

SURVEY MANUAL



STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION

2010

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FORWARD

The purpose of this manual is to outline policies and procedures adopted by the New Hampshire Department of Transportation that will serve as a guide for those performing duties related to survey work for the Department. Hopefully, this should result in a standardization of survey methods.

It is not intended that the publication of this manual will in any way preclude departures from the suggested methods on occasions where individual initiative could provide other acceptable methods that would be more practical and economical.

This manual is subject to continual change and updating. Such changes will be distributed as they are made. The Crew Chief will be responsible for keeping the manual updated.

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The conventional survey team consists of up to four (4) people: a Crew Chief, classification of Survey Team Technician IV (STT4); an Instrument Operator, classification of Survey Team Technician III (STT3); a Head Rodperson, classification of Survey Team Technician II (STT2); and a Rodperson, classification of Survey Team Technician I (STT1). On occasion a (STT1) will be down graded to a Survey Team Aide (STA1) or (STA2).

A Geodetic Survey Team consists of up to three (3) person crews to establish all the horizontal and vertical control to be used on all state projects. To perform this work the crews use Global Positioning Systems (GPS), geodetic quality and mapping grade quality receivers, 1" theodolites and total stations, automatic levels with micrometers, and digital levels. In addition, the geodetic crews establish photogrammetry control.

With the advent of GPS, many more uses have been found to be valuable to the Department, which the crews are responsible for. Some of these would include mapping of wetlands, mapping of river channels with GPS receivers tied in with a depthfinder, and other special projects, which come up.

111 DUTIES OF THE SURVEY CREW PERSONNEL

The Crew Chief (STT4) shall be held responsible for the activities, actions and remarks of the entire crew at all times and in all conditions. The Chief shall instruct them in the proper performance of their duties and insist that they cultivate the habit of doing the field work expeditiously as well as accurately. The Chief shall direct the attention of their superiors to individuals who have extraordinary ability and diligence as well as to those who are not responsive or show little aptitude for survey work. Any individual who is guilty of negligence, disobedience or gross misconduct shall be immediately reported to the Survey Supervisor who will take the appropriate action. The Crew Chief's first allegiance can only be toward the best interest of the Department, which in the final analysis will be most beneficial to everyone involved. It is vital that the Chief be prompt in submitting the various administrative reports covered elsewhere in this manual.

The Instrument Operator (STT3) must be able to use, adjust and care for any precision instrument. The individual should be taught to keep notes and take charge of the crew during the absence of the Crew Chief. Duties will include checking the Chief's computations and instructing other members of the crew the proper survey methods employed by the Department. The Instrument Operator will be considered a Crew Chief-In-Training.

The basic duties of a Head Rodperson (STT2) are similar to the Rodperson (STT1). In the absence of the Instrument Operator, or on other occasions, the Head Rodperson will assume the duties of the Instrument Operator. The Head Rodperson is considered an Instrument operator-in-training. The Head Rodperson must be responsible for all work done with the "Prism pole". The Head Rodperson must also be familiar with 'MOSS' String label conventions and the "Data Recorder" operations.

The Rodperson (STT1) performs all duties assigned to him/her by the Crew Chief which are laborious in nature; i.e., cutting brush and small trees, carrying supplies to and from the project and vehicle, handling level rod, assisting in "Prism pole" operations, etc.

As indicated above, each member of the crew should learn the duties of the position above theirs, in the interest of the Department as well as their own.

In order to have a survey team perform its work efficiently, every member must willingly avail himself or herself to accomplish the many menial tasks involved in preliminary surveys.

125 PUBLIC RELATIONS

Surveyors working for this Department represent the State of New Hampshire and in reality are employees of every taxpayer of the State. The general public observes the conduct of all representatives of the State. The Department will contact all property owners within the project area prior to entering their property. The property owners will be contacted and given 10 days to respond to this letter. The letter will contain a brief description of the project, the name of the area Survey Supervisor and Project Manager, and the length of time that the crew is expected to be in the area. The appropriate telephone numbers of the project's lead person will also be included. Citizens like to know what is occurring, and in the course of a field survey many questions are asked. The Department insists these questions shall be answered courteously.

Team members should politely refer all questions to the Crew Chief who will explain, within reason, the objectives of the work. Courteous treatment of the abutting property owners is the first step toward securing their cooperation.

130 RIGHT OF ENTRY FOR SURVEY PURPOSES

Existing laws within this State authorize the Commissioner or representatives to make surveys on private properties for highway purposes. The specific law is hereby quoted:

"RSA 498-A:10 Right to Enter Property Prior to Condemnation. Prior to the time of filing the declaration of taking, the condemnor or its employees or agents shall have the right to enter upon any land or improvement which it has the power to condemn, in order to make studies, surveys, tests, soundings, and appraisals; provided, however, that the condemnee has been notified 10 days prior to entry on the property. Such entry and related activities shall not constitute a trespass, but the condemnor shall be liable for any actual damages caused thereby. This liability may be enforced in a civil action against the condemnor brought in the superior court in the county in which the property is located, with damages to be assessed by the board in the manner provided in RSA 498-A:24."

"RSA 228:33 Right to Enter. The commissioner and his agents may enter private lands to make surveys and establish boundaries of highways.

This right of entry must be respected to the fullest extent as it involves property damage. It is also the policy of the Department that only brush will be cut in wooded areas. Ornamental shrubs and trees will not be damaged in any way. Offset lines or other procedures must be utilized to accomplish the above. Trees larger than 3 inches (0.08 m) in diameter may be cut only after special permission from the landowner is received. The Crew Chief shall make crew members aware of the fact that damage must be minimized. Care must be exercised to maintain the appearance of areas

through which a survey is being made. Cut brush and trees, survey stakes, risers, flagging, and debris of any kind, must be reduced to a minimum or made as inconspicuous as humanly possible in a manner that is consistent with an expedient operation. Special care must be utilized when work is being accomplished near lawns, gardens, ornamental trees, shrubs, waterways etc.

The assumption that "the State is going to buy it anyway" should not influence respect toward private property. Line changes are not uncommon.

The State is liable for any damages to private property by Department personnel, and the Crew Chief should be able to justify the actions of the crew at all times.

When cherry, crab apple, or locust trees of any type are cut in any area where livestock are pastured, all brush must be removed from pastured area. This brush can cause death or serious illness to the livestock.

Theft of fruit, vegetables or other crops will be cause for disciplinary action. There will be no scavenging on private property. Scavenging on private property is prohibited and will be cause for disciplinary action up to & including termination.

Avoid littering at all times. Refrain from careless markings with crayon, ink or paint on road surfaces, trees, walks, etc. Poor conduct of this nature reflects immediately upon the Department. The use of Glo-Orange paint should be kept to a minimum due to the nature of its brilliance!

When a survey project is complete, unnecessary flagging, stakes, and any obtrusive survey materials should be removed from the project area.

133 AUTHORITY FOR PROJECT SURVEY

The Chief of Design Services is directly responsible to the Administrator, Bureau of Highway Design for the conduct and the work of all survey crews including Consultant Survey Crews. The Chief of Design Services, through the Survey Supervisor, delegates the various projects to be surveyed to one or more survey crews selected to accomplish such work. The various types of communications commonly used to guide the survey crew in accomplishing the assigned work are as follows:

1. Survey request slip outlining project descriptions with pertinent information: (Survey Request Slips available in Survey Section)
 - A. Name of person requesting survey with Bureau name.
 - B. Map with dimensions outlining survey area with units of measurement.
 - C. Original plans of certain highways on which proposed changes are indicated, where possible.
 - D. U.S. Geological Survey Topographical maps, usually enlarged showing approximate alignment to be accomplished.

The NHDOT Safety Manual and amendments will govern safety procedures and NHDOT Policies & Procedures will be followed as a minimum, additional safety precautions noted in this Manual and in the Job Hazard Analysis' may have to be utilized in other situations.

135.1 USE OF SURVEY RODS UNDER HIGH VOLTAGE LINES

The use of survey rods under high-tension lines is extremely dangerous.

Electricity can arc from high voltage lines to a metallic conductor at the ratio of one inch to every one thousand volts. The 25 ft and the 7 m fiberglass rod that are in current use by the Department could conceivably prove dangerous if the rod and ground are damp. All precautions will be taken while working directly under high voltage lines.

Direct measurements with rods will not be used in obtaining elevations of high voltage lines. The only acceptable methods are by triangulation or by using a Total Station. (Remote Elevation Method)

135.2 MINIMUM REQUIREMENTS FOR SIGN PROTECTION

The following equipment and requirements will be used by all Survey Crews when working within the limits of the traveled way (TW) upon any highway and is intended to be considered minimum requirements by the Department:

- 2 Roll-up signs "SURVEY CREW AHEAD" with stands for use on secondary roads. For Interstate/Turnpikes sign packages from the local Maintenance Shed must be used.
- 10 Florescent orange cones
- 4 Flags with staff for signs and traffic control

Orange Fluorescent vests (one for every crew member): In addition, there will be one green fluorescent vest per crew to be used by the flagger when performing flagging operations.

Note: The information stated above is minimum protection, if your survey task requires more equipment see your Area Supervisor or the survey office for additional equipment.

135.3 LOCATION AND USE OF SIGNS

The signs warning the oncoming traffic shall be a minimum distance of 1500 ft (460 m) from any person working in the highway with a posted speed of 65 mi (100 km/hr) per hour, and decreasing proportionately according to design speed and safety requirements, and a maximum distance of 4500 ft (1370 m) apart: Under no condition shall any member of the crew attempt to do any work within the traveled portion of the road until the signs are in place.

When working on New Hampshire highways these guidelines should be followed: (remember these are guidelines, if actual speeds are higher, adjust sign package to better protect yourselves and the public.)

55 mph (90 kmh) speed limit = 500 ft (150 m) between signs and 500' from last sign to first cone.

35 mph (55 kmh) speed limit = 350 ft (100 m) between signs and 350' from last sign to first cone.

Cone spacing should be 80 ft (25 m) apart. (Every other white line)

Signs shall be moved as the work progresses so as to keep within suggested distances. The maximum distance for a work zone will be 3 mi (5 km). When workers leave the highway, such as lunch break, etc., all signs shall be removed and placed so that the traveling public cannot see or read them.

135.4 GENERAL SAFETY INFORMATION

If in the opinion of the Crew Chief, the signs are not adequate for the conditions, or the traveling public does not heed to caution, it may be necessary to employ flag-persons or even solicit State Police or Local Police for the necessary protection. The Crew Chief will be responsible w/ coordinating this need with the Survey Supervisor.

It should be kept in mind at all times that when the motorist is blinded by direct sunlight; it is not safe to be working on the highway. Usually the progress of the work can be planned to avoid this situation.

Survey crews will not work on the highway during severe road conditions or low visibility. The Crew Chief will make this determination. Crews should report to their designated inclement weather assigned locations.

In order to further insure the safety of our personnel, and the traveling public, flashing warning lights on vehicles will be used as follows:

1. Whenever any of the survey crew is working within the right of way limits of the highway. The vehicle shall be parked within the signed area.
2. Flashing warning lights need not be used whenever the vehicle is parked off the traveled way or shoulders and the crew is working entirely outside of the highway right of way limits.

135.5 LIFE PRESERVERS

Survey personnel, while working in an area that in any way could be considered a potential drowning hazard, must wear life preservers, which will be readily available from the Department. All current NH Department of Safety boating rules and regulations must be followed while operating the Department's boats.

135.6 CARE IN USE OF CUTTING IMPLEMENTS

Extreme care should be exercised in the use of cutting implements, such as axes, machetes, etc. New and inexperienced survey personnel should be given special instructions and training in the use of these implements before allowing them to operate under normal conditions with other experienced survey personnel during clearing operations. Under no condition should crew members using the above implements simultaneously be within 15 ft (5 m) of each other. This is intended to avoid accidental laceration.

The use of powered chain saws by survey personnel is absolutely prohibited!

135.7 SAFETY HATS

The Department upon request furnishes florescent baseball caps. These can be worn at all times, and are recommended in traffic situations. Hard hats are required in accordance with the latest NHDOT policies and procedures.

135.8 SAFETY GLASSES

Safety glasses shall be worn in accordance with the latest N.H.D.O.T. policies and procedures.

135.9 SAFETY VESTS

All New Hampshire DOT personnel are required to wear the blaze orange safety vest while conducting their activities on or along any traveled highway. During the deer-hunting season all personnel are required to wear the safety vests while conducting their field activities in any area that is or could be inhabited by hunters. In addition, 1 fluorescent green vest will be provided to be worn by the flagger at all times during flagging operations.

The vests can be acquired as needed through the Survey Supervisors.

139 CARE OF EQUIPMENT

The proper care and use of survey equipment cannot be over-emphasized. It is the responsibility of all employees using the equipment to treat it with the utmost care and to maintain it in first class condition. The efficiency, pride, and satisfaction of a job well done are generally reflected in the manner in which the equipment is maintained. Carelessness with State owned instruments and equipment will not be tolerated. The private use of State owned equipment for personal projects, or the continual misuse of State owned equipment will be cause for disciplinary action up to and including termination.

In addition to observing common sense rules about the care of equipment, the following suggestions should receive particular attention:

- A. Wet tapes should be wiped dry before they are put away. Rub the dry tapes with an oily cloth to prevent rusting.
- B. If possible, level rods should be wrapped or carried in a case to preserve paint and graduation marks when transported.

- C. Never leave any equipment unattended where it might be stolen. Vehicles shall be locked at all times when left unattended.
- D. Ice chisels must not be used to pry with or cut frozen earth. They must be used only for cutting ice.
- E. Prism Poles are very expensive and must be used for their intended purpose only. They must not be used to pry with. The prism poles should be calibrated periodically to insure accuracy.
- F. Total Station/Data Recorder instruments can be adversely affected by rain. The use of these instruments in adverse weather may incur costly repairs. Please avoid use in extreme inclement weather. The Instrument must be cleaned on the exterior only by wiping with a soft cloth. Do not lubricate any moving parts.

140 USE AND CARE OF INSTRUMENTS IN THE FIELD

Careful attention to suggestions given herein will save needless wear on instruments and reduce the dangers of accidents to a minimum, besides increasing the quality and quantity of the work.

- A. Equipment should be stowed in the survey vehicle in a manner that will eliminate unnecessary wear. Instruments should not be subjected to severe jolts. The self-leveling level must be transported on a cushion of shock absorbent material, never on the floor of the vehicle. Sharp jolts can easily affect the accuracy and adjustment of this instrument. When the self-leveling level work is completed on any given project it will be turned back into the area Survey Supervisor. The area Survey Supervisor will assign these high accuracy levels where needed, they are not to be kept in the survey vehicles.
- B. Tripod: Inspect the tripod legs and shoes. The leg of the wide leg tripod is of proper tightness if, when lifted to an elevated position, it sinks gradually of its own weight.
- C. Instrument/Instrument case: Handle the instrument gently in removing it from and returning it to the case. It is best to place the hand beneath the tribrach base in handling the detached instrument. Considerable patience is sometimes required to close the lid after returning the instrument. If properly placed, the lid closes freely. Never force the lid; look for the obstruction and correct it.
- D. Mounting Level: See that the instrument is securely attached to the tripod. Undue haste may sometimes result in costly accidents. When screwing the instrument on tripod head, it should first be turned in a counterclockwise direction until a slight click is heard, indicating that the threads are properly engaged.
- E. Sunshade: Always attach the sunshade regardless of the kind of weather. It is part of the telescope tube. In attaching or removing the sunshade, hold the telescope tube firmly with one hand and with the other hand twist the shade to the right.

- F. Eyepiece: Before beginning the observations, focus the eyepiece perfectly on the cross hairs. This is best done by sighting the sky.
- G. Special care must be exercised so as not to sight the sun directly. Doing so can damage the Total Station. This repair is very expensive.
- H. Setting up in field: When setting up in the field, bring the tripod legs to a firm bearing with the plates approximately level. Give the tripod legs additional spread in windy weather or in places where the instrument may be subjected to vibration or other disturbances. On side-hill work, place one leg uphill. With the level, place two leveling screws in the general direction of the line of levels. On pavement in sunny weather, or under most winter conditions, use "shoes" (flat wooden slats) under each leg to prevent settlement.
- I. Use instrument cover provided when conditions warrant. If the instrument should get wet, thoroughly wipe it dry before returning it to the case. Take the instrument indoors at night for further drying if necessary.
- J. Proper care of instrument: Cultivate from the very beginning the habit of delicate manipulation of the instrument. Rough and careless treatment of field instruments is characteristic of an unskilled operator.
- K. Plate leveling screws: In leveling the instrument, the leveling screws should be brought just to a snug bearing. If screws are too loose, the instrument rocks and accurate work cannot be done. If too tight, the instrument is damaged and the delicacy and accuracy of the observations are reduced. Much needless wear of leveling screws may be avoided if the tripod head is brought about level when the instrument is set up. Upon completion of setup, leveling screws must be returned to a neutral position. Leveling screws in a tribrach must not be over extended.
- L. Lenses: Do not remove or rub the lenses of the telescope. If necessary to clean lens, dust first with a soft, clean camels hair brush and use a very soft cloth with caution to avoid scratching or marring the polished and coated surfaces.
- M. The apparent cause for the major portion of survey equipment repair costs is the direct result of carelessness or the lack of adequate consideration in surmounting obstacles such as stone walls, all types of fences, rocky precipitous areas, shallow stream beds with unstable footing, snow covered as well as icy areas, etc. It is the sole responsibility of the instrument person to anticipate the seriousness of these obstacles when carrying a precision instrument and to utilize assistance of other members of the crew to assure absolute security of the instrument. It is also the responsibility of the Crew Chief to insist constantly the above precautionary measures be fulfilled.

140.1 TESTING OF THE INSTRUMENT

The Total Stations should be tested frequently. The surveyor who is thoroughly familiar with the condition of the instrument can get excellent results even with an instrument, which is not in perfect

adjustment. Adjusting one part usually affects other parts. When testing the Total Station follow, the instructions in the manual provided with your instrument.

In testing an instrument, these precautions should be observed:

1. Set up in the shade, but in good light.
2. Set up on firm, dry ground.
3. See that the tripod legs are well spread and firmly planted and that the metal tips are secure.
4. See that the tripod plate is nearly level, tripod screws well tightened, and the instrument firmly screwed on.
5. Carefully level the instrument.

140.2 ADJUSTMENT OF A DUMPY LEVEL

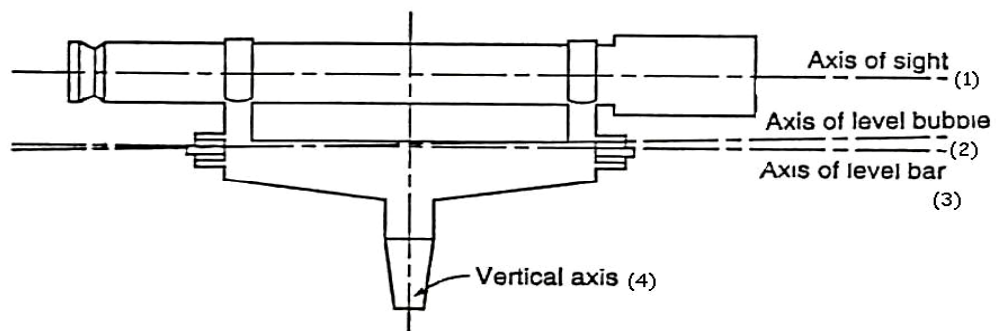
A level in adjustment establishes a horizontal plane of sight when the telescope is revolved about a vertical axis. The principal lines of the dumpy level, as illustrated in Figure A-1, are (1) axis of sight, (2) axis of the level bubble, (3) axis of the level bar, and (4) vertical axis.

For perfect adjustment it is necessary that the axis of sight, the axis of the level bubble, and the axis of the level bar be parallel to each other, and perpendicular to the vertical axis. There are two adjustable parts: the cross hairs and the level vial. The adjustments should be made in the order given.

A. Adjustment of Level Vial

Purpose. To make the axis of the level bubble perpendicular to the vertical axis.

Figure A-1 Dumpy Level.



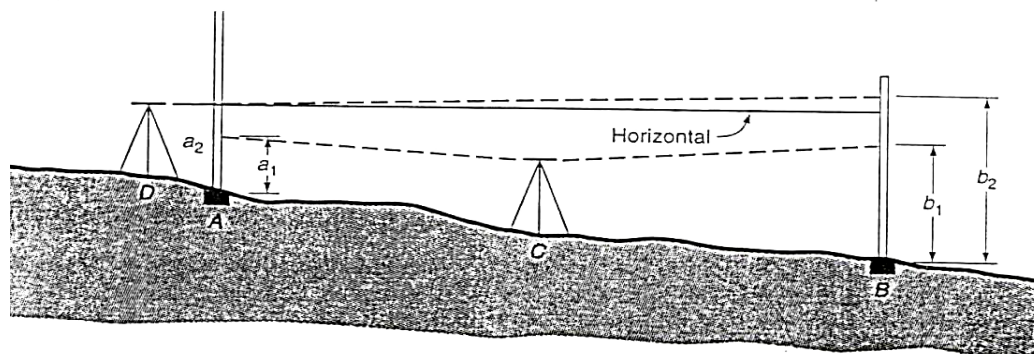
Correction. Turn the capstan nuts at one end of the level vial to move the bubble *halfway back* to the centered position. Level the instrument using the leveling screws. Repeat the test until the bubble remains centered during a complete revolution of the telescope.

Purpose. To make the horizontal cross hair truly horizontal when the instrument is leveled.

Correction. Loosen the four capstan screws holding the reticle. Rotate the reticle in the telescope tube until the horizontal hair remains on the point as the telescope is turned. The screws should then be carefully tightened in their final position.

Purpose. To make the axis of sight perpendicular to the vertical axis and thus parallel to the axis of the level bubble. This adjustment is also called the *two-peg method* and the *direct adjustment*.

Figure A-2 Peg Adjustment.



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If the axis of sight is parallel to the axis of the level bubble (that is, horizontal), the rod reading b_2 should equal the rod reading at A plus the difference in elevation between A and B , or $a_2 + (b_1 - a_1)$. The difference, if any, between the computed and actual readings is the error to be corrected by adjustment.

Correction. Loosen the top (or bottom) capstan screw holding the reticle, and tighten the bottom (or top) screw to move the horizontal hair up or down and give the required reading on the rod at B . Several trials may be necessary to get an exact setting. (*Caution.* One screw should be loosened before the other is tightened on older instruments to avoid breaking the cross hair!)

140.3 THE SELF-LEVELING LEVEL

Before it is assumed that adjustments are necessary, it is essential to make sure that any apparent need for adjustment is actually due to the conditions of the instrument and is not caused by deficiencies in the test. To test an instrument properly, observe the following precautions:

1. Choose a firm support for the instrument. Usually this can be found only outdoors. The floor of a building, even when made of concrete, will deflect when the observer moves around the instrument.
2. If possible, choose a cloudy day. If the sun is shining, the work must be carried out in the shade, but in good light.
3. The instrument must have time to acclimate itself to the temperature. This requires 10 to 15 minutes, depending on how great a temperature difference exists between the place of storage and the outdoor temperature. The operation of many automatic levels is very erratic during periods when the temperature ranges from near zero to sub-zero.
4. Be on the look out for creep when adjusting the circular level. Creep is caused by tripod settlement, or by the temperature of the instrument changing. This is particularly apt to happen if the instrument has just been brought out-of-doors or is exposed to body or other radiant heat. After setting a bubble or the line of sight, let it stand a few seconds to see that no movement occurs.
5. For adjustment of self-leveling levels, see instructions included with each instrument.
6. It is recommended that the three leveling screws be constantly checked for looseness. These screws, located on the lower side of the base plate, must be adjusted only with the proper pins furnished with the instrument.

141 CARE AND USE OF STATE OWNED BOATS

The boats that are to be used for survey purposes only and are stored at various locations throughout the State. Oars, ropes and life preservers shall be requisitioned from the Survey Supervisor. The above equipment must be returned promptly to these areas when the current work has been completed.

After each day of use, the boat and related equipment must remain in a secure location. The boat and equipment may be stored with the survey vehicle or at the closest maintenance shed.

142 CARE AND USE OF STATE OWNED VEHICLES
(See Policy & Procedure # 404 – STATE VEHICLES)

Smoking is prohibited in all State Vehicles. (See Policy # 401.07 as amended)

Each Crew Chief is assigned a State owned vehicle to transport survey personnel and equipment for the execution of the work assignment. This vehicle should always be cared for and treated in a superior manner. It should always be kept in a good state of repair and properly lubricated and maintained as prescribed within the owner's manual.

The following precautions and preventative maintenance measures are required:

1. Use another member of survey crew, stationed to the rear of vehicle to guide operator of vehicle in backing into hazardous or questionable areas.
2. Use extreme care in driving over woods roads and construction sites, to prevent damage to underside of vehicle.
3. Maintain recommended tire pressure.
4. Apply a few drops of oil on door hinges, door locks, etc.
5. Coordination with the Highway Garage for proper maintenance is required.

The Crew Chief is solely responsible for the proper care of the assigned vehicle. All members of the survey crew shall cooperate.

Use of any State vehicle to tow or push other vehicles is prohibited.

Always be helpful in warning traffic of hazards. When driving conform to all rules of the road; more than that, give way to the other motorist. Try to be of assistance during accidents and helpful to other motorists who may need assistance.

Survey vehicles shall be parked in such a manner as not to create a hazard to the public or an obstacle to property owners. Many property owners will provide a safe area if consulted.

It is imperative after taking all the necessary survey equipment from the vehicle, whether working near or away from vehicle, that survey personnel habitually close all vehicle doors,

windows, and tail gate. During hot summer days, the windows could be down a short distance to allow for some circulation. When the work to be performed is out of sight or not immediately adjacent to the vehicle, the vehicle shall be locked to discourage pilferage.

During cooler weather, the vehicle should only be idled, in the morning long enough to clear the frost from the windows. Once this is done the vehicle needs to be shut off.

142.1 GOVERNING POLICY

(See Policy & Procedures, 404 - State Vehicle)

State owned or leased motor vehicles shall be used only for official purposes. It is State policy to interpret the term "official purposes" strictly. The use of official vehicles for such purposes as attending to personal business affairs, attendance at luncheons or other social engagements, pleasure trips and the like, is obviously not for "official purposes" and hence not permitted. Employees and officials using, or authorizing the use of, official vehicles have the primary responsibility of assuring LEGAL use of such vehicles. Official and non-official business must not be intermingled.

Employees' families or other individuals not on official business shall not be permitted to travel in State owned vehicles except when so authorized by their respective Director. Any such authorizations shall be for individual trips involving special circumstances that justify an exception to the general policy of not permitting travel in State vehicles by other than State employees on official business.

A State owned vehicle shall be operated in a manner consistent with applicable NH Motor Vehicle Laws and Regulations.

145 FIELD NOTEBOOKS

The field notebooks become a matter of record and therefore should receive considerable attention, forethought, and planning as to their organization and completeness.

They should be stored in a safe and orderly manner, along with an accurate record of all books handled by the Crew Chief, and not left on the seat of the vehicle.

The first lined page, and page number 1, if it is anticipated that the space will be needed, will be set up as the index page or pages. The index shall be complete and as informative as possible.
(See plate 145)

Within any section of the field notebook, when revisions or corrections are necessary, they may be made by lightly crossing out, in pencil, the original information and entering the new information adjacent to it. It may become necessary to cross out an entire page and relocate the information in another section of the book. **Erasures are not acceptable in field notebooks.**

At the start of each day's work, the date, weather, and the names and duties of each member of the survey party shall be entered in all books used that day. This is a very simple procedure and

yet it is vitally important that it be followed to the letter. **No other methods or deviations are acceptable.** (*See various plates within this manual.*)

Notes should never be crowded. They should be neat and legible. A soft leaded pencil, about a 3-H must be used for note keeping. The notes for each separate operation of a survey on a given project must be identified properly by the entries at the top of the left-hand page. It should include the name and State number of the project and its character of work, such as "Alignment Continued" or "Topo Continued," etc. If it is necessary, at some later date for various reasons, to continue the alignment in another section of the book, the above procedure should be maintained, in addition to complete cross referencing in both sections.

All superseded notes of record must be marked superseded initialed and cross referenced fully.

Alignment and detail notes should be recorded in books separate from bench lines and leveling notes. All pit topo or cross-sections should also be in separate books.

Green pencils will be used in the field when editing notes in the notebooks. Red pencils will be used by the office staff only.

A log documenting the transmittal of survey books shall be maintained by the Crew Chief.

150 ADMINISTRATIVE REPORTS

All equipment and timesheet reports will be done in MATS. See MATS User Guide for instructions.

150.2 BI-WEEKLY EQUIPMENT REPORT

All equipment use will be entered into MATS. No report is necessary.

150.3 STATE MOTOR VEHICLE ACCIDENT REPORTS

(See Policy & Procedure # 404.05 – MOTOR VEHICLE ACCIDENT REPORTING)

1. All accidents will be reported on Report of Motor Vehicle Accident forms. These forms will be filled out as completely as possible.
2. NHDOT Vehicle Accident Cause and Prevention Report. This form is to be completed by the immediate supervisor and will describe the accident cause. (*See plate 150.3*)
3. Witness statements will be obtained, if possible, and forwarded with the accident report.
4. Four copies of every accident report are required by this office.
5. All accident reports will be forwarded within 48 hours, to State of New Hampshire, Department of Transportation, Survey Section, Attention: Chief of Design Services.

6. Blank forms of Motor Vehicle Accident forms will be carried in all survey vehicles. Extra forms can be procured from the Survey Supervisors.

(See plate 150.31 (DSMV 400 Revised 1/91))

150.4 PERSONAL ACCIDENTAL INJURY OR OCCUPATIONAL DISEASE

General Information: If injured call the appropriate Workers Comp. carrier and Inform your Supervisor.

A. FORMS

1. 8a WCA - To be made out and signed by injured employee. If the employee is unable to do so, the Crew Chief or Survey Supervisor can make it out, with a note of explanation attached. Supervisor or Crew Chief will sign on employer's line. This form is internal to be used by the Department. *(See plate 150.41 (Revised 8/93))*
2. Information for Workers Comp. Sheet - This form will provide the Clerical section information in order to make out additional forms. To be filled out by Workers Comp. Agent.
3. NHDOT ACCIDENT INVESTIGATION REPORT. This form is to be completed by the immediate supervisor and will describe the accident cause. *(See plate 150.42)*
4. Witness Statements - Should be filled out and submitted along with the other forms by anyone actually witnessing the injury or viewing the area where the occupational disease was contacted. *(See plate 150.43)*

B. INSTRUCTIONS

1. The Crew Chief will forward all accident forms and statements through the Supervisor or US Mail Service to reach the Bureau of Highway Design, Worker's Compensation Agent, Concord, NH 03301, within 24 hours or less, after an accident. Blank accident forms will be issued, as needed, to Crew Chiefs by their Supervisors. This must be done as soon as possible. Delays may be cause for non-acceptance by the workers compensation carrier.
2. Survey Supervisors will personally investigate and submit a full written report to the Bureau's Worker's Compensation Agent, concerning all accidents to employees under their jurisdiction.
3. The Survey Supervisor must notify the Worker's Compensation Agent of the date and time when the injured employee returns to work.

