

**CHAPTER 15**  
**PEDESTRIAN FACILITIES**

# INDEX

<b>Section</b>		<b>Page</b>
15-01	GENERAL	1
15-02	PEDESTRIAN FACILITIES TERMINOLOGY	11
	15-02.01 Paved Shoulders	1
	15-02.02 Sidewalks	1
	15-02.03 Wheelchair Ramps	1
	15-02.04 Marked Pedestrian Crosswalks	1
	15-02.05 Traffic Signals	2
	15-02.06 Pedestrian Grade Separations	2
15-03	CHARACTERISTICS OF PEDESTRIAN FACILITIES	2
	15-03.01 Paved Shoulders	2
	15-03.02 Sidewalks	2
	15-03.03 Wheelchair Ramps	2
	15-03.04 Marked Pedestrian Crosswalk	2
	15-03.05 School Zones and School Crossings	3
	15-03.06 Traffic Signals	3
	15-03.07 Pedestrian Grade Separations	3
15-04	WARRANTS FOR THE PROVISION OF PEDESTRIAN FACILITIES	5
	15-04.01 Paved Shoulders	5
	15-04.02 Sidewalks	5
	15-04.03 Wheelchair Ramps	5
	15-04.04 Marked Pedestrian Crosswalks	5
	15-04.05 School Zones and School Crossings	5
	15-04.06 Traffic Signals	5
	15-04.07 Pedestrian Grade Separations	7
15-05	DESIGN SPECIFICATIONS OF PEDESTRIAN FACILITIES	8
	15-05.01 Paved Shoulders	8
	15-05.02 Sidewalks	8
	15-05.03 Wheelchair Ramps	8
	15-05.04 Marked Pedestrian Crosswalks	8
	15-05.05 School Zones and School Crossings	8
	15-05.06 Traffic Signals	9
	15-05.07 Pedestrian Grade Separations	9
15-06	CONSTRUCTION PLANS	10
15-07	REFERENCES AND GUIDES	10

## LIST OF FIGURES

Figure No.	Title	Page
15-A	Shoulder in Typical Section	11
15-B	Sidewalk with Planting on Local Street	12
15-C	Wheelchair Ramps	13
15-D	Typical Crosswalk Markings	14
15-E	Pedestrian Signal Installation	15
15-F	Hazard Identification Beacon	16
15-G	Elevated Pedestrian Crossing	17
15-H	Underground Pedestrian Crossing	18
15-I	School Zone	19
15-J	Paved Shoulder Markings	20
15-K	Construction Details for Wheelchair Ramps	21
15-L	Wheelchair Ramps	22
15-M	Urban Standard Crosswalk Marking	23
15-N	Rural Crosswalk Marking with Longitudinal Lines for Added Visibility	24
15-O	Pavement Marking and Signing for School Zones	25
15-P	Traffic Signals Installation	26
15-Q	Elevated Pedestrian Facilities Design Characteristics	27
15-R	Underground Pedestrian Facilities Design Characteristics	28

## CHAPTER 15

### PEDESTRIAN FACILITIES

#### 15--01 GENERAL

This chapter provides guidance and details on the policies and standards concerning the provisions of pedestrian facilities in the various types of highways. It complements information appearing in Chapter 2 "Typical Sections" and Chapter 9 "Traffic Control Devices" of this Manual on facilities to be included parallel or transversally to the traveled way, in access controlled or non access controlled highways, both urban and rural.

The facilities described in this Chapter comprises shoulders, sidewalks, marked crosswalks, school zones, traffic signals, and elevated or underground facilities.

The designer of pedestrian facilities should take into consideration the overall impact, including the need of and measures to insure the proper use of the facility, on the surrounding area by the adequate planning of it. The appropriate facility, according to the need as determined by the corresponding study, should be selected. Adequate safety for preventing pedestrian accidents such as falls and collisions with fixed objects and crime prevention by having the proper illumination and visibility is to be provided in the overall planning and design of the facility. Its visual impact on the environment, or aesthetics of the project, especially when elevated pedestrian facilities are contemplated, is to be given appropriate consideration.

Consideration should also be given to the possibility that some sectors of the right of way of the road could be used for passive recreation. In those places benches, drinking fountains, proper illumination, shelters, signs as need and designed in accordance to the standards set in Puerto Rico's MUTCD, litter containers, etc., should be provided. These areas can be given scenic treatment or landscaping with grass, bushes, trees, flowering shrubs, etc.

In constructing these facilities, differently textured and or colored materials, including materials such as bituminous asphalt concrete, stainless steel, aluminum or wood could be used to enhance their appearance making them aesthetically more pleasing. The different colors could be given by the addition of pigments to the mixture used, by painting the surface or by using different colored aggregates.

#### 15--01 PEDESTRIAN FACILITIES TERMINOLOGY

Pedestrian facilities are hereby defined and examples shown in figures 15-A, 15-B, 15-C, 15-D, 15-E, 15-F, 15-G and 15-H.

##### 15--02.01 PAVED SHOULDERS

These are Paved portions of the roadway contiguous with the traveled way for accommodation of stopped vehicles for emergency use and for lateral support of the base and surface courses. In Puerto Rico, due to our densely populated condition, usually the shoulders of non-access or partial access controlled highways are used by pedestrians. Sometimes, this occurs also on full access controlled ones. (Fig. 15-A)

##### 15--02.02 SIDEWALKS

These are paved portion of the right of way dedicated to the exclusive use of pedestrians. (Fig. 15-B)

##### 15--02.03 WHEELCHAIR RAMPS

These are inclined planes at curbed sidewalks to facilitate access to them to the handicapped. (Fig. 15-C)

#### 15-02.04      **MARKED PEDESTRIAN CROSSWALKS**

These are markings made with paint or other marking devices (raised pavement markers, etc.) on the pavement and used to indicate the pedestrians the point where they can cross the highway at grade and to warn the motorist, identified or not together with traffic signs, where pedestrian activity can be expected. They also help to establish the right of the pedestrians to be on the traveled way of the highway and the responsibility of drivers to yield them the right of way. (Fig. 15- D)

#### 15-02.05      **TRAFFIC SIGNALS**

These are electro-mechanical, electronic, solid state, etc., devices used to assign the right of way to vehicles and/or pedestrians on the highway according to a fixed or variable program, usually through visible indications by means of electronically illuminated signal lenses, (Fig. 15-E). A hazard identification beacon, (Fig. 15-F), which is one or more sections of a standard traffic signal with a flashing circular yellow indication in each section, can be used to warn motorists of midblock crosswalks or other hazardous zones, as in school zones, etc. For additional information related to their use refer to Chapter IV of the Puerto Rico MUTCD.

#### 15-02.06      **PEDESTRIAN GRADE SEPARATIONS**

These are structures or means to separate physically pedestrians from vehicular activity or traffic, and thus are usually the measures providing the most safety to pedestrians by eliminating vehicle-pedestrian conflicts. They can be elevated and underground or depressed facilities. (Fig. 15-G and 15-H).

### 15-03      **CHARACTERISTICS OF PEDESTRIAN FACILITIES**

#### 15-03.01      **PAVED SHOULDERS**

Paved shoulders provide satisfactory protection for pedestrians or other users in need to utilize them, on all highways, by keeping those from walking parallel to traffic along the roadway. They are specially useful for this at night or when mud or other unsatisfactory conditions exist as on unpaved shoulders. To be effective in this usage they shall be properly delineated by pavement markings and signs, as needed.

#### 15-03.02      **SIDEWALKS**

Sidewalks provide additional safety for pedestrians walking along rural or urban highways and streets by introducing or providing physical separation from the traveled way, usually by means of curbs. They are often used with planting strips from 1.25 to 2.50 meters wide that provide additional separation from traffic and also serve as a means of beautification for the facility.

Sidewalks can also be used in some cases together with barriers and fences to provide additional safety to pedestrian from vehicles intruding upon them and to keep pedestrians from the traveled way.

#### 15-03.03      **WHEELCHAIR RAMPS**

Provide the handicapped access to the curbed sidewalk at established pedestrian crossings.

#### 15-03.04      **MARKED PEDESTRIAN CROSSINGS OR CROSSWALKS**

Marked pedestrian crossings establish the right of way of pedestrians over vehicles when making use of them to cross a street or highway at places other than signalized intersections or when used together with pedestrian controlled signals.

At signalized intersections they serve to delineate the area of permitted pedestrian activity.

At locations other than intersections (i.e. mid-block) and when used together with signs, they serve to warn motorists of places where pedestrian activity can be expected, including school crossings. The last can be of two types: school crossings only or school zones. Marked pedestrian crossings do not eliminate vehicle pedestrian conflicts.

#### 15- 03.05 SCHOOL ZONES AND SCHOOL CROSSINGS

School zones and school crossings are special types of marked pedestrian crosswalks. (Fig. 15-1).

A school zone is that part of a highway or street directly in front of a school plus an additional distance to every side of a variable length in which a limited or low speed is established. It is so identified and indicated by signs and pavement markings. Its purpose is to give special protection to school children crossing the right of way or taking or leaving transportation at the curb.

A school crossing is a pedestrian crosswalk used by any number of school children when the school is located more than 100 meters from the street or highway.

#### 15-03.06 TRAFFIC SIGNALS

Traffic signals generally provide adequate safety to pedestrian crossings at highways and streets, through their operation and control of traffic at intersections, mid-block or other locations where they are installed. Traffic signals, when not properly designed and installed, can cause vehicle traffic interruptions or delays and increase accident frequency (especially the rear-end type). At intersections, signals usually do not eliminate right and/or left turn vehicle interference unless a special pedestrian phase is provided.

Traffic signals can be pedestrian actuated, vehicle and pedestrian actuated and fixed time.

Pedestrian actuated signals shall be used only at locations between intersections or at other special sites. These and the other two types to be used at intersections or other locations, are to be determined by an engineering study, as established in the next section of this chapter and in the Puerto Rico MUTCD.

A flashing traffic signal or beacon is a warning device that can be used to call with more urgency the attention of drivers approaching a hazardous pedestrian crossing, for the protection of these.

#### 15-03.07 PEDESTRIAN GRADE SEPARATIONS

Pedestrian grade separations provide maximum safety to pedestrians from traffic accidents. On full or partially access controlled highways, a facility of this type could offer the only legal means to pedestrians for traveling from one side of the road to the other. On the other hand, unless certain minimum conditions exist and necessary restrictions can effectively be imposed on pedestrians, the facility might be a less than desirable investment.

Pedestrian grade separations can be of two types: elevated or underground. Because of the high crime incidence in Puerto Rico, underground facilities are not too strongly recommended.

### OVERCROSSINGS OR ELEVATED PEDESTRIAN FACILITIES (OVERPASSES)

#### A. ADVANTAGES:

1. Separate physically the pedestrian movement from vehicular movement, offering

pedestrians the maximum safety, thus increasing the efficiency and safety of the transportation system.

2. Improve at grade vehicular circulation by eliminating pedestrian caused vehicular delays.
3. Accidents will decrease, resulting from a reduction in conflicts.
4. Can be readily included in new highway construction or in existing ones.
5. Do not cause significant personal security problems to the pedestrian user.

**B. DISADVANTAGES:**

1. High construction cost.
2. Require change in grade, with the complementary inconveniences to the different classes of pedestrians, and their acceptance of it.
3. Can interfere adversely with adjacent properties and utilities.
4. Need the utilization of adequate controls to channelize and force pedestrians into using the facility.
5. Create potential danger for motorists, by possible falling objects, if not totally or adequately designed against this hazard.
6. May affect adversely the aesthetics of the city or the highway environment.

**DEPRESSED OR UNDERGROUND PEDESTRIAN FACILITIES**

**A. ADVANTAGES:**

1. Separate physically the pedestrian movement from vehicular movement, offering pedestrians the maximum safety from traffic accidents and thus increasing the offering and safety of the transportation system.
2. Provide built-in protection from the sun and inclement weather.
3. Improve at grade vehicular circulation by eliminating pedestrian-caused vehicular delays.
4. Accidents will decrease, resulting from a reduction in conflicts.
5. Can be readily included in new construction.
6. Maintain an unobstructed city-scape.
7. May interfere much less or not at all with adjacent properties.
8. The required grade separation may be much less than for an overpass.

