

# Revision of Statewide Traffic Data Standards Indicated During Implementation of a Traffic Monitoring System

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The New Mexico State Highway and Transportation Department developed the first statewide traffic monitoring standards. The standards went into effect October 1, 1988. To implement the standards, a mainframe computer-based traffic monitoring system was designed to receive, summarize, and report traffic data. The system became operational on June 1, 1989. During the development of the traffic monitoring system, modifications of the state traffic data standards were indicated. Modifications were for standards related to data collection, summarization, and analysis. Existing standards require refinement, and new standards must be written to address changing traffic monitoring technology and report requirements. Research activities will also further refine the data standards. Research issues identified during implementation of the traffic monitoring system may result in standards modification. A primary research issue raised was the impact of data summarization on summary statistic accuracy and precision. To address this issue, an alternative to data summarization by roadway functional classification was conceptualized and is currently being investigated. The revisions indicated to the traffic data standards demonstrate the importance of annual standards review. In the future, traffic monitoring issues may be more appropriately addressed because of the existence and continuing refinement of traffic monitoring standards.

The New Mexico State Highway and Transportation Department, in cooperation with the FHWA, developed statewide traffic monitoring standards. Adherence to the traffic data standards is required for governmental agencies and private consulting engineering firms. The standards are mandatory on all state roads and on all roads for which state or federal moneys are proposed to be used.

The process of drafting the standards began with a consultation of New Mexico traffic monitoring technicians in March 1988 (1). Draft standards were presented for federal and state review. Eighty-nine traffic monitoring standards were signed by the Secretary of the Highway and Transportation Department and became effective October 1, 1989 (2). From this date, equivalent traffic data were collected in New Mexico.

A system to accept, evaluate, and report the data was needed next. This system would be developed to electronically receive all traffic data collected in the state. All data collected would need to be tested for compliance with state standards. After testing, the system would be required to store compliant data in a primary data file for planning and engineering use, and

to store noncompliant data in a research file for further analysis. Such a system would also be needed to produce daily, monthly, quarterly, and annual traffic reports.

To meet these needs, a traffic monitoring system was designed by the department and developed by a private consultant on the department's VAX Model 8550 mainframe computer. The traffic monitoring system was installed for daily operation on June 1, 1989.

One of the traffic monitoring standards requires an annual review and, if required, revision to the standards. During the development of the traffic monitoring system, limitations in the initial state standards were identified. In some instances, midyear waivers from the standards were provided before the annual review of standards.

The principal modifications to the traffic monitoring standards, which were indicated in the first year of statewide, standardized traffic data collection, are identified in this paper. Modifications indicated to the initial standards are organized into three groups: data collection, data summarization, and data analysis. Within each of these groups, modifications are organized on the basis of current standards revision, new standards which should be developed, and recommended traffic monitoring research that may impact future traffic data standards.

## DATA COLLECTION STANDARDS

The New Mexico standards identified the procedure, equipment requirements, and period for collecting traffic data. During implementation of the traffic monitoring system, modifications were identified for standards revision and development of new standards, related to the data collection period. Data collection research issues were recommended related to standards designed to ensure base data integrity.

### Revision of Current Data Collection Standards

One characteristic of equivalent data is the uniform period of data collection. There are required periods for permanent and portable traffic recording device data acceptance. Portable traffic recording device activities are termed coverage or short-term counts, and include vehicle volume, classification, and weight data collection.

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One of the state standards specifies that a minimum of 48 consecutive hours of data will be reported for each coverage count site. The count period was derived from the improvement in the mean traffic statistic when based on a 48-hr count as compared with a 24-hr count. This improvement was identified in the *Traffic Monitoring Guide* published by FHWA in 1985 (3).

The standards are designed to enable consistent computation of traffic summary statistics from permanent and portable traffic monitoring devices. The primary summary statistics computed are annual average daily traffic (AADT), estimating traffic during a 7-day week; annual average weekday traffic (AAWDT), estimating traffic during the typical work week; and annual average weekend traffic (AAWET), estimating typical traffic on the weekend. Because of variability between the first four weekdays and Friday, the standards stipulated that coverage counts would be taken for 48 consecutive hours from Monday through Thursday.