C. GENERAL INFORMATION

1. Injured employees disabled over 7 consecutive days will be placed on Worker's Compensation and paid in accordance with Worker's Compensation Laws.
2. All reporting forms are available from the Survey Supervisor, or from your temporary assigned headquarters.
3. To determine the date of injury of an occupational disease, such as poison ivy, etc., the first date of treatment by a licensed physician shall be taken as the date of injury.
4. If additional information is desired, contact the DOT Highway Design Bureau, Worker's Compensation Agent, Concord.

150.5 BI-WEEKLY TIME AND EXPENSE REPORTS

All Time and Expense Reports will be done in MATS. These forms must be in the DOT Bureau of Highway Design Office by Wednesday, at the closing of the pay period. They must be signed by the individual and checked and initialed by the Crew Chief.

All Weekly Report Sheets, Annual Leave and Sick Leave Slips must be in the Survey Office in order to substantiate the Time and Expense Reports. This schedule could vary due to holidays. *(See plate 150.5 & 150.51 (PD8 Revised 8/96))*

Book work, computations, cross referencing of field books, etc., that is pertinent to the project survey should be charged to the project under a Work Class Code, *(See Plate 150.52)*

150.6 INVENTORY OF SURVEY EQUIPMENT

All survey equipment and special equipment in possession of each State Survey Crew must be inventoried the first week in January of each year. Inventory forms will be issued, and the completed forms collected by the Survey Supervisors. Any item not assigned to a specific crew will be recorded by the Survey Supervisor. (i.e. Self Leveling Level)

150.7 LETTER OF TERMINATION

An employee who is terminating his/her services is expected to submit a letter to the Chief of Design Services at least two weeks prior to termination. The letter will state the date and hour of termination.

155 REPORT OF LOST/STOLEN NON-EXPENDABLE EQUIPMENT

The following procedure will govern the action of survey crews, including those private crews contracted to do work for the State of New Hampshire, in reporting violations such as stealing, willful destruction, etc., of State owned property.

1. Immediately record and document all pertinent information related to the incident. If stolen be specific as to the number and type by description of the items involved, and every detail concerning the violator, or violators, including name if available. Include the full names of all witnesses and the name of the Area Survey Supervisor who has jurisdiction over the work being performed. In most cases concerning safety signs and accessories, individuals commit

these violations with or from a vehicle, thus time is of utmost importance. Ascertain the data on the registration plates, plus any other features of the vehicle itself.

2. Immediately relay this information by telephone to the Chief of Design Service's office.
(See plate 155(Form P-18))

160 NEW HAMPSHIRE STATE PLANE COORDINATE SYSTEM

The N.H. State Plane Coordinate System of 1983 will be used. The use of assumed horizontal and vertical datums is no longer acceptable, but on rare occasions, it may be necessary to use assumed values on a temporary basis.

Use of the New Hampshire Coordinate System provides the following benefits:

1. All control surveys are on a single datum, and thus the relationship of one survey to others is established.
2. All subsequent surveys can originate and close at stations of known position and reliability. Hence the reliability of the new survey can be easily determined and appropriate adjustment applied.
3. Points are permanently located, and can be readily reestablished if monuments are destroyed.
4. Route surveys for highways, or other projects, can be started at various points along the route with assurance that the survey sections will "fit", when tied together.
5. A convenient method for indexing property descriptions, route surveys, etc., is automatically provided.

For a more detailed description of the State Plane Coordinate system and further computations see NOAA Manual NOS NGS 5, State Plane Coordinate System of 1983, January 1983. This can be obtained from the Geodetic Section Area Supervisor.

160.1 SPECIFICATIONS: HORIZONTAL 1:15,000

Methods, procedures and equipment used for primary horizontal control surveys shall be sufficiently precise to insure the Department's accuracy standards. See Section 222.

If a survey fails to conform to these standards prior to adjustment, a re-survey shall be made after discussion with the NHDOT Survey Supervisor.

Bearings, or azimuths, of all lines and coordinates of all points shall be based on the State Plane Coordinate System without exception.

Horizontal distances shall be reduced to the State Plane Coordinate System datum prior to adjusting the survey by applying:

- a. The appropriate elevation factor.
- b. The appropriate scale factor.

The survey shall be adjusted by an approved method prior to computing coordinates, bearings, or distances.

Only coordinates, bearings and distances computed from and consistent with the adjusted survey shall be used for design or other purposes.

All subsequent preliminary surveys shall be adjusted to the primary horizontal control survey.

160.2 SPECIFICATIONS: VERTICAL

Methods, procedures and equipment used for primary vertical control surveys shall be sufficiently precise to insure third order accuracy.

1. Differential - Square Root # of Mi X .05 (Km X 0.015 m) = Allowable error.
2. Trigonometric Levelling - Standards will be determined on a project-by-project basis.

If a survey, or any part thereof, fails to conform to third order standards prior to adjustment, a re-survey shall be made after discussion with the NHDOT Survey Supervisor.

All level lines, loops, or nets shall be adjusted prior to computing elevations of points on the survey.

Elevations of all points shall be based on the NGVD29 or NAVD88.

All subsequent level surveys shall be adjusted to the primary vertical control survey.

Locate points where convenient for subsequent surveys where least likely to be disturbed.

PRELIMINARY SURVEYS
SECTION II
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210 DEFINITION - PRELIMINARY SURVEY

The definition of a preliminary survey insofar as this Department is concerned is any survey that is made at any time prior to the advertising date of any project.

214 GENERAL PROCEDURE

The notes of the preliminary survey must show the actual physical conditions as they are at the time the survey is made. Particular attention must be given to all details underground, on the surface, or overhead, which may in anyway affect the location of the proposed highway. The notes must be complete and neatly entered in the notebooks.

Before starting the survey, the Area Supervisor shall coordinate with the Geodetic Supervisor to obtain the most current Vertical and Horizontal Control for the area to be surveyed. The Supervisor shall also compile any old plans that exist, any previously closed traverses, all NHDOT field books that would be pertinent to the project, project number, charge code, and most current string label conventions and any other necessary data. If the project is large and more than one crew will be assigned to the project, the Area Supervisor may want to assign blocks of numbers for control points and also assign file naming conventions so as to minimize duplicate point numbers and duplicate file names.

Prior to entry onto any private property, Right-to-Enter letters will be sent to all property owners that are in the project area. These property owners will be given ten working days to respond to said letters in accordance with RSA 498-A:10

Once the ten-day waiting period has elapsed the preliminary survey generally proceeds in the following manner:

1. On projects with temporary points set by Geodetics, a benchmark will be set.
2. A traverse is performed to establish control in the project area. This traverse will be three-dimensional and the traverse points will be placed advantageously so as to adequately cover the area to be surveyed accurately and maximize the crew's safety. The minimum standards for accuracy will be 1:15,000 Horizontal and 0.05 ft times the sq. root the distance in miles (0.015 m times the sq. root of the distance in Km).
3. Take full topographic coverage of the area outlined in the Survey Request including river topography. This coverage will include enough points to provide accurate contours to 1 ft (0.250 m).
4. All survey procedures will include adequate checks to a degree commensurate with the character of the work to insure the required accuracy.
5. Review entire project with Survey Supervisor as a check on the completeness of the survey.

6. Complete check on books for indexing, cross-referencing, proper page headings, dates, lined-out superseded information, recording book numbers and nature of work in Crew Chief's record book, etc.

Note: Special care must be exercised when encountering suspected safety problems. Hazardous materials, heavy traffic, ticks, poisonous plants, etc. may require special attention! When exposed to these special conditions consult Area Supervisor or Bureau Safety Representative for guidance.

216 MEASUREMENTS

All traverse measurements will be done with Total Station EDMs. These EDMs must be calibrated yearly at one of the NHDOT's Survey Section's approved Baselines. All Baseline data sheets will be filled out in entirety and kept on record at NHDOT Headquarters. Prior to calibration, coordinate with the Geodetic Section. A schedule of calibration times per crew is posted in the NHDOT Survey Office.

Significant digits and accuracy standards for different topographic features will be determined by NHDOT Survey office.

Smallest unit required, example:

1. Building Dimensions with cloth tape = 0.10 ft (.030m)
2. Swing Ties to Traverse P.I.s = 0.01 ft (0.003 m)

217 ERRORS

In the measurements of surveying, instrumental errors arise from imperfections or faulty adjustment of the devices with which measurements are taken: personal errors occur through the observer's inability to read the instruments exactly; and natural errors occur from variations in the phenomena of nature such as temperature, humidity, wind, gravity, refraction, and magnetic declination.

217.1 ERRORS IN INSTRUMENT WORK

1. Instrumental errors. The adjustments, even though carefully made, are never exact. Likewise, the graduations are not perfect, and the centers are not absolutely true.

Errors in horizontal angles due to non-adjustment of plate levels or of horizontal axis become large as the angle of inclination of sight increases.

Non-adjustment of the line of sight becomes of consequence only when the telescope is not plunged.

Errors due to instrumental imperfections or non-adjustments are all systematic. By proper methods of procedure, usually by double-sighting, they may be eliminated or reduced to a negligible quantity. The systematic part of the error due to inclination of the vertical axis is eliminated by double centering.

In order to minimize instrument error, the instrument or level will be checked for adjustment prior to the start of each new job, traverse or immediately after the instrument has been subjected to abnormally hard usage.

A few minutes spent with the "peg" test or the collimation test will tell whether or not the instrument is badly out of adjustment. *(See Section 140.2)*

You should consult the manual provided with your instrument and go through adjustments.

After going through all of your adjustments, if the instrument or level is grossly out of adjustment, the instrument should be sent to the Survey Office through the Area Supervisor for repair, accompanied by documentation stating the user's version of the instrument's faulty conditions.

2. Personal errors. Personal errors arise from the limitations of the human eye in setting up and leveling the instrument and in making observations. The instrument may not be set up exactly over the point: the plate bubbles may not be centered exactly: the verniers may not be set or read accurately: parallax may exist in focusing: and the line of sight may not be directed exactly at the point. Also failing to observe balanced back-sights or fore-sights. When traversing, limit traverse legs to 600 ft (180 m).
3. Natural errors. Sources of natural errors are (a) settlement of the tripod: (b) unequal atmospheric refraction: (c) unequal expansion of parts of the telescope due to temperature changes: and (d) wind, producing vibration of the instrument or making it difficult to plumb accurately.

220 TOPOGRAPHY

Topography, commonly referred to as detail, is generally taken after the completion of the traverse including balancing the traverse at NHDOT Survey Office. Detail includes all physical features that will influence the proper design of the project. Current NHDOT string label conventions will be utilized for all projects. *(See Plate 220)*

The following are the various methods of recording topography notes in the order of preference adopted by this Department:

1. Total station and Data collector.
2. Station and offset.
3. Swing ties (two ties to each reference point shown) Traverse Points
4. Angle and taped distance.
5. Two angles and base line distance off centerline.

Dimensions must be shown in their entirety. Descriptive notes should be applied to all buildings, such as 1 1/2-story house, wooden; commercial, garage, brick, include steps in foundations etc.

Wells and springs (water) will show diameter, type of lining, and date.

Information on isolated trees, 28 inches (0.700 m) in circumference and over, with type of tree and show circumference of trunk at 4 ft (1.2 m) above ground level. Stumps will show circumference. Ornamental trees, regardless of size, will show circumference and type.

Locate private septic systems within normal survey area to include approximate size of fields.

Geodetic Monuments should be shown accurately on plans.

All historical markers will be located and recorded along with an exact wording of any inscription(s).

Whenever a proposed location is adjacent to an airport the following data must be secured in order to determine the glide angle:

1. The distance from the end of the runway to the proposed center line.
2. The elevation of the end of the runway.
3. Width of the landing area and runway.
4. The airport boundary adjacent to the project.

The Area Supervisor or the Crew Chief must coordinate with the airport authorities prior to entering any flight areas. When surveys are made under winter conditions, notations should be appropriately entered in the book indicating what survey datum, including topography, should be retaken or checked under bare ground conditions.

220.2 METHODS USED TO TIE IN PROPERTY LINES, TREE LINES, ETC.

Usually the survey crew working on a preliminary survey does not know where the existing right of way lines or property lines are in relation to the proposed highway centerline. Therefore, every tree line, stonewall or iron pin found adjacent to the highway is treated as though it is or might be a property line.

Stonewalls, iron pins, stone monuments, fences or a row of bushes could be a property line. When picking up these features provide enough information so as to be able to develop lines for abstracting. Full definition of any wall and bushes should be taken.

220.3 UTILITIES

When appropriate the crew shall check with the Supervisor to contact Dig Safe @ 1-800-DIG SAFE.

Utilities located above ground - power, telephone and telegraph poles, hydrants, etc., should be located by Total Station/Data Recorder and prism. Always record the utility Company identification and numbers (if any) that are on the pole. When poles are in joint usage, the owning utility is listed first, for example - a pole used by New England Telephone, but owned by Public Service Company:

PSCO 27

NET 34

Utility lines crossing the proposed location should be located for at least 200 ft (60 m) from center line in each direction, to include at least two poles each side that will not normally be affected by construction. If an angle point in the utility line occurs within two poles beyond this distance, the angle point and direction and degree of angle should be located. Running a spur traverse along the pole line is a convenient method. Poles with guys should be noted "guy". Heavy guying, such as on transmission poles, should be located at the point of entry into the ground.

Any overhead major utility line - other than service lines to individual buildings - which crosses the proposed location shall be located and the elevation of the wire where it crosses the center line shall be determined. Employ remote elevation option from the Total Station or the Data Collector.

222 TRAVERSES

A traverse is a series of connected lines of measured length related to one another by measured angles. In general, traverses are of two classes.

The first class is an *open* traverse. It originates at a known horizontal position and terminates at another known horizontal position

- It originates at a point of either known horizontal position with respect to a horizontal datum or at an assumed horizontal position, and terminates at a point with an unknown horizontal position.

The second class of traverse is a *closed* traverse, which can be described in any one of the following three ways:

- It originates at a known horizontal position and terminates at another known horizontal position
- It originates at an assumed horizontal position and terminates at the same point.
- It originates at a known horizontal position with respect to a horizontal datum and terminates at the same known point.

A traverse that originates at a known position and closes on another known position is by far the most reliable because a check on the position of the final point checks both the linear and angular measurements of the traverse.

Closed traverse is the required method of traverse at the NHDOT. An *open* traverse is unacceptable.

All control surveys will be tied to the New Hampshire State Plane Coordinate System.

Geodetic control (data to be furnished by supervisor) The quantity of control to be established will be determined by the Supervisor dependent on traverse length.

In most cases, traverses 0.6 mile (1 km) or longer will have control at both ends with a maximum of 1.0 mile (1.6 km) spacing between control points.

Data for projects 1000 feet (300 meters) or smaller in length may be collected directly from geodetic control points.

All control within the area of a project's limits shall be occupied or side shot.

All traverses will be done using tripods at the instrument setup, backsight, and foresight stations. Traverses should be laid out to balance distances and angles and minimize the use of intermediate points.

Under most circumstances, distances between traverse points shall not exceed 600 ft (180 m).

Horizontal tolerances set in electronic equipment should never exceed 20 seconds. Vertical tolerances set in electronic equipment should never exceed 20 seconds. All observations taken with more than these set tolerances will not be accepted.

A record of current and successful calibration tests on all EDM equipment, including total stations, used on NHDOT projects must be on file at the NHDOT Survey Office. The test must certify that the equipment meets or exceeds manufacturer's specifications. Consultant Crews must submit a complete baseline certification done within 3 months of the start of State projects. All crews must do a complete baseline certification every twelve months. *(See plate 222.1)*

Adjustments of the total station (per equipment manual)

These items should be checked weekly or anytime the integrity of the instrument is in question. Generally, the process should take less than 1/2 hr.

- Plate level
- Collimation
- Tribrachs, checked regularly including circular level
- Do not perform cross hair adjustments. This adjustment must be done at a certified repair facility.

Least-Squares

The least-squares method of adjustment of a traverse applies corrections to survey observations in such a manner that the weighted sum of the squares of the adjustments to the measured angles and distances is a minimum. The least-squares method of adjustment is the accepted method of adjustment at the NHDOT.

Minimum Horizontal Closure - 1:15,000

Minimum Vertical Closure - square root of miles x 0.05 foot (km x 0.15 m) for differential levels. Trigonometric standards will be determined by the Survey Office on a project by project basis.

If required, differential leveling shall be used to check vertical accuracy on all photogrammetry projects and other projects as determined by the Survey Office.

If a traverse fails to conform to the required standards, a rerun of the traverse will be made.

All traverse information collected in electronic data recorders is to be delivered to the NHDOT Survey Office in MOSS format for adjustment. Remote survey crews must download data onto the global drive at designated District Office locations. Consultant Crews may submit data to the Survey Office by e-mail or diskette. Copies of field notes are to be faxed to the Survey Office. All downloads must be accompanied by an SDR processing log. *(See plate 222.2)*

SEE “DATA COLLECTOR PARAMETER SETTINGS” documentation for required data collector information.

224 BRIDGE SURVEYS

Where stream, road, railroad, etc., crossings necessitate a structure, information must be accurately obtained to enable designers to adequately design a structure to fit the conditions.

The following information will be taken from the center line or traverse:

1. Complete Topography of the river to include at least 200 ft (60 m) upstream & 100 ft (30 m) downstream
2. Locate all ledge outcrops, abandoned piers and abutments, and large boulders.
3. Record approximate location, type and size of nearest structure upstream and downstream.
4. Note any other information, which may be beneficial to the designers.

Special in-depth surveys may be requested to determine any lateral or vertical movement of an existing structure. This survey will usually involve complete detail of the structure, horizontally and vertically. Detailed instructions will be furnished to the Crew Chief on each project.

(See plate 224.1 – 224.4)

225 RAILROAD CROSSINGS

The following information will be collected for railroad crossing surveys:

1. Alignment with bearing and detail along both roadway and track for three hundred feet (90 m) on ninety-degree crossings, more if the crossing is on a skew. Alignment shall be in the centerline of the existing roadway at the crossing if possible.
2. Profiles of the road and both rails.
3. Existing drainage and conditions of it.
4. Check AAR-DOT number of crossing (Should be on signal post, crossbuck or nearest pole.)
5. General comments on crossing and protection, if any, description and condition of crossing.
6. General detail wanted: width of road, shoulders, paved or gravel, switches, frogs, telephone poles, tree lines, building, utilities (sewer, water, drainage, power, fiber optics, etc.).
7. Establish a bench mark on the project. Do not use railroad equipment for a bench mark as it will probably be removed during construction.

226 CHANNEL CHANGES

Extensive channel change surveys are sometimes required to conform to highway relocation proposals. Information regarding high and low water conditions, existing retaining walls, area drainage patterns, adjacent facilities using water from a stream and its purpose, and any other existing conditions or items that in some way have a direct bearing on the proposal, ecologically or otherwise, must be obtained.

Generally a full topographic survey will be taken utilizing state plane coordinates with an accuracy of 1 ft (0.250 m).

227 LAND SURVEYS

At times a complete property survey, plus a plan, is required to be made by the Survey Section. These are to conform to current regulations as established by law, and the Code of Ethics and Standards as adopted by the New Hampshire Land Surveyors Association.

228 SURVEYS FOR SPECIAL PURPOSES

In addition to surveys for highway projects, the Department, from time to time, will perform surveys for other agencies within the State. (i.e.: Fish and Game, Dept. of Safety, etc)

228.1 HYDROGRAPHIC SURVEYS

1. In waters not affected by tides, the usual objective of the survey is to ascertain water volume or the underwater contour features.
2. In tidal streams, adjacent to existing structures where erosion exists, periodic evaluations are made to determine any subsequent changes caused by erosion.

228.2 HYDRAULIC SURVEYS

This section provides procedures for the most direct means of acquiring survey measurements for the hydraulic analysis of culverts and stream crossings. Many times the survey information is needed as part of an emergency response, therefore the request for survey should have the required cross section measurements without a complete topographic survey of the area which is not required nor is it cost effective. The extra details involve additional survey time, as well as plan preparation and consequently delay the hydraulic analysis.

Planning and orientation of traverse points:

- GPS control is needed for hydraulic surveys because most of the watersheds are delineated using USGS Quads and other information on State plane coordinates.

Vertical control:

- At least two TBMs will be set.

Spacing and naming of cross sections:

- At least four cross sections will be measured upstream of the crossing and three sections will be measured downstream of the crossing.
- Two of the cross sections will be within two (2) ft of the inlet and the outlet of the culvert or bridge. This is to determine convergence and divergence of flow entering and leaving the culvert.
- There will be a cross section taken approximately 20 ft upstream of the inlet in order to further detail the convergence at the headwater pool.
- There will be two additional cross sections required on each side of the road. These sections will be selected based on the best representation of the natural stream channel known as a “reach”. Generally, it is useful to space the additional cross sections to provide a representation of the change in the gradually varied flow. The exact location of these cross sections will be determined and flagged by the engineer.
- Occasionally it may be required to monument a cross section with iron rods in order to monitor long-term sediment transport and migration of the stream channel.

Points acquired at the cross section:

- Measurements should be taken with a total station unless the conditions are favorable for reliable survey grade GPS.
- Points acquired within a cross section must start from left to right, looking downstream. This is how the data is entered into the hydraulic engineering software.

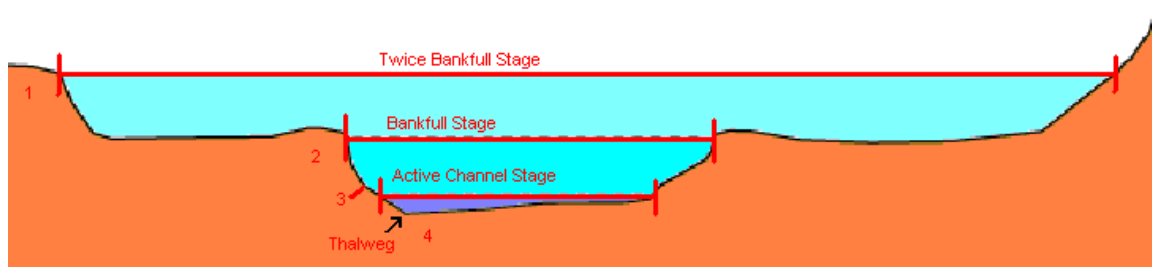
- Cross sections must be numbered starting from the downstream end. The labeling scheme is 10, 20,30,40,50,60, 70 with 30 & 40 typically being immediately upstream and downstream of the culvert or bridge. This labeling scheme allows room for additional cross sections that can be interpolated or measured (*see plate 228.2*).
- There are 4 locations required to accurately determine capacity of a given reach. Survey points are needed at the thalweg, bottom of bank, top of bankfull, and twice bankfull depth for each cross section. The hydraulics section will flag the cross section locations and individual shots.
 - Thalweg- The deepest part of the channel at the given cross section (not the center of the reach).
 - Bottom of Bank- this point is delineated by a transverse break in stream channel slope
 - Top of Bank (bankfull elevation)- This stage is delineated by the elevation point of incipient flooding, marked by deposits of sand or silt at the active scour mark, break in stream bank slope, perennial vegetation limit, rock discoloration, and root hair exposure
 - Twice Bankfull- this is the flood prone area of a given reach. These survey points should delineate the width of the stream provided it were running at 2 times the depth at bankfull.

Sketch:

- The survey sketch should show the road and the stream as well as all cross sections and control points and any other relevant features.
- Inverts, several centerline stream elevations, and the elevation of the road at the culvert should be shown on the sketch.
- The culvert material and the length must be shown on the sketch.
- The sketch should include a description of the channel bed material (boulders, gravel, pebbles, sand, silt, clay)
- Any known buildings that have flooded need to be shown on the field sketch and the address must be recorded. The building and sill should be located.

Field Notes:

- Shots on a sections will be coded PELV, with a note for the description. Shots not located on a section will be coded with the appropriate code. (*see plate 228.2*)
- Figure names of X10, X20, X30, etc... need to be used for the cross section strings when collected from left to right as seen looking downstream.
- Changes in rod height should be kept to a minimum.



Looking down stream the sequence of these shots is left to right. These shots are mirrored on the opposite bank.

1. Twice Bankfull
2. Bankfull
3. Bottom of Bank
4. Thalweg

229 BORING LAYOUTS

The responsibility of locating boring points, with elevations, on many structure sites may be delegated to the Survey Section.

The location of these points must be accurately laid out as described on bridge boring plans, which accompany each request. Ground elevations should be noted at each point. In some cases, it may be impractical to place stakes at the exact location of the boring, therefore it may be necessary to place other stakes that give direction and offset information to these points. The points should be flagged with pink flagging.

The loose-leaf field notes or the excel spreadsheet, is to be returned with boring layout plans after completion of layout, will be complete as to descriptions, computations, project number, date, weather, names of crew members, etc. (*See Plate 229*)

CONSTRUCTION SURVEYS
SECTION III
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300 CONSTRUCTION PLANS FOR LAYOUT WORK

The Crew Chief should thoroughly study the construction plans that are delivered during the bid advertising stage. There will be a set of working plans which have been reduced photographically to approximately half scale, a set of right-of-way prints (where right-of-way is to be purchased) and a set of bridge plans, where needed will be furnished. Alignment stakeout report sheets, with coordinates, will also be provided.

301 CONSTRUCTION SURVEY REQUEST PROCEDURES

All construction requests for services of a survey crew will be made by the Contract Administrator directly to the Survey Office, the Survey Area Supervisor or the Chief of Design Services. The survey crew will accomplish what was specifically stated in the request, without deviations, unless additional work is requested by the Contract Administrator. If this occurs, the Survey Office must be notified.

302 CARE AND USE OF FIELD NOTEBOOKS

The Survey Supervisor will issue the pertinent field books for Construction purposes. As soon as the State field office is set up, the Crew Chief will store these books each night in the office safe, in a drawer assigned by the Contract Administrator. It is important to leave the books at the field office, readily available to the Contract Administrator or to other survey crews that may be assigned to the project. Any transfer of books to the Concord Office during the construction phase must be made through the Survey Supervisor. When a project is closed down for the winter, the storage of the field books shall be coordinated with the Survey Area Supervisor. This rule will also apply at the termination of a project, prior to the removal of the field office.

All rules pertaining to indexing, referencing and legibility found under PRELIMINARY SURVEY will apply to the construction phase. Other special rules pertaining to the use of notebooks will be given under the various items of CONSTRUCTION SURVEY. Consultant survey crews working on projects with Supplemental Specification 105.08 will be required to make Xerox copies of information in the field books for their daily operations. *(See Plate 302.1 & 302.2)*

303 INITIAL LAYOUT

The Initial Layout stage includes all survey duties, which will be initiated after the project has been advertised and will hopefully be completed before the bids are opened. These are listed in the suggested order of completion.

303.1 ALIGNMENT

The traverse on all surveys should be carefully run, as it is the basic control for all phases of the survey and construction. The traverse will be balanced at NHDOT Survey Office in Concord to insure that it meets the Horizontal and Vertical standards. *(See section 160.1 & 160.2)*

There are certain procedures, which if carefully followed, will increase the accuracy of work done with the instrument. With the use of controls set by the Geodetic Survey Section, errors, which previously went unnoticed or were ignored, now become apparent. The procedures mentioned hereafter should be followed in all alignment work.

To layout a given alignment, the Area Survey Supervisor will obtain the final adjusted traverse information, the coordinates of all control points and 50 ft (20 m) stationing, COGO reports supporting the alignment, and any plans showing the alignment with respect to the physical features on the ground. This information will be provided by the Design Group requesting the alignment layout.

Traverse points set from Geodetic Control Monuments are placed at intervals of approximately 750 ft (230 m) along the existing roadway. These points will be utilized for “setting out” the alignment with the Total Station/Data Recorder. The crew chief will either keyboard enter the alignment information or have the Survey Office personnel Upload the information into the Data Recorder. The Instrument Operator will verify the information keyboard entered or Uploaded is correct. When any information is received by the Survey Crew, the first task is to verify that the information received is correct. All curve information is independently computed and compared to the plan information. Once this has been determined the deflection angles will be computed and the alignment information will be entered into NHDOT field books for a permanent record.

Stationing at 50 ft (20 m) intervals will proceed. All points will be on flushed stakes (where applicable) with a reference stake noting the station. Generally the stationing will run in a south to north, or west to east direction.

In order to find the flushed centerline stake under adverse conditions, such as deep snow, the following procedure in respect to reference stakes, [sometimes called witness stakes] and risers will be utilized on every project. Risers will be placed 1 ft (0.3 m) from centerline stakes on the right side of the stake. The reference stakes will be placed on the opposite side of the centerline stake from the riser and 6 inches (0.15 m) from the centerline stake.

303.12 CONSTRUCTION LINE OFFSETS

Where access to Construction Centerlines are not possible or reasonable, offset lines will be utilized.

303.13 ESTABLISHMENT OR REHABILITATION OF CONSTRUCTION LINES

Any construction line change shown on the plans must be established in the field as soon as possible, and field-closing the layout must be done to insure that no mistakes have been made. All layout should be coordinated/prioritized with the Contract Administrator. Occasionally a survey crew may be given a construction line change to stake prior to advertising for bids, in which case charges will be to the preliminary phase of the project.

303.14 BOOKS OF TABLES

Survey personnel, as well as office personnel, will use data from HIGHWAY CURVES by IVES and Kissam for TRANSITION CURVES FOR HIGHWAYS by JOSEPH BARNETT.

IVES and KISSAM tables are based on the arc definition. The principal change in procedure lies in the fact that these tables establish the length of radius for a 1-degree curve at 5729.58 ft (1746.3789 m).

Survey, as well as Design, will use the tabular values as shown in Table 10 plus the appropriate T and E corrections as shown in IVES and KISSAM. For chord corrections, Table II,

will be used as shown. However, the policy for work in the field to establish 25 foot stations within curvatures 10 degrees or greater will be followed.

