Traffic Data Program
Pocatello/Chubbuck Urbanized Area

August 24, 2015

BANNOCK
Transportation Planning
ORGANIZATION
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The preparation of this report has been funded in part by the U.S. Department of Transportation through the Federal Highway Administration and Federal Transit Administration under the Metropolitan Planning Program Section 104(f) of Title 23 United States Code. The contents of this report do not necessarily reflect the official views or policy of the U.S. Department of Transportation, Federal Highway Administration or the Federal Transit Administration.

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Introduction

Bannock Transportation Planning Organization (BTPO) has collected traffic data for at least twenty years. Collection efforts have not always been a comprehensive effort but rather data was collected for specific projects with specific goals. The traffic count program was developed when BTPO developed a Travel Demand Model (TDM) in the 1990's. At that time, there was not a lot of count data available or being collected. The purpose of that traffic count program was to assist in the validation and calibration of the travel demand model.

Over the past few years, federal planning requirements, technology and demands have changed the need for, and requirement to have, more and better quality data. Moving Ahead for Progress in the 21st Century (MAP-21) is the federal legislation for Metropolitan Planning Organizations (MPOs) like BTPO. MAP-21 requires long range transportation planning efforts to have a performance based approach. Many of the performance measures being considered rely on Vehicle Miles Traveled (VMT) and Vehicle Hours Traveled (VHT) which depend on data from the Traffic Data Program (TDP).

Technology changes over the last five years have introduced new methods that can be used to collect transportation data in ways that were impractical just a few years ago. Corridor travel times, which required a lot of field work to produce a static report, now can be collected in real time. There have been some changes in the way traffic data is collected. Some of the changes were in response to the limitation of road tubes. Road tubes that send air pulses to a machine are still the most common form of collecting traffic data. This technology works well on two lane roads with low to medium traffic volumes but not as well on multilane roadways with congestion. Vendors of road tube counters have made changes in technology and firmware to reduce errors and allow classification of slower moving vehicles.

Public and agency demand is another factor driving changes of how and what data is collected and how that data is disseminated. Traffic data is not just used by public agencies for transportation planning purposes, the data is also used to help determine locations for businesses and other business applications. Google applications and mobile devices have exposed people to much more data and information than ever before. People now expect that data, including traffic data, to be available and reliable. These factors highlight the fact that BTPO's traffic data collection processes need to be updated to reflect changing needs and available technologies. Existing traffic data collection efforts also need to be more transparent about how data is collected and presented in order to ensure confidence in the information presented.

The approach taken to resolve these issues and responds to changing requirements was to develop a formal Traffic Data Program. The TDP will outline current and proposed traffic data collection efforts that will be used to support performance management efforts in the region. The TDP will also provide methods of collection, analyzation, reporting and quality assurance.

The TDP is not intended to replace the Highway Performance Monitoring System (HPMS) for our area. HMPS is a federal requirement for states and includes traffic counts, Annual Average Daily Traffic (AADT), VMT, pavement and other reported data. BTPO works with the Idaho Transportation Department (ITD) Traffic Survey Section to coordinate traffic count collections and analysis. The ITD HMPS program does not provide all the data BTPO needs to calibrate the model or monitor performance.

Traffic Data Collection Needs

BTPO has primarily collected only traffic volume data. Speed or vehicle classification data has been collected at times when requested. The need for this type of data is increasing with the traffic operations center, traffic control software and federal requirements. Traffic data needs come from requirements of other transportation planning and design activities.

Traffic data was collected to assist in validating and calibrating the regional TDM. Traffic data is compared to data from the TDM to determine how well the TDM is performing. The Motor Vehicle Emission Simulator (MOVES) model takes a lot of data including vehicle volume, speed and classification by roadway type to estimate the vehicle emissions for a specific region. Traffic data is also used to determine how a specific roadway is operating. When designing a new roadway, traffic data helps to determine the specific design of pavement and the number of travel lanes.

Traffic data is the backbone data that serves as input into many process used by BTPO, ITD, cities and the county in planning for, operating and maintaining the transportation network. Traffic data needs for the BTPO urban area are volume, vehicle classification, speed data and travel time. Travel time will not be addressed in this document.

Volume data is the basic traffic data collected. Traffic volume is the number of vehicles that pass a specific point during a specific time period. Volume data is divided into continuous and short term counts. Continuous counts have a collection device which records the traffic volume all day every day. These continuous count locations are the best type of traffic counts since they operate every day. Short term counts are counts that can vary from 24-hours to several weeks of traffic volume data.

Vehicle classification is a system of classifying the type of vehicles which are included in the traffic volume data. Classification data divides vehicles into different classes such as passenger cars and trucks. This classification data is determined by the length of a vehicle.

Speed Data, as the name suggests, is the speed of vehicles as they travel a specific roadway segment. Speed data is usually reported as average daily speed. Speed data can also be collected into bins or five miles per-hour intervals.

Travel Time is similar to speed but in this case is the average time it takes vehicles to go from point A to point B. BTPO has developed several delay studies where travel times and speed for a specific corridor and segment were determined and compared to free flow speeds to determine congestion and level of service for a specific road segment.

Roadway Classification

FHWA has developed a set of classifications which divide roadways into local, collector, arterial and interstate. These classifications are also used in the TDM. Only collectors, arterials, interstates and some important local roads are included in the TDM. Traffic data collection also primarily focuses on collector, arterial and interstate roadways. The Traffic Data Program manual will focus on collecting data from these roads. Local street data is important and there has been guidance on increasing the sample of local streets to get additional data to assist in development of annual VMT data. When local streets are sampled, the procedures in this document will be used.

Monitoring Equipment

Short term and continuous are the two general types of traffic volume monitoring equipment. Short term counters are temporary in nature and are usually in place for 48 hours to as long as several weeks. Continuous counters are installed at a specific location and collect data 24 hours a day for an entire year. Short term counters are typically used to collect data at random and frequent locations. Continuous counters are site specific but the data can provide quality control data and information that can be used to improve the quality of short term counts.

Short Term Technology

Tube Counters: Tube counters use air switches that are activated when rubber hoses are stretched across a roadway. Tube counters can be used for volumes, speed and classification data collection. Tube counters work best in lower volume roadways and free flow conditions.

Radar Portable: Portable radar units use microwave energy pulses to detect vehicles. These radar technologies can also detect classification of the vehicle and its speed. Trailer mounted and portable are the two currently available technologies. Portable units are a newer technology and can only be used for two lane roadways.

Video Camera: There are several video camera technologies, some which are manual and others where the video is processed using computers. Video cameras are mounted on the side of the roadway and video is captured. Video technology is usually limited to 24 hour counts due to cost.

Continuous Count Technology

Radar: Portable radar units use microwave energy pulses to detect vehicles. These radar technologies can also detect classification of the vehicle and its speed.

Inductive Loops: This type of technology has several sub categories but all basically use a loop cut into the roadway that detects the presence of a vehicle through change in magnetic or electrical fields. Inductive loop technology requires another type of device to store the data collected.

The list below is the type of equipment used and what types of data it can collect.

