TCRP SYNTHESIS 49

TRANSIT COOPERATIVE RESEARCH PROGRAM

Sponsored by the Federal Transit Administration

Yield to Bus—State of the Practice

A Synthesis of Transit Practice

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

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A Synthesis of Transit Practice

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SUBJECT AREAS
Public Transit

Research Sponsored by the Federal Transit Administration in Cooperation with the Transit Development Corporation

TRANSPORTATION RESEARCH BOARD

WASHINGTON, D.C.
2003
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TRANSIT COOPERATIVE RESEARCH PROGRAM

The nation's growth and the need to meet mobility, environmental, and energy objectives place demands on public transit systems. Current systems, some of which are old and in need of upgrading, must expand service area, increase service frequency, and improve efficiency to serve these demands. Research is necessary to solve operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the transit industry. The Transit Cooperative Research Program (TCRP) serves as one of the principal means by which the transit industry can develop innovative near-term solutions to meet demands placed on it.

The need for TCRP was originally identified in *TRB Special Report 213—Research for Public Transit: New Directions*, published in 1987 and based on a study sponsored by the Federal Transit Administration (FTA). A report by the American Public Transportation Association (APTA), *Transportation 2000*, also recognized the need for local, problem-solving research. TCRP, modeled after the longstanding and successful National Cooperative Highway Research Program, undertakes research and other technical activities in response to the needs of transit service providers. The scope of vice configuration, equipment, facilities, operations, human resources, maintenance, policy, and administrative practices.

TCRP was established under FTA sponsorship in July 1992. Proposed by the U.S. Department of Transportation, TCRP was authorized as part of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). On May 13, 1992, a memorandum agreement outlining TCRP operating procedures was executed by the three cooperating organizations: FTA, the National Academy of Sciences, acting through the Transportation Research Board (TRB), and the Transit Development Corporation, Inc. (TDC), a nonprofit educational and research organization established by APTA. TDC is responsible for forming the independent governing board, designated as the TCRP Oversight and Project Selection (TOPS) Committee.

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The TCRP provides a forum where transit agencies can cooperatively address common operational problems. TCRP results support and complement other ongoing transit research and training programs.

TCRP SYNTHESIS 49

Project J-7, Topic SA-13
ISSN 1073-4880
ISBN 0-309-06969-6
Library of Congress Control No. 2003110286

Price $16.00

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Each report is reviewed and accepted for publication by the technical panel according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

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TRANSIT COOPERATIVE RESEARCH PROGRAM

are available from:

Transportation Research Board
Business Office
500 Fifth Street, NW
Washington, D.C. 20001

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Printed in the United States of America

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FOREWORD

By Staff
Transportation
Research Board

Transit administrators, engineers, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and unevaluated. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem.

There is information on nearly every subject of concern to the transit industry. Much of it derives from research or from the work of practitioners faced with problems in their day-to-day work. To provide a systematic means for assembling and evaluating such useful information and to make it available to the entire transit community, the Transit Cooperative Research Program Oversight and Project Selection (TOPS) Committee authorized the Transportation Research Board to undertake a continuing study. This study, TCRP Project J-7, "Synthesis of Information Related to Transit Problems," searches out and synthesizes useful knowledge from all available sources and prepares concise, documented reports on specific topics. Reports from this endeavor constitute a TCRP report series, *Synthesis of Transit Practice*.

The synthesis series reports on current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals. Each report in the series provides a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems.

PREFACE

This synthesis report will be of interest to transit agency staff and those who work with them in dealing with Yield to Bus (YTB) programs. It offers information on existing YTB programs and documents transit agency experiences for the benefit of others considering implementation of similar programs. The report focuses on YTB programs in California, Florida, Oregon, Washington State, and British Columbia. It documents information gathered about the legislative process and history; program implementation, including public awareness and education campaigns, employee awareness and training, and the design and location of the yield display on the bus; as well as transit agency experiences covering transit operational issues, traffic operational issues, institutional issues, and public acceptance.

This report from the Transportation Research Board integrates the information obtained from a literature review and from Internet searches, with survey responses obtained from staff at transit agencies in California, Florida, Oregon, Washington State, and British Columbia. In addition, survey responses from bus operators at several transit agencies convey their perceptions as to the effectiveness of YTB programs. Case studies offer additional information.

A panel of experts in the subject area guided the work of organizing and evaluating the collected data and reviewed the final synthesis report. A consultant was engaged to collect and synthesize the information and to write the report. Both the consultant and the members of the oversight panel are acknowledged on the title page. This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As progress in research and practice continues, new knowledge will be added to that now at hand.

CONTENTS

ACKNOWLEDGMENTS

Rolland D. King, Columbus, Ohio, was responsible for collection of the data and preparation of the report.

Valuable assistance in the preparation of this synthesis was provided by the Topic Panel, consisting of Paul Branch, Federal Transit Administration; Terry Compton, King County Department of Transportation (Metro Transit); Mark J. Dorfman, Assistant General Manager, Santa Cruz Metro Transit District; Steven L. Jones, Assistant Professor, Department of Civil and Environmental Engineering, University of Alabama at Birmingham; Herbert S. Levinson, Principal, Herbert S. Levinson Transportation Consultant; Paul McDaniel, PRMC Consulting Services, Surrey, British Columbia; Allen Morgan, Training Supervisor, Tri-County Metropolitan Transportation Department; Peter L. Shaw, Senior Program Officer, Transportation Research Board; and Bill Sorrells, Safety and Training, Broward County Division of Mass Transit.

This study was managed by Donna L. Vlasak, Senior Program Officer, who worked with the consultant, the Topic Panel, and the J-7 project committee in the development and review of the report. Assistance in project scope development was provided by Stephen F. Maher, P.E., and Jon Williams, Managers, Synthesis Studies. Don Tippman was responsible for editing and production. Cheryl Keith assisted in meeting logistics and distribution of the questionnaire and draft reports.

Christopher W. Jenks, Manager, Transit Cooperative Research Program, assisted TCRP staff in project review.

Information on current practice was provided by many transit agencies. Their cooperation and assistance was most helpful.

YIELD TO BUS—STATE OF THE PRACTICE

SUMMARY

To minimize the impact of bus stops on traffic, when possible, it has been the general practice of traffic engineers to encourage the use of "out-of-the-traffic-lane" bus stops. Such bus stop designs are also thought to increase passenger safety as they board and alight. As traffic volumes increase, however, it becomes more difficult for transit buses to quickly merge into traffic and to continue along their route from such a stop. A typical transit bus operator may pull into and out of 400 stops in an 8-h shift. To mitigate bus delays and maintain safety, several countries in Europe enacted laws in the 1970s to provide priority to public transit buses when leaving a bus stop. In the United States and Canada such laws are generally referred to as "Yield to Bus" (YTB) laws. Currently, there are four states and two provinces that have enacted YTB laws.

This study investigated the practices and experiences of YTB programs at transit agencies in the states of California, Florida, Oregon, and Washington and in the province of British Columbia. It involved several tasks, including surveys of transit agencies that provide fixed-route services in these four states and one province, surveys of operators at four transit agencies with YTB programs, reviews of documents and websites, the analysis of safety data from three transit agencies, and six on-site case studies.

Surveys were sent to 73 transit agencies that were identified as providing fixed-route services in those four states and province. Responses were received from 31 transit agencies, with 19 reporting having YTB programs. Sixteen transit agencies, four large, six medium, and six small, provided detailed information. Four of the case study transit agencies conducted surveys to obtain bus operator perceptions on issues and the effectiveness of their YTB programs. A total of 722 operator responses to those surveys were received and evaluated.

The findings drawn from this research are outlined here.

- From the responses, the transit agencies expressed mixed evaluations of their YTB programs—some were pleased and some were not. The level of satisfaction varied by location (state or province), the magnitude of their public education campaign, and the type of yield sign used. The three transit agencies where the YTB program had the strong support of management also tended to rate their YTB programs more favorably ("good").
  - Transit agencies in British Columbia, California, and Oregon all, with one exception, rated their YTB programs favorably (from "satisfactory" to "excellent")—one agency in Oregon rated its YTB program as "fair."
  - The transit agencies in British Columbia and California that had conducted relatively large public education and awareness campaigns rated their YTB programs more favorably, either "excellent" or "good," than those agencies that had smaller campaigns.

  - All 10 transit agencies that reported using a flashing light-emitting diode (LED) yield signal, with one exception, generally rated their YTB programs favorably—from "satisfactory" to "excellent," although one rated its program as "fair."
  - The nine transit agencies, with one exception, that used only a yield decal were less satisfied and rated their YTB programs as either "fair" or "poor." The one exception that rated its program as "good" had also conducted a large public education campaign at the time the program was implemented, and this YTB program had strong management support.
- The five transit agencies from British Columbia rated their YTB programs as very effective, four as "good" and one as "excellent." The two largest systems indicated that the success with their YTB programs was linked to their "Thanks for the Brake" programs, which had been in existence for 25 years prior to the implementation of the YTB law. The Thanks for the Brake program has created a more friendly and courteous environment between motorists and bus operators.
- The combined cost for public education campaigns of the two transit agencies in California was approximately $249,000. The cost of the public education campaigns for British Columbia was more than $500,000 CAN (about $325,000 US). Only in British Columbia were funding resources provided by other stakeholders for the public education campaigns on the YTB law.
- Transit agencies in California and Oregon use the same flashing LED yield signal. The yield signal is a flashing red triangle border with the word "Yield" flashing in the darkened center of the triangle. Some transit agencies in British Columbia use a white flashing LED yield signal (the word "Yield") in addition to the official yield decal.
- The transit agencies in Florida, Washington, and British Columbia use yield decals that vary in size from 6 to 18 in. and display a red or black triangle on a yellow background with "Yield" or "Yield for Buses" messages.
- The costs for an installed electronic LED yield signal ranged from $250 to $600 per bus for the U.S. agencies and from $600 to $800 CAN ($390 to $520 US) per bus for the transit agencies in British Columbia. The costs for the yield decals ranged from $5 to $20 per decal.
- The preferred location for the yield sign (decal or electronic sign) for two-thirds of the transit agencies was approximately half way up and to the left side on the rear of the bus. A second location used by the other transit agencies was in the lower-left corner of the bus, just above the bumper. The reason given for selecting the higher location was that the yield sign would be more visible to the second and third vehicles following the bus, those vehicles considered to be the most likely to yield.
- Those transit agencies that used a yield decal had essentially no changes in the training of their operators. The transit agencies using the flashing LED yield signals provided training on the use of the YTB controls. Only three transit agencies reported providing refresher training on YTB operations for their operators. All transit agencies reported that the costs for the YTB operator training were insignificant.
- Approximately one-third of the respondents reported some improvements in schedule adherence because of their YTB operations, but none were able to provide any data to support their statements. All reports of improvements were based on anecdotal information, mostly from bus operators.
- The transit agencies were divided over whether complaints had increased with the implementation of their YTB programs. Nine reported that there had been no change and seven mentioned some increases in complaints of aggressive driving by bus operators.
- The majority of the transit agencies (12 of 16) reported that they had not experienced any safety problems with their YTB programs. Most (14 of 16) noted that they did not have accident data that were specific to YTB operations.

- Three transit agencies provided data on bus zone accidents that were potentially YTB related. The number of accidents was small and not considered as an increase for two of the three. However, one transit agency reported a significantly large increase in the number of accidents resulting from a vehicle colliding with a bus leaving a bus zone following implementation of its YTB program.
- The lack of enforcement of the YTB law was mentioned by almost all respondents, with agencies reporting that enforcement occurred less than 10% of the time. The only exceptions were for transit systems in British Columbia, where some transit agencies reported that enforcement was not needed. Many bus operators commented that more enforcement could help to solve the problem of motorists not yielding.

From the findings of the case studies and survey responses, several factors and practices that appear to lead to a more effective YTB program have emerged. Those factors and practices are summarized here.

- *Legislation Phase*—An agency considering YTB legislation needs to identify and engage as many of the stakeholders as possible early in the legislative process.
- *Education Phase*—There are two primary groups that need education on a YTB program, motorists (e.g., auto, commercial truck, and taxi drivers) and transit employees (in particular, the operators).
  - Public awareness and education campaigns need to be significant and to be ongoing to be effective.
  - The YTB educational efforts for transit employees were effectively accomplished by means of posters, e-mail messages, flyers in pay envelops, and small group education meetings.
- *Development and Locations of YTB Signs*—Transit agencies with active YTB signals reported more satisfaction with their YTB programs than those agencies using a passive yield decal. The flashing LED yield signal was preferred by all case study agencies to be preferred over a passive YTB decal, but in some cases the higher cost of the active yield signal was considered to be prohibitive.
- *Traffic Conditions*—The responses from the transit agencies indicated that more time savings from their YTB program were obtained under traffic conditions where the speeds were lower—generally less than 25 mph. For safety reasons, the YTB laws in Europe and Canada generally contain a maximum speed limit for those streets and roads where the YTB law can be used.
- *Driver Courtesy*—The Thanks for the Brake program that has been in place in British Columbia for 25 years was reported to be a major factor in the success their YTB programs.
- *Evaluation Phase*—As for any program, the YTB program should be evaluated periodically to determine whether changes are needed (including cancellation). Ideally, a transit agency considering a YTB program would have defined the problem to be solved (e.g., an increase in transit operational effectiveness and increased safety of merging operations from stops) and would have collected data on operations (i.e., schedule speeds and adherence, delays at stops, and safety data on merging from a stop) before the implementation of a YTB program.

CHAPTER ONE

INTRODUCTION

BACKGROUND

In most urban areas traffic congestion is on the rise. The *2002 Urban Mobility Study* reports that the number of urban streets and freeways that are congested during peak periods is higher, and that the volume of roadways where travel is congested has grown. For the year 2000, the averages for the 75 urban areas included in the study for percentage of lane-miles of roadway that are congested in peak periods are 54% for urban freeways and 61% for principal arterial streets. In some urban areas, the increases from 1982 to 2000 have been as high as 300% (*1*).

The trend to increasing congestion on our urban roadways is unlikely to change anytime soon. The Bureau of Transportation Statistics reports increases in urban roadway lane-miles from 1980 to 2000; however, the number of highway vehicles is increasing faster and the vehicle-miles traveled have almost doubled, as shown in Table 1.

To enhance the free flow of traffic, it has been the general practice of traffic engineers when possible to encourage the use of "out-of-the-traffic-lane" bus stops. Also, such bus stop designs are thought to increase passenger safety while they board and alight (*3*). Figures 1 and 2 show examples of bus stops that are out-of-the-traffic-lane stops. However, as traffic congestion increases, it has become more difficult for transit buses to reenter traffic lanes and continue on their routes once they have pulled into a bus stop out of the traffic lane. A typical transit bus operator may pull into and out of 400 bus stops during an 8-h shift (*4*). Attempting to reenter the traffic flow from a bus stop is perhaps one of the most challenging tasks required of a bus operator.

An approach to help mitigate bus delays and maintain safety, which was first undertaken in Europe in 1970, was to provide priority to public transit vehicles when leaving a bus stop. In most countries decals bearing the words "Priority," "Please Yield," or "Thank You for Giving Way" were placed on the rear of each transit bus. This practice has been generally referred to as "bus priority" in Europe and "Yield to Bus" (YTB) in North America. One argument that has been used for giving priority to transit buses is that because tax funds are used to subsidize transit operations, the general public is financially involved, and that correspondingly an efficiency improvement for transit buses would benefit all individuals (*5,6*).

In North America, the states of California (demonstration basis), Florida, Oregon, and Washington and the provinces of British Columbia and Quebec have passed legislation and implemented programs for YTB. These programs share a common goal of enabling a transit bus to quickly and safely reenter the traffic lane after stopping in a bus stop to board or drop off passengers. However, although these YTB programs share a common goal, their implementations and experiences have been different.

PURPOSE AND SCOPE

It is the purpose of this synthesis to gather information on existing YTB programs and to document the experiences with these programs so that other transit agencies can benefit when considering the establishment of similar programs. The study has focused on the YTB programs and experiences in California, Florida, Oregon, Washington, and British Columbia, and the information gathered included

- The legislative process and history;
- The implementation of the YTB program at transit agencies including public awareness and education

TABLE 1
CHANGES IN LANE-MILES, HIGHWAY VEHICLES, AND VMT—1980 TO 2000

Highway Physical Infrastructure and Use	Year 1980	Year 1990	Year 2000	Percentage Change 1980 to 2000
Estimated urban roadway lane-miles (in miles)	1,395,245	1,670,496	1,915,180	37
No. of highway vehicles	160,961,370	192,430,389	225,075,116	40
Urban roadway VTM (in millions of miles)	855,265	1,275,484	1,664,164	95

Notes: VMT = vehicle-miles traveled.
Source: *National Transportation Statistics 2001* (*2*).

FIGURE 1 Bus stop located in the parking lane of a street.

FIGURE 2 Bus stop (bus bay) located next to the traffic lane of a road.

campaigns, employee awareness and training, and the design and location of the yield display on the bus; and
- The experiences transit agencies have had with their YTB programs including transit operational issues, traffic operational issues, institutional issues, and public acceptance.

APPROACH AND ORGANIZATION

The methodology used to prepare this synthesis included the following several elements:

- A questionnaire was sent to transit agencies in California, Florida, Oregon, Washington, and British Columbia requesting information as to whether or not they had a YTB program and if they did, how was it implemented and what were their experiences with the program.
- Information was gathered from a review of the literature and from a search of the Internet for websites that contained information on YTB programs. Websites of transit agencies, legislative bodies, and transit associations in Canada, Europe, and the United States were searched for information on YTB programs.
- Case studies were then conducted by means of site visits, telephone conversations, and e-mail messages of the following transit agencies regarding the implementation and experiences with their YTB programs.
  - Broward County Transit (BCT)—Pompano Beach, Florida.
  - Coast Mountain Bus Company (CMBC)—Vancouver, British Columbia.
  - King County Department of Transportation (Metro Transit)—Seattle, Washington.
  - Santa Clara Valley Transportation Authority (VTA)—San Jose, California.
  - Santa Cruz Metropolitan Transit District (SCMTD)—Santa Cruz, California.
  - Tri-County Metropolitan Transportation District of Oregon (Tri-Met)—Portland, Oregon.
- Surveys of bus operators at several transit agencies were conducted to obtain their perceptions as to the effectiveness of their YTB programs.

The remainder of this report gives the results of these efforts. Chapter two overviews the origin of bus priority in Europe and the spread of YTB legislation in North America. Chapter three discusses the case study findings of how the YTB programs were implemented. Chapter four presents the results of the transit surveys and synthesizes the experiences with the YTB programs. Chapter five summarizes the responses of the operator surveys. Finally, chapter six summarizes the conclusions of the study. The appendixes contain the survey questionnaires used, a listing of the transit agencies and organizations that participated in this study, YTB laws, operator survey responses, an analysis of safety data from one transit agency, and the specifications for the yield sign for Oregon.

CHAPTER TWO

HISTORICAL DEVELOPMENTS

ORIGIN OF PRIORITY FOR BUSES LEAVING A STOP

The start of traffic regulations giving priority to public transport vehicles when leaving a stop to reenter the traffic flow began with a recommendation of the European Ministers of Transport meeting at the 1968 Vienna Convention on Road Traffic. In Article 15 the following recommendations were made:

> Article 15: Special regulations relating to regular public-transport service vehicles
>
> Domestic legislation must provide that in built-up areas, in order to facilitate the movement of regular public transport service vehicles, the drivers of other vehicles shall, subject to the provisions of Article 17, paragraph 1, of this Convention, slow down and if necessary stop in order to allow public transport service vehicles to perform the maneuver required for moving off from stops marked as such. The provisions thus laid down by Contracting Parties or subdivisions thereof shall in no way affect the duty incumbent on drivers of public service vehicles to take, after having given warning by means of their direction indicators of their intention to move off, the precautions necessary to avoid any risk of accident (*7*).

The pioneers in 1970 in the implementation of the Article 15 recommendations were Germany and Switzerland. Since then, many other European countries have passed traffic regulations giving priority to public transit vehicles when leaving a stop. This practice has now spread to Australia, Japan, and North America (*5*).

In general, these priority traffic regulations require that the bus operator signal or in some manner indicate their intention to pull out from the bus stop. The vehicles traveling in the same lane as the bus must then slow down or stop and give the bus operator the opportunity to merge into the traffic lane. However, the bus operator must proceed with caution and respect for the safety of all motorists using the roadway. Several countries restrict the application of the priority rule to urban areas and some countries only allow the priority rule to be used on roadways with moderate speed limits (i.e., 50 to 60 km/h). The Switzerland regulations require the use of a special yield signal in addition to the turn signal to indicate the bus operator's intent to merge into traffic. Information on some of the countries that have traffic regulations providing priority to transit buses reentering the traffic flow from a stop is provided in Table 2. Examples of the signs used to warn and remind motorists of the priority of the bus when leaving a stop are given in Figure 3.

YIELD TO BUS IN NORTH AMERICA

The following sections describe the introduction of YTB programs in Quebec and the spread of the practice in Canada and into the United States.

The Beginning in Quebec

During a revision of the Quebec Highway Traffic Code, the Ministry of Transport proposed an amendment giving priority to transit buses that are attempting to reenter the traffic lane after servicing a stop in an urban area. The amendment was approved by the legislature on June 18,

TABLE 2
EXAMPLES OF PRIORITY GIVEN TO TRANSIT VEHICLES MERGING FROM A STOP

Country	Priority Regulation	Operator Requirements	Transit Agency Requirements	Other Conditions That Apply
Australia	New South Wales, Reg. 74(c), 1983 Victoria, Reg. 604, 1984 Queensland, 1985	Operators must signal and allow sufficient time for motorists to stop	Bus must have a rear decal that is defined in the regulations	The speed limit for the roadway cannot be more than 60 km/h
France	R-6.1, 1972	Operators must signal and reenter the traffic lane with care	Buses have a decal on the rear as a reminder to motorists	Bus stops must be clearly marked on the road with zig zag stripes
Germany	Article 20 of the StVO, 1970	Operator must signal	Buses have a decal on the rear that says "Danke"	Bus stops must be clearly marked
United Kingdom	Article 49 of the Highway Code	Not provided	Buses have decal on rear of bus	Not provided

[*Source*: Geehan (*5*).]

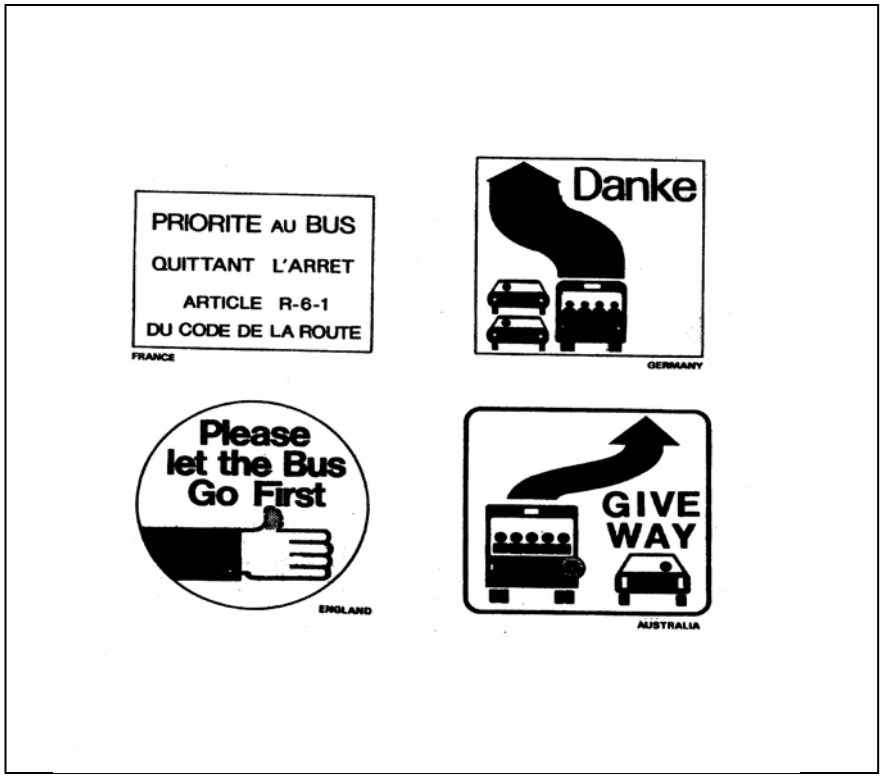


FIGURE 3 Examples of priority signs used in Australia and Europe to warn motorists. [*Source*: Geehan (*5*).]

1981, and became law as a part of Bill 104 covering the Rules of the Road for the Highway Traffic Code on April 1, 1982 (*6*). The Quebec bus priority law has many of the features found in the European laws, and an English translation of the law is provided here.

> Clause 382: The operator of a bus or a minibus shall, while loading or unloading passengers, bring his vehicle to a stop at the right edge of the roadway or at specific zones designed for this purpose.
>
> Clause 383: The authority with jurisdiction over the maintenance of a roadway can designate stopping zones which it must designate with appropriate signing.
>
> Clause 384: Within the limits of a town or city, the operator of a motor vehicle shall yield right of way to a bus when the operator of the bus has activated his turn signal for the purpose of re-entering the traffic lane in which he operated before coming to a stop. This obligation to yield right of way rests only with the motorists traveling in the lane that the bus operator wishes to access to.
>
> Clause 385: The bus operator shall only activate his turn signal at the moment he is ready to re-enter the traffic lane and after assuring that the lane change maneuver can be completed without risk.

In the section of the code that deals with noncompliance and fines, Article 469 stipulates that "a person found guilty of not complying with Clauses 382, 383, 384, and 385 is liable to a fine from $25 to $50 (CAN) plus costs" (*3*).

The implementation of the priority measure involved four interrelated activities: the legislative phase, the development of a priority sign, an educational campaign aimed at the public transit authorities and their bus operators, and finally, a public awareness campaign to inform the general public of the new requirement to give priority to buses when leaving a stop.

No evaluation of the priority measure was undertaken before the introduction of the amendment. The proposed legislation, which borrowed heavily from the French and Swiss experiences, was accepted on the perceived merits of increased efficiency. An increase in efficiency of 10% was often mentioned in news releases (*5*).

From the literature it appears that the priority sign was developed within the Quebec Ministry of Transport. The design of the priority sign was based on the international yield symbol, an inverted equilateral triangle with sides of 38 cm and a red message on a white background (Figure 4). The priority yield sign was placed in the lower-left corner of the rear window of the bus (*6*).

Because none of the transit authorities had been involved during the legislative process, it was important that

FIGURE 4 Bus priority sign used in Quebec.

they and their operators be made aware of the law and its ramifications. The Ministry of Transport provided the nine public transit authorities with self-adhesive priority signs, publicity signs, and information pamphlets for bus operators that were developed to publicize the new bus priority law. The public transit authorities used various ways to inform their bus operators of the new law and of their responsibilities under the law. Some authorities enclosed pamphlets in employee pay envelopes, others held classroom training sessions, some placed pamphlets in the operator's in-house mailbox, and several posted information bulletins in the operator's room. In general, these campaigns focused on the meaning of the new law and of the right-of-way privileges granted when operators follow the conditions of the new law and do so without risk to other motorists using the roadway. One authority asked that their operators take extra care to ensure that the new priority law would be used prudently, because many motorists were from other provinces and not aware of this new legislation, which did not exist elsewhere in Canada.

The final step in the implementation process was a public awareness campaign. The campaign was conducted in the fall of 1982, a few weeks before implementation of the priority law by the transit agencies. The campaign included newspaper advertisements, televised interviews, and advertisements on the rear bus board illustrating the official priority sign and a message as to its meaning. The public awareness campaign was sponsored by the Quebec Ministry of Transport, the nine public transportation authorities in Quebec, and Régie de I'assurance automobile du Quebec (the provincial insurance company). The theme of this information campaign was that because approximately two-thirds of the cost of public transit is paid by the general public, it is in everyone's interest to help increase transit efficiencies, and hence lower costs of public transit.

The Spread of Interest in Canada

Interest in the bus priority measure spread to transit authorities in the adjacent province of Ontario. In the fall of 1982, the Toronto Transit Commission launched a media campaign designed to encourage motorists to voluntarily give way to transit buses to allow reentry into the traffic lane. This effort was designed to develop information showing the potential benefits of voluntary cooperation to support legislative changes to provide priority for buses leaving a stop. The sign that was used on their buses is shown in Figure 5.