This standard resulted in each traffic recording device being used at one site each week. The devices were set early Monday morning and recorded traffic data for 48 consecutive hours. Unfortunately, not enough week day hours remained to move the devices to another site and record a second 48-hr period. The efficient use of equipment and personnel suggested that the standard be modified.

Hourly automatic traffic recorder (ATR) data were reviewed, and the variability of Friday traffic was typically found beginning Friday afternoon. Friday morning traffic was similar to traffic recorded in the preceding 3 days. On this basis, an immediate waiver from state standards was granted in coverage count activities. The waiver specified that the 48 consecutive hours will be in either the AAWDT (00:00 Monday to 13:00 Friday) window or the AAWET (13:00 Friday to 24:00 Sunday) window. The existing standard was modified during system implementation in response to concern for efficient field data collection and on the basis of a review of existing traffic data.

A second revision of data collection standards was initiated by field equipment limitations. One of the principles of the state standards and the traffic monitoring system is "nesting." There is vertical nesting of counts as recommended in the *Traffic Monitoring Guide*. Vertical nesting of counts includes, for example, vehicle weight data being disaggregated and accessible for vehicle volume and classification data uses.

In addition to vertical nesting, the state standards also provide horizontal nesting, which is the disaggregation of summary statistics to base traffic data, and access to the data among organizations. The traffic count activities of other governmental units and the private sector in New Mexico are identical, and data are summarized identically, so the data base and summary statistics are equivalent and may be compared directly.

The state standards included vehicle speed compliance monitoring in the vertical nesting. Although the federal speed compliance activities are for one direction and for 24 hr, one standard required that compliance monitoring will be based on 48-hr intervals in both directions. This would nest volume data, and perhaps classification depending on the device used, with the speed data.

The traffic monitoring devices available to department field crews on October 1, 1989, could not accurately record the

nested speed data. The alternatives were to collect data without volume and classification vertical nesting or to collect no speed data. A waiver during the first year of standard data was provided. The waiver permits 24-hr speed monitoring in one direction. The traffic monitoring system software was modified to accept and report these data. The volumes cannot be used for other applications because they do not have a standard short-term coverage count period. This standard modification is an interim procedure. As equipment is upgraded, speed data collection activity will return to the principle of vertical nesting.

This modification of the state standards exemplifies the method used by the department to implement the traffic monitoring standards. Implementation included responsiveness to data collection activities and physical equipment limitations. The process of setting standards also defined the justification for upgrading traffic monitoring devices and established the data collection specification for new equipment acquisition.

### New Data Collection Standards

When the state standards were signed into effect, all automated vehicle classification monitoring conducted in New Mexico used portable equipment. The standards reflected this in requiring that vehicle classification counts be taken over 48-hr. The period would ensure vertical nesting of the data.

During implementation of the traffic monitoring system, the state traffic activities were extended to include permanent vehicle classification devices at nine sites. The sites are the traffic monitoring locations for the 12 New Mexico Strategic Highway Research Program (SHRP) sample road segments. The permanent devices, automatic vehicle classifications (AVCs), will be operational in 1990. The existing standard should be rewritten so the period only defines short-term classification counts. New standards must be prepared.

New standards will be needed to define base data and summary statistics for the AVCs. Although this discussion could be included under data summarization standards, it is developed at this point because the new standards will be generated from new data collection activities.

Classification summary statistics from AVCs will be defined parallel to traffic volume summary statistics provided from ATRs. Data will be summarized for each day, typical days of the week will be summarized by month, and monthly typical days of the week will be summarized for the annual traffic statistics. For a given site, there will be typical daily vehicle classification based on a 7-day week, the work week, and the weekend.