- Tube Counters (Volume, Classification and Speed)
  - 18 Diamond Unicorn Limited (Allows many different study types)
  - 4 Diamond Apollo (Limited to preset tube layouts)
- Radar Fixed (Volume, Classification and Speed)
  - 1 Rural location (Volume, Classification and Speed)
  - 6 Interstate locations (Volume, Classification and Speed) (An additional interstate site is coming online)
  - 8 Principal or Minor Arterial (Only Chubbuck Road has Speed or Classification)
  - 2 Collectors (Cheyenne will be eliminated with completion of South Valley Road these only count volume)
- Portable Radar (Volume, Classification and Speed)
  - 1 Jamar Radar Recorder
- Detector Camera (Volume): This technology uses video detector cameras at intersections to create a form of Continuous Count Station (CCS). This new technology uses traffic signal controllers to count the number of vehicles detected. Currently, Pocatello is testing this at Alameda and Cedar and the results look great. Additionally, the region has implemented the Purdue phase diagrams which use advanced detectors and radar units to count speed and approach volumes. If implemented, eight addition CCSs can be online this summer and an additional 32 over the next four years. These are mostly on state highways.
- Video Camera (Turning Counts)
  - 1 MioVision Scout (requires video to be sent to company for processing)
  - 2 Counting Count Cam 100 (requires manual processing of video data)

Traffic Volume Sampling Plan

The Traffic Volume Sampling Plan describes the process used to identify traffic count locations and the number of traffic counts that are needed. The Federal Highway Administration Highway Monitor Guide provides a lot of information on how State Departments of Transportation can set up an HPMS program, therefore much of the information is presented in this traffic data collection manual.

Short Term Travel Demand Model Network Samples

There are some areas where 100 percent of the roadway miles are sampled which make determining where and what to sample a non-issue. BTPOs planning area consists of 1,102 roadway sections and on average only 105 sections are counted annually. Guidance from FHWA and the American Association of State Highway and Transportation Officials (AASHTO) is that roadway segments get sampled every three to six years depending upon the classification. The National Cooperative Highway Research Program (NCHRP) Report 716 Travel Demand Forecasting parameters and techniques recommends that only counts taken during the same year the TDM is being validated can be used for validation. BTPO revalidates the TDM every five years so, in theory, we only need to conduct traffic counts every five years. NCHRP Report 716 indicates that traffic counts used to validate a TDM should be the year of validation but since the region's growth rate is slow those counts taken the year prior to the validation, and the validation year, can be used.

ITD divides all the Federal Aid Highway systems into road segments. These segments have similar roadway characteristics. ITD assigned the TPO area 329 segments. BTPO completed a similar exercise of dividing the region into segments which has similar travel characteristics. That exercise end up with 156 segments (Figure 1) including serval local streets which were not included in the state HPMS segments. These segments are consistent with the links within the TDM.

There is limited guidance on the number of counts which should be completed for vehicle classification or vehicle speed data. BTPO gets the classification data primarily from vehicle registration data for the county. That data provides the amount of each type of vehicle for the region, but that data does not provide what class of vehicle uses specific roads. Speed data is in the form of corridor travel time studies. The Yellowstone Corridor currently has Bluetooth readers which determine vehicle operating speed. Other corridors travel time data is calculated using the floating car method. With exception of some CCS sites with speed data there is limited speed data collected.

The goal is to increase the number of counts twenty percent of the roadway sections including a section from each of the BTPO count segments. Additionally, twenty percent of the counts taken should include classification and speed data.

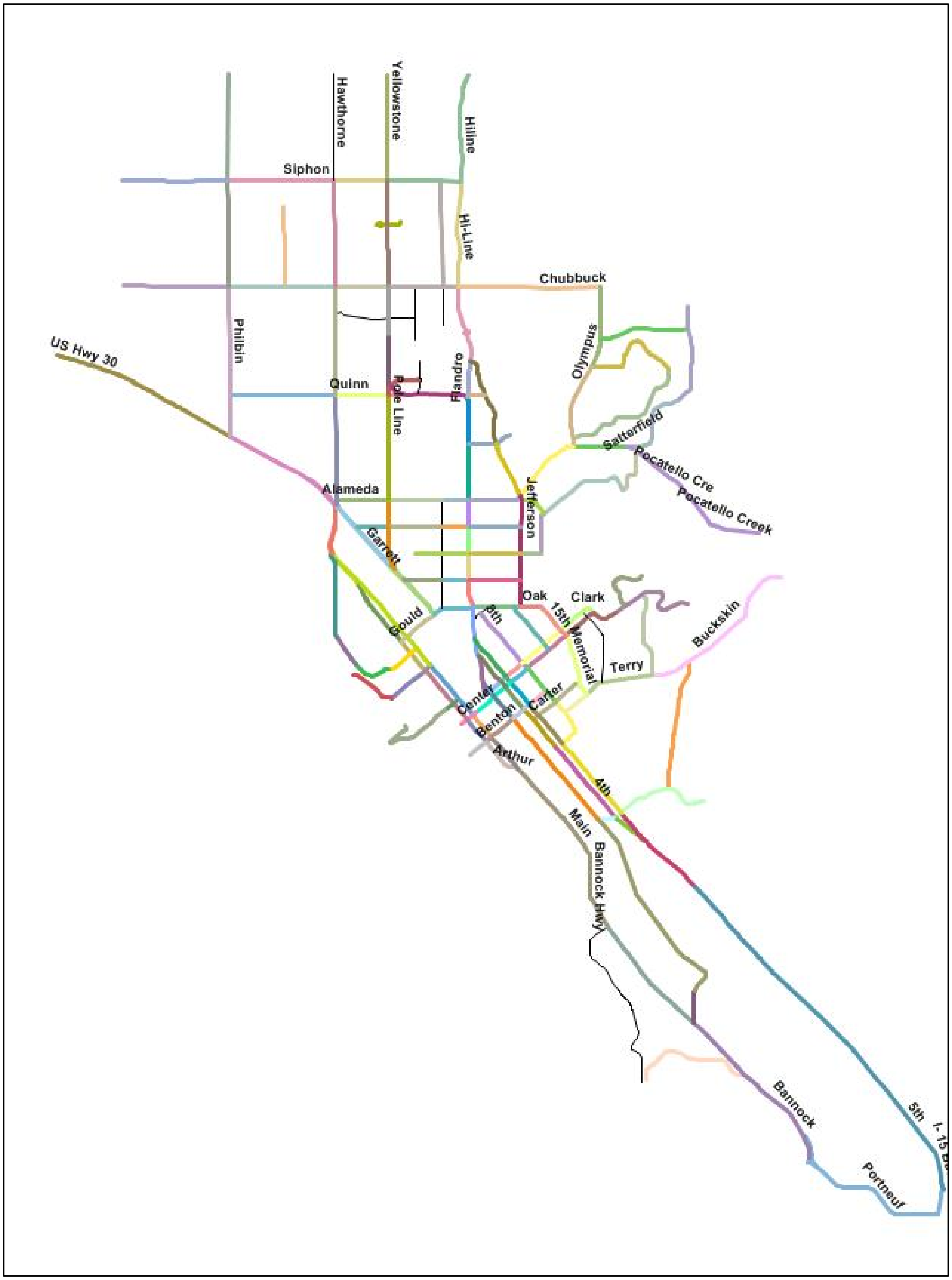


Figure 1: Traffic Data Collection Segments

Screen Line Analysis

In addition to the TDM network sections, three screen lines are used in the validation of the travel demand model. These screen lines are used to compare the volume of vehicle which crosses the screen line. The screen lines represent barriers like railroad tracks or interstates. Most of the links affected by the screen line have a CCS at that location (Figure 2).

