



Office of the City Auditor

**Report to the City Council
City of San José**

**AN AUDIT OF THE
CROSSING GUARD PROGRAM**

**The City's Process For Determining
Whether Crossing Guards Are Warranted
Needs To Be Improved**

**Report 04-02
May 2004**



CITY OF SAN JOSÉ, CALIFORNIA

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May 28, 2004

Honorable Mayor and Members
of the City Council
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Transmitted herewith is a report on *An Audit of the Crossing Guard Program*. This report is in accordance with City Charter Section 805. An Executive Summary is presented on the blue pages in the front of this report. The City Administration's response is shown on the yellow pages before the appendices.

This report will be presented to the Making Government Work Better Committee at its June 9, 2004, meeting. If you need any additional information, please let me know. The City Auditor's staff members who participated in the preparation of this report are Mike Edmonds and Ruth Garcia Merino.

Respectfully submitted,

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Executive Summary

In accordance with the City Auditor's 2003-04 Audit Workplan, we audited the Department of Transportation's (DOT) process for determining whether adult crossing guards are warranted at various locations throughout the City of San José. We conducted our audit in accordance with Generally Accepted Government Auditing Standards and limited our work to those areas specified in the Scope and Methodology section of this report.

Finding I The City's Process For Determining Whether Crossing Guards Are Warranted Needs To Be Improved

In 1950, the San José Traffic Safety Advisory Council (STSAC), the forerunner to the School Pedestrian Safety Committee (SPSC), developed a safety index formula to measure the relative safety of school crossings. The Department of Transportation (DOT) processes requests for the placement of adult crossing guards. To determine whether an adult guard is warranted, DOT collects information on an intersection, enters the information into a formula, and calculates the safety index. We found the following issues with the City's process for determining whether an adult crossing guard is warranted:

- The safety index formula incorrectly assumes that Kindergarten (K) through 5th (K-5) and K through 6th (K-6) grade schools have a student safety patrol;
- The safety index formula limits the number of turns considered;
- The safety index formula does not provide sufficient weight to intersections with high numbers of children crossing the street;
- The City Council has not reviewed the safety index formula and safety index value since 1985;
- The DOT has incorrectly entered data into the safety index formula;

- The DOT needs procedures to ensure that it analyzes intersections in a consistent manner and that the rationale for its decisions is adequately documented; and
- The information that the DOT provides the SPSC may not always allow the SPSC to fully evaluate whether the placement of a guard is warranted.

As a result, the City's process for determining whether an adult crossing guard is warranted does not always ensure that crossing guards are placed at locations that need them the most. In our opinion, the DOT should revise the safety index formula for determining if school intersections qualify for adult crossing guards. The DOT is in the process of revising the safety index formula. Further, the DOT should re-calculate the intersections that have not qualified in the past three years using the revised safety index formula and submit the revised results to the SPSC. Also, the DOT should submit the revised safety index formula to the SPSC and the City Council for approval including an analysis of the anticipated budgetary implications of increasing or decreasing the safety index. Finally, the DOT should develop additional written procedures for the safety index process and provide additional intersection information to the SPSC.

RECOMMENDATIONS

We recommend that the Department of Transportation:

- Recommendation #1** **Revise the safety index formula to 1) provide a more appropriate age factor for K-5 and K-6 schools and turn factor for the number of cars turning into a crosswalk and 2) provide sufficient weight to intersections with high numbers of children crossing the street. (Priority 3)**
- Recommendation #2** **Re-calculate the intersections that have not qualified for an adult crossing guard during the past three years using the revised safety index formula and submit the results to the SPSC. (Priority 3)**
- Recommendation #3** **Submit the revised safety index formula to the SPSC and the City Council for approval. (Priority 3)**

- Recommendation #4** **Submit to the City Council the anticipated budgetary implications of increasing or decreasing the safety index value. (Priority 3)**
- Recommendation #5** **Develop written procedures for entering information into the safety index formula and provide sufficient supervisory review. (Priority 3)**
- Recommendation #6** **Develop written procedures for analyzing intersections and documenting the rationale for its decisions. (Priority 3)**
- Recommendation #7** **Provide the SPSC with the posted speed limit and the date of any applicable speed study, and a diagram of the intersection it is considering for an adult crossing guard showing**
- **the number of children, their approximate ages, and the direction they are crossing;**
 - **the total number of vehicles crossing each leg of the intersection and the direction they are going; and**
 - **the total number of vehicle turns crossing each leg of the intersection. (Priority 3)**

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Introduction

In accordance with the City Auditor's 2003-04 Audit Workplan, we audited the Department of Transportation's (DOT) process for determining whether adult crossing guards are warranted at various locations throughout the City of San José. We conducted our audit in accordance with Generally Accepted Government Auditing Standards and limited our work to those areas specified in the Scope and Methodology section of this report.

The City Auditor's Office thanks the staff of the Department of Transportation and the Police Department who gave their time, information, insight, and cooperation during the audit.

Background

The City of San José hired its first adult crossing guard in 1945 and the need for guards has increased throughout the past decades. In 2003-04, the City budgeted \$1.6 million to pay for 205 adult crossing guards at 114 authorized intersections throughout the City. These adult crossing guards provide protection to school children in the morning before school begins and in the afternoon after school lets out.

In 1946, the City initiated a safety committee to advise on the placement of adult crossing guards throughout the City on an equitable basis. The committee has operated under various names and is currently called the School Pedestrian Safety Committee (SPSC). The SPSC consists of representatives from the City of San José, schools, parents, and citizens.