Unlike volume information, there will not be automatic computation of mean vehicle classification statistics by functional classification of roadway. The coefficient of variation (CV) of the vehicle classifications for each functional classification of roadway will be reviewed. The review will discern if some or all road classifications are appropriate for grouping vehicle classification data. If some grouping of data is indicated, monthly classification ratios (MCRs) could be calculated and used in a manner similar to monthly traffic ratios for adjusting coverage count activities.

Prior to installing the number of counters that would be required to establish an MCR, a benefit-cost analysis will be

conducted. The analysis would have to be positive before new standards are written to permit MCR adjustment of coverage count classification data to annual summary classification statistics.

The same demand for new standards caused by AVC installation was also created by changes in truck weight monitoring. When the standards were written, only portable weigh-in-motion (WIM) devices were proposed for New Mexico truck weight monitoring and inclusion in the traffic monitoring system. During implementation, it became evident that the traffic monitoring system should be written to accept data from permanent weighing stations. New truck weighing devices that would present a different magnitude of data than the portable WIM devices were planned for installation.

The data collection devices to be installed in New Mexico, for which new data standards must be written, are permanent Automatic Vehicle Weighing (AVW) stations. The two types of devices that will be installed and operational by 1990 to 1991 are roadway and bridge WIM systems.

The traffic monitoring system could be modified to receive permanent WIM data. However, the system cannot be revised to test and summarize these data until standards are written to define appropriate site daily, weekly, monthly, and annual data summarization from permanent devices. The new AVW standards will be drafted parallel to the volume and vehicle classification summary statistics. The monthly weight ratios (MWRs) will initially be standardized as unique, significant only at the site at which they are collected, until data can be reviewed to determine if weight data can be grouped among sites.

The development of standard traffic data, and standard implementation through the traffic monitoring system, creates the opportunity to closely compare equivalent data. New standards are required to conduct counts using improved technologies. Standardized data and new types of data lead to traffic monitoring research.

### Research Issues for Data Collection Standards

Whereas new standards are needed to summarize data from new traffic monitoring devices, further examination of MCRs and MWRs exemplifies a data summarization research activity. In the area of traffic data collection, there are two additional examples of needed traffic monitoring system research. These research activities will require further development of the traffic monitoring system software and may result in revision of the data standards. The data collection research activities relate to base data integrity.

A key principle on which the state standards and the traffic monitoring system were built is data integrity. The standards specify that during traffic monitoring, missing or inaccurate data may not be completed, filled in, or replaced for any type of traffic count, at any location, under any circumstance. This relates to "truth in data": traffic data users must have confidence that a 48-hr count is an actual 48-hr count, without use of imputation techniques or professional judgment with unknown and inestimable bias.

The data integrity standards were required to correct then-current traffic data practices. However, a valid, related research activity is needed to examine alternative imputation techniques, given varying missing data points, to determine the

error. It must be noted that this activity is only valid if the data used to test imputation approaches are equivalent data. The traffic monitoring system data base of standardized data will need to have been in operation for at least 1 year before this research activity can proceed. With an adequate data base, alternative imputation techniques in varying data cases, by data type, can take place.

If this research activity determines that under specific circumstances specific imputation techniques can be applied, the standards may be revised accordingly. The principle of traffic monitoring data integrity is important and retained in this procedure. There will be no data manipulation until the statistical impact of that manipulation has been demonstrated. Even in this instance, should an imputation technique be appropriate within well-defined boundaries, the traffic monitoring system will retain the base data prior to imputation to continue to monitor the activity. Imputation techniques are essentially hypotheses. The distinction between actually counted base data and hypotheses for imputing missing points will be preserved. This will permit alternative hypotheses to be posed in the future, and the impact may be assessed on the associated summary statistics.

A second research activity related to base data integrity was discovered during implementation of the traffic monitoring system. The development of and testing for compliance with state standards achieved horizontally nested current data collection. It also achieved uniform computation and application of annual growth factors (AGFs) for road segments not counted in the current year. The AGFs are based on the mean growth rate for the same functionally classified roads, provided there is a minimum of five ATR sites that have standard data to aggregate for this purpose.