**B. DISADVANTAGES:**

1. Extremely expensive and difficult to construct and can interfere greatly with underground utilities.
2. Present various and difficult security, ventilation, illumination, drainage, maintenance, vandalism, etc., problems, that must be adequately solved.
3. Require change in grade, with the complementary inconveniences to the different classes of pedestrians and their acceptance of it.
4. Need the utilization of adequate controls to channelize and force pedestrians into using the facility.

15 04           **WARRANTS FOR THE PROVISION OF PEDESTRIAN FACILITIES**

15 04.01       **PAVED SHOULDERS**

Paved shoulders should be provided, from the point of view of the pedestrian, where light (less than 20 per hour) pedestrian activity along rural and sub-urban uncontrolled or partially controlled access highways exists or is expected.

15- 02.02      **SIDEWALKS**

Sidewalks should be provided along rural uncontrolled or partially controlled access highways in addition to paved shoulders, if possible, on one or both sides of the roadway, where a high pedestrian activity of more than 20 per hour exists or is to be expected according to the existing or proposed traffic generators considered during route planning. They shall be included in front of semi-urban areas, factories, schools and other developed sections.

In urban highways, sidewalks shall be provided as set forth in Chapter 2, Article 2-04.09 (2) and in this Chapter, Article 15-05.02. .

15 04.03      **WHEELCHAIR RAMPS**

As established in Section 228 of the Highway Safety Act of 1973 (CURBED RAMPS FOR THE HANDICAPPED) and set forth in EHPM 6-2-1-1 of January 11, 1977, wheelchair ramps are to be installed at all pedestrian of crosswalks on Federal-aid projects approved for construction after July 1, 1976, and, wherever feasible, on all such projects approved for construction prior to that time.

15-04.04      **MARKED PEDESTRIAN CROSSWALKS**

Marked pedestrian crosswalks are to be provided at all signalized traffic crossings. When determined necessary from a study of existing or new created hazardous or undesirable conflicts between pedestrians and turning vehicles, the marked pedestrian crosswalks at any one of the accesses or approaches to the intersection can be omitted or eliminated and, in urban areas, signs R9 (Peatón No Cruce Aquí) may be installed facing the traffic for which they are intended.

Marked pedestrian crosswalks should be provided at all other intersections where there is substantial conflict between vehicle and pedestrian movements. Also, at other appropriate points of pedestrian concentration, such as at loading islands, mid-block pedestrian crossings and/or where pedestrians could not otherwise recognize the proper place to cross. For additional information please refer to section 3B-15 of the Puerto Rico MUTCD.

15-04.05      **SCHOOL ZONES AND SCHOOL CROSSINGS**

A school zone is warranted in front of any school that is located adjacent to a street or highway.

A school crossing sign is intended for use at any marked pedestrian crossing, including those at signalized intersections, used by school children going to and from school. Only crossings adjacent to schools and those on established school children routes shall be signed.

15-04.06      **PEDESTRIAN TRAFFIC SIGNALS**

Traffic signals to be provided for the express purpose of serving the pedestrian are justified under warrants 3 (Minimum Pedestrian Volume) and 4 (School Crossing) and specification number 3 of Warrant 6 (Accident Experience) of the Puerto Rico MUTCD. Warrant 3 reads as follows:



"The Minumun Pedestrian Volume warrant is satisfied when, for each of any 8 hours of an average day, the following traffic volumes exist:

1. On the major street, 600 or more vehicles per hour enter the intersection (total of both approaches); or where there is a raised median island 4 feet or more in width, 1,000 or more vehicles per hour (total of both approaches) enter the intersection on the major street; and
2. During the same 8 hours as in paragraph (1) there are 150 or more pedestrians per hour on the highest volume crosswalk crossing the major street."

"When the 85th percentile speed of major-street traffic exceeds 40 miles per hour (65 Kms. per hour), or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the minium pedestrian volume warrant is 70 percent of the requirements above (in recognition of differences in the nature and operational characteristics of traffic in urban and rural environments and smaller municipalities)."

"A signal installed under this warrant at an isolated intersection should be of the traffic actuated type with push buttons for pedestrians crossing the main street. If such a signal is installed at an intersection within a signal system, it should be equipped and operated with control devices which provide proper coordination."

"Signals installed according to this warrant shall be equipped with pedestrian indications conforming to requirements set forth in other section of this Manual (Puerto Rico MUTCD)."

"Signals may be installed at non-intersection locations (mid-block) provided the requirements of this warrant are met, and provided that the related crosswalk is not closer than 45 mts. to another established crosswalks. Curbside parking should be prohibited for 30 mts. in advance of, and 6 mts. beyond, the crosswalk. Phasing, coordination, and installation must conform to standards set forth in this Manual. Special attention should be given to the signal head placement and the signs and markings used at non-intersection locations to be sure drivers are aware of this special application."

**Warrant 4 reads:**

"A traffic control signal may be warranted at an established school crossing when a traffic engineering study of the frequency and adequacy of gaps in the vehicular traffic stream as related to the number and size of groups of school children at the school crossing shows that the number of adequate gaps in the traffic stream during the period when the children are using the crossing is less than the number of minutes in the same period (sec. 7A-3)."

"When traffic control signals are installed entirely under this warrant:

1. Pedestrian indications shall be provided at least for each crosswalk established as a school crossing.
2. At an intersection, the signal normally should be traffic-actuated. As a minimum, it should be semi-traffic-actuated, but full actuation with detectors on all approaches may be desirable. Intersection installation that can be fitted into progressive signal system may have pretimed control.
3. At non-intersection crossings, the signal should be pedestrian-actuated, parking and other obstructions to view should be prohibited for at least 30 mts. in advance of and 6 mts. beyond the crosswalk, and the installation should include suitable standard signs and pavement markings. Special police supervision and/or enforcement should be provided for a new non-intersection installation."

**Warrant 6 reads:**

“The Accident Experience warrant is satisfied when:

1. Adequate trial of less restrictive remedies with satisfactory observance and enforcement has failed to reduce the accident frequency; and
2. Five or more reported accidents, of types susceptible of correction by traffic signal control, have occurred within a 12-month period, each accident involving personal injury or property damage to an apparent extent of \$100 or more; and
3. There exists a volume of vehicular and pedestrian traffic not less than 80 percent of the requirements specified either in the minimum vehicular volume warrant, the interruption of continuous traffic warrant, or the minimum pedestrian volume warrant; and
4. The signal installation will not seriously disrupt progressive traffic flow.

Any traffic signal installed solely on the Accident Experience warrant should be semi-traffic-actuated (with control devices which provide proper coordination if installed at an intersection with a coordinate system) and normally should be fully traffic-actuated if installed at an isolated intersection.”

A flashing traffic signal can be installed in conjunction with a marked pedestrian crossing at locations of limited sight distance.

**15-04.07 ELEVATED AND UNDERGROUND PEDESTRIAN FACILITIES**

The study of the need for the installation or construction of elevated or overhead and depressed or underground pedestrian crossings in new projects can be divided into two types:

- A. Where pedestrian activity is not permitted or not possible, as in highways with full or partial control of access between intersections, or sites where, due to some conditions such as a center barrier, pedestrians are unable to cross.

Elevated or underground facilities (overpasses or underpasses) are to be provided to serve points of significant pedestrian trip generation or attraction as suggested and recommended in the study made by the New Jersey Department of Transportation, its Report No. 75-006-7712 “Pedestrian Grade Separation Locations—A Priority Ranking System” Volume I and II, December 1975.

The factors to consider are: 1) pedestrian trip generation, 2) distance to nearest crossing; and 3) a judgement factor which is in itself divided into: a) safety at alternate crossing; b) surplus trip generation; and c) uniqueness of location. Appropriate weights are given to these according to the procedures detailed in that report which shall be consulted and used in conjunction with this Manual for the justification of the construction of pedestrian grade separations.

As explained in the aforementioned report, a costs and benefits analysis is not used because of the many unknown or incomplete data that is needed and which can not be accurately obtained and, also, because of the excessive weight given to the cost of fatal and non-fatal pedestrian accidents which are variable occurrences.

- B. For locations where pedestrian activity is possible, the same study establishes the following parameters that are to be analyzed and weighted by the method established thereby: 1) pedestrian and vehicle volumes, 2) actual sight distance-desirable sight distance ratio or maximum green and yellow for pedestrians compared to the pedestrian crossing time needed; 3) school crossing; 4) distance to alternate crossing and type of protection at it; and 5) judgement.

## 15-05 DESIGN SPECIFICATIONS OF PEDESTRIAN FACILITIES

### 15-05.01 PAVED SHOULDERS

To provide safety to pedestrians on rural routes paved shoulders outside the right pavement edge should be at least 1.20 meters wide, depending on the type of highway, up to a maximum of 3.00 meters, clearly identified or delineated from the traveled way by a white border line 10 cms. wide (see Fig. 15-1). For additional details refer to the typical sections in Chapter 2.

### 15-05.02 SIDEWALKS

- A. **RURAL HIGHWAYS**—When required, sidewalks should be a minimum of 1.25 meters wide with a planting strip of 1.25 meters. When necessary from pedestrian circulation and/or refuge, as in front of schools, industrial, commercial, etc., areas, the sidewalk could be a maximum of 2.50 meters wide and a planting strip of 1.50 meters. The whole width can also be paved, if needed by the existing or anticipated pedestrian density. As a basic safety concept, sidewalks in rural highways should be as far as possible from the traveled way.
- B. **URBAN HIGHWAYS AND STREETS**—Depending on the typical section used for the design of the facility, in residential areas the minimum sidewalks width shall be 1.25 meters together with a planting strip of 1.25 meters. In front of schools or similar areas it may be wider, separated by a planting strip.

In commercial, industrial or similar areas, the sidewalk could be a minimum of 1.25 meters with a planting strip of 1.25 meters. Preferably the sidewalk should be 1.50 meters wide with a planting strip 1.50 meters wide. The whole width could also be paved as sidewalk depending on existing or anticipated pedestrian density.

For special highway sections (urban or rural), sidewalks of a minimum of 1.70 meters in width are required. For this, and additional information see Chapter 2 and the Regulation for the Control of Accesses to the Public Highways in Puerto Rico, promulgated by the Department.

### 15-05.03 WHEELCHAIR RAMPS

Wheelchair ramps shall have a maximum slope of 12:1. The minimum width shall be 1.00 meter. Included as a reference for their design is the one adopted by the Highways Authority and approved by the Federal Highway Administration. Figures 15-K and 15-L.

### 15-05.04 MARKED PEDESTRIAN CROSSWALKS

Pedestrian crosswalks can be marked using two parallel white lines from 15 centimeters wide up to 60 centimeters wide where the 85th percentile speed is over 60 KPH across the intersection approaches where they are to be marked, or at the point between intersections where the pedestrian crossing is to be established. The separation between lines or crosswalk width will range from a minimum of 1.80 meters to as wide as necessary (Figure 15-M). Pedestrian crosswalks can also be marked with white longitudinal lines at a 90° angle to the line of the crosswalk (Fig. 15-N). These lines should be approximately 60 centimeters wide and spaced 60 centimeters apart. When a marked crosswalk is to be provided at rural locations between intersections, traffic signs W11-2 (Cruce de Peatonos) shall be installed as established in Section 2C-32, of the Puerto Rico MUTCD. The use of these signs is optional in urban conditions.

### 15-05.05 SCHOOL ZONES AND SCHOOL CROSSINGS

A school zone is established by painting a yellow line 30 cms. wide at a distance of fifty (50) meters from both sides of the entrance to a school adjacent to a street or highway. Sign

S5-1 ("Escuela, Velocidad Máxima 25, 6 AM — 6 PM") shall be installed on each approach (Fig. 15-0). Depending on conditions at the site, the speed limit at a school zone can vary from 10 MPH to 25 MPH. School advance Signs (S1-1) shall be installed in advance of established school zones in each direction of travel at not less than 90 mts. nor more than 120 mts.