303.15 SPIRAL CURVES

Spiral curves will be utilized on all Primary and Interstate alignment within curves of 1 degree or more, unless otherwise specified. Simple and compound curves will be used in all other places. *(See plates 303.15CE, 303.15SE, 303.15CM, & 303.15SM)*

303.2 LINE TIES

Tie points should be established a maximum distance of 500 ft (150 m) apart along the centerline. The plan profile of finished grade should be studied for the location of vertical curves, in order to insure level sight distance between tied out control. Sharp curves may require additional ties, where trees or other obstacles may present a problem in turning off deflections with the instrument. Be sure that the nearest tie to the centerline is located a minimum of 20 ft (6 m) outside the clearing edge. Hub ties are preferable, using standard survey stakes or oak hubs driven flush with the ground, with nails driven through appropriate ribbon. Three hub ties should be used on one side of the centerline. Where practical, there should be a minimum of 30 ft (10 m) and preferably not more than 50 ft (15 m) between each hub. It will also be helpful to place one of the hubs on the right-of-way line. A reference stake, slanted toward the hub, will be driven about 6 inches (0.15 m) into the ground beside each tie point. The reference stake will be marked showing the station and offset distance from centerline. A tall riser flagged with appropriate ribbon color will be driven on the opposite side of each tie point. *(See plate 303.2)*

Hub ties will be set at 90 degrees to the centerline, and so shown in the alignment book on the sketch pages with the alignment. Occasionally it may be necessary to tie out a point on a skew angle, to avoid some object such as a large tree. Be sure to show the skew angle on your alignment sketch. *(See plate 303.21)*

In urban areas it is sometimes necessary or more practical to use swing ties. Three objects should be located outside of the work areas, where tie points can be conveniently established for the control station. The angle from the control point to any pair of swing ties should be approximately 60 to 90 degrees. Common swing tie locations are corners of foundations or other similar objects. Care should be taken that the points picked can be used during all stages of construction. When using corners of foundations or corner boards of buildings, it is also important to indicate the point from which the measurement was taken, such as the height above the ground or the number of concrete blocks above the ground. In urban areas it is a must that the Crew Chief ask for permission from the property owners before putting stakes of any kind outside of the State right-of-way.

Any stakes placed on lawns must be driven flush. It is suggested that the top of the flushed stake be dabbed with a spot of yellow or white paint for easy identification. Existing line ties should be checked, and replaced or added to as needed.

303.25 COORDINATE TIES

Coordinate tie points can be used instead of line ties when your supervisor has made arrangements with the Contract Administrator for the Project. Coordinate tie points can either be line ties coordinated or a construction traverse. A construction traverse will be set and adjusted before any layout is started. Trigonometric levels should be run with any construction traverse; sometimes you will need to locate detail, needing elevations, on a project. The points should be set outside of all working areas for the project to avoid being destroyed.

303.3 STAKING FOR RIGHT-OF-WAY BOUNDS

The survey crew will be expected to set all bound points during the construction stage. A complete list of bound point locations should be recorded in the alignment book at the time of the original stakeout (for the Contract Administrator's use) and as bound points are set during the construction stages, each location should be checked off, dated and initialed in the book.

(See plate 303.3)

A record should be kept by the Crew Chief of any bound points, which must be reset because the Contractor has knocked out the original bound ties. This record should be forwarded to the Contract Administrator after the bound points have all been set.

The accepted method of setting bound points is to set a hub stake at the bound location with straddle stakes. A reference stake at the bound location should show the station and offset. The straddle stakes should be set by instrument a minimum of 5 ft (1.5 m) either side of the bound location. The line nails on the straddles should protrude above the stakes. The stakes should be firm, but high enough to allow stringing above the bound location with enough vertical clearance for a plumb bob. Distances from the straddle nails to the bound points should be measured either a steel tape or prism and recorded to 0.01 ft (0.004 m) on the inside face of each straddle stake. It is advisable, where bound points are located at a considerable distance from the centerline, to leave additional tie stakes, in case the bound straddles are lost.

All bound points should have a riser and be flagged, using a combination of green and white plastic ribbon.

303.32 STAKING FOR UTILITY POLES

The responsibility of utility pole staking on many projects may be delegated to the Survey Section.

The location of these points must be accurately laid out as described on the Pole Relocation Summary Sheets, which accompany each request. The stakes should be marked with UTL POLE, the station and offset, and painted orange. The stakes should also have a witness riser flagged with red and white. In some cases, it may be impractical to place stakes at the exact location of the utility pole. In those cases contact the survey request originator to discuss an appropriate plan of action.

(See plate 303.2)

The loose-leaf notes, to be returned with the Pole Relocation Summary Sheets after completion of layout, will be complete as to description, computations, project number, date, weather, names of crew member, etc. *(See plate 303.321)*

303.35 CONSTRUCTION BENCH LINE

Level work is extremely important and the Crew Chief shall thoroughly train members of his crew in the proper methods to obtain the accuracy required for this work.

It is the policy of the Department of Transportation to use National Geodetic Vertical Datum of 1929 and mean low water along the coast where tidal waters are involved to correspond with Government charts and maps. A conversion to the North American Vertical Datum of 1988 is available on request. A near complete record of all known bench marks is maintained at the Concord office. A tie-in shall be made to the datum of any previous survey at either end, or crossing, of the survey.

Bench marks provide a series of semi-permanent marks of reference of known accurate elevation at frequent points along the construction line.

Bench marks shall be established at:

- [a] Approximately 500 ft (150m) intervals in level country.
- [b] At 50 ft (15 m) difference in elevation in hilly country.
- [c] One per city block on urban surveys.
- [d] Any others that may be considered useful during construction, such as structure locations, grade crossings, etc. On structures, two bench marks must be established, one high and one low.

All work involved in setting bench marks shall be done with the self-leveling level. These levels can be procured through the Area Survey Supervisor. These levels are to be returned to the Area Survey Supervisor as soon as vertical control is established.

Bench marks shall be established on some permanent object outside of construction limits and should be accessible for construction purposes. Bench marks should be set on permanent, solid objects. Trees in inhabited areas must not be scarred in any way. Bench marks shall be numbered to agree with the number of the full station preceding it. The description of the bench mark, stating actual station and offset distance, should be complete and accurate and recorded into the notebook. A descriptive stake may be nailed to bench mark trees in wooded areas. Turning points (T.P.'s), should be established on a firm and distinct point for accurate work. T.P.'s must be numbered consecutively from the point of beginning starting with Number 1. A brief description of the T.P.'s shall be noted. *(See plate 303.35)*

A double-rodged bench line is run throughout the project with accuracy consistent with third order leveling, which is 0.05 ft (0.015 m) times the square root of the length of the level run in miles (kilometers). Starting and ending where possible, with a permanent bench mark of known elevation.

Where there aren't any permanent bench marks at the end of the project, a double rodged run is required for accuracy. An acceptable bench line run should then be adjusted as shown.
(See Plate 303.351)

Precautions necessary to assure accurate bench mark levels include:

1. Peg test instrument.
2. Balanced backsights and foresights not to exceed 200 ft (60 m).
3. The level rod must be of correct length and graduation - check it with a steel chain for absolute length.
4. Always lightly tap the self-leveling level before reading, observing that the prism is "floating" properly as shown by a "float" of several hundreds above and below the final reading as the level stabilizes.

303.36 RELOCATION OF BENCH MARKS

All bench marks that fall within the clearing limits must be transferred prior to construction. The transfer should be made before the bench mark tree is cut; even though the root with the spike and washers may still be in the ground. The tree roots will occasionally shift position when relieved of the weight of the tree. All bench mark transfers should have the letter "A" suffixed to the number [e.g., B.M. 102-A]. Use the bench mark book to record all B.M. transfers, and void all those bench marks that have been destroyed.

If any Geodetic Control disk is found to be in the construction work area, take a disk rubbing, record a description and notify the Survey Office. The Geodetic Survey Section will determine if replacement is warranted.

303.4 SIDE-STAKING CENTERLINE

As soon as construction line alignments are final, reference stakes (called side stakes) should be set at right angles to each 50 ft (20 m) construction centerline station. These stakes should be placed 20 ft (6 m) beyond the clearing edge.

Normally, side stakes should be set left and right of centerline. In certain situations it may be necessary to double-stake on one side only, but stake on both sides if possible. Double staking should be used on the right-of-way side of double barrel highways when the median strip is going to be worked during construction. There should be a minimum of 20 ft (6 m) between double stakes.

A side stake should be driven into the ground two-thirds of its length, leaving a wide face parallel to the centerline. The face seen from the centerline shall be marked with the station and offset distance, e.g., 192' over 72+50. A tall riser flagged with red plastic ribbon [blue or white on ramp side stakes] shall be set within 1 ft (0.3 m) and directly behind each side stake.
(See plate 303.2 & 303.35)

Occasionally it is necessary to drive the side stakes flush with the ground, where they fall on a lawn or where there is extensive vandalism. When this is the case the top of the stake should be painted to aid in finding the stake.

In urban areas, side stakes should not be set outside of the right-of-way, unless the Crew Chief has obtained permission from the property owner.

All side stake distances must be measured with a steel tape or Total Station EDM. It is customary to set all side stakes to an even distance. Be certain, after the stake is in the ground that the offset distance and station are still showing, and the distance on the stake agrees with the actual distance measured.

303.5 SIDE STAKE LEVELING

All side stakes must be leveled at the earliest possible opportunity. In wooded areas no attempt should be made to do any leveling until the trees and brush are removed. Generally, the most efficient method of leveling side stakes is to use two Rodpersons and two rods. This gives a minimum of delay between readings by the Instrument Operator. The Rodperson should carefully set the rod on the high corner of the side stake. Where possible, he/she should stand directly behind the rod, facing the instrument. In this way he/she can make the rod plumb and can accurately rock the rod through plumb 6 inches (0.15 m) to the front and 6 inches (0.15 m) to the rear. The Instrument Operator should carefully check his level bubble before each reading, pick the lowest reading obtained on the rod and clearly call it out to the notekeeper, calling each digit separately. The notekeeper should repeat the reading, and the Rodperson should immediately call out the station number and the offset distance left or right. Before leaving the stake, the Rodperson should make certain the corner of the stake, which was leveled, is clearly marked with an indelible marker.

The notekeeper should record the level notes on loose-leaf notepaper, being careful to show the offset distances in the second column from the left. In areas where the stakes are driven flush the notekeeper will have to refer to the notes showing the distances recorded at the time the side stakes were set. (*See plate 303.5*)

All stake elevations must be computed and then checked by another person in the survey crew. Then the backs of the stakes will be marked with the proper elevations.

The most efficient procedure is to have one person reading the elevations, two people marking side stakes, and the fourth person checking or figuring other stake notes. Acceptable alternative methods include: Remote elevation, using Data Recorder/Total Station.

303.7 ROADWAY TOPOGRAPHY

Occasionally there will be areas where excavation or fill has changed the contour of the ground since the original roadway topography was taken. New topography must be taken in these areas prior to construction.

304 STRUCTURE LAYOUTS

Prior to any structure layout all adjustments must be made to the Total Station. On a construction project where one or more structures are to be built, the survey crew will be furnished with a full size set

of bridge plans. Generally, a survey layout sketch is incorporated on one of the plan sheets for each bridge. If not, a suitable layout must be developed from the plans. The Survey Crew Chief will obtain the Contract Administrator's approval for the proposed layout. Occasionally, field conditions may warrant a change in the normal layout procedure. However, every layout, even if only a partial layout, must have a triangulation check.

The Crew Chief will make a layout sketch in the field notebook. Use as many pages as needed to show all of the required information. It is important to show the bridge number and description and the stations and angles of crossing to the centerline or centerlines of construction. Use the following steps for bridge layout procedures:
(See plate 304)

It should be noted that the layout must be developed independently by the Crew Chief and recorded in the field book with his/her signature. The Instrument person will independently check the layout as developed from the plans and indicate by his/her signature agreement with the Crew Chief.

It is acceptable for all working points on the original bridge layout to be set from two proven traverse points in the immediate vicinity of the work area.

The purpose of the checks is to avoid costly mistakes. The accuracy needed in all field measurements cannot be over emphasized. This is especially true where multiple span structures are involved. The normal tolerance in diagonal check measurement should not be over 0.01 ft (3 mm). The diagonal distance checks are very important, but angle checks are also helpful in determining errors in layout. As many working points as possible should be checked by span and diagonal inverse field measurements. (See plate 304)

Once the bridge layout has been completed and checked on one side of the centerline of bridge, intermediate tie points should be set on the same line of sight. After the tie points are all set on one side of the bridge, new line of sight should be taken on the furthest sight point and each point carefully checked. Any slight variation must be corrected. It is customary to use cup tacks to mark the line on the stakes.

To establish the sight points on the same centerline of bearing on the opposite side of the centerline of bridge, the preferred method is to set the instrument on one of the outermost ties just established, then take line on the point just occupied on the centerline of bearing at the centerline of bridge and to project thru this point to set a tie point a maximum distance on the opposite side of the centerline of bridge. Intermediate tie points can now be set. Where possible, all of the points now established along the centerline of bearing should be checked from one set-up, by taking line from one outside point to the opposite outside point and making sure that each intermediate point is on a perfectly straight line.

All distances must be measured with a calibrated Total Station. If this type of instrument is not available a calibrated bridge tape must be used.

Where wing lines are laid out on skew angles, the accuracy of the layouts should be checked with additional diagonal measurements to the ends of the wings from the nearest centerline of bearing at the centerline of bridge.

When bridge targets are used, it is important to have a hub tie directly under the target or within a few feet of the target. This will allow the Contract Administrator to accurately check the target to see if it has been disturbed.

All bridge tie hubs shall be driven flush with the ground, with reference stakes clearly marked for each hub. "Bull pens" made with risers and spaced far enough apart to allow the setting up of an instrument between them, shall be set around each hub. The "bull pens" shall be well outlined with yellow plastic ribbon. Bridge targets shall be nailed onto rugged frames, well braced and firmly attached to permanent objects or driven firmly into the ground. With the small bridge targets, it may not be necessary to make an elaborate frame.

The preliminary bridge layout will include ties and targets as requested by the Contract Administrator along the centerline of bridge, the centerline of bearings for the abutments and piers and along the working lines for the wings. The centerline of bearings and the centerline of bridge should have a minimum of three ties each side of the location of the structure. There should be three hub ties for each skewed wing.

Following the complete bridge layout, a survey crew may be called back to check spans after the concrete has been poured. The Contract Administrator will set his own grades on abutments, piers and footers.

305 TOPOGRAPHY FOR STRUCTURE EXCAVATION

Structure excavation is paid for as a separate bridge item; therefore the survey crew, upon completion of a bridge layout, will be asked to take topography for excavation for the footings of abutments and piers. The base line used for these sections is the same base line as used for the layout of the abutments and piers, i.e., the centerline of bearing or the face of abutments. Topography must be well beyond the limits of construction. A section will be taken to cover every angle point on the footing for the abutments, wings and piers. In ledge areas it may be first necessary to take topography for earth structure excavation. Then after the ledge has been exposed, it may be necessary to take additional topography for ledge structure excavation. A layout sketch or sketches must be in the field book to show the layouts for structure excavation for each abutment or pier. This book would include the structure layout, the ties, T.B.M. transfer information and structure excavation sections. Two T.B.M.'s established for the bridge should be set at a convenient location to be used during construction. The elevation should be set by running a double-rodged or inverted rod line from an established bench mark through the T.B.M.'s to another established bench mark beyond the structure. The T.B.M. elevation should then be adjusted to fit the two bench marks. See minimum standards of Bench Mark Closures. The integrity of the TBMs for Structure Construction must be maintained. See construction Bench line section 303.35

306 TOPOGRAPHY FOR LEDGE EXCAVATION

Please be advised on ledge projects, if the ledge is greater than 10' (3 m) in height, the use of a reflectorless total station will be used. The survey supervisor will arrange a crew for this work. No person will be exposed to the hazard of falling.

Ledge topography requires much more attention for accurate quantities, please exercise more care. Where ledge is classified, (i.e.; a bid price is set for ledge excavation), the survey crew will be asked to take topography or original sections on all ledge after it has been exposed. Care should be used, since the prices for classified ledge excavation run high. The Survey Crew Chief should refuse to detail any ledge that is not properly stripped. On ledge that lacks uniformity, small pockets of unstripped ledge will occasionally be found. The Survey Crew Chief will not detail this ledge unless the contractor furnishes a man with a hand shovel to expose the ledge in the questionable areas. In the interest of accuracy, if drill rigs are actively working in the area to be detailed, the contractor should be asked to shut down the rigs briefly until the sections have been completed.

Note: Alternative methods may be employed for ledge work. Coordinate with your Contract Administrator prior to doing any work.

The topography will be taken with at least one shot shown beyond the exposed ledge.

On jobs where ledge is bid unclassified, (i.e., where ledge is paid for on the same price basis as earth excavation), the survey crew may be asked to take original topography. The purpose of this topography is to give a quantity basis for over-breakage or when a sub-contractor is involved.

307 TOPOGRAPHY FOR MUCK EXCAVATION

Where there is a separate item for muck excavation, topography will be taken following the excavation. Topography will be carried out to old ground, with the shots actually taken in the muck clearly labeled with an M above the offset distances. Zero-out stations must be shown at the beginning and end of the muck area.

Note: Alternative methods may be employed for muck work. Coordinate with your Contract Administrator prior to doing any work.

309 WASTE AREAS

During the construction stage there may be excavated material classified as waste. This material may be deposited in an area approved by the Contract Administrator. It may be placed within roadway sections or in a pit. Original topography must be taken to show elevations of the ground prior to the deposit. When the waste is placed in an area that was detailed prior to construction, the originals for waste will in effect be semi-finals for the particular roadway area or pit area. Then the finals will give the quantity of the waste deposit.

310 STAKES AND GRADES DURING CONSTRUCTION

See Supplemental Specification #105

312 LAYOUT FOR CURBING AND SIDEWALKS

See Supplemental Specification #105

315 LAYOUT FOR FENCING ALONG RIGHT-OF-WAY

When right-of-way fencing alignment is required, it is customary to lay out the computed angle with a transit that will give the computed right-of-way bearing from one bound to the next. In heavily wooded areas the survey crew will place risers flagged with green and white plastic ribbon along the right-of-way line for about 200 ft (60 m) in each direction from the bound. When the fence clearing crew has brushed out the line, the survey crew may return and give good line for the fence. Survey stakes, marked R.O.W. will be set along the line at approximately 100 ft (40 m) intervals. A riser flagged in green plastic ribbon will be set beside each survey stake. If, in the opinion of the Survey Area Supervisor, the survey crew can lay out the line for brushing and then with a minimum of delay follow immediately behind the brushing crew with stakes for fencing, permission to proceed in this manner may be granted.

317 ESTABLISHING GRADES FOR PAVEMENT

See Supplemental Specification #105

320 FINAL CENTERLINE ALIGNMENT

The survey crew may be required to run centerline on the final course, when it is requested. Blank nails (not flagged) will be used on centerline every 50 ft (20 m). A small spot of paint should be made directly in front of each nail for a guide to stripe paint the centerline. The station may be painted in the road in small figures every 500 ft (150 m). There will be no other painting of stations.

322 DEVIATIONS FROM ESTABLISHED PROCEDURES OR POLICIES

Whenever there is any deviation in layout work covered by specific instructions previously issued by this office that is requested by the Contract Administrator or his representative, it is imperative that the Crew Chief appropriately document the procedure followed, indicating all deviations and under whose instructions such deviations were made. Also, within twenty-four [24] hours, the Crew Chief shall contact the Area Survey Supervisor, or the Survey Office to discuss the deviations and to receive further instructions.

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NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION VEHICLE ACCIDENT CAUSE AND PREVENTION REPORT

VEH: REG. # _____

DATE OF ACCIDENT _____
DISTRICT/BUREAU _____

1. To be completed by immediate supervisor:

EMPLOYEES NAME _____	INJURED	HOSPITALIZED
Was seat belt used? YES _____ NO _____	VEH. 1: _____	_____

OTHERS DRIVERS NAME _____ VEH. 2: _____

LOCATION OF ACCIDENT _____

DESCRIPTION _____

(State Vehicle should be referred to as Vehicle # 1)

2. To be completed by District Engineer/Bureau Administrator

ACCIDENT CLASSIFICATION

() (Preventable) Our driver failed
to do everything reasonable to
prevent the accident() (Non – preventable) Our driver did
everything reasonably possible to
prevent the accident

WHAT DID OUR DRIVER (DO, NOT DO) TO PREVENT THE ACCIDENT? _____

ACTION RECOMMENDED _____

DATE LAST ATTENDED DEFENSIVE DRIVING CLASS _____

DATE: _____

SIGNED: _____
(DISTRICT ENGINEER/BUREAU ADMINISTRATOR)

3. Driver's acknowledgement: I have read this report and (concur) (non-concur) with the above statements and comments. (explain non-concurrence on reverse side)

DRIVER'S SIGNATURE _____

4. To be completed by Bureau of Mechanical Services:

Est. damage to state vehicle #1 \$ _____ Est. damage to other Veh. \$ _____

Est. damage to state vehicle #2 \$ _____ Est. damage to property \$ _____

5. REVIEWED BY DEPT. ACCIDENT REVIEW BOARD: DATE _____ CHAIRMEN _____

ACTION RECOMMENDED _____

*Without DESCRIPTION OF ACCIDENT, ESTIMATE OF REPAIR, or OPERATOR'S SIGNATURE, report will NOT be accepted.

SECTION D

YOUR VEHICLE				OTHER VEHICLE				BICYCLIST	
DRIVER LICENSE NO. STATE CLASSIFICATION				DRIVER LICENSE NO. STATE CLASSIFICATION				PEDESTRIAN	
DRIVER'S NAME LAST, FIRST, MIDDLE				DRIVER'S NAME LAST, FIRST, MIDDLE					
D.O.B.			SEX	D.O.B.			SEX		
CURRENT ADDRESS, NUMBER AND STREET			PHONE NO.	CURRENT ADDRESS, NUMBER AND STREET			PHONE NO.		
CITY/TOWN		STATE	ZIP CODE	CITY/TOWN		STATE	ZIP CODE		
PLATE NO.	STATE	TRAILER PLATE NO.	STATE	PLATE NO.	STATE	TRAILER PLATE NO.	STATE		
SAME AS DRIVER <input type="checkbox"/>	OWNER NAME LAST, FIRST, MIDDLE			SAME AS DRIVER <input type="checkbox"/>	OWNER NAME LAST, FIRST, MIDDLE				
CURRENT ADDRESS, NUMBER AND STREET			PHONE NO.	CURRENT ADDRESS, NUMBER AND STREET			PHONE NO.		
CITY/TOWN		STATE	ZIP CODE	CITY/TOWN		STATE	ZIP CODE		
MAKE		YEAR	COMMERCIAL VEHICLE ACCIDENT <input type="checkbox"/>	MAKE		YEAR	COMMERCIAL VEHICLE ACCIDENT <input type="checkbox"/>		
V.I.N.				V.I.N.					
VEHICLE <input type="checkbox"/>	BY	TO		VEHICLE <input type="checkbox"/>	BY	TO			
DESCRIBE DAMAGE TO VEHICLE				DESCRIBE DAMAGE TO VEHICLE					
*ESTIMATED COST TO REPAIR				*ESTIMATED COST TO REPAIR					

SECTION E

YOUR INSURANCE CO.		ESTIMATED PROPERTY DAMAGE (OTHER THAN VEHICLE)	
AGENT		IDENTIFY DAMAGED PROPERTY OTHER THAN VEHICLE(S)	
ADDRESS			
POLICY NUMBER	EFFECTIVE DATE		

SECTION F

ACCIDENT DIAGRAM

Check one of the diagrams if it adequately describes the accident, OR draw your own diagram on a separate sheet and attach. Number the vehicles, with your vehicle being No. 1.

 1	 2	 3	 4	 5	 6	 7	 8
-------	-------	-------	-------	-------	-------	-------	-------

* DESCRIBE THE ACCIDENT

* OPERATOR'S SIGNATURE

DATE OF REPORT

DAY MON YEAR

VEHICLE TYPE 1. Automobile 2. Pick-Up/Light Truck 3. Panel/Van 8. Motorcycle 9. Moped 10. Motor Home 11. Passenger Light Van 12. Utility Vehicle (4X4) 13. Other/Unknown Light Truck 97. Motor Carrier 98. Other **			YOUR Vehicle Other Vehicle	16 17 18 19		
VEHICLE DIRECTION 1. North 2. East 3. South 4. West 99. Unknown			YOUR Vehicle Other Vehicle	20 21		
PRE-ACCIDENT ACTION <table style="width:100%;"> <tr> <td style="vertical-align: top;"> VEHICLE: (Box 20 and/or 21) 1. Following Roadway 2. Right Turn on Red 3. Making Right Turn 4. Making Left Turn 5. Making U-Turn 6. Starting From Parked 7. Starting in Traffic 8. Slowing or Stopping 9. Stopped in Traffic 10. Entering Park Position 11. Parked Properly 12. Parked and Rolled 13. Changing Lanes/Merging 14. Overtaking/Passing 15. Passing on Right 16. Backing 17. Parked Improperly </td> <td style="vertical-align: top;"> 18. Avoid Something in Road 19. Wrong Way on a 1-Way 97. OTHER Action in Road (Box 21 only) 41. Crossing with Signal 42. Crossing against Signal 43. Crossing at Crosswalk No Signal 44. Crossing No Signal/Crosswalk 45. Walk/Ride with Traffic 46. Walk/Ride against Traffic 47. Emerge from Front/Rear of Parked Vehicle 48. Get On/Off School Bus 49. Get On/Off Vehicle 50. Pushing/Working on Vehicle 51. Playing/Jogging 52. Standing/Walking 98. OTHER Pedestrian/Bicyclist Action </td> </tr> </table>					VEHICLE: (Box 20 and/or 21) 1. Following Roadway 2. Right Turn on Red 3. Making Right Turn 4. Making Left Turn 5. Making U-Turn 6. Starting From Parked 7. Starting in Traffic 8. Slowing or Stopping 9. Stopped in Traffic 10. Entering Park Position 11. Parked Properly 12. Parked and Rolled 13. Changing Lanes/Merging 14. Overtaking/Passing 15. Passing on Right 16. Backing 17. Parked Improperly	18. Avoid Something in Road 19. Wrong Way on a 1-Way 97. OTHER Action in Road (Box 21 only) 41. Crossing with Signal 42. Crossing against Signal 43. Crossing at Crosswalk No Signal 44. Crossing No Signal/Crosswalk 45. Walk/Ride with Traffic 46. Walk/Ride against Traffic 47. Emerge from Front/Rear of Parked Vehicle 48. Get On/Off School Bus 49. Get On/Off Vehicle 50. Pushing/Working on Vehicle 51. Playing/Jogging 52. Standing/Walking 98. OTHER Pedestrian/Bicyclist Action
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THE STATE OF NEW HAMPSHIRE
DEPARTMENT OF LABOR
SPAULDING BUILDING
95 PLEASANT STREET
CONCORD, NEW HAMPSHIRE

NOTICE OF ACCIDENTAL INJURY OR OCCUPATIONAL DISEASE 8aWCA
(Please print or type)

To _____ Phone # _____
(Name of **Employer**)

(Business Name and Address)

IN ACCORDANCE WITH RSA 281-A:20, This is to notify you that an injury occurred.

(Name of Injured **Employee**) SS # _____

(Address of Injured Employee) Daytime Phone # _____

(Date of Accident or First Treatment)

(Place Accident Happened)

Describe your injury or disease, and how it happened. Identify the body part(s) affected. _____

I have been unable to work since my injury. _____
Yes No

I have incurred the following medical bills.	_____	_____	_____
	Name of Doctor	Dates of Service	Amount
	_____	_____	_____
	Name of Hospital	Dates of Service	Amount
	_____	_____	_____
	Other	Dates of Service	Amount
	_____	_____	_____

_____	_____
(Employer's Signature)	(Employee's Signature)

_____	_____
(Date)	(Date)

This form can be returned to DOL with or without employer's signature.

NOTICE TO EMPLOYER

YOU MUST FILE AN EMPLOYER'S FIRST REPORT, Form No. 8WC, WITH THE LABOR COMMISSIONER AND THE NEAREST CLAIMS OFFICE OF YOUR INSURANCE CARRIER, AS SOON AS POSSIBLE AFTER ACQUIRING KNOWLEDGE OF THE OCCURRENCE OF AN OCCUPATIONAL INJURY OR DISEASE TO ONE OF YOUR EMPLOYEES OR UPON PRESENTATION OF THIS NOTICE BY HIM, BUT NO LATER THAN FIVE DAYS THEREAFTER. FAILURE TO COMPLY CARRIES AN AUTOMATIC CIVIL PENALTY OF UP TO \$2500. (RSA 281-A:53)

NH Department of Transportation**Accident Investigation Report**

*Reports are to be completed within 24 hours of notice of injury, by the
IMMEDIATE SUPERVISOR
and submitted to Human Resources within 3 working days of notice.*

PLEASE PRINT

WHO Employee _____ Job title _____
Bureau/District _____

WHEN Date and Time of Accident/Incident _____
Date and Time Reported to Supervisor _____
Witness(s) Name _____ Pictures taken? _____

INJURY Description of Injuries _____

Medical attention required: _____ Hospital _____ MD Office visit
_____ First Aid only _____ Crew administered _____ Self-administered _____ Other

FOR DOCUMENTATION PURPOSES ONLY ☐ Yes ☐ No

WHERE Exact location where accident/incident occurred _____

WHAT Type of accident/incident (See reverse side) _____
Description of accident: detail what employee was doing and how _____

EQUIPMENT What physical objects, tools, machines, structures or equipment were involved? _____

WHY Identify all causes which contributed to the accident/incident (May be more than one) _____

PPE Type of personal protective equipment (PPE) worn at time of accident/incident
_____ Traffic vest _____ Safety glasses _____ Work gloves _____ Hard hat _____ Ear protection
_____ Safety boots _____ Seatbelt _____ Other (Describe) _____

PREVENTION What action could be done and by whom to prevent reoccurrence of this type of accident/incident?

What corrective measures have been or will be implemented? _____

BUREAU ADMINISTRATOR/DISTRICT ENGINEER'S RECOMMENDATIONS

☐ Unsafe Act ☐ Unsafe Condition(s) ☐ Other factors (please explain in detail) _____

SIGNATURES

Supervisor's Signature _____ Date _____

Safety Coordinator's Signature (whenever available) _____ Date _____

Employee Signature (whenever available) _____ Date _____

Bureau Administrator/District Engineer Signature _____ Date _____

TYPE OF ACCIDENT

- | | | | |
|---|--|----|---|
| 1 | Fall from elevation | 8 | Resulting from motor vehicle accident (report attached) |
| 2 | Slip, trip, mis-step | 9 | Cuts, abrasions, contusions, punctures |
| 3 | Struck by | 10 | Repetitive motion |
| 4 | Caught in, under, or between | 11 | Other (describe) _____ |
| 5 | Overexertion | 12 | Dermatitis (poison ivy, rashes) |
| | a. push, pull | 13 | Foreign body in eye or skin |
| | b. lift, lower | 14 | Hearing loss |
| | c. carry, hold | 15 | Insect/animal bite |
| | d. twist, turn | 16 | Environmental (sunburn, heat exhaustion, frost bite) |
| | e. bend | | |
| 6 | Electrical contact | | |
| 7 | Chemical exposure or contact (oil, fluids, carbon monoxide, etc) | | |

FOR UNIT SAFETY COMMITTEE ONLY**ACCIDENT CAUSE ANALYSIS**

☐ Unsafe Act ☐ Unsafe Condition(s) ☐ Other factors (please explain in detail) _____

UNIT SAFETY COMMITTEE COMMENTS

NOTE: From the report, the committee should write a short concise statement regarding the suggested corrective actions to prevent reoccurrence.