Until the traffic monitoring system was interfaced with the department's Consolidated Highway Database (CHDB) historical traffic data, it was not fully appreciated that most road segments in New Mexico will not be counted in the first years of traffic monitoring system operation. The data collected beginning October 1, 1989, will be equivalent, and the factors from these data will be equivalent, but the majority of traffic volumes in the state data base are the result of inconsistent data collection and data estimation.

A research proposal was developed to examine methods of testing for historical traffic data obsolescence. Through the department's CHDB, all historical traffic data are readily identifiable by unique road segment. When a coverage count is taken and adjusted for seasonality and axle correction, it is entered through the traffic monitoring system into the CHDB for general user computer access. A research activity is needed to test the date and quantity of other, noncounted, contiguous road segments. Because the CHDB has all road characteristics, intersecting roads and associated volumes will also necessarily be examined.

Alternative procedures will be developed to replace the uncounted, historically factored data when defined as obsolete. The potential replacement data would be based on the contiguous road segment count data. Traffic counts on segments with obsolete data will then be taken to determine if the data obsolescence procedure produced results consistent with count-based summary statistics.

This proposed research activity is scheduled to begin in July 1990 and be completed by July 1991. Recommended standards

modification, if the research project is successful, would be presented during annual standards review in September 1991. If successfully developed and approved by the department and FHWA, a data obsolescence procedure would be in place by October 1, 1992.

## DATA SUMMARIZATION STANDARDS

Data summarization is the procedure used to aggregate collected traffic data. The aggregation takes the form of attempting to represent the central tendency of the data in mean statistics (primarily for volume, classification, and weight), and median statistics (primarily for speed). Summary statistics also include the growth, axle, and seasonal adjustment factors noted during the description of changes in data collection standards. The way in which data are summarized fundamentally affects the adequacy of the resulting traffic statistics. During implementation of the traffic monitoring system, revision of current standards and research issues were identified.

### Revision of Current Data Summarization Standards

The state traffic monitoring standards establish a series of definitions for ATR data summary statistics. AADT is defined as the mean of monthly average daily traffic (MADTs/12). Similarly, AAWDT is the mean of monthly average weekday traffic (MAWDTs/12), and AAWET is the mean of monthly average weekend traffic (MAWETs/12).

Additional related summary statistic definitions include the following:

- MADT is the mean of monthly average days of the week (MADWs/7).
- MADW is the sum of all daily volumes of each day, Sunday through Saturday, in a month divided by the number of occurrences of standard accepted data for that day in the month. This will produce an average for each day of the week for that month.
- MAWDT is the mean of MADWs for Monday through Thursday in a given month.
- MAWET is the mean of MADWs for Friday through Sunday in a given month.

Alternative summary statistic computation procedures are available for standard testing. One approach, which is not appropriate for research activity because it requires unlimited missing data estimation, is to define AADT as the sum of all daily traffic in a year divided by 365.

The standards also define the minimum number of days with standard data for use of a permanent counter in computing mean adjustment factors by functional classification of roadway. "Included" ATRs are those within a functional classification, for a given count year, for which MTRs may be calculated. "Excluded" ATRs are those within a functional classification, for a given count year, for which MTRs may not be calculated. This is typically based on an inadequate sample of days of the week. The related standard specifies that for any ATR monthly traffic summary, if there are not

2 days with standard traffic data, for each day of the week, MTRs will not be calculated.

The standard was written incorrectly. The intention was to exclude data from ATRs with too few standard data in computing the mean MTR by functional classification used in adjusting coverage counts. However, there is still a need to calculate the MTR at the site and to be used appropriately. The traffic monitoring system was functionally developed to compute MTR for site-specific purposes for included and excluded ATRs. The standards required revision to distinguish between the minimum data for computing summary statistics at a specific site and the minimum data for including the summary statistics for functional classification adjustment factors.

