

Should Emergency Call Boxes Be Placed in Freeway Medians?

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Current guidelines related to emergency call boxes call for them to be placed on the right-hand side of the unidirectional roadway. The advisability of also placing call boxes in freeway medians or adjacent to high-occupancy vehicle (HOV) lanes in medians is considered. The opinions of California Highway Patrol officers and various professionals involved in the provision of call boxes in California and elsewhere were surveyed; opinions of survey respondents were mixed, but they were generally negative concerning median or HOV lane call boxes except in the case of barrier-separated HOV lanes. A review of accident reports to determine the number of persons struck while attempting to cross freeway lanes to access call boxes revealed that such accidents are exceedingly rare. A cost study showed that the costs of call boxes are quite modest compared with alternative means of providing motorist assistance. Based on the accident study it is concluded that installation of call boxes in median areas is not warranted except in the case of barrier-separated HOV facilities, where there would otherwise be no access to motorist assistance services.

Emergency call boxes are increasingly being used in California to allow drivers of disabled vehicles to communicate conveniently with the California Highway Patrol (CHP) so that roadside assistance can be provided. They are especially valuable on limited-access facilities, where the distance to off-facility telephones is often excessive, and where the potential accident exposure of disabled vehicles and pedestrians walking along the roadway to summon help is greatest. As of July 1994, 14 Service Authorities for Freeway Emergencies (SAFEs) had been authorized to provide call box service in California, and 11 were already in operation. These cover most major metropolitan areas in California and several rural areas. Statewide, some 14,500 call boxes were in operation.

Several alternative means of providing motorist assistance also exist. In addition to call boxes several local agencies provide freeway service patrols (FSPs). The goal of the FSPs is to reduce congestion by removing disabled vehicles and debris from traffic lanes as soon as possible. FSP programs generally consist of special fleets of dedicated tow trucks or other emergency vehicles that patrol selected sections of roadway during specific times (1). Besides these publicly provided services, increasing numbers of private vehicles are equipped with cellular telephones, and these have begun to play a significant role in providing CHP with notification of traffic incidents.

To date, however, only the call box program provides universal access to emergency services. FSPs are severely limited as to their hours of operation, and many vehicles are not equipped with cellular phones. Consequently, although traffic-blocking incidents are apt to receive timely responses even in the absence of call boxes, routine breakdowns may not. This is especially true if they occur at off-peak hours or on less critical facilities not served by FSPs.

The spacing and locations of call boxes are governed by a set of guidelines adopted jointly by the California Department of Transportation (Caltrans) and CHP (2). The typical call box installation consists of solar-powered cellular telephones spaced at intervals of 0.4 to 3.2 km, depending on the cost and anticipated use. Normal practice in California has been to locate call boxes on the right-hand side of the unidirectional roadway, just outside the edge of the shoulder. In most cases, left-hand shoulders are also available; consequently, some disabled vehicles may stop on the left-hand side of the roadway.

In addition, several types of high-occupancy vehicle (HOV) lanes are provided in California freeway medians. In some cases these are physically separated from the rest of the freeway by traffic barriers, so that the vehicles using HOV lanes are not able to reach the right-hand shoulder of the main freeway. Although the usual practice is to place call boxes on the right-hand shoulder only, at least one such HOV facility, the I-15 reversible HOV roadway in San Diego, has call boxes that are located in the median area.

Concern exists that drivers who stop their vehicles on the left-hand shoulder or on the side of a median HOV lane may attempt to cross the main freeway lanes to reach a call box and risk being hit by a moving vehicle. This concern was expressed as a part of a Caltrans safety stand-down in 1992, and as a result a study was conducted to investigate the need for and value of locating call boxes in medians or adjacent to median HOV lanes (3).

The objective of the study was to investigate the advisability of installing call boxes in medians or adjacent to HOV lanes in medians. This included investigating the safety implications of installing or not installing such call boxes, the experience and concerns of existing call box providers and law enforcement personnel, and the potential cost of such installations.

The study included (a) a telephone survey of SAFE administrators, vendors, and consultants to SAFEs, Caltrans headquarters and district personnel who work directly with the call box program, and CHP administrators who are involved in the call box program; (b) a written survey of CHP officers from Southern California who are familiar with call boxes; (c) a telephone survey of professionals outside California who are involved in providing call boxes in freeway medians or alongside median HOV lanes; (d) a detailed study of dismounted pedestrian accidents in Southern California that was intended to determine the number of accidents involving people crossing freeway lanes to access call boxes; and (e) an analysis of the costs of installing and operating call boxes in medians or alongside median HOV lanes.