The Ottawa–Carleton Regional Transit Commission (OC Transpo) launched a similar bus priority campaign where motorists were asked to let buses merge back into the traffic flow to facilitate faster service. Advertisements were placed on the exterior bus boards on OC Transpo buses featuring a bus filled with happy faces and the bus operator tipping his hat with thanks (*5*).

As more people became aware of this bus priority measure, there was an interest in information as to its effectiveness, and the development of uniform bus priority measures across all of Canada. In response to these interests, the Canadian Urban Transit Association (CUTA) provided a forum in the early 1990s for discussion of the priority measure. CUTA encouraged the government of Quebec to evaluate the experiences of their public transit agencies with the priority measure. This evaluation was

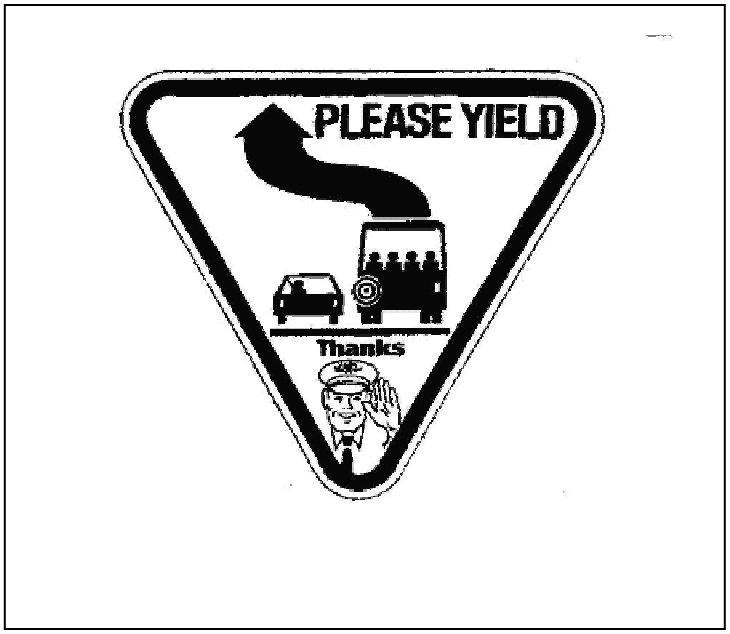


FIGURE 5 Request to Yield sign used by the Toronto Transit Commission.

conducted by Lavalin Transport for the Ministry of Transportation of Quebec (*6*). CUTA translated and provided English-language copies of the evaluation report to its members. CUTA also sent a formal letter to the provincial transportation ministries to encourage them to adopt YTB legislation and recommended that transit agencies encourage such legislation in each province.

In 1994, the province of Ontario passed legislation to provide priority for buses leaving a stop as an amendment to Part X of the Rules of the Road of the Highway Traffic Act. However, shortly thereafter, a change in provincial government occurred and interest in the law waned, and therefore the law was not implemented because the necessary regulations were never developed. Efforts were also pursued in Alberta and British Columbia; however, only British Columbia has passed legislation for YTB.

British Columbia

During the 1998 legislative session of the British Columbia Parliament, a section was added to the Greater Vancouver Transportation Authority Act (GVTAA) called "yielding to bus." The major proponent of the YTB legislation was the planning department of the Greater Vancouver Transportation Authority (TransLink) with the goal of improving transit service. Initial opposition came from the Insurance Company of British Columbia (ICBC), because of their concern about a greater exposure of risk because of an increase in accidents. The ICBC provides the motor vehicle insurance coverage for both the private and the public sector in British Columbia. Opposition to the legislation also came from automobile and police associations. Arguments in opposition were that this would be a different rule of the road, that the law would have an imputative effect on members, that it was one more thing to do, and that low enforcement was likely. After approximately 1 year of meetings and negotiations, the wording of the legislation was determined that satisfied the concerns of the opposition. The ICBC then commissioned a study of the safety implications of YTB legislation. The report was a qualitative evaluation of the safety implications, and the major finding was that no negative safety experiences related to YTB legislation in other countries with YTB laws were found. The report concluded that YTB legislation could have some positive safety impacts arising from increased transit ridership, clarity of right-of-way at bus stops, and reduced friction and lane changes of motorists through facilitating the use of bus bays. The report concluded that necessary prerequisites for safe operation with the YTB legislation were extensive education of bus and automobile drivers and enforcement of the legislation (*8*). With the passage of the GVTAA, a new section, 169.1, Yielding to Bus, was added to the Motor Vehicle Act in May 1999.

Yield to Bus Legislative Developments in the United States

The State of Washington Legislature was the first in the United States to enact legislation on YTB. The reported sponsor of the legislation was the Amalgamated Transit Union (ATU) 587. No record of the arguments in support of or opposition to the legislation was found. Apparently,

with little opposition, House Bill (HB) 1107 was passed by both chambers and was signed into law on May 15, 1993. HB 1107 added a new section to Chapter 46.61, Rules of the Road, of the Revised Code of Washington, which provides priority to transit vehicles that have signaled to reenter the traffic flow.

During the 1997 regular session of the Oregon Legislative Assembly, the Committee on Transportation held hearings on Senate Bill (SB) 437 that "creates the offence of failure to yield the right of way to a transit bus entering traffic." Some of the issues discussed were warnings that would be placed on the buses; notice to the public prior to implementation of the measure; and the effect of the measure on public safety, traffic flow, and bus schedules. The proponents of this legislation were the bus operators acting through their union, ATU 757. No record was found of anyone speaking in opposition to the measure. SB 437 was passed by both houses, and became law in 1997 with a provision for local implementation option.

By the early 1980s, traffic congestion had become a growing problem in the Miami–Fort Lauderdale area. Bus pullout bays were favored by traffic engineers and the transit agencies to facilitate traffic flow. A land development code in Broward County enabled the transit agency to require developers to include pullout bays in their developments at the developer's expense. As a result, Broward County has more than 400 pullout bay bus stops, more than any other county in Florida. Although the increased use of pullout bays assisted in maintaining the free flow of traffic, it also increased the delay experienced when bus operators attempted to reenter the traffic flow. The BCT planning staff learned of the Washington State YTB law and proceeded to push for a similar YTB law in Florida. BCT was joined by their neighbors, Miami–Dade Transit and Palm Tran (public transportation for Palm Beach County) in this effort. ATU 1276 also supported the legislation. The Florida Transit Association included an amendment in the Department of Highway Safety legislation package during the 1999 legislative session that provided priority for transit buses when leaving a stop. During the hearings there was opposition from the automobile association, and the wording of the YTB law was narrowed to being applicable only when the bus is leaving a "designated bus pull out bay." With this modification, the priority measure was approved, becoming law in July 1999.

Assembly Bill (AB) 1218, which would require motorists to yield the right-of-way to transit buses signaling to reenter the traffic lane, was introduced in the California Assembly on February 26, 1999. The supporters for AB 1218 were the SCMTD and United Transit Union Local 23. A day earlier, an identically worded bill (SB 906) had been introduced in the Senate, and that bill was supported by the California Conference Board of the ATU and the VTA. A few weeks later the senate bill was dropped and all support was placed behind the assembly bill. As AB 1218 proceeded through the legislature, it gained the support of the Orange County Transportation Authority (OCTA), California Transit Association, California State Sheriff's Association, Scotts Valley Police Department, and the California Teamsters Public Affairs Council. The California Highway Patrol (CHP) had expressed some concern, but took a neutral position after an amendment established an advisory committee that would report to the legislature on the impacts of the YTB law and make a recommendation as to whether or not the law should made permanent on a local or statewide basis.

During hearings, arguments made in favor of the measure by the Assembly Committee on Transportation were that this bill " . . . would reduce the number of right-of-way accidents, save taxpayer money through a decrease in the number of accidents, and at the same time improve air quality and reduce traffic congestion . . . and shorten travel time for buses and will make transit a more attractive alternative to single occupancy vehicle travel. . . . that buses attempting to reenter traffic are blocked by passing motorists, leading to substantial delays for transit systems, which reduces their efficiency" (*9*).

In opposition to AB 1218, the California State Automobile Association (CSAA) raised three concerns: (1) it may not be feasible for the motorist to stop, citing the possibility of being stuck in an intersection when the light turns red or being rear ended by other motorists that could not see the activated yield sign; (2) the proposed bill would create an inconsistency in the "rules of the road" that would lead to motorist confusion and dangerous traffic situations; and (3) the bill might shift the liability for a collision between a vehicle and a merging bus from the bus driver to the motorist. The CSAA suggested that a better solution might be an education campaign or equipping buses with a sign asking motorists to yield when possible (*10*).

As originally introduced, AB 1218 was proposed as a statewide priority measure, did not specify the type of yield sign, and the applicable bus stop was not defined. As the bill worked its way through both legislative chambers, the following amendments were added:

- Requiring an electronic flashing yield sign on the rear of the bus (*11*);
- Giving priority only for buses that had entirely exited the active traffic lane (*12*);
- Limiting the use of the priority measure only to the SCMTD and possibly two other participating transit agencies, requiring a public education program in all of the affected areas, requiring that the Commissioner of the CHP report on the effectiveness of the right-of-

TABLE 3
SUMMARY OF SOME FEATURES OF THE YIELD TO BUS LAWS IN NORTH AMERICA

State or Province	Date	When Applicable	Yield Sign	Operator Responsibility	Other
Quebec	June 1981	Bus stopped at right edge of road or designated stopping zone has activated the left-turn signals to signal the intent to reenter the traffic lane	Not specified	Operator must use turn signal to make known intention to reenter the traffic lane and the maneuver can be completed without risk	The law only applies within the limits of a town or city and also only applies to drivers in lane adjacent to bus stop
Ontario	1990	Stopped in bus bay—to be defined by regulations	To be defined by regulations	To be defined by regulations	The required regulations were never made
Washington	May 1993	Bus is signaling and reentering the traffic flow	Not specified	Operator must signal intention to reenter traffic flow and drive with due regard for the safety of all persons using the roadway	
Oregon	April 1998	Bus is signaling from a stop the intention to reenter the traffic lane	An illuminated flashing yield sign is required	Operator is signaling intention to reenter traffic lane and must drive with due regard for safety of all persons using the roadway	Details of the yield sign were specified by the Oregon Transportation Commission
British Columbia	May 1999	Bus is stopped, standing, or parked and signaling intention to move into the traveled portion of the highway	A yield sign or other signal device is required	Operator must signal intention to reenter traffic flow and it must be safe to reenter the traveled portion of the highway	The law applies to roadways with speeds of 60 km/h maximum
Florida	July 1999	Bus has signaled and is re-entering the traffic flow from a specifically designated pullout bay	Not specified	Operator must signal the intention to reenter traffic flow and drive with due regard for safety of all persons using the roadway	
California	April 2001	Bus has entirely exited the traffic lane at a designated stop and is signaling intention to merge with traffic	An illuminated flashing yield sign is required on the left rear of the bus	Operator must use the left turn signals and the yield signal to signal intent to merge and must drive with due regard for the safety of all persons and property	Demonstration program with four transit agencies eligible to participate

[*Sources*: Santa Clara Valley Transportation Authority and Santa Cruz Metropolitan Transit District (*4*), Geehan (*5*), Lavalin Transport (*6*), Delcan Corporation (*8*), AB 1218 Assembly Bill (*10*), Florida Statute 316.0815 (*16*), Oregon Revised Statutes (*17*), California Vehicle Code (*18*).]

way regulations, as prescribed, by December 31, 2004, and that the measure would be in effect until January 1, 2005, unless a later statute changes that date (*13*);

- Adding OCTA as an eligible transit agency, requiring the evaluation report by December 31, 2002, and changing the sunset date to January 1, 2003 (*14*); and
- Adding the Alameda–Contra Costa Transit District (AC Transit), and the Santa Clara Valley Transit District as eligible participants (*15*).

The OCTA and AC Transit elected to not participate in the demonstration program.

In summary, the support for YTB legislation came from various stakeholders, transit labor unions, and transit management. The opposition and concerns were generally voiced by automobile associations, insurance organizations, and law enforcement organizations. The most active and consistent supporters for YTB legislation have been the transit labor unions. Support arguments generally have referred to increases in safety and improved transit efficiency. Arguments in opposition have generally centered on inconsistency with existing right-of-way rules, concerns about safety, and increased liability exposure. An overview summary of some of the features of YTB legislation in North America is given in Table 3. The wording of the various YTB laws is provided in Appendix C.

CHAPTER THREE

IMPLEMENTATION EXPERIENCES

With the passage of YTB legislation, the transit agencies had the task of deciding how to implement this new law. In all cases there was no funding from the state or provincial governments. In some cases, the implementing regulations of the YTB law were prescriptive as to what actions needed to be done, and in others the law was nonspecific as to how it was to be implemented. To learn how it was done, information was first gathered through surveys of transit agencies in the four states and the province of British Columbia. Then, field visits were made to the six transit agencies that had played key roles in implementing the YTB laws in their jurisdictions.

The following sections provide information on the steps undertaken by transit agencies in British Columbia, California, Florida, Oregon, and Washington to implement the new bus priority measures. Because the California YTB law is a pilot program with only two transit agencies participating, and they jointly implemented the California YTB program, both agencies were included in the field visits. The six transit agencies are BCT (Florida), CMBC (British Columbia), Metro Transit (Washington State), TriMet (Oregon), SCMTD (California), and VTA (California).

BROWARD COUNTY TRANSIT

Background

Broward County encompasses almost 1,200 square miles, with BCT providing bus services to the more than 1,600,000 permanent residents living in the agency's service area of 410 square miles. There are more than 30 cities, towns, and communities in this service area. BCT, with a fleet of 208 standard-size buses, provides fixed-route service on 40 routes from 5:00 A.M. until midnight during the week and from 7:00 A.M. to 10:00 P.M. on weekends and holidays. Annual ridership on the fixed-route service is approximately 13 million trips. BCT estimates that there are more than 5,000 stops on the 40 routes, and that approximately 6% of the stops are pullout bay stops. Along with fixed-route service, BCT also offers paratransit [Transportation Options (TOPS)], and Community Bus services through purchased service agreements. The TOPS buses are not included in the YTB program because their service is door to door. However, the Community Buses, which serve as neighborhood circulators and feeders to BCT's fixed-route service, are included in the YTB program. The Community Bus vehicles are small buses, less than 30 ft in length.

Broward County has a land development law that allows BCT to request that pullout bay stops be included in any new development that is being served by a BCT route, at no cost to BCT. Over the years, a large number of pullout bay stops (more than 300) have been constructed. The reasons for implementing a YTB program were to reduce traffic delays for buses reentering the traffic lane and to facilitate safe reentry of buses into the traffic lane. Although these stops did facilitate the flow of traffic, they also resulted in increasing delays for bus operators attempting to reenter the traffic lanes.

The Florida YTB law does not provide guidance to transit agencies on to how to implement the law (e.g., requirement of a public education campaign or the type of yield sign to be used). It simply requires that "the driver of a vehicle yield the right-of-way to a publicly owned transit bus travelling in the same direction, which has signalled and is reentering the traffic flow from a designated pullout bay" (*16*). The second part of the statute requires the bus operator to drive with due regard to the safety of all persons using the roadway.

Public Education and Awareness Activities

BCT management established a project team that included members from the Departments of Safety and Training, Marketing, Service Development, and Maintenance to plan and carry out the YTB program implementation tasks. Marketing and Service Development were responsible for the public education and awareness campaign, which included the use of signs and posters on buses, news releases to the local media, meetings with the various community officials, and handouts and pamphlets that were made available to the general public. Safety and Training was responsible for one-on-one meetings with the communities' law enforcement officials to answer questions and to explain the YTB program. Safety and Training was also responsible for operator training. Safety and Training and Maintenance were responsible for the development of the yield sign and the location of the yield sign on the bus. Through contact with officials of the Florida Department of Highway Safety, BCT has encouraged the addition of a question on the YTB law on the Florida motor vehicle license test. The *Florida Driver Handbook*, starting with the 2000 edition, contains a brief paragraph that explains the requirement to yield to public transit vehicles (*19*). Figures 6 and 7 show the contents of the threefold handout that was

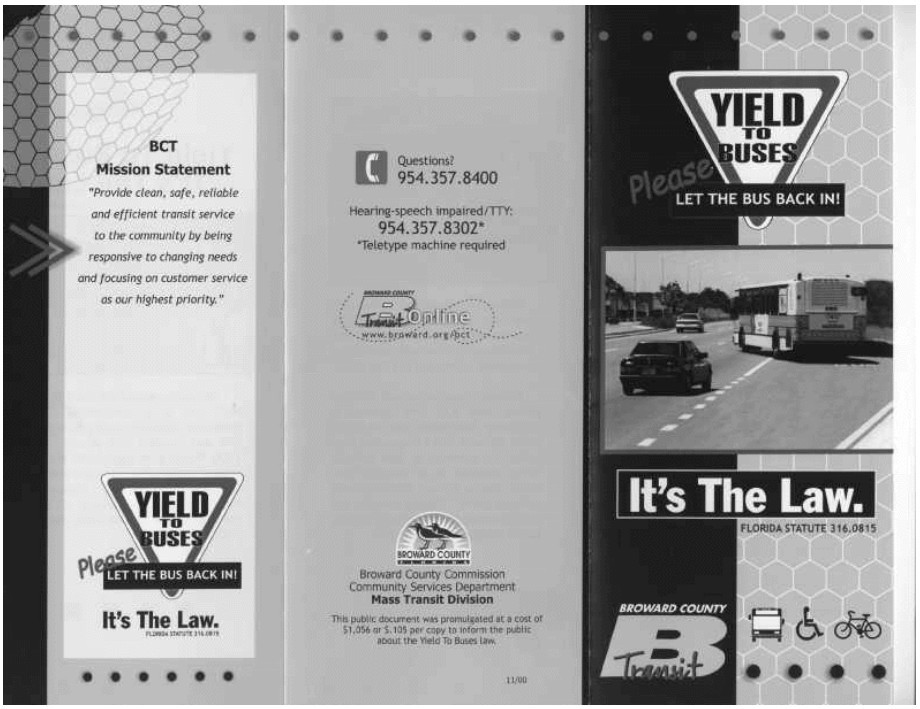


FIGURE 6 Handout used by Broward County Transit (outside page). (*Source*: Broward County Transit.)

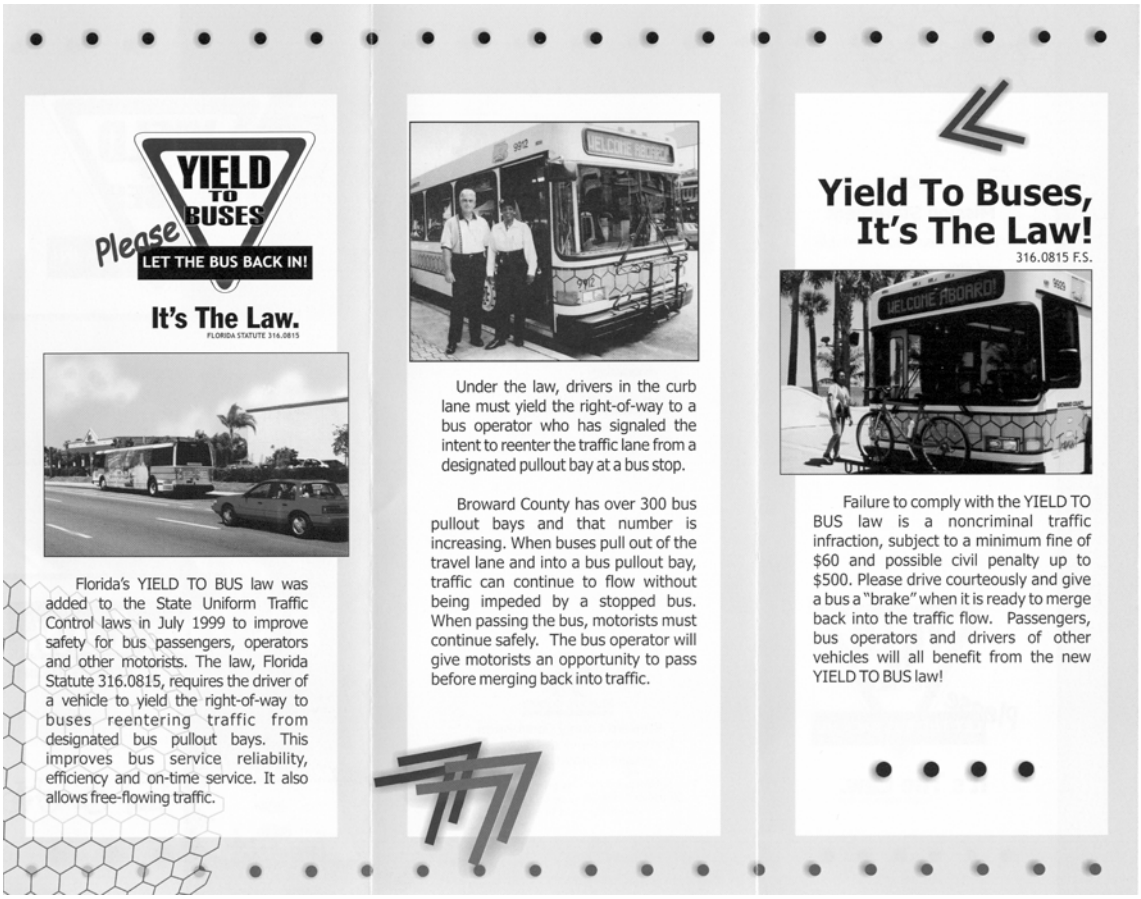


FIGURE 7 Handout used by Broward County Transit (inside page). (*Source*: Broward County Transit.)

used by BCT. For a few weeks following the passage of the YTB law, BCT used the rear bus board to display the yield sign and to educate the public about the new law. The printed message along with an oversized yield sign stated: "YIELD to BUSES . . . *Please* LET THE BUSES BACK IN! . . . It's The Law . . . Florida Statute 316.0815."

Employee Education and Awareness

BCT employees were made aware of the YTB law through employee staff meetings and posters, pamphlets, and articles. Posters were placed on bulletin boards and articles were written for the monthly employee newspaper, providing background information on the reasons for the law, the wording of the law, and when the law was applicable. Information pamphlets were placed in employee pay envelopes. Bus operator training involved discussions of the application of the YTB law and the operator's responsibility under the law. The new operator training has a unit added to the classroom instruction and a unit added to the in-vehicle training for explaining and answering questions concerning the YTB law. No refresher training on YTB operations has been given to BCT operators since the initial training. Operator training emphasized the second paragraph of the law, which requires the bus operator to drive safely, and holds the operator responsible for any traffic citations given for aggressive driving behavior.

Yield to Bus Sign

The yield sign adopted by BCT was similar to the decal that was being used in Washington State. When BCT operators are ready to reenter the traffic lane from a bus stop, they signal their intention by using the left-turn signal, and merge into the traffic flow when it is safe to do so. The yield sign is an equilateral triangle approximately 18 in. on a side. The colors used are a red triangle on a yellow background, with black lettering on a white background. Reflective pigments are used. An example of the yield sign is provided in Figure 8. BCT considered using electronic flashing yield signs; however, concerns about electrical power load and the possible negative impact on the bus warrantee caused them to elect to use a decal yield sign. The yield sign is located in the lower-left rear corner of the bus, just above the bumper and adjacent to the turn signals, as can be seen in Figure 9. This location was chosen because it was considered the most likely view area for a following motorist to see, and would be consistent with the location of the yield sign for all of BCT's fixed-route buses. With the use of a passive yield sign there were no changes required in the operational procedures of the bus operators.

FIGURE 8 Broward County Transit bus yield decal.

FIGURE 9 Rear of a Broward County Transit bus showing the yield sign.

COAST MOUNTAIN BUS COMPANY

Background

The CMBC is the operating company for bus operations for the Greater Vancouver Transportation Authority (GVTA) in Vancouver, British Columbia. CMBC's service area is approximately 1,800 square kilometers, with a population of more than 2,000,000. CMBC's fixed-route bus fleet numbers slightly more than 1,000, and is composed of

diesel and compressed natural gas standard-size buses, articulated diesel buses, and standard-size trolleybuses. The buses operate over 180 routes, with a daily ridership of more than 400,000.

As mentioned in chapter two, the YTB legislation was a part of a strategic plan to enhance public transportation in the greater Vancouver area. The reasons for implementing the YTB program were to reduce traffic delays for buses reentering the traffic lane, thus improving efficiency, and to facilitate the safe reentry of the bus into the traffic flow.

In Vancouver, a program called Thanks for the Brake has been actively pursued for more than 25 years, and has been adopted by all transit systems in British Columbia. This policy asks a bus operator to give a friendly wave out their window or a blink of the four-way lights as a thank you to acknowledge when a motorist yields to a bus pulling out from a stop. This program has been highly successful in nurturing a more friendly and courteous environment between bus operators and motorists. Some customer complaints have been received in instances where a bus operator has not given the motorist their expected "thank you." Through their market research surveys and focus groups, CMBC has found this practice to be rated as very important with the public. This program is perceived to have facilitated the acceptance of the YTB law by the motorists in British Columbia.

Public Education and Awareness Activities

The CMBC project team to implement the YTB law was formed during the year-long period of legislative hearings and negotiations with various YTB stakeholders. The project team also included members of the BC Transit–Victoria Regional Transit System, who represented the interest of the transit systems in Victoria and the smaller communities in British Columbia.

During the legislative period, stakeholders who had initially been opposed to the YTB legislation were won over (or satisfied) through a consensus process, and some later became partners in the public education and awareness campaigns on the new YTB law. The CMBC and ICBC both contributed $250,000 CAN (about $165,000 US) to fund the public education and awareness campaign. The British Columbia Automobile Association provided free advertisements in their monthly magazine, *Westworld*, to inform motorists of the new law. Provincial agencies and police agencies were also involved in these efforts to increase public awareness of the new law. All of these various groups were involved with CMBC in public meetings and media interviews, and with the formation of policy for the pubic awareness campaign.

Because of the expense, paid television public service announcements (PSAs) were not used by CMBC. However, CMBC did take advantage of television news interviews, in particular, to communicate to the public that YTB violations by bus operators would not be tolerated by CMBC. CMBC also made extensive use of radio PSAs, newspaper advertisements, advertisements on the rear panels of their buses, handouts and pamphlets, mailed information pamphlets to delivery and taxi companies, and news releases provided to the media and posted on the Internet. Figure 10 is an example of an Internet web page of the North Vancouver Detachment of the Royal Canadian Mounted Police, which was used to inform the public of the new YTB law. Information on the YTB law is included in the ICBC publication, *RoadSense for Drivers*, which is used to help new drivers prepare for the knowledge tests and road tests for driver licenses (*20*).

Employee Training and Awareness Programs

CMBC employees were informed of the YTB law through staff meetings, e-mail messages, posters on bulletin boards, pamphlets in pay envelopes, and by articles in the BC Transit employee bi-monthly magazine, *Transit Exchange*. Operators' information sessions on the YTB law were started approximately 6 months before the law became effective and included on-site workshops, field training at the transit centers, and rotating shift instruction. These information sessions emphasized the continued need for safe, controlled driving; the use of good judgment; and the exercising of caution. It was pointed out that under the new YTB law, the responsibility of the operator remained unchanged and emphasized that " . . . a bus driver must not move into the travelled portion of the highway unless it is safe to do so." The new law does not give operators the right to cut off motorists (*21*).

Yield to Bus Sign

The design of the yield sign used input from market research studies of the general public and from other transit agencies. The yield sign is a square decal, approximately 25 cm (10 in.) in size, containing the symbol of a red equilateral triangle with a white interior with the message, YIELD, and a bus silhouette in black, all mounted on a yellow background. The sign uses reflective pigments. The sign, which is used throughout British Columbia, is shown in Figure 11.