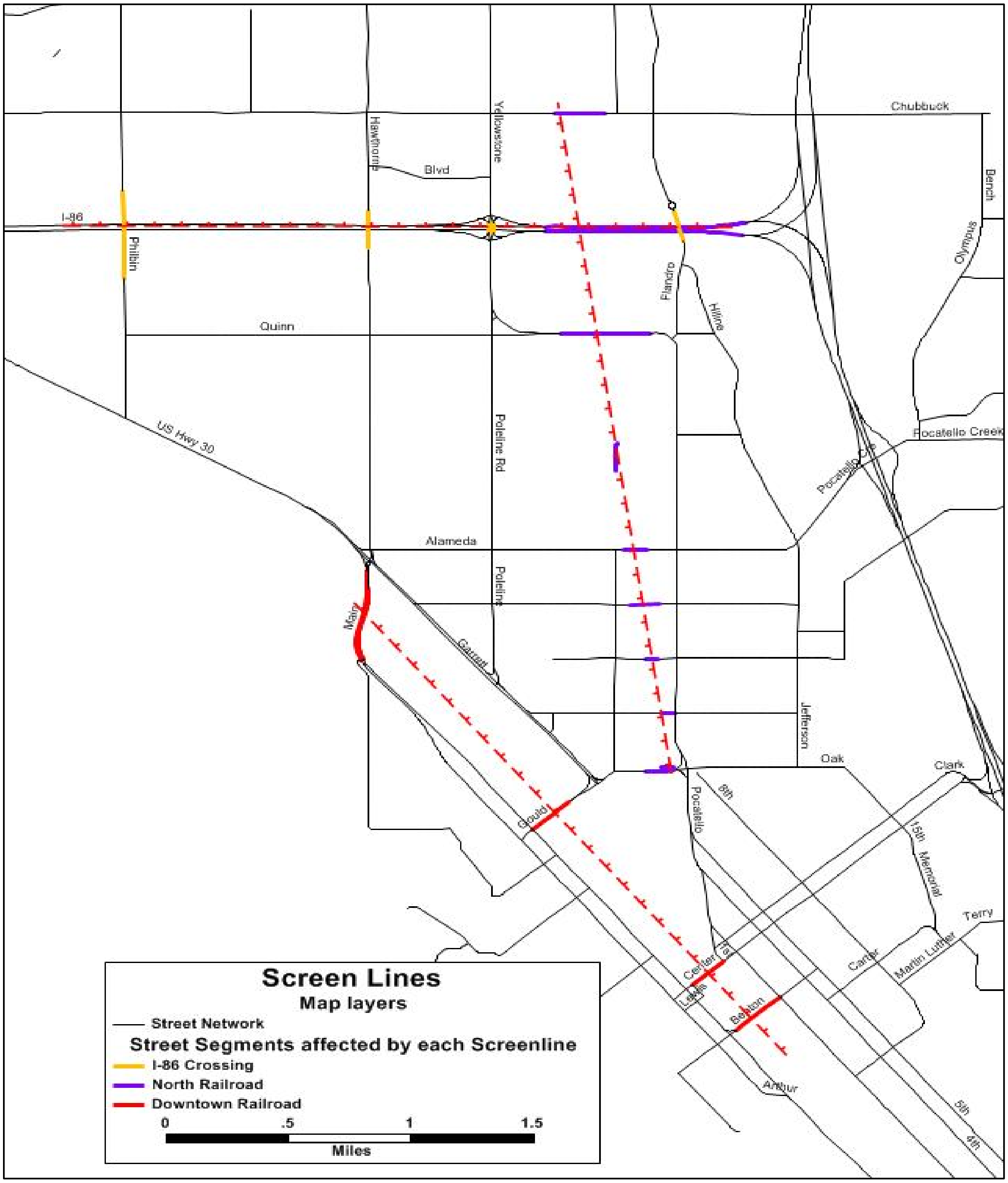


Figure 2: Travel Demand Model Screen Lines

For those links which do not have a CCS count should be taken every five years in conjunction with the TDM maintenance update.

Short Term Count Collection Periods

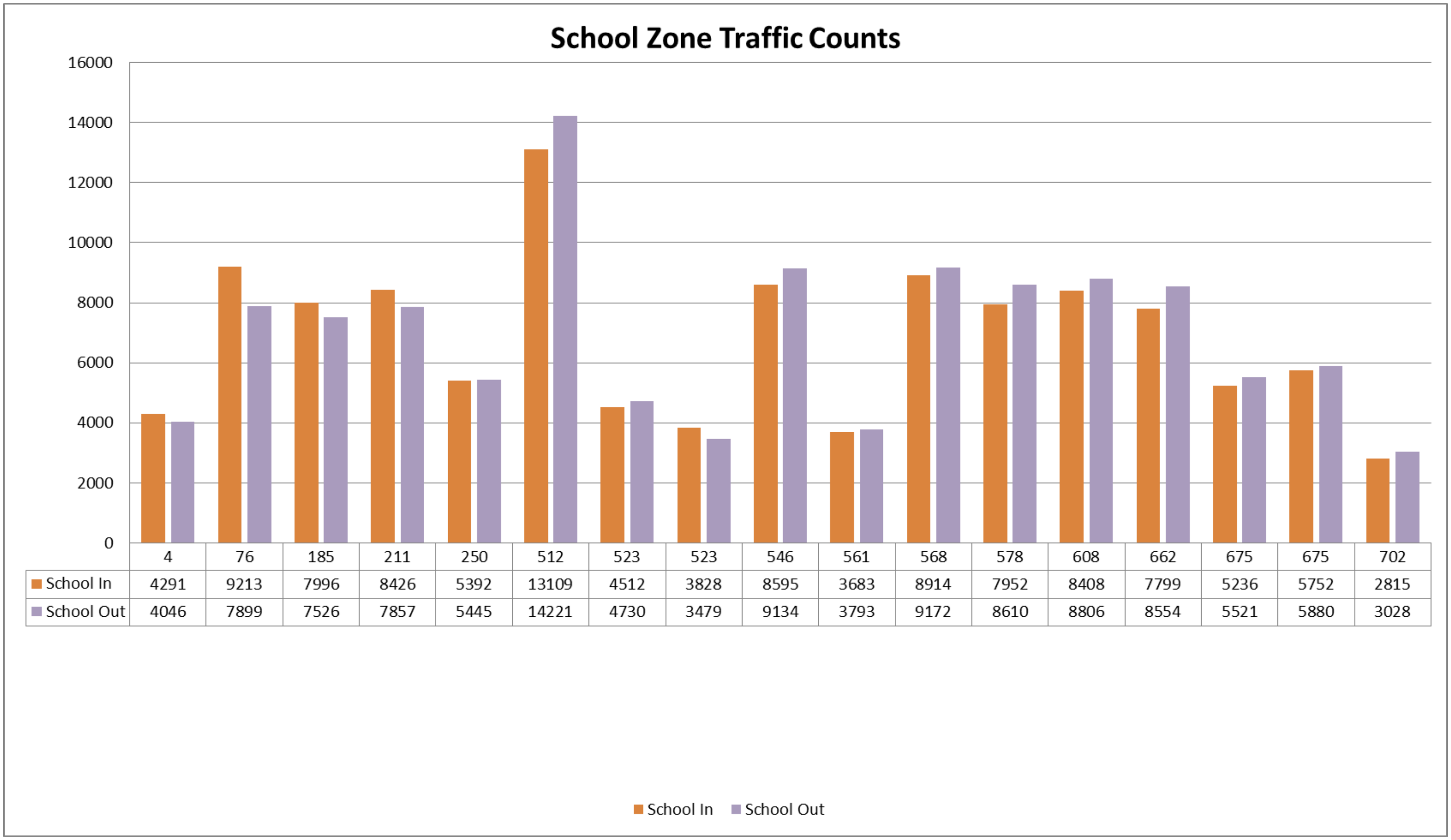
In the past short terms counts were taken in summer months and during the weekday. The TDM tries to simulate and average weekday traffic. Therefore, traffic counts taken should be in the same period. Short term counts can be as short as one day but to increase the accuracy of the count multiple days should be counted. Short term counts for BTPO are usually set on Monday and picked up on Friday but there are times when counts are set for a complete week. For a short term count to be added to the count database that count must be at least 48-hours or two days but 72-hour counts are preferred. Only Tuesday, Wednesday and Thursday are usually collected but any weekday can be used in the short term counts. Holidays are excluded from the short term counts. These 48 to 72 hour counts are called Average Daily Traffic (ADT).