A related data summarization error in the initial state standards concerns excluded ATR data. For excluded ATRs, the standards required annual average summary statistics at that site to be based on the same functional classification coverage count mean statistics. The coverage count functional classification growth rate was to be used to adjust the excluded ATR's previous year annual summary statistics to the current year.

An excluded ATR meant only that the summary data should not be included in functional classification mean adjustment factors. It did not mean that there were no valid data at the site. Moreover, if a growth rate must be applied, a more standard consistent source would be from other ATRs on the same functional classification. The standard must be revised to use site-specific data. The distinction needed in revising the standard summarization is between site-specific data use and use in mean adjustment factors by functional classification.

### Data Summarization Standards Research

Data summarization is the dominant subject of traffic monitoring research identified during implementation of the traffic monitoring system. Examples of needed summarization research have been indicated above. Research concerning the number of ATR sites required for mean adjustment factor calculation, minimum standard data days for included ATR sites, and an alternative to functional classification summarization are identified in this section.

The state standards required the installation of a minimum of eight ATRs for each functional classification of roadway. The standards permit grouping of the formal classification scheme to reduce the number of classifications by variability of data. Grouping of classifications is determined by cluster analysis. The standards further note that for application of the mean traffic volume summary statistics by functional classification, there must be a minimum of five ATRs for each functional classification or group of functional classifications.

The department has conducted cluster analysis of permanent counter data. It was found that the monthly data summaries could be grouped by four rural functional classes (Interstate, Principal Arterial, Minor Arterial and Major Collector, and Minor Collector and Local Road) and four urban functional classes (Interstate, Principal Arterial, Minor Arterial, and Collectors and Local Roads) (4).

The installation of a minimum of eight devices by functional classification group is based on estimated equipment mal-



function so that there will be a minimum of five included ATR sites. However, in the absence of equipment-maintenance monitoring, and because of completion practices for missing data, there is no way to correlate missing data by station with standard data requirements. One research need is to examine the research file data, collected but not standard compliant, by counter device. This will require modification of traffic monitoring system reports to conduct the equipment maintenance research, and may in turn result in modification of the standards. It will also be important to include in this equipment research activity newly installed AVC and AVW devices.

Under the state standards, functional classification monthly traffic summary data must be based on a representative sample of the days within the month, which will include a minimum of two days for each day of the week. This initial threshold for standard data days came from the experience of the traffic data professionals participating in the standards consultation. Other alternatives exist for defining included and excluded permanent device data. One alternative is the requirement of 14 consecutive days in a month, as stated in Appendix K of the *Highway Performance Monitoring System* (HPMS) manual (5). One of the data summarization research issues that will be investigated is the evaluation of alternative requirements, including the requirements under the present standards and HPMS.

In each of the data summarization research issues considered, roadway functional classification of data has been assumed. One of the primary research and development issues raised during development of the traffic monitoring system was an alternative data summarization method to this procedure.

The standards require that annual and monthly adjustment factors be based on the mean statistics from ATRs on the same roadway functional classification. Regional traffic variation will be analyzed across time, but now there will be no regional adjustment within a functional classification. The standards assume the validity of functional classification of data and use of monthly traffic adjustment factors as representative of seasonal variation.

The summarization of traffic data by functional classification of roads constrains traffic data. The way in which traffic data are summarized constrains data in four ways. The base data are grouped by hour. The hourly data are grouped by weekday and by the three summary statistics related to weekday hours. The weekday traffic summaries are grouped by month. The monthly traffic data are grouped by functional classification of roadways.

When a traffic planner or engineer applies the resulting summary statistics, the statistics have been affected, to some extent, by the process. The structure of this method of summarizing base data may be termed "functional classification summarized base data." The concern for this method is related to summary data accuracy and precision.

Traffic summary statistics must be adequate to their use. Adequacy depends on the accuracy and precision of the summary statistics. In previous New Mexico practice, this was not a concern only because no attempt was made to estimate or calculate confidence level and interval of summary statistics. Under the state standards, summary statistics must be accompanied with a statement of accuracy and precision.