The yield decal is located just to the left of the rear window on CMBC buses (Figure 12). This location was selected because it can easily be seen by following motorists, it was a location that was available throughout the fleet,

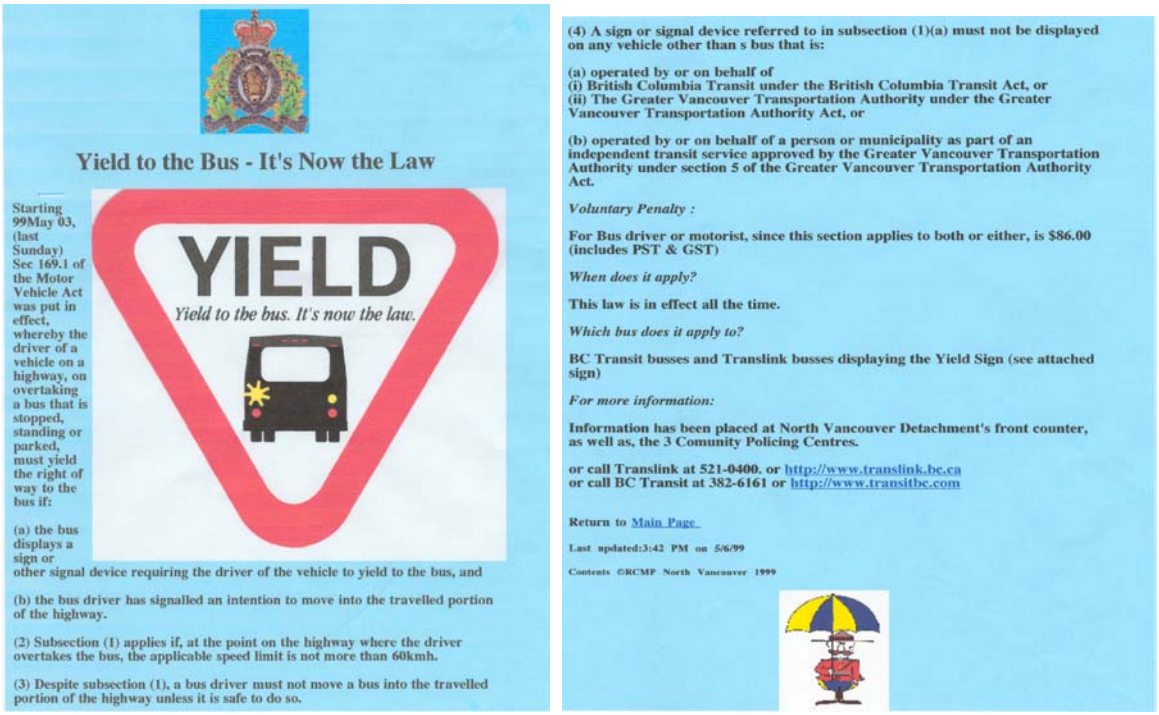


FIGURE 10 Internet news release of Yield to Bus law. (*Source*: North Vancouver Detachment website.)

FIGURE 11 British Columbia yield decal. [*Source*: *Roadsense for Drivers: BC's Safe Driving Guide* (*20*).]

and the yield decal would be clear of the areas used for advertising.

BC Transit buses that operate in Victoria have a smaller size, 15-cm (about 6-in.) yield decal in combination with a light-emitting diode (LED) yield sign mounted in the lower-left corner of the rear window. The rear of a BC Transit bus is shown in Figure 13. Some of the CMBC buses that operate in West Vancouver use the LED yield sign in addition to the larger CMBC yield decal.

The reason that CMBC chose the yield decal over the electronic yield sign was cost. The electronic yield sign

FIGURE 12 Coast Mountain Bus Company bus with a yield decal. (*Source*: Coast Mountain Bus Company.)

cost approximately $800 CAN (about $500 US), whereas the cost of the yield decal was about $30 CAN ($20 US).

In addition to the official yield decal, two YTB-related decal signs are used on all CMBC buses. These decals are located on the rear bumper or just below the rear advertisement panel of the bus (Figure 14).

FIGURE 13 BC Transit bus with the yield decal and electronic yield sign. (*Source*: BC Transit–Victoria.).

FIGURE 14 Additional Yield to Bus decals used by the Coast Mountain Bus Company. (*Source*: Coast Mountain Bus Company.)

If in the operator pre-trip inspection there is a problem with the yield decal or yield signal, the bus is sent to maintenance for repair. If the failure occurs when the bus is in service, the bus remains in service, and the failure is reported in the operator's report. During any preventive maintenance of the bus, the yield decal and yield signal (if so equipped) are inspected.

KING COUNTY DEPARTMENT OF TRANSPORTATION—METRO TRANSIT

Background

The greater Seattle area has a population of more than 3,275,000, according to 2000 census information. Surrounded by mountains and water, the topology provides a challenge to transportation planners. Traffic congestion has been an increasing problem for the last decade with 65% of the principal arterial streets congested during peak hours (*22*). Like Vancouver, Seattle is a major trade gateway with the Pacific Rim countries.

Metro Transit operates a fleet of approximately 1,400 buses—including small, standard, and articulated buses; standard and articulated electric trolleys; and dual-powered articulated buses. Approximately 1,700,000 residents live within the 2,134-square-mile service area. In 2001, annual ridership was approximately 99 million. Metro Transit buses provide fixed-route service to more than 9,500 stops on 243 routes. The weekday service period of 22 h is from 5:00 A.M. to 3:00 A.M.

Washington was the first state to pass YTB legislation. The Washington YTB law is simple, but broad, in that it does not have any constraints as to where it is applicable. The Washington law has only these two sections (*23*):

> (1) The driver of a vehicle shall yield the right-of-way to a transit vehicle traveling in the same direction that has signaled and is reentering the traffic flow.
> (2) Nothing in this section shall operate to relieve the driver of a transit vehicle from the duty to drive with due regard for the safety of all persons using the roadway.

The law does not provide any guidance to transit agencies on how to implement the new priority measure. The legislation also did not provide any funding for implementation. Metro Transit was concerned because the law did make a significant change to the conventional right-of-way rule of vehicles merging into traffic. However, their bus operators were supporters. Therefore, Metro Transit management decided to implement the new law to reduce traffic delays for buses reentering the traffic lane and to facilitate safe reentry of buses back into the traffic lane.

Public Education and Awareness Programs

Metro Transit formed a project team to plan and coordinate the different YTB implementation tasks. Although there were no outside funds and internal funds were limited, Metro Transit was able to provide for some public awareness and education efforts without cost. These efforts included providing news releases to the media and mailings to educational and instructional organizations such as auto insurance companies, driver's education instructors (both public and private), and package delivery companies. There were also a few free television news spots featuring interviews with bus operators and union officers. Metro Transit's advertising contractor made available 100 bus rear advertisement panels for 3 months to introduce the public to the new YTB decal and law (Figure 15). The YTB law is included in the Washington motor vehicle driver license manual and test.

After approximately 9 years experience, there was a perception by transit agencies serving the greater Seattle area that the motoring public was not aware of the law. In March 2002, five transit agencies serving King, Pierce, and Snohomish counties partnered in a joint public education campaign to raise public awareness. The campaign used

FIGURE 15 Public advertising sign used by Metro Transit. (*Source*: Metro Transit.)

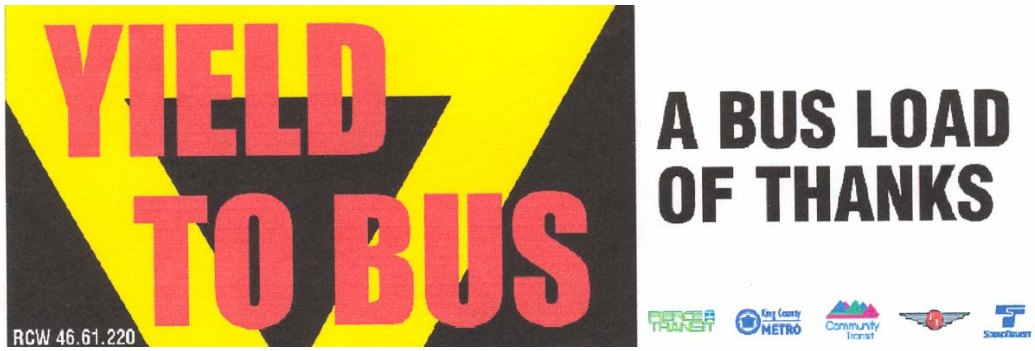


FIGURE 16 Bus billboard sign used in media campaign in Seattle area. (*Source*: Community Transit.)

news releases to the local media and signs on bus rear advertisement panels. The campaign's message was "Yield to Bus: A small courtesy for a bus load of thanks" (Figure 16) (*23*).

Employee Education and Awareness Programs

Metro Transit employees were made aware of the new YTB law through posters on bulletin boards, articles in the employee newspaper, voice mail, and operations bulletins (required reading). Because the Washington YTB law did not change the duties of an operator when leaving a stop, there was no need for any special training. Metro Transit Safety provided their operators information on the YTB law and explained what their responsibilities were through Safety Bulletins, voice mail, and individual discussions to answer questions. An example of a Safety Bulletin is shown in Figure 17. It is of interest to note the reminder to the operators in the second and third paragraphs.

Yield to Bus Sign

Metro Transit used an advisory group to meet and decide on the wording and the graphic for the yield decal to be used on the back of the buses. The international yield triangle symbol was selected as the graphic. For the wording, "Yield" was placed in the center of the triangle and "for Buses" directly below the triangle. In small print along the right leg of the triangle a statute reference, "RCW 46.61.220," was provided. The decal has a yellow background with a red triangle with a white center, and black lettering. Reflective pigments are used in the sign print materials (Figure 18).

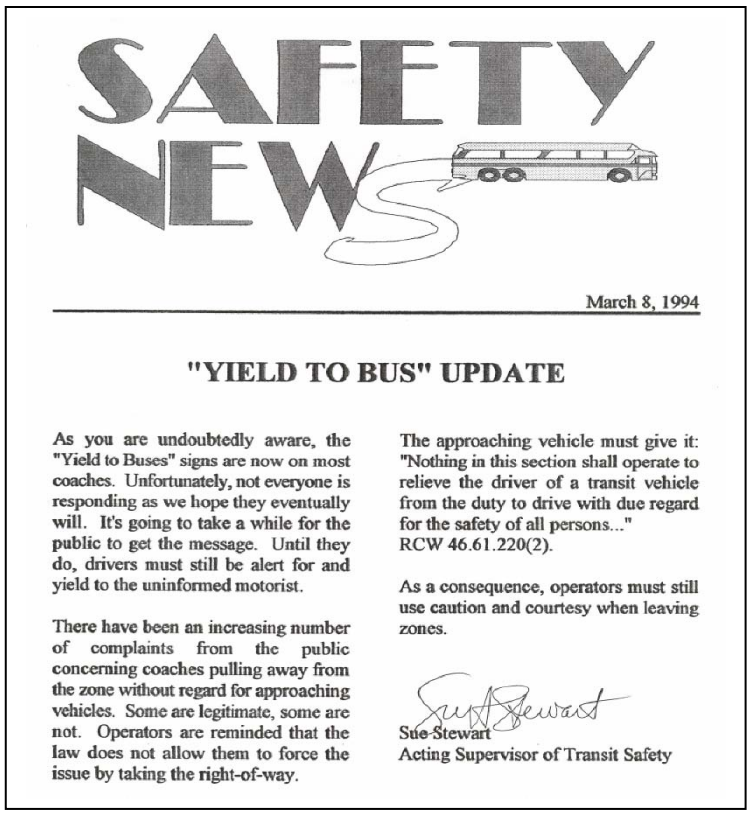
The yield sign is a self-adhesive decal located just to the left of the rear window. This location was chosen because all of the buses had that area available and it was considered the best location from a visibility standpoint. A lower location was believed to be too difficult for the second and third following vehicle drivers to see. These vehicles were considered the most likely to be able to yield to the bus (Figure 19).

TRI-COUNTY METROPOLITAN TRANSPORATION DISTRICT OF OREGON

Background

Tri-Met is a municipal corporation that provides public transportation for the three counties in the Portland, Oregon, metropolitan area. The population of this metropolitan area is approaching 2 million.

Tri-Met provides bus and rail services to more than 1.3 million residents living in its 590-square-mile service area



SAFETY NEWS

March 8, 1994

"YIELD TO BUS" UPDATE

As you are undoubtedly aware, the "Yield to Buses" signs are now on most coaches. Unfortunately, not everyone is responding as we hope they eventually will. It's going to take a while for the public to get the message. Until they do, drivers must still be alert for and yield to the uninformed motorist.

There have been an increasing number of complaints from the public concerning coaches pulling away from the zone without regard for approaching vehicles. Some are legitimate, some are not. Operators are reminded that the law does not allow them to force the issue by taking the right-of-way.

The approaching vehicle must give it: "Nothing in this section shall operate to relieve the driver of a transit vehicle from the duty to drive with due regard for the safety of all persons..." RCW 46.61.220(2).

As a consequence, operators must still use caution and courtesy when leaving zones.

Sue Stewart
Acting Supervisor of Transit Safety

FIGURE 17 Metro Transit safety bulletin on Yield to Bus. (*Source*: Metro Transit.)

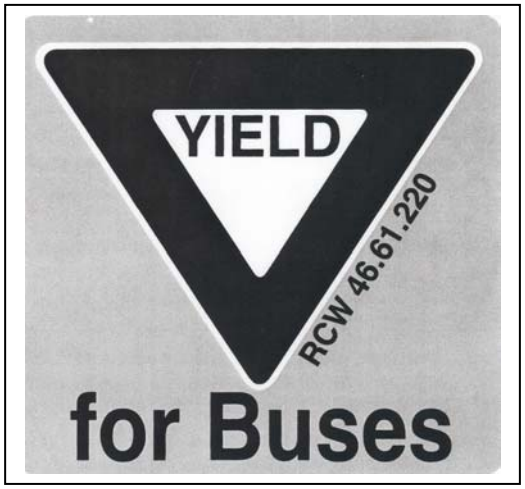


FIGURE 18 Metro Transit yield sign. (*Source*: Metro Transit.)

FIGURE 19 Metro Transit bus with yield sign.

in Portland and adjoining towns and communities. The Tri-Met bus fleet provides fixed-route services on approximately 100 routes, with more than 8,400 stops. Fixed-route service begins at about 4:30 A.M. and ends around 1:30 A.M., with service frequencies of between 6 and 15 min on many of the routes operating in the city core. There are 661 standard-size and small diesel-powered buses in the active fleet. Annual ridership on the fixed-route service is approximately 63 million.

The language of the Oregon YTB law arrives at providing priority to buses pulling out from a stop that is somewhat different from other YTB laws. It creates " . . . the offence of failure to yield the right to a transit bus entering traffic . . . " and stipulates the penalty for the offence (*17*). It specified an electronic flashing yield sign, and required that the Oregon Transportation Commission adopt by rule the specifications for the sign. The law does not address the issues of public education, traffic speeds, or the type of bus stop where it is applicable. It does, however, require

that the driver of a transit bus operate with due regard for the safety of all persons using the roadway. As with all other YTB legislation, no funds were provided to implement the new law.

The proponent of the YTB legislation in Oregon was the ATU, which represents both the operators of C-TRAN (Vancouver, Washington), which has had a YTB program since 1993, and Tri-Met. Tri-Met's reasons for implementing the YTB law were both to reduce delays for buses reentering the traffic flow and to facilitate safe reentry into the traffic lane.

Public Education and Awareness

The implementation efforts for the YTB program were carried out through normal management meetings and assignments with a project team that included members from operations, marketing, maintenance, and training. No outside organizations assisted Tri-Met in the implementation. The public awareness and education campaign included news releases to the media, web pages with news releases on the YTB law linked from the Tri-Met home page, and information signs on the rear advertisement panels of the buses. Figure 20 shows a Tri-Met bus with the public education YTB advertisement. The Oregon Department of Transportation (DOT) also had a web page devoted to the new YTB law, with a flashing, animated yield sign. This web page contained links to frequently asked questions on YTB law and the Public Transit Section of Oregon DOT.

FIGURE 20 Tri-Met bus with a Yield to Bus advertisement. (*Source*: Tri-Met website.)

Employee Awareness and Training

Tri-Met employees were made aware of the new YTB law through articles in the employee newspaper and Internet web page news releases. Bus operators were informed of the YTB law and the implementation status of the YTB program through frequent articles in the "Operator's Report," a flyer distributed with each paycheck. The first article appeared in the August 3, 1998 issue, approximately 6 months before any of the electronic yield signs had been installed, to remind operators of their responsibilities under the law. The message was " . . . whether or not your bus is equipped with a 'Yield' sign, right of way is something that is given, not taken. . . . it will remain the responsibility of the Operator to give consideration to any overtaking vehicles, and merge into traffic safely and with due caution" (*24*). Later articles dealt with the status of yield sign development, how the yield sign controls would function, reminders on the proper use of the yield sign, legal interpretations of the YTB law from Tri-Met's assistant general council, and issues raised from complaints that Tri-Met had received on improper use of yield signal by operators.

Yield to Bus Sign

The YTB law, ORS 811.167, requires that all transit agencies in Oregon use a yield sign that meets the specifications developed by the Oregon Transportation Commission. The specifications call for a sign face that contains a triangle graphic with the word YIELD on the interior of the triangle. Both the triangle and yield message were to be red in color when flashing. Additional details on specifications for the yield sign are contained in Appendix F (*25*).

Tri-Met selected a yield light that is triangular in shape, with both the triangle and word YIELD flashing red. The lamp technology used was LED. The dimensions of the triangle yield light are approximately 8 in. on a side. The location for the yield light chosen by Tri-Met was in the lower-left corner of the engine access door, as shown in Figure 21.

FIGURE 21 Tri-Met yield light. (*Source*: Tri-Met.)

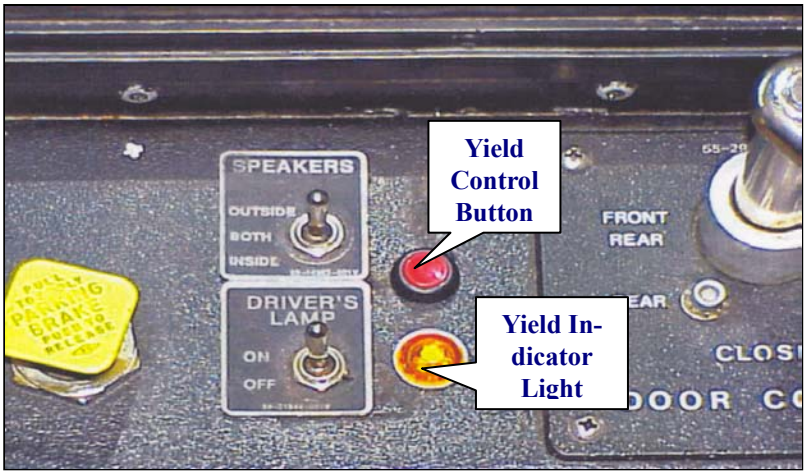


FIGURE 22 Yield light controls for Series 2100 bus. (*Source*: Tri-Met.)

Detailed installation instructions for the yield light for the four bus fleets used in fixed-route service were developed by the maintenance training staff. The yield lights were installed by the maintenance staff. The control switch (red push button) and indicator lamp (amber) for the yield light are located on the left side control panel for all four of Tri-Met's bus fleets used in fixed-route service. For some fleets the controls are aft of the door control lever, and for other bus series the controls are in front. Figure 22 shows the location of the yield light control switch and indicator lamp for one of the four Tri-Met bus fleets.

To use the yield light the operator first activates the left-turn signal and keeps it on. Then, the operator pushes the yield light control button located on the left panel. The indicator lamp will illuminate indicating that the yield light is flashing. The yield light will go off when the left-turn signal switch is released.

The functioning of the yield light is included in the pre-trip operator inspection. If a failure is noted, the bus is released for service and a work defect card is generated by the operator. Also, if a yield light failure occurs while the bus is in service, the bus continues in service and the failure is recorded in the operator's report.

In the bus-only Transit Mall, the 5th and 6th Avenues in downtown Portland, the yield light is not used. The functioning of the yield light is included in the preventive maintenance inspections.

SANTA CLARA VALLEY TRANSPORTATION AUTHORITY AND SANTA CRUZ METROPOLITAN TRANSIT DISTRICT

Background

San Jose is home to the Santa Clara VTA. The service area of VTA is about 1,312 square miles, with approximately 1,700,000 residents living in 15 cities and towns within its service area. The VTA fixed-route bus fleet operates 520 standard-size and articulated diesel buses. The fleet operates over 78 routes, with an annual ridership of approximately 48 million.

Santa Cruz County is just over the mountains to the west of Santa Clara County and has a population of approximately 285,000. Constrained by the Monterey Bay and the Santa Cruz Mountains, roadway capacity is an increasing challenge and traffic congestion is a major and growing issue in the county.

Santa Cruz County is the home of the SCMTD. The service area of the SCMTD is approximately 441 square miles, with a population of approximately 240,000, with about one-half living in four cities and the other half in small communities and rural areas. The SCMTD fixed-route fleet operates 123 standard-size and small buses. The buses operate over 44 routes, with an annual ridership of approximately 6.5 million.

Of the four eligible transit agencies, Santa Clara VTA and Santa Cruz Metro were the only transit agencies that decided to participate in the California "Yield to Bus" pilot program. Because the two systems worked as partners in the many YTB implementation tasks, their implementation efforts are here combined in one section. Because the SCMTD had been a sponsor of the YTB legislation and the VTA was in favor of the legislation, a positive and optimistic environment existed for establishing the program. The major reasons for implementing a YTB program were to reduce traffic delays for buses reentering the traffic lane and to facilitate the safe merging of buses back into the traffic lane.

Public Education and Awareness

Both systems used a project team approach to plan and coordinate the implementation tasks, which were then carried

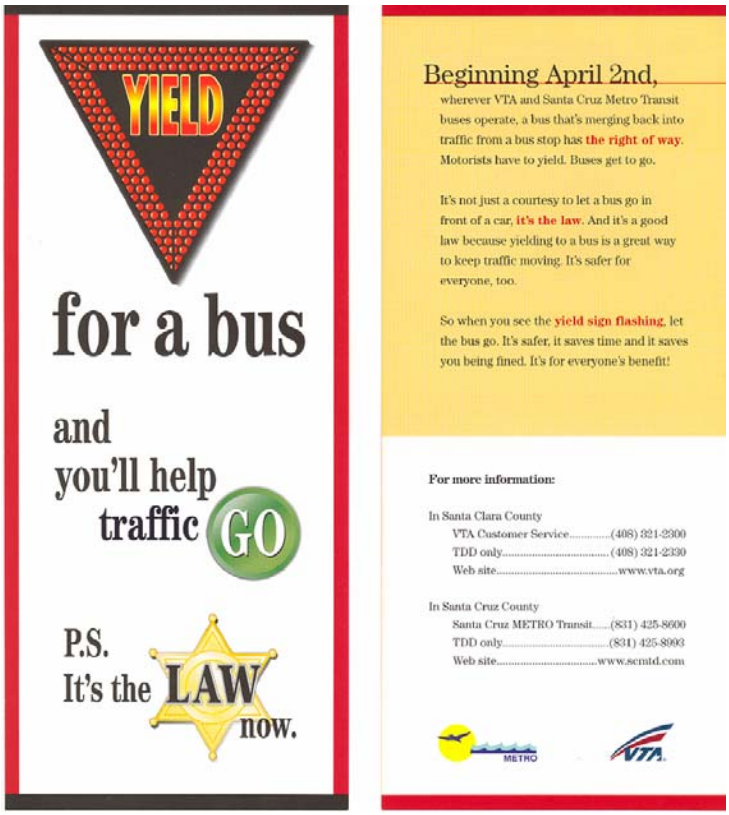


FIGURE 23 Yield to Bus flyer (both sides). (*Source*: Valley Transportation Authority and Santa Cruz Metropolitan Transit District.)

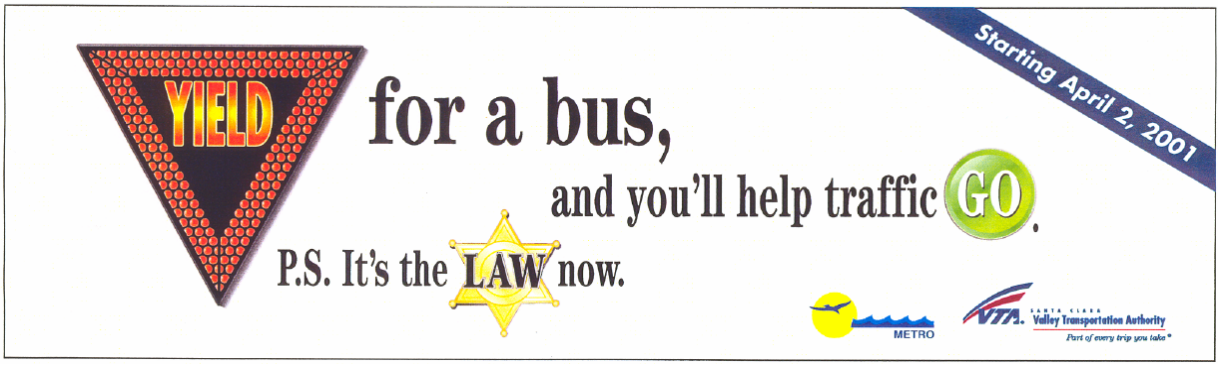


FIGURE 24 Yield to Bus poster advertisement used on busboards. (*Source*: Valley Transportation Authority and Santa Cruz Metropolitan Transit District.)

out by staff from operations and support groups as needed. The California YTB law required that participating transit agencies develop and implement a public education program, which was a joint effort of the VTA and SCMTD. The public education campaign included the use of radio and television PSAs, television news interviews, news releases distributed to the media, articles in local and regional newspapers, posters in stores and libraries, handouts and flyers, and signs on buses.

The YTB program was launched simultaneously by VTA and SCMTD on April 2, 2001, by a media event held at the San Jose Caltrain Station, which is an intermodal transportation center that is served by buses from both agencies. Media kits were provided that included information in English, Spanish, Vietnamese, and Chinese in the form of flyers, a frequently asked questions handout, and information on VTA and SCMTD. Still photographs and television video tape of buses equipped with the new yield signal moving in traffic were also provided to the media. Buses from both agencies were on display, and more than 20,000 flyers were distributed (*4*). The English language flyer is shown in Figure 23. Figure 24 shows the public education sign that was used on the exterior busboards.

TABLE 4
SUMMARY OF THE PROMOTIONAL AND EDUCATIONAL COSTS FOR SANTA CLARA VALLEY TRANSPORTATION AUTHORITY

Component	Activity	Cost ($)
Radio advertising	Local and regional stations—estimated total audience of over 6 million adults 18 and older	100,867
Print advertising	State, regional, and local publications with estimated exposure of almost 12 million	70,584
Transit advertising	All VTA revenue-generating vehicles—bus and rail—busboards, rail cards, posters, etc.	21,981
Incentive items	Flashing buttons, highlighters, etc.	21,241
Professional services	Copywriting, translations, etc.	11,495
Yield to Bus flyers	Handouts	11,249
Yield to Bus posters		3,795
News coverage	Local and regional radio, TV, and newspapers	0
VTA website	Yield to Bus information posted on website	0
Total promotional external costs		240,212

Notes: VTA = Santa Clara Valley Transportation Authority.
[*Source*: Santa Clara Valley Transportation Authority and Santa Cruz Metropolitan Transit District (*4*).]

TABLE 5
SUMMARY OF THE PROMOTIONAL AND EDUCATIONAL COSTS FOR SANTA CRUZ METROPOLITAN TRANSIT DISTRICT

Component	ACTIVITY	Cost ($)
Paid advertising	Ads in local newspaper and public information spots on the local cable provider	7,119
Transit advertising		1,434[a]
Yield to Bus posters	Posters on display at transit centers	0
Yield to Bus flyers	Handouts	[b]
News coverage	Local and regional radio, TV, and newspaper	0
SCMTD website	Yield to Bus information posted on website	0
Total promotional external costs		8,553

Notes: SCMTD = Santa Cruz Metropolitan Transit District; VTA = Santa Clara Valley Transportation Authority.
[a]Contract with advertising contractor allows for advertisements to be installed at no cost to SCMTD.
[b]Flyer printing cost included in the VTA costs.
[*Source*: Santa Clara Valley Transportation Authority and Santa Cruz Metropolitan Transit District (*4*).]

