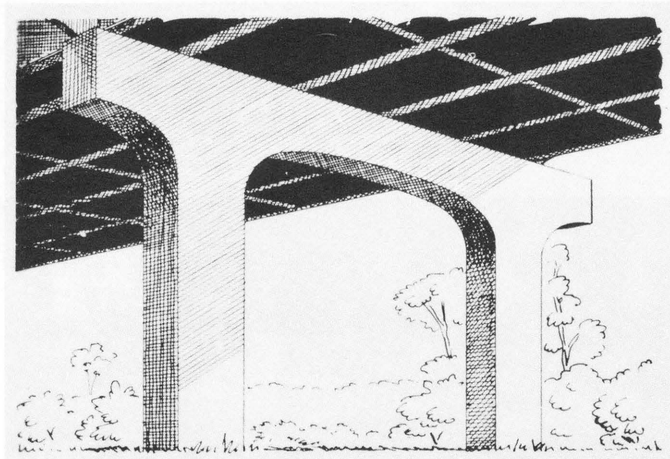


Figure 27. Open type concrete pier.

Figure 28. Solid concrete pier.

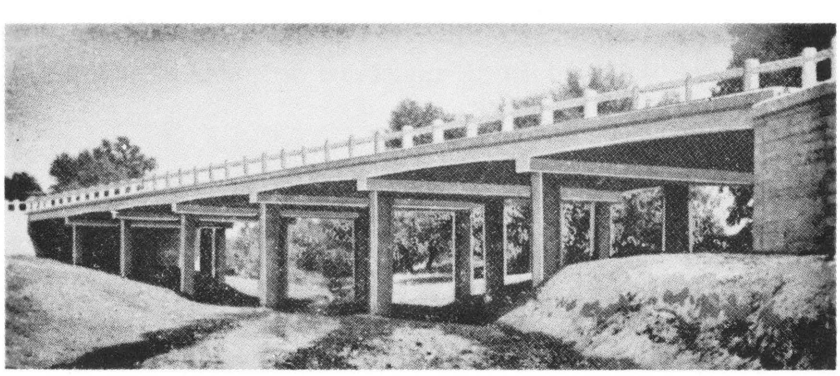
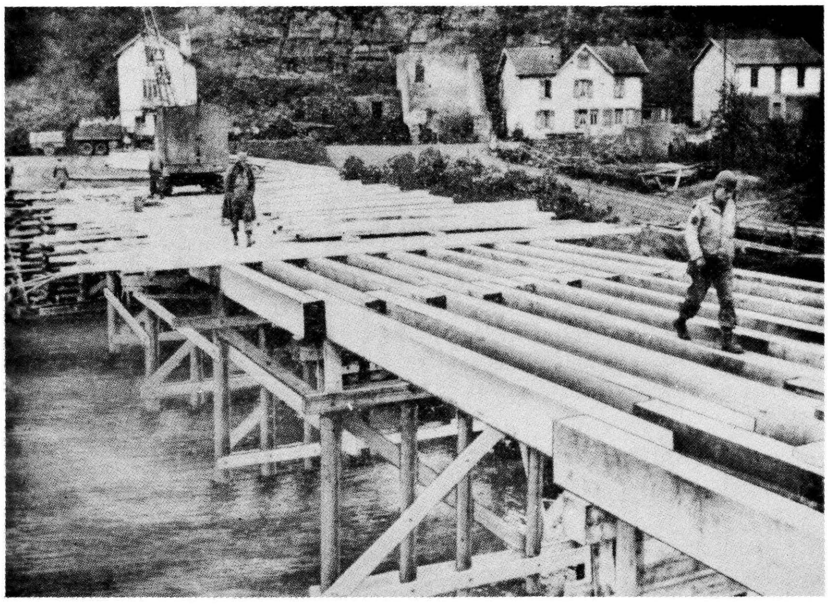


Figure 29. Concrete slab bridge.



a. Flooring being placed on wooden stringers.

b. Nomenclature for stringer bridges with trestle bents.

Figure 30. Diagram and photo of a wood stringer bridge with trestle bents.

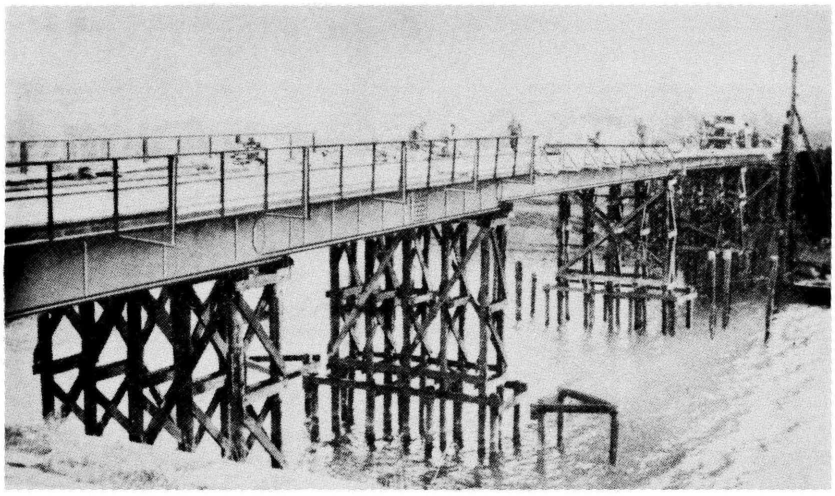


Figure 31. Steel stringer bridge.

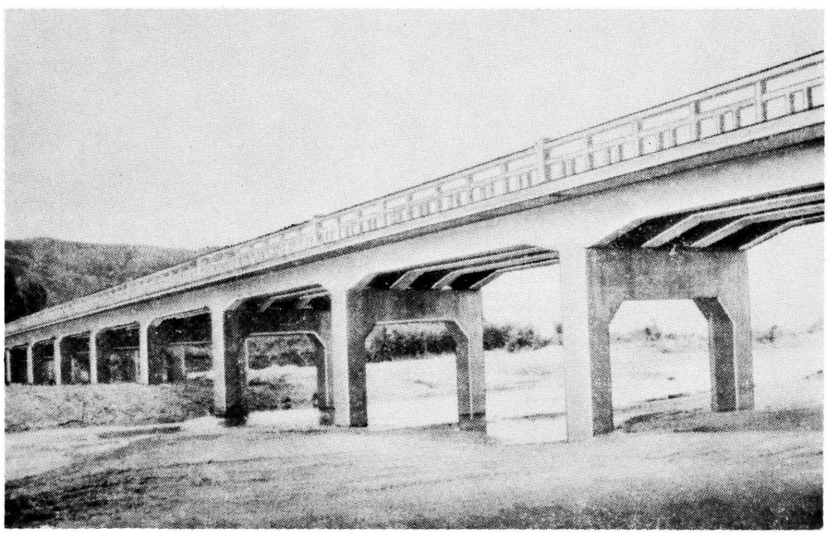


Figure 32. Concrete continuous beam bridge.