A school crossing is established by using an S2-1 sign ("Cruce de Escolares") together with regular pedestrian crossing pavement markings. A School Advance sign S1-1 shall be used in advance of the School Crossing sign.

#### 15-05.06 TRAFFIC SIGNALS

Traffic signals located or to be installed at intersections or other locations as determined by a study according to the warrants established in Section 15-04.05, or other warrants of the Puerto Rico MUTCD, shall be complemented with pedestrian signal indications under the conditions specified in Section 4D-3 of the Manual.

The basic combinations of pedestrian signal intervals with vehicular signal operations shall be as indicated on Section 4D-7 of the Manual.

The design requirements for the pedestrian indications and the detectors (push - button or other type) are set forth on Sections 4D-4, 4D-6 of the Manual. See Figure 15-P for details on pedestrian signal faces installation.

Traffic signal installations shall include appropriate pavement markings and the signs necessary for adequate pedestrian guide and control.

#### 15-05.07 PEDESTRIAN GRADE SEPARATIONS

The design characteristics of pedestrian grade separations should include (See Figures 15-Q, 15-R):

##### A. For elevated pedestrian facilities or overpasses:

1. A minimum width of 2.13 meters (7 feet) for the stairs, ramps and super structure.
2. The use of ramps instead of stairs when available space permits. Their gradient shall be no more than 8.33%. When stairs are used, their gradient shall be no more than 64.3% and one or two intermediate landings of 2.13 meters (7 feet) in length shall be provided.
3. The maximum free span for the superstructure shall be 38.00 meters (135 feet).
4. The free height over the roadway shall be no less than 5.20 meters (17 feet and not over 6.40 meters (21 feet).
5. The superstructure shall be an enclosed or partially covered one to prevent objects to fall or to be thrown to the roadway below and to provide additional safety to pedestrians making use of it, especially children and old aged or handicapped citizens.
6. Illumination should be provided as determined by the location studied.

##### B. For underground pedestrian facilities or underpasses:

1. A minimum width of 2.13 meters (7 feet) for the stairs, ramps and underground structure with a minimum height of 2.44 meters (8 feet).
2. Ramps with an inclination of no more than 8.33% should be preferred over stairs, when possible. Stairs shall have an inclination of no more than 64.3% and one or two intermediate landings of 2.13 meters (7 feet) should be provided, if necessary.
3. Adequate illumination, ventilation, drainage and maintenance shall be provided. Measures should be taken or considered for the protection or physical security of

pedestrians (especially children, women, and old aged and handicapped citizens) and, also, for the prevention of vandalism.

4. Provision could be made for their closing at night or at other times deemed necessary.
5. Every effort should be made in the design of the facility to provide a continuous visual line or visibility for the pedestrian from one end of the facility to the other.

#### 15-06 CONSTRUCTION PLANS

Pedestrian facilities construction plans and specifications are to be included in the project plans. Paved shoulders are to be presented in the construction and pavement marking sheets. Sidewalk details, including wheelchair ramps, shall appear in the construction plans. Marked pedestrian crossings and school zones shall appear in the pavement markings and signs plans. Traffic signals will appear on the plans as set forth in Chapter 9, Section 9-04.03 of this Manual. Elevated and or depressed facilities shall appear in the construction plans.

#### 15-07 REFERENCES AND GUIDES

The following is a list of selected references and guides to be used in the selection and design of pedestrian facilities:

1. Puerto Rico Manual on Uniform Traffic Control Devices for Streets and Highways — Puerto Rico Department of Transportation and Public Works — 197—
2. Transportation and Traffic Engineering Handbook — Institute of Traffic Engineers, 1976
3. Traffic Control Devices Handbook — Federal Highway Administration, 1975
4. Standard Highway Signs — Federal Highway Signs — Federal Highway Administration, 1972
5. Manual of Traffic Engineering Studies — Institute of Traffic Engineers, 4th Edition
6. A Manual for Planning Pedestrian Facilities — Federal Highway Administration — 1974
7. Regulation for the Control of Accesses to Public Highways in Puerto Rico — Puerto Rico Department of Transportation and Public Works, — 1976
8. Pedestrian Grade Separation Locations — A priority Ranking System — Volume I and II — New Jersey Department of Transportation — 1975

## SHOULDER IN TYPICAL SECTION

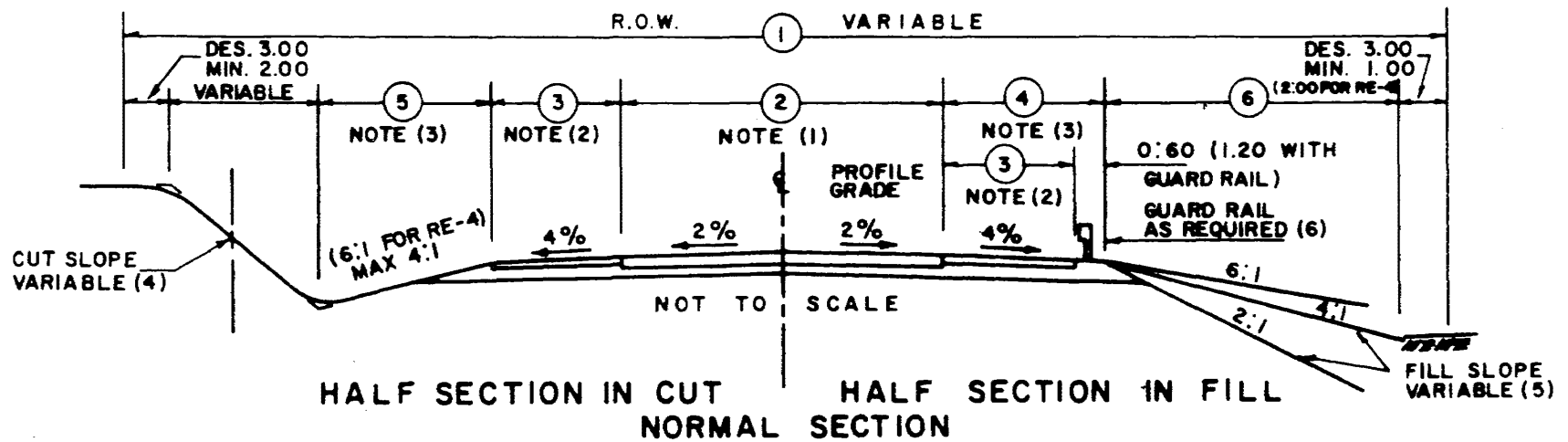


FIG. 15-A

**NOTES:**

- (1) THE ELEMENTS OF THE PAVEMENT STRUCTURE ARE TO BE DETERMINED FOR EACH PROJECT, SEE CHAPTER
- (2) MAY BE REDUCED IN MOUNTAINOUS TERRAIN, SEE TABLE 1-12
- (3) FOR VARIATIONS SEE FIG. 2-H.
- (4) FOR TYPICAL CUT SECTIONS SEE FIG. 2-J.
- (5) FOR TYPICAL FILL SECTIONS SEE FIG. 2-K
- (6) FOR WARRANTS FOR GUARD RAIL SEE CHAPTER 8.

**SECTION ELEMENTS**

	R-6	R-7	R-8	RE-4
① MIN. R.O.W.	30.00	22.00	20.00	30.00
② NORMAL PAVEMENTS	7.30	6.70	6.10	7.30
③ SURFACED SHOULDER	3.00	2.40	1.00	3.00
④ SHOULDER ON FILL	3.60	3.00	2.40	3.60
⑤ NORMAL INSLOPE	4.00	3.00	3.00	6.00
⑥ MIN. FILL SLOPE	4.00	3.00	3.00	5.00

SIDEWALK WITH PLANTING  
ON LOCAL STREET-RESIDENTIAL U - 10

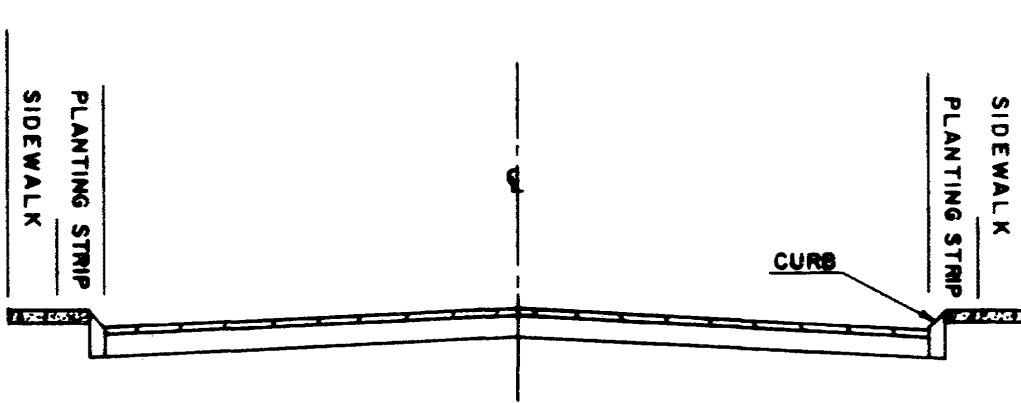
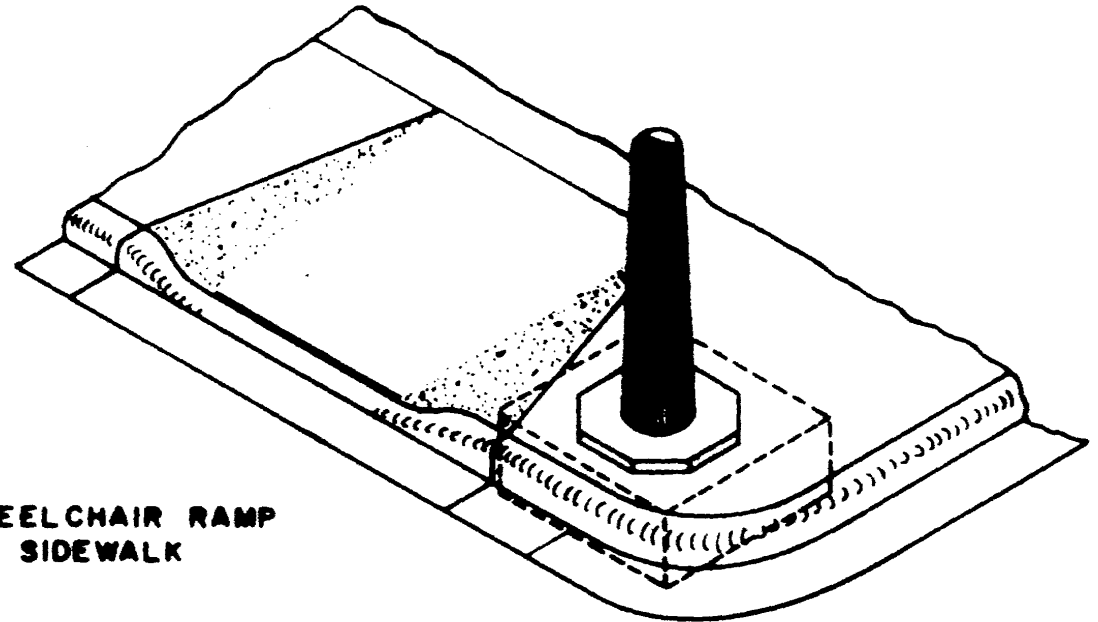
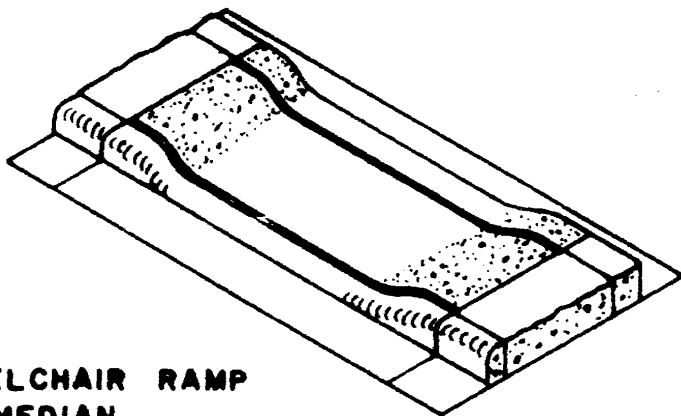