Similar posters were used in the interior of the buses and in the rail cars of VTA. YTB promotional "give a way" items, such as highlighters and bus blinking buttons, were also used to serve as a reminder of the YTB law. The promotional flyers were also distributed at transit centers, to sheriff and local police departments, and at neighborhood fairs and events. The costs of the promotional and educational efforts were significant and are summarized in Tables 4 and 5.

Employee Education and Awareness

The employees of VTA and SCMTD were made aware of the YTB law through staff meetings, posters on bulletin boards, articles in the employee newspaper, and in training classes. The officers of the operators' union at SCMTD were very helpful and involved in the training meetings on the proper use of the YTB signal. The union was a cosponsor of the YTB legislation and wanted to ensure that the operators used the priority measure correctly. They answered operators' questions on the interpretation of the law, and were able to stress the need to strictly abide by the rules so that the YTB law would have a chance to be made permanent. Some of the operator training on how to use the YTB signal controls was done during bus pre-trip and pullout. The VTA operators were also given laminated cards with the instructions on the YTB law and how to use the controls.

Yield to Bus Sign

The California YTB law requires that the bus " . . . is equipped with a yield right-of-way sign on the left rear of the bus. The sign shall be . . . illuminated by a flashing light when the bus is signalling . . . to enter a traffic lane. . . . " (*18*). The two transit agencies jointly procured the YTB sign and the one chosen is essentially the same as the one used by Oregon. However, the sequence for the activation of the signal is different. The sign is mounted on the rear of the bus on the left side just above the engine access door. This location was chosen for visibility and consistency reasons.

The control button and status light for the yield sign are located on the left-side control panel, similar to the Tri-Met locations. There are some small variations in the locations

on the panel because of differences between the buses in the fleets. The steps for operating the yield sign for VTA and SCMTD buses are as follows:

1. When ready to pullout, the operator activates the yield sign by pushing the yield switch (button) on the left panel. The yield status light will come on steady, indicating the system is armed. The yield sign remains armed for an adjustable period—10 to 15 s.
2. The operator depresses the left-turn signal (floor switch), and both the left-turn signals and the yield signal flash at the same rate. The yield status light will now flash. If it safe to move back into the active traffic lane, the operator will pull out from the stop.
3. The red flashing yield sign will remain on as long as the operator has the left-turn signal depressed.
4. When the operator releases the left-turn signal, the yield sign will stop flashing and the yield circuitry will reset.
5. If the operator cannot move out within the 10 to 15-s period, the left-turn signal must be released and the yield control button pushed again.

The approach of arming of the yield sign prior to the activation of the left-turn signal was selected by VTA and SCMTD so that the operator could have both hands on the steering wheel when pulling out from a stop. The yield sign control button and status light is shown in Figure 25 and VTA and SCMTD buses equipped with the yield signs are shown in Figures 26 and 27.

FIGURE 25 Yield sign controls for Santa Cruz Metropolitan Transit District bus.

FIGURE 26 Santa Clara Valley Transportation Authority bus with yield sign.

FIGURE 27 Santa Cruz Metropolitan Transit District bus with yield sign.

The functioning of the yield sign is included in the operator's pre-trip inspection. If the yield sign is not functioning, the bus is released for service and the failure noted in the operator's report. If the yield sign fails during revenue service, the bus continues in service and the failure is noted in the operator's report.

CHAPTER FOUR

ANALYSIS OF SURVEY RESPONSES

INTRODUCTION

Surveys were mailed to those transit agencies in British Columbia, California, Florida, Oregon, and Washington State that had been identified as providers of fixed-route service and therefore potential candidates for having a YTB program. These agencies were selected from the directories of

- Public transit associations of Florida, Oregon, and Washington;
- DOTs of Florida, Oregon, and Washington; and
- APTA and CUTA.

Because the two participating transit agencies in the California YTB pilot program were already known, no search of a California directory was required.

A total of 73 surveys were mailed to transit agencies in these states and province. A breakdown by state/province of the number of transit agencies that provided information in response to the survey is provided in Table 6. The listing of all transit agencies that responded to the survey questionnaire, both with and without YTB programs, is given in Appendix B.

With a few exceptions, the transit agencies that did not respond were generally the smaller systems operating in areas where YTB probably was not considered to be needed for their traffic conditions. A high percentage of the Florida respondents did not have YTB programs. A reason for this could be the restrictive wording of the Florida YTB law, which is only applicable for a bus moving out from a "designated pullout bay." Another Florida respondent had tried to implement a YTB program, but discontinued the program because of negative public reaction.

Survey responses from transit agencies that had YTB programs ranged from small to large with respect to the size of their fixed-route bus fleets. Table 7 provides a breakdown of the survey respondents that reported having a YTB program by the size of their fixed-route fleet. The classification of size was done by using the following criteria:

- Small—100 or fewer buses;
- Medium—more than 100, but fewer than 500 buses; and
- Large—500 or more buses.

As can be seen in this table, there is a reasonable balance in representation by large, medium, and small transit agencies in the survey responses.

TABLE 6
NUMBER OF TRANSIT AGENCIES PROVIDING INFORMATION IN RESPONSE TO SURVEYS

State or Province	Surveys Sent and Responses Received			No. of Respondents with YTB	Total Respondents (%)
	Sent	Received	Percentage		
British Columbia	16	5	31	5	100
California	2	2	100	2	100
Florida	25	11	44	3[a]	27
Oregon	8	4	50	3	75
Washington	22	9	41	6	67
Totals	73	31	42	19	61

[a]One respondent was testing YTB operations on one route and plans to expand the program to all routes sometime in the future.

TABLE 7
SURVEY RESPONDENTS WITH YIELD TO BUS PROGRAMS BY SIZE AND STATE/PROVINCE

State or Province	Large	Medium	Small	Totals
British Columbia	1	1	3	5
California	1	1	0	2
Florida	1	2	0	3
Oregon	1	1	1	3
Washington	1	3	2	6
Totals	5	8	6	19

Notes: 19 survey responses.

TABLE 8
PUBLIC AWARENESS CAMPAIGN APPROACHES AND EFFECTIVENESS

Public Educational Approaches	Used	Effectiveness Rating				
		Excellent	Very Good	Satisfactory	Fair	Poor
Radio public service announcements	11	3	1	3	2	2
TV public service announcements	5	1	1	1	1	1
Radio interviews/talk shows	4		3	1		
TV news interviews	7	1	5		1	
Newspaper advertisements	8	3	2	2		1
Billboards	3	1	1	1		
Posters in stores, libraries, offices, etc.	5		1	2	2[a]	
Posters/signs on buses	10	5	2	1	2	
Handouts/pamphlets	6	2	1	1	2	
News releases	11	3	2	3	2	1
Public meetings	1			1		
DMV license test question	3	1		1	1	
Other _____		2[b,c]			[d,e]	

Notes: 14 survey responses.
[a]Department of Motor Vehicle's offices.
[b]Thanks for the Brake program.
[c]Market research.
[d]In our schedule.
[e]Letters to law enforcement.

TABLE 9
EMPLOYEE TRAINING AND AWARENESS PROGRAMS USED BY SURVEY RESPONDENTS

Employee Training and Awareness Programs	No.	Respondents (%)
Articles in employee newspapers/magazines	8	50
Employee staff meetings	10	62
E-mail	2	12
Posters	6	38
Other methods as reported by respondents		
Flyer in pay envelope	2	12
Training classes and union participation	1	6
Notice and training	2	12
Training video	1	6
Memos and notices	3	19
Operations bulletin and required reading	1	6

Notes: 16 survey responses.

Of the 19 survey responses, only 16 provided information on most of the questions asked in the survey. In the following sections, the experiences as reported by the survey respondents will be discussed.

EXPERIENCES WITH YIELD TO BUS PROGRAMS

In chapter three the implementation experiences of the case study transit agencies were discussed. In the following paragraphs the approaches used and the reported experiences of all survey respondents are summarized.

Implementation of Yield to Bus Programs

The most frequently used methods to inform the public of the new YTB law were news releases, radio PSAs, and information signs on bus advertisement panels. Posters and signs on buses were reported to be the most effective approaches, with radio PSAs, television news interviews, newspaper advertisements, and news releases next with respect to effectiveness. A summary of the methods used and the reported effectiveness is given in Table 8.

Employee Education and Awareness Efforts

Employee meetings, articles in the employee newspaper, and posters on bulletin boards were reported as the most frequent methods used by survey respondents. A breakdown of the approaches by the survey respondents is given in Table 9.

The approaches used for operator training and awareness for the case studies were discussed in chapter three. The other 11 survey respondents reported using similar methods. A summary of the methods used by all respondents is given in Table 10. For the existing operators the respondents reported using classroom instruction and in-vehicle training equally. A large majority of the respondents have not used refresher training. Whether this is be-

TABLE 10
OPERATOR TRAINING AND AWARENESS PROGRAMS USED BY SURVEY RESPONDENTS

Operator Training and Awareness Programs	No.	Respondents (%)
Current operators		
Classroom instruction	9	56
In-vehicle training	9[a]	56
Other methods as reported by respondents		
Informational campaign	1	6
Depot orientation (question and answer meeting)	1	6
Performance driving reviews conducted periodically	1	6
Written instructions	2	12
Refresher training		
Yes	3	19
No	13	81

Notes: 16 survey respondents.
[a]One transit system reported providing training during bus pullout.

TABLE 11
SUMMARY OF TYPE AND LOCATION OF YIELD SIGNS REPORTED IN SURVEY RESPONSES

Yield Signs	No. of Responses	State or Province				
		BC	CA	FL	OR	WA
Type Used						
Yield decal—only	9[a,b]	1		3		5
Flashing LED yield signal—only	5		2		3	
Flashing LED yield signal and yield decal	5[b]	5				
Locations						
Lower-left corner—just above the bumper	6			3	3	
Mid-height left corner	12[c]	5	2			5
Lower-left corner of rear window	5[c]	5				

Notes: 18 survey responses. CMBC = Coast Mountain Bus Company; BC = British Columbia; CA = California; FL = Florida; OR = Oregon; WA = Washington State.
[a]Only Pinellas Suncoast Transit Authority and Miami–Dade Transit provided information on their yield signs.
[b]Some CMBC buses had only the passive yield decal and others were equipped with both the yield decal and an active flashing yield signal.
[c]All BC buses have a passive yield decal at the mid-height left corner location. BC buses equipped with a flashing yield signal have them placed in the left corner of the rear window.

cause the YTB programs are fairly new or because the YTB skills and knowledge requirements are relatively simple (in particular with a passive yield sign) is not known. Two of the three respondents that reported using YTB refresher training had electronic yield signs.

Experiences with Yield to Bus Signs

In California and Oregon, the YTB law requires the use of a flashing yield signal (an active yield sign). All transit agencies in these states use the same flashing LED yield signal. The survey responses from Florida and Washington all reported using yield decals (a passive yield sign) in their YTB programs. However, the YTB laws in these states would permit the use of an active flashing yield sign. Pierce Transit, serving Tacoma, Washington, is testing the use of a flashing LED yield signal. A small system in a rural area reported having a YTB program, but *not* using a yield sign.

In general, all transit agencies within a state or province use the same or very similar yield signs. The yield signs used by the case study systems are shown in chapter three. Some variations in the design of the yield signs were observed during the field trips. An example of such variation is the yield sign used by C-Tran (Vancouver, Washington). The C-Tran yield decal is a red border triangle with a message in black on a white background. The sign message reads "YIELD . . . Required by Law," and a reference to RCW 46.61.220 is also provided.

Survey respondents reported two general locations for their yield decals: either in the lower-left corner area just above the bumper or in an area approximately half the way up and towards the left corner of the bus. The active flashing LED yield signals in the United States were in similar locations. However, the active LED yield sign location for buses in British Columbia was in the left- rear corner of the rear window. A summary on yield sign types and locations as reported by the survey respondents is given in Table 11.

The survey respondents favored by three to one the higher location for the yield sign, because it is more visible to the second and third vehicles following the bus, which are the most likely vehicles that could yield to the bus and allow it to merge back into the traffic lane.

Finding a place for the yield sign that would be available for all the buses in their fleets was frequently mentioned as the most important consideration when selecting the location for the yield sign. One factor to be considered

was the possible interference of advertisements with the yield sign. The transit agencies want to have the yield sign where it is most visible to the following motorist; however, the advertisement contractor wants to have the sign in the most visible area too. The use of full or partial wrap advertisements present additional challenges.

Two survey responses noted a problem with some of their buses that had the engine exhaust pipe and muffler directly behind the area where they had wanted to locate the electronic yield sign. The problems were heat and physical interference. Their solutions were to add some insulation and to move the yield light a few inches inboard (more to the center of the bus), a location where the temperature of the bus surface was lower and there was no interference with the mounting fasteners and the exhaust system.

Some transit agencies reported problems where or when an advertisement had covered up some or all of the yield sign. The advertisement contractor employees generally work during the early morning hours when the buses are all available in the yard at a time when few of the transit agency employees are available to check on the proper placement of the advertisements. Although the agreement with the advertisement contractor most likely prohibits any advertisement from covering up safety signs, mistakes can happen. An example of such a problem was observed during a field visit and is illustrated in Figure 28. Another problem is the distracting aspect of advertisements with regards to the yield sign. In particular, with partial- and full-wrap rear advertisements there can be a lot of distracting messages (and clutter) that may divert the attention of following motorists. An example is a photo of a flashing yield signal in the middle of a full-wrap advertisement as shown in Figure 29. Even with the flashing yield light, a motorist could miss the yield signal in bright daylight.

FIGURE 28 Example of potential problem with advertisement on rear of bus.

FIGURE 29 Yield sign in middle of advertisement.

The survey responses reported a wide range in the estimated cost for an installed flashing LED yield sign. The reported costs ranged from $250 per bus to $600 per bus for the U.S. systems. The cost for the flashing LED yield sign used in British Columbia was estimated to be $600 to $800 CAN ($390 to $520 US). The reported cost for a self-adhesive yield decal ranged from $5 to $20 per decal.

Operational Issues and Changes

The survey respondents generally reported none or only small changes to their operations because of their YTB programs. All survey respondents using electronic yield signs included them as a part of the operator's pre-trip inspection check of lights and signals. Most would release a bus for service with a failed yield sign, with only one reporting that they repaired an in-service failure of the yield sign or replaced the bus. Three respondents reported including the decal yield sign in the operator's pre-trip inspection. Only one survey respondent reported not releasing the bus for service if the yield sign was determined to be ineffective because of damage. The only failure reported for the decal yield sign was damage caused over time by the bus washer. Table 12 summarizes reported actions taken during the operator's pre-trip inspection and during revenue service when a failure occurs to the yield sign. The six case study transit agencies were asked a number of questions concerning other operational changes undertaken because of their YTB programs. There were no changes reported in how they handled accidents, complaints, or aggressive driving behavior relating to YTB operations. Also, no changes were reported in routes or bus stop locations because of the YTB operations. The operational policies

TABLE 12
OPERATIONAL CHANGES FOR YIELD TO BUS SIGN

Type of Yield Sign	Included in Operator's Pre-Trip Inspection		Actions Following Pre-Trip Inspection			In-Service Failure		
	Yes	No	Released for Service	Sent to Maintenance	Not Applicable	Continue Service	Repair or Replace	Not Applicable
Electronic sign	10		6	4		9	1	
Decal sign	3	4	2	1	4			7

Notes: 16 survey responses (one response had both electronic and decal signs).

and procedures were essentially the same with and without a YTB program.

Operating Experiences: Benefits and Problems

The primary purposes of implementing a YTB program are to reduce delays and to enhance the safety of buses merging back into traffic from a bus stop. In the following sections the reported benefits and problems of YTB programs are discussed.

Have Improvements Occurred in Schedule Adherence?

Although 6 of the 16 survey respondents reported some improvements in schedule adherence because of their YTB operations, none were able to provide any quantitative data to support their statements. It needs to be emphasized that all reports of time savings were based on anecdotal information, primarily from bus operators. Four of the survey respondents mentioned that they were not sure if improvements to schedule adherence had occurred because of their YTB operations. It was not possible for them to credit any time improvement solely to their YTB program because of the many factors that can influence schedule performance. These included such other factors as changes in traffic congestion, route restructuring, signal prioritization, road construction detours, schedule changes, and bus stop conversions.

Have Complaints Increased?

The survey responses were mixed with regards to increases in the number of complaints from motorists. A majority (nine) of the respondents reported no change in the number of complaints resulting from operator driving behavior. The CMBC reported no complaints as a result of their YTB program. However, seven respondents did report increases in complaints from motorists because of aggressive operator driving behavior (buses cutting off automobiles). The reported increases ranged from 2% to 5% for two small systems in British Columbia to a more than 400% increase in complaints for Metro Transit. The Pinellas Suncoast Transit Authority in Florida reported that they had discontinued their YTB program because of its unpopularity with the public.

Have There Been Safety Problems or Increases in Insurance/Claims Costs?

The survey responses for the questions concerning changes in safety, in the number of bus zone accidents, and in insurance or claims costs were generally positive; however, most did not have quantitative data to support their statements. Thirteen respondents reported no changes in insurance or claims costs resulting from their YTB programs. One small transit system in British Columbia reported a *decrease* in their insurance/claims costs. Two large transit systems in the United States noted that they did not know if there were any changes in their insurance/claims costs because of their YTB programs.

In response to the survey question, "Have there been any safety problems experienced with your YTB program?" the majority of respondents (12) said no and 4 said yes. Those reporting problems provided some additional clarifying comments; i.e., "operators need to continue to exercise good judgment," "increase in 'near miss' accidents," "more aggressive drivers," and " a huge increase in collisions when leaving bus zones." Most agencies reported that they did not have accident data that was specific to YTB operations. However, Metro Transit did provide accident data that was believed to be related to their YTB operations. In addition, BCT provided data on accidents that occurred in the bus stop zone, and the VTA and SCMTD provided some safety data in their evaluation report to the CHP on their YTB (CVC 21810) programs.

The BCT maintains an accident database that lists 62 accident codes, of which there are 5 that are used to report accidents that occur in bus zones. For the 31-month period from January 2000 through July 2002, there were 385 accidents reported under these 5 accident codes. To determine whether the collision occurred when the bus was leaving a stop, the operator's narrative was reviewed. Using that analysis, there were 11 accidents reported where a vehicle collided with a bus as it was leaving the stop. It

was not possible to determine the type of bus stop (out of the traffic lane or in the traffic lane) involved in the accident. These 11 accidents represented less than 3% of the bus zone accidents. The BCT did not feel that the number of accidents had changed with their YTB program.

In the CVC 21810 demonstration program evaluation report to the CHP, the VTA reported that there were three recorded accidents during the 13-month evaluation time period of the demonstration program that could possibly be attributed to a violation of the YTB law (*4*). One accident involved an injury and two were property-damage-only accidents. In its survey response, the VTA reported no change in the number of accidents because of its YTB program. The three *possible* YTB accidents were VTA's Accident Occurrence Type 27 (collision with the bus leaving a stop). To put the three possible YTB accidents into perspective, there were a total of seven Code 27 accidents during the 13-month YTB evaluation period, whereas there had been nine in the 13-month period just prior to the YTB evaluation period. The accident data sample is considered too small to attach any statistical significance to the differences.

Metro Transit has an accident code (Code 227) in their database that is for a vehicle colliding with a bus leaving a stop. This code would only be used for collisions at stops with the bus entirely outside the traffic lane and, therefore, a Code 227 accident is considered to be a YTB accident. During the 5 years just prior to the implementation of the YTB program, Metro Transit experienced a low number of Code 227 accidents, an average of 5.2 per year. When comparing that experience with the accident experience for the first 5 years with a YTB program (an average of 17 accidents per year), the increase was significantly large, more than 200%. However, because of the high variance in the Code 227 accident data (in particular the without YTB years), a larger sample size is needed to obtain a statistically significant evaluation.

Metro Transit has maintained an excellent accident database for more than 20 years. The numbers of Code 227 accidents by year are shown graphically in Figure 30, where it can be seen that the number of accidents per year varies considerably. The mean of these data is 12.8 Code 227 accidents per year for this period of time (1976 to 2001), and the linear fit line has a small positive slope of 0.133. A portion of this gradual increase may be attributed to increases in congestion and the number of fleet vehicle-miles over this time period. Additional information on the safety data and analysis are given in Appendix E.

The implementation of Metro Transit's YTB program began about the middle of 1993, and was completed by the end of that year. Code 227 accident data for the 8 years since the implementation of the program (1994 through 2001) were compared with the Code 227 accident data for the 8 years just prior to the implementation (1986 through 1993). During the 8 years just before its YTB program the mean of Code 227 accidents was 10.25 per year, as compared with the mean average of 16.5 Code 227 accidents per year for the 8 years with YTB operations, an increase of 61%. These data are statistically significant at $t = 0.12$.

Metro Transit has an accident review process that results in a judgment of whether an accident is preventable or nonpreventable. During the 1986 to 1993 period, 82 Code 227 accidents were recorded and 21 (25.6%) of those accidents were determined to be preventable. During the 1994 to 2001 period, there were 132 Code 227 accidents and 35 (26.5%) of those accidents were determined to be preventable Because the percentage of preventable accidents did not significantly rise during the period with a YTB program, these data would seem to indicate that there

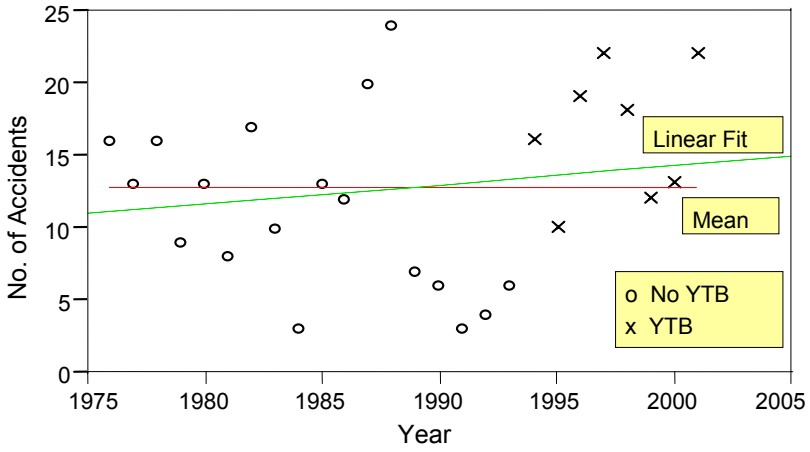


FIGURE 30 Number of Code 227 (vehicle colliding with bus leaving a stop) accidents by year (1976 to 2001). (*Source*: Metro Transit.)

has not been a significant increase in aggressive driving on the part of the Metro Transit operators.

Further analysis of the Code 227 data indicates that buses operating in the heavier traffic areas (e.g., the central business district) were more likely to have Code 227 accidents than buses operating in the suburban areas with lower traffic flows. Almost 71% of Code 227 accidents occurred with buses operating in the more congested areas.

Have Police Enforced the Yield to Bus Laws?

The general lack of enforcement of the YTB law was reported by most respondents. In conversations with bus operators during the field trips many mentioned inadequate enforcement as being a major problem. In the operator survey responses it is the most frequently cited issue. Many bus operators believe that more enforcement would solve the problems of motorists not yielding when the bus operators signal their intent to merge back into the traffic lane. They appear to not fully understand (or accept) that under the YTB law their responsibility for the safety of all users of the roadway is unchanged—that right-of-way is given, not taken.

One reason for the inadequate enforcement may be the result of a lack of awareness of the YTB law by police officers, although most respondents reported meeting with and providing educational information to their local law enforcement agencies. A frequent comment however was that the police did not view a YTB violation as a high priority. During a field visit, a chance conversation with one local police officer at a train station revealed that he was not aware of the California YTB law. A bus was standing at a stop nearby, and the yield sign was pointed out with an explanation that when the yield sign was flashing, a following motorist was to yield to the bus merging back into traffic. The officer replied that this was not his understanding and, then, recited the conventional right-of-way rules.

There is also a low level of enforcement of the YTB law in Europe. In contacts with European transit systems, several commented that their bus priority law was not enforced by police. One German colleague stated that "the police do not enforce the StVO law, but if there is an accident, the bus wins."

A summary of the survey responses to the question concerning police enforcement of the YTB law is provided in Table 13. As can be seen, enforcement is reported to be low almost everywhere. BC Transit–Victoria reported a "seldom" level of enforcement, but commented that no enforcement was needed.

TABLE 13
POLICE ENFORCEMENT OF THE YIELD TO BUS LAWS

Level of Enforcement	No. of Responses
Almost always—more than 90% of the time	
Most of the time—60–90%	1
About half of the time—40–60%	
Some of the time—10–40%	3
Seldom—less than 10%	11
"No violators stopped by police"	1

Notes: 16 survey responses.

Under Which Traffic and Road Conditions Have YTB Operations Been Most Effective?

The transit agencies were asked to identify traffic conditions and street designs where their YTB operations were the most effective in saving time. The agencies were asked to indicate where time savings had been observed or reported. The responses indicated that time savings were perceived to occur at lower traffic speeds. Several agencies reported that time savings were unknown or that they had no experience with a particular traffic condition. Survey responses are summarized in the Table 14.

The transit agencies were asked to identify the type of street designs where their YTB operations had been effective in saving time. They were to indicate the type of street

TABLE 14
SURVEY RESPONSES ON TRAFFIC CONDITIONS AND YIELD TO BUS EFFECTIVENESS

	YTB Experiences, Time Savings			
Traffic Conditions	Significant	Some	None	No Experience/ Unknown
Congested stop-and-go flow	3	5	2	6
Very low speeds (10–15 mph) with moving heavy-traffic flows	2	6	2	6
Low speeds (15–25 mph) with moving heavy-traffic flows		10	1	5
Low speeds (15–25 mph) with moving moderate-traffic flows		7	2	7
Moderate speeds (25–45 mph) with moving moderate-traffic flows		4	3	9

Notes: 16 survey responses.

TABLE 15
SURVEY RESPONSES FOR STREET DESIGNS AND YIELD TO BUS EFFECTIVENESS

Street Designs	YTB Experiences, Time Savings			
	Significant	Some	None	No Experience/ Unknown
Single traffic lane per direction with street parking	2	6	1	7
Multiple traffic lanes per direction with street parking	1	7	1	7
One-way single traffic lane with street parking		6	2	8
One-way multiple traffic lanes with street parking		7		9
Other: multiple or one-way with bike lane	1			

Notes: 16 survey responses.

TABLE 16
EFFECTIVENESS OF YIELD TO BUS OPERATIONS FOR DIFFERENT DRIVING CONDITIONS

Driving Conditions	YTB Operations More Effective or Fewer Accidents			
	Day	Night	No Difference	Unknown
Times of day—more effective	5	1	4	6
Driving condition—more effective	1		7	8
Times of day—more accidents	1		9	6

Notes: 16 survey responses.

FIGURE 31 Overall evaluation of Yield to Bus programs by respondents. (16 survey responses.)

designs where savings had been reported or to indicate unknown or no experience. A summary of their responses is given in Table 15.

The responses to the survey questions concerning the times of day or driving conditions that resulted in fewer YTB accidents or where the YTB operations have been more effective in time savings is summarized in Table 16.

During the field visits, the case study transit agencies were asked if visibility or weather conditions have any impacts on their YTB operations. Only one reported that their YTB operations were more effective under dry driving conditions. All others either responded that any impacts were unknown or that there were no differences.

Overall Experiences, Comments, and Lessons Learned with Yield to Bus Programs

All survey respondents were asked to provide an overall assessment of their experiences with YTB operations. As can be seen in Figure 31, the evaluations were almost equally divided between those reporting excellent and good experiences and those reporting fair and poor experiences.

There did not appear to be any differences in evaluation by the size of the transit agency; however, there were significant differences depending on location. A breakdown of the overall evaluation by state and province is given in Table 17.

Clearly, the transit agencies surveyed in British Columbia and California were pleased with the results of their

TABLE 17
OVERALL EVALUATION OF YIELD TO BUS PROGRAMS BY STATE OR PROVINCE

State or Province	Overall Evaluation by Number of Transit Agencies					Totals
	Excellent	Good	Satisfactory	Fair	Poor	
British Columbia	1	4				5
California		2				2
Florida				1		1
Oregon		1	1	1		3
Washington				1	4	5
Totals	1	7	1	3	4	

Notes: 16 survey responses.