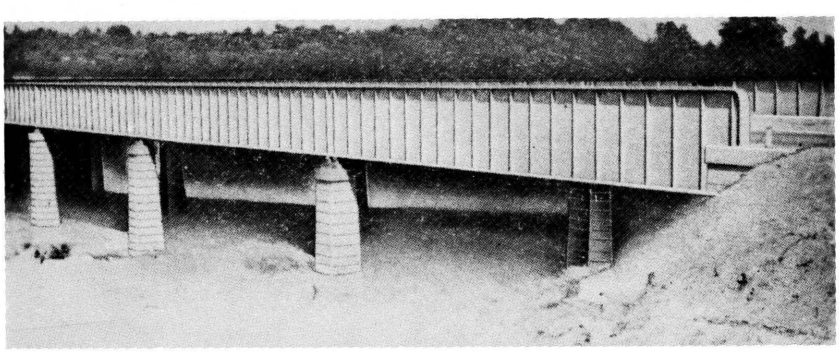


Figure 33. Steel girder bridge, through type.

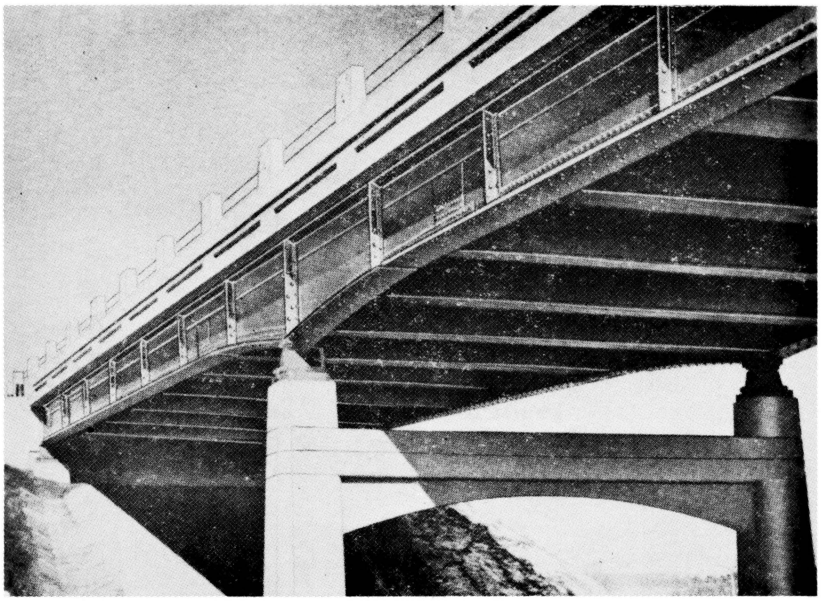


Figure 34. Steel girder bridge, deck type.

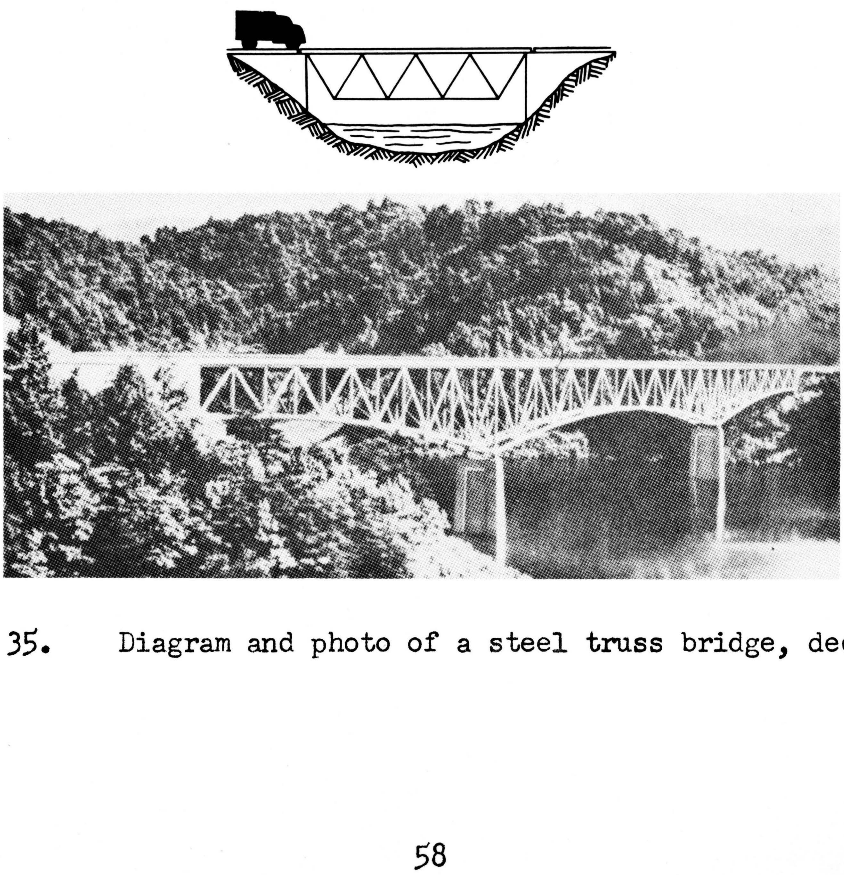
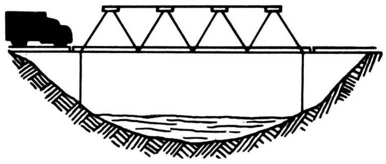


Figure 35. Diagram and photo of a steel truss bridge, deck type.



a. Truss bridge.

b. Steel arch bridge.

Figure 36. Diagram and photo of through type bridges.