School Influence

The current count program is primarily competed in summer months when schools are not in session. Counts have been taken near schools in both the summer and winter and there does not seem to be a difference. During the development of the Traffic Data Program there were questions regarding how and what affect, if any, school traffic has on traffic counts on streets near schools. To help decide if traffic counts should be completed when school is in session (or if it matters) a comparison test was completed. Twenty-six locations were initially selected but only seventeen were completed due to construction or other factors. For the seventeen locations (Figure 3) two septate 72- hour traffic counts were taken; once during the school year and once after the school year and results were compared.

Table 1 shows results of the comparison. Eleven of the seventeen count locations have higher average daily counts when school in NOT in session. The results seem to show that conducting traffic when school is in session or not does not matter. In fact, the data seems to suggest that counts should be taken when school is not in session. An analysis of the school zone traffic count data and the seasonal traffic count data shows that traffic is variable and that this variation can mask the effect of school traffic on roads.

Table 1: School Zone Traffic Counts



	4	76	185	211	250	512	523	523	546	561	568	578	608	662	675	675	702
School In	4291	9213	7996	8426	5392	13109	4512	3828	8595	3683	8914	7952	8408	7799	5236	5752	2815
School Out	4046	7899	7526	7857	5445	14221	4730	3479	9134	3793	9172	8610	8806	8554	5521	5880	3028

East of station 523 McKinley and Cedar Street (railroad tracks). This chart shows that Wednesdays throughout the year can vary more than 1,000 vehicles per week.

Variations in traffic patterns are so random that changes as a result of school being in or out of session are hidden. School does not seem to have an impact on traffic patterns, with the exception of ISU. One ISU count, due to construction on MLK, had a large decrease (1,314) which was more than double of any other decrease. The Oak and 15th count was also lower when school was out, which some of that can be attributed to ISU.

While overall daily counts do not seem to be affected by the school session, patterns of those routes are affected. In some cases the peak hour switched from AM to PM when school was not in session. For other roads, there seemed to be an overall increase in hourly traffic. Schools do affect traffic patterns, so if a count is being conducted for a specific project or application not related to capacity or the travel demand model that count should be completed when school is in session.

For these reasons BTPO will not consider school session in selecting time to count roads near school with the exception of roads near (1/4 mile) Idaho State University or low volume roads (under 2,000 AADT), which have direct access to the school.