Signature of witness

WORK CLASS CODES

The following Survey Work Class Codes will be used on Time and Expense Reports:

- 100 FIELD SURVEY – Roadway, Bridge, and Accident Surveys.
- 101 FIELD SURVEY – Env. Including wetlands, mitigation, and archeology.
- 102 FIELD SURVEY – Photo Id Control.
- 103 FIELD SURVEY – Geodetic Control.
- 104 OFFICE SURVEY – Scheduling, coordination, project data reduction.
- 105 OFFICE SURVEY – Geodetic and photogrametric comps.
- 253 FIELD SURVEY - All Engineering Survey and Property Survey in support of a Construction Project that occurs on or after the date that the project is advertised for bids. This work includes original survey of gravel areas, crushed gravel stockpiles, classified and unclassified material and uncovered ledge.
- 254 OFFICE SURVEY
- 885 HOLIDAY
- 888 LEAVE – Bonus (Regular and Fiscal Year), Floating Holiday, Annual, Sick, Compensatory Time, Jury Duty, and Military.
- 889 SHUTDOWN
- 904 TRAINING
- 905 PERSONNEL ADMIN. – Interview Committee, Evaluations, Personnel Hearing, etc.
- 911 CARE OF EQUIPMENT - Non-Project Charge - Training, inclement weather, and meetings. Due to inclement weather, unable to perform survey work on project, sharpening tools, cleaning and adjusting instruments. When using this charge check with your supervisor before entering it onto your timesheet.

(Bureau or District) _____
(Location) _____
(Date)

To _____

I do solemnly swear or affirm the property listed on the reverse side of this report charged to _____ has been lost, stolen, destroyed, or damaged, in the manner stated in "Explanation " column.

Title

Date _____

that All the available evidence and testimony have been examined, and it is believed

And it is recommended that

Signature _____ Title _____

Date _____

Approved for _____

Signature _____ Title _____

DESCRIPTION OF PROPERTY

ASSIGNED
CONTROL
NUMBER

DESCRIPTION
OF EQUIPMENT

MAKE

MODEL

SERIAL
NUMBER

EXPLANATION

GENERAL USE:

Bench mark, Survey disk
 Boring, Test Pit
 Level string
 Elevation Point Survey
 Elevation Point Survey - Not at Ground

String Label:

PBMK
 PBOR
 L
 PELV
 PEVV

BOUNDARIES:

Bound
 Drill hole
 Iron pin or pipe
 Project marker
 State line marker
 Town line marker

String Label:

PBND
 PDHL
 PIPN
 PRJM
 PSLM
 PTLM

ROADWAY FEATURES:

Center of road
 Edge of Gravel Road
 Edge of traveled way
 Edge of pavement
 Lane markings
 Driveway
 Trail
 Curb - Left
 Curb - Right
 Curb - Top
 Beam guard rail - Left
 Beam guard rail - Right
 Cable guard rail - Left
 Cable guard rail - Right
 Double face beam guard rail
 Jersey barrier
 Ditch line
 Bottom of slope
 Top of slope

String Label:

CO
 EG
 TW
 EP
 LM
 DR
 TL
 CL
 CR
 TC
 BL
 BR
 GL
 GR
 DF
 JB
 DL
 BS
 TS

BRIDGE FEATURES:

Arch - Bottom
 Bridge deck
 Bridge abutment - Top
 Bridge abutment - Bottom
 Expansion joint
 Exposed bridge footing - Top
 Exposed bridge footing - Bottom
 Pier - Top
 Pier - Bottom
 Wing wall - Top
 Wing wall - Bottom
 Rip-rap

String Label:

BK
 BG
 TB
 BB
 EJ
 TF
 BF
 TP
 BJ
 WT
 WB
 RP

Bridge spot elevations
 Bridge miscellaneous detail features - point string

PEBV
 PMBF

RAILROAD FEATURES:

Railroad
 Railroad sign
 Railroad signal
 Railroad switchstand

String Label:

RR
 PRSN
 PRSL
 PRSW

STRUCTURES:

Catch basin top
 Catch basin/Drop inlet sump
 Concrete Pad (gas station island; etc.)
 Dam
 Dam - bottom
 Drainage pipe (Survey: use IGL for dir. shots)
 Drop inlet top
 Fence - Barbed wire
 Fence Other
 Flushing Basin
 Foundation/Ruin
 Ground at/near building
 Retaining wall - Left ---^---^---
 Retaining wall - Right ---v---v---
 Retaining wall - Top
 Sidewalk / Patio
 Sill Point
 Sound Wall
 Steps

String Label:

PCBD
 PSUM
 CP
 DM
 DB
 DP
 PDID
 FB
 FO
 PFLS
 FD
 BE
 RL
 RW
 TR
 SK
 PSIL
 SA
 SP

UTILITIES:

Fire hydrant
 Fuel Tank
 Gas Pump
 Gas pumps
 Gas shutoff
 Guy pole or stub
 Guy wire anchors
 Headwall, culvert end - Bottom
 Headwall - Top
 Intelligent Transportation Systems
 Joint power and telephone pole
 Junction box
 Light on joint pole
 Light on power pole
 Light pole
 Manhole - Drainage
 Manhole - Electric
 Manhole - Gas

String Label:

PHYD
 PFTK
 PGAS
 GP
 PGSO
 PGUY
 PANC
 BH
 TH
 IT
 PJNT
 PJCT
 PLTJ
 PLTP
 PLIT
 PMHD
 PMHE
 PMHG

Manhole - Sewer	PMHS
Manhole - Telephone	PMHT
Manhole - Water	PMHW
Pole	PPOL
Power pole	PPWR
Sluiceway	SU
Storage tanks	SG
Storage tank fill cap	PSTT
Public telephone	PBTH
Telephone/telegraph pole	PTEL
Tower - all types	PPTR
Transmission line/Aerial electric lines	AE
Underground Cable TV	UC
Underground Electric	UE
Underground Fiber Optics	UP
Underground Fire Alarm	UF
Underground Gas	UG
Underground Sewer	US
Underground Telephone	UT
Underground Water	UW
Water gate	PWGT
Water shutoff	PWSO

SIGNING/SIGNALS:

	<u>String Label:</u>
Controller cabinet	PCCT
Handhole	PHHL
Loop detector	SD
Magnetic detector sleeve	DS
Mast arm pole	PMAP
Meter Pedestal	PMTR
Pedestrian Signal Pole	PWLK
Pullbox	PPBX
Sign - Single post	PSGN
Sign - Double post	PSND
Sign - Billboard or other large sign (string feature)	SN
Signal conduit	SC
Street light conduit	LC
Traffic signal without mast arm	PSGL

OTHER GROUND FEATURES:

	<u>String Label:</u>
Athletic Field	AF
Berm	BM
Boulder	PBDR
Bush	PBUS
Cemetery	CM
Gate	GA
Ground light/yard light	PGLT
Flag pole	PFPL
Gravestone	PGRV
Hedge	HE

High water mark	HW
Intermittent or small stream	ST
Lamp post/private light pole	PLPT
Leachfield	LF
Mail box	PMBX
Miscellaneous detail features - Point string	PMDF
Miscellaneous detail features - Not at Ground	PMVF
Miscellaneous detail features - Feature string	FM
Monuments/statues or other related items	PMON
Ornamental features (flower beds; etc.)	OR
Parking Meter	PARK
Pool	QP
Post - all types	PPST
Ramp - Boat; etc.	RM
Ridge line	RD
Rock outcrop Left	RO
Rock outcrop Right	RK
Satellite dish	PDAT
Septic Tank	PSTK
Shore line - Left	SL
Shore line - Right	SR
Stockpile	SO
Stone wall	SW
Stump	PSTP
Swamp/marsh or wet area	WA
Swamp symbol	PSWP
Top of slope	TS
Tree - Coniferous	PTCS
Tree - Deciduous	PTDS
Vent pipe - Outlet	PVNT
Waterfall	WF
Well	PWEL
Woods line or brush line - Left	WL
Woods line or brush line - Right	WR

ENVIRONMENT:

Invasive Species

Monitoring Well

HOTL

MHT

OHT

OHW

Prime Wetland

Special Aquatic Site

TBZ

TOB

TOBOHW

Vernal Pool

Wetland Delineated

String Label:

VA

PMWL

VT

VM

VK

VH

VR

VS

VZ

VB

VO

VP

WD

PIT SURVEYS: (Construction/Audit Items)	<u>String Label:</u>
Bottom of slope	BS
Level string	L
Limit of pit	LP
Limit of work	LW
Old ground	OG
Stockpile	SO
Top of slope	TS
Waste	WS

MASKING LIST:(NOT USED FOR CONTOURS)

PJCT	PIPN
PBDR	PCON
PMAP	PBND
PSGL	BG
PSTT	WD
PBMK	HW
PRJM	GA
PMON	**B
PGRV	PMDF
PBOR	PGAS
PDHL	PFTK
PWEL	FMV
PMWL	PEVV
PPST	PLIT
PCCT	PSIL
PPBX	JB
SP	PSLM
RR	PARK
U*	PTLM
PSSA	BP
PSDR	DS
DP	AE
PSUM	BY
PMH	PRSL
PHYD	PVNT
PGSO	BK
PWSO	PSTK
PWGT	PMTR
PSTP	

* = wild card

TOTAL STATION BASELINE OBSERVATIONS		
BASELINE:		DATE:
CREW:	INSTRUMENT TYPE: SERIAL NUMBER:	
INSTRUMENT STATION:	MIRROR STATION:	
TIME	OBSERVED HORIZONTAL DISTANCE with chart ppm & standards offset dialed in	
ATMOSPHERIC "STATION" PRESSURE NOT SEA LEVEL	1	6
	2	7
TEMPERATURE " F "	3	8
	4	9
PPM FROM CHART	5	10
INSTRUMENT HEIGHT	MEAN OBSERVED DISTANCE = AVG. OF 10 SHOTS PUBLISHED DISTANCE = FROM B/L SHEET DIFFERENCE = MUST BE LESS THAN 5 MM OR 0.017 FT.	
MIRROR HEIGHT		
INSTRUMENT STATION:	MIRROR STATION:	
TIME	OBSERVED HORIZONTAL DISTANCE with chart ppm & standards offset dialed in	
ATMOSPHERIC PRESSURE	1	6
	2	7
TEMPERATURE	3	8
	4	9
PPM FROM CHART	5	10
INSTRUMENT HEIGHT	MEAN OBSERVED DISTANCE = PUBLISHED DISTANCE = DIFFERENCE =	
MIRROR HEIGHT		

TOTAL STATION BASELINE OBSERVATIONS		
BASELINE:		DATE:
CREW:	INSTRUMENT TYPE: SERIAL NUMBER:	
INSTRUMENT STATION:	MIRROR STATION:	
TIME	OBSERVED HORIZONTAL DISTANCE with chart ppm & standards offset dialed in	
ATMOSPHERIC "STATION" PRESSURE NOT SEA LEVEL	1	6
	2	7
TEMPERATURE " F "	3	8
	4	9
PPM FROM CHART	5	10
INSTRUMENT HEIGHT	MEAN OBSERVED DISTANCE = AVG. OF 10 SHOTS PUBLISHED DISTANCE = FROM B/L SHEET DIFFERENCE = MUST BE LESS THAN 5 MM OR 0.017 FT.	
MIRROR HEIGHT		
INSTRUMENT STATION:	MIRROR STATION:	
TIME	OBSERVED HORIZONTAL DISTANCE with chart ppm & standards offset dialed in	
ATMOSPHERIC PRESSURE	1	6
	2	7
TEMPERATURE	3	8
	4	9
PPM FROM CHART	5	10
INSTRUMENT HEIGHT	MEAN OBSERVED DISTANCE = PUBLISHED DISTANCE = DIFFERENCE =	
MIRROR HEIGHT		

TOTAL STATION BASELINE OBSERVATIONS		
BASELINE:		DATE:
CREW:	INSTRUMENT TYPE: SERIAL NUMBER:	
INSTRUMENT STATION:	MIRROR STATION:	
TIME	OBSERVED HORIZONTAL DISTANCE with chart ppm & standards offset dialed in	
ATMOSPHERIC "STATION" PRESSURE NOT SEA LEVEL	1	6
	2	7
TEMPERATURE " F "	3	8
	4	9
PPM FROM CHART	5	10
INSTRUMENT HEIGHT	MEAN OBSERVED DISTANCE = AVG. OF 10 SHOTS PUBLISHED DISTANCE = FROM B/L SHEET DIFFERENCE = MUST BE LESS THAN 5 MM OR 0.017 FT.	
MIRROR HEIGHT		
INSTRUMENT STATION:	MIRROR STATION:	
TIME	OBSERVED HORIZONTAL DISTANCE with chart ppm & standards offset dialed in	
ATMOSPHERIC PRESSURE	1	6
	2	7
TEMPERATURE	3	8
	4	9
PPM FROM CHART	5	10
INSTRUMENT HEIGHT	MEAN OBSERVED DISTANCE = PUBLISHED DISTANCE = DIFFERENCE =	
MIRROR HEIGHT		

TOTAL STATION BASELINE OBSERVATIONS		
BASELINE:		DATE:
CREW:	INSTRUMENT TYPE: SERIAL NUMBER:	
INSTRUMENT STATION:	MIRROR STATION:	
TIME	OBSERVED HORIZONTAL DISTANCE with chart ppm & standards offset dialed in	
ATMOSPHERIC "STATION" PRESSURE NOT SEA LEVEL	1	6
	2	7
TEMPERATURE " F "	3	8
	4	9
PPM FROM CHART	5	10
INSTRUMENT HEIGHT	MEAN OBSERVED DISTANCE = AVG. OF 10 SHOTS PUBLISHED DISTANCE = FROM B/L SHEET DIFFERENCE = MUST BE LESS THAN 5 MM OR 0.017 FT.	
MIRROR HEIGHT		
INSTRUMENT STATION:	MIRROR STATION:	
TIME	OBSERVED HORIZONTAL DISTANCE with chart ppm & standards offset dialed in	
ATMOSPHERIC PRESSURE	1	6
	2	7
TEMPERATURE	3	8
	4	9
PPM FROM CHART	5	10
INSTRUMENT HEIGHT	MEAN OBSERVED DISTANCE = PUBLISHED DISTANCE = DIFFERENCE =	
MIRROR HEIGHT		

SDR FILE LOG

PROJECT NAME: _____

PROJECT NUMBER: _____

SURVEY REQUESTED BY: _____

DESCRIPTION: _____

FILE NAME: _____

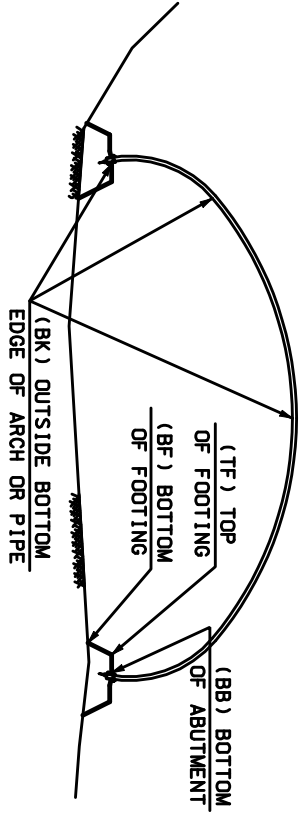
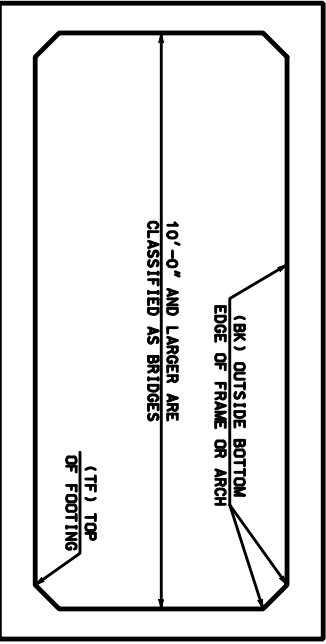
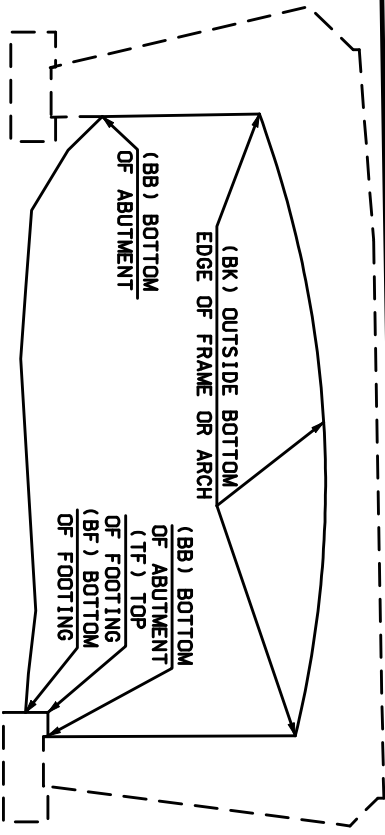
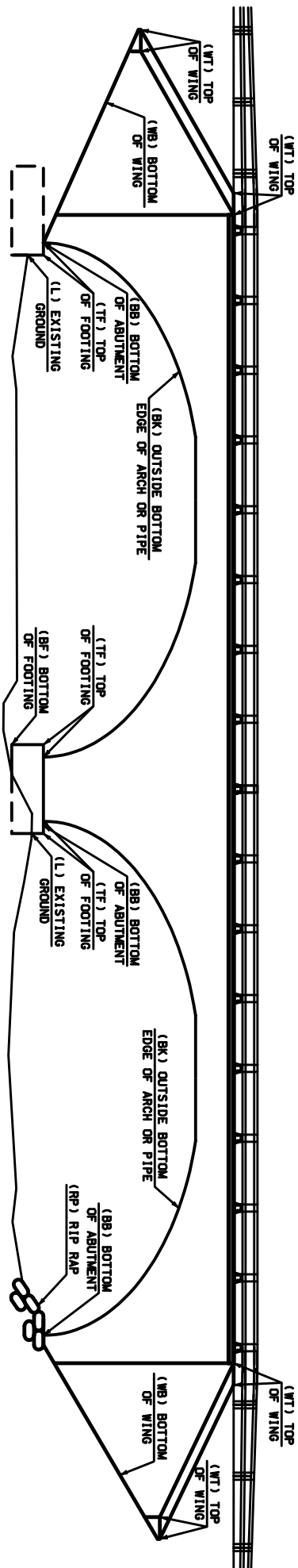
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SURVEY CREW: _____

TRAVERSE REFERENCED: _____

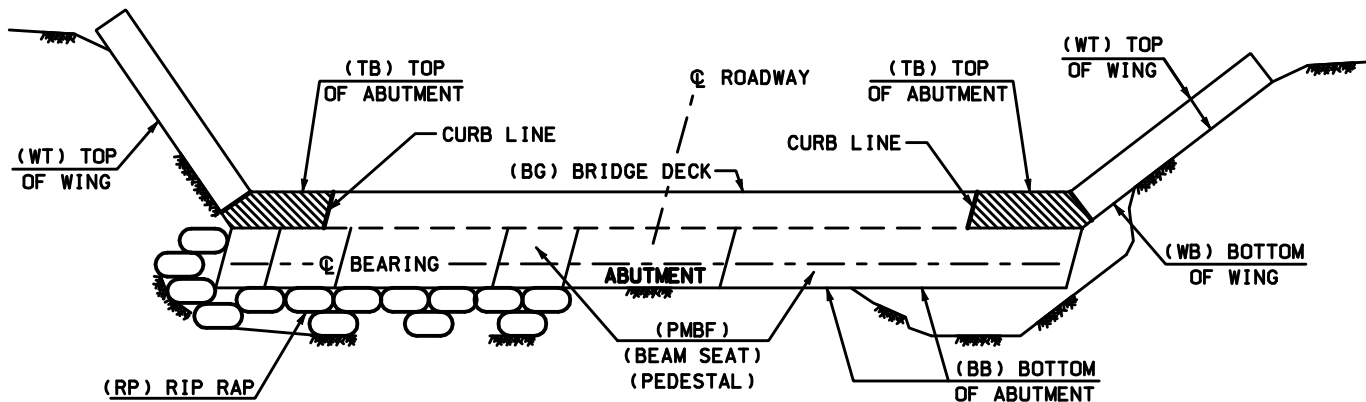
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COMMENTS: _____

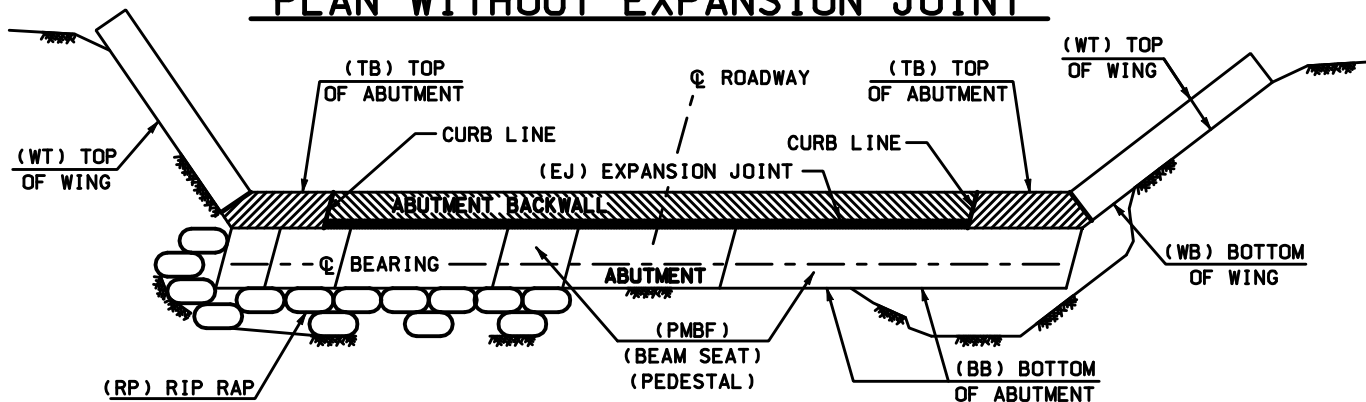


DGN. NAME
SAVED VIEW
DIRECTORY

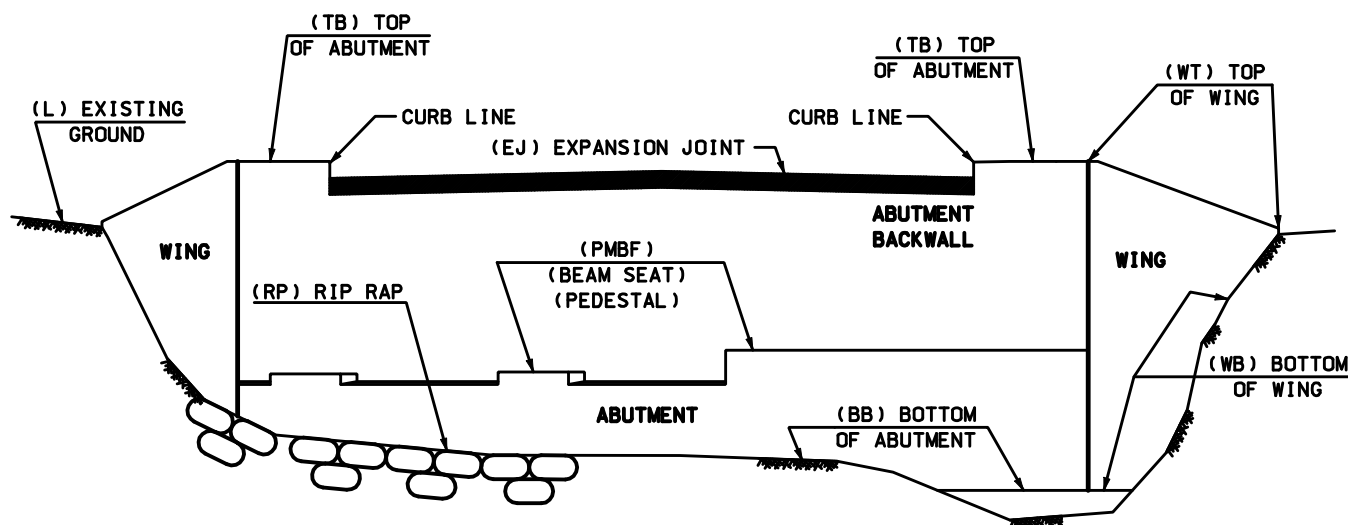
STATE OF NEW HAMPSHIRE			
DEPARTMENT OF TRANSPORTATION - BUREAU BRIDGE DESIGN			
FEDERAL PROJECT NO.	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS



PLAN WITHOUT EXPANSION JOINT



PLAN WITH EXPANSION JOINT



ELEVATION

DGN. NAME

SAVED VIEW

DIRECTORY



STATE OF NEW HAMPSHIRE

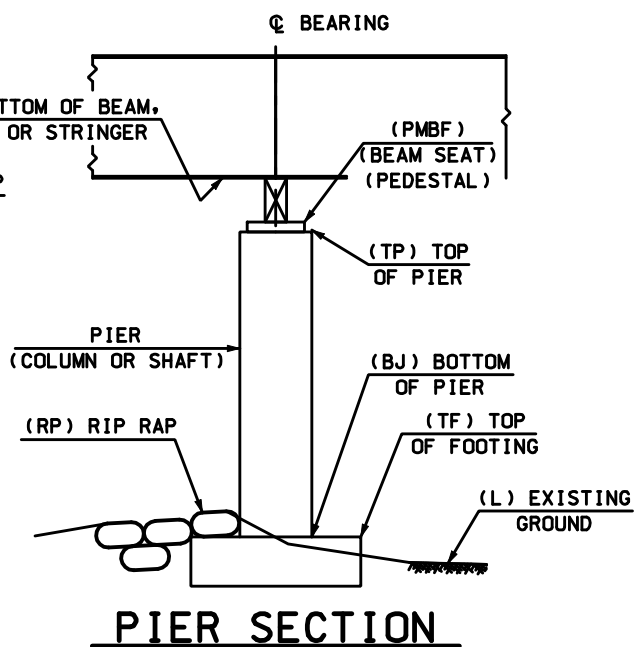
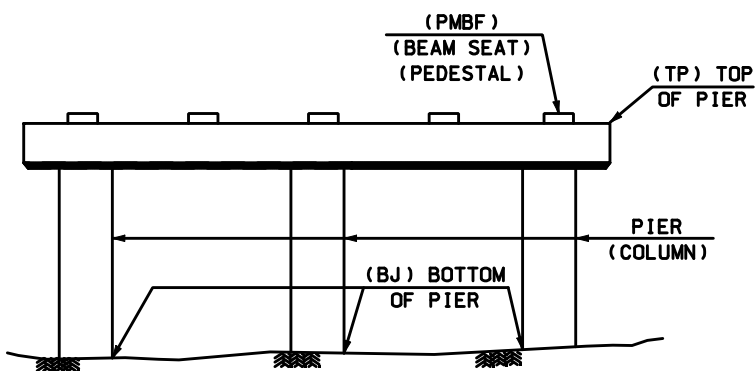
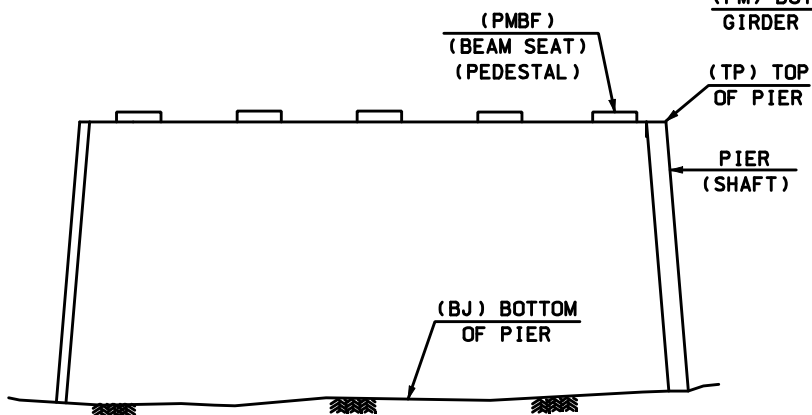
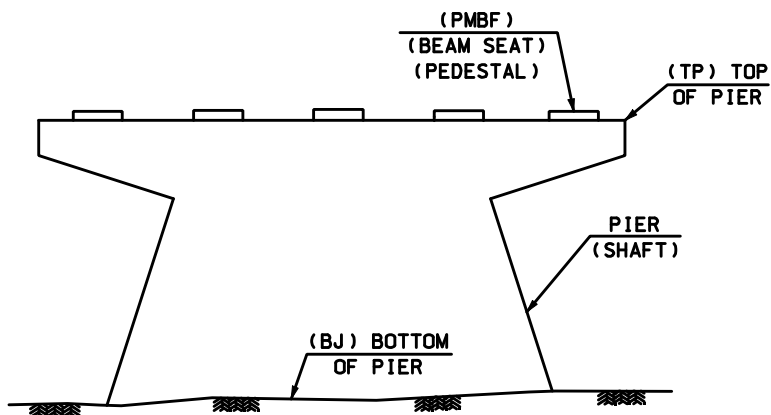
DEPARTMENT OF TRANSPORTATION - BUREAU BRIDGE DESIGN

FEDERAL PROJECT NO.

STATE PROJECT NO.

SHEET NO.

TOTAL SHEETS



DGN. NAME

SAVED VIEW

DIRECTORY



STATE OF NEW HAMPSHIRE

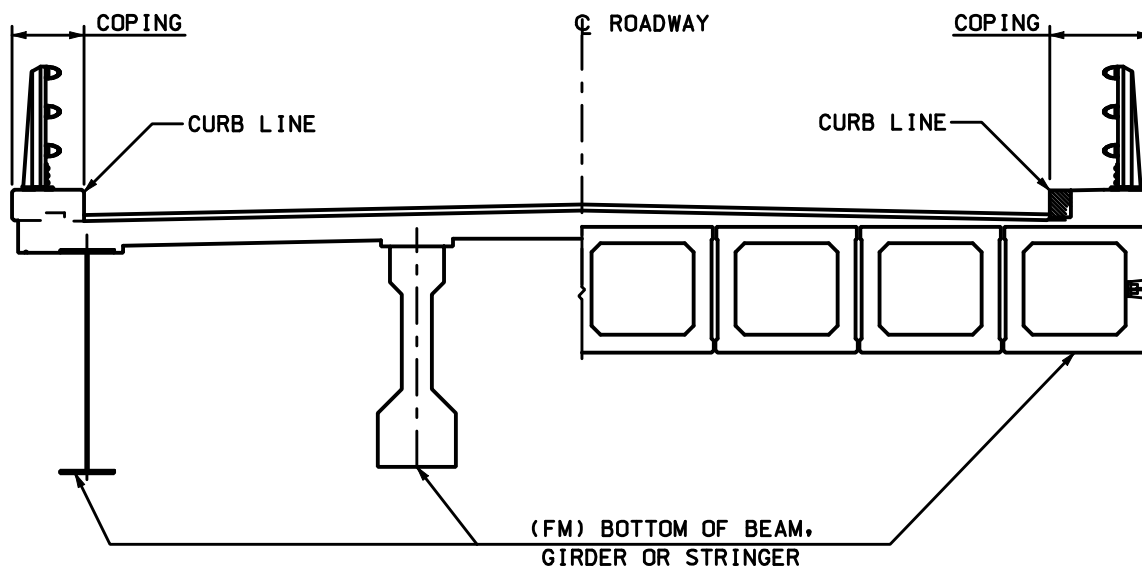
DEPARTMENT OF TRANSPORTATION - BUREAU BRIDGE DESIGN

FEDERAL PROJECT NO.

