920   SCHOOL CROSSWALKS

The purpose of this section is to establish a uniform procedure of evaluating the need for school crosswalks. A school crosswalk is defined as a crosswalk established for the use of school children in compliance with Arizona Revised Statutes §28-797 and marked in accordance with the "Traffic Safety for School Areas" document published by ADOT. A school age pedestrian is defined as a child that appears to be between the age of five and fifteen.

920.1   SCHOOL CROSSWALK WARRANTS

A.	Average Time Between Gaps Warrant	Maximum	10 Points
B.	School Age Pedestrian Volume Warrant	Maximum	10 Points
C.	Approach Speed or Speed Limit Warrant	Maximum	5 Points
D.	Average Demand Per Gap Warrant	Maximum	8 Points

Maximum Total Points   33 Points

The minimum warrant for the installation of a marked school crosswalk is satisfied when a location rates at least two points for school age pedestrian volumes and has an overall total of at least 16 points in an urban area or 12 points in an isolated community of under 10,000 population (rural). The evaluation period should include the survey period during which 80% of the school age pedestrian crossing activity takes place. A School Crosswalk Warrant Evaluation Form is provided in Exhibit 920-A.

A.   Average Time Between Gaps

Point assignment is based on gap measurements taken during the evaluation period.

Average Minutes Between Usable Gaps in Traffic	Points
less than 1	0
1.01-1.25	2
1.26-1.67	4
1.68-2.50	6
2.51-5.00	8
over 5	10
Maximum	**10**

B.   School Age Pedestrian Volume Warrant

Points are assigned in accordance with the total number of school age pedestrians crossing at the study location on the way to or from school during the evaluation period. A school crossing shall not be installed where the school age pedestrian volume is 10 or less.

| | School Age Pedestrian Volume | |
Urban	Rural	Points
10 or less	10 or less	0
11-30	11-20	2
31-50	21-35	4
51-70	36-50	6
71-90	51-65	8
over 90	over 65	10
Maximum		**10**

C.   Approach Speed or Speed Limit Warrant

Points are assigned in accordance with the vehicular approach speed from both directions of travel as determined through engineering speed studies or from the posted speed limit. No school crosswalks shall be installed on roadways having posted speed limits in excess of 45 mph.

Approach Speed Speed Limit mph	Points
under 20	0
20-25	1
26-30	2
31-35	3
36-40	4
41-45	5
over 45	0
Maximum	**5**

D.   Average Demand Per Gap Warrant

Points are assigned in accordance with the average number of demands per gap during the evaluation period. Since school children frequently walk in groups, the arrival of each individual, or group, at the crossing location should be construed as one demand, i.e., the arrival of a group of three, one individual, a group of two, and another individual constitute four demands.

Average Demand Per Gap	Points
1 or less	0
1.01-1.67	2
1.68-2.33	4
2.34-3.00	6
over 3.00	<u>8</u>
Maximum	**8**

920.2 <u>FORMULAS</u>

(1) School Age Pedestrian Crossing Time = $\dfrac{W}{3.5} + 3 + 2(N-1)$

$\dfrac{W}{3.5}$ = crossing time in seconds (critical width in feet of the pavement to be crossed divided by the assumed juvenile pedestrian walking speed of 3.5 feet per second).

3 = pedestrian perception and reaction time (the number of seconds required for a child to look both ways, make a decision, and commence to walk across the street).

$2(N-1)$ = pedestrian clearance time (additional seconds of time required to clear the largest observed group of children from the roadway). The children are assumed to cross the roadway in rows of five with two-second time intervals between each row. The clearance time interval is equal to $2(N-1)$ where N is the number of rows, 1 represents the first row, and 2 the time interval between rows.

(2) Trial Usable Gap = $W + 3$

(3) $\dfrac{\text{Average Minutes}}{\text{Between Gaps}}$ = $\dfrac{\text{Length of Evaluation Period in Minutes}}{\text{Number of Usable Gaps}}$

(4) $\dfrac{\text{Average Number of}}{\text{Demands Per Gap}}$ = $\dfrac{\text{Total Demands During Evaluation Period}}{\text{Number of Usable Gaps}}$

920.3 SURVEY METHODS

A.   Personnel Requirements: One person.

B.   Duration of Survey: Forty-five minutes before school starts to 15 minutes after school starts in the morning and 30 minutes before school ends to 30 minutes after school ends in the afternoon.

C.   Equipment: Stop watch and field data forms.

D.   Type of Survey:

1.   School age pedestrian count within the proposed crosswalk area during the evaluation period.

2.   Usable gap time count during the same evaluation period.

a.   Children may cross roadways in groups and additional seconds of time are required to clear the largest observed group of children from the roadway. Since the size of the groups is unknown until the field data collection is completed, a trial usable gap should be used for field data collection.

b.   The trial usable gap is the curb-to-curb width of the street, in feet, plus 3. This ensures that the usable gaps measured in the field will include as a subset all of the actual usable gaps since a group size of no more than one row is assumed.

c.   During the evaluation period, the length of each gap that is equal to or exceeds the calculated trial usable gap time is entered on the field data form in seconds.