FIG. 15 - B



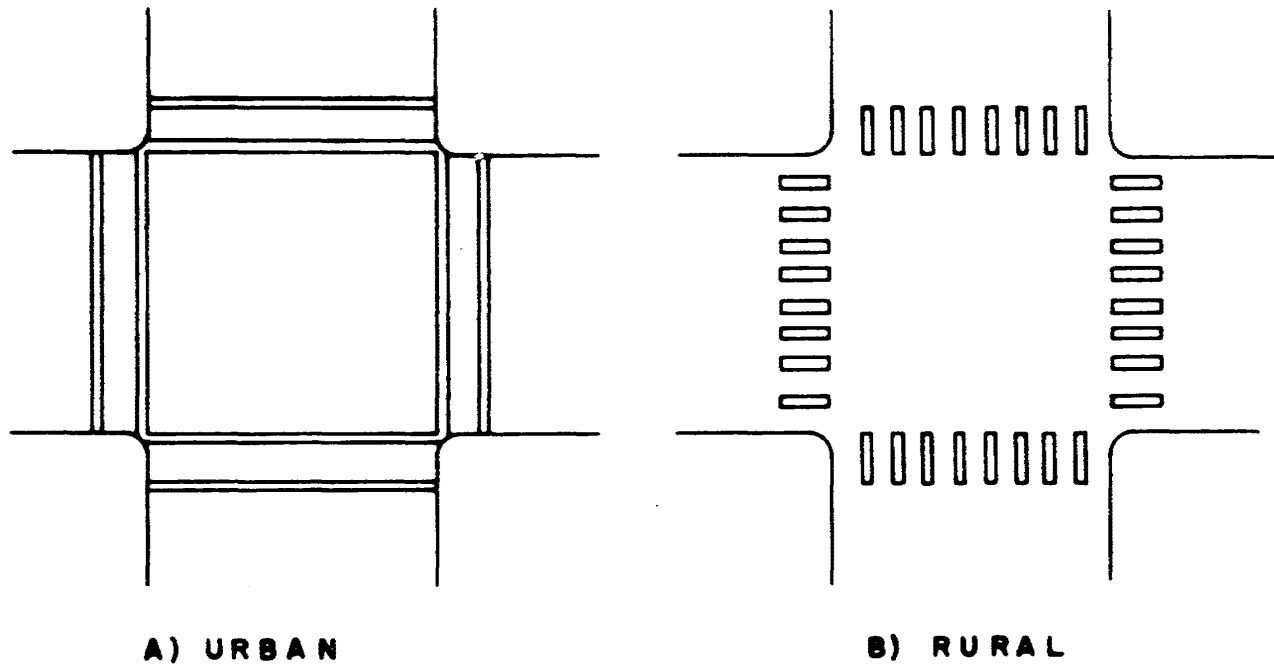
(A) WHEELCHAIR RAMP  
ON SIDEWALK



(B) WHEELCHAIR RAMP  
ON MEDIAN

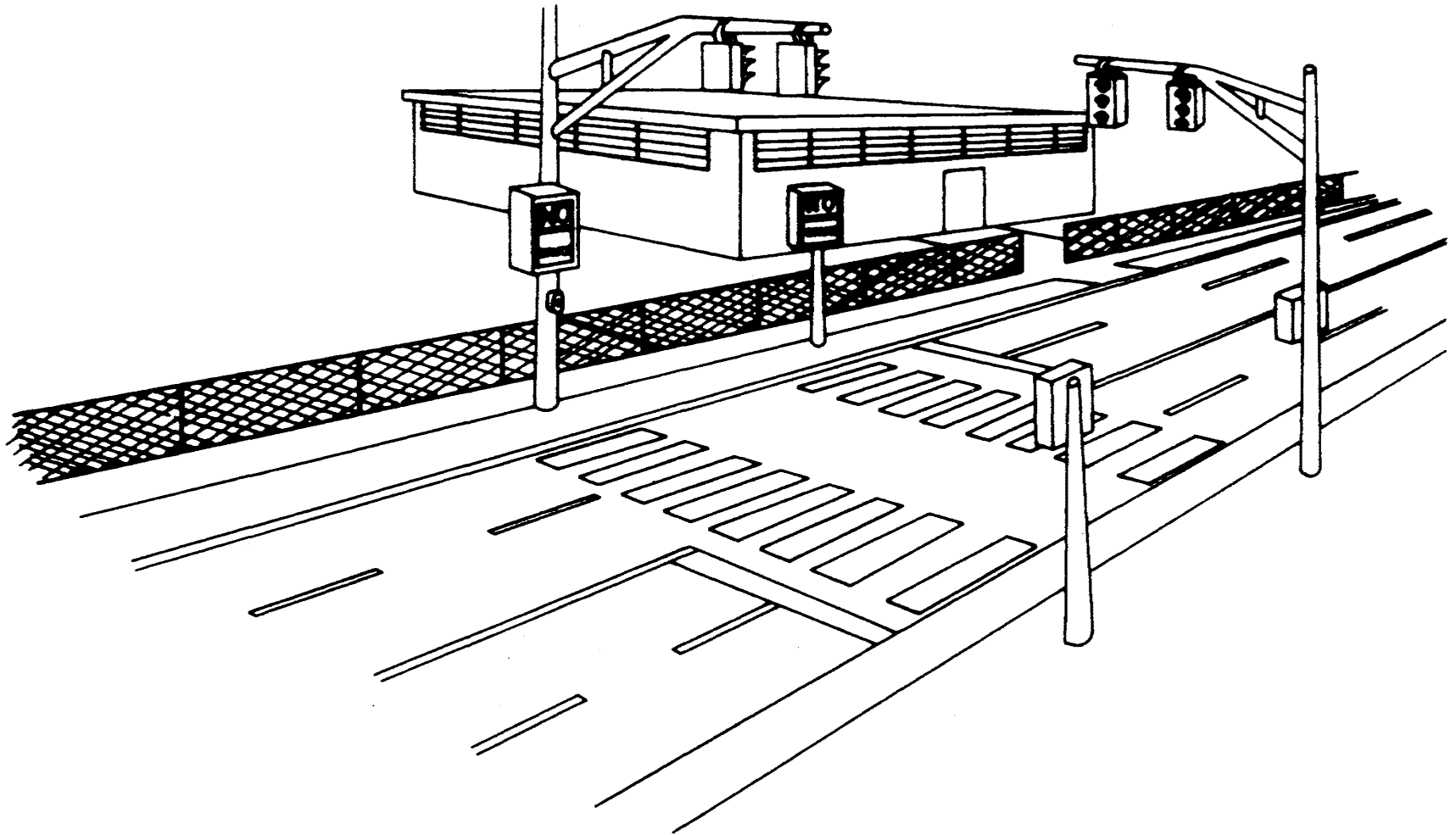
WHEELCHAIR RAMPS  
FIG. 15-C





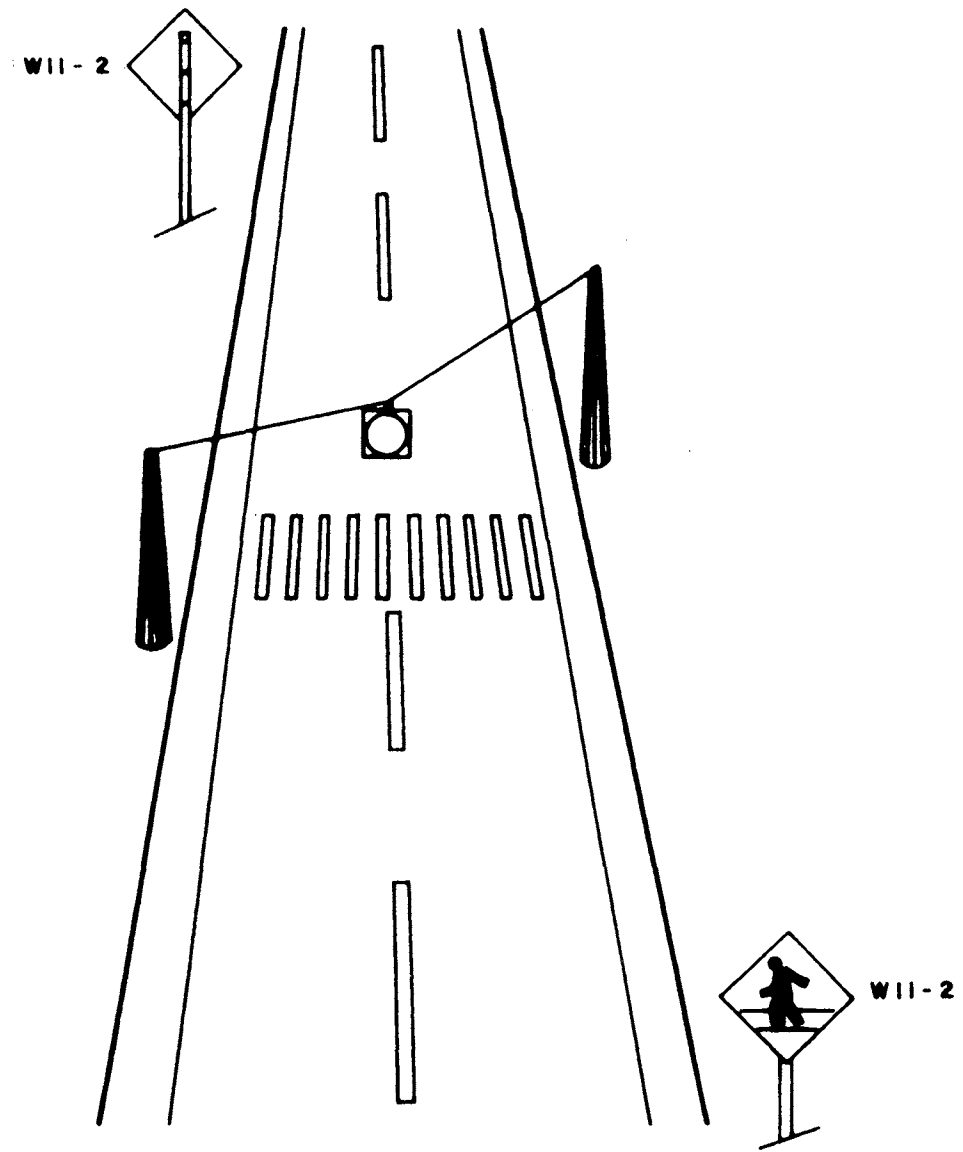
**TYPICAL CROSSWALK MARKING**

**FIG. 15- D**



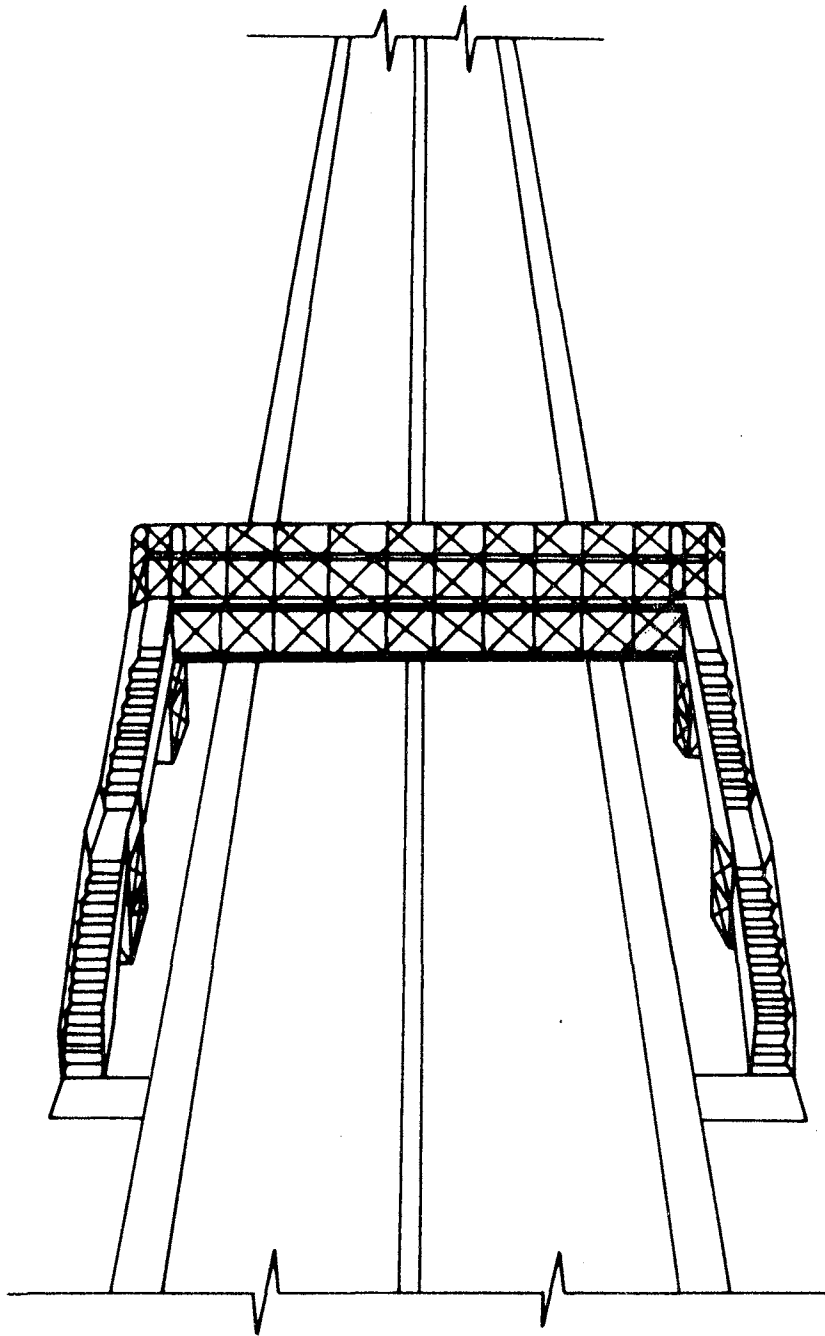
PEDESTRIAN SIGNAL INSTALLATION

FIG. 15 - E



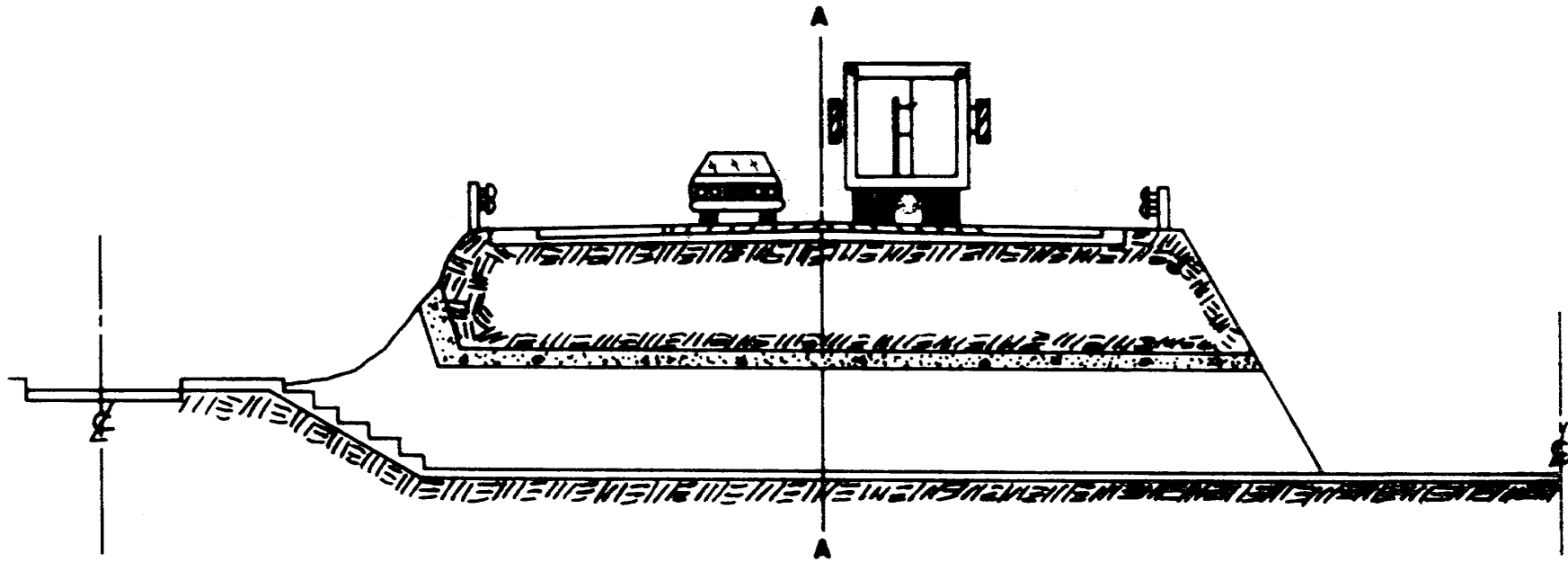
**HAZARD IDENTIFICATION BEACON**

**FIG. 15 - F**



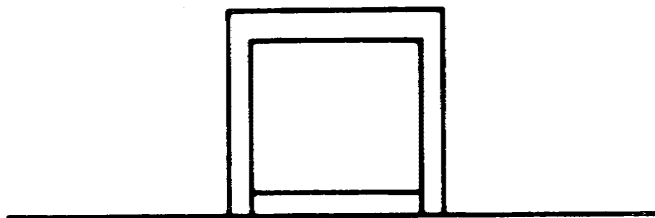
ELEVATED PEDESTRIAN CROSSING

FIG. 15-G

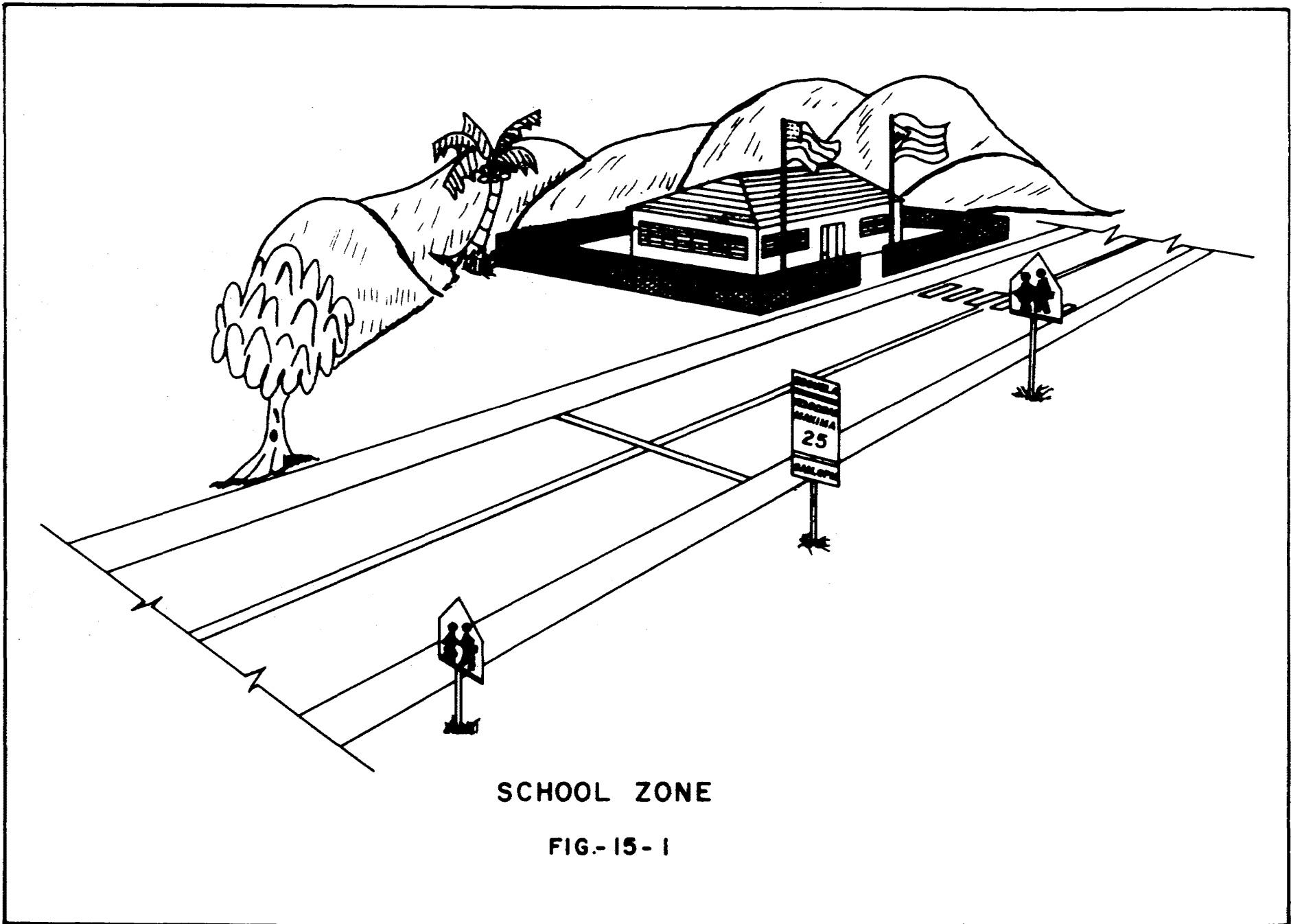