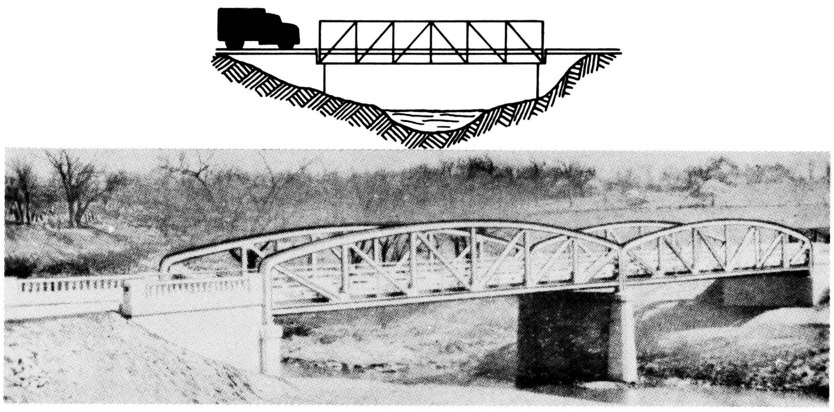


Figure 37. Diagram and photo of steel truss bridges, half-through type.

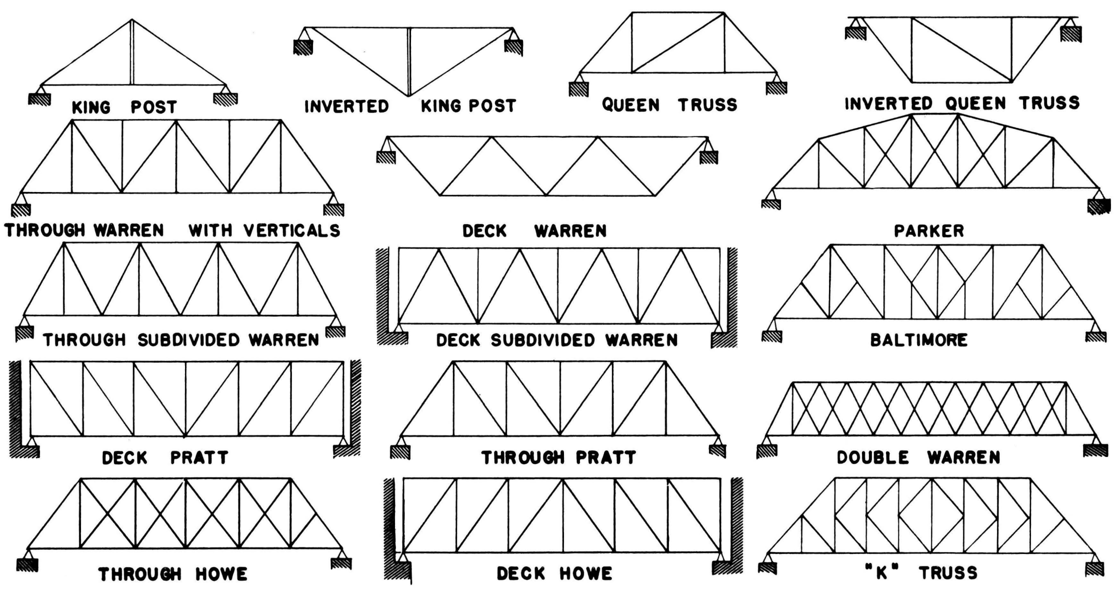


Figure 38. Common types of bridge trusses.

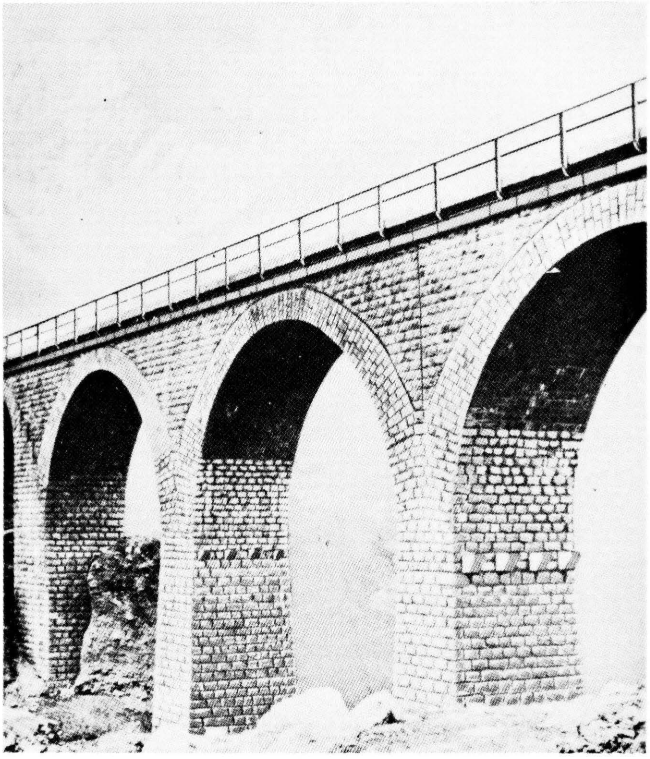


Figure 39. Solid masonry arch bridge.

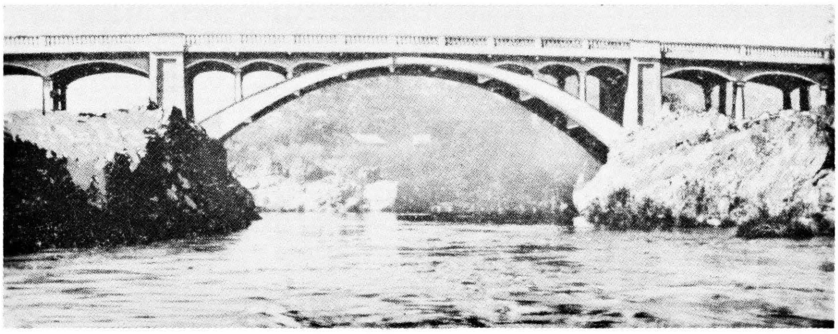


Figure 40. Open spandrel concrete arch bridge.