The SPSC is an advisory committee to the San José Police Department on matters involving school safety and the placement of school crossing guards. The primary objective of the SPSC is to ensure that crossing guard protection is distributed on an equitable basis throughout the City while maintaining the level of service that the budget will allow. Other SPSC objectives include:

- Promoting overall school traffic safety;
- Establishing uniform practices of school traffic safety;
- Providing continuing evaluation of safety practices; and
- Promoting good public relations.

To accomplish these objectives, the SPSC serves as a forum for discussion and appeal for residents, and a means of communication among school officials, City officials, and organizations concerned with school safety and the general public. The SPSC reviews studies for school traffic controls and safety programs such as:

- Placement and removal of adult crossing guards;
- Installation of signals, signs, and crosswalks;
- Effective use of school safety patrols;
- Promotion of bicycle and pedestrian safety;
- Designation by schools of “Walking Routes to School”; and
- Coordination of engineering, education, and enforcement to achieve an effective balance.

In 1950, the School Traffic Safety Advisory Council (STSAC), the forerunner to the SPSC, formed a committee to develop a criterion for determining the need for school crossing protection. Their objective was to establish a uniform and objective system to measure the relative safety of a given location and determine the type of controls best suited for the situation. The STSAC committee developed a safety index formula to evaluate which intersections needed an adult crossing guard. The committee picked a safety index of 120 as the minimum value for recommending placement of an adult crossing guard.

The safety index is intended to be an objective guide for evaluating the relative safety of locations throughout the City. For instance, a location with an index of 200 is considered less safe than an intersection with an index of 100. A minimum of 20 children crossing during one hour is required at a crossing to establish an index. Although the safety index formula has undergone some modification over the years, a safety index value of 120 is still used as the minimum value to warrant an adult crossing guard. The index is calculated using the following factors:

- Width of the roadway;
- Number of vehicles (including turns) crossing the crosswalk;

- Number of and the age of school children crossing in one hour;
- Existing traffic controls (signals, stop signs, etc.);
- Distance of crossing from the main school entrance;
- Speed of traffic; and
- Walking speed/decision time.

The State of California (State) also has guidelines for the placement of adult crossing guards. The State and the City's guidelines for the placement of adult crossing guards are generally similar, in that both use vehicle volume as a chief determining factor, and also consider speeds and turning vehicles. However, in some instances, the City's safety index formula makes it easier to justify a crossing guard compared to the State guidelines. For instance, the State guidelines generally recommend a crossing guard be placed at locations where a minimum of 40 students (30 in rural areas) cross the street. San José's guidelines require only 20 students as a minimum. Also, State guidelines only consider turning vehicle movements at signalized locations, whereas San José's guidelines consider turning movements at all studied locations. In addition, State guidelines address only elementary school children, whereas San José's guidelines also allow for middle school children.

The San José Department of Transportation (DOT) receives school pedestrian safety issues from parents, schools, the City Council, and City staff. Schools submit written requests to the DOT for placement of adult crossing guards at specific intersections. In turn, the DOT's traffic engineers perform engineering studies to determine whether an adult crossing guard is warranted.

The DOT processes the requests for crossing guard studies. DOT performs engineering studies to determine the relative need for adult crossing guards and presents the results to the SPSC.

To determine whether an adult crossing guard is warranted at a specific location, DOT calculates the safety index. To calculate the safety index, DOT staff analyzes the intersection being considered. Specifically, DOT counts the number of students and vehicles crossing a given intersection. For instance, DOT staff counts the number of vehicles going in each direction, the number of turns crossing the intersections, and the number of

children crossing the intersections. DOT staff performs the counts for about an hour before school and again for about another hour after school.

After the counts are completed, DOT staff enters the data into an Excel spreadsheet that calculates the safety index. DOT staff also identify any unusual conditions such as excessive vehicle violations, odd intersection configurations, accident history, or other factors affecting the safety of the intersection. DOT presents the results of its crossing guard analysis to the SPSC. Based on the safety index calculation and any other information relevant to the decision, the SPSC recommends whether a guard should be placed at a given intersection. If the intersection has an index of 120 or higher, the SPSC will normally recommend that an adult crossing guard be placed at the intersection. However, the SPSC does not rely exclusively on the index when considering guard placement. If a location has an index below 120, the SPSC may consider other circumstances which are not taken into account in the index calculation. If the other circumstances are significant, the SPSC may recommend placement of a guard at a location with an index of less than 120.

The San José Police Department (SJPD) manages the Adult Crossing Guard Program for the City through its School Safety Education Unit (SSEU). The SSEU's goal is to reduce and prevent accidents to school children. It currently provides three programs to accomplish this goal: Adult Crossing Guards; Safety Patrol; and Safety Education Programs. Under the supervision of a police sergeant, four Crossing Guard Coordinators direct the above programs. For the Adult Crossing Guard Program, the SSEU responsibilities include: recruiting, selecting, training, supervising, and scheduling of crossing guards throughout the City. In 2003-04, the Adult Crossing Guard Program is authorized for 205 guards and the SJPD currently has 185 guards to staff 114 intersections. For the Safety Patrol Program, the SSEU trains student safety patrol members. Besides these two programs, the SSEU provides programs on pedestrian and bicycle safety, as well as child molestation prevention.