**UNDERGROUND PEDESTRIAN CROSSING**

**FIG. 15-H**

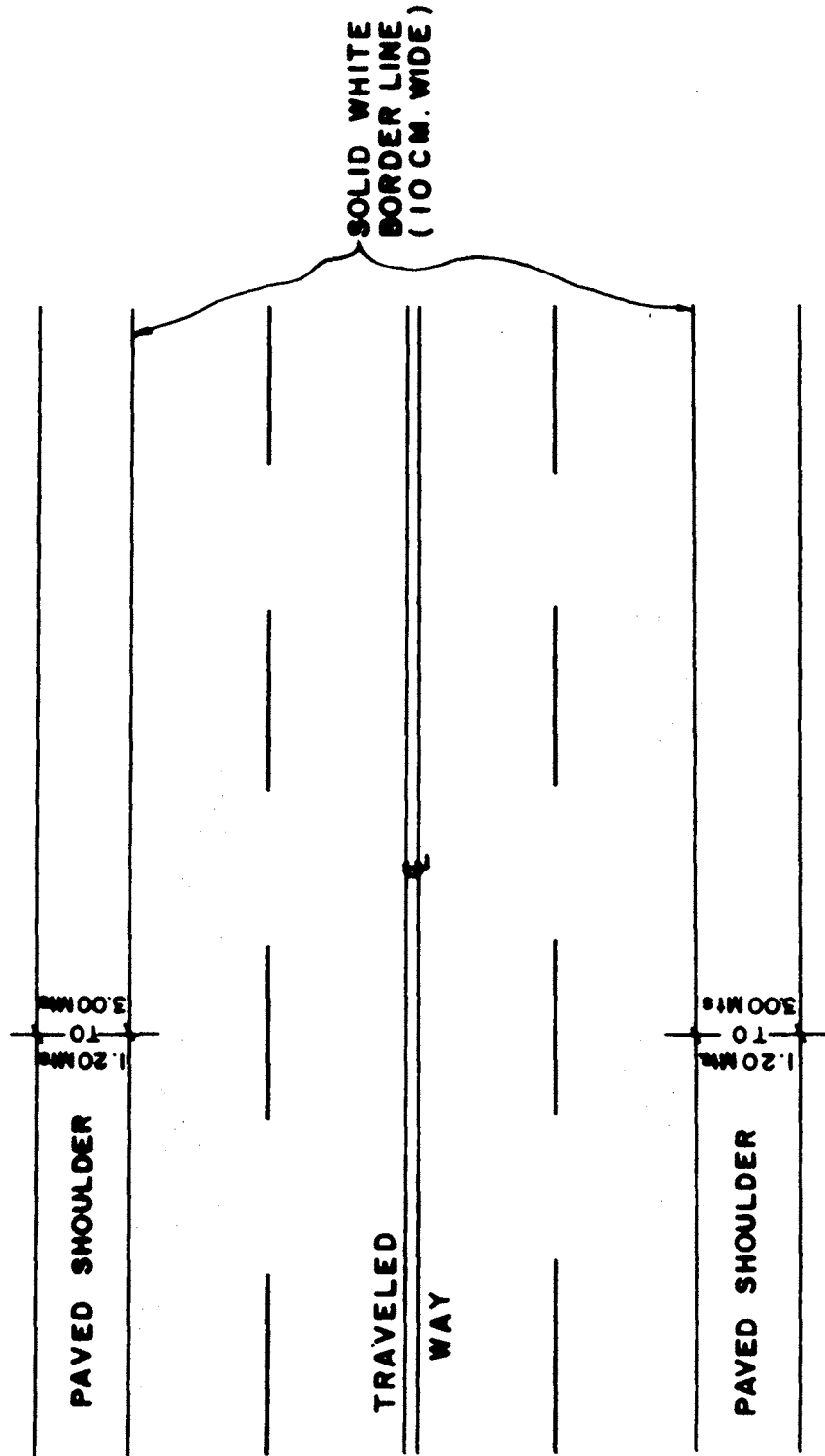


**SECTION A - A**

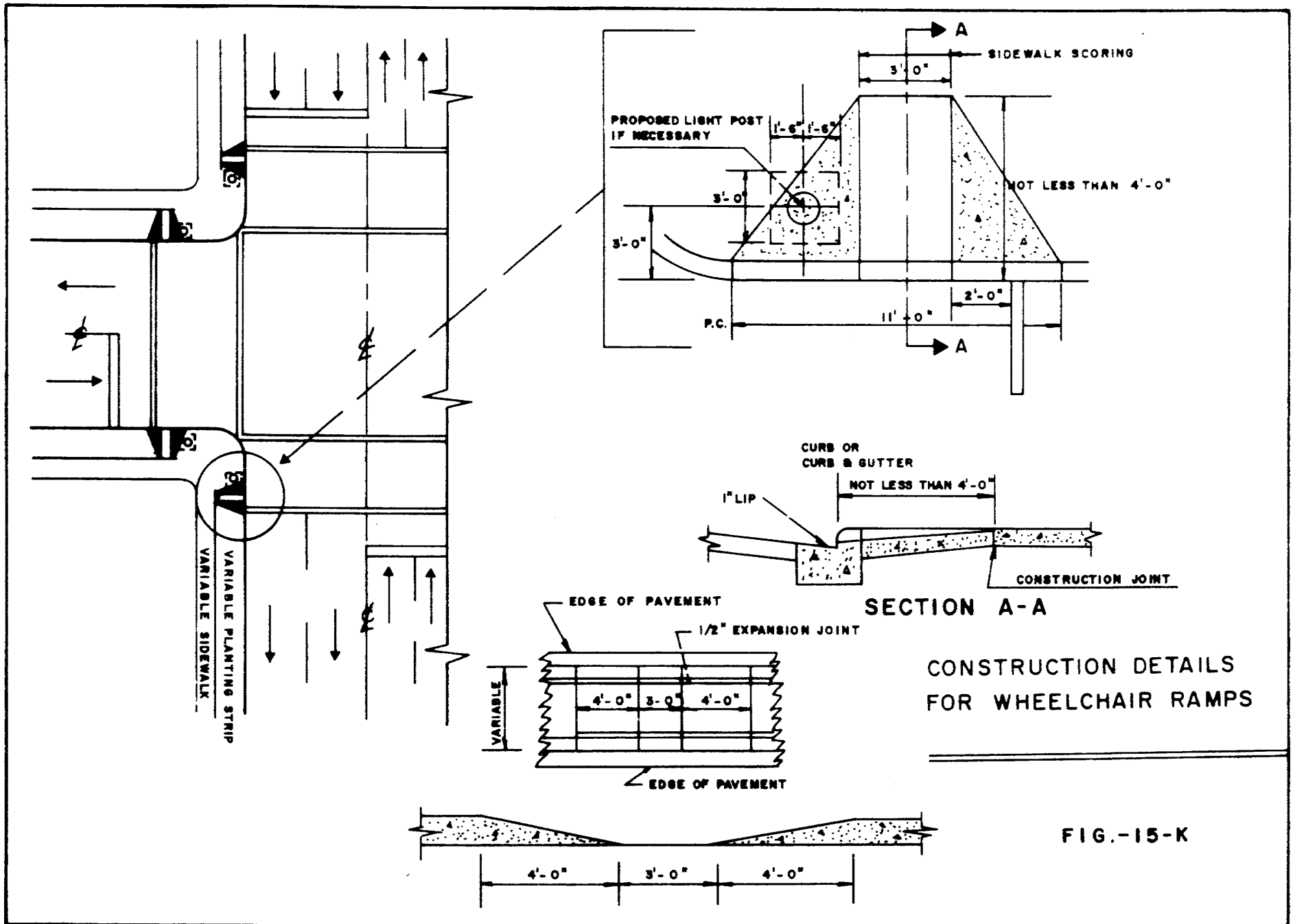


SCHOOL ZONE

FIG.-15-1



**FIG. 15-J**  
**PAVED SHOULDER MARKINGS**



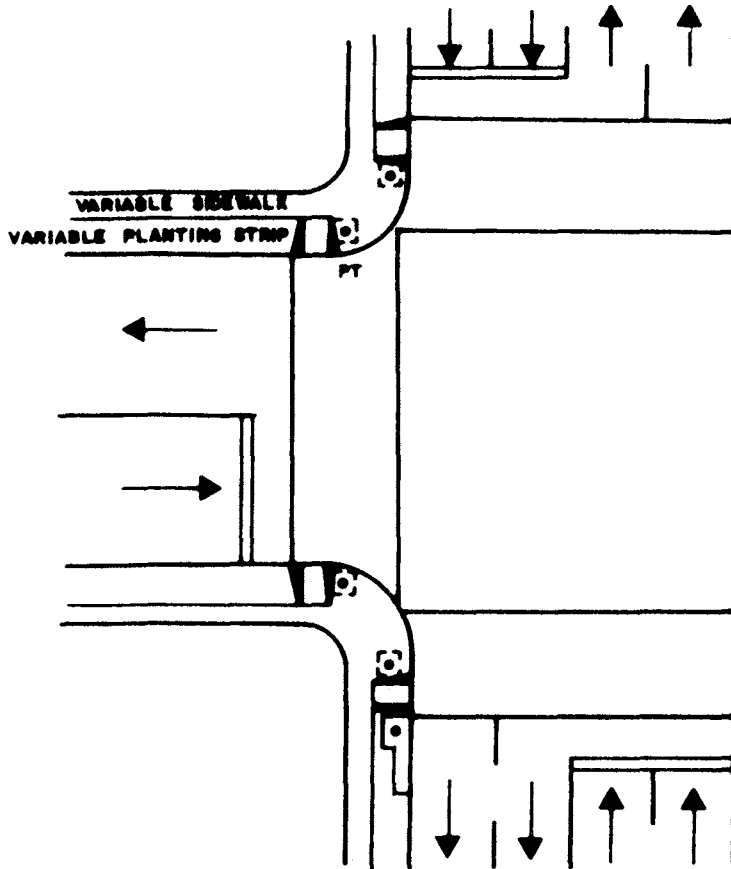
CONSTRUCTION DETAILS FOR WHEELCHAIR RAMPS