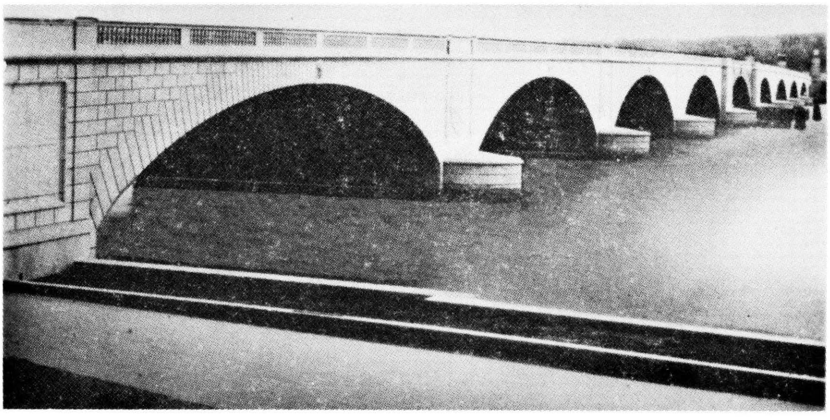


Figure 41. Filled spandrel concrete arch bridge.

Figure 42. Steel trussed deck arch bridge.

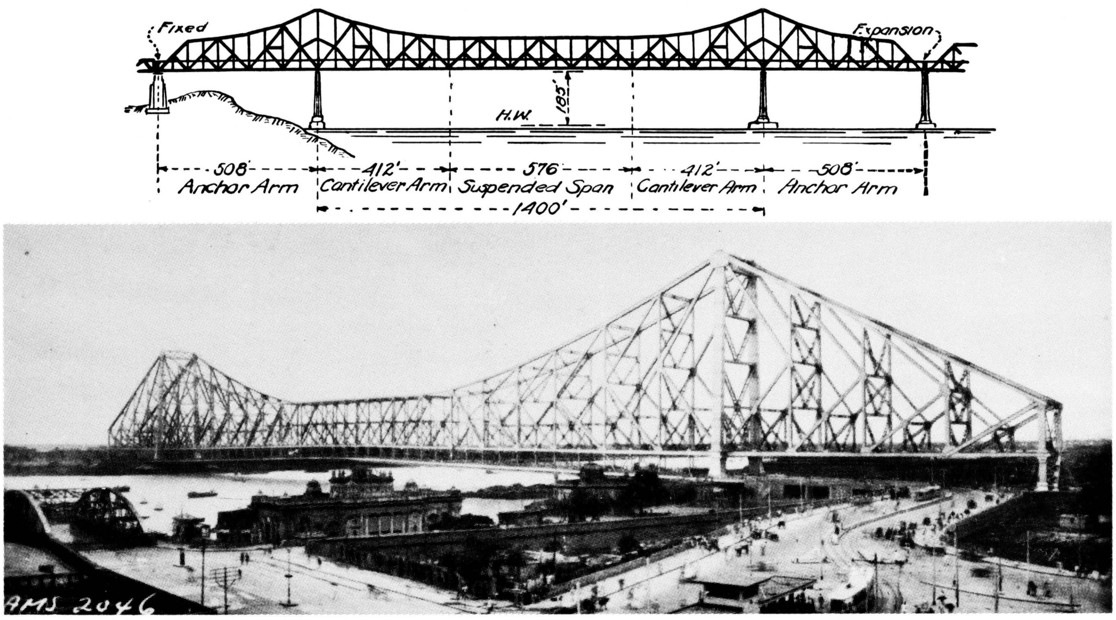


Figure 43. Diagram and photo of a steel cantilever bridge.

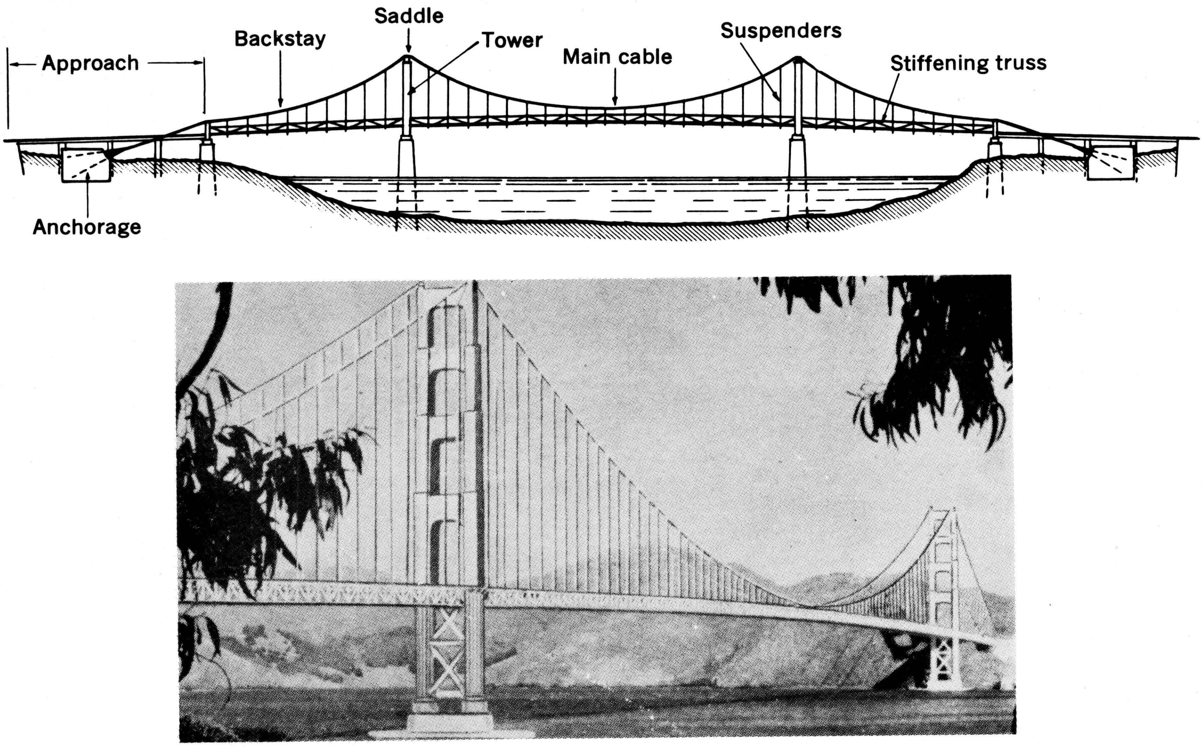


Figure 44. Diagram and photo of a suspension bridge.