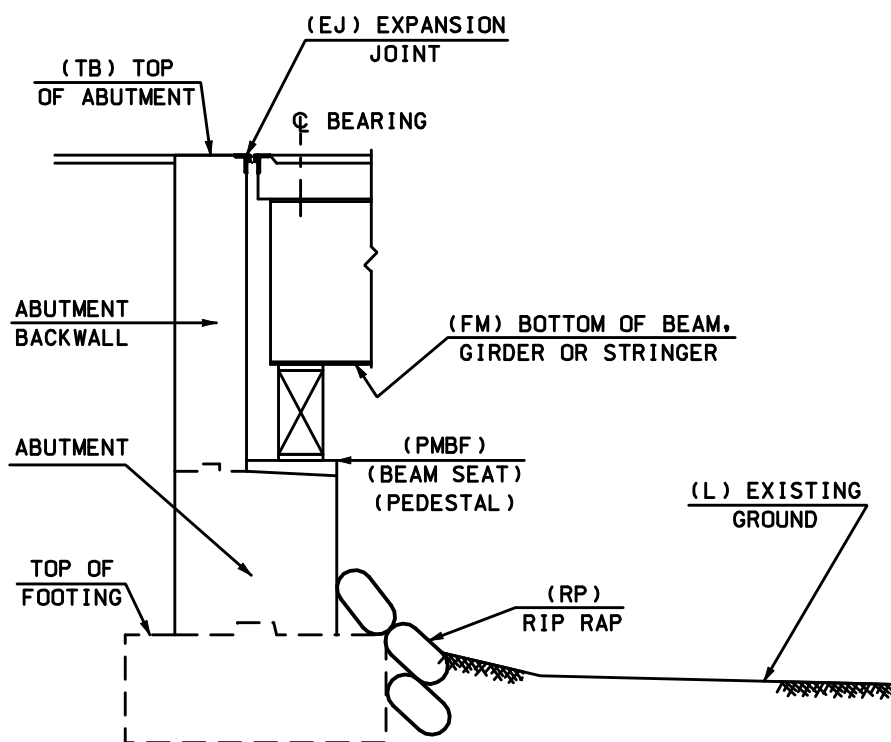
STATE PROJECT NO.

SHEET NO.

TOTAL SHEETS



DECK SECTION



ABUTMENT SECTION

DGN. NAME

SAVED VIEW

DIRECTORY



STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION - BUREAU BRIDGE DESIGN

FEDERAL PROJECT NO.

STATE PROJECT NO.

SHEET NO.

TOTAL SHEETS

TOWN NAME
PROJECT NO.

WHITE ∇
GREEN \square
RED \emptyset

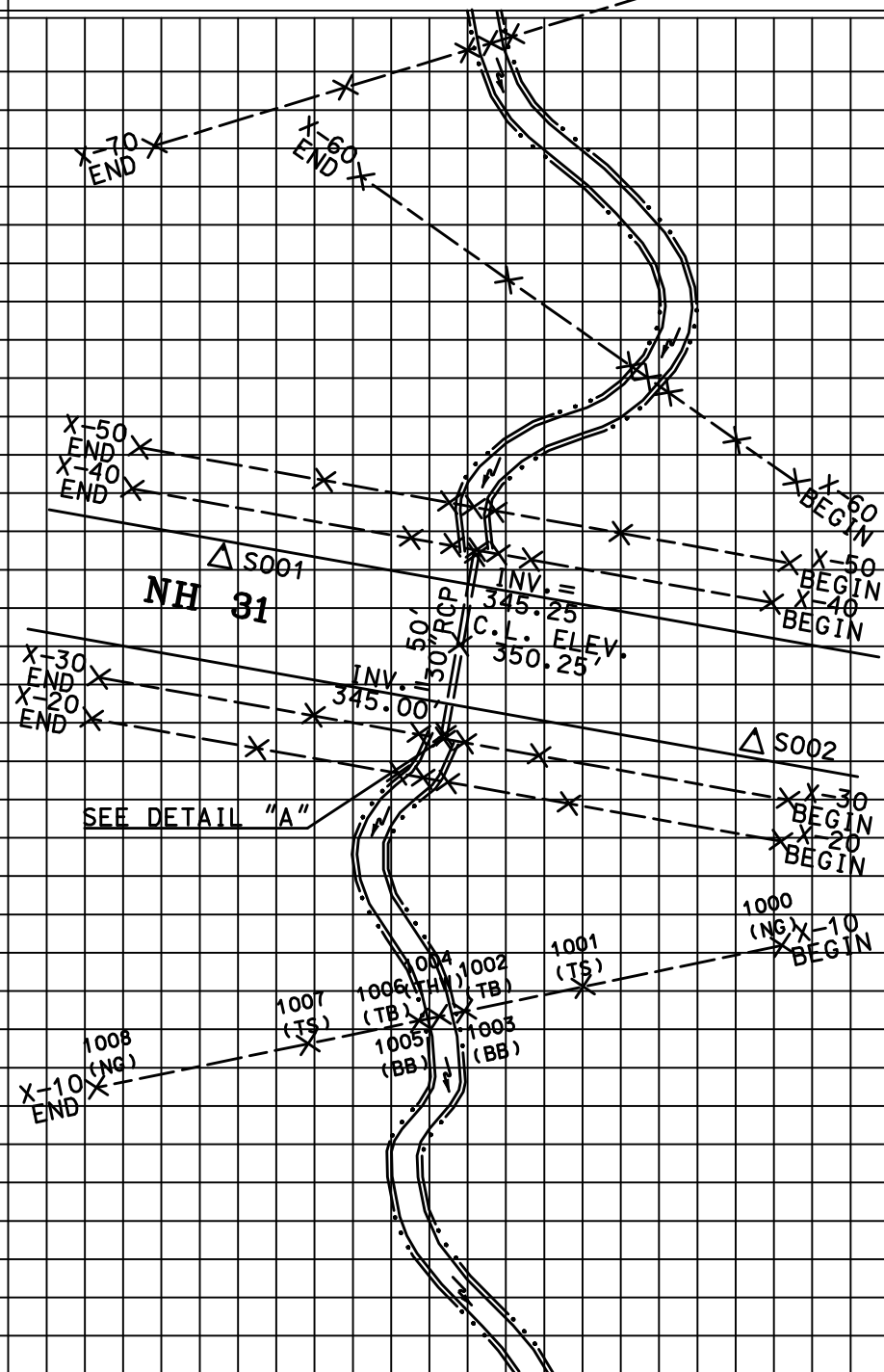
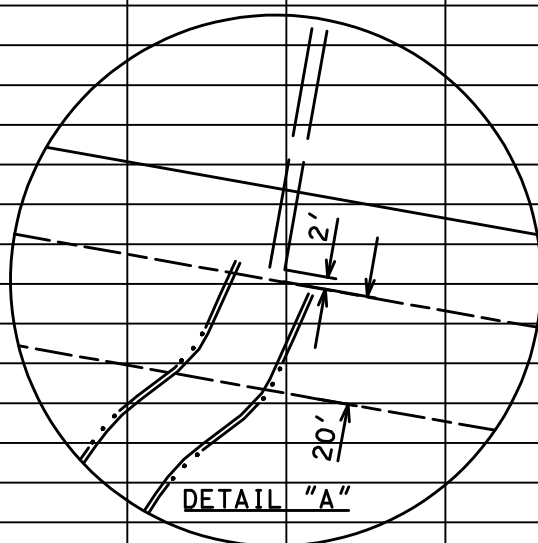
DEC. 18, 2009

∇ @ 5002		BS @ 5001
H.I. = 5.25'		H.I. = 5.00'
SHOT *	CODE	DESCRIPTION
X - 10 BEGIN		
1000 - 1008	PELV	NG, TS, TB, BB, THW, BB, TB, TS, NG
X - 10 END		

*PUT NOTES IN BOOK
& COLLECTOR*

ABBREVIATIONS

NORMAL GROUND = NG
TOP OF SLOPE = TS
TOP OF BANK = TB
BOTTOM OF BANK = BB
THALWEG = THW
ON SLOPE = OS



TYPICAL BORING NOTES - LOOSELEAF

					STA.	O.S.	H.I.	F.S.	ELEV.
CAMPTON - FRANKONIA					B.M.*1822	1.67	801.54		799.87
P-3801					O.H.*1 N.B.			11.4	790.1
					O.H.*2 N.B.			12.7	788.8
BORING ELEVATIONS					O.H.*3 N.B.			10.0	791.5
					O.H.*4 N.B.			9.3	792.2
BRIDGE NO. 200/100 S.B.					O.H.*5 N.B.			7.8	793.7
BRIDGE NO. 201/100 N.B.									
					O.H.*4 S.B.			16.3	785.2
INTERSTATE 93 OVER									
					T.P.*4	4.67	790.79	15.42	786.12
TRIPOLI ROAD									
JAN. 4, 1969									
CLEAR - COLD									
28" SNOW									
BLACK C.P.									
GREEN ∇									
WHITE C.H.									
BLUE \perp									

105.08 Construction Stakes, Lines, and Grades. The Engineer will set stakes and furnish data necessary to establish the line and grade of the finished surface, the lines and grades of all waterways and structures, and such other points and bench marks as are necessary to lay out the Work correctly. This “initial” layout will include control points, bench marks, line ties, and leveled side stakes as required for grade control and reproduction of construction center line. It will also include bridge targets, line ties and reference stakes for bridges, retaining walls, full span overhead sign structures.

The Engineer will take cross sections as required to complete measurement of quantities as provided in 109.01. This work includes reference points, base lines, stakes, bench marks, and cross sections for borrow pits where applicable.

The Engineer will stake and reference all required Rights-of-Way, easement limits and bounds.

The Contractor shall cooperate in the setting and shall be responsible for the preservation of all “initial” layout stakes and marks, and if any of the construction stakes or marks have been carelessly or willfully destroyed or disturbed by the Contractor, the cost of replacing them will be charged against the Contractor and will be deducted from the payment for the work. Damaged or destroyed points, bench marks or stakes or any reference points damaged or made inaccessible by the progress of the construction shall be replaced or transferred by the Contractor, subject to verification by the Engineer. Replacement of all “initial” layout (with the exception of side stakes or drainage reference stakes) shall be performed by or under the direction of a Licensed Land Surveyor.

The Contractor shall perform all necessary layout work not specified above in order to construct all elements of the Project as shown on the Plans and specified in the Contract. This work shall include, but shall not be limited to stakeout necessary for re-establishment of line and grade as earthwork operations progress; stakeout, layout, and elevations as required for structures, forms, pile layouts, and paving. Prior to paving, the Contractor shall perform all work necessary to set the blue top stakes for fine grading.

The Contractor shall perform all required layout work with competent, qualified personnel to meet minimum Third-order, Class I survey accuracy and procedures (Horizontal: 1 in 10,000, Vertical: 2.0 mm (0.05 ft) $\times \sqrt{\text{distance in kilometers (miles)}}$). Any error, apparent discrepancy, or absence of data in the Department's “initial” layout shall be referred to the Engineer in writing for correction or interpretation. The Contractor is solely responsible for the accuracy of the Work. All computations necessary to establish the exact position of the Work from control points, shall be made and preserved by the Contractor. All computations, notes and other records necessary to accomplish the Work shall be neatly made. Such computations, notes and other records shall be made available to the Engineer upon request.

The Engineer may check all or any portion of the layout, stake-out or notes made by the Contractor. Any necessary correction to the Work shall be made immediately by the Contractor. Such checking by the Engineer will not relieve the Contractor of any responsibilities for the accuracy or completeness of the work. Rechecking, by the Engineer, of any portion of the Contractor's layout, stakeout or notes will be charged against the Contractor and will be deducted from the payment for the work.

No claim will be considered because of alleged inaccuracies unless the Contractor notifies the Engineer thereof in writing immediately upon discovery of the alleged

inaccuracies and affords the Engineer opportunity to check or verify the stakes or marks in question.

105.08.1 No work to establish line and grade will be provided by the Department on resurfacing areas.

105.08.2 On recycling or reclamation areas the Department will not establish line and grade. The Contractor shall supply all material and perform all work to determine the existing line and grade and cross-slopes prior to recycling or reclamation work and establish finished line, grade and cross-slopes. Original plans and computed cross-slopes at curves will be provided by the Engineer.

The Contractor shall determine and lay out, with survey instruments, the finished alignment at 20-meter (50-foot) intervals including all horizontal curve points (PC, PI, PT, spiral to curve (SC), spiral to tangent (ST), and POC as required). The Contractor shall lay out and set all grade control necessary to complete the final grading.

STATE OF NEW HAMPSHIRE
INTER-DEPARTMENT COMMUNICATION

DATE: September 9, 1998

FROM: Charles R. Schmidt, II **AT (OFFICE):** Bureau of Highway Design
 Chief of Design Services

SUBJECT: SURVEY SPECIFICATIONS

TO: **All Survey Crew Chiefs**
 and Area Supervisors

MEMORANDUM

After review of the Survey Spec. 105.08. the following guide lines have been agreed upon with the Bureau of Construction and Survey Section. This list will not be all inclusive but should give you guidance in following the Survey Specifications.

A presurvey meeting should be held with the Contractor's survey crew, NHDOT Survey Supervisor, Prime Contractor and Contract Administrator to discuss project survey needs and exchange project survey notes.

I.) State Will Be Responsible For:

1. Layout full span overhead sign structures
2. Layout and x-sections on retaining walls
3. Offset line for presplit when necessary
4. Original and final centerline (or an offset line)
5. Sidestakes w/elevations
6. Establish, as required, all control points in areas of realignment on recycling or reclamation projects
7. Ties to centerline control points
8. Original and final sections and or topo (Moss system) for mitigation sites
9. Original bridge layout and ties
10. Channel and bridge excavation originals and finals (this may be done with topo under Moss system)
11. Bounds location layout
12. Fence line location (will not cut fence line)
13. Final X-sections (when needed)
14. Setting of original bench marks
15. Survey will supply, upon request, a hard copy of all "s" (traverse) points, bridge points, and centerline coordinates

1. Upon request of the Contract Administrator, through the Survey Supervisor, the survey section will perform SPOT-CHECKS on the following:
 - a) Line and grade run by Contractor on subgrade and select materials
 - b) Line and grade checks for bluetops
 - c) All working and reference points for bridge and retaining wall construction

Note: It is critical that you keep track of all times expended in checking and rechecking a Contractor's work.

II.) Contractor's Responsibility:

1. Curb and pavement layout
2. Replace any sidestakes, ties, bench marks, working points, destroyed by contractor
3. Mast arm, pullbox layout and elevations, light poles
4. Sign base layout
5. All bridge layout except for the original layout
6. CB's DI's, MH's, outlets and other elements of drainage systems
7. Any offset of centerline
8. Any line or grade for resurfacing, reclamation, or recycling projects
9. Any elev. needed for construction
10. Line and grade for subgrade, select materials, and bluetops
11. Any and all layout for Contractor's use

CRS/blc

cc: Robert Greer
Gil Rogers
Jesse Dennis
Craig Green
Ed Sargent
Lennart Suther

S:\UTIL\CHUCK\SURVEYSP.DOC

CURVE FORMULAE

(ENGLISH)

$$DC = 5729.578 / R$$

$$R = 5729.578 / DC$$

$$T = R \times \tan(\Delta / 2)$$

$$L = (\Delta / DC) \times 100$$

$$\Delta = (L / 100) \times DC$$

$$EXT = T \times \tan(\Delta / 4)$$

$$LC = 2R \times \sin(\Delta / 2) = 2R(\sin \text{ OF DELFECTION})$$

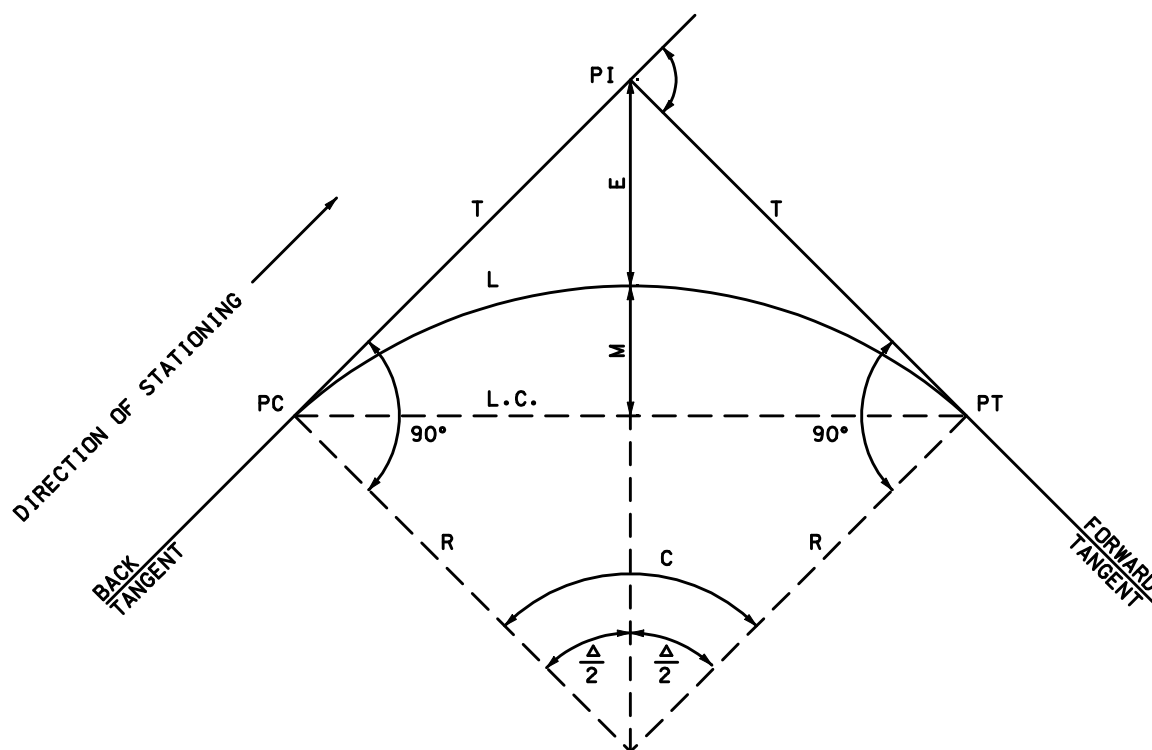
$$\text{DEFLECTIONS PER FOOT} = DC/200$$

$$\text{DEFLECTIONS PER } 50' = DC/4$$

$$2 \times \text{FULL DEFLECTION} = \Delta \text{ DELTA}$$

$$P.C. + T = P.I. \quad P.I. - T = P.C.$$

$$P.C. + L = P.T. \quad P.T. - L = P.C.$$



METRIC CURVE FORMULAE

P. I. = SUPPLIED BY DESIGN

\triangle = SUPPLIED BY DESIGN

$R = \frac{28.64789}{d/m}$ } SUPPLIED
BY
DESIGN

$T = R \times \tan \frac{\triangle}{2}$

$L = 2 * R \times \frac{\triangle}{360}$

$E = T \times \tan \frac{\triangle}{4}$

$d/m = \frac{28.64789}{R}$

$L.C. = 2R \times \sin \frac{\triangle}{2}$

SPIRAL CURVE

P.I.

FORMULAE

(ENGLISH)

 Δ

$$\Delta_c \quad \Delta - 2\phi_s$$

$$d/m \quad \frac{5729.578}{R}$$

$$T_s \quad K + (Rc + P) \times \tan \frac{\Delta}{2}$$

$$E_s \quad P + (Rc + P) \times \sec \frac{\Delta}{2}$$

$$L_c \quad \frac{\Delta}{DC} \times 100 \quad \text{OR} \quad 2\pi R \times \frac{\Delta}{360}$$

$$Rc \quad \frac{5729.578}{DC}$$

$$L_s \quad 1.6 \frac{V^3}{R}$$

$$L.T. \quad X_c - \left(\frac{Y_c}{\tan \phi_s} \right)$$

$$S.T. \quad \frac{Y_c}{\sin \phi_s}$$

$$\phi_s \quad \frac{L_s \times Dc}{200} \quad \text{OR} \quad L_s \times d$$

$$P \quad Y_c - (R \times \sin \phi_s)$$

$$K \quad X_c - (R \times \sin \phi_s)$$

$$X_c \quad \frac{L_s}{100} (100 - 0.0030462 \times \phi_s^2)$$

$$Y_c \quad \frac{L_s}{100} (0.58178 \times \phi_s - 0.000012659 \times \phi_s^3)$$

$$L.C. \quad \sqrt{X_c^2 + Y_c^2} \quad \text{or} \quad \frac{Y_c}{\sin \frac{\phi_s}{3}} \quad \text{or} \quad \frac{X_c}{\cos \frac{\phi_s}{3}}$$

$$\text{CONSTANT} \quad \frac{\phi_s}{3L_s^2} \times L_1^2 = \text{DEFL.} \propto$$

OFFSETT (PARALLEL) SPIRAL

$$L_s \quad L_s \pm \left(\text{OFFSET} \times \frac{\phi_s}{57.29578} \right)$$

$$L \quad L \pm \left(\text{OFFSET} \times 3 \times \frac{\phi_s}{57.29578} \right)$$

$$\text{or} \left(\begin{array}{l} \text{FOR ASYMETRIC SPIRAL} \\ T_{s_1} = K_1 + (R + P_1) \tan \frac{\Delta}{2} + (P_2 - P_1) \operatorname{COSEC} \Delta \\ T_{s_2} = K_2 + (R + P_2) \tan \frac{\Delta}{2} + (P_2 - P_1) \operatorname{COSEC} \Delta \end{array} \right)$$

METRIC SPIRAL

P.I.

 Δ $\Delta_c \quad \Delta - 2\phi_s$ d/m $\frac{28.64789}{R}$ (defl. per meter) $T_s \quad K + (R_c + P) \times \tan \frac{\Delta}{2}$ $E_s \quad P + (R_c + P) \times \text{EXC} \frac{\Delta}{2}$

FOR ASYMETRIC SPIRAL

or $\left(\begin{array}{l} T_{s_1} = K_1 + (R + P_1) \tan \frac{\Delta}{2} + (P_2 - P_1) \text{COSEC} \Delta \\ T_{s_2} = K_2 + (R + P_2) \tan \frac{\Delta}{2} + (P_2 - P_1) \text{COSEC} \Delta \end{array} \right)$

$\left. \begin{array}{l} L_c \\ R_c \end{array} \right\} \text{ TO BE SUPPLIED } \\ \text{BY DESIGN}$

 $L_s \quad 2 \pi R \times \frac{\Delta}{360}$ L.T. $X_c - \left(\frac{Y_c}{\tan \phi_s} \right)$ S.T. $\frac{Y_c}{\sin \phi_s}$ $\phi_s \quad L_s \times d/M$ $P \quad Y_c - (R \times \text{VERS } \phi_s)$ $K \quad X_c - (R \times \sin \phi_s)$ $X_c \quad \frac{L_s}{100} (100 - 0.0030462 \times \phi_s^2)$ $Y_c \quad \frac{L_s}{100} (0.58178 \times \phi_s - 0.000012659 \times \phi_s^3)$ L.C. $\sqrt{X_c^2 + Y_c^2}$ or $\frac{Y_c}{\sin \frac{\phi_s}{3}}$ or $\frac{X_c}{\cos \frac{\phi_s}{3}}$ CONSTANT $\frac{\phi_s}{3L_s^2} \times L_1^2 = \text{DEFL.} \propto$

PLASTIC FLAGGING COLOR CODE

Various colors of 1 in (0.025 m) plastic flagging, conspicuously attached to reference risers will be used to readily distinguish the character of alignment or control point to which it refers.

The following color code will govern:

RED	Center line or side stake
BLUE	Ramp center line and ramp side stakes
WHITE	Ramp center line and ramp side stakes
DAY – GLO RED	Geodetic Survey
DAY – GLO ORANGE	Geodetic Survey
RED & WHITE STRIPED	Wetlands Delineation
YELLOW	Benchmarks
PINK	Borings

COMBINATION OF COLOR

RED & YELLOW	Center line control points and ties
BLUE & YELLOW	Ramp control point and ties
YELLOW & WHITE	Ramp control point and ties
GREEN & WHITE	Right of Way lines and bound points
RED & WHITE	Proposed utility pole location

POLERELO.XLS

[illegible]

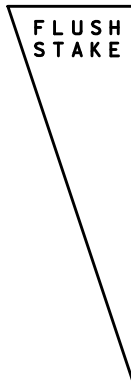
Notes: 1) Offsets are measured from Construction Centerline to face of pole. 3) Occupant: P = Power; T = Telephone; C = Cable TV; F = Fire Alarm; J = Joint; tw = travelled way; uvc = Urban Vert. Curb; gr = Guardrail.
2) Approved locations shall not be changed without approval of the Utilities E 4) Guys and puch brace easements and locations are the responsibility of the Pole Maintainer.

PLATE 303.32

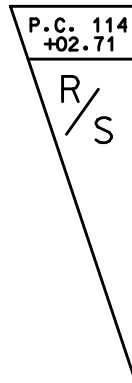
FRONT		BACK	
		STA.	LT. RT.
MANCHESTER		123+49	49'
12328			
CANDIA ROAD		126+52	47'
UTILITY POLE LAYOUT		129+63	52'
		131+24	52'
		133+35	52'
	JANUARY 5, 2005		
	CLOUDY & COLD		
	BLACK		
	BROWN		
	WHITE		
	GREEN		

STAKE MARKING CODE

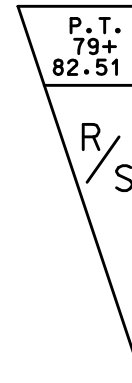
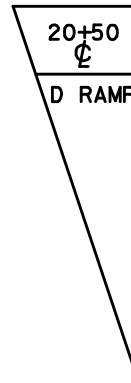
¢ STAKE



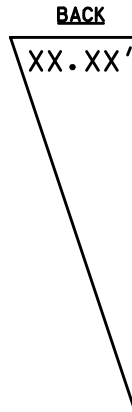
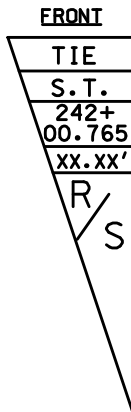
¢ REFERENCE STAKE



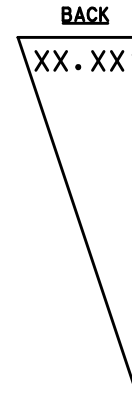
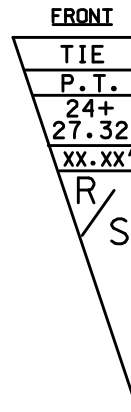
RAMP ¢ STAKE RAMP REFERENCE STAKE



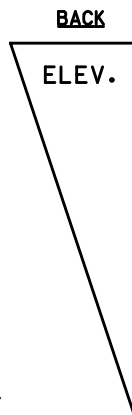
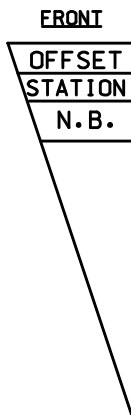
¢ TIES REFERENCE STAKES



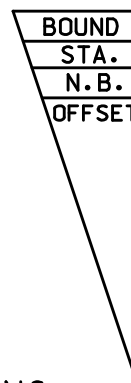
RAMP ¢ TIES REFERENCE STAKES



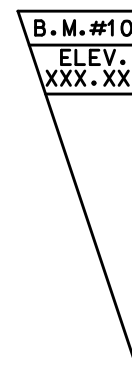
SIDE STAKES



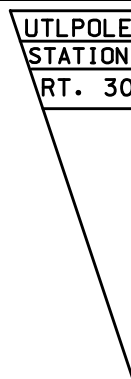
BOUND



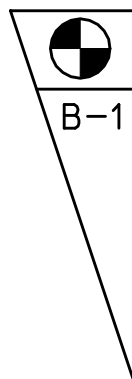
BENCH MARK



POLE STAKING



BORING



[illegible]

BENCH LINE

[illegible]

BENCH LINE

[illegible]

PEMBROKE 16132

WHITE
GREEN
BROWN
BLACK

AUG. 12, 2002

3

NH BOUND LIST - ROUTE 3

HAZY, HOT, HUMID

STA.	LT.	RT.	LAY OUT
	15.321		8/09/02
20+40		32.643	8/09/02
	30.515		
20+60		33.667	8/09/02
	30.515		8/09/02
30+20		UNABLE TO LAY OUT / IN WORK AREA	
PC 31 +55.321	31.211		8/09/02
		35.011	8/09/02
	35.000		8/09/02
35+60		UNABLE TO LAY OUT / IN WORK AREA	

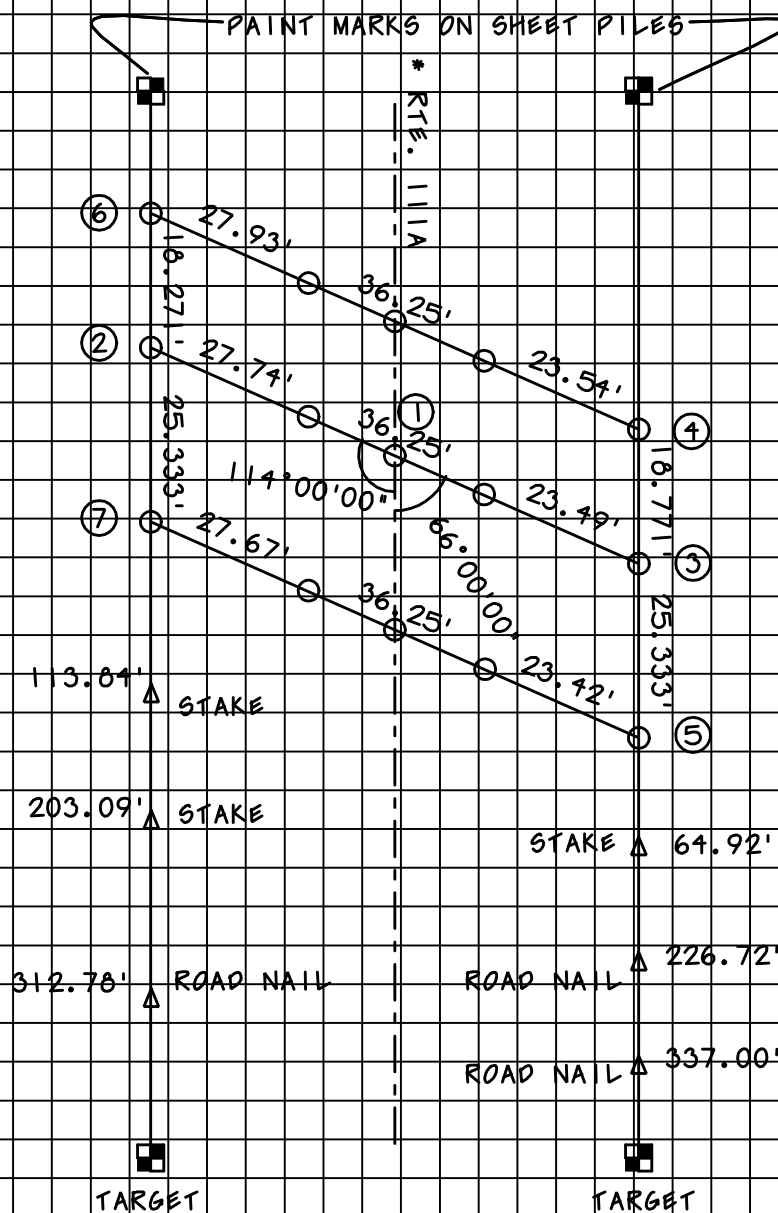
[illegible]

1-93 N.B. BRIDGE OVER RTE. 111A LAYOUT & TIES

DEC. 12, 2002
SNOW & COLD

POINT *'S COMP.	FIELD
① - ②	36.250'
① - ③	36.250'
④ - ⑤	44.104' 44.10'
⑥ - ⑦	44.104' 44.10'
⑤ - ⑦	72.500' 72.49'
③ - ②	72.500' 72.49'
④ - ⑥	72.500' 72.49'
③ - ⑥	81.915' 81.91'
④ - ②	67.317' 67.13'
④ - ⑦	67.914' 67.91'

NOTE: TIE POINTS SET ON RTE. 11A UNDER OLD
BRIDGE ARE ROAD NAILS.