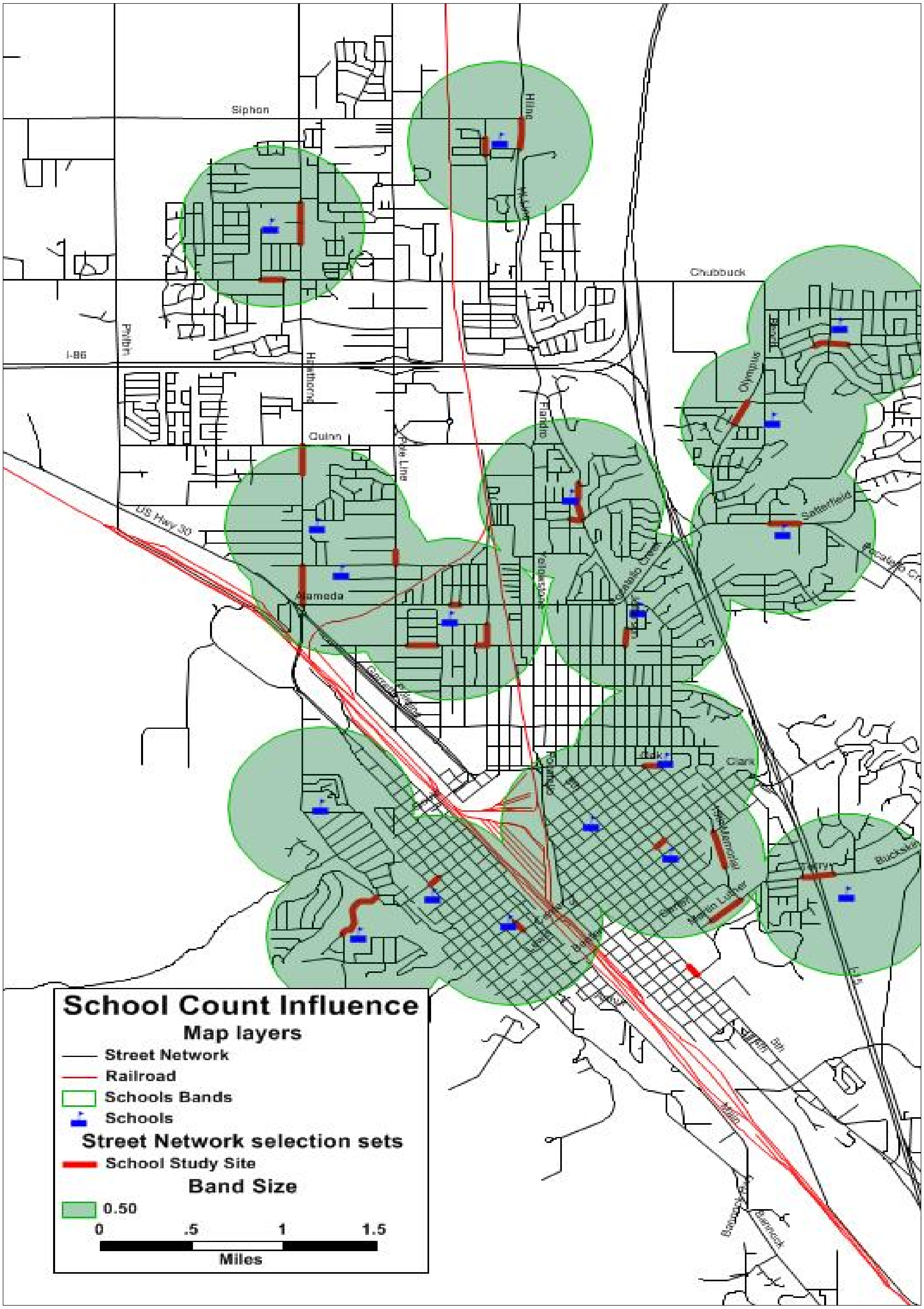


Figure 3: School Influence Locations

Continuous Count Stations

Continuous Count Stations (CCS) are a very critical part of the traffic data collection efforts. They are locations with radar equipment which count vehicles all day every day. CCS locations provide information about traffic that cannot be gained from short term counts. CCS locations will be used in the quality control and editing of the data section of this report. Information from the CCS can also be used in roadway design and other management systems. Figure 34 shows locations of the 18 current and the 19 proposed continuous count locations.

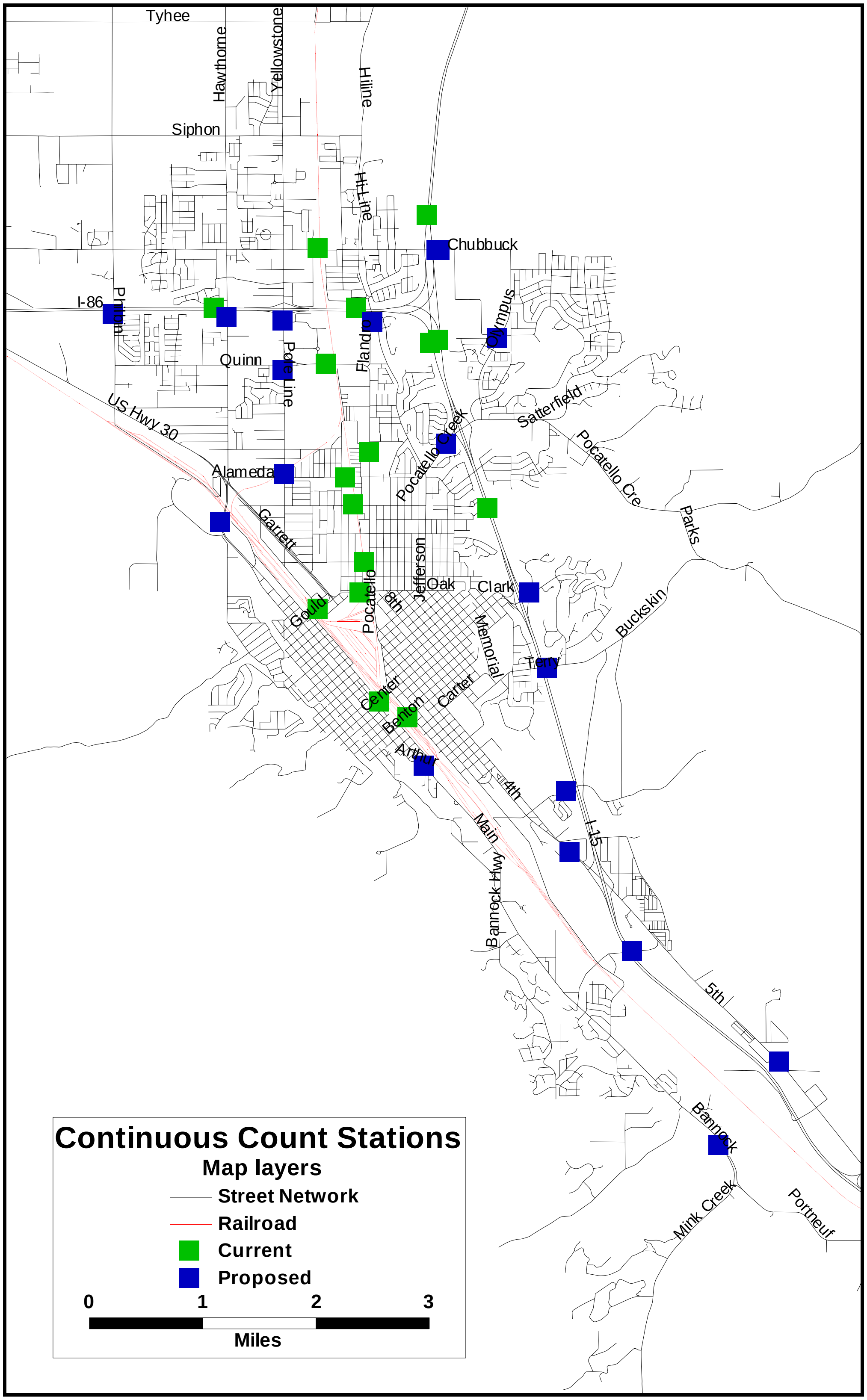


Figure 4: Continuous Count Site Locations

Quality Control and Data Validation

This section presents information on the quality assurance and controls process used to ensure the traffic data collected is reliable and valid. This section and the field manual (Appendix A) go together to make every effort to ensure that the traffic data collected is accurate.

The NCHRP Report 716 and the AASHTO Guidelines the definition of quality control, quality assurance, and data editing seem to overlap. For this report, quality control is the procedures used ensure the equipment used to collection traffic data is operating according to accepted specifications. Data validation is the procedure used to review and process the data collected prior to acceptance for use.

The equipment used to collect traffic data is primarily tube counters although the use of portable radar and traffic signal detection technology is increasing the BTPO now uses these types of device to collect data.   The traffic signal detection is new for the region and procedures no active sites current exist. As this technology is developed and brought into the system procedures will need to be developed.

Tube Counter Quality Control

BTPO currently uses Diamond Unicorn Limited or Apollo tube counters. There are plans to purchase another manufacture those counters which can count bicycles and vehicles with the same setup. All manufactures use firmware to operate the electronics within the equipment to report the vehicle, speed, and classification. The counters are also very dependable and can last ten or more years without failure. Does a 10 year old counter preform as well as a new counter? How well do the counters perform? Are the counters setup correctly? These are some of the questions which will be addressed in this section. The manufactures of tube type traffic counters have little information or processes to ensure that the counters work properly in the field. Most have methods to validate the counts in their offices but that service comes with a cost.