SURVEYS

Survey of California Call Box Professionals

A telephone survey of various types of professionals involved in the current California call box program was conducted during the sum-

mer of 1993. A total of 27 interviews were conducted. Of the respondents, 13 were administrators of SAFEs, 4 represented call box vendors or consultants to SAFEs, 6 were Caltrans headquarters or district personnel involved in the call box program, and 4 were CHP administrators involved in the call box program.

Each respondent was asked (a) whether call boxes are needed in freeway medians and why or why not, (b) whether call boxes are needed for median HOV facilities and why or why not, and (c) if call boxes are to be provided in medians or for median HOV facilities, how far apart they should be and whether any particular locations should be included or avoided. In addition, respondents from San Diego County were asked about their experience with the call boxes on the I-15 reversible HOV facility.

A majority of the respondents in this survey were opposed to median call boxes, with about 40 percent favoring them and 60 percent opposing them. The majority of the respondents in all groups surveyed except vendors and consultants were opposed; vendors and consultants were unanimously in favor of call boxes in freeway medians.

In addition, some respondents gave qualified answers. Some of the more important qualifications were (a) that there be adequate room to stop [in one case, a median shoulder width of at least 3 m (10 ft)] and (b) that priority be given to establishing median call boxes on wider freeways. Some respondents who said that median call boxes are needed added that they may not be needed on freeways with only two lanes in one direction or stated that top priority should be given to freeways with four or more lanes in one direction. At the same time other respondents stressed that if median call boxes are not universally available motorists may become confused. Several also stated that under the present funding arrangements, some counties would lack the resources to install call boxes in medians without compromising spacing or coverage; hence, it is almost certain that median call boxes will not be universally installed.

Respondents were also asked their reasons for favoring or opposing median call boxes. Most of those favoring them stated that it is inevitable that some motorists with mechanical problems will stop on left-hand shoulders. If they remain on the left-hand shoulder for very long, they will be more vulnerable than if they were on the right-hand shoulder, primarily because of the higher speeds in the left lane. Also, motorists disabled on left-hand shoulders may feel stranded, and hence may be tempted to cross the freeway lanes.

Those opposing median call boxes tended to agree that left-hand shoulders are more dangerous than right-hand shoulders, but they argued that to install call boxes in the medians would encourage motorists to stop there. Furthermore, they argued that if people do stop on the left side of the roadway they should be encouraged to remain in their vehicles, because their exposure will be even greater if they are out of their vehicles walking to or using call boxes. Several commented that currently, the overwhelming majority of stops are on the right-hand side of the road and that to install call boxes in the median would be to risk changing this. In addition, a few respondents commented that people might actually be tempted to cross from the right shoulder to the left shoulder, especially if a call box on the right shoulder were not functioning. Finally, several respondents emphasized that placing call boxes in medians is sometimes impossible because of a lack of space. This is especially reported to be a problem in the Los Angeles area.

When asked whether call boxes should be installed alongside median HOV facilities, respondents tended to distinguish between situations in which such facilities are physically separated from the

mixed-flow lanes by means of concrete traffic barriers and those in which they are not. In the latter case HOV lanes are typically provided on both sides of the freeway median barrier and are separated from mixed-traffic lanes in the same direction by pavement markings, traffic cones, or a buffer strip. Most respondents favored installing call boxes alongside barrier-separated HOV facilities, but the respondents were about evenly divided as to whether they should be used where such facilities are not separated.

In the case of barrier-separated HOV facilities, the most common reason given for favoring installation of call boxes was the impossibility of vehicles reaching the right-hand shoulder. In the case of nonseparated facilities, an important reason given in opposition to installing call boxes was the lack of adequate shoulders. It was stated that where such facilities are retrofit measures, median shoulders were often sacrificed to provide for the HOV lanes. Otherwise, the reasons for favoring or opposing installation of call boxes alongside median HOV facilities were similar to those for favoring or opposing installation of call boxes in freeway medians.

When asked about call box spacing, respondents most commonly replied that the spacing of median or HOV lane call boxes should be the same as that of call boxes on the right-hand shoulder or that it should be in accordance with the existing call box guidelines. Only a few respondents mentioned specific distances.

Respondents were also asked about specific locations where call boxes should or should not be placed. The most common response to the question of where they should be placed was that they should be at the same locations as call boxes on the right-hand shoulder. Respondents believed that this would minimize the likelihood of people attempting to cross the freeway to use a call box. Common answers to the question of where call boxes should not be placed included

- Locations where there is insufficient shoulder width.
- Locations where there is inadequate sight distance.
- Locations at entrances or exits to either the freeway or an HOV facility.
- Other locations of special hazard.