BRIDGE NO. 104/262

NORTH ABUTMENT

X @ 6027

1.557

D.S. ON 6028

1.485

3629 - 3636

TB

TOP OF CONG. SEAT

3637 - 3643

TB

TOP OF STONE & CONG.
PART OF ABUTMENT

3644 - 3654

TB

SAME AS ABOVE

3655 - 3664

DB

BASE OF STONE & MORTAR
PART OF ABUTMENTNOTE: 3657 - 3664 ARE ALSO THE
BACK EDGE OF THE EXPOSED CONG.
FOOTING

3665 - 3672

TF

EXPOSED CONG. FOOTING

3673 - 3676

BF

SOUTH ABUTMENT

SAME SET-UP

3677 - 3684

TB

TOP OF CONG. SEAT

3685 - 3693

TB

TOP OF STONE & CONG.
PART OF ABUTMENT

3694 - 3700

TB

SAME AS ABOVE

3701 - 3710

DB

BASE OF STONE & MORTAR
PART OF ABUTMENTNOTE: 3704 - 3709 ARE ALSO THE
BACK EDGE OF EXPOSED CON. FOOTING

3711 - 3716

TF

EXPOSED CONG. FOOTING

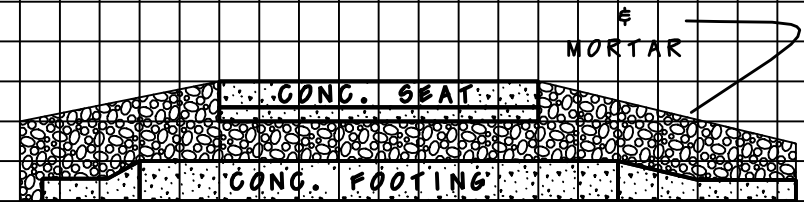
3717 - 3720

BF

END TDB11987

SOUTH ABUTMENT

FRONT VIEW FIELD STONE

3694
THRU
3700

3677

TOP VIEW

3684

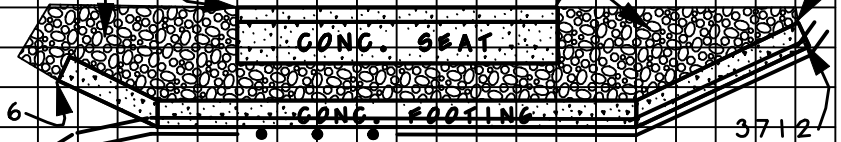
3685

THRU

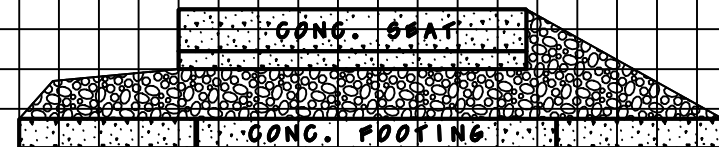
3693

3711

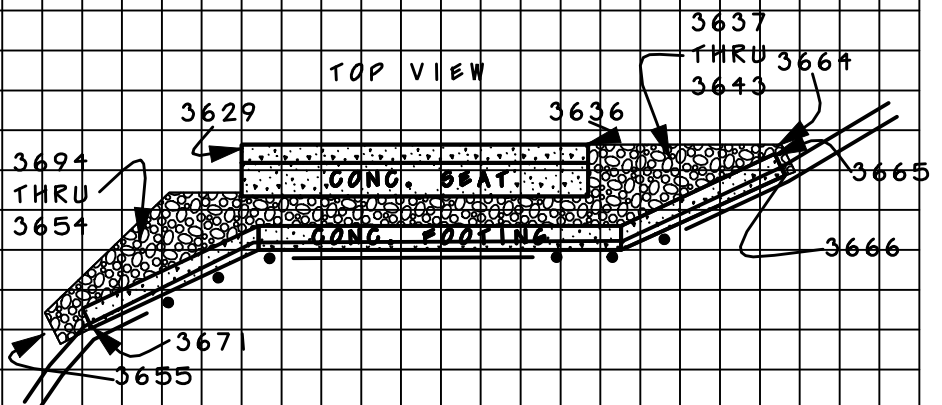
3716



3712

NORTH ABUTMENT
FRONT VIEW

TOP VIEW



3629

3636

3637

THRU

3664

3643

3665

3666

3694
THRU
3654

3671

3655

BERLIN - MILAN

P-6789

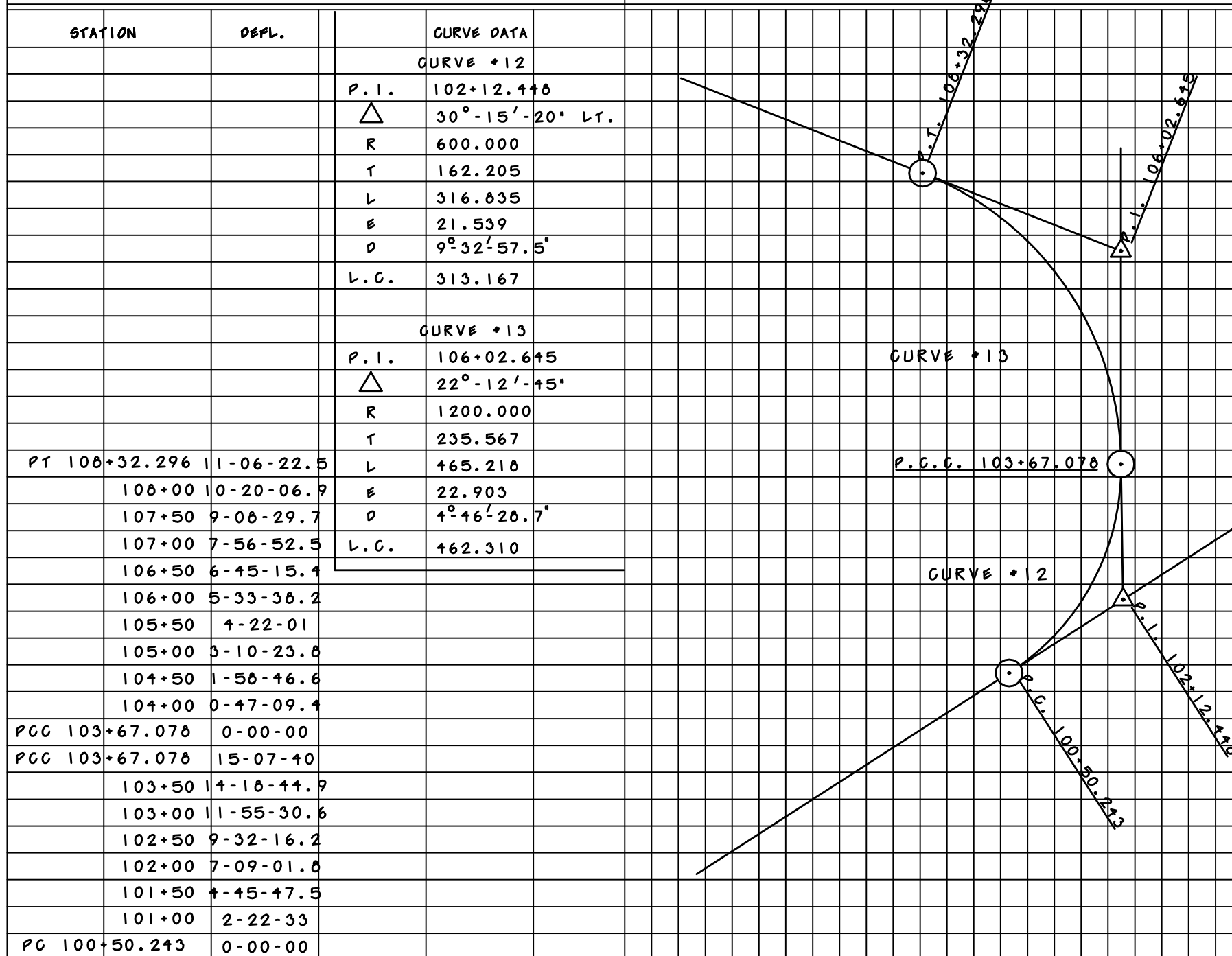
GREEN
WHITE
BROWN
BLACK

12/17/99

3

ALIGNMENT COMPOUND CURVES * 12 & 13

CLEAR & GOLD



BERLIN - MILAN

P-6789

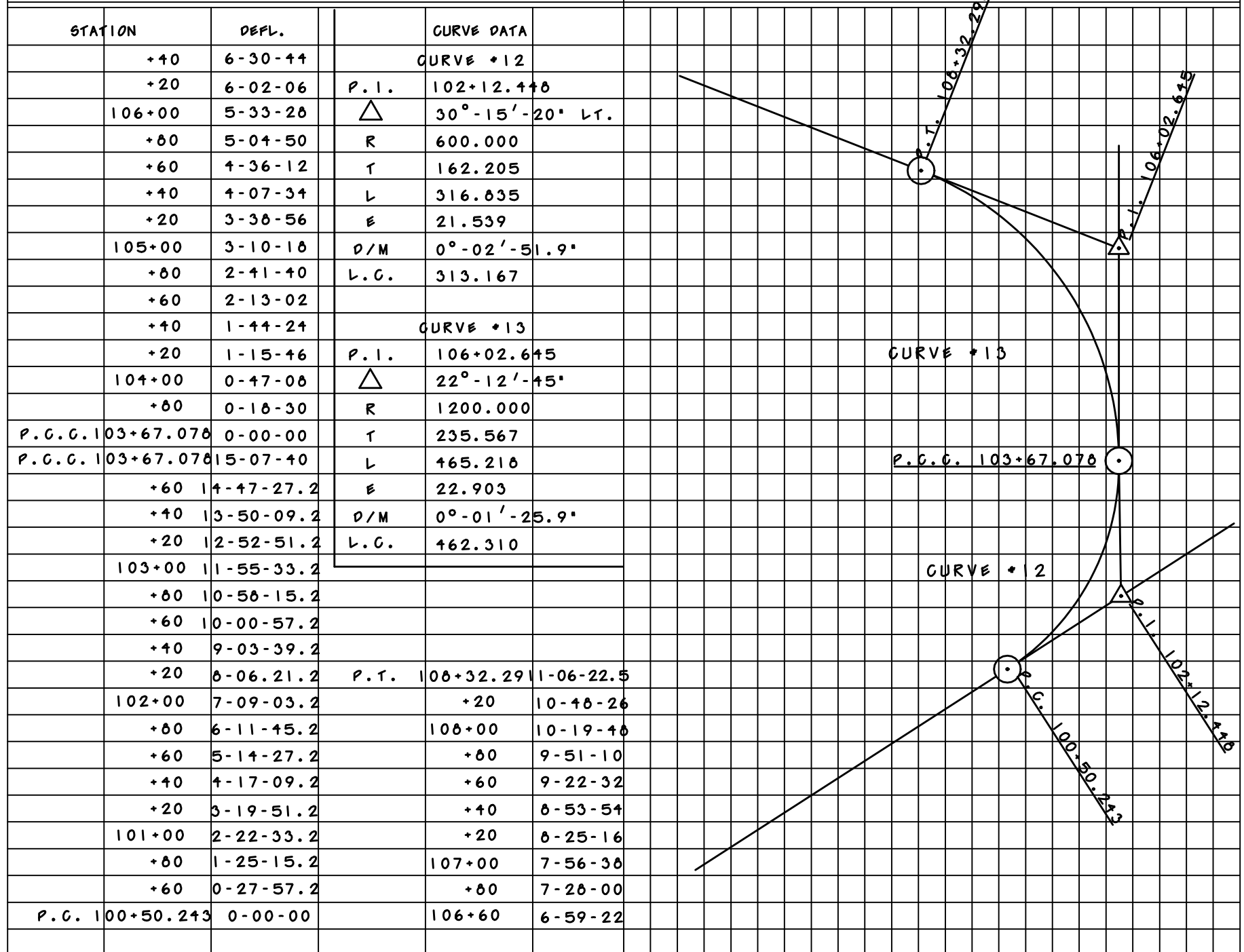
GREEN
WHITE
BROWN
BLACK

12/17/99

3

ALIGNMENT COMPOUND CURVES * 12 & 13

CLEAR & GOLD



BERLIN - MILAN

P-6789

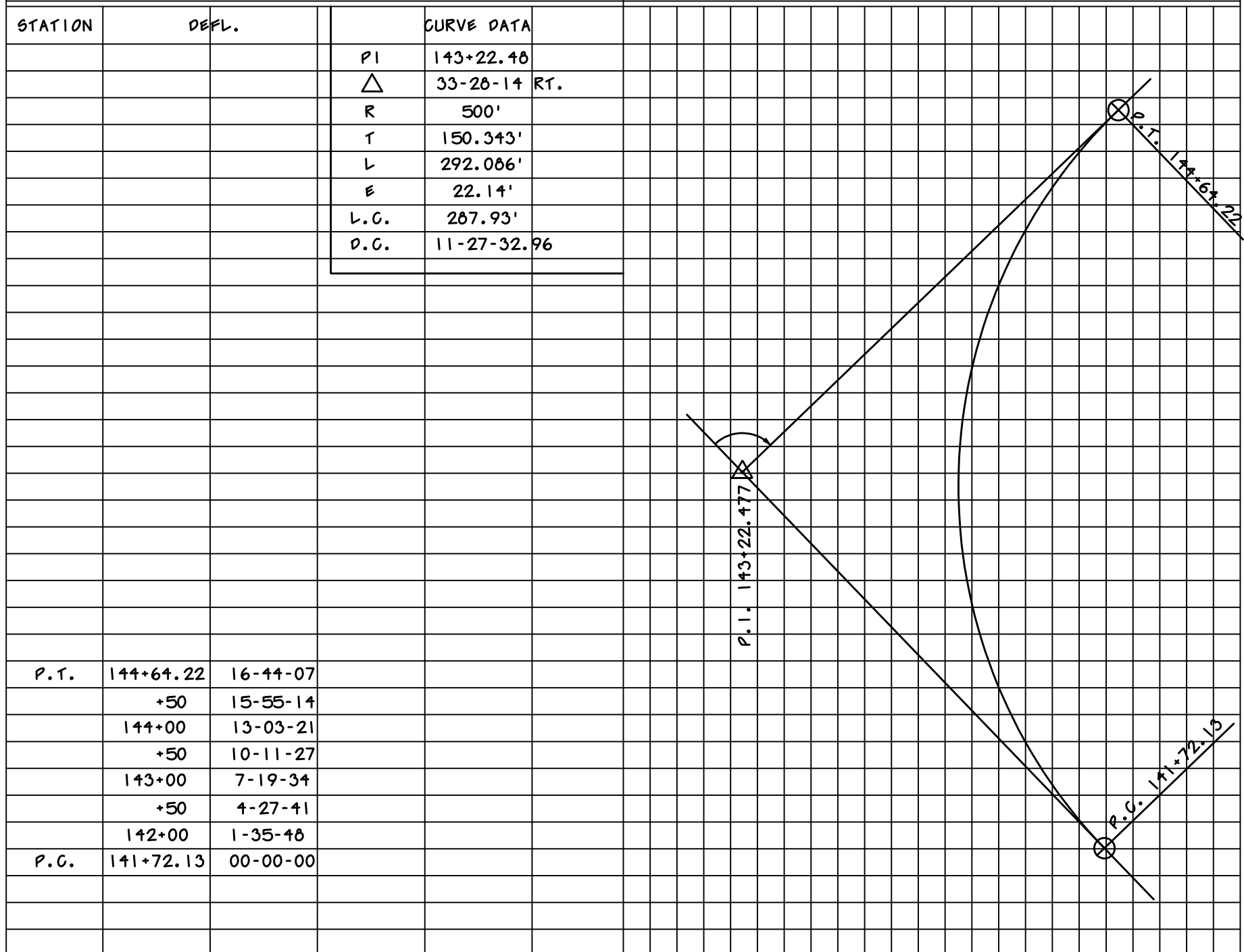
ALIGNMENT CURVE #27

GREEN
WHITE
BROWN
BLACK

12/17/99

3

CLEAR & GOLD



BERLIN - MILAN

P-6789

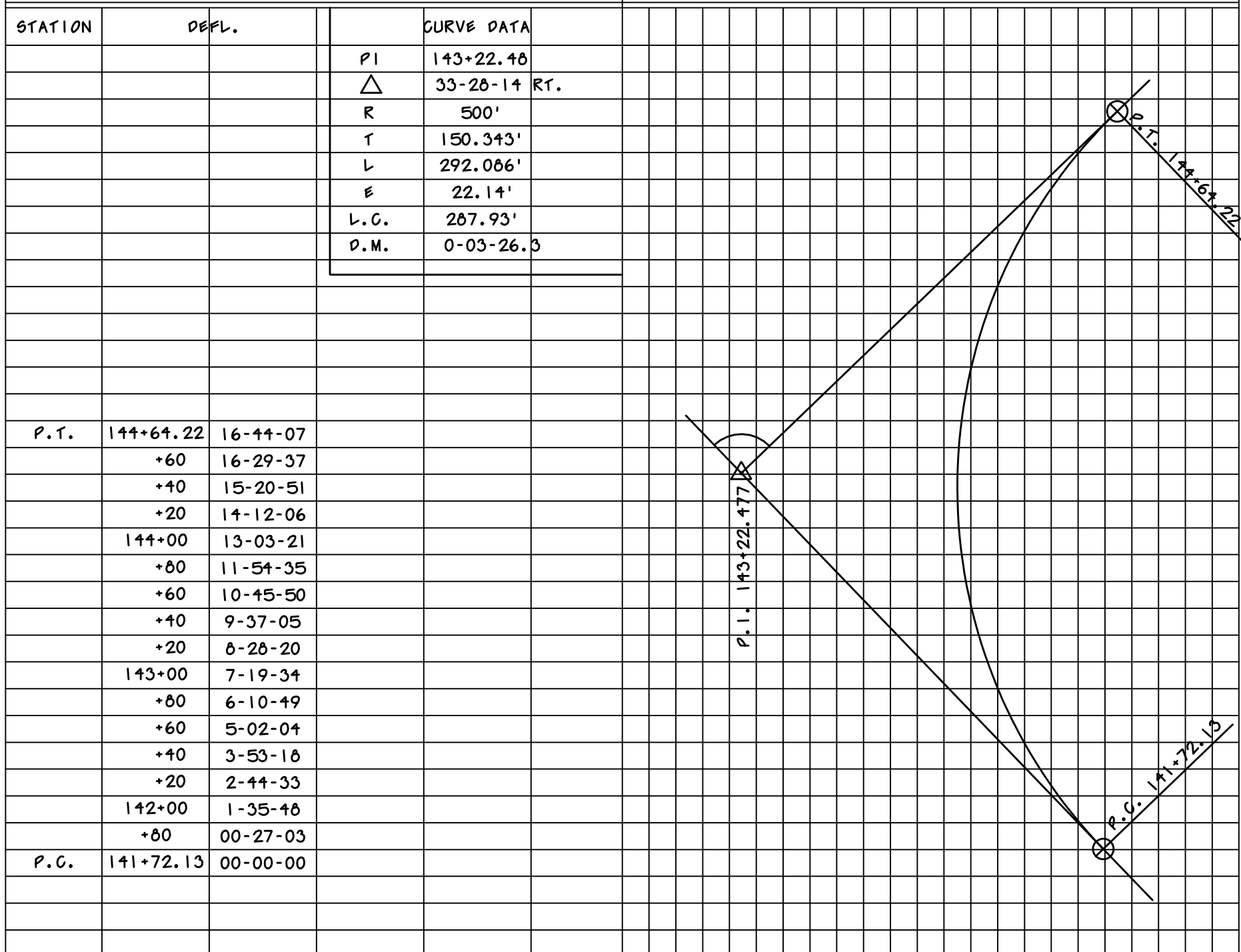
ALIGNMENT CURVE #27

GREEN
WHITE
BROWN
BLACK

12/17/99

3

CLEAR & GOLD



BERLIN - MILAN
P-6789

GREEN
WHITE
BROWN
BLACK

3

ALIGNMENT - N.B. OFF RAMP

MARCH 9, 2002
CLOUDY MILD 30's

P.I. = 173-22.477
 Δ = 35-28-14 RT.
 R = 500.00
 T = 150.343
 L = 292.086
 E = 22.114
 $L.C.$ = 287.950
 $D.C.$ = 11-27-33

P.T. 174+64.220
 38-28-14

N.B.

52+00

P.C. 171+72.134

98

51+46.385

20.126'

P.O.T. 171+00

90

P.T.	174+64.22	16-44-08
	+50	15-55-15
	174+00	13-03-22
	+50	10-11-28
	173+00	07-19-35
	+50	04-27-42
	172+00	01-35-49
P.C.	171+72.13	0-00-00

51+20

BERLIN - MILAN
P-6789

GREEN
WHITE
BROWN
BLACK

3

ALIGNMENT - N.B. OFF RAMP

MARCH 9, 2002
CLOUDY MILD 30's

P.I. = 173+22.477
 $\Delta = 35^{\circ}-28'-14''$ RT.
 R = 500.00
 $T = 150.343$
 $L = 292.086$
 $E = 22.114$
 $D/M = 0^{\circ}-03'-26.3''$
 $L.C. = 287.950$

P.T. 174+64.220

$38^{\circ}-28'-14''$

STATION DEFL.

174+

P.T. 64.220 $16^{\circ}-44'-07''$

N.B.

+60 $16^{\circ}-29'-36.6''$

+40 $15^{\circ}-20'-51.3''$

+20 $14^{\circ}-12'-06''$

174+00 $13^{\circ}-03'-20.7''$

+80 $11^{\circ}-54'-35.4''$

+60 $10^{\circ}-45'-50.1''$

+40 $9^{\circ}-37'-04.9''$

+20 $8^{\circ}-29'-19.6''$

173+00 $7^{\circ}-19'-34.3''$

+80 $6^{\circ}-10'-49.0''$

+60 $5^{\circ}-02'-03.7''$

+40 $3^{\circ}-53'-18.4''$

+20 $2^{\circ}-44'-33.1''$

172+00 $1^{\circ}-35'-47.8''$

+80 $0^{\circ}-27'-02.5''$

171+

P.C. 72.134 $0^{\circ}-00'-00''$

52+80

P.C. 171+72.134

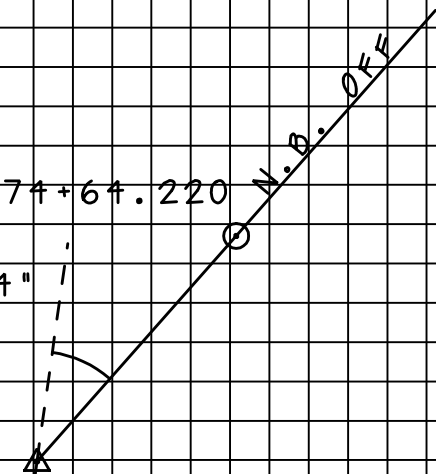
98°

51+46.385 20.126'

P.O.T. 171+00

90°

51+20



PORTSMOUTH
11855

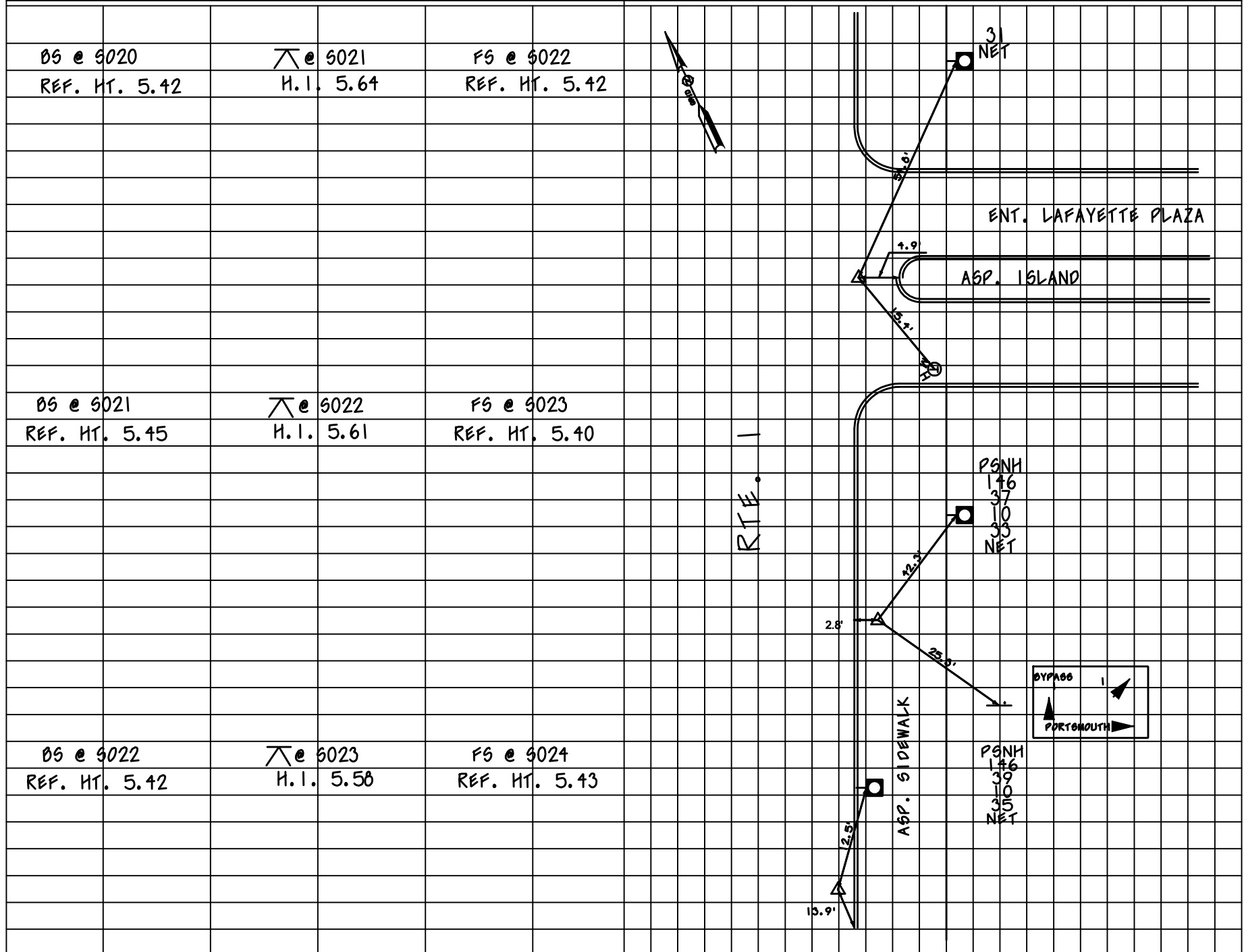
BLACK
WHITE
BROWN
GREEN

9

TRAV. RTE. 1

1RA11855

SEPT. 3, 1995
MILD & WARM



WINDHAM - DERRY

12156

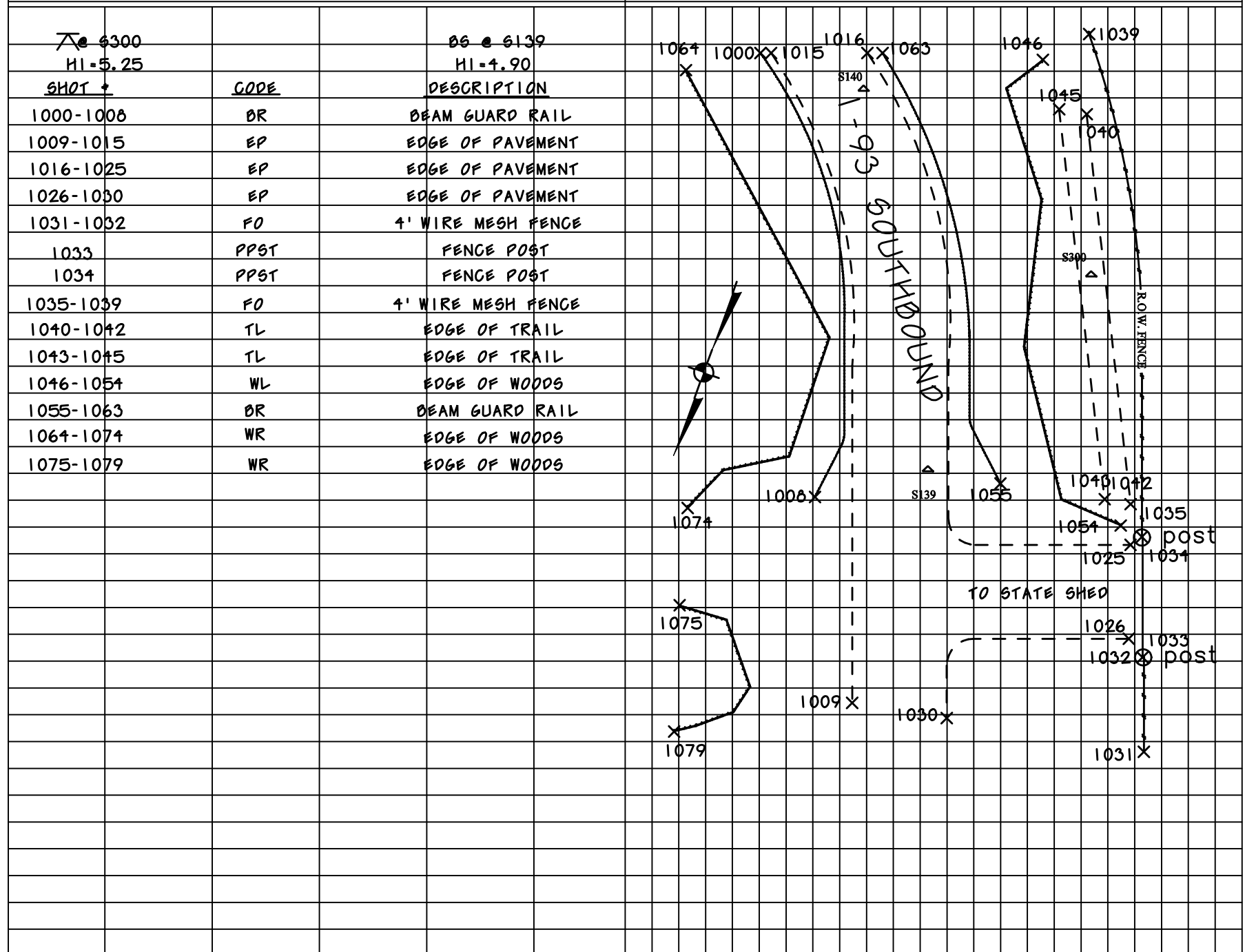
TOPO/DETAIL

1-93 S.B.

BTA12156

DEC. 25, 1994

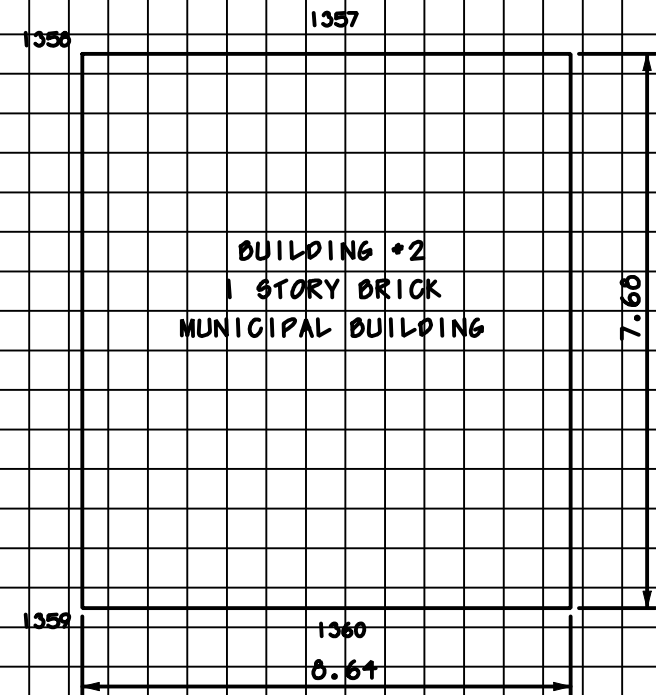
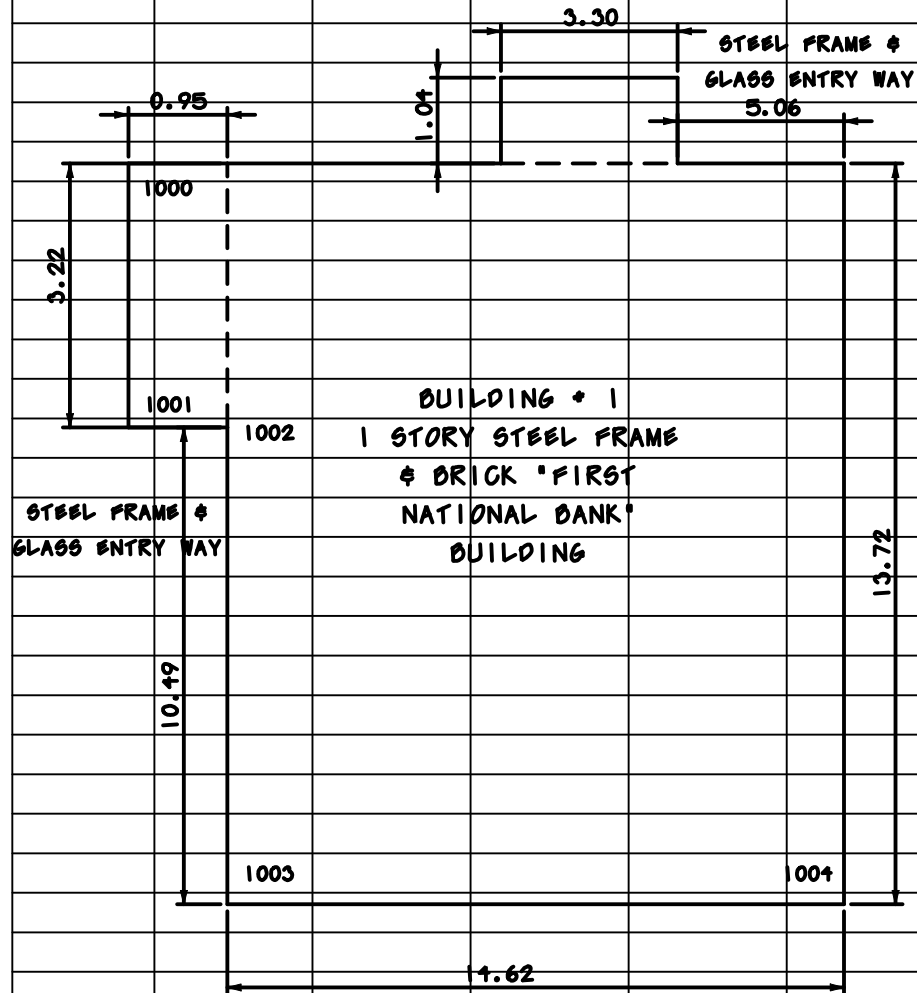
CLEAR, WINDY, & COOL



BUILDING SKETCHES

LTA11855

SNOWY & COOL



**HISTORICAL STANDARD ABBREVIATIONS
(FOR REFERENCE ONLY)**

Azimuth	Az.	Federal-aid Primary	F.A.P.
Average Water Level	A.W.L.	Federal-Aid Secondary	F.A.S.
Back Traverse	B.Tr.	Fence (label type)	Fn.
Bearing	Brg.	Flow Line Elevation	F.L.
Bench Mark	B.M.	Fore Sight	F.S.
Bituminous Coated Corrugated Steel Pipe Arch	B.C.C.S.P.A.	Gas Shut-Off	G.S.O.
Bituminous Coated Corrugated Steel Pipe	B.C.C.S.P.	Gravel	Grav.
Bituminous Coated Perforated Corrugated Steel Pipe	B.C.P.C.S.P.	Grid North	G.N.
Bottom of Bank	B.B.	Hand Level	H.L.
Cast Iron Pipe	C.I.P.	Header	Hdr.
Catch Basin	C.B.	Height of Instrument	H.I.
Cement Lined Cast Iron Pipe	C.L.C.I.P.	Horizontal Control Marker	H.C.M.
Cemetery	Cem.	Hot Bituminous Paved Shoulder	H.B.P.S.
Center Line	C.L. or E.	Hot Bituminous Pavement	H.B.P.
Concrete Bound	Conc.B.	Invert Elevation	Inv.
Conduit	Cond.	Iron Pipe or Pin	I.P.
Construction Center Line	C.C.L.	Ledge to Earth	L.E.
Controlled Access Right of Way	C.A.R.O.W.	Length of Curve or Ledge	L.
Corner Fence Post	C.F.P.	Level Out	L.O.
Corrugated Aluminum Pipe	C.A.P.	Limited Access Right of Way	L.A.R.O.W.
Corrugated Steel Pipe	C.S.P.	Manhole (label type, sewer, telephone, etc.)	M.H.
County Line	Cty.L.	Mean High Sea Level	M.H.W.
Curve to Spiral	C.S.	Mean Low Sea Level	M.L.W.
Degree of Curve	D.	Mean Sea Level	M.S.L.
Down Gradual	D.G.	Mid-Point of Circular Curve	Mid.P.
Drive (label type)	Dr.	Mortar Rubble Masonry	M.R.M.
Drop Inlet	D.I.	Not Stripped	N.S.
Earth to Ledge	E.L.	Observed Magnetic Bearing	Mag.
Edge of Brook	E.Brk.	Old Ground	O.G.
Edge of Pit	E.P.	Old Stone Box	O.S.B.
Edge of River	E.R.	Parking Lot	P.Lot.
Edge of Work	E.W.	Paved Gutter	P.G.
External Distance	E.	Paved Shoulder	P.S.
Extreme High Water	E.H.W.	Perforated Asbestos- Cement Pipe	P.A.C.P.
Extreme Low Water	E.L.W.		

Perforated Corrugated Aluminum Pipe	P.C.A.P.	Spike	Spk.
Perforated Fiber Pipe Underdrain	P.F.P.U.	Spike & Washer	S. & W.
Point of Compound Curve	P.C.C.	Spiral Point of Intersection	S.P.I.
Point of Curve	P.C.	Spiral to Curve	S.C.
Point of Intersection	P.I.	Spiral to Tangent	S.T.
Point of Reverse Curve	P.R.C.	Stake and Stones	S. & S.
Point of Tangent	P.T.	State-Aid Primary	S.A.P.
Point on Curve	P.O.C.	State-Aid Secondary	S.A.S.
Point on Sub-Tangent	P.O.S.T.	State Line	St.L.
Point on Tangent	P.O.T.	Stone Bound	S.B.
Portland Cement Concrete Pipe	P.C.C.P.	Study or Survey Line	S.L.
Project Marker	P.M.	Surface Treated Gravel	S.T.G.
Property Line	P.L.	Temporary Bench Mark	T.B.M.
Radius	R.	Tangent to Spiral	T.S.
Railroad	R.R.	Top of Bank	T.B.
Railroad Crossing	R.R.X.	Town Line	T.L.
Reference Stake	R.S.	Traveled Way	T.W.
Reference Bound	R.B.	Traverse Line	Tr.L.
Reinforced Concrete Pipe	R.C.P.	Turning Point	T.P.
Reinforced Concrete Pipe Underdrain	R.C.P.U.	Up Gradual	U.G.
Retaining Wall (label type)	R.W.	Underdrain	U
Right of Way	R.O.W.	United States Coastal and Geodetic Survey	U.S.C.& G.S.
Rip Rap	Rip.R.	United States Geological Survey	U.S.G.S.
Same Slope	S.S.	Vitrified Clay Pipe	V.C.P.
Sidewalk (label type)	S.W.	Wall (label type)	W.
Sluiceway	Slu.	Water Gate	W.G.
		Water Shut-Off	W.S.O.

DEPARTMENT OF TRANSPORTATION SURVEY REQUEST SLIP

PROJECT NAME: _____

STATE PROJECT NUMBER: _____

METRIC ☐ IMPERIAL ☐ SCALE: _____

DESCRIPTION OF SURVEY REQUEST: _____

REQUESTING BUREAU/SECTION: _____

SURVEY REQUEST BY: _____ DATE: _____

SURVEY COMPLETION DATE REQUESTED: _____

SURVEY REQUEST TO BE RETURNED TO: _____

APPROVED BY: _____

REMARKS: _____

PLAN PREP COMPLETION DATE REQUESTED: _____ NOTED BY: _____

REQUESTER: PLEASE INCLUDE INFO NEEDED BY GROUPS LISTED BELOW

ADDITIONAL INFORMATION REQUEST (PLEASE INITIAL)

PRELIMINARY DESIGN _____

BRIDGE DESIGN _____

FINAL DESIGN _____

ENVIRONMENT _____

CONSULTANT DESIGN _____

UTILITIES _____

MATERIALS & RESEARCH _____

ROW _____

DESCRIPTION OF PROJECT: _____

CONTACT PERSON: _____ TELEPHONE: _____

TWO COPIES TO SURVEY & ONE COPY TO PLAN PREP

FOR SURVEY USE ONLY

REQUEST APPROVED BY: _____ DATE: _____

ESTIMATED COMPLETION DATE: _____

ESTIMATED CREW DAYS: _____

SURVEY SUPERVISOR: _____

PRIMARY CREW CHIEF: _____

TOTAL STATION ☐ CONVENTIONAL ☐ GEODETIC ☐

REMARKS: _____

ACTUAL START DATE: _____

ACTUAL COMPLETION DATE: _____

WEEKLY SURVEY REPORT

FROM

FOR WEEK ENDING

October 31, 2008

DATE & DAY WEATHER	PROJECT & #	PERSONNEL	FIELD BOOK #	JOB DESCRIPTION & LOCATION	REMARKS
MONDAY					
10/27					
TUESDAY					
10/28					
WEDNESDAY					
10/29					
THURSDAY					
10/30					
FRIDAY					
10/31					

JOB INITIALIZATION PROCEDURE

In order to make all data files consistent with each other the following procedure must always be used by all crews.

- | | |
|------------|---|
| 1. JOB | File ID R((for traverse)alpha. sequence & project #)
T((for topo) alpha. sequence & project #)
<u><i>*Before the "R" or "T" use you're designated crew "letter" see attached sheet.</i></u> |
| 2. NOTE | Town name and project number. |
| 3. NOTE | Brief description of operation,(traverse or topo of what area). |
| 4. NOTE | Field book number. |
| 5. NOTE | Crew chief name, instr. oper. name, note keeper and rod person names. |
| 6. NOTE | Project units (metric or US Feet). |
| 7. NOTE | Traverse file or sequence of "S" & "P" points used. |
| 8. SCALE | S.F. 1.0000000000 (apply a scale factor when working above the notch) |
| 9. NOTE CP | SEA LEVEL CRN: N |
| 10.NOTE CP | C AND R CRN: N |
| 11.NOTE CP | ATMOS CRN: N |
| 12.NOTE TS | The current date. |
| 13.INSTR | SET / LEICA |
| 14. POS KI | EAST-----, NORTH-----, ELEV.-----. |
| 15. POS KI | Etc. |
| 16. NOTE | S001 = Disk etc. |
| 17. NOTE | Source of control (NAD 83/86 NGVD 29, GPS or previous traverse file name, etc.) |

**Note starting shot number at the top of the file*

**Note last shot number at the end of the file*

** After last shot please note "end of file"*

** Put date at the end of the file*

**If this file completes the request please note it*

File naming

There have been some past difficulties not duplicating file names and “P” points. In effort to make this easier for everyone, crews are going to be issued a letter for use in file naming and “P” points.

Cloutier	A
	B
Hills	C
Cooper	U
Heath	E
Hicks	F
Gravel	G

	H
Keskinen	P
Grant	J
Fournier	K
Plante	L
Wilkinson	M
Sweeney	N

Example: Cloutier would name a traverse file ARA(project #), a topo file would be ATA(project #) and “P” for Scotts crew will now be “A” points. The next file name on that request would be ARB... or ATB... and so on. If there is a miscellaneous engineering (district project charge) use the first four letters of the town after crew and file designations. For example use ARACONC instead of ARA1832I, for a project in Concord. Attention will still be needed not to duplicate “S” points with other crews working on the same project.

DATA COLLECTOR PARAMETER SETTINGS

UNITS

ANGLE-DEGREES
DIST-F\M_
PRESSURE -IN HG\MM HG
TEMP-FAR\CEL
COORDS- N-E -ELEV
GRADE-%
STA-ING -10+00
DECIMALS SHOWN -DEC 3

COMMS SETUP

PORT-TOP
MODEM-NO
BAUD-RATE-19200
DATA BITS-8
PARITY-NOT SET
STOP BIT- 1
OUTPUT DELAY- 0
FILE- NO

SDR

CURRENT VIEW- YES
OBS VIEW- NO
MC VIEW- NO
RED VIEW- NO
POS VIEW- NO
SEND PARTIAL JOB- NO
SEND ALL AS POS- NO
LELEV\VIEW- NO
SEND ALL AS LELEV- NO

SURVEY OPTIONS

METHOD- DIRECT
DATA- HVD
OF H SETS- 1
OF DIST READINGS- 1
FACE ORDER- F1 ONLY (TOPO)
F1-F2 F1-F2 (TRAVERSE)
OBS ORDER- 123.....123
RETURN SIGHT- NO
PREENTER POINT- YES
RECIP CALC.- NEVER

JOB SETTINGS

JOB - ID#.....
ATMOS CRN- NO (YES IF SET IN TWO-WAY)
C@R CRN- NO
SEA LEVEL CRN- NO

FUNCTION

INSTR.- SET
EDM\SN- SERIAL #
V OBS- ZENITH
PC-MM - "0"

* INSTR. SET 2-WAY (change the following)
* PC-MM- "-30"
* ORIENTATION. "0"

CONFIG. READING

AUTO PT- 1000
TOPO VIEW STORED - OBS
COMBINE F1-F2 - NO (TOPO)
YES (TRAVERSE)
DIST. READINGS - 1
TRACKING - NO
CODE LIST ACTIVE - NO
INFO BLOCKS - 0
CODE FIELDS - 0
RECIP. CALC - NEVER

TOLERANCES

TYPE - TOTAL STATION
TOL. H. OBS - 0-00-10
TOL. V. OBS-0-00-15
EDM TOL. (MM) -5
EDM TOL.(PPM) -5

SURVEY CODE DESCRIPTIONS

GENERAL USE:

Bench mark: PBMK

Locate with a single shot. This code is for both Benchmarks and Survey Disks. Please note in book.

Boring: PBOR

Locate with a single shot. This code is also used for Test Pits and Vacuum Extraction Pits. Please note in book.

Drill hole: PDHL

Locate with a single shot.

Level string: L

A string line used to show elevations. Follow your major changes in contours, do not zig zag across ridges, swales, ditches, etc. If located behind a curved feature, (curb, ep, etc.) locate with a 202 code.

Spot elevations: PELV

Single shot to show high or low spot when string line is not needed when taking general topo. May also be used to show high points of stockpiles, ledge outcrops, etc.

Spot elevations - Not at Ground: PEVV

Same as a PELV but will not be used for contouring.

BOUNDARIES:

Iron pin or pipe: PIPN

Locate top center with single shot. (If leaning, locate at base and note in book.) Note the height, size and type in book.

Bound: PBNB

Locate top center with single shot. Note the height, size and type (concrete, granite, etc.) in book.

Project marker: PRJM

Locate top center with single shot. Note the height, size and type (concrete, granite, etc.) in book.

State line marker: PSLM

Locate point on top with single shot. Note the height, size and type with description of marker (Bronze, Aluminum tablet, Drill hole, etc.) in book.

Town line marker: PTLM

Locate point on top with single shot. Note the height, size and type with description of marker (Bronze, Aluminum tablet, Drill hole, etc.) in book.

ROADWAY FEATURES:

Center of road: CO

Locate with a string line.

Edge of traveled way: TW

Locate with a string line.

Edge of pavement: EP

Locate with a string line.

Lane markings: LM

Locate with a string line.

Driveway: DR

Locate with a string line. Note material in book.

Trail: TL

Locate the center with a string line. Note average width and type in book.

Curb - Left: CL

Locate with a string line. Note type and sloped or straight in book.

Curb - Right: CR

Locate with a string line. Note type and sloped or straight in book.

Curb - Top: TC

Locate with a string line.

Beam guard rail - Left: BL

Locate with a string line.

Beam guardrail - Right: BR

Locate with a string line.

Cable guardrail - Left: GL

Locate with a string line.

Cable guardrail - Right: GR

Locate with a string line.

Double face beam guardrail: DF

Locate with a string line.

Jersey barrier: JB

Locate on top of barrier and measure height to use as prism height. Take an “L” string around base if needed.

Ditch line: DL

Locate center of ditch with a string line. Note average width in collector. If you want Plan Prep to offset the Ditch Line then put a note in the file.

Bottom of slope: BS

Locate with a string line. If located behind a curved feature, (curb, ep, etc.) locate with a 202 code.

Top of slope: TS

Locate with a string line. If located behind a curved feature, (curb, ep, etc.) locate with a 202 code.

BRIDGE FEATURES:

NOTE: Bridge features include the deck along with anything on or above it. The abutments, wings and piers should be taken when regular topo is taken. All bridge features should be taken as a unit so they can be removed as a unit with no regular topo features between start and finish. All features on the deck should have a “B” as the third character.

Arch – Bottom: BK

Locate with a string line on bottom edge of an arch.

Bridge deck: BG

Locate with a string line top outer edge.

Bridge abutment - Top: TB

Locate with a string line at top outer edge of abutment, see top of header example.

Bridge abutment - Bottom: BB

Locate with a string line at ground level of abutment, see bottom of header example.

Expansion joint: EJ

Locate with a string line.

Exposed bridge footing - Top: TF

Locate as a string line top of every corner that is exposed.

Exposed bridge footing - Bottom: BF

Locate as a string line bottom of every corner that is exposed.

Pier - Top: TP

Locate with a string line top outer edge.

Pier - Bottom: BJ

Locate at ground level with a string line, describe in book.

Wing wall - Top: WT

Locate as a string line top outer edge. Use close feature on side where it connects with header abutment.

Wing wall - Bottom: WB

Locate as a string line ground level of wall.

Rip-rap: RP

Use a string line following the outline of the rip rap.

Bridge spot elevations: PEBV

Bridge miscellaneous detail features - point string: PMBF

RAILROAD FEATURES:

Railroad: RR

Locate top of east/north rail first with string line (locate in a west to east/south to north direction). Locate top of second rail with a string line, taking shots on second rail opposite shots taken of first rail in the same direction. Also locate the edge of the ballast with a FM code and note in book. Locate the top of slope on the ballast with a TS code.

Railroad sign: PRSN

Locate with single shot. Note size and type in book.

Railroad signal: PRSL

Locate with single shot. Note base size and type in book

Railroad switchstand: PRSW

Locate with single shot. Describe in book.

STRUCTURES:

Concrete Pad (gas station island; etc.): CP

Locate corners with a string line.

Ground at/near building: BE

Locate corners with a string line.

Foundation/Ruin: FD

Locate corners with a string line. Describe in book.

Sill Point: PSIL

Locate the lowest sill elevation along the roadside face with a single shot.

Sound Wall: SA

Locate the centerline of each support column at the roadside face. Note size and material of column and foundation in book.

Steps: SP

Locate corners with a string line. Note type and number of stairs in book.

Sidewalk: SK

Locate with a string line. Note material in book.

Fence: FO

Locate with a string line. Note type, condition, and how many strands in book.

Retaining wall - Left: RL

Locate with a string line. Note material in book.

Retaining wall - Right: RW

Locate with a string line. Note material in book.

Retaining wall - Top: TR

Locate with a string line.

UTILITIES:

Catch basin top: PCBD

Locate with a point in center of grate.

Catch basin/Drop inlet sump: PSUM

Locate at the bottom of basin with a point.

Dam: DM

Locate top corners or angle points with a string line. Note material in book.

Dam - bottom: DB

Locate corners and angle points with a string line.

Drainage pipe (Survey: use IGL for dir. shots): DP

Locate invert of pipe. Note material and size in book. This is to be used for any drainage structure under 10 feet. Structures over 10 feet will be located in the same manners as a bridge.

Drop inlet top: PDID

Locate with a point in center of grate. This code also applies to Bridge Scuppers.

Fire hydrant: PHYD

Locate with a point on top. This code also applies to Dry Hydrant. Note in book.

Fuel Tank: PFTK

Locate with a single shot at center of tank. Note size and type in book.

Gas Pump: PGAS

Locate with a single shot at center of pump. Note size and type in book.

Gas pumps: GP

Locate perimeter of pumps. Note size, type and number of pumps in book.

Gas shutoff: PGSO

Locate with single shot in center.

Guy pole or stub: PGUY

Locate with single shot at ground at the roadside face.

Guy wire anchors: PANC

Locate with single shot at ground.

"Headwall: culvert end - Bottom": BH

Locate at ground level with a string line.

Headwall - Top: TH

Locate corner and angle points with a string line. Note type in book

Joint power and telephone pole: PJNT

Locate with single shot at the roadside face. Note in book any pole numbers and if it has a transformer.

Junction box: PJCT

Locate with single shot in center. Note size and material in book.

Light on joint pole: PLTJ

Locate with single shot at the roadside face. Note in book any pole numbers and if it has a transformer.

Light on power pole: PLTP

Locate with single shot at the roadside face. Note in book any pole numbers and if it has a transformer.

Light pole: PLIT

Locate with single shot at the roadside face. Note in book any pole numbers, type of pole, and if it has a transformer.

Manhole - Drainage: PMHD

Locate with single shot in center of cover.

Manhole - Electric: PMHE

Locate with single shot in center of cover.

Manhole - Gas: PMHG

Locate with single shot in center of cover.

Manhole - Sewer: PMHS

Locate with single shot in center of cover.

Manhole - Telephone: PMHT

Locate with single shot in center of cover.

Manhole - Water: PMHW

Locate with single shot in center of cover.

Pole: PPOL

Locate with single shot at the roadside face. Note in book any pole numbers and if it has a transformer.

Power pole: PPWR

Locate with single shot at the roadside face. Note in book any pole numbers and if it has a transformer.

Sluiceway: SU

Locate corners and angle points with a string line. Note material in book.

Storage tanks: SG

Locate footprint of tank with string line. Note size, type, and use in book if known.

Storage tank fill cap: PSTT

Locate with a single shot. Note type in book.

Public telephone: PBTH

Locate with single shot in center, if more than one locate separately. If it has a concrete pad, locate pad using concrete pad code.

Telephone/telegraph pole: PTEL

Locate with single shot at the roadside face. Note in book any pole numbers and if it has a transformer.

Transmission line/Aerial electric lines: AE

Locate with a string line following the lines.

Tower: PPTR

Locate with a single shot. This is for Fire Towers, Cell Towers, Transmission Towers, and Radio Towers. Note size and type in book.

Underground Cable TV: UC

Locate with string line as marked on ground or pavement. Note in file any numbering.

Underground Electric: UE

Locate with string line as marked on ground or pavement. Note in file any numbering.

Underground Fire Alarm: UF

Locate with string line as marked on ground or pavement. Note in file any numbering.

Underground Gas: UG

Locate with string line as marked on ground or pavement. Note in file any numbering.

Underground Sewer: US

Locate with string line as marked on ground or pavement. Note in file any numbering.

Underground Telephone: UT

Locate with string line as marked on ground or pavement. Note in file any numbering.

Underground Water: UW

Locate with string line as marked on ground or pavement. Note in file any numbering.

Water gate: PWGT

Locate with single shot on water main valve usually in pavement.

Water shutoff: PWSO

Locate with single shot on residents service valve usually in lawn or sidewalk.

SIGNING/SIGNALS:

Controller cabinet: PCCT

Locate with a single shot on top and note dimensions in book.

Loop detector: SD

Locate with a string line.

Mast arm pole: PMAP

Locate with a single shot, and then locate a “PMDF” below the end of mast arm.

Meter Pedestal: PMTR

Locate with a single shot.

Pullbox: PPBX

Locate with a single shot and note dimensions and material in book.

Sign - Single post: PSGN

Locate with a single shot. Note size, type, and message in book.

Sign - Double post: PSND

Locate with a single shot in the middle of posts. Note size, type, and message in book.

Sign - Billboard or other large sign (string feature): SN

Locate with a string line. Note size, type, and message in book.

Signal conduit: SC

Locate with a string line as marked on pavement or ground.

Street light conduit: LC

Locate with a string line as marked on pavement or ground.

Traffic signal without mast arm: PSGL

Locate with a single shot.

OTHER GROUND FEATURES:

Athletic Field: AF

Locate perimeter with a string line. Locate other features inside of area with a “FM” string and note in book.

Berm: BM

Locate perimeter with a string line. Fill in with level strings and spot elevations as needed.

Boulder: PBDR

Locate with a single shot on top. Note size in book.

Bush: PBUS

Locate with a single shot in center. Note type and size in book.

Cemetery: CM

Locate perimeter with a string line. Locate individual markers with “PGRV” code.

Gate: GA

Locate both end with a string line. Note type and height in book.

Gate post: PGPT

Locate with a single shot. Note type and size in book.

Ground light/yard light: PGLT

Locate with a single shot. Describe in book.

Flagpole: PFPL

Locate with a single shot at the roadside face. Note material and diameter of pole in book.

Gravestone: PGRV

Locate with a single shot. Note size in book.

Hedge: HE

Locate perimeter with a string line. Note height and type in book.

High water mark: HW

Locate with a single shot. Only use when specifically asked for by requester.

Intermittent or small stream: ST

Locate the center with a string line. Note average width in book.

Lamp post/private light pole: PLPT

Locate with a single shot at the roadside face. Describe in book.

Leach field: LF

Locate with a string line.

Mailbox: PMBX

Locate post with single shot. If a line of mailboxes (as trailer parks, etc.) use FM string and note in book. Note how many mailboxes.

Miscellaneous detail features - Point string: PMDF

Use to locate an object with a single point that does not have a code. Describe in book.

Miscellaneous detail features - Not at Ground: PMVF

Locate a single shot. This will have an elevation but will not be used for contours.
(i.e., ..elevation on a raised deck.)

Miscellaneous detail features - Feature string: FM

Use to locate an object with a string line that does not have a code. Describe in book.

Monuments/statues or other related items: PMON

Locate center with a single shot. Note size and type in book.

Ornamental features (flower beds; etc.): OR

Locate with a string line. Describe in book.

Parking Meter: PARK

Locate with a single shot. Describe in book.

Pool: QP

Locate with a string line. Note type, size, and height in book.

Post - all types: PPST

Locate center with a single shot. Note type, size, and height in book.

Ramp - Boat; etc.: RM

Locate with a string line. Note type in book.

Ridge line: RD

Locate with a string line.

Rock outcrop (*Left*): RO

Locate with a string line. Fill in with level strings and spot elevations as needed.

Rock outcrop (*Right*): RK

Locate with a string line. Fill in with level strings and spot elevations as needed.

Satellite dish: PDAT

Locate center with a single shot. Describe in book.

Septic Tank: PSTK

Locate center with a single shot. Describe in book.

Shore line - Left: SL

Locate with a string line.

Shore line - Right: SR

Locate with a string line.

Stockpile: SO

Locate footprint of pile with string line. Show top with level strings or spot elevations as needed. Describe type in book.