FIG.-15-K

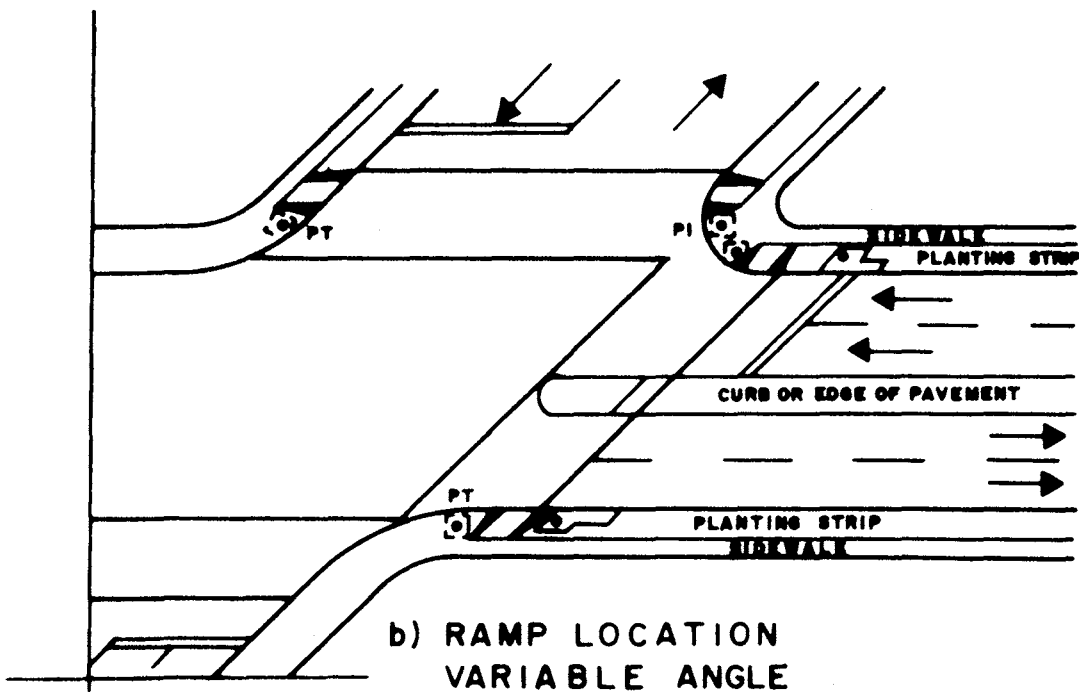


# WHEELCHAIR RAMPS

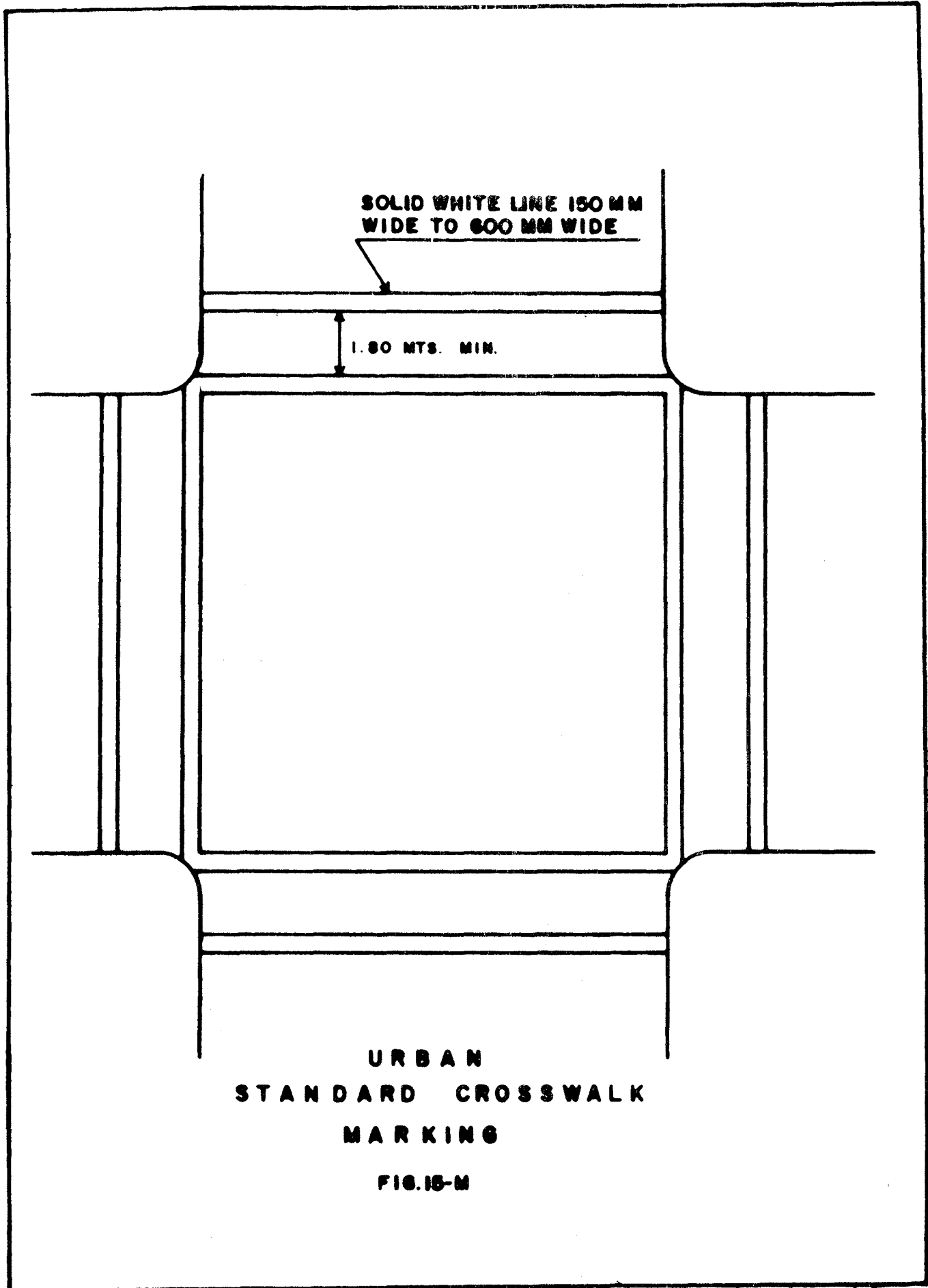
FIG. 15-L



a) RAMP LOCATION  
RIGHT ANGLE INTERSECTION

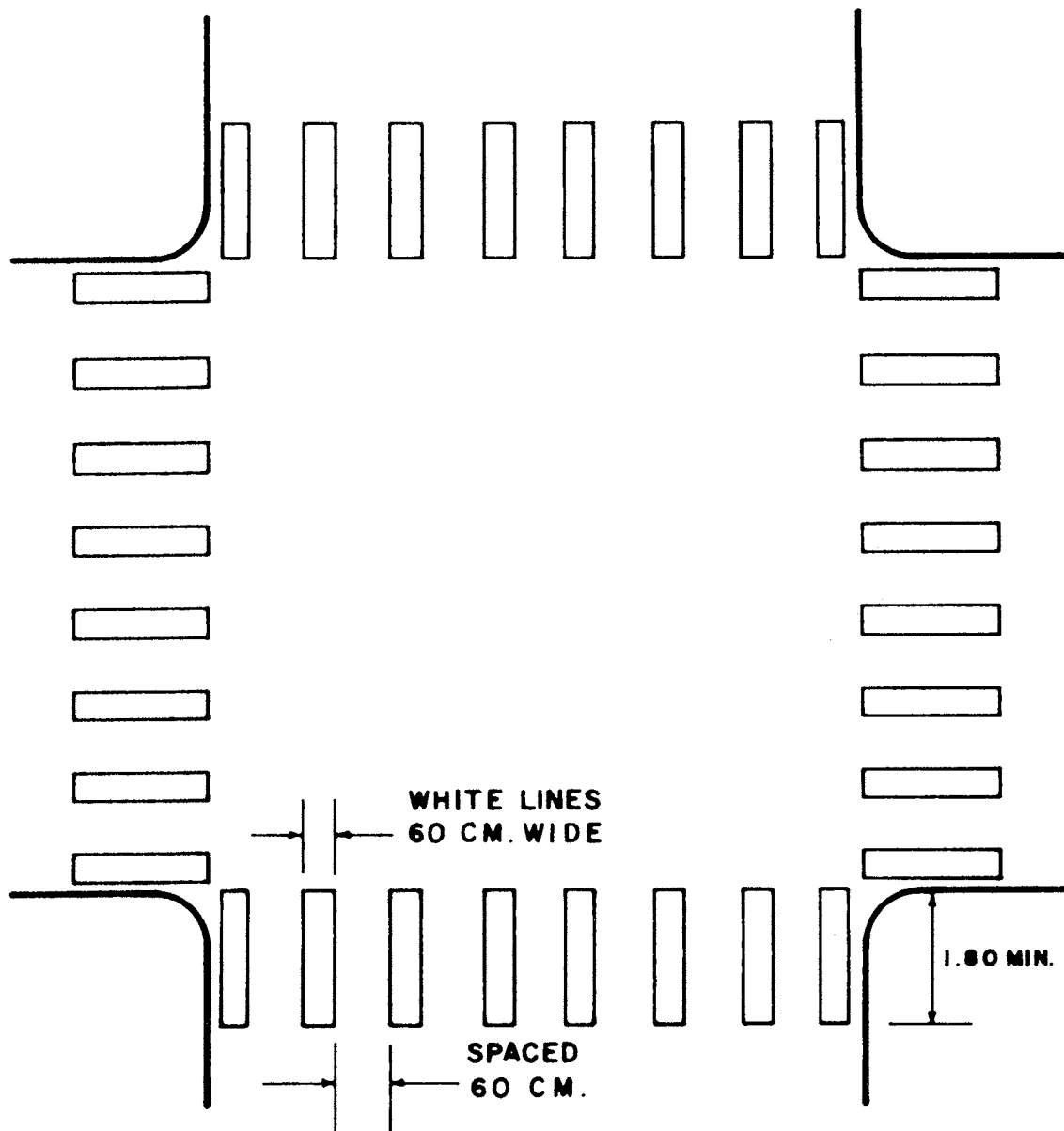


b) RAMP LOCATION  
VARIABLE ANGLE



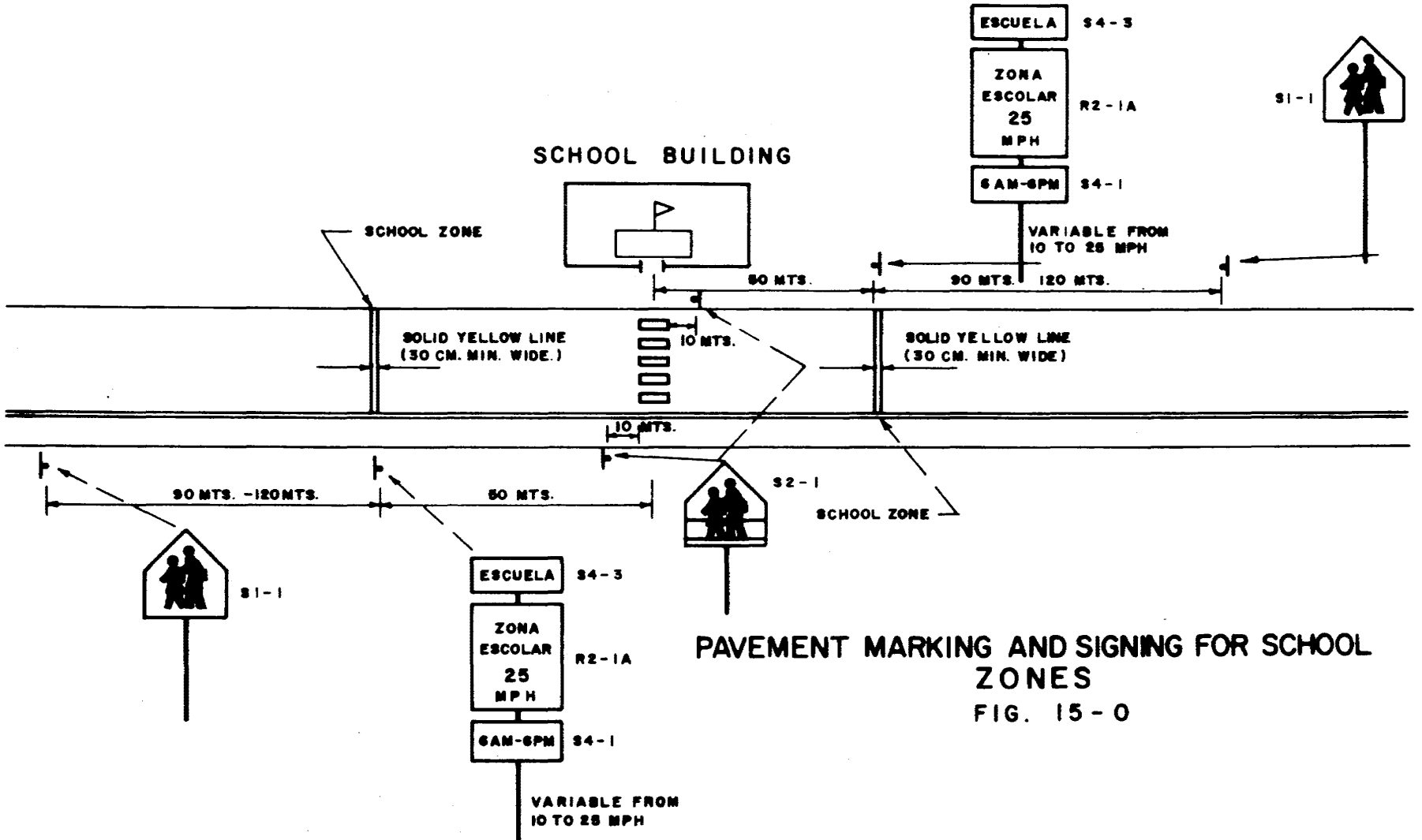
**URBAN  
STANDARD CROSSWALK  
MARKING**