YTB programs. However, the opposite was the case for transit agencies in Florida and Washington. Transit agencies in British Columbia appear to be the most positive and reported more benefits from their YTB programs than all other survey respondents. One explanation could be their Thanks for the Brake program, which had been in place for 25 years before the implementation of the YTB program. Bus operators and motorists alike had become more courteous to each other over the years. A comment from one British Columbia transit system noted that they seldom used the yield signal because it was not needed. Also, they reported low police enforcement of the YTB law because it was not necessary. It is interesting to note that the CMBC operator survey responses indicated a need for more enforcement (as discussed in chapter five). The reasons for the fair or poor evaluations in Florida and Washington were because of the increased number of accidents and complaints and the general lack of benefits. The lack of resources for more public education also seems to be a factor. The British Columbia and California transit agencies had the benefit of larger public awareness and education programs compared with the programs undertaken by transit agencies in Florida, Oregon, and Washington. The use of a flashing LED yield sign may also be a factor in the perceived effectiveness evaluation.

Valuable insights were reported by respondents in their written comments and information on lessons learned. These comments also further explain their positions with respect to YTB operations. These lessons learned and comments are provided here (italics have been added for clarification).

British Columbia

- "require sustained funding for public education."
- "We are not burdened with heavy traffic congestion as this is not a large city, so our experience would be different from a city like Victoria or Vancouver. The YTB does work for us when we need it. We had to educate operators not to 'cut traffic off'; yield is a courtesy not a right. Also, not to use (*yield signal*) making left turns, etc."
- "Used safely—the YTB program is quite a help in keeping the bus on schedule. This is an excellent program which helps with the efficiency of the buses."

California

- (*would like a*) "Brighter sign."
- "Our bus operators generally like the yield to bus signal; multi-media promotions and law enforcement are necessary."

Oregon

- "Operators need to be consistent."
- (*would like more*) "Better public awareness and education, applying information decals to rear of bus; to reduce confusion, we are now mandating use of yield sign."

Washington

- "1) Even with education, bus drivers don't understand their obligations; 2) law enforcement agencies are ambivalent to the statute; 3) YTB has cost more than its benefit. The American driving mentality does not support HOVs in the YTB legislation. The European model works because of more sympathy to public transit and aggressive enforcement."
- "Difficult to communicate and gain compliance. Police reluctant to enforce yield to stopped vehicle by moving vehicle."
- "Bus drivers need to drive defensively no matter what. This law tends to make them feel that it is not as important for them, but other drivers need to watch out for the bus."
- "The public is slow to learn, law enforcement is not anxious to enforce, some operators are too aggressive."
- "The electronic version is showing great promise; vehicles actually stop for the bus. The sticker version (*decal yield sign*) might as well not be there. Very little law enforcement.

CHAPTER FIVE

INSIGHTS OBTAINED FROM OPERATOR SURVEYS

INTRODUCTION

Because few quantitative operational data were available to evaluate the impacts of YTB programs on safety and time savings, several of the case study transit agencies conducted surveys to obtain the perceptions of their operators on various issues and the effectiveness of their YTB programs. The VTA conducted a survey of approximately 20% (195) of their operators, which was included in their evaluation report to the CHP (*4*). During the course of this synthesis study, four other transit agencies conducted surveys of their operators: BCT, CMBC, Metro Transit, and Tri-Met. More than 700 responses were received from these four surveys. The survey formats featured multiple-choice responses to the questions with an optional provision for written comments. A complete documentation of the operator surveys of the five transit agencies and a tabulation of the responses are given in Appendix D.

Ideally, for comparative analysis purposes, all of the survey questions should have been the same. However, because of the differences in how the YTB programs were implemented, and the specific interests and situations of the transit agencies, there were differences in some of the individual survey questions. There were, however, several question topic areas that were included in two or more of the surveys; and while there were small differences in the specific wording of the individual questions, they were considered similar enough to be grouped as asking the same question. An explanation of the groupings that were made is provided in Appendix D.

ANALYSIS OF OPERATOR SURVEY RESPONSES

Summaries of the insights gained from the analysis of the survey responses by topic area as to the way bus operators perceive their YTB programs and an overview of the written comments that were provided by the operators are presented here. For each topic area, the first table provides the responses for the individual response options. For several of the topic areas, a second table is provided that summarizes combined response options. Because of round-off error, some rows do not add up to 100%.

Motorists Awareness of Yield to Bus Laws

Four of the surveys asked the question, "What percentage of motorists do you feel are aware of the Yield to Bus law?" The responses to this question are given in Table 18. Combining the responses in two groups as shown in Table 19 sharpens the differences in the responses of operators from these agencies.

Clearly, the BCT and Metro Transit operators do not believe that many motorists in their jurisdictions are aware of their YTB laws. The slightly more favorable perception of the Metro Transit operators may be attributed to their recent public awareness campaign. The perceived higher percentage of motorists being aware of the YTB law by CMBC operators may be attributed to the extensive public awareness and education campaign prior to implementation of their YTB law and the 25 years of their Thanks for the Brake program. The Tri-Met operators also reported that a high percentage of their motorists are aware of their YTB law. Because they also reported a higher percentage of motorists yielding when they signal their intent to merge into traffic (see Table 20) it would be consistent for them to perceive that a higher percentage of their motorists were aware of their YTB law.

Percentage of Motorists Yielding

Four of the surveys asked a question relating to the percentage of motorists that yielded when bus operators sig-

TABLE 18
AWARENESS OF MOTORISTS OF YIELD TO BUS LAWS BY TRANSIT AGENCY (individual response options)

	Operator Survey Responses (in percent of total by transit agency)					
Transit Agency (no. of responses)	Almost All	High Percentage	About Half	Low Percentage	Very Few	No Response
Broward County Transit (150)	1	2	6	27	63	1
Coast Mountain Bus Company (167)	4	20	31	28	17	1
Metro Transit (158)	2	4	12	37	44	1
Tri-Met (247)	5	17	33	31	13	2
Average of agency responses	3	11	20	31	34	1
All responses (722)	3	12	22	30	31	1

TABLE 19
AWARENESS OF MOTORISTS OF YIELD TO BUS LAWS BY TRANSIT AGENCY (combined responses)

	Operator Survey Responses (in percent of total by transit agency)		
Transit Agency (no. of responses)	Almost All, High Percentage, and About Half	Low Percentage Very Few	No Response
Broward County Transit (150)	9	90	1
Coast Mountain Bus Company (167)	55	45	1
Metro Transit (158)	18	81	1
Tri-Met (247)	55	44	2
Average of agency responses	34	65	1
All responses (722)	37	61	1

TABLE 20
OPERATOR SURVEY RESPONSES ON MOTORISTS YIELDING (individual response options)

	Operator Survey Responses (in percent of total by transit agency)					
Transit Agency (no. responses)	Almost All	High Percentage	About Half	Low Percentage	Very Few	No Response
Broward County Transit (150)		1	7	31	60	1
Coast Mountain Bus Company (167)	4	13	29	31	23	
Metro Transit (158)	1	2	9	40	48	
Tri-Met (247)	3	22	36	25	12	2
Average of agency responses	2	10	20	32	36	1
All responses (722)	2	11	22	31	32	1

TABLE 21
OPERATOR SURVEY RESPONSES ON MOTORISTS YIELDING (combined responses)

	Operator Survey Responses (in percent of total by transit agency)		
Transit Agency (no. responses)	Almost All, High Percentage, and About Half	Low Percentage Very Few	No Response
Broward County Transit (150)	8	91	1
Coast Mountain Bus Company (167)	46	54	
Metro Transit (158)	12	88	
Tri-Met (247)	61	37	2
Average of agency responses	32	68	1
All responses (722)	35	63	1

naled their intent to merge into the traffic lane from a bus stop. The responses to this question are given in Table 20. Combining the responses intensifies the differences in operator perceptions from the four transit agencies. The combined responses are shown in Table 21. The survey responses indicated that the operators from BCT and Metro Transit perceive that few motorists yield for them. In contrast, the operators from Tri-Met reported a much higher percentage of motorists yielding for them, and the operators from CMBC reported an intermediate percentage. The survey responses from BCT, CMBC, and Metro Transit were all from operators driving buses with passive yield decals. The Tri-Met operators were driving buses with an active flashing yield sign. The CMBC and Metro Transit decals are in the same general location on the rear of their buses, about midway on the left side, whereas the BCT has placed its decals in the lower-left corner on the rear of its buses. The Tri-Met buses have their active flashing yield signal in the same general location as the BCT. Could the type of yield sign used (active versus passive) be a significant factor in the difference in the responses among the four transit agencies? The higher percentage of motorists yielding for the CMBC operators may also be attributed to their Thanks for the Brake program.

The responses to two of the questions (questions 1 and 3) in the VTA operator survey also indicated a large change in the percentage of motorists that yielded when VTA operators used their active yield signal to signal their intent to merge into traffic. Table 22 provides a comparison of the responses to the two questions.

Safety Impacts of Yield to Bus Programs

Three of the operator surveys contained a question concerning whether the YTB sign had made the merging from a bus stop safer. A summary of the responses is given in Tables 23 and 24. BCT operators reported a much lower perceived safety benefit from the YTB sign when merging

TABLE 22
SANTA CLARA VALLEY TRANSPORTATION AUTHORITY OPERATOR PERCEPTIONS OF MOTORISTS YIELDING WITH AND WITHOUT THE USE OF THE YIELD TO BUS SIGNAL

	Operator Survey Responses (in percent of total)				
Use of Yield Signal (no. of responses)	Always	Most of the Time	Some of the Time	Rarely	Never
Not Using Yield Signal (193)	2	4	41	44	9
With Using Yield Signal (195)	3	26	42	27	3
	Always, Most of the Time, and Some of the Time			Rarely and Never	
Not Using Yield Signal (193)	47			53	
With Using Yield Signal (195)	71[a]			30[a]	

[a]Where the total exceeds 100% percentages have been rounded.
[*Source:* Santa Clara Valley Transportation Authority and Santa Cruz Metropolitan Transit District (*4*).]

TABLE 23
SAFETY IMPACT OF THE YIELD TO BUS SIGN (individual response options)

	Operator Survey Responses (in percent of total by transit agency)				
Transit Agency (no. of responses)	Lot Safer	Some Safer	No Change	Less Safer	No Response
Broward County Transit (150)	5	26	67	1	1
Coast Mountain Bus Company (167)	10	59	26	4	2
Tri-Met (247)	29	57	11	2	1
Average of agency responses	15	47	35	3	1

TABLE 24
SAFETY IMPACT OF THE YIELD TO BUS SIGN (combined response options)

	Operator Survey Responses (in percent of total by transit agency)			
Transit Agency (no. of responses)	Lot Safer and Some Safer	No Change	Less Safer	No Response
Broward County Transit (150)	31	67	1	1
Coast Mountain Bus Company (167)	69	26	4	2
Tri-Met (247)	86	11	2	1
Average of agency responses	62	35	3	1

TABLE 25
PERCEPTIONS OF THE HELPFULNESS OF THE YIELD TO BUS SIGN (individual response options)

	Operator Survey Responses (in percent of total by transit agency)					
Transit Agency (no. of responses)	Very Helpful	Some Help	No Difference	Hinders Some	Hinders Lot	No Opinion
Broward County Transit (150)	5	25	66	1	1	3
Tri-Met (247)	34	55	8	2		1
	Operator Survey Responses (in percent of total)					
	Very Helpful	Somewhat Helpful	No Opinion	Somewhat Unhelpful	Very Unhelpful	
Valley Transportation Authority (195)[a]	34	40	7	14	6	

[a]*Source:* Santa Clara Valley Transportation Authority and Santa Cruz Metropolitan Transit District (*4*).

into traffic from a bus stop than the safety benefits perceived by the CMBC and Tri-Met operators. The location and type of yield sign appear to be factors in the level of perceived safety of the operators from the three transit agencies. The yield decals are positioned higher on the CMBC buses than the BCT buses, and although the yield sign is in the same location on the Tri-Met and BCT buses, the Tri-Met buses are equipped with an active yield signal and the BCT buses with passive yield decals.

Yield to Bus Helpfulness to Operators

Three of the surveys contained a question concerning the amount of help the YTB sign provided the operator while driving the bus. A summary of the responses is presented in Tables 25 and 26. There is a large difference in the responses to the survey questions concerning the helpfulness of the YTB sign to driving of (or operation of) the bus between the BCT operators and the VTA and Tri-Met opera-

TABLE 26
PERCEPTIONS OF THE HELPFULNESS OF THE YIELD TO BUS SIGN (combined response options)

Transit Agency (no. of responses)	Operator Survey Responses (in percent of total by transit agency)			
	Very Helpful Some Help	No Difference	Hinders Some Hinders Lot	No Opinion
Broward County Transit (150)	30	66	2	3
Tri-Met (247)	89	8	2	1
	Operator Survey Responses (in percent of total)			
	Very Helpful Somewhat Helpful	No Opinion	Somewhat Unhelpful Very Unhelpful	
Valley Transportation Authority (195)[a]	74	7	20	

[a]*Source:* Santa Clara Valley Transportation Authority and Santa Cruz Metropolitan Transit District (*4*).

TABLE 27
OPERATOR PERCEPTIONS OF POLICE ENFORCEMENT OF YIELD TO BUS LAWS

Transit Agency (no. of responses)	Operator Survey Responses (in percent of total by transit agency)					
	Most of the Time	Some of the Time	Seldom	Never	No Opinion	No Response
Broward County Transit (150)	1	1	3	75	20	
Coast Mountain Bus Company (167)	1	2	8	79	10	
Tri-Met (247)	2	1	13	64	19	2
Average of agency responses	1	1	8	73	16	1

tors. Both the VTA and Tri-Met buses are equipped with active yield signs, whereas the BCT buses have a passive yield decal. The location of the yield signs are the same for BCT and Tri-Met, whereas the location of the yield sign is higher (midway and on the left side) for the VTA buses. Although there may be other factors that are influencing the responses, the type of yield sign used appears to be a factor in the perceptions of the operators.

Police Enforcement of Yield to Bus Laws

Three of the surveys contained questions concerning enforcement of YTB laws. A comparison of the responses is given in Table 27. The issue of police enforcement of YTB laws appears to be the same for all agencies when operator responses are examined. This issue (the perceived lack of enforcement) was one of the most frequent of the written comments of operators from all five of the surveys, and a point of frustration. Many of the written comments implied that there was no police enforcement of the YTB law. Because it is unlikely that the level of enforcement will dramatically increase, perhaps some emphasis during operator training on YTB could be made so that operator expectations on YTB law enforcement are consistent with the levels of enforcement that can (or will) be provided by local police. For undetermined reasons, the operators from Tri-Met appear to have a slightly higher level of enforcement than the other two transit agencies. However, approximately 30 of the police positions assigned to transit operations in Portland are paid for by Tri-Met.

Responses to Other Survey Questions

Several of the surveys had questions that addressed specific areas of interest of the transit agency. The responses to these areas of interest are provided here.

Two questions on the Metro Transit survey concerned a recent campaign to raise the level of public awareness of the Washington State YTB law. The specifics of the campaign are discussed in chapter three. One question asked whether the operator was aware of the campaign, and the second asked if there had been a change in the percentage of motorists yielding after the campaign. Summaries of the responses to these questions are provided in Table 28. The campaign seems to have had some small positive effect on the percentage of motorists yielding for buses signaling to merge into traffic.

Two of the surveys included a question on how often the operator used the yield signal. This question would only have meaning for those using an active yield signal. A summary of the responses is given in Table 29. The responses from the two transit agencies on the use of the yield signal are very similar. A few of the operator comments also addressed this topic, but there was no consensus as to how often the yield signal should be used.

Two of the operator surveys contained a question on the frequency that operators were given a negative reaction from a motorist when they used the yield signal to merge into traffic. This question would only have meaning for those agencies using an active yield signal. A summary of

TABLE 28
PUBLIC AWARENESS CAMPAIGN OF FIVE TRANSIT AGENCIES IN THE SEATTLE AREA

Survey Question	Operator Responses (in percent of total)			
	Yes		No	
"Are you aware of the campaign . . . ?"	50		50	
	Large Increase	Moderate Increase	Small Increase	No Change
". . . change in percentage of motorists yielding . . . ?"	1	9	34	56

Notes: Number of responses = 158.

TABLE 29
HOW OFTEN DO YOU USE THE YIELD SIGNAL?

Transit Agency (no. of responses)	Survey Responses (in percent of total by agency)				
	Always	Most of the Time	Some of the Time	Rarely	Never
Tri-Met (247)	38	43	16	2	0
Valley Transportation Authority (195)[a]	45	32	18	4	0

[a]*Source:* Santa Clara Valley Transportation Authority and Santa Cruz Metropolitan Transit District (*4*).

TABLE 30
FREQUENCY OF OPERATORS RECEIVING A NEGATIVE RESPONSE FROM MOTORISTS WHEN USING THE YIELD SIGNAL

Transit Agency (no. of responses)	Survey Responses (in percent of total by agency)					
	Very Often	Somewhat Often	Not Often	Never	No Opinion	No Response
Valley Transportation Authority (195)[a]	29	34	24	6	8	
Tri-Met (247)	13	26	47	10	3	1

[a]*Source:* Santa Clara Valley Transportation Authority and Santa Cruz Metropolitan Transit District (*4*).

TABLE 31
DIFFERENCE IN EFFECTIVENESS OF YIELD SIGNAL—DAY VERSUS NIGHT

Question (no. of responses)	Survey Response (in percent of total)			
	Day	Night	No Difference	No Response
"Is the YTB light more effective . . . ?" (247)	2	30	65	3

the responses is given in Table 30. The experiences of the operators from the two transit agencies are similar, with the Tri-Met operators appearing to have somewhat more supportive motorists.

The Tri-Met survey included a question on whether the yield signal was more effective during day or night conditions. A summary of the responses is given in Table 31. Approximately two-thirds of the Tri-Met operators perceived no difference on the effectiveness of the yield light between day and night conditions. The yield light does appear to be slightly more effective during night conditions, which is an expected response, because the flashing light would be more visible at that time.

There were two other questions that were included in some of the surveys: one concerned the number of years of experience the respondent had driving a bus, and the other sought information on whether the operator was using the yield signal properly. The responses to these questions may be found in Appendix D.

Overall Effectiveness of Yield to Bus Programs

All five surveys included questions that addressed the effectiveness of the YTB law or program. This question is simple in its wording, but complex in the factors that could influence the responses. There were minor wording differences among some of the questions in four of the surveys, and the VTA survey question was worded somewhat differently and provided for different response options (see Appendix D for the comparison of these questions). However, it was concluded that all of the questions on the topic of the effectiveness of YTB programs were basically asking for the same information. Therefore, the responses to this question were examined as if there were only a single question. A summary of the operator responses to the questions on overall effectiveness is given in Tables 32 and 33. The responses indicated that the VTA and Tri-Met operators were the most satisfied with their YTB programs, in sharp contrast to the operators of BCT and Metro Transit, who were the least satisfied. The operators of CMBC fell

TABLE 32
OPERATOR PERCEPTIONS ON THE EFFECTIVENESS OF THEIR YIELD TO BUS LAWS AND PROGRAMS (individual response options)

	Operator Survey Responses (in percent of total by transit agency)					
Transit Agency (no. of responses)	Excellent	Good	Satisfactory	Fair	Poor	No Response
Broward County Transit (150)	1	5	2	21	70	
Coast Mountain Bus Company (167)	6	16	13	19	46	
Metro Transit (158)	1	4	10	26	58	1
Tri-Met (247)	12	29	17	25	17	
Average of agency responses	5	14	10	23	48	
	Operator Survey Responses (in percent of total)					
	Very Effective	Somewhat Effective	No Opinion	Somewhat Ineffective	Very Ineffective	
Valley Transportation Authority (194)[a]	28	32	11	14	15	

[a]*Source:* Santa Clara Valley Transportation Authority and Santa Cruz Metropolitan Transit District (*4*).

TABLE 33
OPERATOR PERCEPTIONS ON THE EFFECTIVENESS OF THEIR YIELD TO BUS LAWS AND PROGRAMS (combined response options)

	Operator Survey Responses (in percent of total by transit agency)		
Transit Agency (no. of responses)	Excellent, Good, and Satisfactory	Fair and Poor	No Response
Broward County Transit (150)	8	91	
Coast Mountain Bus Company (167)	35	65	
Metro Transit (158)	15	84	1
Tri-Met (247)	58	42	
Average of agency responses	29	70	
	Operator Survey Responses (in percent of total)		
	Very and Somewhat Effective	Somewhat and Very Ineffective	No Opinion
Valley Transportation Authority (194)[a]	60	29	11

[a]*Source:* Santa Clara Valley Transportation Authority and Santa Cruz Metropolitan Transit District (*4*).

TABLE 34
SUMMARY OF OPERATOR SURVEY RESPONSES WITH COMMENTS

			Comment Topics[a] (in percent of total by agency)			
Transit Agency	No. of Responses	No. with Comments	Public Education	Enforcement	Yield Sign	Other
BCT	150	53 (35%)	45	32	34	15
CMBC	167	52 (31%)	35	55	8	29
Metro Transit	158	94 (59%)	27	48	13	26
VTA[b]	195	43 (22%)	26	70	7	14
Tri-Met	247	138 (56%)	37	53	13	26
Column totals and averages	917	380 (41%)	34	52	15	22

[a]Comments with multiple topics were counted under each topic; therefore, row sums may be more than 100 percent.
[b]*Source:* Santa Clara Valley Transportation Authority and Santa Cruz Metropolitan Transit District (*4*).

about mid-way between those two groups in their satisfaction with their YTB program. The reasons for the differences in responses are undoubtedly complex, but are probably the result of how the individual programs were implemented; that is, the type and location of the yield sign, the amount of public awareness and education conducted, and other factors such as a Thanks for the Brake program.

ANALYSIS OF OPERATOR SURVEY WRITTEN COMMENTS

Many of the operator survey responses, approximately 41%, contained written comments to augment or emphasize the responses to the survey questions. A summary of the written comments by topic areas is given in Table 34. For a majority of the transit agencies the most frequent comment topic concerned enforcement (or the lack thereof) of the YTB law. The higher percentage of VTA operator comments concerning enforcement may be because of the newness of their YTB program and the frustration of not having expectations met. Also, that their YTB program is a demonstration project with only two participating transit agencies in California participating may also be a factor. The exception was for the BCT operators, where public education and awareness was the most frequent comment topic. The type and location of the yield sign was the second most frequent topic of concern for the BCT operators. The BCT yield sign has the combined disadvantages of being placed in a low location and being a passive decal sign. Many of the BCT comments emphasized the need for a larger, more visible yield sign. A high percentage of the comments from all transit agencies concerned the need for more and continued public education of the YTB law.

CHAPTER SIX

CONCLUSIONS

This synthesis research investigated the use and experience of the transit industry with Yield to Bus (YTB) programs. Transit agencies in British Columbia, California, Florida, Oregon, and Washington were examined to learn about their experiences with YTB programs. The study involved several tasks, including

- A survey of transit agencies in these states and province that provide fixed-route service to learn whether they had a YTB program, and if they did, what their experiences were;
- A survey of bus operators at four transit agencies to gather information on their insights and perspectives of their YTB programs;
- Reviews of documents and websites;
- An analysis of safety data from three transit agencies; and
- Six detailed on-site case studies.

The primary purposes of a YTB program are to reduce delays of buses merging into traffic from a bus stop and to enhance the safety of those merging operations. Whether YTB programs have been effective in achieving those objectives has not been completely answered. Some transit agencies were satisfied with the effectiveness of their YTB programs, whereas others were not. No quantitative data were found on the time savings effectiveness of such programs. A majority of the transit agencies reported some time savings improvements; however, all of their perceptions were anecdotal, primarily from their bus operators. Some data were found on the safety impacts of YTB programs. Although most transit agencies reported no safety problems, one agency provided data on the increase in accidents for buses leaving a stop that was attributed to their YTB program. It is concluded that in-depth and controlled studies are needed to determine whether a YTB program can be effective in saving time and does not have adverse safety impacts.

Detailed conclusions drawn from this research are outlined here.

- From the survey responses, transit agencies expressed mixed evaluations of their YTB programs—some were pleased and some were not. The level of satisfaction varied by location (the state or province), the magnitude of their public education campaigns, and the type of yield sign used. The three transit agencies where the YTB programs had strong management support also rated their YTB programs more favorably (good).
  - Transit agencies in British Columbia, California, and Oregon all, with one exception, rated their YTB programs very favorably (from "satisfactory" to "excellent")—a single agency in Oregon rated its YTB program as "fair."
  - The transit agencies in British Columbia and California that had conducted relatively large public education and awareness campaigns rated their YTB programs more favorably, either "excellent" or "good," than those agencies that had smaller campaigns.
  - All 10 transit agencies that used a flashing LED yield signal generally rated their YTB programs favorably (from "excellent" to "satisfactory"), with one exception: a single agency rated its program as "fair."
  - The nine transit agencies that used only a yield decal were less satisfied and rated their YTB programs as either "fair" or "poor," with one exception. The one agency that was pleased with its YTB program (rating it as "good") had also conducted a large public education campaign when their program was implemented and its YTB program had the strong support of management.
- The five transit agencies from British Columbia rated their YTB programs as very effective, four as "good" and one as "excellent." The two larger systems indicated that YTB program success was linked to their Thanks for the Brake programs that had been in existence for 25 years prior to the implementation of the YTB law. The Thanks for the Brake program has developed a more friendly and courteous environment between motorists and bus operators.
- None of the YTB laws provided any funds for public education. Only the California YTB law (a demonstration program) required the participating transit agencies to develop and carry out public education campaigns. No other YTB laws addressed the subject of public education.
- Only in British Columbia were there funding resources provided by other stakeholders for the public education campaigns on the YTB law. The other stakeholders included the Insurance Corporation of British Columbia, the insurance provider for public and private motor vehicles, the Automobile Association of British Columbia, and various provincial governmental and police agencies.

- The combined cost for public education campaigns of the two transit agencies in California was approximately $249,000. The cost of the public education campaigns for British Columbia was more than $500,000 CAN (about $325,000 US).
- News releases, radio public service announcements, newspaper advertisements, and information signs on the rear of the buses were the most frequently used methods to inform the public about the new YTB laws. Television news interviews, billboards, handouts, and posters in public places were also frequently used.
- Transit agencies reported that the most effective methods for public education were signs on the rear of their buses, radio public service announcements, television news interviews, newspaper advertisements, and news releases. The use of television was considered very effective because of its potential for reaching large numbers of people, but was also considered too expensive, and was only used when it could be done as a news event or public service announcement.
- Transit agencies used many methods to inform their employees of the new YTB laws. The most frequently cited methods included employee meetings, articles in employee newspapers and magazines, and posters on bulletin boards. Other means included flyers in pay envelopes, memos, and e-mail messages.
- The transit agencies used a mix of classroom and in-vehicle training to instruct their operators about the YTB laws. All placed particular emphasis on the appropriate use of the yield sign and the operator's responsibilities under the YTB law. The operator's obligation was unchanged. All YTB laws require that a bus operator drive with caution and consideration of the safety for all persons using the roadway.
- Those transit agencies that used a yield decal had essentially no changes in the training of their operators. The transit agencies using the flashing light-emitting diode (LED) yield sign provided training on the use of the YTB controls. Only three transit agencies reported providing refresher training on YTB operations for their operators. All transit agencies reported that the costs for the operator training were insignificant.
- Only California and Oregon YTB laws specify the use of a particular type of yield sign—a flashing light. All transit agencies in the United States use the same flashing LED yield signal. The yield signal is a flashing red triangle boarder with the word "Yield" flashing in the darkened center of the triangle. Some transit agencies in British Columbia use a white flashing LED yield signal (the word "Yield") in addition to the official yield decal.
- Transit agencies in Florida, Washington State, and British Columbia use yield decals that vary in size from 6 to 18 in. and that display a red or black triangle on a yellow background with "Yield" or "Yield for Buses" messages. The decals use reflective pigments and are self-adhesive.
- The costs for an installed electronic LED yield sign ranged from $250 to $600 per bus for U.S. agencies and from $600 to $800 CAN ($390 to $520 US) per bus for the transit agencies in British Columbia. The costs for the yield decals ranged from $5 to $20 per decal.
- The preferred location (two-thirds of the transit agencies) for the yield sign (decal or electronic sign) was approximately half way up and to the left side on the rear of the bus. The other location used by the transit agencies was in the lower-left corner of the bus rear panel, just above the bumper. The reason given for selecting the higher location was that the yield sign would be more visible to the second and third vehicles following the bus and that these were the vehicles most likely to yield. One system reported the need to move the location of their yield sign inward on some of their buses because of a conflict with the exhaust system at the original location. Finding an area that would be available for the yield sign for all buses in their fleets was reported by transit agencies as the most important consideration when selecting a location.
- Some transit agencies reported problems with advertisements on the back of the bus covering up some or all of the yield sign. Partial- or full-wrap advertisements are a problem in that they are more distracting to following motorists and can make a yield sign less visible.
- Approximately one-third of the respondents reported some improvements in schedule adherence because of their YTB operations, but none were able to provide any data to support their statements. All reports of improvements were based on anecdotal information, primarily from bus operators. Many claimed that it was not possible for them to credit any time improvement solely to the YTB program because of the many factors that can influence schedule performance.
- The transit agencies were divided on whether complaints had increased with their YTB programs. Nine reported that there had been no change and seven reported some increases in complaints of aggressive driving by operators; in other words, the bus cutting them off. The increases in complaints ranged from 2% to more than 200% at one agency. One Florida transit agency reported that they discontinued their YTB program because of its unpopularity with the public.
- The majority of the transit agencies (12 of 16) reported that they had not experienced any safety problems with their YTB program. Most of the transit

agencies reported that they did not have accident data that were specific to YTB operations. Those transit agencies reporting safety problems provided comments such as "more aggressive drivers," "operators need to continue to use good judgment," and a "huge increase in collisions when leaving bus zone."