920.4 USE OF THE CROSSWALK WARRANT FIELD FORMS

A.   Fill out the location information on the heading of the Warrant Evaluation form, sketch the area on the bottom of the form, compute the trial usable gap, and enter the figure (in seconds) in the appropriate space on the Warrant Evaluation form.

B.   For the duration of the survey, enter on the field data sheet the length (in seconds) of those gap times equal to or exceeding the calculated trial usable gap time. During this period also note the time at which the gaps occurred in the TIME column (this will be used to determine the gaps which occurred in the evaluation period at the end of the survey).

C.   For the duration of the survey also record the school age pedestrian volume by five-minute intervals. Individual pedestrians may be recorded by tally marks. Groups should be indicated by size (i.e., 7 for a group of seven pedestrians).

D.   After the field data is collected, the school age pedestrian crossing time (actual usable gap time) is calculated by determining the size of the largest group observed in the evaluation period and dividing by five to determine the number of rows N. Any remainder counts as one row, i.e., for a largest group size of eight pedestrians there would be 1.6 rows which would be rounded up to two rows of pedestrians. The school age pedestrian crossing time equals $W/3.5 + 3 + 2(N-1)$.

E.   Determine the evaluation period (in minutes) by finding, from the pedestrian count data, the time period during which 80% of the pedestrians crossed.

F.   The field data for the evaluation period is reviewed, and all recorded gaps that are shorter than the actual usable gap time are deleted from the data.

G.   To obtain average minutes between gaps, divide the evaluation period (minutes) by the number of usable gaps in the period.

H.   To obtain the average number of demands per gap, divide the number of demands during the evaluation period by the number of usable gaps.

I.   Record the average minutes between gaps, the school age pedestrian volume, the approach speed, and the average number of demands per gap on the Warrant Evaluation form.

J.   Evaluate the individual warrants, assign points as merited, and tabulate to determine if a marked school crosswalk installation is justified.

The location and marking of school crosswalks shall be approved by the Regional Traffic Engineer.

Figure 920-A. School Crosswalk Warrant Evaluation Form

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
TRAFFIC ENGINEERING GROUP

SCHOOL CROSSWALK WARRANT EVALUATION

ROUTE:_____ M.P. _____ INTERSECTION:_____ COMMUNITY:_____
DATE:_____ TIME:_____WEATHER:_____
DISTRICT:_____ COUNTY: _____ INVESTIGATOR:_____

TRIAL USABLE GAP	PEDESTRIAN CROSSING TIME
$W + 3 =$	$\dfrac{W}{3.5} + 3 + 2(N-1) = \underline{\quad} + 3 + 2(\quad) =$

MAXIMUM NO. OF USABLE GAPS	AVERAGE MINUTES BETWEEN GAPS
$\dfrac{\text{TOTAL USABLE GAP TIMES DURING E.P.*}}{\text{PEDESTRIAN CROSSING TIME}} = \underline{\qquad} =$	$\dfrac{\text{TIME INTERVAL (MINUTES) DURING E.P.*}}{\text{NO. OF USABLE GAPS}} = \underline{\qquad} =$

AVERAGE NO. OF DEMANDS PER GAP	
$\dfrac{\text{TOTAL DEMANDS DURING E.P*}}{\text{NO. OF USABLE GAPS}} = \underline{\qquad} =$	

* EVALUATION PERIOD (E.P.) = THE PERIOD WHEN 80% OF THE SCHOOL AGE CROSSING ACTIVITY OCCURS.

EVALUATION: URBAN CONDITIONS – 16 POINTS   ⬜
RURAL CONDITIONS – 12 POINTS   ⬜

WARRANTS	FIELD DATA	ASSIGNED POINTS	MAXIMUM POINTS
1. AVERAGE TIME BETWEEN GAPS (MINUTES)			10
2. SCHOOL AGE PEDESTRIAN VOLUME (NO.)			10
3. APPROACH SPEED or POSTED SPEED LIMIT (MPH)			5
4. AVERAGE DEMAND PER GAP (NO.)			8
TOTAL	✕		33

SKETCH

Figure 920-B. Pedestrian Volume and Usable Gap Time Form

PEDESTRIAN VOLUME & USABLE GAP TIME

TIME	USABLE GAP TIME	TIME	USABLE GAP TIME	TIME	USABLE GAP TIME	TIME	USABLE GAP TIME	TIME	USABLE GAP TIME	TIME	USABLE GAP TIME

PEDESTRIAN COUNT DIVIDED INTO 5 MINUTE INTERVALS

	1	2	3	4	5	6	7	8	9	10	11	12
TIME	:	:	:	:	:	:	:	:	:	:	:	:
GROUPS												
PEDS												

REMARKS: