Effective performance measures for highway patrol agencies to change poor driver behaviors

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Abstract

Several indicators suggest that the number of traffic fatalities is likely to increase in the United States. While motor vehicle crashes have multiple contributing factors, the approach that can have the highest impact in improving traffic safety is the one that focuses on the driver; as the driver behavior is the largest source of causal factors related to crashes. Highway patrol agencies enforce traffic laws in an attempt to catch violators who put their own safety and that of others at risk. Their ultimate goal is to make a positive change in undesirable driver behaviors. As such, highway patrol agencies play a critical role in improving traffic safety. Given this, the purpose of this paper is to introduce a comprehensive set of measures that could be used by highway patrol agencies to measure and improve their organizational performance. A case study was conducted, studying the current performance measures that are in use in the Wyoming Highway Patrol (WHP) to identify ways to improve those. This study scrutinized WHP’s performance measures to propose new and more effective performance measures considering two main characteristics of patrol operations in enforcing traffic laws: activity and visibility. The proposed performance measures have the potential to increase the organizational performance of WHP, enabling WHP to better meet its goals as an agency. The reasoning behind each proposed performance measure, specifically the concept of “meaningful activity” as proposed in this paper, could be beneficial for developing national performance measures for highway patrol agencies to ultimately establish a consistent framework at the national level.

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Keywords: Driver behavior; Highway patrol; Performance measures; Traffic safety
1. Introduction and background

According to the U.S. Department of Transportation [1], highway fatalities account for nearly 93 percent of the total U.S transportation related fatalities [1]. In the United States, travelling by motor vehicles is the primary mode of transportation [2], yet despite all of its convenience and advantages, motor vehicle crashes are considered to be the leading cause of death for people up to age 34, specifically for teens and young adults with ages from 15 to 24 [3].

The National Highway Traffic Safety Administration (NHTSA), in its 2010 overview of motor vehicle crashes, has documented that 2010, with 32,885 people killed and 2,239,000 people injured [2] had the lowest number of fatalities since 1949, declining 2.9 percent since 2009 [4]. This declining trend continued with 32,367 people killed in motor vehicle crashes in 2011 [1]. It should be noted that although this number represents the fewest number of people killed in traffic crashes in a single year since 1950, it also indicates that an average of 89 lives per day were lost in traffic crashes [3]- one every 16 minutes [2]. Moreover, based on an estimated 34,080 fatalities during 2012, there is an increase of about 5.3 percent compared to the number of fatalities that occurred in 2011 [5]. This is the first year-to-year increase in traffic fatalities since 2005. Unfortunately, several indicators suggest that the number of traffic fatalities is likely to increase in the coming years [6].

All of the facts presented above suggest the importance of traffic safety and the need to improve it. When talking about traffic safety, it is important to have the roadway, the vehicle, and the roadway user (e.g., drivers) in mind, as research indicates that they contribute to 33, 10 and 93 percent of the crashes, respectively [7]. Motor vehicle crashes have multiple contributing factors; therefore to promote traffic safety, there needs to be a multidisciplinary approach which includes all stakeholders. The most common approach to include the broad stakeholder communities responsible for making roads safer is known as the “4 Es” of traffic safety [7, 8]:

- Engineering (e.g., roadway planning, design and traffic engineers, operation, and maintenance);
- Enforcement (city police, sheriff, state, and local law enforcement agencies);
- Education (e.g., driver education, state traffic safety offices, schools, citizen advocacy groups); and
- Emergency Medical Services (EMS) (e.g., first responders, paramedics, fire, and rescue).

Each of these four categories brings a unique viewpoint to improving traffic safety practices. For instance, engineers tackle safety issues from the roadway and vehicle perspective while law enforcement entities focus on road users’ behavior. These two, along with educational approaches, contribute to traffic safety from a preventive point of view rather than post collision care, which is mostly the focus of emergency groups [8].

While motor vehicle crashes have multiple contributing factors; the approach that has the potential to have the highest impact in improving traffic safety is the one that focuses on the roadway user; as driver (more specifically driver behavior) is the largest source of causal factors related to crashes. An important outcome of this fact is that actions that can influence driver behavior are key to reducing the frequency (and severity) of crashes. As roadway users contribute to a large percentage of traffic crashes, highway patrol agencies enforce traffic laws in an attempt to catch violators who put their own safety and that of others at risk. Their ultimate goal is to make a positive change in undesirable roadway user behaviors.

2. The need and the purpose

In order for the agencies to improve their performance in enforcing traffic laws to prevent the crashes, they need to be able to measure their performance in the first place. This calls for the use of effective performance measures that best reflect the purpose of traffic safety.

With the use of effective and consistent performance measures in an organization, internal and external benchmarking can be performed to improve the performance. There are many definitions available on the topic of benchmarking. Construction Industry Institute defines it as “the systematic process of measuring one’s performance against recognized leaders for the purpose of determining best practices that lead to superior performance when adapted and utilized”[9]. Benchmarking process can be done either internally or externally. In the case of internal benchmarking, comparative analysis is made against organization’s own projects; while in the case of external
benchmarking, projects are sought from other organizations as well; and ultimately the comparison is conducted among multiple organizations [10]. Internal benchmarking, often considered to be the starting point of the quantitative process examination [10], would enable decision makers to compare the divisions of an organization, identify the best performing ones, and learn their best practices so that other divisions could take advantage and improve their performance as well. The same logic applies to external benchmarking of several organizations that follow the same goal, with the added value of comparing one organization against its competitors [10].

Given the important role of performance measures in improving an agency’s performance (either through internal or external benchmarking), the purpose of this paper is to propose a set of effective performance measures for highway patrol agencies. Most of the highway patrol agencies currently use performance measures such as the number of citations, number of fatalities, and number of fatal and injury crashes. This paper aims at scrutinizing and improving those measures, via the use of a case study approach focusing on the measures used by the Wyoming Highway Patrol, to propose measures to promote more effective actions that could improve enforcement. This is in line with the “Moving Ahead for Progress in the 21st Century” Act, commonly known as MAP-21 (in effect since July 2012). MAP-21, among other things, is designed to help transportation safety administrations reduce traffic crashes, injuries and fatalities. It also makes federal funding for transportation agencies and State Departments of Transportation (DOTs) available based on their performance [11]. Moreover, the American Association of State Highways and Transportation Officials (AASHTO) Standing Committee on Performance Management (SCOPM) task force on performance measure development reports that, based on the MAP-21, there is a need to develop a set of standard and consistent national performance measures [12]. The traffic safety performance measures proposed in this paper could serve this purpose as well.

### 3. Methodology

To propose effective performance measures for highway patrol agencies, this research uses the Wyoming Highway Patrol (WHP) as a case study to identify how their current Strategic Plan is regarded by highway troopers and executive staff. According to Stake [13], a case study is a strategy of inquiry where the depths of a program or process are explored by the researcher [13]. The researchers try to collect detailed information on the subject using a variety of data collection procedures. Creswell [14] lists observations, interviews, documents and audio-visual materials as approaches for qualitative data collection. Creswell [14], also suggests that contrary to quantitative research where a large number of data points are typically required, qualitative research does not necessarily call for the selection of a large number of interviewees [14].

The authors conducted semi-structured interviews with six of WHP’s staff, including two majors, three captains, and a lieutenant; which resulted in a rich gathering of information. The interviewees were selected based on their knowledge of and involvement with the performance measures currently used in WHP. The choice of semi-structured interview method was to help minimize the variation of discussions and at the same time not restrict the interviewees too much [15]. As a result, these interviews allowed for detailed explanations and elaborations on the answers and necessary clarifying questions. The interviewees were asked several open-ended questions about WHP’s current Strategic Plan, its shortcomings, and suggestions for improvement. As suggested by Creswell [16], the authors asked general, open-ended questions so that the interviewees were given the chance to provide answers with minor influences from the interviewer [16].

The audio taped interviews were transcribed and studied further (manually and also with the help of NVIVO- a qualitative data analysis software) in order to find the common threads between them. General information on WHP (as described under the section entitled “Background information on WHP”) was previously gathered through another semi-structured interview with WHP’s Captain of Safety, Training, and Records.

After the interviews were reviewed by the authors, the performance measures developed were introduced to WHP’s Field Services Commander, Support Services Commander, and Captain of Safety Training and Records to seek their feedback and validation. The performance measures proposed in this paper, along with the logic behind their development could be used by highway patrol agencies across the nation to evaluate and improve their performance measures.
4. Background information on WHP

Wyoming is the 10th largest state and one of the least populous ones, making it the state with the second lowest population density after Alaska. The capital of the state, Cheyenne, with 60,000 residents, is Wyoming’s most populous city [17].

Established in 1933, the Wyoming Highway Patrol (WHP) defines its primary duty as “to keep the motoring public safe as they travel over 6800 miles of highways in the state, including 900 miles of interstate.” WHP consists of two sections: Field Operations and Support Services [18], where civilian (with no arresting powers) and sworn officers (with arresting powers) are working. WHP is within the Wyoming Department of Transportation (WYDOT). The head of WHP, with the rank of colonel, reports directly to the director of WYDOT.

Wyoming is divided into five districts, which are further subdivided to make a total of 17 divisions throughout the state. The amount of available manpower differs from district to district depending on the number of enforcing officers required to meet the enforcement needs of each division. This is based on division’s characteristics, such as population, traffic volume, Commercial Motor Vehicle (CMV) traffic, terrain, typical weather conditions, mileage, and number of calls/complaints received over the course of a year, as well as trends and changing demographics. For instance, Division T covers a region that has greatly developed the oil and gas rich resources, which has significantly changed the demographics within that division.

During the years 2003/2004 and for accountability purposes, WHP was encouraged to take advantage of performance measures in their organization at the suggestion of the Governor’s Office. WHP, then, studied the Colorado State Patrol (CSP) that had been utilizing performance measures at that time and developed measures that were very similar to those of CSP’s. The idea of implementing Balanced Scorecards to measure the performance of the various programs within WYDOT came into the picture at this time. There was a natural fit between WYDOT’s use of Balanced Scorecards, and the use of performance measures by WHP.

The Balanced Scorecard concept, developed by Kaplan and Norton, was introduced as a way to measure and improve organizational performance [19]. The Balanced Scorecard suggests four different perspectives that need to be considered in order to have a comprehensive performance measurement framework. These four categories are as follows: (i) financial, (ii) customer, (iii) internal business process, and (iv) innovation and learning, later renamed as learning and growth [20, 21]. As a result, WHP has considered the Balanced Scorecard perspectives and developed seven overall goals that are outlined in its strategic plan [18]. These goals, as extracted from WHP’s scorecard, are as follows[18]:

- Reduce highway fatalities, alcohol-related crashes, and injury crashes
- Maximize our enforcement, educational, and support efforts
- Develop and care for our employees
- Perform our duties and obligations without reservation
- Handle every call with a service-oriented response
- Develop and maintain an agency structure that prepares WHP for future growth and demands
- Operate within a balanced budget

Fortunately, these early efforts were in line with directions encouraged by NHTSA and other federal agencies. According to a report published in August 2008, a minimum set of performance measures was decided by NHTSA and the Governors Highway Safety Association (GHSA) to be used by state and federal agencies in the preparation process of their highway safety plans [22]. The report discusses that performance measures should be used to set goals as well as measures and assess an organization’s progress on local, state, and federal levels. It goes on to categorize behavior traffic safety performance measures into three groups: outcomes (crashes, injuries, and fatalities), activities (media, education, and all other activities that may affect traffic safety), and behavior itself (observed behaviors on the road and/or in surveys) [22].

However, despite the fact that WHP has been using performance measures for quite some time now, Wyoming’s fatality rates are still higher than the national average [23]. Table 1 compares fatality rates in Wyoming, the USA average, and the best state.
Table 1. Fatality rates: Wyoming, USA average, and the best state.

| Year | Fatalities per 100 Million Vehicle Miles Travelled (VMT) |
|------|--------------------------------------------------------|
|      | Wyoming | USA Average | Best State* |
| 2007 | 1.60    | 1.36        | 0.79        |
| 2008 | 1.68    | 1.26        | 0.67        |
| 2009 | 1.40    | 1.15        | 0.62        |
| 2010 | 1.62    | 1.11        | 0.64        |

*Note that the lowest rate in the best state could be in a different state each year.

This study focuses on the first two categories of the Balanced Scorecard section of WHP’s 2011–2013 Strategic Plan. That is mainly because the first two performance categories (i.e., (1) “Reduce highway fatalities, alcohol related crashes and injury crashes” and (2) “Maximize our enforcement, education and support efforts”) make up most of the performance measures used by WHP. This is in line with their attributed importance in highway patrol performance, as acknowledged by all six interviewees.

5. Findings

After discussing the current performance measures in WHP and by taking into consideration the interviewees’ viewpoints and concerns as to how to make these measures more effective, the proposed performance measures, discussed in the following two sections, were defined. These performance measures are introduced in a way that emphasizes two main characteristics of patrol operations in enforcing traffic laws: activity and visibility. Some of the developed performance measures specifically focus on troopers’ activities and their results (see the section entitled “Recommended performance measures related to citations and crashes”); while another one is mainly concerned with their visibility (see the section entitled “Recommended performance measure related to time”).

5.1. Recommended performance measures related to citations and crashes

One important metric in measuring patrol performance is citations. However, utilizing the “number of issued citations” measure individually does not necessarily provide a good reflection of the patrol performance. An officer can make many traffic stops to issue speeding citations only because it is very easy to have/catch drivers speeding on a specific stretch of a highway; despite the fact that there are no crashes happening because of speeding in that same stretch. Since eliminating/reducing crashes is very important, in addition to having a measure related to number of citations, WHP’s balanced scorecard has measures related to critical crashes (crashes which result in fatalities or incapacitating injuries) as well. Given these, instead of looking at citations individually, we propose to combine citations and crashes into one measure as will be explained in detail throughout this section.

It was mentioned by all of the interviewees that changing drivers’ behavior is the most important overarching goal of WHP that would result in the reduction in all kinds of crashes. In other words, while critical crashes are important to acknowledge and address (i.e., reduce), what WHP is charged with is to address and reduce the certain bad behaviors exhibited by the drivers resulting in those crashes. Progress toward this goal can only be measured by concurrently considering the number of issued citations aimed at changing bad driver behavior and the number of bad behaviors that have resulted in crashes (i.e., the measure of interest is not the number of crashes but the number of bad behaviors exhibited by drivers that have resulted in those crashes), regardless of the crash severity. To do this, we propose to normalize the number of issued citations for bad driver behaviors (different categories of “bad” driver behaviors are explained later in this section) by the number of bad behaviors exhibited by the drivers that have resulted in crashes. It is important to note that different from WHP’s current performance measures that only focus on critical (fatal and incapacitating injury crashes), this research takes into account all severity level crashes (from property damage only to fatal crashes). This is mainly because as discussed above, the ultimate goal of WHP is to change drivers’ behavior, which is independent from the severity of the crash; e.g., a driver exhibiting the bad
behavior of drunk driving could result in a crash that can be property damage only or fatal. Regardless of the severity of the crash, the driver is exhibiting bad behavior that needs to be changed.

The abovementioned way of concurrently considering the citations aimed at changing bad driver behavior and the number of bad behaviors resulting in crashes depicts meaningful activity by patrol that contribute to a desirable outcome (i.e., citations issued to reduce crashes resulting from bad driver behaviors) as opposed to independently investigating citations which would only depict activity by patrol. An important implication of introducing this performance measure (concurrently considering citations aimed at changing bad driver behavior and the number of bad behaviors resulting in crashes) would be to help push the idea of issuing meaningful citations, those that focus on bad behaviors that actually result in crashes. This requires a cultural shift in troopers’ mindset with respect to how, when, and where to issue citations. With the proposed way of defining measures, a trooper will look better if his/her enforcement activities result in one less bad driver behavior resulting in a crash as opposed to 100 more citations. This way, troopers will value where to invest their efforts to be more effective and efficient. It could be argued that this approach might convey a message of “working less” to the troopers, but this is not the case. The results of this new performance measure will teach troopers how to be more effective in achieving their ultimate goal of changing behavior. Working more is always good; however working more in a more logical and effective way is even better.

The abovementioned approach has been implemented to three different categories of “bad” driver behaviors as recognized by WHP: (i) Alcohol and drug-related, (ii) Speeding-related, and (iii) Distracted driving-related. It should be noted that these three categories of bad driver behaviors were recognized as main contributing factors to crashes as a result of a data-driven enforcement study conducted by WHP and was mentioned by all interviewees. These categories are individually and equally important and valuable to the agency and thus are incorporated into the proposed performance measures separately. Also it should be noted that one crash can have multiple reasons, the same way that one traffic stop could lead to multiple citations. Presented below in Equations 1-3 are the separate performance measures developed for each category. It is important to note that, WHP (like many other highway patrol agencies) keep a robust citation database with information on every single citation issued as well as a crash database with information on the bad driver behavior(s) that were prominent in (i.e., resulted in) every single crash. Therefore, the performance measures presented below can easily be computed for a chosen period (e.g., quarter, year, etc.) to assess the performance over that period.

- **Performance Measure for Addressing Alcohol and Drug-related Behaviors:**

\[
\frac{\text{Number of Driving Under the Influence (DUI) citations issued}}{\text{Number of alcohol and drug-related bad behaviors exhibited by the drivers that have resulted in crashes}}
\]  
(1)

- **Performance Measure for Addressing Speeding-related Behaviors:**

\[
\frac{\text{Number of speeding citations issued}}{\text{Number of speeding-related bad behaviors exhibited by the drivers that have resulted in crashes}}
\]  
(2)

- **Performance Measure for Addressing Distracted-related Behaviors:**

\[
\frac{\text{Number of distracted driving citations issued}}{\text{Number of distracted driving-related bad behaviors exhibited by the drivers that have resulted in crashes}}
\]  
(3)

Although the abovementioned three categories of behaviors are the ones that most contribute to crashes, there are still other reasons for crashes, which are mostly relevant to improper lane usage and following too close as indicated by WHP staff. Since limiting the performance measures to the abovementioned three categories could result in troopers concentrating solely on them, it is important to introduce a fourth performance measure that includes all other behaviors. This performance measure would ensure that the troopers get credit for issuing other citations (other than the citations issued for the abovementioned three categories) and ultimately preventing crashes resulting from other bad behaviors. Therefore, we introduce the following measure in Equation 4 in addition to the three that were introduced earlier:
• Performance Measure for Addressing Other Bad Behaviors:

\[
\frac{\text{Number of other citations issued}}{\text{Number of other bad behaviors exhibited by the drivers that have resulted in crashes}} \quad (4)
\]

It was mentioned above that with the proposed way of defining measures, a trooper will look better if his/her enforcement activities result in one less bad driver behavior resulting in a crash as opposed to 100 more citations. This is due to the typical disparity in the order of magnitudes of the numbers that will go into the numerator vs. denominator in the proposed measure. Since in general, and certainly in the case of WHP, the number of crashes (and thus the number of bad behaviors that have resulted in crashes) is significantly lower than the number of citations in terms of order of magnitude, a change in denominator tends to affect the overall measure more so than a similar amount of change in numerator. This can be illustrated by actual data from one of WHP’s divisions for Calendar Year 2011: In that calendar year, this particular division had issued a total of 5099 (i.e., the value of the numerator in the proposed measure) speeding citations. In the same time period, there were 18 (i.e., the value of the denominator in the proposed measure) speeding-related bad behaviors exhibited by the drivers (e.g., exceeding the speed limit, going too fast for conditions, racing) that have resulted in crashes. This results in a performance score of 283 (5099/18) for this division for the proposed performance measure. If, say, for the same time period, the troopers issued 100 more citations without being able to reduce the number of bad driver behavior-related crashes, the division’s score would yield to 289 (5199/18). If, on the other hand, some of the 5099 speeding citations they issued were issued in more crash-prone areas and crash-prone times; thereby resulting in a change in driver behavior in those areas and times; even if reducing the number of speeding-related bad behaviors exhibited by the drivers that have resulted in a crash by just 1, this division’s performance score would significantly increase, to 300 (5099/17). The main point of this discussion is that while more activity by the troopers will be rewarded based on the proposed performance measure (e.g., performance score going from 283 to 289), meaningful activity will be much more rewarding (e.g., performance score going from 283 to 300).

5.2. Recommended performance measure related to time

This performance measure is composed of the following two components: (i) Number of Enforcement Hours and (ii) Number of Hours Dedicated to Public Outreach Programs

The first component of this performance measure, i.e., “Number of Enforcement Hours”, depicts the visibility performance of the patrol. The hours that are included in this measure represent patrolling and enforcement time, which accounts for the number of hours that a trooper is out in the field, being visible and proactive; and thereby potentially changing bad driver behaviors through that visibility. Thus, the remainder a trooper’s time during which she/he could be engaged in administrative work (e.g., entering citations and crash information into relevant databases, recording evidence, making a court appearance, meeting with the district attorney, etc.) instead of being in the field, visible, is excluded from this measure.

The “Number of Hours Dedicated to Public Outreach Programs” is the second component of this performance measure. Outreach programs provide visibility by the patrol on the educational side. Although they may not be considered conventional enforcement activities, they will eventually contribute to a change of behavior and safer traffic manners. The importance of these activities was highlighted by many of the interviewees.

6. Conclusion and future research

This study scrutinized the performance measures in the top two performance categories of WHP ((1) “Reduce highway fatalities, alcohol related crashes and injury crashes” and (2) “Maximize our enforcement, education and support efforts”) and proposed new and more effective performance measures considering the two main characteristics of patrol operations in enforcing traffic laws: activity and visibility. A total of five new performance measures are proposed under two main headings, four under the heading “Measures Related to Citations and Crashes” and one under the heading “Measure Related to Time”. The proposed performance measures have been developed based on meetings and interviews with WHP’s staff. The reasoning behind each new performance
measure, as documented in this paper, was discussed with WHP’s high-ranking officers; and all new measures were validated by them as reasonable and effective. Furthermore, these new performance measures were recognized by WHP as useful for fulfilling the agency’s goals. The proposed performance measures can be utilized by other highway patrol agencies with similar goals to those of WHP. Moreover, the reasoning behind each proposed performance measure, as documented herein, could be beneficial for developing national safety measures for highway patrol. This is also helpful for establishing a consistent framework on a national level. With a set of consistent performance measures, benchmarking processes are easier to conduct which are advantageous for improving the performance of organizations.

Future research is needed to use the developed performance measures to conduct internal and external benchmarking to further improve the organizational performance of the highway patrol agencies. With findings discussed in this paper and existence of useful, effective, and consistent performance measures, the possibility of conducting internal and external benchmarking studies would be higher. Moreover, further studies could be conducted on the efficiency of the organizations, where the effectiveness of an organization’s performance is measured against the amount of resources that it consumes. These resources could range from the amount of available manpower and equipment to the amount of available funding.

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