- Three transit agencies provided data on bus zone accidents that were potentially YTB related. The number of accidents was small and not considered as an increase for two of the transit agencies. However, one transit agency reported a significant increase in the number of accidents (more than 200%) of a vehicle colliding with a bus leaving a bus zone with their YTB program. This evaluation was based on using the 5 years immediately before YTB operations as a basis for comparison with the 8 years of experience with their YTB program. Because of the large variance in the accident data, a longer period of evaluation was needed. Using an 8-year base period to compare with the 8 years with YTB operations, the increase in accidents was found to be 61%.
- The lack of enforcement of the YTB law was mentioned by almost all respondents, who reported that enforcement occurred less than 10% of the time. The only exceptions were for transit systems in British Columbia, where some transit agencies reported that enforcement was not needed. However, universally, including operators from Vancouver, the operators' responses to the survey question on the level of police enforcement were "seldom" or "never." Many bus operators commented that more enforcement could solve the problem of motorists not yielding.
- Approximately one-third of the transit agencies reported some time savings with their YTB programs for traffic conditions of low-speed and moderate-to-heavy traffic flows. None of the transit agencies provided any data to support their statements; all evidence was anecdotal.
- Most transit agencies reported either "no difference" or "unknown" in the number of accidents or the effectiveness of their YTB programs between day and night operations.

The following conclusions were drawn from the operator surveys.

- Four of the surveys asked about the percentage of motorists who yielded to buses when the buses signaled their intent to merge into traffic. A wide range in percentages was reported. The Tri-County Metropolitan Transportation District of Oregon (Tri-Met) and Santa Clara Valley Transportation Authority (VTA) reported the highest (both 71%), whereas Broward County Transit (BCT) and the King County Department of Transportation (Metro Transit) reported the lowest (8% and 12%, respectively). The operator responses reporting a higher percentage of motorists yielding were from systems that were using an active LED yield signal, whereas the reported lower percentages were from systems using a passive yield decal.
- Three of the surveys contained a question on the perceptions of safety. A majority of the responses from the Coast Mountain Bus Company (CMBC) and Tri-Met indicated that the operators felt safer with their YTB programs (69% and 86%, respectively). Of the BCT operators, 31% reported some increase in safety with their YTB program. A large majority of operators from all three agencies (CMBC, Tri-Met, and BCT) reported either "no change" or "some increase" in safety with their YTB programs (94% to 99%).
- Three of the surveys contained a question on the perceptions of whether the YTB program was helpful in operating the bus. A high percentage of operators from VTA and Tri-Met (74% to 89%, respectively) indicated that they felt their YTB program was of some help in operating the bus. A much lower percentage of operators from BCT (30%) indicated that they felt their YTB program was of some help in operating the bus. Tri-Met and VTA use an active LED yield signal and BCT uses a passive yield decal.
- Three of the surveys contained a question on the perceptions of police enforcement of their YTB law. A large majority of those operators (ranging from 77% to 87%) reported a low enforcement level, indicating "seldom" or "never" in their responses. For all five of the surveys, the lack of police enforcement of the YTB law was the most frequently written operator comment. The lack of enforcement was frequently linked to the operator's poor evaluation of their YTB program and to the low percentage of motorists yielding.
- Two of the surveys contained a question concerning operators receiving a negative reaction from motorists when they use the yield signal. This question would only have meaning for systems using an active yield signal. The percentage of operators reporting that they had received a negative reaction from motorists either "somewhat often" or "very often" ranged from 39% for Tri-Met to 63% for VTA.
- All of the operator surveys contained a question on the overall effectiveness of their YTB programs. The percentages of operators who felt their YTB program was effective (i.e., "excellent," "good," or "satisfactory") ranged from 8% to 60%. The operators from Tri-Met and VTA were the most satisfied with their YTB programs (58% and 60%, respectively, rating their YTB programs as "excellent," "good," or "satisfactory"). The operators from Metro Transit and BCT were the least satisfied, with 84% to 91%, respectively, rating their YTB programs as either "fair" or "poor." The CMBC operators were approximately

half way between, with 35% rating their YTB program as effective (i.e., "excellent," "good," or "satisfactory"). The reasons for the differences in the operators' perceptions on the effectiveness of their YTB programs are varied and complex. Some of the ratings, however, appear to be related to how the individual YTB programs were implemented; that is, the type and location of the yield sign, the amount of public awareness and education conducted, and other factors such as a Thanks for the Brake program.

From the findings of the case studies and survey responses, several factors that appear to lead to a more effective YTB program have emerged. These factors and YTB program phases where transit management could concentrate their resources are summarized here.

- Legislation phase—First, it is important to identify and engage as many of the stakeholders as possible early in the legislative process. It is useful to know and understand the concerns of the stakeholders that oppose (at least initially) the YTB legislation. Dialog and consensus building are effective processes to resolve various concerns, to lead to "buy in" by stakeholders on the need to mitigate the merge delays that are occurring, and to build partnerships for sharing some of the costs of implementing a YTB program (e.g., public awareness and education campaigns). Law enforcement agencies need to understand transit's needs for a YTB law and to participate during the legislative process to ensure that the wording of the law addresses their concerns and, hopefully, to ensure their willingness to enforce the YTB law. For consistency, the YTB law should include wording on the type of yield sign to be used and where and when it can be used (i.e., the type of bus stop and speed limits of the street/road).
- Education phase—There are two primary groups that need education on the YTB program, motorists (e.g., auto, commercial truck, and taxi drivers) and transit employees (in particular, the operators).
  - The public awareness and education campaigns need to be significant and to be ongoing to be effective. Examples of good multi-media public awareness campaigns are summarized in the case studies. Several of these agencies emphasized the need for continual motorist educational refresher efforts. The need for more and continued public education was a frequent comment in the operator survey responses. Periodic meetings with local commercial fleet operators and flyers on the YTB program for their bus drivers were reported as effective educational tools. The addition of the YTB law as a question on motor vehicle license tests is seen as an effective means to educate motorists. The periodic placement of YTB program public information messages on the rear busboard was reported as an effective and low-cost method of positive reinforcement to motorists of the YTB program.
  - The transit employee YTB educational efforts can be effectively accomplished through posters, e-mail messages, flyers in pay envelopes, and small group education meetings. The operators are the most important employee group to train so that a consistent and comprehensive understanding of their responsibilities with the YTB law is known and understood by all. Emphasis needs to be made that *the operator's* responsibility for safe merging operations has not changed under the existing YTB laws—that right-of-way is *given by motorists*, not taken by the operator. Also, operator training needs to point out the practical limitations of YTB enforcement and that they should not have unrealistic expectations on the level of enforcement of the YTB law. All of the case studies and a majority of the operator responses indicated that a low level of enforcement is the norm, and it is unlikely to increase substantially.
- Development and locations of YTB sign—Transit agencies with an active YTB signal reported being more satisfied with their YTB programs than those using a passive yield decal. The flashing LED yield signal was preferred by all case study agencies over a decal, although in some cases the higher cost of the active yield signal was considered to be prohibitive. An increase in the size (and brightness) of the yield signal in current use in the United States was recommended by some transit agencies. Ideally, the location of the yield signal would be standardized—on the local transit fleet and throughout all states. The preferred location was one that was mid-height and to the left side on the rear of the bus. This location would lessen conflict with advertisements on the rear of the bus and is more likely to be seen by following drivers who are in position to yield to a bus merging into the traffic from a stop.
- Traffic conditions—The responses from transit agencies indicated that more time savings from their YTB programs was obtained under traffic conditions where the speeds were lower—generally less than 25 mph. For safety reasons the YTB laws in Europe and Canada generally contain a maximum speed limit for streets/roads where the YTB law can be used. In British Columbia, the YTB law is only in effect for areas where the speeds are less than 60 km/h (about 37 mph).
- Driver courtesy—The Thanks for the Brake program that has been in place for 25 years was reported to be a major factor in the success of the YTB programs in British Columbia. Through feedback from focus groups and their market research efforts, the CMBC found their Thanks for the Brake program to be very

important for public acceptance of the YTB law and public satisfaction with their transit operations. It appears to have promoted a more personal and friendly relationship between motorists and bus operators. Rather than yielding to a transit bus, the motorist is yielding to another person, and receiving a thank you for their courtesy.

- Evaluation phase—As for all programs, the YTB program should be evaluated periodically to determine whether changes are needed (including cancellation). Ideally, a transit agency considering a YTB program would have defined the problem to be solved (e.g., an increase in transit operational effectiveness and increased safety of merging operations from stops) and have collected data on operations (i.e., schedule speeds and adherence, delays at stops, and safety data on merging from a stop) before the implementation of a YTB program. These data then provide a baseline for periodically evaluating whether the YTB program is an effective tool in solving the problem. Also, periodic evaluation often provides insight for needed program changes that will enhance program effectiveness.

Increases in traffic and congestion in our urban areas will undoubtedly continue into the foreseeable future. Therefore, the problems associated with buses merging into the traffic flow are not going to diminish, and they are likely to increase. The primary objectives of a YTB program are to reduce delays of buses merging into traffic from a stop and to enhance the safety of those merging operations. Three areas for future study were identified.

- No quantitative data were found on the time savings effectiveness of YTB programs or the disadvantages to motorists. A majority of the responding transit agencies reported some time savings improvements, but all of their perceptions were based on anecdotal information, mostly from operators. Some data were found that accidents had increased for buses merging from a stop into traffic, and the increase was attributed to their YTB program. However, it is not clear what portion of the increase in accidents could be also attributed to increases in traffic congestion, increases in fleet vehicle-miles, and in the changes in motorist behavior and courtesy. Again, data are needed from several transit agencies before making a determination as to the safety implications of YTB programs.

  It is suggested that more in-depth and controlled studies be undertaken to resolve the issues of YTB impacts on transit operational efficiencies and safety. These studies would include

  – The development of methods to measure the time savings in transit operations and the time lost to motorists because of YTB programs, and the undertaking of controlled evaluation studies at several transit agencies to determine whether time savings are realized because of YTB programs.
  – The undertaking of controlled studies of the accident data from several transit agencies to determine whether changes in accident rates have resulted because of YTB programs.
- The Thanks for the Brake programs in British Columbia were reported to have provided an environment that facilitated the success of their YTB programs. Operators at Tri-Met are beginning to employ the practice and reported it to be effective. A study is suggested to investigate the potential of a nationwide Thanks for the Brake program. The promotional burden could be shared by many transit agencies, transit associations, insurance companies, government agencies, and other stakeholders. The costs to implement would be modest and the benefits could be a more friendly and courteous environment on the roadways, as well as more efficient transit operations.
- The lack of police enforcement of YTB laws was considered to be a problem by most surveyed transit agencies and bus operators. A study is suggested to investigate the reasons for the low enforcement of YTB laws and what initiatives could be undertaken to increase the level of enforcement.

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ACRONYMS AND ABBREVIATIONS

AB	Assembly Bill
AC Transit	Alameda–Contra Costa Transit District
ATU	Amalgamated Transit Union
BCT	Broward County Transit
CAN	Canadian (dollar)
CHP	California Highway Patrol
CMBC	Coast Mountain Bus Company
CSAA	California State Automobile Association
CUTA	Canadian Urban Transit Association
CVC	California Vehicle Code
GVTAA	Greater Vancouver Transportation Authority (TransLink)
ICBC	Insurance Company of British Columbia
LED	light-emitting diode
Metro Transit	King County Department of Transportation
OCTA	Orange County Transportation Authority
OC Transpo	Ottawa–Carleton Regional Transit Commission
PSA	public service announcement
RSW	Revised Code of Washington
SB	Senate Bill
SCMTD	Santa Cruz Metropolitan Transit District
Tri-Met	Tri-County Metropolitan Transportation District of Oregon
VTA	Santa Clara Valley Transportation Authority
VTM	vehicle-miles travelled
YTB	Yield to Bus

APPENDIX A

Survey Questionnaire

TRANSIT COOPERATIVE RESEARCH PROGRAM

Synthesis Topic SA-13

Yield to Bus Programs—State of the Practice

Questionnaire

The states of California (demonstration basis), Florida, Oregon, and Washington and the province of British Columbia have passed legislation for yield to bus programs. These programs share a common goal of enabling a bus to quickly and safely reenter the traffic lane after stopping in a bus stop to board or drop off passengers. While these programs share a common goal, their implementations and experiences have been different.

The purpose of this survey is to gather information on existing yield to bus program implementations and experiences so that other transit agencies can benefit when considering the establishment of similar programs. How was the program implemented at the various transit agencies? What agencies and organizations were involved in the implementation and what were their roles? How were the implementation costs funded and how much were they? How was public awareness and acceptance accomplished? How were the local police and traffic engineers involved? Has the program been effective in reducing delays or reducing accidents? What program features have worked best, and what has not worked? Under what traffic environments has the priority measure worked best? Under what traffic environments have there been problems? How were employees made aware of the program, and how were they trained? What priority sign on the bus is used, and what has been the experience?

General Information on Transit System

Transit Agency Name _____

Address _____
(Street)

_____
(City) (State/Province) (Zip/Postal Code)

Contact Name/Title _____ Date _____

Telephone _____ Fax _____ E-Mail address _____

Service area size _____ Service area population _____
(Indicate if in square kilometers)

Total size of active fleet _____ Total annual unlinked passenger trips _____

Does your agency have a Yield to Bus program? [ ] Yes [ ] No

If yes, please complete the rest of the survey.

If no, please return the survey with the above information.

Transit System Description and Services Provided

Size of fixed-route active fleet _____ Total number of stops _____

Number of routes _____ Total length of directional-route miles _____
(Indicate if in kilometers)

Does your Yield to Bus (YTB) program include your paratransit fleet? [ ]Yes [ ] No

What is the size of the paratransit fleet _____ and the annual ridership (PT) _____

Reasons for YTB Implementation at Your Agency (check all that apply)

[ ] To reduce traffic delays for buses reentering the traffic lane [ ] To improve schedule speed
[ ] To facilitate safe reentry of bus into traffic lane [ ] Other _____

Who Championed Your YTB Implementation? (check only the one that most applies)

[ ] General Manager/CEO [ ] Operations Management [ ] Operators [ ] Board Members
[ ] Local Government [ ] Labor Unions [ ] Other _____

Public Education of Yield to Bus Operations

1. Did you conduct a public awareness campaign concerning the Yield to Bus (YTB) law?
   [ ] Yes [ ] No. If yes, please fill out the following table. Please indicate with check marks all approaches used and your evaluation of how effective they were.

Public Educational Approaches	Used	Effectiveness Rates				
		Excellent	Very Good	Satisfactory	Fair	Poor
Radio Public Service Announcements						
TV Public Service Announcements						
Radio Interviews/Talk Shows						
TV News Interviews						
Newspaper Advertisements						
Billboards						
Posters in Stores, Libraries, Offices, etc.						
Posters/Signs on Buses						
Handouts/Pamphlets						
News Releases						
Public Meetings						
DMV License Test Question						
Other _____						

2. Were your YTB public awareness campaign costs significant? [ ] Yes [ ] No. If yes, please provide an estimate of the amount. _____

3. Did other organizations assist you in your public awareness campaign? [ ] Yes [ ] No
   Type of assistance provided? [ ] Funding [ ] Public Support [ ] Other _____

4. Who provided assistance? [ ] Auto Associations [ ] Unions [ ] Insurance Carriers
   [ ] Local Government Agencies [ ] Other _____

Employee Training and Awareness Programs (check all that apply)

1. How were employees made aware of your YTB program?
   [ ] Staff Meetings [ ] Articles in Employee Newspaper [ ] E-Mail [ ] Posters
   [ ] Pamphlet in Pay Envelope [ ] Other _____

2. How were your existing operators trained in the proper use of the YTB signals?
   [ ] Class Room Instruction [ ] In-Vehicle Training [ ] Other _____

3. Has refresher training on YTB operations been given to your operators? [ ] Yes [ ] No

4. Were your employee YTB training costs significant? [ ] Yes [ ] No. If yes, please provide an estimate of the amount.

   _____

YTB Bus Modifications

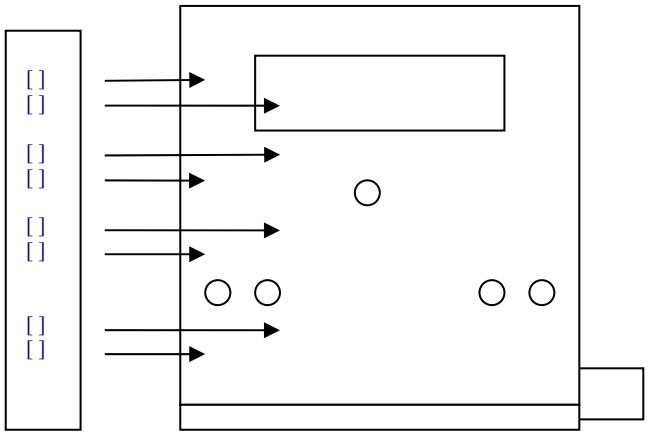
1. What YTB display(s) are used on the rear of your buses to alert following motorists of their responsibility to yield to the bus?
   [ ] A passive yield sign that is used in conjunction with the turn signals.
   [ ] An active yield sign with flashing lights that is used in conjunction with the turn signals.
   [ ] A printed message informing motorists of the requirement to yield.
   [ ] Other _____

2. Does your YTB display use the triangular international "yield" symbol? [ ] Yes [ ] No

3. What type of control is used to activate the YTB display? [ ] Hand Operated Button/Switch
   [ ] Foot Operated Button/Switch [ ] Other _____

4. Are the YTB controls and locations the same for all vehicles? [ ] Yes [ ] No

Check the approximate location of your YTB display in the sketch below.



5. Did any issues/conflicts arise when selecting the location of the YTB display? [ ] Yes [ ] No. If yes, please explain:

   _____

6. Are there other messages, such as, “Thanks for the Brake” on the rear of your buses? [ ] Yes [ ] No. If yes, what is the message? _____

7. What were the approximate costs per vehicle for your YTB modification? _____

8. Are photos available of your YTB display on a bus? [ ] Yes [ ] No

Operational Issues and Changes

9. Is a YTB display check included in the operator pre-trip inspection? [ ] Yes [ ] No

10. What actions are taken when the YTB display fails the pre-trip inspection?
[ ] Bus is sent to maintenance for repair. [ ] Bus is released for revenue service.

11. What actions are taken when the YTB display fails while in revenue service?
[ ] Bus continues in revenue service and failure is reported in operator’s report.
[ ] Failure is reported, and bus is either repaired or is pulled from service.
[ ] A replacement bus is dispatched.
[ ] Other _____

12. Are there situations, such as, routes, times of day, or traffic conditions where you do not use the YTB display to assist the operator in pulling out from a bus stop? [ ] Yes [ ] No. If yes, please explain: _____

Operating Experiences: Benefits and Problems

13. Have improvements occurred in schedule adherence on some routes due to YTB operations?
[ ] Yes [ ] No. If yes, are data available? [ ] Yes [ ] No

14. Were there other initiatives (i.e., schedule changes, signal priority, etc.) undertaken during this same time period that could have affected on-time performance? [ ] Yes [ ] No
What were these initiatives? _____

15. Have changes been made to routes because of your YTB operations? [ ] Yes [ ] No. If yes, please explain: _____

16. Have changes been made in the location of bus stop zones to better accommodate YTB operations?
[ ] Yes [ ] No. If yes, please explain: _____

17. Have changes been made to your schedules due to your YTB operations? [ ] Yes [ ] No

18. Has the number of bus stop zone accidents/incidents changed due to YTB operations?
[ ] Yes [ ] No. How have they changed? [ ] Decreased [ ] Increased
Are accident/incident statistical data available? [ ] Yes [ ] No

19. Have insurance costs changed significantly due to YTB operations? [ ] Yes [ ] No. If yes, have they [ ] Increased or [ ] Decreased Please provide an estimate _____

20. Have any YTB display or control hardware problems occurred? [ ] Yes [ ] No. If yes, please explain: _____

21. How well do motorists comply to your YTB operations? Please provide your best estimate.
[ ] Almost always (more than 90% of the time) [ ] Most of the time (60 to 90%)
[ ] About half of the time (40 to 60%) [ ] Some of the time (10 to 40%)
[ ] Seldom (less than 10%) Comments:_____

22. Have complaints from motorists increased because of YTB operations? [ ] Yes [ ] No. If yes, would you provide an estimate of the increase? _____

23. Under which traffic conditions have your YTB operations been effective in saving time? Indicate with a check mark in the appropriate column where time savings have been observed or reported. Leave blank where you do not have experience with the traffic condition.

Traffic Conditions	YTB Experiences Time Savings		
	Significant	Some	None
Congested stop-and-go flow			
Very low speeds (10–15 mph) with moving heavy-traffic flows			
Low speeds (15–25 mph) with moving heavy-traffic flows			
Low speeds (15–25 mph) with moving moderate-traffic flows			
Moderate speeds (25–45 mph) with moving moderate-traffic flows			
Other _____			
Other _____			

24. For which street designs have your YTB operations been effective in saving time? Indicate with a check mark in the appropriate column where time savings have been observed or reported. Leave blank where you do not have experience with the street design.

Street Designs	YTB Experiences Time Savings		
	Significant	Some	None
Single traffic lane per direction with street parking			
Multiple traffic lanes per direction with street parking			
One-way single traffic lane with street parking			
One-way multiple traffic lanes with street parking			
Other _____			
Other _____			

25. Which times of the day have the YTB operations been more effective in saving time?
[ ] Daytime [ ] Night [ ] No significant difference [ ] Unknown

26. Under which driving conditions have YTB operations been more effective in saving time?
[ ] Good visibility [ ] Poor visibility [ ] No significant difference [ ] Unknown

27. Under what weather conditions have YTB operations been more effective in saving time?
[ ] Dry [ ] Wet/rainy [ ] Snow/ice [ ] Fog [ ] No significant difference [ ] Unknown

28. What has been your experience with police enforcement of the YTB law when an officer has observed (was in a position to observe) an obvious violation? Please indicate your perception.
[ ] Almost always (more than 90% of the time) [ ] Most of the time (60 to 90%)
[ ] About half of the time (40 to 60%) [ ] Some of the time (10 to 40%)
[ ] Seldom (less than 10%) Comments: _____

29. Have there been any safety problems experienced with your YTB operations? [ ] Yes [ ] No. If yes, please explain:

_____

_____

30. What have been your overall experiences with YTB operations? (please check one)
[ ] Excellent [ ] Good [ ] Satisfactory [ ] Fair [ ] Poor

31. What lessons have been learned? _____

_____

_____

Available Reports and Data (Please check those that are available)

[ ] Reports or data on accidents/incidents related to YTB operations
[ ] Reports or data on changes in schedule adherence related to YTB operations
[ ] Reports or materials on the public awareness campaign
[ ] Reports or data on complaints from the public due to YTB operations
[ ] Reports on employee training programs
[ ] Other, please identify _____

Additional Comments

_____

_____

_____

_____

_____

_____

_____

If you have any questions, please contact Rolland King at (614) 451-4195 or by E-mail at tordking@aol.com.

When completed, please return this survey to Rolland King by:

E-mail: tordking@aol.com
FAX: (614) 451-8189

Mail: 1266 Southport Circle
Columbus, OH 43235

Thank you in advance for your cooperation and participation in this study.

APPENDIX B

Transit Agency Participants

The following lists include the names of the transit agencies that provided information and assisted in this study.

Case Study Transit Agencies

- Broward County Transit
- Coast Mountain Bus Company
- King County Department of Transportation/Metro Transit
- Santa Clara Valley Transportation Authority
- Santa Cruz Metropolitan Transit District
- Tri-County Metropolitan Transportation District of Oregon

Transit Agencies—Survey Respondents and Information

- Albany Transit System
- BC Transit–Victoria
- Central Florida Regional Transportation Authority–LYNX
- City of Pullman—Pullman Transit
- Clallam Transit System
- Clark County Public Transportation Benefit Area Authority–C-Tran
- Escambia County Area Transit
- Farwest Coach, Inc.
- Farwest Transit Services, Inc.
- Hillsborough Area Regional Transit Authority
- Lakeland Area Mass Transit
- Lane Transit District
- Lee County Transit–Lee Tran
- Miami Beach Transportation Management Association
- Miami–Dade Transit
- Palm Tran—West Palm Beach
- Pierce Transit
- Pinellas Suncoast Transit Authority
- Powell River Transit
- Regional Transit System—Gainsville
- Sarasota County Area Transit
- Space Coast Area Transit
- Spokane Transit Authority
- Valley Transit

Other Organizations—Information

- America Public Transportation Association
- Canadian Urban Transit Association
- International Association of Public Transport—Bus Committee

APPENDIX C

Yield to Bus Laws

INTRODUCTION

In North America, seven states and provinces have passed "Yield to Bus" (YTB) legislation. The province of Quebec was the first to pass legislation to provide priority to transit buses when leaving a stop, and the state of California has been the most recent to pass such legislation. Information on the date, wording, and statute reference is provided below.

State of California

With the passage of Assembly Bill 1218, California's "Yield to Bus" law became effective on January 1, 2000. The law can be found in the California Vehicle Code (CVC) Section 21810, which establishes a pilot program commonly known as "Yield to Bus." The program began in April 2, 2001, and will be repealed in January 1, 2004, unless extended by statute. The wording of the code is provided below.

21810 Right-of-Way: Yielding to Buses

(a) The driver of a vehicle overtaking a transit bus shall yield the right-of-way to the bus if all of the following conditions are present:
  (1) The transit bus has entirely exited an active traffic lane to board or deboard passengers at a designated bus stop, and is attempting to reenter the lane from which it exited.
  (2) Directional signals on the transit bus are flashing to indicate that the bus is preparing to merge with traffic.
  (3) The transit bus is equipped with a yield right-of-way sign on the left rear of the bus. The sign shall be both of the following:
    (A) Designed to warn a person operating a motor vehicle approaching the rear of the bus that the person is required to yield the right-of-way to the bus when the bus is entering traffic.
    (B) Illuminated by a flashing light when the bus is signaling in preparation for entering a traffic lane after having stopped to receive or discharge passengers.

(b) Nothing in this section requires a transit agency to install the yield right-of-way sign described in paragraph (3) of subdivision (a).

(c) This section does not relieve the driver of a transit bus from the duty to drive the bus with due regard for the safety of all persons and property. Nothing in this section relieves the transit agency from complying with the standard of care for its passengers established by Section 2100 of the Civil Code.

(d) The provisions of this section are applicable to the Santa Cruz Metropolitan Transit District, the Orange County Transportation Authority, the Alameda–Contra Costa Transit District, and the Santa Clara County Transit District. If the governing board of the district approves a resolution, after a public hearing on the issue, requesting that this section be made applicable to it, and transmits a copy of the resolution to the commissioner.