Call box professionals working in San Diego County were also asked about their experience with the call boxes on the I-15 reversible HOV lanes and were asked to provide any related statistical information they might have, such as usage rates. All reported that there had been no problems with them. Based on statistics supplied by the San Diego SAFE, from 50 to 100 calls are placed from the 15 call boxes concerned each month. According to one respondent most of these calls are from motorists in the mixed-flow lanes. This respondent also stated that breakdown and accident rates for the HOV facility are very low.

Written Survey of CHP Officers

A written survey was administered to 40 CHP officers representing the San Diego, Orange County, Los Angeles, and San Bernardino-Riverside areas. A total of 39 responses were received. Questions were similar to those in the survey of California call box professionals.

A majority of the respondents in this survey opposed the installation of median call boxes, but there were considerable differences in the responses from different geographical areas.

The reasons for favoring or opposing median call boxes were similar to those advanced by California call box professionals.

Those favoring installation of call boxes in medians usually stated that some motorists will stop on left-hand shoulders and will be tempted to cross the freeway lanes if call boxes are provided on the right side but not on the left. Those opposed to median call boxes tended to argue that providing call boxes in medians will encourage motorists to stop in medians, where they are more vulnerable than on the right shoulder because speeds are higher in the left lane than in other lanes. Also, as in the case of the California call box professionals, some officers pointed out that other means of communication are available.

The second question was whether call boxes are needed alongside median HOV facilities and why or why not. Unlike the California call box professionals, CHP officers tended not to differentiate between barrier-separated and non-barrier-separated facilities, although assumptions as to which type of facility was meant may have influenced their answers, which were almost evenly divided.

When asked about spacing for median call boxes, CHP officers tended to respond with specific distances, which were mentioned in 21 responses. Of these, 12 recommended spacings of 0.4 km or less, 3 recommended 0.8 km, and 3 recommended 1.6 km or greater. In addition, three respondents listed a range of spacings.

Responses to the question of where call boxes should be placed included CHP enforcement areas and places with wide shoulders. Responses to the question of where they should not be placed included locations with inadequate sight distances, locations with inadequate median widths, elevated transition roads or bridges, and undercrossings. This last location was said to involve noise problems.

Experiences of Jurisdictions Outside California

A third survey was conducted to determine the experiences of jurisdictions outside California that provide call boxes either in medians or alongside median HOV lanes. Selected members of the TRB Freeway Operations Committee and FHWA representatives were polled in an attempt to identify such installations. Telephone surveys were then conducted to determine the details of the installations, the experiences of their operators, and the respondent's recommendations as to whether California should provide similar facilities. Only two installations were identified, one of them a toll bridge and the other a tunnel. Since both involved somewhat unusual situations, experience with them was of limited relevance to the study.

ACCIDENT STUDY

An accident study was conducted to establish the numbers and severities of accidents that might be prevented by providing median call boxes. The Traffic Accident Analysis and Surveillance System (TASAS) data base was used to identify all dismounted pedestrian accidents occurring in Caltrans Districts 7, 8, 11, and 12 during the 3-year period from January 1, 1990, to December 31, 1992. These four Southern California districts were selected because of their geographical proximities to San Diego State University and because they contain the majority of call boxes in California. Collision reports on file in the headquarters of these Caltrans districts were reviewed to establish the exact circumstances of these accidents.

Dismounted pedestrian accidents result from a variety of circumstances, most of which have nothing to do with call box use. To identify accidents that might have been prevented had a median call box been available, the following criteria were adopted: (a) a vehicle was stopped on the left-hand shoulder or in or next to a median HOV lane, (b) some individual (driver or passenger) from this vehicle was struck while attempting to cross the freeway lanes, and (c) there was cause to believe that the individual had attempted to cross the freeway lanes to use a call box.

A total of 642 dismounted pedestrian accidents were identified through the TASAS data base. Collision reports were located and reviewed for 602 of these. Table 1 summarizes the results.

Of the 602 accidents reviewed, only 2 clearly involved the three elements set forth earlier. One of these was fatal and the other involved injuries to the pedestrian. In addition, four accidents involved unexplained attempts to cross the freeway from the left-hand shoulder. These might have been related to attempted call box use, but there was no positive evidence that this was so. Three of these accidents resulted in fatalities; the fourth involved collisions among vehicles attempting to avoid a pedestrian who was not struck. None of these six accidents involved an HOV facility.

In addition to accidents meeting the criteria stated above, there were a number of accidents in which call box use was involved but was clearly not the cause of the accident. These included one case in which a victim had successfully crossed from the left-hand shoulder to use a call box, had returned successfully, and then was struck while standing on the left-hand shoulder. In another case a person other than the one crossing to use the call box was struck while standing on the left-hand shoulder.