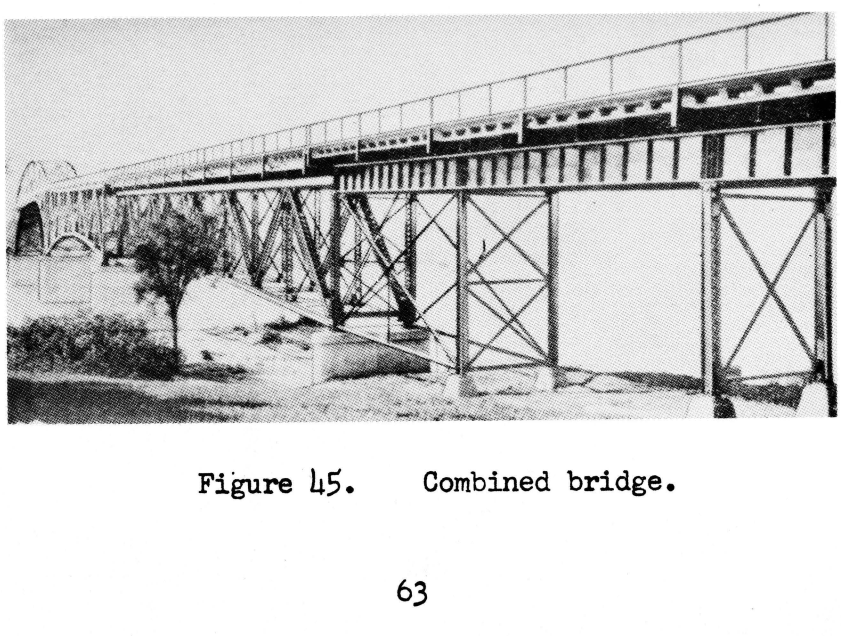


Figure 45. Combined bridge.

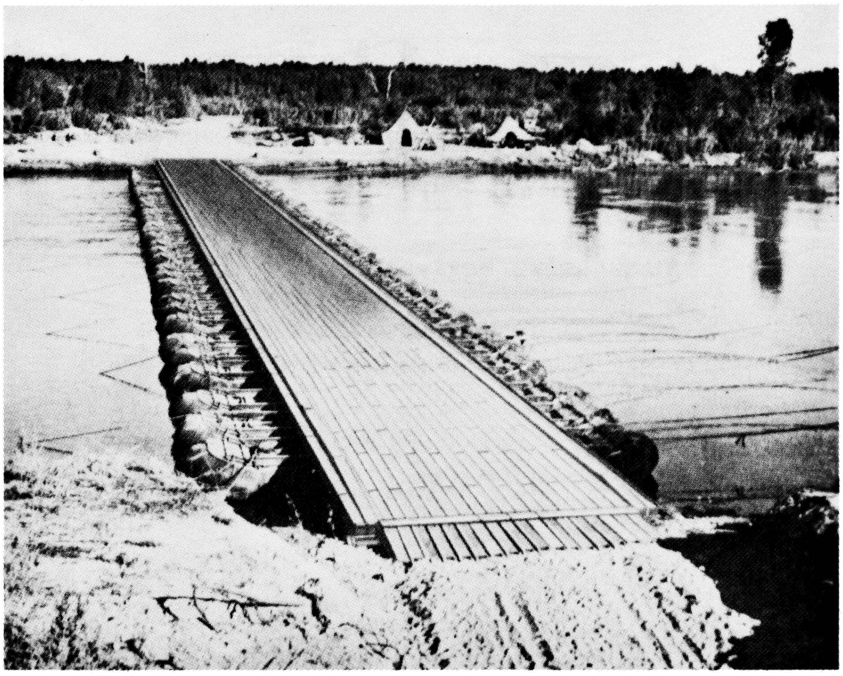
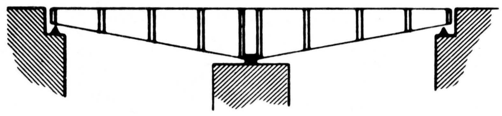
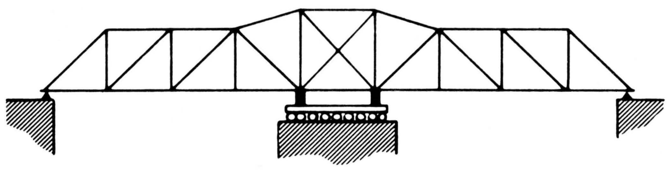


Figure 46. Ponton (floating) bridge.



a. Deck-type swing span.



b. Through-type swing span.

c. The housing is over the center of the swing span, which can be pivoted until it is directly over the wharflike structure.

Figure 47. Diagrams and photo of swing spans.

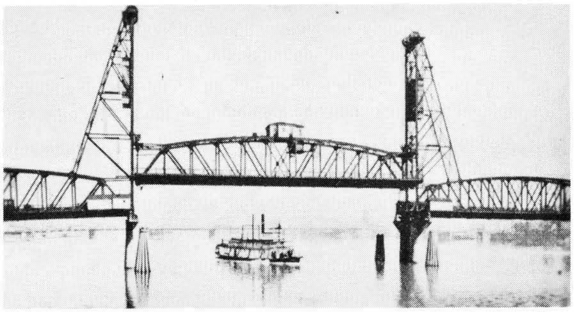


Figure 48. Lift span.

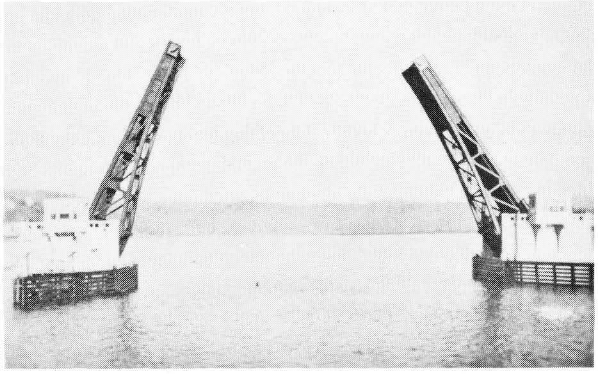


Figure 49. Bascule span, double leaf, trunnion type.

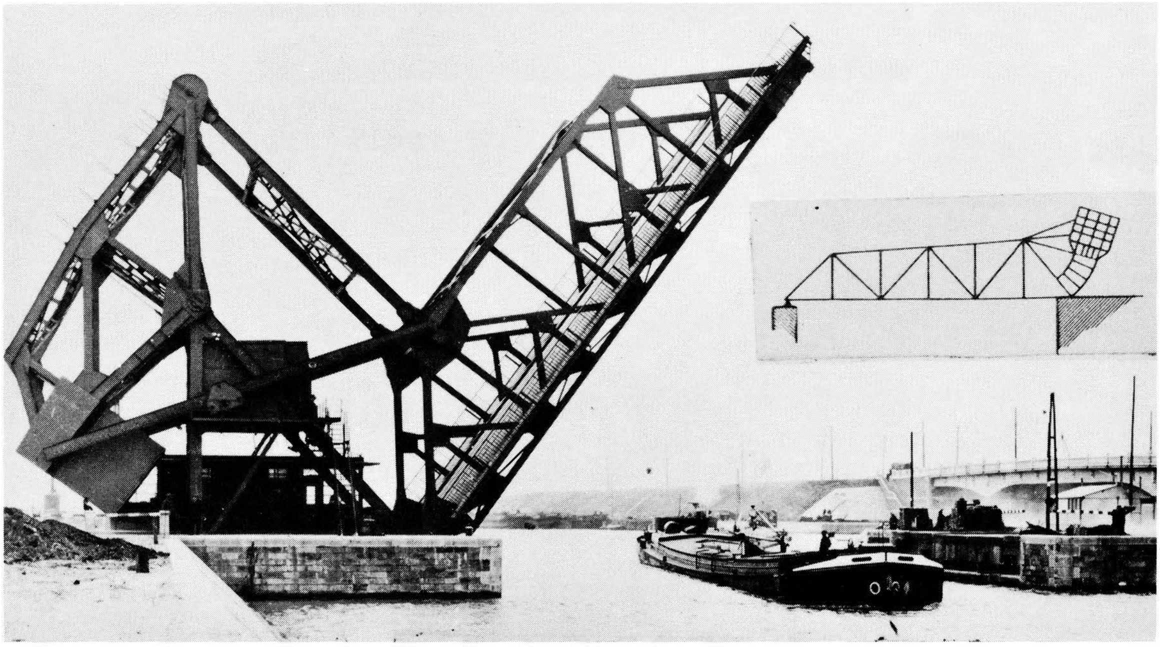


Figure 50. Diagram and photo of a bascule span, single leaf, rolling-lift type.

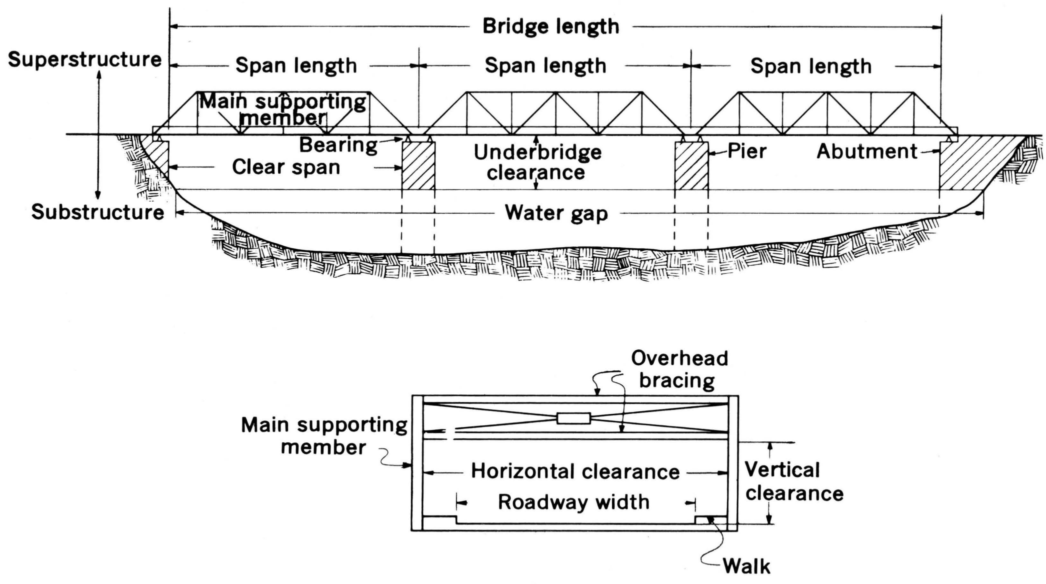


Figure 51. Principal bridge measurements.

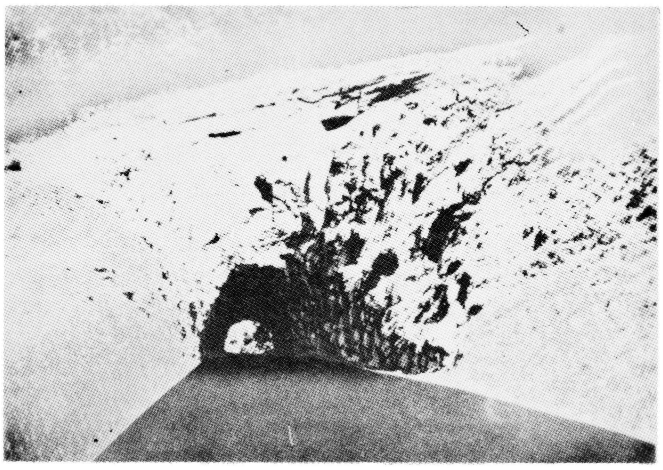


Figure 52. Unlined tunnel.

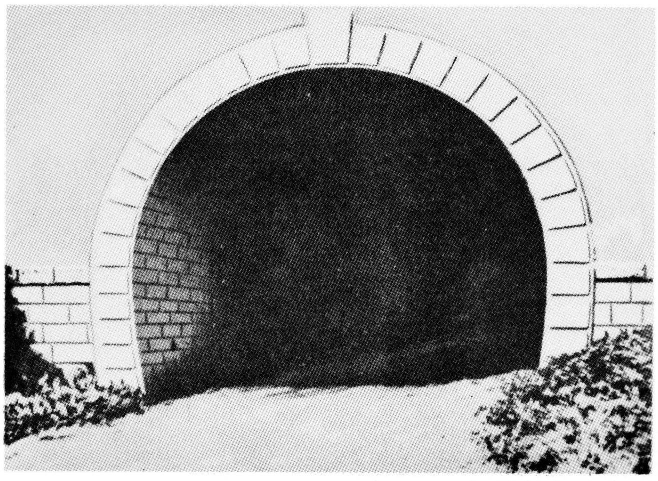


Figure 53. Masonry lined tunnel.

Figure 54. Concrete lined tunnel.

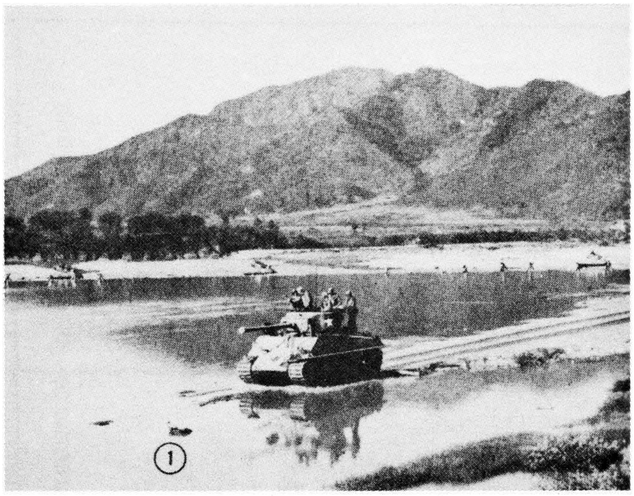


Figure 55. Ford for vehicles.

Highway Route Log

Route No. 5, Paxton to Grafton

Mile (km) Point	Junction	Pavement Surface			Bridges					Remarks
		Type	Width (ft)	Condition	Type	Total Length (ft)	Spans			
							Number	Type	Length (ft)	
0.0	Paxton	Concrete	22	Good	Concrete	330	7	Deck	40	(For Bridges: Crossings, clearances and load capacity, either posted or estimated.)
5.7	Auburn	Macadam	22	Fair	Steel truss	275	2	Through	125	(For Tunnels: length, clearance, lining, ventilation.) (For Shoulders: type, width, condition.) (Other Data: sharp curves, deep cuts, high hills, gorges, defiles, slides, flood area, bottlenecks.)

Figure 56.

ROADWAY DATA - TRANSPORTATION INTELLIGENCE (FM 55-8) (See Footnote 1 for explanation of Roadway)	NAME OF FACILITY	PREPARED BY	HEADQUARTERS	PAGE NUMBER	NUMBER OF PAGES
	National Highway # 39	B. B. GOYLE, Major, TC, Opn S-3	HHC 39th Transportation Truck Bn	1	8
				KEY: NA - Not Available	

ROUTE NUMBER	SECTION	LOCATION (Origin and Destination)	DISTANCE (Miles)	PAVEMENT BASE				PAVEMENT SURFACE				SHOULDERS[2]			DATE AND SOURCE OF INFORMATION	REMARKS (Adequacy of base and drainage, bridges with restricting width and capacity, etc.)
				TYPE	WIDTH (Ft.)	THICKNESS (In.)	CONDITION	TYPE	WIDTH (Ft.)	THICKNESS (In.)	CONDITION	TYPE	WIDTH (Ft.)	CONDITION		
39A	A	Klung to Welkenburg routes 60, 70, and 89	53	Macadam	20	6	Good	Bitumen	20	1-1 1/2	Good	Earth	28	Good	Route recon 10 June 1956	
39	B	Welkenburg to Prentch, routes 60, 70, and 89	60	Macadam	22	8	Good	Asphalt	22	3	Good	Earth	30	Good	As above	Numerous short shallow fords are on this section
39	C	Irentch to Flaggen, route 89	92	Earth	21	9	Good	Concrete	21	1-1 1/2	Good	Earth	28	Good	Ministry of Transport Annual Report, July 1955	Fog and frost restrict traffic in winter months (Dec-Feb)
39	D	Flaggen to Campfen, route 89	52												As above	
		Mile 0 to Mile 12		Macadam	16	4	Good	Bitumen	16	1-1 1/2	Good	Earth	26	Good		
		Mile 12 to Mile 42		Macadam	14	3	Fair	Crushed stone	14	NA	Fair	Earth	20	Fair		
		Mile 42 to Mile 52		Macadam	18	6	Good	Asphalt	18	2	Good	Earth	26	Good		This section has a 9-inch telford subbase

[1] That portion of highway bounded by outside line of shoulders or inside line of curbs and ordinarily used for vehicular traffic or parking.

[2] That portion of roadway bounded by edge of pavement surface and inside line of ditch or top of slope.

ADDITIONAL REMARKS

None

DATE	TYPED NAME AND GRADE	SIGNATURE
15 June 1956	J. T. BARNUM, Major, TC, Adjutant, S-1	J. T. Barnum

DA FORM 1 JUN 56 55-174

Figure 57. Sample report, roadway data.

397359 O - 56 (Face page 62) No. 2

BRIDGE DATA - TRANSPORTATION INTELLIGENCE (FM 55-8)	NAME OF FACILITY: National Highway # 39	PREPARED BY: J. T. RAINS, Major, TC, Highway Traffic Engineer	HEADQUARTERS: 41st Transportation Highway Transport Command	PAGE NUMBER: 1	NUMBER OF PAGES: 12

KEY: NA - Not Available; XXX - Not Applicable

ROUTE NUMBER	SECTION	LOCATION OF BRIDGE	TYPE OF BRIDGE	OVERALL LENGTH OF BRIDGE (Ft.)	ROADWAY WIDTH (Ft.)	VERTICAL CLEARANCE ABOVE ROADWAY (Ft.)	STANDARD BRIDGE CLASSIFICATION	CLEAR HEIGHT[1] OF SPAN UNDER BRIDGE (Ft.)	SPANS NUMBER	SPANS TYPE	SPANS LENGTH (Ft.)	DETOURS AVAILABLE	DATE AND SOURCE OF INFORMATION	REMARKS (Bridges having low capacity, horizontal or vertical restrictions, other critical features, etc.)
39	A	Mile 5.2 (5.2 miles N of Klung)	Concrete	330	20	Unlimited	35	25	7	Concrete	40' each	Stream fordable in dry weather	Route recon 1 May 1956	Over New River—deck girder bridge
39	A	Mile 21 (21 miles NW of Klung)	Stone masonry	400	25	Unlimited	40	20	8	Stone masonry	45' each	Bridge 0.5 mile upstream	As above	Over Old River—completed in 1953—arch-type structure
39	B	Mile 60 (Prentch)	Steel truss and concrete T-beam	670	19.7	14.8	24	20	1	Steel truss	178.8'	Rail bridge 0.3 mile downstream	As above	9-span through-truss bridge over railway lines. Carries single-track electric carline extending along middle of structure; 4.9-ft walks
									3	Concrete T-beam	51' each			
									5	Concrete T-beam	57.9' each			

ADDITIONAL REMARKS

None

[1] Bridge over water measured from normal water level

DATE: 1 May 1956

TYPED NAME AND GRADE: L. D. MUIR, Lt Colonel, TC, Adjutant, S-1

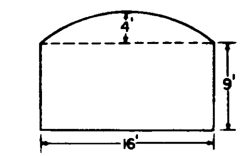
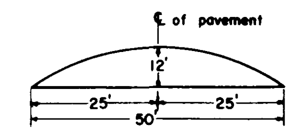
SIGNATURE: L. D. Muir

DA FORM 1 JUN 56 55-175

Figure 58. Sample report, bridge data.