**Audit Objectives,
Scope, And
Methodology**

Our audit objective was to evaluate the City of San José's (City) process for determining whether intersections near schools qualify for adult crossing guards. Specifically, we reviewed the safety index formula to determine if it provided an

equitable and objective method for determining those intersections that pose the greatest risk. Further, we determined if the Department of Transportation (DOT) correctly calculated the safety index and if the City Council had approved the present safety index formula. The scope of our audit was adult crossing guard engineering studies the DOT performed from March 2001 through March 2003.

To accomplish our audit objectives, we extensively reviewed the safety index formulas. We reviewed the City's Municipal Code and City memoranda and documents related to adult crossing guards and the safety index formula to document the authorization of the safety index formulas the DOT used. We also compared the safety index formulas and assumptions DOT used to the U.S. Department of Transportation and State of California Department of Transportation guidelines for school area pedestrian safety and to the Institute of Transportation Engineers publications regarding child pedestrian and school area pedestrian safety. We reviewed the DOT procedure for traffic vehicle and pedestrian counts and observed a DOT traffic checker performing vehicle and pedestrian counts at school intersections. Based on our reviews and observations, we questioned the validity of the safety index formula assumptions.

We interviewed staff from the DOT and the San José Police Department (SJPD), regarding the Adult Crossing Guard Program. We surveyed some of the City's schools and a school district to determine why some schools did not have student safety patrol programs. We attended SPSC meetings to help us understand the process for the approval of a placement of a guard. We also attended a community meeting at a school regarding the City's rejection of a request for an adult crossing guard.

Finally, we verified the accuracy and reliability of the computer-generated safety indexes by verifying that all of the formulas and factors that DOT used to calculate the safety index were the same as those shown in City memoranda and documents. Further, we verified the accuracy of the data by comparing the information the traffic checkers collected to the information the DOT staff entered into the safety index formula. For any engineering study errors we identified, we recalculated the safety index with the corrected information.

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Finding I

The City's Process For Determining Whether Crossing Guards Are Warranted Needs To Be Improved

In 1950, the San José Traffic Safety Advisory Council (STSAC), the forerunner to the School Pedestrian Safety Committee (SPSC), developed a safety index formula to measure the relative safety of school crossings. The Department of Transportation (DOT) processes requests for the placement of adult crossing guards. To determine whether an adult guard is warranted, DOT collects information on an intersection, enters the information into a formula, and calculates the safety index. We found the following issues with the City's process for determining whether an adult crossing guard is warranted:

- The safety index formula incorrectly assumes that Kindergarten (K) through 5th (K-5) and K through 6th (K-6) grade schools have a student safety patrol;
- The safety index formula limits the number of turns considered;
- The safety index formula does not provide sufficient weight to intersections with high numbers of children crossing the street;
- The City Council has not reviewed the safety index formula and safety index value since 1985;
- The DOT has incorrectly entered data into the safety index formula;
- The DOT needs procedures to ensure that it analyzes intersections in a consistent manner and that the rationale for its decisions is adequately documented; and
- The information that the DOT provides the SPSC may not always allow the SPSC to fully evaluate whether the placement of a guard is warranted.

As a result, the City's process for determining whether an adult crossing guard is warranted does not always ensure that crossing guards are placed at locations that need them the most. In our opinion, the DOT should revise the safety index formula for determining if school intersections qualify for adult crossing guards. The DOT is in the process of revising the safety index

formula. Further, the DOT should re-calculate the intersections that have not qualified in the past three years using the revised safety index formula and submit the revised results to the SPSC. Also, the DOT should submit the revised safety index formula to the SPSC and the City Council for approval including an analysis of the anticipated budgetary implications of increasing or decreasing the safety index. Finally, the DOT should develop additional written procedures for the safety index process and provide additional intersection information to the SPSC.

*The STSAC
Developed The
Safety Index In 1950*

As noted in the Background, in 1950, the San José Traffic Safety Advisory Council (STSAC), the forerunner to the School Pedestrian Safety Committee (SPSC), developed a safety index to provide a uniform and objective method for measuring the relative safety of school crossings. The safety index uses a formula to predict the number of gaps in traffic long enough to allow a pedestrian to cross an intersection without encountering a vehicle. The required length of the gap depends on factors such as walking speed, street width, and time for a decision to be made.

The STSAC adopted a safety index of 120 as the minimum value which would warrant placement of an adult crossing guard without consideration of extenuating circumstances. The STSAC's decision to use the 120 safety index was based on the level of service that the 1950 budget would support.

In 1968, the STSAC added the following factors to the City's safety index formula:

1. Age of the children;
2. Distance of the crossing from the school;
3. Traffic speed (at uncontrolled intersections); and
4. Excessive vehicle turning movements.

In 1973, the STSAC developed a refined safety index formula for school crossings without traffic controls. The City Council approved the revised formula in 1975 and reaffirmed the use of 120 as the minimum value to warrant a crossing guard. See Appendices B and C for the formulas the DOT uses to analyze school crossings with and without traffic controls, respectively. In this report we refer to both formulas as the safety index formula.

We reviewed the City’s formula for calculating the safety index and identified several problems that should be addressed. Specifically, we found the safety index formula:

- Incorrectly assumes that all K-5 and K-6 schools have a student safety patrol;
- Limits the number of turns considered; and
- Does not provide sufficient weight to intersections with high numbers of children crossing the street.