A three step quality control is used to ensure that the equipment used is function correctly. The steps include annual tests, setup validations and a monitoring component. The three steps are:

- Annual Bench Test
- Setup Validation
- Monitoring

Annual Bench Test

Jamar Technologies Inc. makes a traffic tube tester which can be used for two air sensors traffic count units. Many of the BTPO counters have four air sensors. The bench testing is conducted for two tubes but it is assumed that if the two sensor work than the four sensor setup would also work. A volume, speed and classification test are conducted on each counter annually to determine if the counter is with in specification. The test procedures are detailed in Appendix B. In general the following test and parameters are run on each tube counter:

- Volume Count – 100 counts per direction with one 1 missed count. The output level of the tester is noted to detect potential problem in air sensors.
- Classification – The counters simulates all 13 of the FHWA scheme F class with class 2 and 3 repeated twice. The patterns are run 10 times within 15 minutes. To pass the counter should not miss count more than one classification.
- Speed – Speeds from 35 to 80 miles per hour at 5 MPH intervals. An error rate of five percent for each speed range is acceptable. Most of the speed counts are combined into groups called bins. These five MPH bins allow for some variation in the speed while providing accurate data.

If a counter fails any of the tests fail the equipment is reset or cold restarted and the test repeated. Cold restart returns the equipment to factory original settings. If the second test shows another failure the counter will be pulled from service and sent in for repair. All repaired counters will be tested prior to being put into service.

Setup Validation

Once a counter has been setup for the specific traffic count a validation test will be completed. The test depends upon the type of count taken. The validation tests are subjective completed by the traffic count technician. A summary of test procedures are:

- Vehicle Count – Determine that vehicles in each direction are counted correctly and that vehicles are not counted twice.
- Classification and Speed Count – Determine that vehicles in each direction are counted correctly and that vehicles are not counted twice. Compare the vehicle length to the vehicle classification as each vehicle crosses the tube.

The count should begin only after tests are successful.

Monitoring

Monitoring is the process of manually comparing counts taken to manual counts. These monitoring counts are taken during the count program at random intervals with random counters. The basic process is to select a 15 minute interval then count the vehicle by direction for a specific count. After the data is downloaded, the manual 15 minute count is compared to the tube counter count. If the difference is more than 10 percent the counter should be flagged and another monitoring scheduled to validate the error. Monitoring is the least critical of the quality control checks and the test where the most can go wrong. The manual count might be the error and not the equipment – that is why the counter is rechecked. Counters that fail two consecutive monitoring tests should be bench tested. The counter should be sent in for repair depending upon results of the bench test.

Data Quality

Data quality has components that are very specific and components which require experience to determine if there is a problem with the traffic count. Once the traffic count is complete the data is downloaded by the manufactures software. The data is converted into reports and into an access database. Data quality would be added by the use of computer software but these software packages are very expense for a small count program. The state of Idaho is in the process of developing an online package which could complete the data quality checks. Until than the process to ensure data quality is to review the download data for errors or issues. Data quality may be questioned if any of the following is found:

- Consecutive series of zero values (low volume streets between after midnight sometimes have zero values)
- Consecutive series of repeating values
- No data for one direction
- Unbalanced data which is when one direction has more than 60 percent higher than the other direction. This does not mean there is an error but the data should be checked against known unbalanced roadways.
- Random series of large numbers or extremely high values
- Data for multiple hours or days have same values
- Data seems consistent with previous counts. If the counts is over 20% higher or lower than the previous year the count is revaluated.

Unlike the tube counter quality control checks the next steps are not as obvious. An analysis on the data should take place to determine if the entire set of data is unusable or if some days can be used. If there is any questions on the quality of the data the count should be redone. At a minimum two days of complete data must be available during the week the count was taken.

Traffic Data Reporting and Summarization

Seasonal Adjustments

Traffic volumes are variable and depending upon the day or month, traffic patterns and volumes can be different. Traffic counts over the course of a week and individual counts are recorded. The problem is determining if the count just taken represents or the average count for that roadway. To help get the count closer to the average, several days are averaged together. BTPO averages 48 to 72 hour counts to create an Average Daily Traffic (ADT). While these 48 to 72 hour average counts improve the likelihood an average count it does not account for differences in seasonal traffic patterns. To account for seasonality the ADT counts need to be converted into an Annual Average Weekday Daily Traffic (AAWDT). AAWDT estimates traffic on a specific link for the average weekday. ADTs are converted into AAWDTs by adjusting counts by adjustment factors. There are many different ways to adjust the ADTs and no widely adopted method. Three of the common options are described below.

- Region wide adjustment – All the CCS data will be averaged to create a Monthly Average Weekday Traffic adjustment factor. That factor will be applied to all road counts except the interstate and ramps.
- Area specific adjustment or group adjustment – Similar to the region but the CCS data is divided into sub regions there the traffic patterns are similar. The issue with this one is most of the CCS are close to each other and few are in the north or south parts of the region. Also most are for east/west travel not north/south.
- Daily Adjustment Factor – This process should be used in a region or area specific adjustment but instead of only adjusted the traffic for month collected it would adjust for day and month collected.

Due to the limited geographic area and the limited number of CCSs, BTPO uses a region wide 3 year running average adjustment which calculates a monthly adjustment factor for each weekday throughout the year. All CCS sites not on the interstate highway system are averaged. Figure 5 shows the actual counts for each Wednesday in 2014. The average weekday count is shown in red. Weekday correction averages all the weekday counts for a month and divides that amount by the annual average. Day correction divides the daily average to the month average. While Figure 5 does not seem to make the counts converge to the average they do improve the accuracy of the count. When the entire year is calculated the AAWDT for Cedar was 5,677. The calculated AAWDT using weekday correction and daily correction was 5,566 and 5,589 respectively.

Even with seasonal adjustments the difference in the counts can be several thousand. The actual traffic counts were taken the first week of June was 1,000 vehicles higher than the count the next week. What this shows is traffic counts have noise and that noise is unpredictable at times. The daily adjustments seem to do a much better job. The adjustments above and using a 48 to 72 hour counts will filter the noise but the counts are still just estimates of an average day which the travel demand model is also trying to reproduce.