Because of the importance of summary statistic accuracy and precision in many applications (from pavement design to traffic flow simulation), any error in variability caused by the summarization method would be an appropriate subject for research. The issue that arose during traffic monitoring system implementation is whether additional variability is introduced when constraining data by constructs as provided in functional classification summarized base data. The hypothesis formed was that functional class definition constrains summarization of monthly data, monthly definition of days constrains daily or weekly summarization of data, and uniform definition of the three key summary statistics into days of the week constrains summarization of hourly or 15-min base collected data.

The basis for the hypothesis is that data do not necessarily conform to these constraints, and inasmuch as they do not conform to these constraints, variability of the data is improperly modified. For example, traffic volume on a given road segment may be grouped in time intervals between 16:45 and 19:15 hours, or very commonly between 13:15 and 16:00. This would not be true for all segments, which makes the point that the data should determine the groups of data for analysis.

Taking this principle further, what defines "typical workday" travel may vary from roadway to roadway. What defines the representation of work and weekend days may be defined by the traffic on the roadway.

Under the current functional classification summarization method, monthly traffic summaries provide identical constraint on the data. In rural areas, the seasonal shift in traffic may relate more directly to crop periods than calendar months. In urban areas, the seasonal holiday or major event traffic may result in the mean statistic not representing the central tendency of the traffic for the month in which the events occur. Just as the traffic flows define the period of grouping the traffic, and the representation of work and weekend days, so the seasonal summarization of data may be based on the observed variance of the data rather than on the calendar seasons.

Finally, functional classification of roads is only an approximate representation of appropriately grouped roadways. Because a road segment is functionally classified in a group of other roadways does not mean that the actual traffic seasons are identical. The mean traffic summaries for roads in the same functional classification may not represent the character of the traffic.

The alternative is to define the operational classification of roads on the basis of the seasonal traffic variation. In "operational classification," the principle is that the data should define the categories, rather than the categories define the traffic data summaries.

Proposed for traffic monitoring system research and development is the use of both data summarization methods. The development of operational classification traffic summary statistics will allow comparison of functional classification summary statistics for the same roadways. Monthly traffic summary statistics may be compared with seasonal summaries. The functional classification monthly traffic ratio and adjustment factor may be compared with the operational classification seasonal traffic ratio and adjustment factor for the same road segment. By comparing the ratios and factors on roads with known data, the ability of either adjustment to estimate

reality can be observed. Similarly, weekday traffic summary statistics may be compared with variable day, and hourly with time increment traffic summary statistics. This will indicate whether there is a benefit from the revised summarization of traffic data.

Preliminary investigation of the impact of the proposed summarization procedure has been conducted. One of the first activities in assessing the potential of operational classification was based on prestandard, 1988 ATR daily traffic summary statistics. The daily volumes in August, September, and October were reviewed at seven ATR sites. The findings raised additional questions. Why did the September average daily traffic approximate unity with the annual average daily traffic, as typical nationally? The question became more interesting when the daily traffic summary for the September holiday was virtually identical with the September average daily traffic volume. This raised the contrainuitive result that the typical daily volume at the ATR sites was represented by a specific holiday at that site.

The problem with the initial data review could be partially attributed to previous data completion practices and to the examination of daily traffic summaries. The analysis proceeded to the review of hourly traffic volumes, principally peak hour volumes significant in, among other applications, pavement design and traffic simulation.

Traffic volume during 1988 from two permanent counters, rural and urban, were analyzed. Three hourly volumes (based around the peak hour) for Wednesdays throughout the 1-year period were reviewed. The monthly coefficients of variation were reduced through grouping of weeks based on data variability rather than month.

Two examples using November 1988 data illustrate the results of this initial experiment. At the rural Interstate counter location, the 95 percent confidence interval for the Wednesday 16:00 to 17:00 hourly volume mean was  $\pm 33.4$  percent. This interval improved to  $\pm 7.8$  percent when the data were grouped by season. The Wednesday peak hour statistic for the urban arterial counter location, with a 95 percent confidence interval of  $\pm 15$  percent, was reduced to  $\pm 2$  percent when the data were grouped by season.

The preliminary improvement of the seasonal peak hour data summary statistics through operational seasonal data partitioning suggests that more accurate and precise summary statistics may be calculated with alternative summarization methods. The improvement may enable further development of traffic data uses, such as comprehensive transportation modeling, previously restricted by traffic data limitations (6).

The operational summarization procedure is experimental. It is intended as a research activity that would occur within the traffic monitoring system at the same time the functional classification summarization and reporting procedures are conducted. Additionally, it is not proposed that the current functional classification reporting be replaced. For historical purposes, this procedure should be supported.

Traffic monitoring system software development for further experimentation with operational classification summarization has begun and is scheduled for completion by September 1990. Same standard-compliant data will be summarized using both functional and operational classification methods, and the impact analyzed for common traffic adjustment factors based on mean summary statistics.

## DATA ANALYSIS STANDARDS

The state traffic monitoring standards address some data analysis practice. Truth in labeling, as described above, provides information the traffic professional needs to analyze both base and summarized data. The standards also address data analysis in requiring that all traffic data be transmitted with confidence level and interval. During traffic monitoring system implementation, a need was discovered to revise the current standards and create standards.

### Revision of Data Analysis Standards

The state standards stipulate that all published or transmitted summary statistics must include a confidence level and interval and indicate one of the three standard units of volume measurement. The intention of the standards was that not only system-level, but also site-specific accuracy and precision should be identified and communicated as an integral part of any data analysis.

There was inadequate data from which to conclude specific or characteristic confidence in the traffic summary statistics. During implementation of the traffic monitoring system, other research was examined for default values. Proposed default values for characteristic confidence in the data, by data type and collection method, made assumptions which could not be confirmed by the New Mexico data base (7). The decision was made to defer the calculation or estimation of confidence level and interval until the traffic monitoring system data base had developed and data analysis could appropriately proceed. The implementation of confidence level and interval information was rescheduled to begin in July 1990.

A similar revision to the initial standards related to the desired accuracy and precision of the traffic data. Not only at a system level, but also at a site level, the standards defined a desired summary statistic confidence level of 95 percent and a mean variability interval of  $\pm 10$  percent. The standard did not take into account the inherent variability of traffic at some sites for some summary statistics. More appropriately, the standard should be revised to state the actual objective of the traffic monitoring program: to conduct the count activities in such a way as to reflect and document the central tendency and variability of the traffic.

### New Data Analysis Standard

A new data analysis standard was indicated during implementation of the traffic monitoring system. It is related to accuracy and precision issues for vehicle classification and weight data.

As noted above, the state standards require the publication of confidence level and interval with traffic summary statistics. Not addressed in the present standards is the indication of data variability in summary vehicle classification and weight statistics. On what would the variability of the data be based? Would there be a separate indication of variability by vehicle classification, and one for the resulting axle correction factor? Would there be an indication of variability by truck weight interval, and one for the resulting pavement loading char-

acteristics? New standards will need to be written to address these issues. Now the direction of the state standards is to comprehensive summary statistic accuracy and precision calculation or estimation. The feasibility of this direction will be assessed as the data base becomes more extensive through AVC and AVW data.

## SUMMARY

A traffic monitoring system was required to implement the New Mexico traffic monitoring standards. During implementation, modifications to the state standards were identified. After the first year of statewide standardized data activity, the interpretation of some standards has changed and the requirement for additional standards has been recognized.

Consistent in the process is the central importance of standardized traffic data collection, summarization, and analysis. The specific changes indicated in this paper were not anticipated when the standards were adopted. However, that changes would be required was anticipated and structured into the data standards as a review process. The experience of implementing standards in New Mexico emphasizes the importance

of making annual review a primary characteristic of standardized traffic data.

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