TABLE 1 Results of Study of Dismounted Pedestrian Accidents

Caltrans District	Accident Circumstances				Total
	Call Box Use Involved	Unexplained Freeway Crossing	Definitely No Call Box Use	Report Not Found	
7	1	2	344	22	369
8	0	0	87	9	96
11	0	2	107	4	113
12	1	0	58	5	64
Total	2	4	596	40	642

Based on this accident study it appears that the number of accidents involving people struck while crossing freeway lanes to access call boxes is on the order of one per year in Southern California. By way of contrast, numerous dismounted pedestrian accidents result from people exiting vehicles stopped in the lanes because of accidents or mechanical problems, people ejected from vehicles during accidents who are subsequently struck by a vehicle, and people exiting vehicles parked on the shoulder (most often the right-hand shoulder) and either standing on the shoulder or working on a vehicle. A rather large proportion of dismounted pedestrian accidents occur at night, and a very large percentage of them involve drivers who are intoxicated or otherwise impaired. In any case call box use is not a significant factor in such accidents.

COST ANALYSIS

A cost study was undertaken to determine the approximate cost of installing call boxes in medians or alongside median HOV facilities. The unit costs of installing and operating call boxes in medians were assumed to be similar to those for call boxes on right-hand shoulders. A recent estimate by the San Diego SAFE of the cost of extending call box service to Imperial County was used as a basis for calculating unit costs. In addition, the costs of extending FSPs as an alternative to providing median or HOV lane call boxes were calculated for purposes of comparison.

The average annual cost of installing and operating a call box, assuming a 10-year life and interest rates of between 5 and 10 percent, was estimated to be between \$1,320 and \$1,400. In areas for which guidelines specify 0.4-km spacing, installation of one additional call box in the median opposite the existing call boxes would require 2.5 additional boxes per kilometer, at an annual cost of approximately \$3,500.

By way of comparison, average FSP costs in Los Angeles reported by Finnegan (1) are about \$50/hr/truck, with an average of 0.25 trucks per directional kilometer served required to provide the current level of service. Provision of such service 24 hr/day for 365 days/year would cost about \$110,000/km/year; provision of service for 8 hr/day on weekdays only (similar to the service currently provided) costs about \$25,000/km/year.

POTENTIAL SAFETY IMPACTS

Installation of emergency call boxes in freeway medians and alongside median HOV facilities is warranted only if they promise to provide a distinct safety advantage at a reasonable cost. The results of the accident study and the cost analysis indicate that although the costs are quite reasonable (especially compared with alternative means of providing motorist assistance), there is no reason to believe that there would be a significant safety advantage.

The major argument in favor of installing median call boxes is that they can prevent accidents that result when persons are struck while attempting to cross freeway lanes to access a call box. The accident study showed that such accidents are exceedingly rare. Meanwhile, many of the respondents in the surveys of California call box professionals and CHP officers expressed the opinion that median call boxes would actually cause more accidents than they would prevent.

The argument that median call boxes might increase accident risk is based on the assumptions that (a) they encourage motorists to stop

on the left-hand shoulder, and (b) accident risks are distinctly higher on left-hand shoulders than on right-hand ones. To show this conclusively it would be necessary to establish the fact that placing call boxes in medians increases the exposure of persons and vehicles on median shoulders and that the risk of accidents is greater on the left-hand shoulder than on the right-hand shoulder when the different levels of exposure are considered.

Establishing these facts is quite difficult, since establishing the levels of exposure requires measuring the times spent by both vehicles and dismounted pedestrians on left-hand and right-hand shoulders. Such data are not readily available, and their collection was well beyond the scope of the study.

The only information found that seems to bear directly on the exposure issue is data regarding the location of FSP contacts with disabled vehicles. These data are broken down according to whether the vehicle serviced was stopped on the left shoulder, in the lanes, on the right shoulder, on a ramp, or at some other location. Exact figures vary somewhat on the basis of the service area and the time period considered, but in general, about 5 or 6 percent of the contacts occur on the left-hand shoulder and about 80 to 85 percent occur on the right-hand shoulder (4). In other words disabled vehicles are 13 to 17 times as likely to be on the right-hand shoulder as on the left-hand shoulder. It should be understood that these figures may not be entirely representative, since FSPs are limited as to the areas and the times of day that they serve. Also, they reveal only the numbers of vehicles stopped in various locations and not the amounts of time that they would remain there in the absence of the FSP.