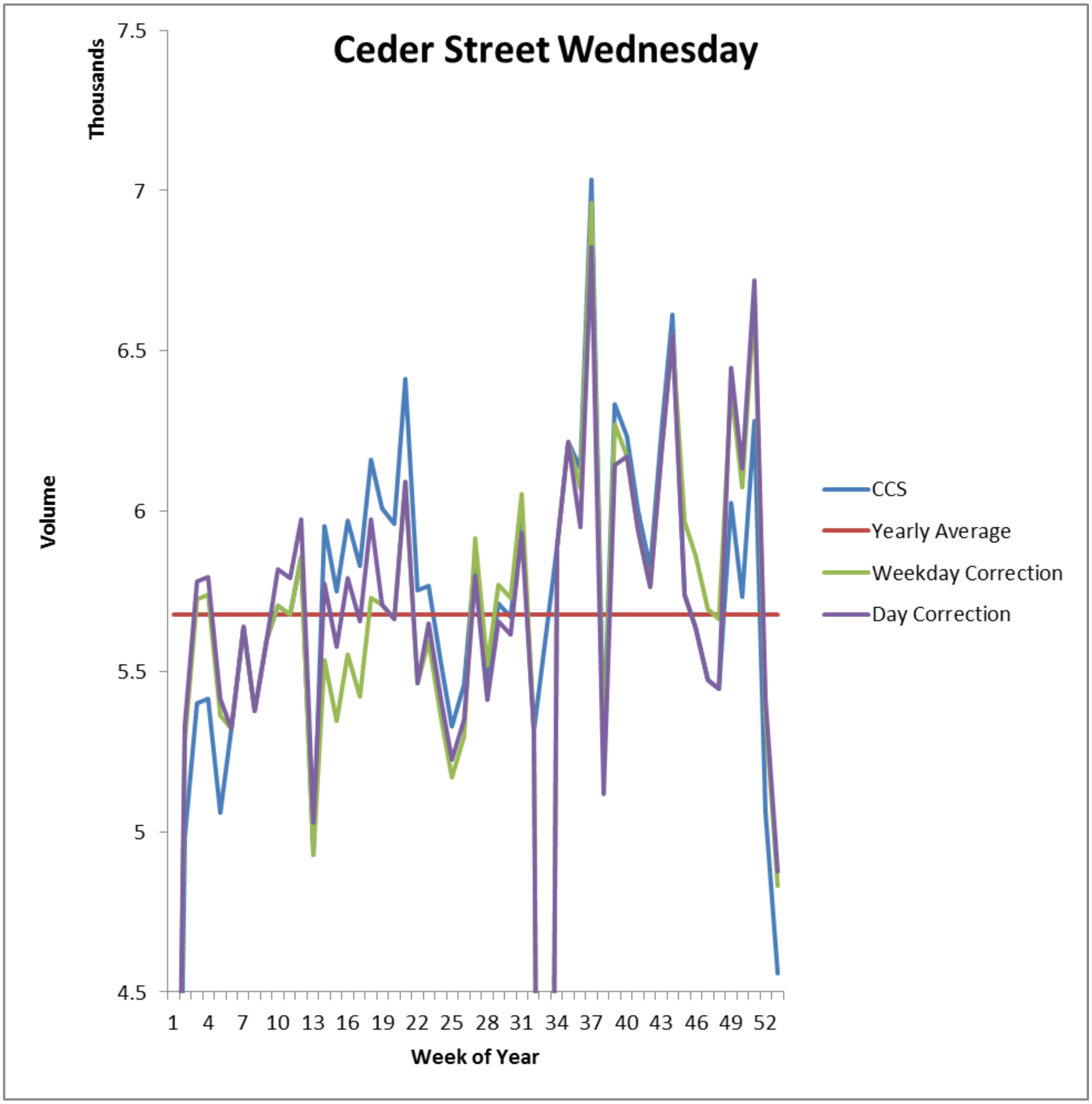


Figure 5: Adjustment Factors for Wednesday

Axel Correction Factor

The road tube counters use air to indicate the presence of a vehicle. Most traffic counts are taken on two way streets and the counts are taken by direction. As a vehicle crosses the tubes both axels are counted and the firmware software for the counter divides the number of hits by two to compensate for a vehicle having two axels. For volume counts a factor of two is used for all roadways. As mentioned the vehicle classification data is a weakness in the region and as this information is gathered on more roadway the faction might be adjusted but for now is set to two. This provide for a slight over counting of vehicles.

Traffic Count Duration

Traffic Counts are taken for a week from Monday to Friday, but sometimes the counts are longer if a specific issue or data is being investigated. Regional adjustment factors for the BTPO region (Monday through Thursday) seems to be similar. Friday is much higher than the rest. BTPO uses counts collected on Tuesday, Wednesday and Thursday to create an ADT. This ADT is seasonally correctly as described above.

Table 2: BTPO ADT Adjustment Factors for 2015

Average all ARTs										
Month	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	MADT	MAWDT	MAWET
Jan	0.77	0.95	1.00	0.98	1.01	1.07	1.23	0.89	0.94	0.90
Feb	0.77	0.93	1.00	1.00	1.01	1.06	1.23	0.89	1.00	0.96
Mar	0.77	0.98	0.99	0.99	1.00	1.05	1.23	0.90	1.00	1.01
Apr	0.76	1.01	0.97	0.99	0.99	1.04	1.24	0.90	1.07	1.06
May	0.78	0.90	1.00	1.01	1.02	1.07	1.22	0.90	1.05	1.08
Jun	0.81	0.98	0.99	1.01	1.00	1.02	1.19	0.90	1.03	1.04
Jul	0.83	1.00	1.01	1.00	0.99	1.00	1.17	0.90	0.99	1.01
Aug	0.83	0.98	0.99	1.00	1.00	1.03	1.20	0.90	1.00	1.01
Sep	0.78	0.90	1.01	1.02	1.01	1.06	1.22	0.90	1.01	1.02
Oct	0.78	0.97	0.99	1.00	1.01	1.05	1.24	0.90	1.01	1.01
Nov	0.77	1.01	1.03	1.02	0.89	1.04	1.23	0.90	0.96	0.94
Dec	0.78	1.01	0.98	0.95	0.99	1.07	1.22	0.90	0.94	0.96

Processing of Traffic Data

The data is downloaded from the unit and the data entered into a spreadsheet where are the data is kept. The data recorded includes the 07:00 – 08:00, 12:00 – 13:00, 17:00 – 18:00, and the daily total for every day that is complete and passes quality checks. The above counts are averaged for Tuesday through Thursday and the average is multiplied to the correction factor. Corrected factors are shorted into a database for use with the TDM and report on BTPO’s website in database and map formats.

Appendix A Field Manual

This field manual is not design to replace the instruction manuals provided by the counter manufactures but rather provide clear instructions on placement and quality control checks.

Site Selection

Volume Counts

- Select locations which are approximately 100 feet for the intersection of interest.
- Unsure the location is far enough back from intersection that vehicle which que back during peak hour will not reach tube counter.
- The location should, if possible, be prior to any major driveways.
- Locations should be close to a fixed object where the counter can be chained. Do not chain counters to private property unless permission is granted. Best objects include power pole, light poles, sign poles and fences.
- Do not locate tube on a curve. Curves increase the change the number of axels for the average vehicle will be incorrect.

Speed and Classification Count

- Select locations far enough from intersections as to represent a feed flow speed. If the intersection of interest is signal or stop controlled the site should be located 400 feet from the intersection, if possible.
- The location should, if possible, be before any major driveways.
- Locations should be close to a fixed object where the counter can be chained. Do not chain counters to private property unless permission is granted. Best objects include power pole, light poles, sign poles and fences.
- Do not locate tube on a curve. Curves increase the number of axels so the average vehicles would be incorrect.

Quality Checks

Volume Counts

- After road tubes have been placed according to manufactures recommendation verify that counter is counting vehicles in each direction and that over count is not occurring. The number of counts varies by location but try for at least five in each direction.

Speed and Classification Count

- After device has been placed according to manufactures recommendation verify that counter is counting vehicles in each direction and that over count is not occurring. The number of counts varies by location but try for at least five in each direction.

- Verify that classification and approximate speed of the vehicle. A standard car should have axel length of five to six feet. The speeds of the vehicle on average should be within 5 MPH of the posted speed.