The Safety Index Formula Incorrectly Assumes That K-5 And K-6 Grade Schools Have A Student Safety Patrol

The safety index formula considers the age of the students and assigns a higher age factor to schools with younger children. According to the Traffic Engineering Handbook that the Institute of Transportation Engineers published, the ability of younger children to safely cross the street is not well-developed. Furthermore, the literature states that children aged 5 to 7 have the highest rate of pedestrian accidents. Therefore, the safety index model gives a higher age factor to the schools with younger children. The exhibit below shows the respective age factors for grades K-4, K-5 or K-6, and 7th or 8th.

Exhibit 1 The Safety Index Formula’s Respective Age Factor For Grades K-4, K-5 Or K-6, And 7th Or 8th

Highest Grade	Age Factor
K-4 or less	3.0
K-5 or K-6 schools with a crosswalk more than 900 feet from the school	2.0
K-5 or K-6 schools with a crosswalk less than 900 feet from the school	1.0
Highest grade 7 th or 8 th	.5

As Exhibit 1 shows, the safety index formula assigns an age factor of 3 for schools with grades K-4. In comparison, the model assigns an age factor of either 2 or 1 for schools with grades K-5 or K-6. Schools with crosswalks more than 900 feet away receive an age factor of 2 and schools with crosswalks less than 900 feet away receive an age factor of 1. The rationale for this is based on the assumption that intersections within 900 feet of K-5 or K-6 schools will have a student safety patrol.

We found that the assumption that K-5 or K-6 schools have a school safety patrol is not always valid. Specifically, we found that many K-5 and K-6 schools do not have safety patrols. For example, some schools do not have student safety patrols because the schools believe that it is either too dangerous for their students or the school lacks the resources to have a staff member or volunteer to oversee the program. In fact, one school district does not allow its schools to have safety patrols.

As shown above, the current safety index age factors provide a significant advantage to schools with only K-4 students relative to schools with K-5 or K-6 students. The K-5 or K-6 schools, especially the ones that do not have a student safety patrol, still may have many K-4 children who walk to school and cross streets without a parent or a guardian. In our opinion, the formula should be modified to provide more appropriate age factors for K-5 and K-6 schools.

We discussed this problem with the DOT and they are revising the safety index formula to provide more appropriate age factors for K-5 and K-6 schools.

**The Safety Index
Formula Limits
The Number Of
Turns Considered**

According to the Traffic Engineering Handbook, cars turning into an intersection statistically pose a greater hazard than cars going straight through an intersection. Accordingly, the safety index formula assigns a higher turn factor to intersections that have a high number of cars turning across the crosswalk during the time period that school children are crossing. The more turns crossing the crosswalk, the higher the turn factor. Exhibit 2 below shows the number of turns and the weight assigned for the specified number of turns.

**Exhibit 2 Relative Turn Factors For The Number Of Turns
Per Hour**

Number Of Turns Per Hour	Turn Factors
0-149	1.0
150-199	1.25
200-249	1.5
250-299	1.75
300 or more	2.0

As Exhibit 2 shows, the safety index formula assigns a higher turn factor for intersections having more turns. However, the safety index formula only assigns a maximum turn factor of 2 to crosswalks with 300 or more cars turning into it. Thus, the safety index formula does not reflect any difference between one intersection having 300 cars turning into it and another intersection having 600 cars turning into it. For both intersections, the model would assign a turn factor of 2. With all other factors being equal, the intersection with 600 cars turning, theoretically, poses a greater risk than the intersection with 300 cars turning. However, the current safety index formula does not recognize this difference. In our opinion, the DOT should modify the safety index formula to provide appropriate turn factors for intersections with a higher number of turns.

We discussed this problem with the DOT and they are revising the safety index formula to assign higher turn factors to those intersections with more turns. Such a change would increase the safety index for those intersections with a high number of turns per hour.

The Safety Index Formula Does Not Provide Sufficient Weight To Intersections With High Numbers Of Children Crossing The Street

The safety index formula does not adequately consider the number of children crossing the intersection. The safety index formula requires a minimum of 20 children crossing a crosswalk during one hour. Once the 20 minimum is met, the number of children above 20 crossing an intersection has a minimal effect on the safety index calculation.

We calculated the effect that different numbers of children crossing an intersection has on the safety index calculation. We based our calculations on the information from an actual San José intersection. The analysis of this leg of an intersection had 30 children crossing and we calculated the safety index to be 31. We then calculated a safety index of 38, 51, and 64 assuming 100, 150, and 200 children, respectively, crossing this leg of the intersection. In our example, while the number of children crossing this leg of the intersection increased by 567 percent; the safety index increased by only 106 percent. Although an increase in the number of children should not proportionally increase the safety index, it should provide additional weight to intersections with high numbers of children crossing.

In our opinion, the safety index formula does not provide sufficient weight to intersections with high numbers of children crossing the street and the DOT should revise the safety index formula accordingly.

We discussed this problem with the DOT and they are revising the safety index formula to give provide more weight to intersections with high numbers of children crossing the street. Such a change would increase the safety index for these intersections with more children crossing the street.

We recommend that the DOT revise the safety index formula to 1) provide a more appropriate age factor for K-5 and K-6 schools and turn factor for the number of vehicles turning into a crosswalk and 2) provide sufficient weight to intersections with high numbers of children crossing the street.

We recommend that the Department of Transportation:

Recommendation #1:

Revise the safety index formula to 1) provide a more appropriate age factor for K-5 and K-6 schools and turn factor for the number of cars turning into a crosswalk and 2) provide sufficient weight to intersections with high numbers of children crossing the street. (Priority 3)

Upon implementation of Recommendation #1, the DOT should re-calculate the intersections that have not qualified for an adult crossing guard during the past three years and submit the results to the SPSC.

We recommend that the Department of Transportation:

Recommendation #2

Re-calculate the intersections that have not qualified for an adult crossing guard during the past three years using the revised safety index formula and submit the results to the SPSC. (Priority 3)

The City Council Has Not Reviewed The Safety Index Formula And Safety Index Value Since 1985

Based on our review of City memoranda, it appears the City Council last approved the safety index formula in 1975, and last approved the 120 safety index value in 1985. Furthermore, the School Traffic Safety Advisory Council arbitrarily set the safety index at 120 back in 1950 based upon budget considerations. If the City Council were to lower the index, more locations would qualify, thereby increasing the cost of the program. Because the DOT is in the process of revising the safety index formula, we recommend that the DOT submit the revised safety index formula to the SPSC and the City Council for approval. In addition, the DOT should also present to the City Council the anticipated budgetary implications of increasing or decreasing the safety index value.

We recommend that the Department of Transportation:

Recommendation #3

Submit the revised safety index formula to the SPSC and the City Council for approval. (Priority 3)

Recommendation #4

Submit to the City Council the anticipated budgetary implications of increasing or decreasing the safety index value. (Priority 3)

The DOT Has Incorrectly Entered Data Into The Safety Index Formula

As noted in the Background section of this report, the DOT processes requests for crossing guard studies. To determine whether an adult crossing guard is warranted at a specific location, the DOT performs an analysis of the location. First, the DOT counts the number of vehicles, turns, and the number of children crossing. It also measures the width of the intersection and identifies any unusual features. Then, the DOT enters the data it has collected on the intersection into the safety index formula and calculates the safety index. It is important that the DOT correctly enters this information into the formula.

We found that the DOT, for at least the last several years, has been overstating the turn factor when calculating the safety index. Specifically, DOT staff misunderstood the procedure for calculating the number of cars turning into an intersection.

DOT staff incorrectly counted all the vehicles turning into an intersection instead of only those turns that crossed the leg of the intersection being analyzed.

Consequently, DOT staff has overstated the safety index for intersections it has evaluated. However, as noted above, the safety index formula mitigates the overstating of turns by limiting the number of turns in the turn factor. In fact, for some intersections, the DOT's overstatement of the number of turns did not have any effect on the safety index. However, we identified two intersections that had a safety index of 120 or more because the DOT overstated the number of cars turning into the intersection. The safety index for these two intersections should have been 92¹ and 88², respectively, if the DOT had counted the turns correctly.

Besides the problem with the turn count, we also identified other errors in the DOT's input of data from the counts to the safety index formula. Specifically, we found examples where the DOT incorrectly entered the number of vehicles, the number of children crossing, the length of the crosswalk, vehicle speed, and the grade level of children. These errors resulted in both lower and higher safety indexes than warranted. For one intersection, if the DOT would have input the correct number of vehicles into its safety formula it would have calculated a safety index of 122 instead of 112 and the intersection would have qualified for an adult crossing guard.

For another intersection, the DOT's input errors resulted in the intersection qualifying for an adult crossing guard when it should not have qualified. Specifically, the DOT incorrectly input the width of the intersection, the number of vehicles, and the number of turns and calculated a safety index of 123, which meant that the intersection automatically qualified for an adult crossing guard. If the DOT had entered the correct information it would have calculated a safety index of 99 and the intersection would not have automatically qualified for a crossing guard.

¹ Besides the turn factor, DOT also incorrectly entered the width and the number of vehicles for this intersection as discussed later on this page. The safety index factor would have been 92 if we had only re-calculated the turn factor. However, by combining the turn factor error with the other errors, we re-calculated the safety index to be 99.

² Besides the turn factor, DOT also incorrectly entered the vehicle speed for this intersection. The safety index factor would have been 88 if we had only re-calculated the turn factor. However, by combining the turn factor error with the other error, we re-calculated the safety index to be 136.

In our opinion, the DOT needs to develop written procedures for entering information into the safety index formula. Furthermore, the DOT needs to provide sufficient supervisory review to ensure that staff follows these written procedures, and correctly enters the data into the safety index formula.

We recommend that the Department of Transportation:

Recommendation #5

Develop written procedures for entering information into the safety index formula and provide sufficient supervisory review. (Priority 3)

The DOT Needs Procedures To Ensure That It Analyzes Intersections In A Consistent Manner And That The Rationale For Its Decisions Is Adequately Documented

When the DOT performs an engineering study of an intersection, it analyzes all of the legs of the intersection. For instance, an intersection could have four possible legs (east, west, north, and south) for the children to cross. According to DOT staff, they calculate the safety index on the leg that would generate the highest safety index, and in their professional judgment, is the most practical leg for the children to cross.

The safety index is intended to be an objective guide for evaluating intersections throughout the City. However, DOT uses its professional judgment to determine which leg of the intersection to analyze. While appropriate, professional judgment can lead to some subjectivity in the safety index calculation. Moreover, DOT's professional judgment can significantly affect the outcome of the safety index calculation and must be able to withstand public scrutiny.

We identified an intersection for which DOT's professional judgment affected the outcome of the safety index. Specifically, we identified an intersection where the DOT did not calculate the safety index on the leg of the intersection that generated the highest safety index. For this intersection, the DOT calculated the safety index to be 49 using the west leg of the intersection. However, the north leg of the intersection would have generated a safety index of 91. Moreover, if the DOT had used an age factor of 2 (the K-5 school does not have a student safety patrol) instead of 1, this leg of the intersection would have generated a safety index of 182. According to the DOT, it used the west leg to calculate the safety index because, in their professional judgment, it would not be practical to place a guard on the north leg. Although we do not disagree with the

DOT's professional judgment, this example demonstrates that DOT's judgments can significantly affect the outcome of the safety index calculation and must be able to withstand public scrutiny.

Accordingly, the DOT should develop written procedures to ensure that it analyzes intersections in a consistent manner and documents the rationale for its decisions.

We recommend that the Department of Transportation:

Recommendation #6

Develop written procedures for analyzing intersections and documenting the rationale for its decisions. (Priority 3)

The Information That DOT Provides To The SPSC May Not Always Allow The SPSC To Fully Evaluate Whether The Placement Of A Crossing Guard Is Warranted

After the DOT performs an engineering study and calculates the safety index, it presents the information to the SPSC. The DOT presents this information using a form called the Adult Crossing Guard Analysis form. This form includes the information the DOT used for the leg of the intersection it analyzed to calculate the safety index and includes the:

- School;
- Width of the crosswalk;
- Type of traffic control;
- Vehicle speed;
- Morning and afternoon count of vehicles, pedestrians, and turns;
- Safety index calculation; and
- Safety index score.

The DOT also presents the intersection's accident history and certain extenuating circumstances regarding the design of the intersection, such as visibility conditions. However, this information may not always allow the SPSC to fully evaluate whether the placement of a crossing guard is warranted. For instance, we identified one intersection where the safety index calculation and the information the DOT presented to the SPSC did not fully reflect the volume of traffic and the number of children crossing the intersection before and after school. A diagram of this intersection is shown in Exhibit 3.

Exhibit 3 Traffic And Pedestrian Counts Diagram

As Exhibit 3 shows, the intersection has a four-way stop and is located directly in front of a K-5 elementary school. In addition, a middle school is located several blocks away. The intersection has a significant number of vehicles, turns, and children. Specifically, the most recent one-hour count in the morning found the following movement in the intersection:

- 835 vehicles;
- 566 turns; and
- As many as 271 children crossing (137 middle school children and 104 elementary school children plus 30 school children who may be crossing two legs of the intersection).

The DOT has reviewed this intersection on numerous occasions and the safety index is always too low. The DOT last analyzed this intersection in September 2002. The DOT last calculated the safety index at 49. The information the DOT routinely submits to the SPSC after it performs an engineering study of an intersection does not provide a complete picture of the volume of vehicles entering and turning in the intersection and the number and approximate age of the students walking in this intersection. The DOT submitted the safety index calculation to the SPSC based on its analysis of the leg of the intersection that in its professional judgment would provide the highest safety index and be the most practical to cross. The analysis of this intersection was for the west leg which had 30 students crossing. The DOT counts the children walking on both opposite legs of the intersection when determining the number of children crossing. In this intersection, 26 children were walking on the west leg and 4 children were walking on the east leg. However, the information the DOT submitted to the SPSC does not show that 191 children (96 K-5 children and 95 middle school children) were walking on the south leg of the intersection and 50 children (8 K-5 children and 42 middle school children) were walking on the north leg of the intersection. Similarly, the DOT's analysis does not reflect the total volume of vehicles crossing and turning into the intersection.

In our opinion, the DOT should provide more information to the SPSC when it analyzes an intersection. Besides its safety index calculation, accident history, and extenuating circumstances regarding the design of the intersection, the DOT should also include the posted speed limit and the date of any

applicable speed study, and a diagram of the intersection showing the number of children, their approximate ages, and the direction they are crossing; the total number of vehicles crossing the intersection and the direction they are going; and the total vehicle turns. By so doing, the SPSC will be able to make the most informed decision on the safety of the intersection.

We recommend that the Department of Transportation:

Recommendation #7

Provide the SPSC with the posted speed limit and the date of any applicable speed study, and a diagram of the intersection it is considering for an adult crossing guard showing

- **the number of children, their approximate ages, and the direction they are crossing;**
- **the total number of vehicles crossing each leg of the intersection and the direction they are going; and**
- **the total number of vehicle turns crossing each leg of the intersection. (Priority 3)**

CONCLUSION

We found that the City can improve its process for determining when adult crossing guards are needed. Specifically, the safety index formula that DOT uses to measure the relative safety of a school crossing needs to be revised. Moreover, the City Council has not reviewed the safety index formula methodology since 1985. We also found errors in DOT's safety index calculations and that it needs procedures to ensure it analyzes intersections in a consistent manner. Furthermore, we found that DOT needs to provide more information to the SPSC so it can properly evaluate the safety of an intersection. As a result, the City's process for determining whether an adult crossing guard is warranted does not always ensure that crossing guards are placed at intersections that need them the most. Accordingly, the DOT should implement the following recommendations to improve the City process for determining where adult crossing guards are needed.

RECOMMENDATIONS

We recommend that the Department of Transportation:

- Recommendation #1** **Revise the safety index formula to 1) provide a more appropriate age factor for K-5 and K-6 schools and turn factor for the number of cars turning into a crosswalk and 2) provide sufficient weight to intersections with high numbers of children crossing the street. (Priority 3)**
- Recommendation #2** **Re-calculate the intersections that have not qualified for an adult crossing guard during the past three years using the revised safety index formula and submit the results to the SPSC. (Priority 3)**
- Recommendation #3** **Submit the revised safety index formula to the SPSC and the City Council for approval. (Priority 3)**
- Recommendation #4** **Submit to the City Council the anticipated budgetary implications of increasing or decreasing the safety index value. (Priority 3)**
- Recommendation #5** **Develop written procedures for entering information into the safety index formula and provide sufficient supervisory review. (Priority 3)**
- Recommendation #6** **Develop written procedures for analyzing intersections and documenting the rationale for its decisions. (Priority 3)**
- Recommendation #7** **Provide the SPSC with the posted speed limit and the date of any applicable speed study, and a diagram of the intersection it is considering for an adult crossing guard showing**
- **the number of children, their approximate ages, and the direction they are crossing;**
 - **the total number of vehicles crossing each leg of the intersection and the direction they are going; and**
 - **the total number of vehicle turns crossing each leg of the intersection. (Priority 3)**

Memorandum

TO: Gerald A. Silva, City Auditor

FROM: James R. Helmer

SUBJECT: Response to the Audit of the
Crossing Guard Program

DATE: 06-08-04

Approved

Kay Wines

Date

5/27/04

BACKGROUND

The City Auditor's office has been conducting an audit of the City's Adult Crossing Guard Program, and will submit a report to the Making Government Work Better Committee at its June 8, 2004 meeting. This memo is in response to the Auditor's Report after review by the Department of Transportation (DOT).

ANALYSIS

The DOT supports the San José Police Department's Adult Crossing Guard Program by performing analyses of requested intersections, and providing support to the School Pedestrian Safety Committee. The Auditor's Office makes several recommendations pertaining to DOT's processing of Adult Crossing Guard Study Data, based on findings developed in the audit process. In general, DOT agrees with the recommendations contained in the auditor's report. DOT will address both the findings listed in the Auditor's Report, and each of the recommendations below.

Safety Index

The Auditor has concluded that there may be variations within the formula upon which the Safety Index is based. There are three (3) issues:

- The age factor variable within the formula is based on the probability of a safety patrol at a given school.
- There is a limit on the number of turns that can be included within the turning variable that can be calculated in the formula.
- The number of children crossing at an intersection is not given sufficient weight.

Consequently, the auditor recommends:

Recommendation 1. Revise the safety index formula to 1) provide a more appropriate age factor for K-5 and K-6 schools and turn factor for the number of cars turning into a crosswalk and 2) provide sufficient weight to intersections with high numbers of children crossing the street. (Priority 3)

DOT agrees with this recommendation. As noted in the Auditor's Report, the San José Safety Index requires fewer students, and provides a broader range of situations where a guard may be placed than compared with State guidelines. (State guidelines require a minimum of 40 students for an intersection to be considered for a guard, where San José only requires 20, and state guidelines do not consider factors such as width of roadways, and types of controls, etc.) However, DOT has been evaluating revisions to the formula, including but not limited to the recommendations contained within the auditor's report to meet changing traffic conditions, and to more accurately reflect some of the diverse situations that schools in San José present. DOT is revising the formula to:

- Eliminate the presumption of a Safety Patrol
- Provide a turning factor scale that would accommodate different intersection configurations, up to the maximum possible number of turns for an intersection (saturation point).
- Provide for added weight for locations that have a great quantity of students crossing at a particular intersection.
- Add values for "Unusual Conditions," including crashes, visibility, and other factors.
- Refine the age factor to reflect the lowest rather than the highest-grade level.

Recommendation 2. Re-calculate the intersections that have not qualified for an adult crossing guard during the past three years using the revised safety index formula and submit the results to the School Pedestrian Safety Committee (SPSC). (Priority 3)

DOT agrees with the recommendation. DOT will recalculate the intersections using the existing data, and studied within the 2002, '03, and '04 calendar years. It is anticipated that the revised formula may increase the number of guards required, as more crosswalks would likely obtain the minimum safety index of 120 points.

Recommendation 3. Submit the revised safety index formula to the SPSC and the City Council for Approval. (Priority 3)

DOT agrees with the recommendation, and believes that the revised safety index should be approved by City Council before initiating Recommendation 2 above.

Recommendation 4. Submit to the City Council the anticipated budgetary implications of increasing the safety index value. (Priority 3)

DOT agrees with the recommendation. DOT will prepare the analysis in collaboration with the San José Police Department. It is anticipated that the revised formula may increase the number of guards required, which could have a significant impact on the program's budget.

Recommendation 5. Develop written procedures for entering information into the safety index formula and provide sufficient supervisory review. (Priority 3)

DOT agrees with the recommendation, and will comply within the recommended time frame.

Recommendation 6. Develop written procedures for analyzing intersections and documenting the rationale for its decisions. (Priority 3)

DOT agrees with the recommendation. As the auditor's report indicates, there are circumstances that require engineering judgment, or that may not fit within all of the formula's parameters. While there is a need for DOT to have some latitude to make these judgments, the reasons for such decisions should be documented.

Recommendation 7. Provide the SPSC with the posted speed limit and the date of any applicable speed study and a diagram of the intersection it is considering for an adult crossing guard showing

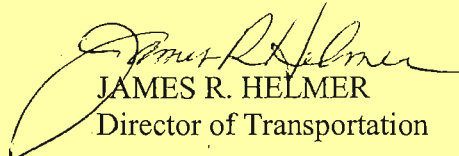
- the number of children, their approximate ages, and the direction they are crossing;
- the total number of vehicles crossing each leg of the intersection and the direction they are going; and
- the total number of vehicle turns crossing each leg of the intersection. (Priority 3)

DOT agrees with the recommendation. DOT has already begun to incorporate this additional information in the packets provided to the SPSC. DOT is also providing the SPSC with digital and/or aerial photos, and other information, such as unusual conditions to the SPSC to assist them in making better-informed decisions.

DOT generally concurs with the Auditor's findings, and will work with the SJPD to address the issues within the timeframe allowed for priority 3 recommendations. DOT believes that most can be implemented in fall of 2004.

COORDINATION

This report has been prepared in coordination with the San José Police Department and the City Attorney's Office.


JAMES R. HELMER
Director of Transportation

APPENDIX A

DEFINITIONS OF PRIORITY 1, 2, AND 3 AUDIT RECOMMENDATIONS

The City of San Jose's City Administration Manual (CAM) defines the classification scheme applicable to audit recommendations and the appropriate corrective actions as follows:

Priority Class¹	Description	Implementation Category	Implementation Action³
1	Fraud or serious violations are being committed, significant fiscal or equivalent non-fiscal losses are occurring. ²	Priority	Immediate
2	A potential for incurring significant fiscal or equivalent fiscal or equivalent non-fiscal losses exists. ²	Priority	Within 60 days
3	Operation or administrative process will be improved.	General	60 days to one year

¹ The City Auditor is responsible for assigning audit recommendation priority class numbers. A recommendation which clearly fits the description for more than one priority class shall be assigned the higher number. (CAM 196.4)

² For an audit recommendation to be considered related to a significant fiscal loss, it will usually be necessary for an actual loss of \$25,000 or more to be involved or for a potential loss (including unrealized revenue increases) of \$50,000 to be involved. Equivalent non-fiscal losses would include, but not be limited to, omission or commission of acts by or on behalf of the City which would be likely to expose the City to adverse criticism in the eyes of its citizens. (CAM 196.4)

³ The implementation time frame indicated for each priority class is intended as a guideline for establishing implementation target dates. While prioritizing recommendations is the responsibility of the City Auditor, determining implementation dates is the responsibility of the City Administration. (CAM 196.4)

APPENDIX B

THE SAFETY INDEX FORMULA FOR SCHOOL CROSSINGS WITH TRAFFIC CONTROLS

Based On The 1973 Study Procedure Presented To The City Council By Public Works
(Hazard Index Is Now Referred To As The Safety Index)

HAZARD INDEX FOR ADULT CROSSING GUARD WARRANT

The warrant for installation of an adult guard at a school crosswalk is an index of 120 or higher.

Calculation of the index is from the formula:

$$\text{Index} = (a + b) \times \text{M.F.} \times \text{A.F.}$$

$$a = \frac{VP}{1000} \quad (\text{Exposure Value})$$

$$b = \frac{VD}{1000 (2.322 - \log_{10} D)} \quad (\text{Safe Gap Value})$$

where:

M.F. = A mechanical factor that accounts for existence of mechanical controls.

A.F. = A factor that accounts for the age or ability of students to handle crossing problems.

V = Number of vehicles crossing the crosswalk during the selected hour.

P = Number of children using the crosswalk during the same hour.

D = Length of the crosswalk (or width of the street) in feet.

The mechanical factors are:

Stop sign at the crosswalk	.50
Signals	.25
Turning Movement Factor	
Less than 150 vehicles per hour	1.00
150 vehicles per hour	1.25
200 vehicles per hour	1.50
250 vehicles per hour	1.75
300 vehicles per hour	2.00

The age (or distance) factors are:

K-5 or K-6 school near enough to the crossing for student patrol	1
K-4 or under, too young for patrol	3
K-5 or K-6, too distant for patrol	2
Seventh grade and above	.50
High school students only	.25

The hour of the day that will produce the highest index is used for determining the warrant.

APPENDIX C

THE SAFETY INDEX FORMULA FOR SCHOOL CROSSINGS WITHOUT TRAFFIC CONTROLS

Adult Crossing Guard Warrant for Uncontrolled Crossings

$$\text{Hazard Index (H.I.)} = [a + (b) (fA)] (fs) (ft)$$

Exposure Value (a) = $VP/1,500$ (minimum value = 30)

The exposure value (a) is the number of elementary age school children (P) observed using the crosswalk during the selected hour, multiplied by the number of vehicles (V) crossing the crosswalk during the same hour---divided by 1,500. A minimum of 20 children crossing during the selected hour is required to generate any hazard index. A minimum value of 30 is used when the calculated value is lower.

Gap Value (b) = $[e^{V(3 + D/3.5)^{9900}} \times (3 + D/3.5)]$

The gap value is a statistical representation, in seconds, of the waiting time for a gap in traffic adequate for a complete crossing from curb to curb without a conflict with traffic.

Minimum gap value required (Gr) = $3 + D/3.5$ where;

D = Centerline length of the crosswalk assumes 3 seconds to make a decision plus 3.5/sec. walking speed

e = natural logarithm = 2.71828

The mechanical factors are:

Uncontrolled crossing	1.00
Speed Factor	Add .05 for every 1 MPH over 30 MPH
Turning Movement Factor	
Less than 150 vehicles per hour	1.00
150 vehicles per hour	1.25
200 vehicles per hour	1.50
250 vehicles per hour	1.75
300 vehicles per hour	2.00

The age (or distance) factors are:

K-5 or K-6 school near enough to the crossing for student patrol	1
K-4 or under, too young for patrol	3
K-5 or K-6, too distant for patrol	2
Seventh grade and above	.50
High school students only	.25

The hour of the day that will produce the highest index is used for determining the warrant.