Of the dismounted pedestrian accidents considered in the accident study, about 8 to 10 percent occurred on the left-hand shoulder and 25 to 35 percent occurred on the right-hand shoulder; that is, the accidents were 3 or 4 times more likely to occur on the right-hand shoulder than on the left-hand shoulder. Comparing the ratio for exposure to that for the number of accidents, it appears that the accident risk for dismounted pedestrians might be 3 or 4 times greater on the left-hand shoulder than on the right-hand shoulder. Such a comparison is certainly not conclusive, but it does suggest that there is a basis in fact for the belief that accident risk is greater on left-hand shoulders.

The question of whether median call boxes encourage motorists to stop on the left side of the freeway is even more difficult to address. At this time the only median call boxes in California are those along the I-15 reversible HOV roadway in San Diego. Analysis of calls from boxes along this section of freeway over a 1-month period showed that of 213 calls made during times when the HOV lanes were closed, 24 were made from median call boxes. That is, calls from the right-hand shoulder are about 8 times as likely as calls from the left-hand shoulder. It should be noted that in this case call boxes are located on only one side of the HOV facility at any given point and are therefore accessible from only one direction of the main lanes. Consequently, the rate of calls from median call boxes in this case should be roughly half that expected when median call boxes are accessible to motorists traveling in both directions. This leads to the conclusion that for normal median call box installations, the ratio of right-hand shoulder to median shoulder calls might be no greater than 4 to 1. If this is compared with the statistics on FSP contacts cited previously (disabled vehicles are 13 to 17 times more likely to be on the right-hand shoulder), it is clear that the median call boxes may very well be encouraging motorists to stop on the left-hand shoulder. Once again the analysis is not conclusive, but only suggestive, since the area involved is small and not necessarily typical of the freeway system as a whole.

To the extent that the issue can be decided, then, it appears that installation of median call boxes will not result in a significant safety benefit and that it might even be detrimental.

MEDIAN HOV FACILITIES

Although it does not appear that median call boxes are warranted in most situations, a somewhat stronger case may be made for them when there are barrier-separated median HOV facilities with adequate shoulders. In this case there is virtually no access to call boxes otherwise. Experience with call boxes alongside the barrier-separated HOV lane on I-15 in San Diego has generally been good, although there appears to be little use of them by traffic from the HOV lane. In all cases in which call boxes are installed along barrier-separated HOV facilities, it is important that adequate shoulders and sight distances be available.

In cases in which HOV lanes are not separated, there appears to be little reason to install median call boxes. Such HOV facilities are of two varieties: those that are separated from the mixed-traffic lanes by intermittent striping only, which are referred to as contiguous, and those that are separated by a paved buffer of 1.2 to 2.1 m (4 to 7 ft) with double yellow stripes on each side. In neither case is the difficulty of accessing the right-hand shoulder significantly greater than that from accessing it from the leftmost lane of a mixed-traffic facility of comparable width. Consequently, the arguments that apply to the advisability of placing call boxes in the medians of regular freeways also apply to nonseparated HOV lanes.

One problem that may be unique to nonseparated HOV lanes is that stalled vehicles can easily block an HOV lane, and if it is to retain its effectiveness, these must be removed promptly. For this purpose FSPs would appear to be more useful than call boxes, despite their higher costs. At present, all buffer-separated HOV facilities and some 85 percent of contiguous HOV lanes in California are served by FSPs. Those nonseparated HOV facilities that do not yet have FSP service are likely candidates for extension of patrol service, since they typically service high volumes of traffic and experience congestion in the main lanes.

CONCLUSION

The present study has considered the advisability of installing emergency call boxes in freeway medians or alongside median HOV facilities. Based on the evidence presented here, it does not appear that median call boxes are warranted except in the case of barrier-

separated median HOV facilities with adequate shoulders. The costs of installing median call boxes are expected to be modest (about \$3,500/km/year for 0.4-km spacing), but it appears unlikely that any significant safety advantage could result. The types of accidents likely to be prevented by providing call boxes in medians are extremely rare; meanwhile, a number of call box professionals argue that median call boxes could increase accident risks by increasing the exposure of persons and vehicles on median shoulders. Although certainly not conclusive, evidence suggests that the accident risk is higher on left-hand shoulders than on right-hand shoulders and that the provision of call boxes in medians would encourage stops on the left-hand shoulder.

In the case of barrier-separated HOV lanes, installation of call boxes may be warranted by the fact that there is virtually no access to motorist assistance services otherwise. In the case of other types of median HOV facilities, access to call boxes on the right-hand shoulder is similar to that from the mixed-traffic freeway lanes, so that median call boxes are not warranted.

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