Appendix B *Tube Counter Bench Test Procedures*

Tube Counter Tests

The tube counter bench test describes the procedures used to test tube traffic counters. A volume, speed, and classification tests are completed on each counter each year. The tests are kept and compared to the following years' counts to determine if the air switches or counter is not correctly recording the count. The tests are completed with a Jamar Technologies Traffic Counter Tester.

Volume Count Procedures

<u>A-B Test</u>

Tester setup:

- Set tube length to 4 inches.
- Set speed to 35 MPH.
- Select A -B test.
- Tester output on 0.

Counter setup:

- Set the counter to collect volumes.
- Put the counter in testing count mode.
- Connect the counter to tester with counter Input 1 on tester Input A and counter Input 2 on tester Input B.

Test:

- Start the test on tester.
- Adjust the tester output until the counter starts to register counts; stop tester and record value.
- Start the test again and allow the volume to reach 100 and record the count in Lane 1.
- Switch the inputs on the traffic counter so the Input 1 is on tester Input B and Input 2 is on tester Input A.
- Adjust the tester output until the counter starts to register counts; stop tester and record value.
- Start the test again and allow the volume to reach 100 and record the count in Lane 2.

<u>A-B, B-A Test</u>

Tester setup:

- Set tube length to 4 feet
- Set speed to 35 MPH
- Select A-B, B-A test
- Tester output on 0

Counter setup:

- Set the counter to collect volumes.
- Put the counter in testing count mode.
- Connect the counter to tester with counter input 1 on tester Input A and counter Input 2 on tester Input B.

Test:

- Start the test on tester.
- Adjust the tester output until the counter starts to register counts on both lane 1 and lane 2; stop tester and record value.
- Start the test again and allow the volume to reach 100 and record the count in lane 1 and lane 2.

Results:

The counter passes the tests if count recorded in the A-B test or B-A test in each direction is 99 – 101. If the counter does not pass the test a cold restart should be completed and the test reran. If the counter fails a second test the counter is removed from service a send in for service. The output values for the volume test should be between three and five. The tester values are compared to the previous years' value and if the value has increased this could indicate the air switches are failing. If the output values are over six and the values increase for two consecutive years the counters air switches should be replaced.

<u>Speed Test</u>

Tester setup:

- Set tube length to 4 feet
- Set speed to 35 MPH
- Select Speed test
- Tester output on 5

Counter setup:

- Set the counter to collect raw data
- Ensure the sensor spacing is 4 feet

- Put the counter in testing count mode.
- Connect the counter to tester with counter Input 1 on tester input A and counter input 2 on tester input B.

Test:

- Start the test on tester.
- The tester provides a class 2 vehicle for speeds from 35 MPH to 80 MPH at intervals of 5.

Results:

Monitor the values speed from 35 to 80 twice verifying that the values for each speed interval are within the high and low values specified in Table B-1. If speeds are not within the intervals conduct a cold restart and retest. Counters which fail two speed tests are removed from service and sent in for repair.

Table B - 1 Speed Ranges

MPH Tested	High Value	Low Value
35	36.75	33.25
40	42	38
45	47.25	42.75
50	52.5	47.5
55	57.75	52.25
60	63	57
65	68.25	61.75
70	73.5	66.5
75	78.75	71.25
80	84	76

Classification Test

Tester setup:

- Set tube length to 4 feet
- Set speed to 35 MPH
- Select classify test
- Tester output on 5
- Set time to 30 Minutes

Counter setup:

- Set the counter to collect raw data.
- Connect the counter to tester with counter Input 1 on tester input A and counter input 2 on tester input B.
- Ensure the sensor spacing is 4 feet.
- Start collecting data when the counter time is almost to a 15 minute period.

Test:

- Start the test on tester.
- The tester provides a class 2 vehicle for speeds from 35 MPH to 80 MPH at intervals of 5.
- Download the data on the software provided by the manufacture and run a classification report.

Results:

The classification report should show 10 for each class 1 through 13 with class 2 and 3 being 20 for any complete 15 minute period. If classification values are more than 1 in any class conduct a cold restart and retest. Counters which fail two classification tests are removed from service and sent in for repair.

Appendix C *Acronyms and Glossary*

Acronyms

AADT – Average Annual Daily Traffic

AASHTO – American Association of State Highway and Transportation Officials

AAWDT – Average Annual Weekday Traffic

ADT – Average Daily Traffic

BTPO – Bannock Transportation Planning Organization

CCS – Continuous Count Station

FHWA – Federal Highway Administration

FTA – Federal Transit Administration

GIS – Geographic Information System

GPS – Global Positioning System

HPMS – Highway Performance Monitoring System

ITD – Idaho Transportation Department

ITS – Intelligent Transportation Systems

MAP-21 – Moving Ahead For Progress in the 21^{st}

MOVES – Motor Vehicle Emissions Simulator

MPH – Miles per Hour

MPO – Metropolitan Planning Organization

MTP – Metropolitan Transportation Plan

NCHRP – National Cooperative Highway Research Program

TAC – Technical Advisory Committee

TDM – Travel Demand Model

TDP – Traffic Data Program

VHT – Vehicle Hours Traveled

VMT – Vehicle Miles Traveled

Glossary

Bannock Transportation Planning Organization (BTPO) – Bannock Transportation Planning Organization is the Metropolitan Planning Organization for the Pocatello/Chubbuck Metropolitan Area. BTPO has been an MPO since 1982. Located in Pocatello, Idaho, BTPO is focused on establishing a comprehensive, coordinated and continuing transportation planning process. BTPO provides a regional forum to address transportation and air quality planning issues. BTPO also works to ensure that the identification and implementation of transportation projects are identified and coordinated by local, state and federal agencies and the general public. BTPO serves the communities of Pocatello, Chubbuck and Northern Bannock County.

Federal Highway Administration (FHWA) – A division of the Department of Transportation with responsibilities to administer the national laws and regulations related to surface transportation.

Intelligent Transportation Systems (ITS) – Refers to adding information and communications technology to transport infrastructure and vehicles in an effort to manage factors that typically are at odds with each other, such as vehicles, loads and routes to improve safety and reduce vehicle wear, transportation times and fuel consumption. Interest in ITS comes from the problems caused by traffic congestion and a synergy of new information technology for simulation, real-time control and communications networks. Traffic congestion has been increasing worldwide as a result of increased motorization, urbanization, population growth and changes in population density. Congestion reduces efficiency of transportation infrastructure and increases travel time, air pollution and fuel consumption.

Moving Ahead for Progress in the 21st Century (MAP-21) – MAP-21 (P.L. 112-141) was signed into law by President Obama on July 6, 2012. MAP-21 is the highway funding authorization legislation.

Metropolitan Planning Organization (MPO) – The Metropolitan Planning Organization (MPO) of urban areas with a central city of 50,000 or more population is responsible for "…plans and programs which lead to the development and operation of an integrated, intermodal transportation system that facilitates the efficient, economical movement of people and goods."

Metropolitan Transportation Plan (MTP) – The MTP is similar to the LRTP but the name was changed in the last highway act to MTP. The MTP is a federally required planning document required to be developed by all MPOs at least every four years. The MTP should cover the twenty year plan for all modes of travel within an urban area.