(e)
  (1) Notwithstanding Section 7055.5 of the Government Code, on or before December 31, 2002, the commissioner, after consultation with the participating transit agencies, participating law enforcement, and the advisory committee established pursuant to paragraph (3) of subdivision (a) of Section 34501 of the Vehicle Code, shall report to the Legislature on the effectiveness of the right-of-way for transit vehicles established by this section, including, but not limited to, any impact on the highway and local road safety and the efficiency of transit operations. The report shall recommend whether or not the right-of-way established by this section should be made permanent on a local basis, and whether it would be effective if implemented on a statewide basis.
  (2) The commissioner, in consultation with the participating transit agencies, the California Transit Association, the advisory committee, and the participating local law enforcement agencies, shall identify the information required for preparation of the report required under paragraph (1). This information may include, but need not be limited to, all of the following:
    (A) The total number of traffic collisions causing fatalities or injuries, and the number causing only property damage,
    (B) Traffic congestion issues,
    (C) Public opinion issues,
    (D) Efficiency of transit operations,

(E) The public education program required under subdivision (i).

(3) The commissioner may develop a format and schedule for reporting the information identified under paragraph (2), and the local law enforcement agencies, transit agencies, and the California Transit Association shall provide the commission with the information by using that format and in compliance with that schedule.

(f) Each transit agency participating in the program shall undertake a public education program to inform motorists of the requirements imposed by this section.

(g) The base fine for a violation of subsection (a) is thirty-five dollars ($35).

(h) This section shall remain in effect only until January 1, 2003, and as of that date is repealed, unless a later enacted statute, that is enacted before January 1, 2003. (*The ending date for the statute has been extended to January 1, 2004.*)

State of Florida

The Yield to Bus law was added to the Florida State Uniform Traffic Control laws in July 1999. The purposes of the law are to improve safety for bus passengers and motorists and to improve the efficiency and service reliability of transit buses. In 1999 a new section was added to the Florida Statutes, Title XXIII, MOTOR VEHCILES Chapter 316, State Uniform Traffic Control providing right-of-way priority for transit buses when re-entering traffic from a designated pullout bay. The wording Section 316.815 is provided below.

316.815 Duty to yield to public transit vehicles.

(1) The driver of a vehicle shall yield the right-of-way to a publicly owned transit bus traveling in the same direction that has signaled and is reentering the traffic flow from a specifically designated pullout bay.

(2) This section does not relieve the driver of the public transit bus from the duty to drive with due regard for the safety of all persons using the roadway.

State of Oregon

During the 1997 Legislative session, Senate Bill 437 was passed that provides priority to transit buses when leaving a stop. The YTB law was established to improve safety for the driving public and transit bus occupants, and to improve the bus operator's ability to maintain schedules. The YTB law may be found in Oregon Revised Statutes (ORS) Chapter 811, Rules of the Road for Drivers. The text is given below.

811.167 Failure to yield right-of-way to transit buses, rules, penalty.

(1) A person commits the offense of failure to yield the right-of-way to a transit bus entering traffic if the person does not yield the right-of-way to a transit bus when:

(a) A yield sign as described in subsection (2) of this section is displayed on the back of the transit bus,

(b) The person is operating a vehicle that is overtaking the transit bus from the rear of the transit bus; and

(c) The transit bus, after stopping to receive or discharge passengers, is signaling an intention to enter the traffic lane occupied by the person.

(2) The yield sign referred to in subsection (1)(a) of this section shall warn a person operating a motor vehicle approaching the rear of a transit bus that the person must yield when the transit bus is entering traffic. The yield sign shall be illuminated by a flashing light when the bus is signaling an intention to enter a traffic lane after stopping to receive or discharge passengers. The Oregon Transportation Commission shall adopt by rule the message on the yield sign; specifications for the size, shape, color, lettering, and illumination of the sign; and specifications for the placement of the sign on a transit bus.

(3) This section does not relieve a driver of a transit bus from the duty to drive with due regard for the safety of all persons using the roadway.

(4) As used in this section, "transit bus" means a commercial bus operated by a city, a mass transit district established under ORS 267.010 to 267.390 or a transportation district established under ORS 267.510 to 267.650.

(5) The offense described in this section, failure to yield the right-of-way to a transit bus, is a Class D traffic violation [1997 c.509 s.2].

A Class D traffic violation is $75, listed under ORS 153.018 schedule of penalties, distribution of proceeds. Class D is the lowest fine.

State of Washington

The House Bill 1107 was passed in April 1993 by the state of Washington Legislature that added a new section to

Chapter 46.61, Rules of the Road, of the Revised Code of Washington (RCW). This new section provided priority for transit vehicles that have signaled to reenter the traffic flow. The text of the law is provided below.

RCW 46.61.220

Transit Vehicles:

(1) The driver of a vehicle shall yield the right-of-way to a transit vehicle traveling in the same direction that has signaled and is reentering the traffic flow.
(2) Nothing in this section shall operate to relieve the driver of a transit vehicle from the duty to drive with due regard for the safety of all persons using the roadway.

Province of British Columbia

During the 1998 Legislative Session of the Parliament, a section was added to the Greater Vancouver Transportation Authority Act (GVTAA) that was called "yielding to bus." With the passage of the GVTAA, a new section, 169.1, was added to the Motor Vehicle Act, Chapter 318, Part 3 entitled "Yielding to bus." The YTB law became effective on May 3, 1999. The text of Section 169.1 is given below.

Yielding to bus

169.1

(1) Subject to subsection (2), the driver of a vehicle on a highway, on overtaking a bus that is stopped, standing, or parked, must yield the right-of-way to the bus if:
  (a) the bus displays a sign or other signal device requiring the driver of the vehicle to yield to the bus, and
  (b) the bus driver has signaled an intention to move into the traveled portion of the highway.
(2) Subsection (1) applies if, at the point on the highway where the driver overtakes the bus, the applicable speed limit is not more that 60 km/h.
(3) Despite subsection (1), a bus driver must not move a bus into the traveled portion of the highway unless it is safe to do so.
(4) A sign or signal device referred to in subsection (1)(a) must not be displayed on any vehicle other than a bus that is:
  (a) Operated by or on behalf of:
    (i) British Columbia Transit under the *British Columbia Transit Act,* or
    (ii) the Greater Vancouver Transportation Authority under the *Greater Vancouver Transportation Authority Act*, or
  (b) Operated by or on behalf of a person or municipality as part of an independent transit service approved by the Greater Vancouver Transportation Authority under section 5 of the *Greater Vancouver Transportation Authority Act.*

Province of Ontario

A new section entitled "Requirement to yield to bus from bus bay" was added to the Highway Traffic Act in 1990 during the 1994 session of Parliament. This law is not in effect because the necessary regulations have never been made. The text of Part X, Rules of the Road, Section 142.1 is given below.

Requirement to yield to bus from a bus bay

142.1(1): Every driver of a vehicle in the lane of traffic adjacent to a bus bay shall yield the right-of-way to the driver of a bus who has indicated his or her intention, as prescribed, to re-enter that lane from the bus bay.

142.1(2): The driver of a bus shall not indicate his or her intention to re-enter the lane of traffic adjacent to a bus bay until the driver is ready to re-enter traffic.

142.1(3): No driver of a bus shall re-enter the lane of traffic adjacent to a bus bay and move into the path of a vehicle or street car if the vehicle or street car is so close that it is impractical for the driver to yield the right-of-way.

142.1(4): The Lieutenant Governor in Council may make regulations for the purpose of this Section.
  a) defining bus and bus bay;
  b) prescribing the manner in which a bus driver shall indicate his or her intention to re-enter the lane that is adjacent to a bus bay;
  c) prescribing signs, signal devices, and markings for bus bays;
  d) prescribing the standards, specifications and location of the signs, signal devices, and markings;
  e) prescribing standards for operating and maintaining any signal devices prescribed under Clause (c).

Province of Quebec

On April 1, 1982, the government of Quebec proclaimed into law Bill 104 that requires motorists to yield the right-of-way to a bus leaving a stop. The text of the YTB law

can be found in the Highway Traffic Code, Rules of the Road, Clauses 382 through 385, and is provided below.

> Clause 382: The operator of a bus or a minibus shall, while loading or unloading passengers, bring his vehicle to a stop at the right edge of the roadway or at specific zones designed for this purpose.
>
> Clause 383: The authority with jurisdiction over the maintenance of a roadway can designate stopping zones that it must designate with appropriate signing.
>
> Clause 384: Within the limits of a town or city, the operator of a motor vehicle shall yield right-of-way to a bus when the operator of the bus has activated his turn signal for the purpose of re-entering the traffic lane in which he operated before coming to a stop.
>
> This obligation to yield the right-of-way rests only with the motorists traveling in the lane that the bus operator wishes access to.
>
> Clause 385: The bus operator shall only activate his turn signals at the moment he is ready to re-enter the traffic lane and after assuring that the lane change maneuver can be completed without risk.

APPENDIX D

Operator Surveys of Five Transit Agencies

INTRODUCTION

Surveys of operator perceptions of their Yield to Bus (YTB) programs were conducted at four transit agencies during this study: Broward County Transit (BCT), Coast Mountain Bus Company (CMBC), King County Department of Transportation (Metro Transit), and the Tri-County Metropolitan Transportation District of Oregon (Tri-Met). The Santa Clara Valley Transportation Authority (VTA) had conducted a survey of their operators perceptions of their YTB program, and the results were included in the evaluation report for the California Highway Patrol on the demonstration YTB programs of VTA and Santa Cruz Metropolitan Transit District (SCMTD) (see reference *4*). The survey questions and a tabulation of the results for each of the surveys are presented in the following sections.

The surveys differed in some of the questions because of the differences in the implementation of the YTB programs and of the specific interests and concerns of the individual transit agencies. However, many of the questions sought answers to the same topic and were considered to be the same for comparative analysis of the responses. A discussion of the rationale of grouping some questions as addressing the same issue is also presented in this appendix.

BROWARD COUNTY TRANSIT

A survey was conducted of BCT operators to gain insight on their perception of the effectiveness of their YTB program. The BCT Operator Questionnaire asked seven questions, with responses received from 150 operators. All bus driving experience levels were well represented with one exception. Only 10 (7%) of the responses were from operators with less than 1 year of bus driving experience. The survey also provided the opportunity for written comments. The survey questions and a tabulation of the responses are provided here.

1. How many years have you driven a bus?

Response	No.	Percent of Total
1 year or less	10	7
1 to 5 years	53	35
5 to 10 years	29	19
Over 10 years	58	39
Total responses	150	

2. What percentage of motorists do you feel are aware of the Yield to Bus law?

Response	No.	Percent of Total
Almost all (90% or more)	2	1
A high percentage (between 60 and 90%)	3	2
About half (between 40 and 60%)	9	6
A low percentage (between 10 and 40%)	40	27
Very few (less than 10%)	95	63
No response	1	1
Total responses	150	

3. Do you feel that the yield sign has made merging from a stop safer?

Response	No.	Percent of Total
Lot safer	8	5
Some safer	39	26
No change	100	67
Less safer	2	1
No response	1	1
Total responses	150	

4. From your experiences, what percentage of motorists stops when you signal your intent to merge into the traffic lane?

Response	No.	Percent of Total
Almost all (90% or more)	—	—
High percentage (between 60 and 90%)	1	1
About half (between 40 and 60%)	10	7
Low percentage (between 10 and 40%)	47	31
Very few (less than 10%)	90	60
No response	2	1
Total responses	150	

5. How often do police enforce the YTB law *when they have directly observed a violation*?

Response	No.	Percent of Total
Most of the time	2	1
Some of the time	2	1
Seldom	4	3
Never	112	75
No opinion	30	20
Total responses	150	

6. How helpful has the Yield to Bus sign been with respect to your driving the bus?

Response	No.	Percent of Total
Very helpful	7	5
Some help	37	25
No difference	99	66
Hinders some	1	1
Hinders a lot	1	1
No opinion	5	3
Total responses	150	

7. Overall, how would you rate the effectiveness of the YTB law?

Response	No.	Percent of Total
Excellent	2	1
Good	8	5
Satisfactory	3	2
Fair	32	21
Poor	105	70
Total responses	150	

Analysis of the BCT Operator Survey Responses

The survey also provided the opportunity for written comments, and approximately 35% of the operators provided comments. Please refer to chapter five for details on the written comments. A number of the questions were examined to see if the responses differed by the years of experience of the respondent. The results of these analyses are given in Tables D1–D5.

COAST MOUNTAIN BUS COMPANY

A survey was conducted of operators at CMBC to obtain information of their perceptions on the effectiveness of their YTB program. Responses were received from 167 operators. The survey asked five questions and provided an opportunity for the operator to provide additional comments. A tabulation of the operators' responses to the survey questions is presented here.

1. What percentage of motorists do you feel are aware of the Yield to Bus law?

Response	No.	Percent of Total
Almost all (90% or more)	6	4
A high percentage (between 60 and 90%)	33	20
About half (between 40 and 60%)	52	31
A low percentage (between 10 and 40%)	46	28
Very few (less than 10%)	29	17
No response	1	1
Total responses	167	

2. Do you feel that the Yield to Bus program has made merging from a stop safer?

Response	No.	Percent of Total
Lot safer	17	10
Some safer	98	59
No change	44	26
Less safer	6	4
No response	2	1
Total responses	167	

TABLE D1
SURVEY RESPONSES OF PERCEPTION OF SAFETY WITH YIELD TO BUS SIGN BY OPERATOR EXPERIENCE SUBGROUP

Operator Experience (no. in subgroup)	Survey Responses (in percent of subgroup)				
	Lot Safer	Some Safer	No Change	Less Safer	No Response
Less than 1 year (10)	10	20	70		
1 to 5 years (53)	4	24	72		
5 to 10 years (29)		24	72		3
Over 10 years (58)	9	29	59	3	
All responses (150)	5	26	67	1	1

TABLE D2
SURVEY RESPONSE OF PERCENTAGE OF MOTORISTS YIELDING BY OPERATOR EXPERIENCE SUBGROUP

Operator Experience (no. in subgroup)	Survey Responses (in percent of subgroup)					
	Almost All	High Percentage	About Half	Low Percentage	Very Few	No Response
Less than 1 year (10)		10		70	20	
1 to 5 years (53)			4	30	64	2
5 to 10 years (29)			14	28	55	3
Over 10 years (58)			7	28	65	
All responses (150)		1	7	31	60	1

TABLE D3
SURVEY RESPONSES ON PERCEPTION OF POLICE ENFORCEMENT BY OPERATOR EXPERIENCE SUBGROUP

Operator Experience (no. in subgroup)	Survey Responses (in percent of subgroup)				
	Most of the Time	Some of the Time	Seldom	Never	No Opinion
Less than 1 year (10)			10	50	40
1 to 5 years (53)		4	2	77	17
5 to 10 years (29)	3		7	72	17
Over 10 years (58)	2			78	20
All responses (150)	1	1	3	75	20

TABLE D4
SURVEY RESPONSES ON PERCEPTION OF THE HELPFULNESS OF YIELD TO BUS SIGN BY OPERATOR EXPERIENCE SUBGROUP

Operator Experience (no. in subgroup))	Survey Responses (in percent of subgroup)					
	Very Helpful	Some Help	No Difference	Hinders Some	Hinders a Lot	Opinion
Less than 1 year (10)		20	60			20
1 to 5 years (53)	8	21	64	2		6
5 to 10 years (29)		21	79			
Over 10 years (58)	8	21	64		2	6
All responses (150)	5	25	66	1	1	3

TABLE D5
SURVEY RESPONSES ON PERCEPTION OF THE EFFECTIVENESS OF THE YIELD TO BUS LAW BY OPERATOR EXPERIENCE SUBGROUP

Operator Experience (no. in subgroup)	Survey Responses (in percent of subgroup)					
	Excellent	Good	Satisfactory	Fair	Poor	No Opinion
Less than 1 year (10)				30	70	
1 to 5 years (53)	4	6		25	66	
5 to 10 years (29)			7	14	79	
Over 10 years (58)		9	2	21	70	
All responses (150)	1	5	2	21	70	

3. From your experiences, what percentage of motorists stop when your bus operators signal their intent to merge into the traffic lane?

Response	No.	Percent of Total
Almost all (90% or more)	6	4
A high percentage (between 60 and 90%)	22	13
About half (between 40 and 60%)	49	29
A low percentage (between 10 and 40%)	52	31
Very few (less than 10%)	38	23
Total responses	167	

4. How often do police enforce the YTB law *when they have directly observed a violation*?

Response	No.	Percent of Total
Most of the time	2	1
Some of the time	3	2
Seldom	13	8
Never	132	79
No opinion	17	10
Total responses	167	

5. How would you rate the effectiveness of the YTB program?

Response	No.	Percent of Total
Excellent	10	6
Good	28	17
Satisfactory	21	13
Fair	31	18
Poor	77	46
Total responses	167	

Analysis of the CMBC Survey Responses

Sixty-nine percent of the survey responses reported that their YTB program made merging back into traffic safer. Forty-six percent of the respondents indicated that motorists were yielding and allowed them to merge back into traffic. However, only 36% of the respondents rated the effectiveness of their YTB program as "satisfactory," "good," or "excellent." The explanation for these slightly inconsistent responses appears to be related to the operators' concerns about the lack of police enforcement of the YTB law. More than 89% of all operator responses to the

survey question on police enforcement were either "seldom" or "never."

A large majority (89% or more) of the CMBC operators that gave their YTB program a "good" or "excellent" rating also reported that a high percentage of the motorists would stop when they signalled their intent to merge back into the traffic lane. The opposite was reported by the operators who had rated their YTB program as either "fair" or "poor." Eighty-four percent of those operators indicated that either "a low percentage" or "very few" of the motorists stopped when they signalled their intent to merge back into the traffic lane.

Fifty-two of the responses contained written comments on one or more topics. The summary of these comments can be found in chapter five.

KING COUNTY METRO TRANSIT

A survey was conducted of Metro Transit operators to gain insight on their perceptions of the effectiveness of their YTB program. Responses were received from 158 operators. The Tri-Met operator survey asked six questions, and provided the opportunity for written comments, if desired. The survey questions and a tabulation of the responses are provided here.

1. Years of experience in driving a bus?

Response	No.	Percent of Total
1 year or less	10	6
2 to 5 years	30	19
6 to 10 years	23	15
Over 10 years	95	60
Total responses	158	

2. What percentage of motorists do you feel are aware of the Yield to Bus law?

Response	No.	Percent of Total
Almost all (90% or more)	3	2
A high percentage (between 60 and 90%)	6	4
About half (between 40 and 60%)	19	12
A low percentage (between 10 and 40%)	58	37
Very few (less than 10%)	70	44
No response	2	1
Total responses	158	

3. Are you aware of the campaign that was initiated in March 2002 as a joint effort of Community Transit, Everett Transit, Metro Transit, Pierce Transit, and Sound Transit to raise public awareness of Washington's Yield to Bus law?

Response	No.	Percent of Total
Yes	79	50
No	79	50
Total responses	158	

4. From your experiences, has there been a change in the percentage of motorists obeying the Yield to Bus law since March 2002 (more motorists now yield and allow you to reenter from a stop)?

Response	No.	Percent of Total
Large increase	2	1
Moderate increase	14	9
Small increase	53	34
No change	89	56
Total responses	158	

5. From your experiences, what percentage of the motorists now obey the YTB law; i.e., they yield to a bus that has signalled to reenter the traffic lane from a bus stop?

Response	No.	Percent of Total
Almost all (90% or more)	1	1
A high percentage (between 60 and 90%)	3	2
About half (between 40 and 60%)	15	9
A low percentage (between 10 and 40%)	63	40
Very low (less than 10%)	76	48
Total responses	158	

6. How would you rate the overall effectiveness of the YTB program?

Response	No.	Percent of Total
Excellent	1	1
Good	6	4
Satisfactory	16	10
Fair	41	26
Poor	92	58
No response	2	1
Total responses	158	

Analysis of the Metro Transit Survey Responses

The majority (60%) of the survey responses were from the operator group with the most experience (10 years or more). With the exception of the representation of operators with less than 1 year of experience driving a bus, the experience levels of the intermediate experience groups are fairly well represented in the survey responses. Tables D6–D10 provide a breakdown of several of the survey questions by operator experience level.

TABLE D6
PERCENTAGE OF OPERATORS AWARE OF PUBLIC EDUCATION CAMPAIGN

Aware of Campaign	Operator Years of Experience			
	One or Less	Two to Five	Six to Ten	Ten or More
Yes	50%	53%	39%	50%
No	50%	47%	61%	50%

TABLE D7
OPERATOR RESPONSES ON THE EFFECTIVENESS OF PUBLIC EDUCATION CAMPAIGN

Campaign Effectiveness	Operator Years of Experience			
	One or Less	Two to Five	Six to Ten	Ten or More
Large increase				2%
Moderate increase	20%		13%	10%
Small increase	30%	33%	30%	34%
No change	50%	67%	57%	54%

TABLE D8
OPERATOR RESPONSES ON MOTORIST AWARENESS

Motorist Awareness of Yield to Bus Law	Operator Years of Experience			
	One or Less	Two to Five	Six to Ten	Ten or More
Almost all				2.5%
A high percentage	10%	7%	4%	2.5%
About half	10%	7%	9%	14%
A low percentage	50%	26%	48%	38%
Very few	30%	60%	35%	41%
No response			4%	2%

TABLE D9
OPERATOR RESPONSES ON MOTORIST COMPLIANCE WITH YIELD TO BUS LAW

Motorist Compliance of Yield to Bus Law	Operator Years of Experience			
	One or Less	Two to Five	Six to Ten	Ten or More
Almost all				1%
A high percentage				3%
About half	20%	7%	9%	9%
A low percentage	50%	40%	48%	39%
Very few	30%	53%	43%	48%
No response				

TABLE D10
OVERALL EFFECTIVENESS BY LEVEL OF EXPERIENCE

Effectiveness Rating	Operator Years of Experience			
	One or Less	Two to Five	Six to Ten	Ten or More
Excellent				1%
Good			4%	5%
Satisfactory	10%	7%	9%	11%
Fair	40%	30%	13%	24%
Poor	50%	60%	74%	58%
No response		3%		1%

SANTA CLARA VALLEY TRANSPORTATION AUTHORITY

In the evaluation report on the California "Yield-to-Bus" pilot program, the VTA reported on a survey that had been conducted with their bus operators. Approximately 20% of the VTA bus operators were surveyed. The survey form asked seven questions and provided the opportunity for additional comments. The survey questions, the tabulation of the survey responses, and survey analysis are from the evaluation report (see reference *4*). The seven survey questions and responses are presented here.

1. When you are NOT using the flashing yield signal, how often will other drivers let you merge into traffic?

Response	No.	Percent of Total
Always	3	2
Most of the time	8	4
Some of the time	79	41
Rarely	85	44
Never	18	9
Total responses	193	

2. How often do you use the flashing yield signal as you merge your bus into traffic?

Response	No.	Percent of Total
Always	88	45
Most of the time	63	32
Some of the time	36	18
Rarely	8	4
Never	—	—
Total responses	195	

3. When you DO use the flashing yield signal, how often will other drivers let you merge into traffic?

Response	No.	Percent of Total
Always	5	3
Most of the time	51	26
Some of the time	82	42
Rarely	52	27
Never	5	3
Total responses	195	

4. How helpful is the flashing yield signal to your operation of a bus?

Response	No.	Percent of Total
Very helpful	67	34
Somewhat helpful	77	40
No opinion	13	7
Somewhat unhelpful	27	14
Very unhelpful	11	6
Total responses	195	

5. When do you think the flashing yield signal should be used?

Response	No.	Percent of Total
Always when reentering the flow of traffic from a bus stop (duck-out)	119	61
Only when there is heavy traffic	23	12
Only when there is someone behind you	3	2
Only when you can't merge into traffic	21	11
Whenever you feel it is appropriate	28	14
Don't know	1	1
Total responses	195	

6. When you use the flashing yield signal, how often do you get a *negative* reaction from motorists?

Response	No.	Percent of Total
Very often	57	29
Somewhat often	66	34
No opinion	15	8
Not often	46	24
Never	11	6
Total responses	195	

7. How effective is the Yield-to-Bus law in promoting safe driving conditions?

Response	No.	Percent of Total
Very effective	54	28
Somewhat effective	62	32
No opinion	22	11
Somewhat ineffective	27	14
Very ineffective	29	15
Total responses	194	

Analysis of the VTA Survey Responses

The evaluation report concluded the following from the results of the operator survey. From the responses to questions 1 and 3, VTA operators felt that the use of the flashing yield signal led to an improvement in the percentage of motorists that would yield and allow their bus to merge into the traffic lane. In addition, the responses to question 4 indicated that 74% of the operators felt that the flashing yield signal was somewhat or very helpful to their operation of a bus. The responses to question 5 indicated that a majority (61%) of VTA operators felt that the flashing yield signal should always be used when reentering the traffic flow from a bus stop ("duck out"). However, only 45% of the respondents reported "always" using the flashing yield signal as seen in the responses to question 2. From question 6 one can see that 63% of the respondents indicated that they received negative reactions from motorists when they used the flashing yield signal. The evaluation report concluded that 60% of the respondents reported the YTB law was either "very effective" or "somewhat effective" in promoting safe driving conditions (*4*). The written comments revealed that the operators felt that support by local law enforcement was the key to the success of the YTB program.

TRI-COUNTY METROPOLITAN TRANSPORTATION DISTRICT OF OREGON

A survey was conducted of Tri-Met operators to gain insight on their perceptions of the effectiveness of their YTB program. Responses were received from 247 operators. The Tri-Met operator survey asked 10 questions and provided the opportunity for written comments. Approximately 56% of the responses contained written

comments. A summary of these written comments is given later in this section. The survey questions and tabulations of the survey responses by question are presented here.

1. How many years have you driven a bus?

Response	No.	Percent of Total
Less than 1 year	7	3
1 to 5 years	80	32
5 to 10 years	62	25
Over 10 years	98	40
Total responses	247	

2. How often do you use the yield signal as you merge your bus into the traffic lane?

Response	No.	Percent of Total
Always	92	37
Most of the time	104	42
Some of the time	40	16
Rarely	6	3
Never	1	0
No response	4	2
Total responses	247	

3. Do you feel that using the yield signal has made re-entry from a stop safer?

Response	No.	Percent of Total
Lot safer	72	29
Some safer	140	57
No change	27	11
Less safer	5	2
No response	3	1
Total responses	247	

4. From your experiences, what percentage of motorists stop when you use the yield signal, and allow you to merge into the traffic lane?

Response	No.	Percent of Total
Almost all (90% or more)	8	3
A high percentage (between 60 and 90%)	55	22
About half (between 40 and 60%)	89	36
A low percentage (between 10 and 40%)	61	25
Very few (Less than 10%)	30	12
No response	4	2
Total responses	247	

5. What percentage of motorists do you feel are aware of the Yield to Bus law?

Response	No.	Percent of Total
Almost all (90% or more)	12	5
A high percentage (between 60 and 90%)	43	17
About half (between 40 and 60%)	81	33
A low percentage (between 10 and 40%)	76	31
Very few (less than 10%)	31	13
No response	4	2
Total responses	247	

6. How often do police enforce the YTB law *when they have directly observed a violation*?

Response	No.	Percent of Total
Most of the time	4	2
Some of the time	3	1
Seldom	31	13
Never	157	64
No opinion	46	19
No response	6	2
Total responses	247	

7. When you use the yield signal, how often do you get a negative reaction from motorists?

Response	No.	Percent of Total
Very often	33	13
Somewhat often	65	26
Not often	115	47
Never	25	10
No opinion	7	3
No response	2	1
Total responses	247	

8. Is the YTB light more effective during daylight or darkness?

Response	No.	Percent of Total
Day	5	2
Night	73	30
No difference	161	65
No response	8	3
Total responses	247	

9. How helpful is the use of the yield signal to your driving the bus?

Response	No.	Percent of Total
Very helpful	85	34
Some help	137	55
No difference	19	8
Hinders some	4	2
Hinders a lot	—	—
No opinion	2	1
No response	2	1
Total responses	247	

10. Overall how would you rate the effectiveness of the YTB program?

Response	No.	Percent of Total
Excellent	31	12
Good	71	29
Satisfactory	41	17
Fair	63	25
Poor	41	17
Total responses	247	

Analysis of the Tri-Met Survey Responses

With the exception of the representation of operators with less than 1 year of experience driving a bus, all of the experience levels are well represented in the survey responses. In Tables D11–D13, the responses to three of the survey questions (questions 3, 4, and 10) will be examined by level of experience.

In responses to the question concerning whether using the yield signal made reentry from a stop safer, a majority in every experience level reported that using the yield signal did make reentry safer. For the operators with 5 or fewer years of experience, more than 90% reported feeling safer with the use of the yield signal.

All experience levels reported that the use of the yield signal was quite helpful. The percentage of respondents that reported that the use of the yield signal as either "very helpful" or "some help" ranged from a low of 82% to 100% for the operators that had 5 or fewer years of experience. It is also of interest to note that only 1% to 2% of the respondents felt that the use of the yield signal was a hindrance. The operators with less than 1 year of experience perceived the YTB program to be more effective than operators with more experience.

RATIONALE FOR GROUPING SOME SURVEY QUESTIONS INTO COMMON TOPIC AREAS

For the purposes of comparative analysis all questions ideally would be identical in wording and in the response options. Of the four surveys that were conducted during this

TABLE D11
OPERATOR PERCEPTIONS OF SAFETY WHEN USING YIELD SIGNAL BY EXPERIENCE LEVEL

Safety Perception	Operator Years of Experience			
	One or Less	One to Five	Five to Ten	Ten or More
Lot safer	71%	29%	18%	34%
Some safer	29%	64%	55%	54%
No change		5%	24%	8%
Less safer		1%	2%	3%
No response		1%	2%	1%

TABLE D12
OPERATOR PERCEPTIONS OF HELPFULNESS OF YIELD SIGNAL BY EXPERIENCE LEVEL

Degree of Helpfulness	Operator Years of Experience			
	One or Less	One to Five	Five to Ten	Ten or More
Very helpful	71%	40%	21%	36%
Some help	29%	53%	61%	56%
No difference		5%	15%	6%
Hinders some		2%	2%	1%
Hinders a lot				
No opinion			2%	1%

TABLE D13
OVERALL EFFECTIVENESS BY LEVEL OF EXPERIENCE

Effectiveness Rating	Operator Years of Experience			
	One or Less	One to Five	Five to Ten	Ten or More
Excellent	14%	16%	10%	11%
Good	57%	21%	19%	39%
Satisfactory	14%	15%	16%	18%
Fair	14%	31%	24%	22%
Poor		16%	31%	9%

study, some of the topic questions differed in wording because of differences in the implementation of the transit agency's YTB program. In addition, some of the transit agencies had specific interests and concerns that required unique questions. The VTA survey had been conducted earlier and although the question topics were the same, the wording of the question and response options differed from the other four surveys. Through a careful review of the wording of the questions and the response options it was concluded to be reasonable to group these questions for comparative analysis. The survey questions that are considered to address the same issue/topic are listed below.

Topic 1. Percentage of Motorist Awareness of the YTB Law

The wording of the question and response options were identical for four surveys as follows.

- "What percentage of motorists do you feel are aware of the Yield to Bus law?"

Topic 2. Percentage of Motorists Yielding

All five of the surveys contained a question addressing this topic. As can be seen, each of the questions differed some in the wording, but the question topic is the same. The last bulleted question had different response options in that it did not have quantitative ranges provided; however, the wordings of the options were quite similar.

- "From your experiences, what percentage of motorists stops when you indicate your intent to merge into the traffic lane?"
- "From your experiences, what percentage of motorists stops when your operators signal their intent to merge into the traffic lane?"
- "From your experiences, what percentages of motorists now obey the YTB law, i.e., they yield to a bus that has signaled to reenter the traffic lane from a bus stop?"
- "From your experiences, what percentage of motorists stops when you use the yield signal, and allow you to merge into the traffic lane?"
- "When you DO use the yield signal, how often will other drivers let you merge into traffic?"

Topic 3. Safety Impacts of the YTB Program

Three surveys contained a question addressing this topic. The response options were identical for all questions. It was concluded that all responses from these three survey questions were appropriate for comparative analysis.

- "Do you feel that the yield sign has made merging from a stop safer?"
- "Do you feel that the YTB program has made merging from a stop safer?"
- "Do you feel that using the yield signal has made reentry from a stop safer?"

Topic 4. Helpfulness of Yield Sign

Three surveys contained questions concerning the helpfulness of the YTB sign or signal in driving the bus. The questions were worded to be appropriate for the type of yield sign used—passive or active. The response options differed in that two of the questions provided for "no difference" as a choice and the third question did not. The questions and response options were considered appropriate for comparative analysis.

- "How helpful has the Yield to Bus sign been with respect to your driving the bus?"
- "How helpful is the use of the yield signal to your driving the bus?"
- "How helpful is the flashing yield signal to your operation of a bus?"

Topic 5. Police Enforcement of YTB Laws

Three surveys contained an identical question and response options concerning the enforcement of the YTB law.

- "How often do police enforce the YTB law *when they have directly observed a violation?"*

Topic 6. Use of the Yield Signal

Two surveys included a question on the frequency of use of the yield signal. This question only applies for agencies with an active yield signal. The questions and response options were nearly identical and are as follows:

- "How often do you use the yield signal as you merge your bus into the traffic lane?"
- "How often do you use the flashing yield signal as you merge your bus into traffic?"

Topic 7. Negative Response from Motorists

Two surveys contained a question on the frequency of operators receiving a negative reaction for a motorist when the yield signal is used. This question was only applicable for those transit agencies using an active yield signal. The questions were nearly identical and the response options were the same.

- "When you use the yield signal, how often do you get a negative reaction from motorists?"
- "When you use the flashing yield signal, how often do you get a *negative* reaction from motorists?"

Topic 8. Overall Effectiveness of Yield to Bus Law/Program

All five of the surveys contained a question that asked the operator to rate their YTB program or law as to overall effectiveness. The response options to these questions were similar. The responses to the survey questions were considered appropriate for comparative analysis.

- "Overall, how would you rate the effectiveness of the YTB law?"
- "How do you rate the effectiveness of the YTB program?"
- "Overall, how would you rate the effectiveness of the YTB program?"
- "How effective is the Yield-to-Bus law in promoting safe driving conditions?"

APPENDIX E

Analysis of Metro Transit Accident Code 227 Data

INTRODUCTION

In Metro Transit's accident database, Accident Code 227 is for Vehicle Collision with Bus Leaving Stop. In addition to accident codes, the database contains many subcodes that provide information such as date, time, vehicle type, operating base, operator, location, property damage to bus, and whether the accident was chargeable to the operator. All accidents recorded under Code 227 are for buses leaving a bus stop that is entirely out of the traffic lane. Metro Transit has other accident codes for vehicle collisions with a bus in a bus stop zone where the bus is in or is partially in the traffic lane. Therefore, Accident Code 227 is a failure of a vehicle to yield the right-of-way to a bus leaving a bus stop and is considered a Yield to Bus (YTB)-related accident.

Metro Transit began to install the yield sign decals on their buses in December 1993, and all buses had the decals by March 1994. Therefore, the first year of operations with a YTB program was 1994, because all Code 227 accidents recorded occurred in the months of January through October.

Metro Transit provided data for Code 227 accidents for the years of 1976 through 2001. A plot by year of the recorded Code 227 accidents is shown in Figure E1, along with the mean and a linear fit of the data. As can be seen, the number of Code 227 accidents has varied significantly over the years. For this period, the mean of Code 227 accidents per year is 12.8. The linear fit trend line indicates a moderate increase (0.133 accidents per year) in accidents over the years.

Because there are data for 8 years with YTB operations, it was decided to use the 8 years just prior to the implementation of the YTB program as a basis for comparison in the analysis. In the following sections the analyses of these accident data are presented.

ANALYSIS OF CODE 227 ACCIDENTS WITH AND WITHOUT YIELD TO BUS PROGRAM

The first analysis was the determination of a linear fit and parabolic fit of the 16 years of data (8 with and 8 without YTB). The results are shown in Figure E2. It is interesting to note that these data exhibit similar linear and parabolic fits as the larger data set in Figure E1.

The next analysis was designed to compare the number-of-accident means of the two subgroups for years without YTB and years with YTB. The results are shown in Figure

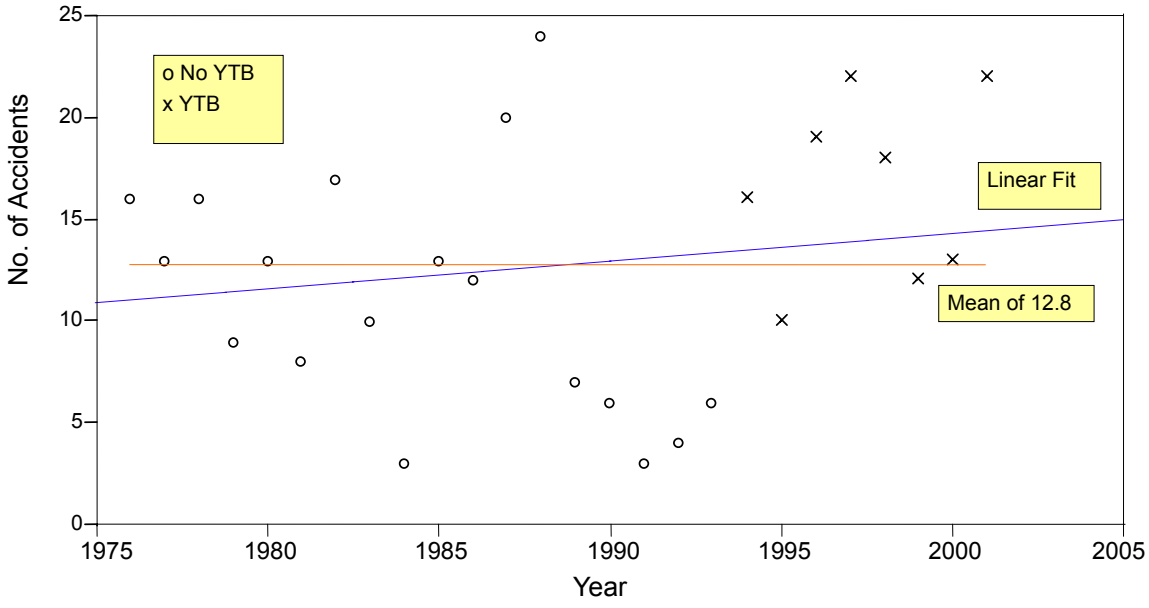


FIGURE E1 Number of accidents recorded as Code 227 over a 25-year period. (*Data Source*: Metro Transit.)

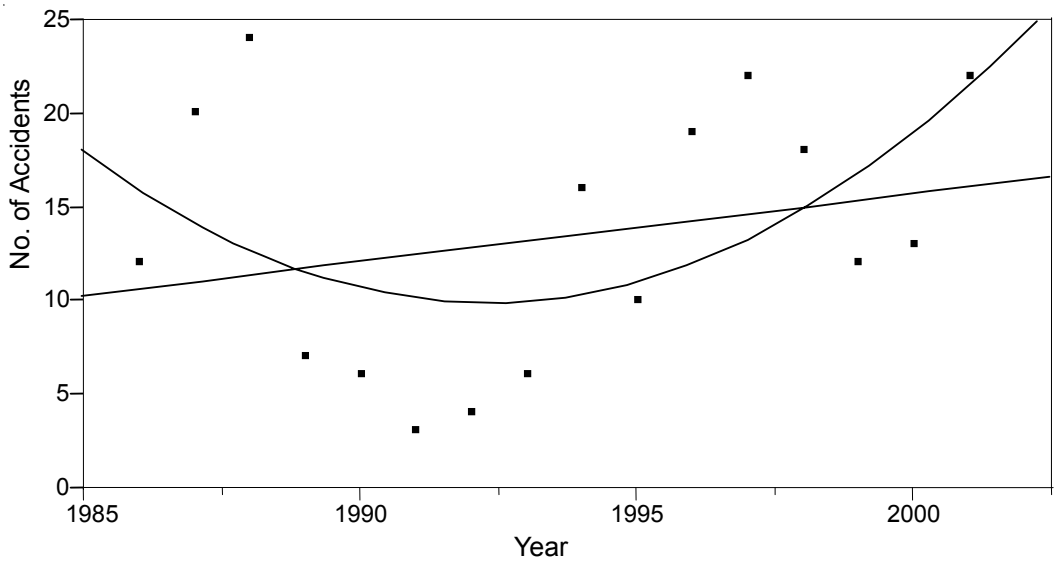


FIGURE E2 Scatter plot of Code 227 accidents for a 16-year period. (*Data Source*: Metro Transit.)

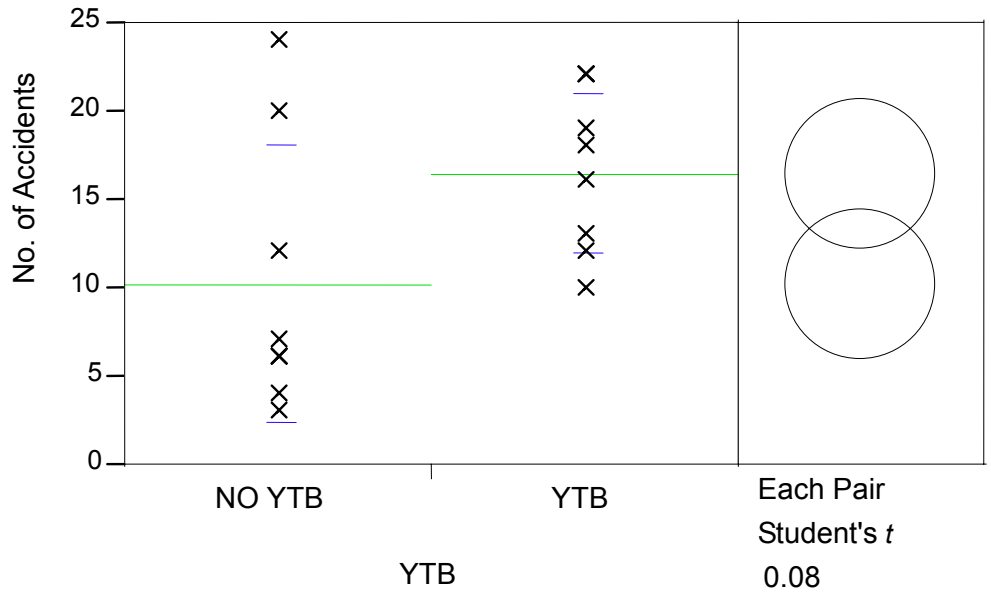


FIGURE E3 Comparisons of the number of Code 227 accidents without and with the Yield to Bus Program.

E3. The mean without YTB was 10.25 accidents per year. The mean with YTB was 16.5 accidents per year. The analysis indicated that the means are significantly different at $t = 0.08$, not a particularly high confidence level, but a difference. Using the above two means, there would be a 61% increase in Code 227 accidents during the YTB program years with over the years without the YTB program.

Metro Transit has an accident review process that results in a judgment of whether an accident is preventable or nonpreventable. During the period from 1986 to 1993, there were 82 recorded Code 227 accidents and 21 of those (25.6%) were determined to be preventable. During the period from 1994 to 2001, there were 132 Code 227 accidents and 35 of those (26.5%) were determined to be preventable. Because the percentage of preventable accidents did not significantly rise during the with YTB period, the data would seem to indicate that there was not a significant increase in aggressive driving on the part of the operators.

As can be seen in Figures E2 and E3, there is more scatter in the number of accidents for the without YTB years than the with YTB years. The standard deviations were 7.796 for the without YTB years and 4.536 for the with YTB years. In particular, for the years of 1987 and 1988, Metro Transit experienced an unusually high number of Code 227 accidents. There were no known explanations for the high number of Code 227 accidents during those years.

During the 5 years just prior to the implementation of the YTB program, Metro Transit had experienced a markedly low number of Code 227 accidents; an average of 5.2 per year. When comparing that experience with the accident experience (17 accidents per year) during the first 5 years with a YTB program, the increase was disturbingly large, more than 200%. However, because of the variance in the data (in particular the without YTB years data), one needed to have a larger sample size (more years of data) to obtain a more correct evaluation.

COMPARATIVE ANALYSIS OF CODE 227 ACCIDENTS

Are the level of traffic congestion or the type of bus used factors in influencing the number of Code 227 accidents? By analyzing where the Code 227 accidents occurred and what types of buses were involved, some insight was obtained on which factors increased the likelihood for a YTB accident.

Metro Transit has seven operating bases. Three bases, Atlantic Operations (AO), Central Operations (CO), and Ryerson Operations (RO), are co-located just south of the central business district and the buses from these bases operate in the highest traffic congestion areas. The East Operations (EO) and Bellevue Operations (BO) are also co-located in the city of Bellevue, and the buses from these bases operate in a lower traffic density area. The North Operations (NO) and South Operations (SO) buses operate in an intermediate traffic flow area. NO is the newest base and opened in 1992. The accident data were examined to discover possible correlations of Code 227 accidents with an Operating Base. Table E1 provides the number and percentage of Code 227 accidents by operating base over the 16-year period. As can be seen in the table, almost 71% of the Code 227 accidents occurred with buses operating from AO, CO, and RO. Only 29% of Code 227 accidents occurred with buses from the other operating bases that have lower traffic levels. Perhaps even more telling is the metric of the average number of Code 227 accidents per year for the seven operating bases. Using the average of the AO, CO, and RO and comparing with the average of BO, EO, NO, and SO, there are 3.4 times the number of Code 227 accidents per year at the bases where the buses are operating in the heavier traffic areas.

An analysis was made of the number and percentage of accidents that occurred by bus type. Because the trolleybuses all operated in the central business district, it is anticipated that they will have a higher percentage of Code 227 accidents than their percentage of the fleet would predict. A breakdown of the Code 227 accidents by bus type is given in Table E2.

TABLE E1
NUMBER AND PERCENTAGE BREAKDOWN OF CODE 227 ACCIDENTS BY OPERATING BASE

Operating Base	No. of Accidents	Percentage of Total	Average No. Code 227 Accidents per Year
Atlantic Operations	40	19.0	2.5
Central Operations	66	31.4	4.1
Ryerson Operations	43	20.5	2.7
East Operations	22	10.5	0.7
Bellevue Operations	3	1.4	0.1
North Operations	18	8.6	1.8
South Operations	18	8.6	1.1
Totals	210	100.0	

TABLE E2
BREAKDOWN OF CODE 227 ACCIDENTS BY BUS TYPE

	Makeup of Fleet		Code 227 Accidents	
Bus Type	No.	Percent of Total	No.	Percent of Total
Articulated—60 ft	274	23	87	41
Standard size—35/40 ft	461	39	54	26
Dual power—60 ft	216	18	9	4
Small—30 ft	95	8	4	2
Trolleybus—40/60 ft	148	12	56	27

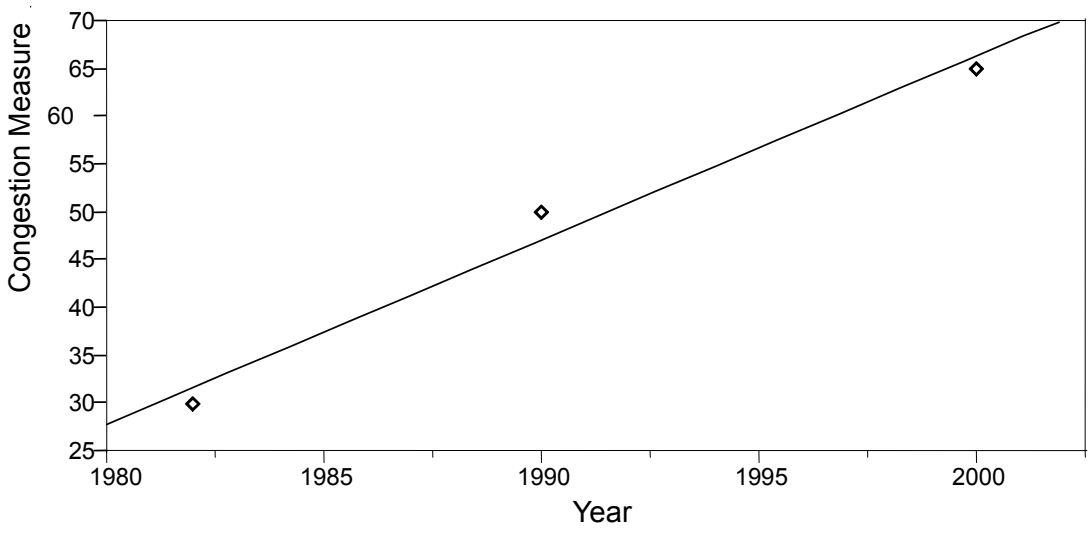


FIGURE E4 Increase in the percentage of principal arterial roadways congested during peak period. [*Source: 2002 Urban Mobility Study* (*1*).]

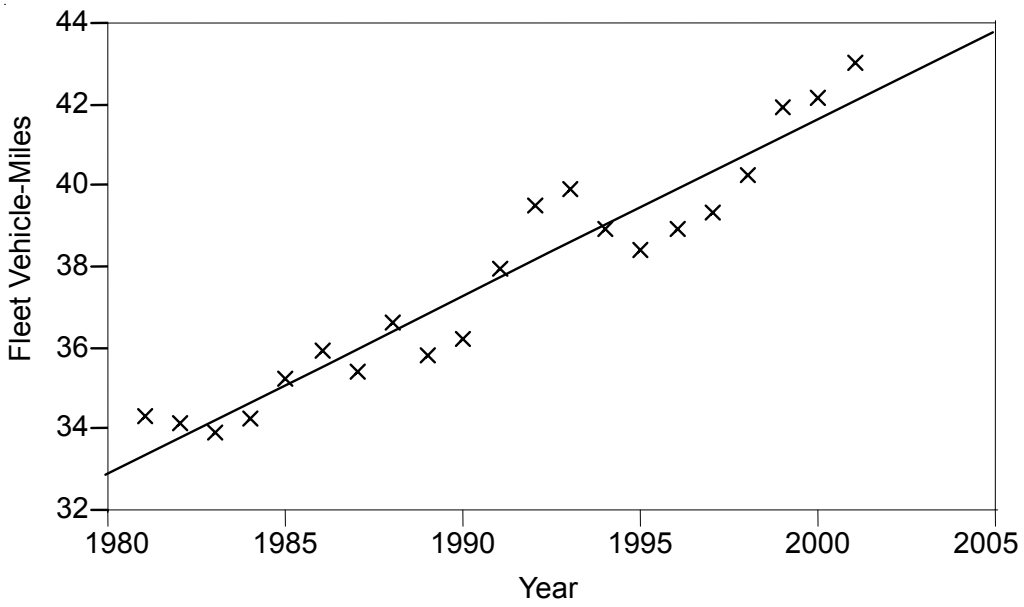


FIGURE E5 Fleet vehicle-miles for Metro Transit. (*Source*: Metro Transit.)

Although the trolleybuses make up approximately 12% of the fleet, they were involved in 27% of the Code 227 accidents. Because a trolleybus has excellent acceleration capability and can pull out of a stop quicker than a standard size diesel powered bus, the reason for their higher accident percentage over their representation in the fleet appears to be the traffic conditions in which they operate; heavy traffic congestion. Articulated buses are generally less nimble and are slower when merging back into the traffic lane from a stop. In this case their lower acceleration capability may explain their higher percentage than their fleet percentage of Code 227 accidents.

OTHER FACTORS THAT POSSIBLY INFLUENCE THE INCREASE IN CODE 227 ACCIDENTS

As was discussed in the previous section, the level of traffic congestion that a bus operates in most likely has an influence in the number of Code 227 accidents that occur. Information on the changes in traffic congestion in the Seattle–Everett area was reported in the *2002 Urban Mobility Study* by the Texas Transportation Institute (*1*). This report has tracked the changes in the percentage of congestion on urban freeways and principal arterial streets for the last 20 years. Figure E4 graphically illustrates the increase

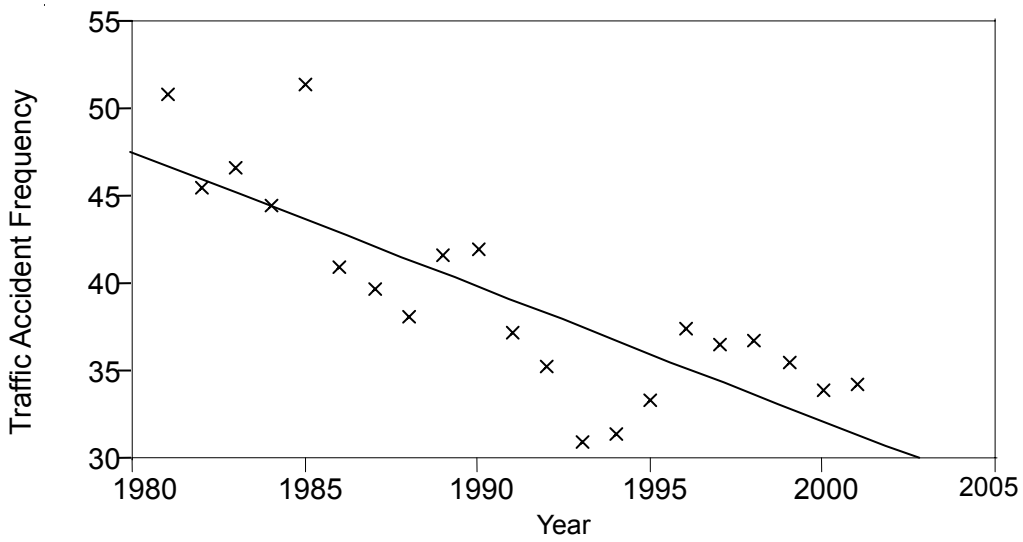


FIGURE E6 Traffic accidents per million vehicle-miles. (*Source*: Metro Transit.)

in the percentage of principal arterial streets in the Seattle–Everett area.

There has been a steady increase in the congestion of the arterial streets, approximately 120% over a 20-year period. An increase in traffic congestion is generally viewed as an increase in the risk of accidents and could account for some of the increase in Code 227 accidents observed by Metro Transit.

Another factor that could account for some of the increase in Code 227 accidents is an increase in the number of vehicle-miles that has occurred over the years. Figure E5 provides the number of vehicle-miles for the Metro Transit bus fleet. These data also indicate a small steady increase in fleet miles and an increase in exposure for an accident. The data are shown as vehicle-miles in millions. The trend line indicates an increase of about one-half million vehicle-miles per year.

Even with increases in traffic congestion and vehicle-miles, Metro Transit has been able to maintain a downward trend in the number of traffic accidents per million vehicle-miles as shown in Figure E6.

APPENDIX F

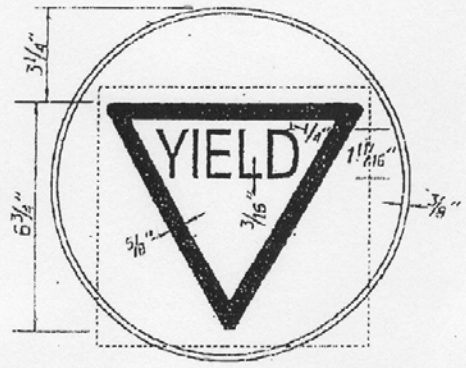
Oregon Yield Sign Specifications

REVISED DRAFT

APPENDIX F: OREGON YIELD SIGN SPECIFICATIONS

The Oregon yield sign specifications are presented below.

EXHIBIT 1



12" Diameter

Sign Background: Flat Black

Sign Legend: Red

Sign face shall match dimensioned drawing shown above, shall be red in color when flashing. Flashing rate shall be between 30 and 80 flashes per minute.
Option: A 12" LED signal face with interior of lens blacked out by paint, vinyl sheeting, or other means to produce sign face as shown above.

OREGON DEPARTMENT OF TRANSPORTATION

Abbreviations used without definition in TRB Publications:

AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
NCHRP	National Cooperative Highway Research Program
NCTRP	National Cooperative Transit Research and Development Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
SAE	Society of Automotive Engineers
TCRP	Transit Cooperative Research Program
TRB	Transportation Research Board
U.S.DOT	United States Department of Transportation