**FIG. 15-M**



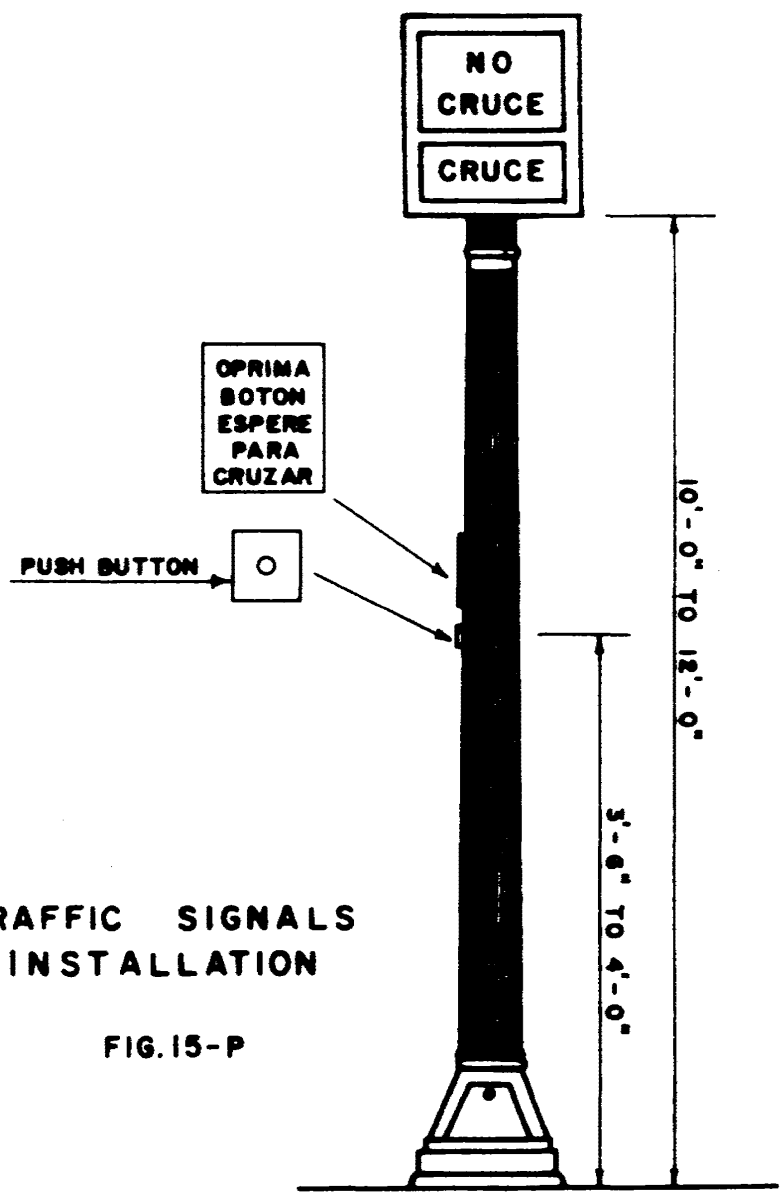
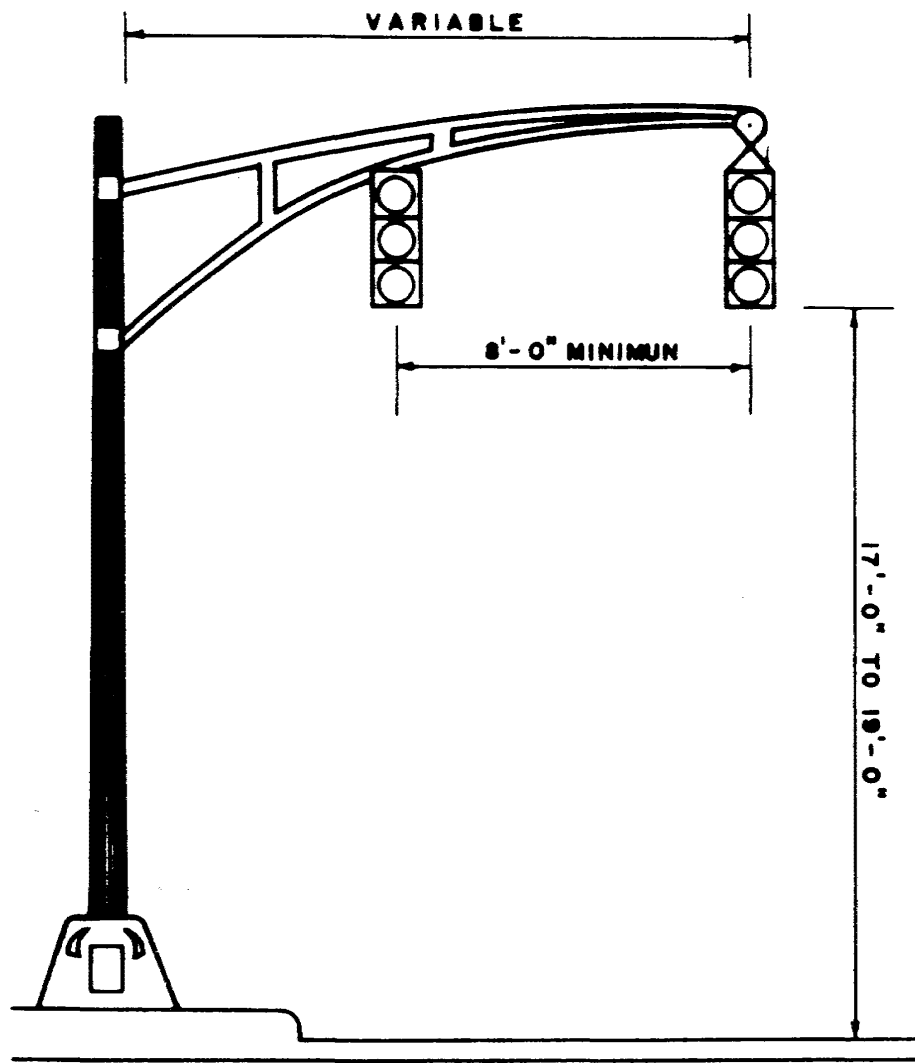
RURAL CROSSWALK MARKING WITH LONGITUDINAL  
LINES FOR ADDED VISIBILITY

FIG. 15 - N



PAVEMENT MARKING AND SIGNING FOR SCHOOL ZONES

FIG. 15-0

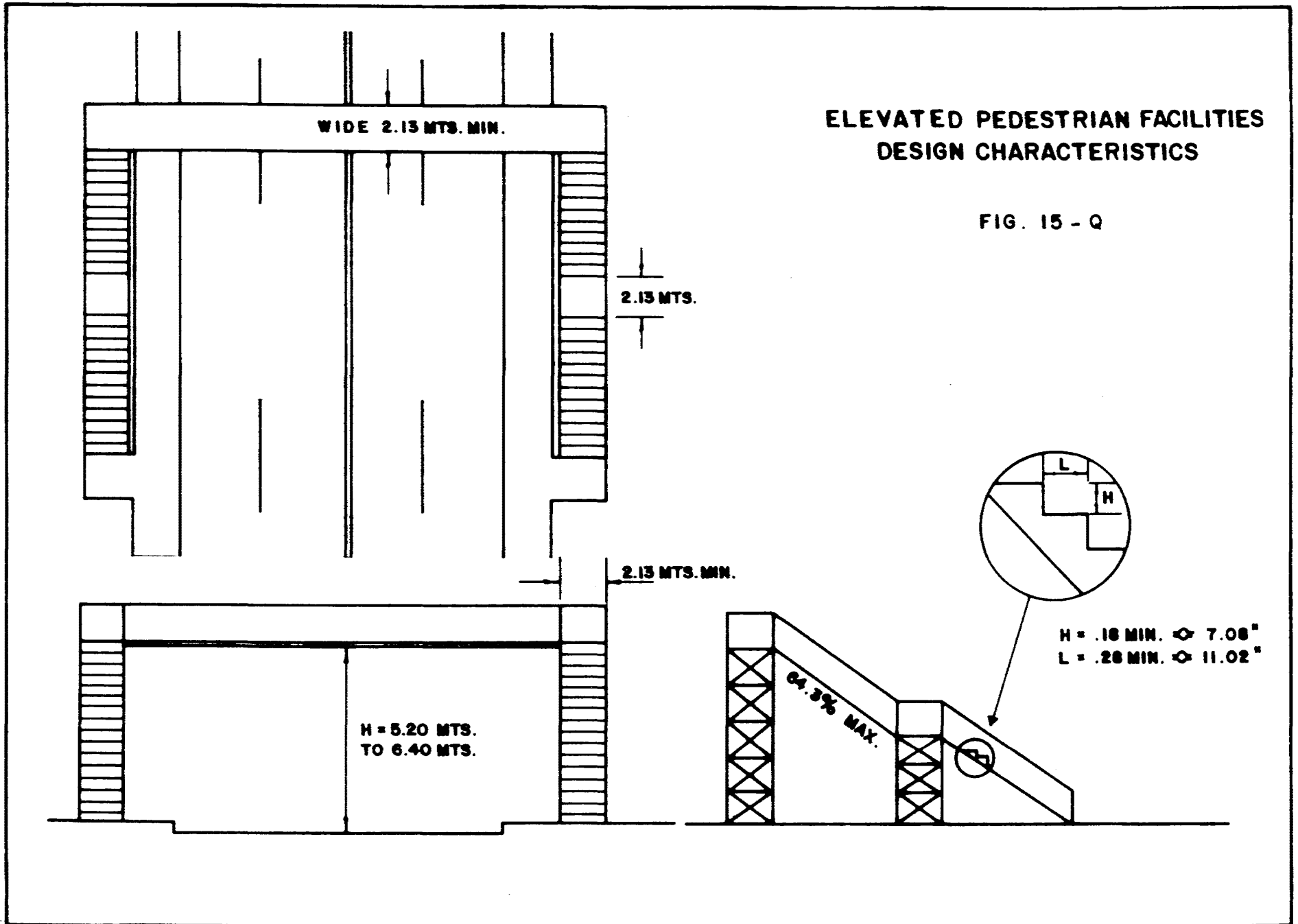


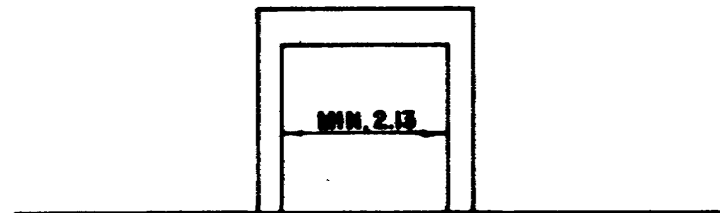
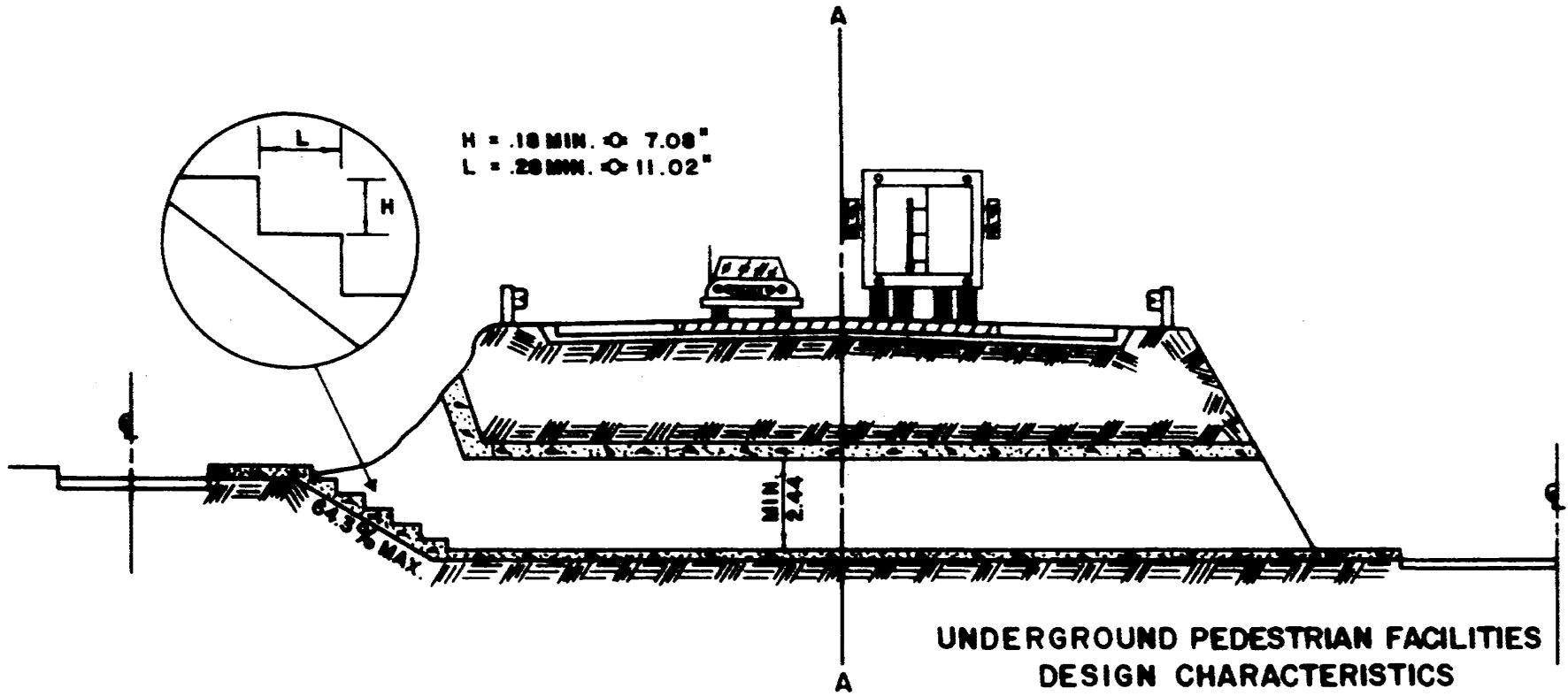
TRAFFIC SIGNALS  
INSTALLATION

FIG. 15-P

### ELEVATED PEDESTRIAN FACILITIES DESIGN CHARACTERISTICS

FIG. 15 - Q





SECTION A-A

FIG. 15 - R