397359 O - 56 (Face page 70) No. 1

TRAFFIC BOTTLENECKS - TRANSPORTATION INTELLIGENCE (Tunnels, Narrow Streets, Sharp Curves, Steep Grades, Switchbacks, Underpasses, Ferries, Fords, Etc.) (FM 55-8)	NAME OF FACILITY	PREPARED BY	HEADQUARTERS	PAGE NUMBER	NUMBER OF PAGES
	National Highway # 39	C. L. POST, Captain, TC, Highway Regulating Officer	41st Transportation Highway Transport Command	1	3
				KEY: NA - Not Available; XXX - Not Applicable	

ROUTE NUMBER	SECTION	LOCATION	TYPE	LENGTH (Ft.)	ROADWAY WIDTH (Ft.)	VERTICAL CLEARANCE (Ft.)	MAXIMUM GRADES (Percent)	MINIMUM CURVE RADIUS (Ft.)	DETOURS AVAILABLE	DATE AND SOURCE OF INFORMATION	REMARKS
39	A	Mile 12.5 (12.5 miles NW of Klung)	Sharp turn	NA	10	XXX	NA	See remarks	Village bypass 3 miles E	Route recon 10 June 1956	90° turn in village
39	A	Mile 27 (27 miles NW of Klung)	Narrow bridge	150	10.5	Unlimited	See remarks	See remarks	Ford adjacent to structure, at low water	As above	East approach to bridge is on a 10% grade; west approach has 90° turn. Bridge class 4
39	A	Mile 39 (39 miles NW of Klung)	Tunnel	4,865	16	See remarks	XXX	XXX	NA	As above	
39	B	Mile 10.5 (10.5 miles N of Welkenburg)	Series of reverse curves and steep grades	1,000	14	XXX	10	See remarks	None	Route recon 15 June 1956	
39	C	Mile 71 (71 miles NE of Prentch)	Ferry	1,000	XXX	XXX	XXX	XXX	None	Ministry of Transport Annual Report, July 55	Ferry service consists of two aluminum pontoon boats powered by outboard motors--capacity, 3 tons (1 passenger car); crossing time, 1 to 2 hours
39	D	Mile 15 to Mile 16 (15 miles N of Flaggen)	Long grade (ascent)	7,300	14	XXX	8	NA	None	As above	
39	D	Mile 17 (17 miles N of Flaggen)	Mountain pass	NA	14	XXX	NA	NA	Parallel route, 30 miles west	As above	Road subject to snow blocks for 1-to 10-day periods, Dec-Feb; elev 5,500ft
39	D	Mile 46.5 to Mile 47 (46.5 miles N of Flaggen)	Flood waters	Aprx 2,500	XXX	XXX	XXX	XXX	NA	As above	Road subject to flooding of 1 to 5 ft during heavy spring rains; water depth markers placed along each side of roadway

ADDITIONAL REMARKS: None

DATE	TYPED NAME AND GRADE	SIGNATURE
2 July 1956	J. T. ILES, Lt Colonel, TC, Adjutant, S-1	J. T. Iles

DA FORM 1 JUN 56 55-176

Figure 59. Sample report, traffic bottlenecks.

397359 O - 56 (Face page 70) No. 2

TUNNEL RECONNAISSANCE REPORT
(FM 5-36)

DATE	12 AUG 54
TO: *(Headquarters ordering reconnaissance)*	S-2 185TH ECB
FROM: *(Name, grade and unit of reconnaissance officer)*	1ST LT. J.J. BLOUGH 185TH ECB

1. ROUTE OR LINE		2. FROM *(Initial Point)*	3. TO *(Terminal Point)*	4. DATE/TIME *(Of signature)*
HIGHWAY	RAILROAD			
202		TOLZ	LUDWIG	12 1100 A AUG 54

5. MAP SERIES NR	6. SHEET NUMBER	7. GRID REFERENCE		8. TUNNEL NUMBER
		TYPE	COORDINATES	
M 841	2624-II SE	UMGRS	BS 636402	T-17

9. LOCATION FROM NEAREST TOWN			10. TYPE *(Subaqueous, Rock, Soil)*
DISTANCE	DIRECTION	NAME OF NEAREST TOWN	
1 MILE	SOUTHEAST	MATAUG	ROCK

11. NAME *(Mountain or Water feature)*	12. LENGTH	13. NUMBER OF TRACKS	14. ROADWAY WIDTH
TARIS MOUNTAIN	120 FT.	NA	21'-0"

15. CLEARANCE		16. GRADE *(Percent)*	17. ALINEMENT *(Straight or radius of curve)*
VERTICAL	HORIZONTAL		
23'-6" center 13'-6" o/s	26'-0"	4%	STRAIGHT

18. LINING *(Material)*	19. PORTALS *(Material)*	20. VENTILATION *(Type)*
CONCRETE	STONE	NATURAL

21. DRAINAGE

EXCELLENT

22. CHAMBERED FOR DEMOLITION	23. COMPLETED *(Year)*	24. CONDITION *(Check appropriate box)*
☐ YES ☒ NO	1872	☐ EXCELLENT ☐ GOOD ☒ FAIR ☐ POOR

25. BYPASSABILITY

BY PASS IMPOSSIBLE

26. ALTERNATE CROSSING

HWY 206 TO PRESTLY & HWY 33 TO KUNE

27. APPROACHES

FAIR

28. IN-TUNNEL RESTRICTIONS

NONE

29. GEOLOGIC DATA

GRANITE

DA FORM 1 JAN 55 1250

Figure 60. Sample report, tunnel data.

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