Stonewall: SW

Locate center with a string line. Note average width in collector. Use “L” string around wall.

Stump: PSTP

Locate center with a single shot. Note size in book.

Swamp/marsh or wet area: WA

Locate edge with a string line. This code is for non-delineated wetlands.

Top of slope: TS

Locate with a string line.

Tree - Coniferous: PTCS

Locate roadside face of tree. Note size and type in book.

Tree - Deciduous: PTDS

Locate roadside face of tree. Note size and type in book.

Vent pipe - Outlet: PVNT

Locate with a single shot. Note size and type in book.

Waterfall: WF

Locate perimeter of falls. Match to river or stream upstream and downstream.

Well: PWEL

Locate center with a single shot. Note size and type in book.

Wetland: WD

Use this code only if wetland has been flagged. Locate each flag and note number in book.

Woods line or brush line - Left: WL

Locate with a string line at the tree line. Locate a brush line with a separate string and note in book. (*Brush is defined as: Area of growth including grass, weeds, crops and trees measuring in circumference 12 in or less at a point 4 ft above the average ground.*)

Woods line or brush line - Right: WR

Locate with a string line at the tree line. Locate a brush line with a separate string and note in book (*Brush is defined as: Area of growth including grass, weeds, crops and trees measuring in circumference 12 in or less at a point 4 ft above the average ground.*)

ENVIRONMENT:**Invasive Species: VA**

Locate flagged or marked points as a string line. Note in book. This code also applies to Shoreland Protection Permit Delineations.

Monitoring Well: PMWL

Locate the center with a point or as instructed in survey request.

HOTL: VT

Locate flagged or marked points as a string line. Note in book.

MHT: VM

Locate flagged or marked points as a string line. Note in book.

OHW: VH

Locate flagged or marked points as a string line. Note in book.

Special Aquatic Site: VS

Locate flagged or marked points as a string line. Note in book.

TBZ: VZ

Locate flagged or marked points as a string line. Note in book.

TOB: VB

Locate flagged or marked points as a string line. Note in book.

TOBOHW: VO

Locate flagged or marked points as a string line. Note in book.

Vernal Pool: VP

Locate flagged or marked points as a string line. Note in book.

Wetland: WD

See above

PIT SURVEYS: (Survey use only):

Bottom of slope: BS

See above

Level string: L

See above

Limit of pit: LP

Locate perimeter with a string line.

Limit of work: LW

Locate with a string line

Old ground: OG

Locate with a string line.

Stockpile: SO

See above

Top of slope: TS

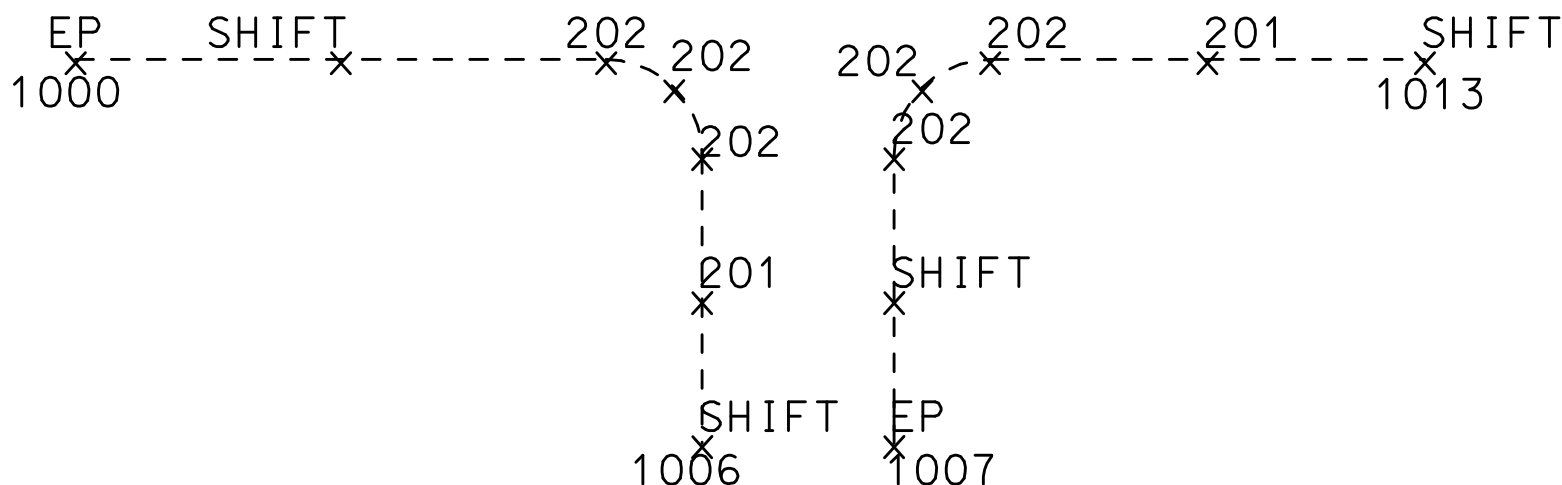
See above

CURVE FITTING

201/202 CODES

EXAMPLE OF CODES 201 & 202

(DO NOT SHIFT OUT OF 202 CODE)



203 CODES

NOTE: 203 REF. CODE NEW CODE ELEVATION OFFSET

UNDER OFFSET { + = RIGHT OR UP }
 { - = LEFT OR DOWN }

EXAMPLE TOP OF A 2 FOOT WIDE STONE WALL USING 203 CODE

NOTE: 203 SW L 0.0 1.0

NOTE: 203 SW L 0.0 -1.0

EXAMPLE TOP OF 0.5 FOOT HIGH STRAIGHT CURB USING 203 CODE

NOTE: 203 CR TC 0.5 0.05

EXAMPLE TOP OF 0.5 FOOT HIGH SLOPED CURB USING 203 CODE

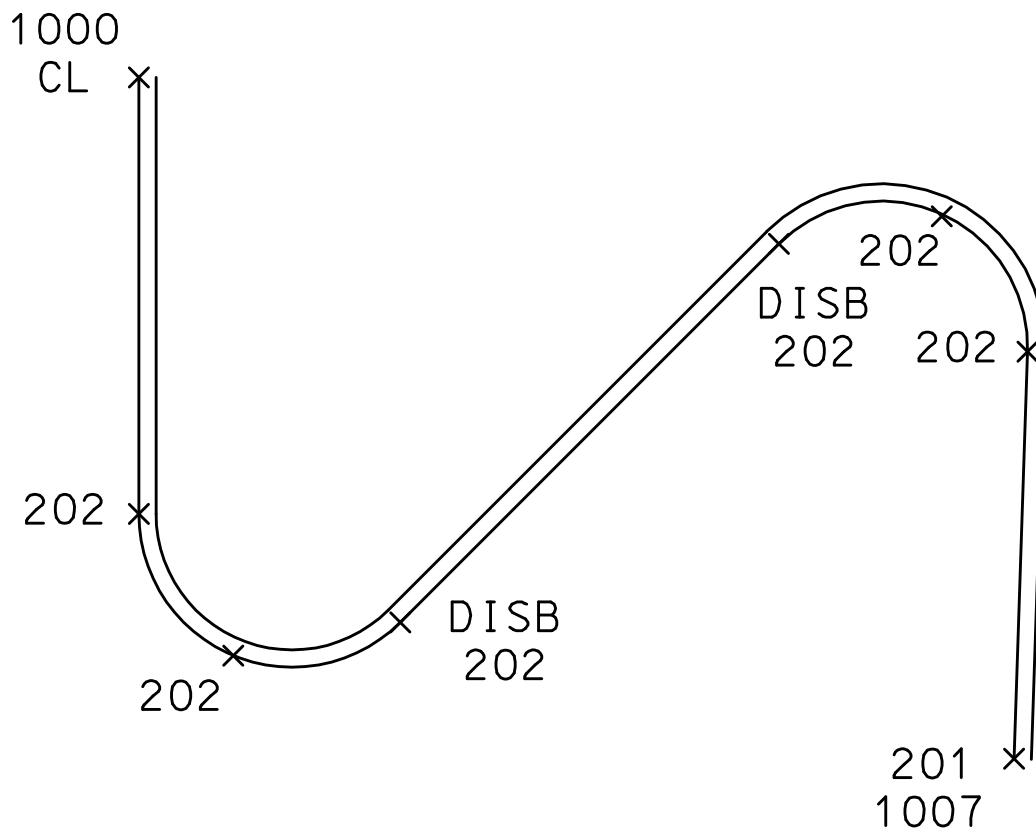
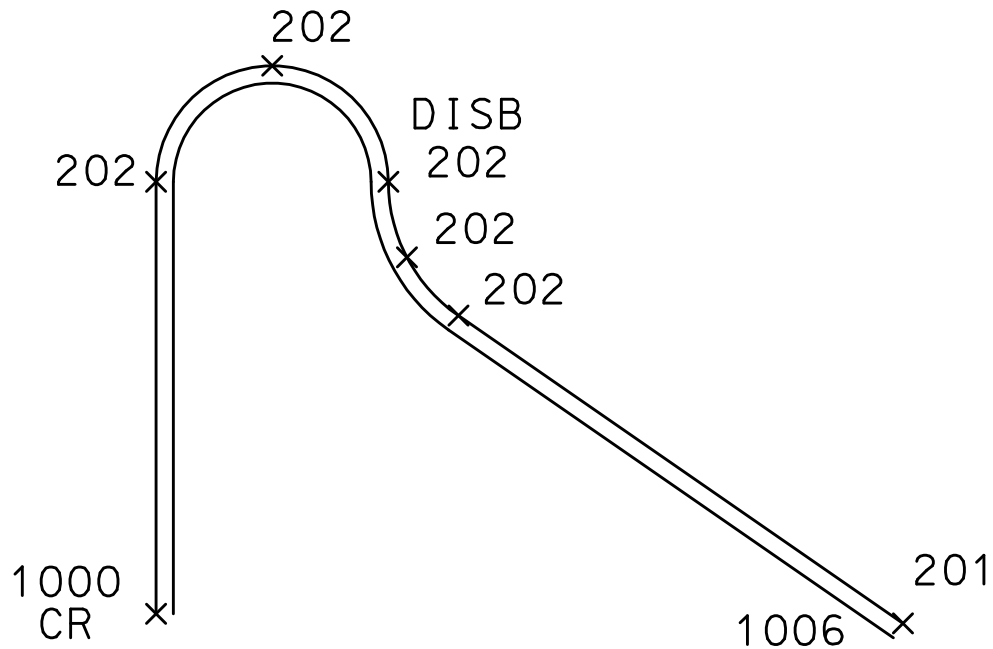
NOTE: 203 CL TC 0.5 -0.4

BEARING DISCONTINUITY

DISB CODE

DISB CODE IS A CODE TO CHANGE RADIUS OR DIRECTION OF A STRING LINE

EXAMPLE



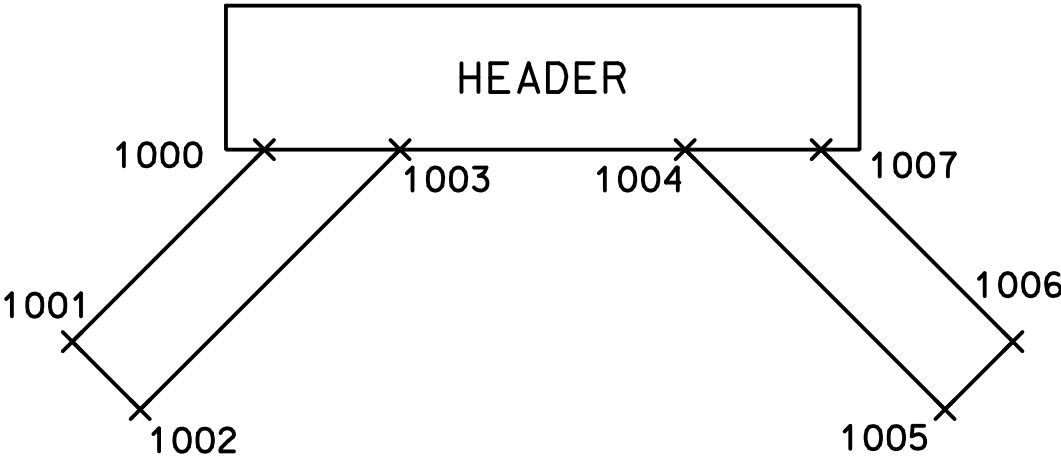
AUTOMATIC CLOSURE FEATURE

TO CLOSE STRING LINE

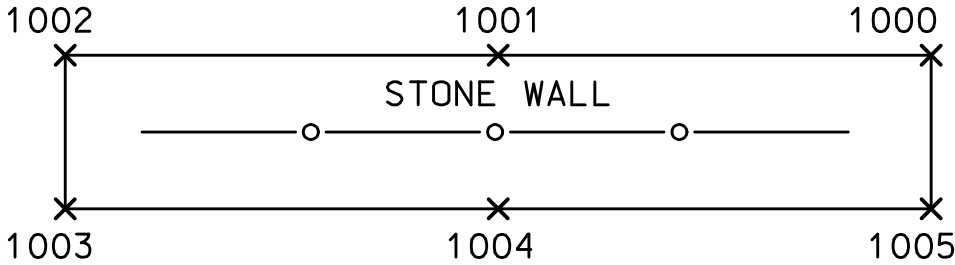
CLOS - CODE USED TO CLOSE A STRING LINE

EXAMPLE

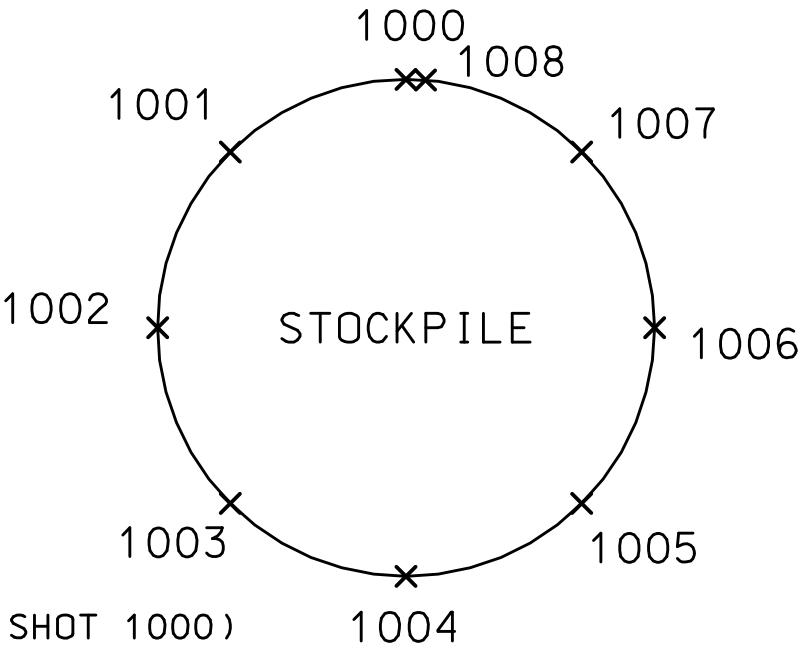
SHOT	CODE
1000	TH
1001	SHIFT
1002	ENTER
1003	CLOS
1004	TH
1005	SHIFT
1006	ENTER
1007	CLOS



SHOT	CODE
1000	L
1001	SHIFT
1002	ENTER
1003	ENTER
1004	ENTER
1005	CLOS



SHOT	CODE
1000	202 SO
1001	202
1002	202
1003	202
1004	202
1005	202
1006	202
1007	202
1008	202



(SHOT 1008 WILL CONNECT TO SHOT 1000)

CIRCLE FEATURE

CENTER CIRCUMFERENCE

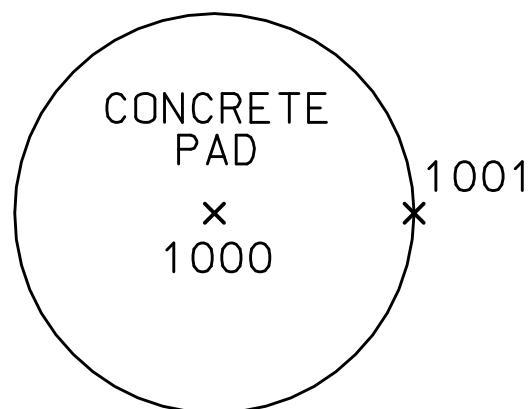
TO GENERATE A CIRCUMFERENCE USING 2 SHOTS

CR2S - GENERATES ELEVATION

CR2L - NULL ELEVATIONS TO ALL POINTS

EXAMPLE

SHOT	CODE
1000	CP CR2S
1001	CR2S



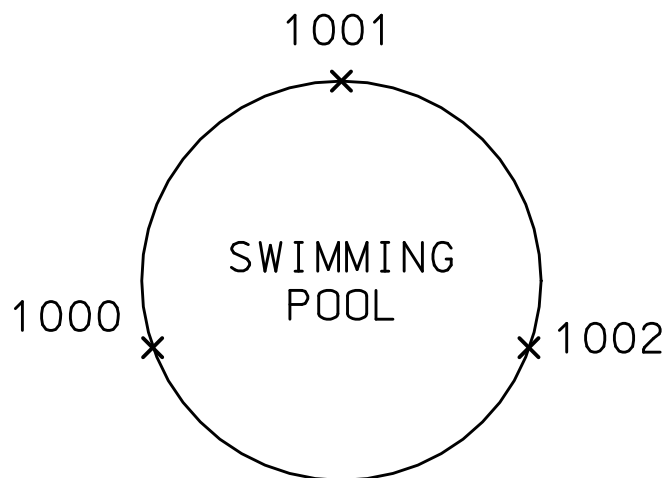
TO GENERATE A CIRCUMFERENCE USING 3 SHOTS

CR3S - GENERATES ELEVATION

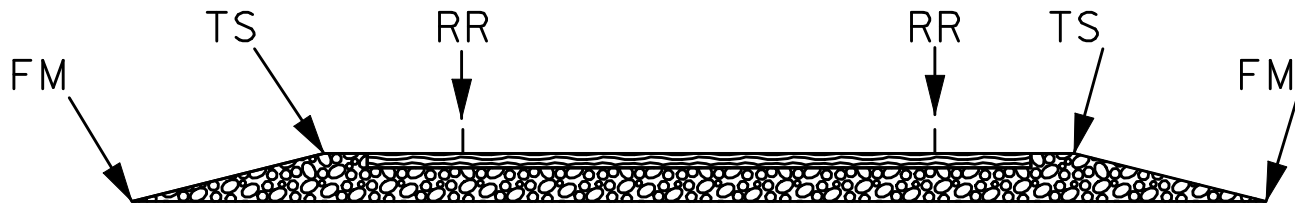
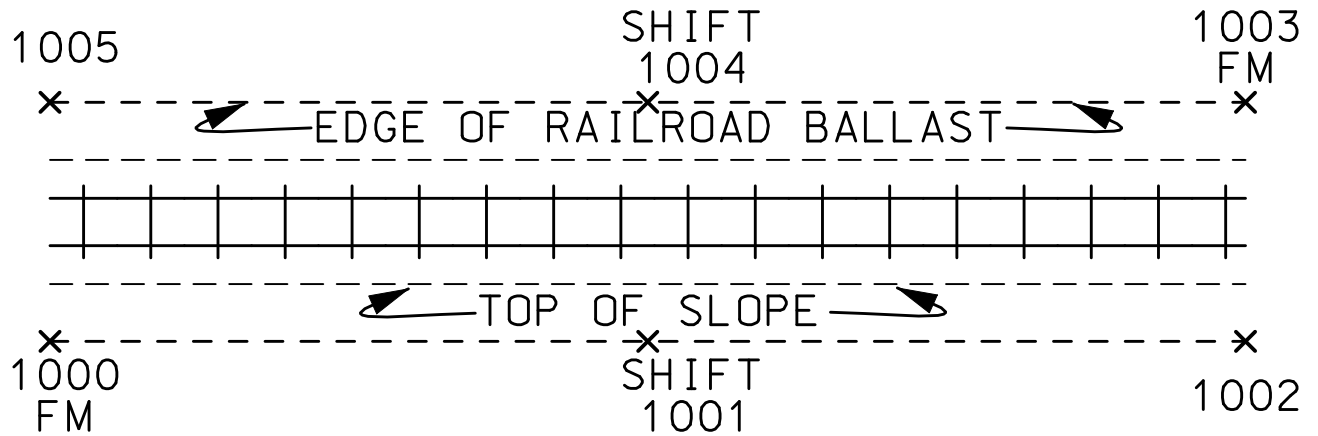
CR3L - NULL ELEVATIONS TO ALL POINTS

EXAMPLE

SHOT	CODE
1000	QP CR3S
1001	CR3S
1002	CR3S

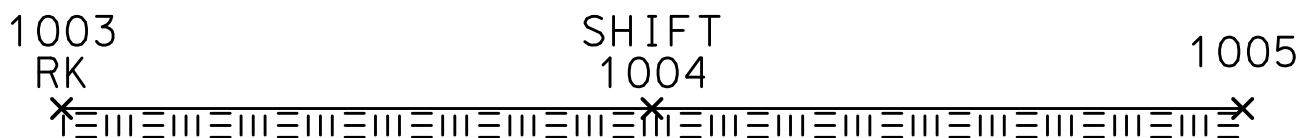


RAILROAD BALLAST LOCATION



ROCK OUTCROP

ROCK OUTCROP LEFT - RO



ROCK OUTCROP RIGHT - RK

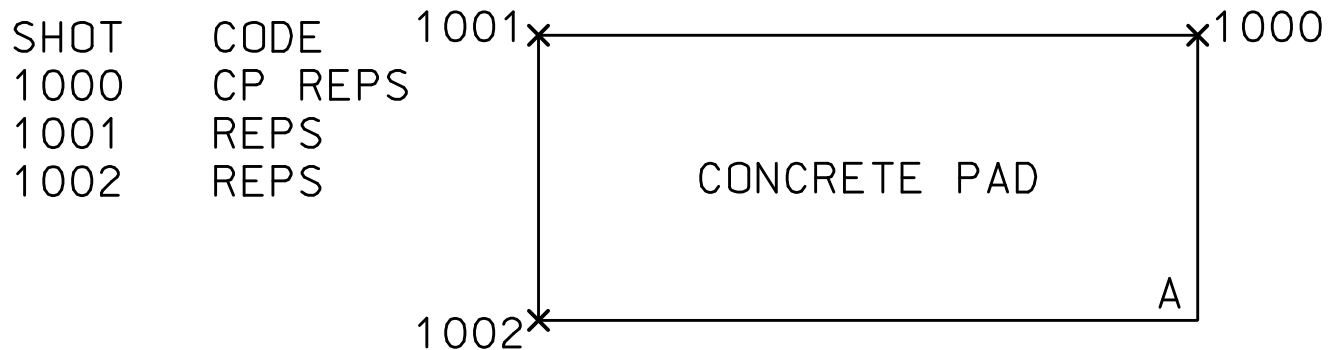
RECTANGLE FEATURE

TO GENERATE 2 CLOSING POINTS ON A RECTANGULAR OR SQUARED OBJECTS.

REPS - GENERATES ELEVATION

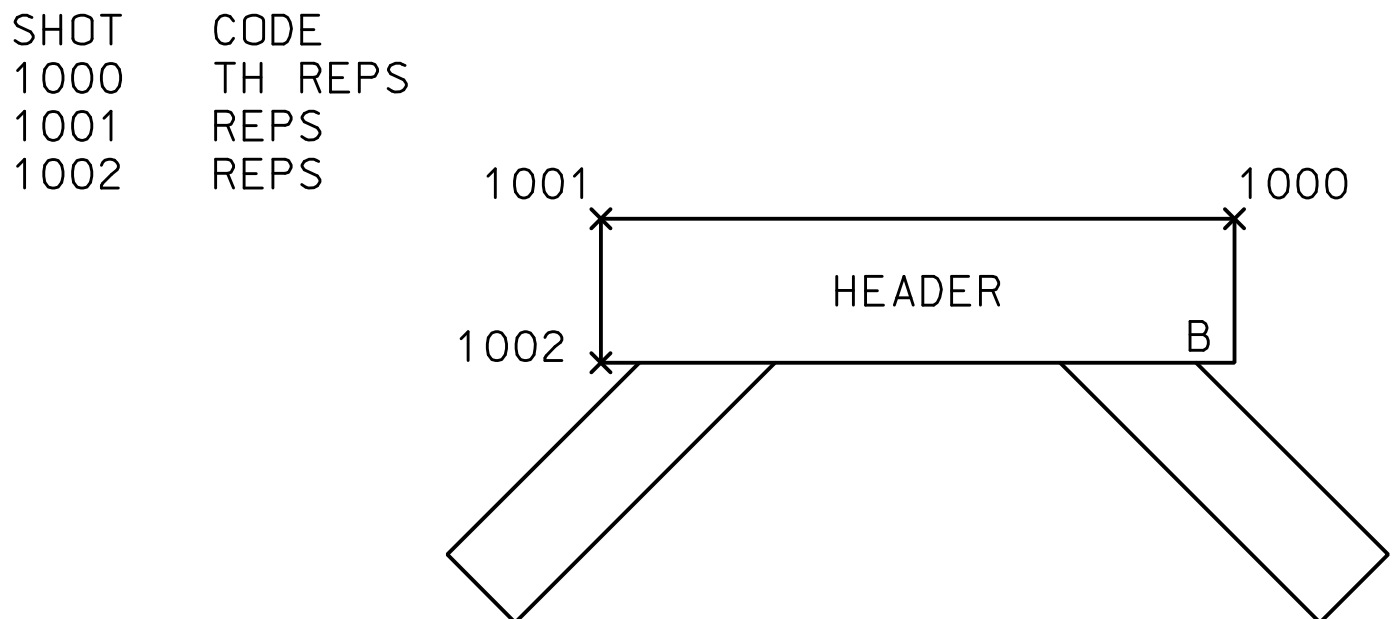
REPL - NULL ELEVATIONS FOR ALL POINTS

EXAMPLE



(POINT "A" WILL BE GENERATED AND STRING LINE WILL CLOSE OUT ON SHOT 1000)

EXAMPLE



(POINT "B" WILL BE GENERATED AND STRING LINE WILL CLOSE OUT ON SHOT 1000)

CENTER OF ROAD, TRAVELED WAY, & EDGE OF PAVEMENT

1000 EP ----- EDGE OF PAVEMENT 1001 SHIFT ----- 1002
X X X
1005 ----- 1004 SHIFT ----- 1003 TW
X X X

1006 CO 1007 SHIFT 1008
+ + +

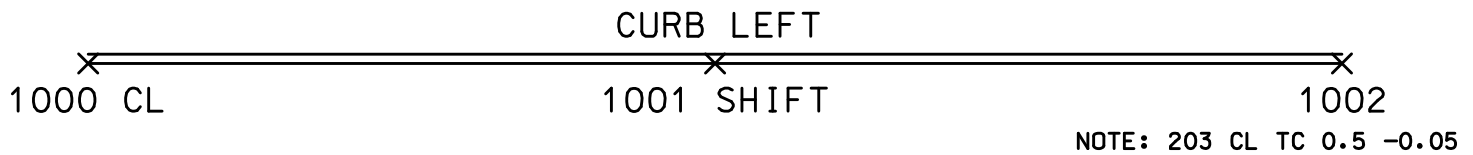
1011 ----- 1010 SHIFT ----- 1009 TW
X X X
1012 EP ----- 1013 SHIFT ----- 1014
X X X

ASPHALT & GRAVEL DRIVE

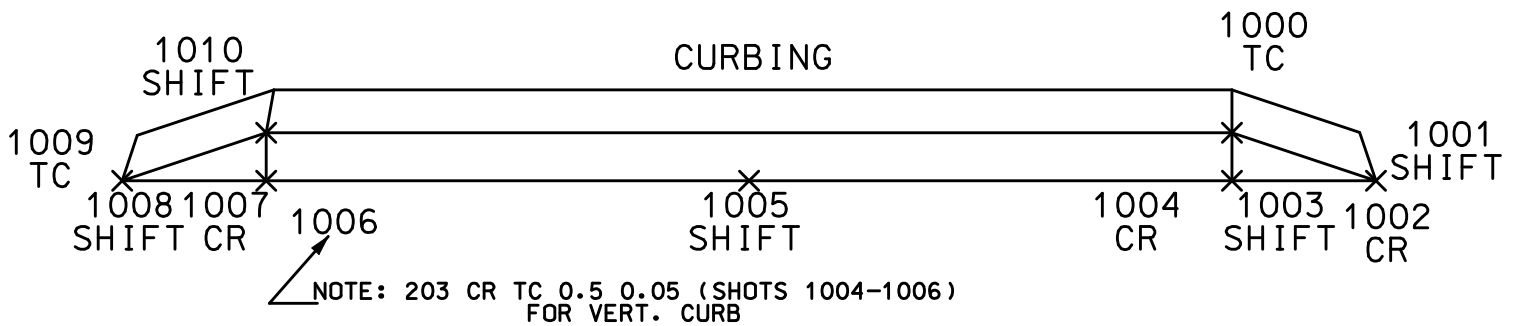
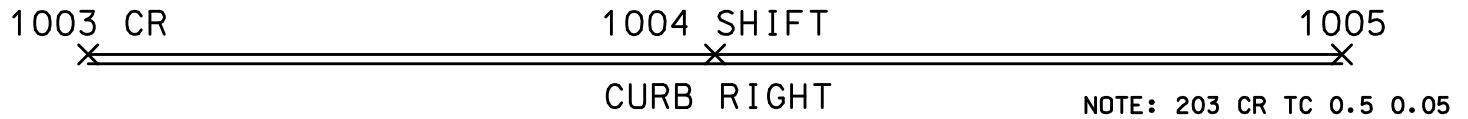
1000 EP 1001 SHIFT 1002
X X X
1003 DR 1008
X X
1004 SHIFT 1007
X X
1005 1006
X X
NOTE: DO NOT BREAK THE EDGE
OF PAVEMENT AT THE EDGE OF
DRIVEWAY. CONTINUE THE EP
ACROSS THE DRIVE AS ONE STRING.

1000 EP 1001 SHIFT 1002
X X X
1003 DR 1008
X X
1004 SHIFT 1007
X X
1005 1006
X X

CURB RIGHT, CURB LEFT, & TOP OF CURB



ROADWAY

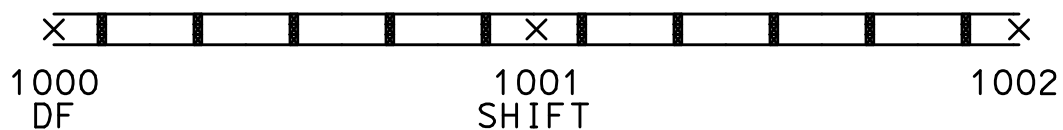


ALTERNATIVE METHOD: NOTE: FIRST AND LAST SHOTS ARE TIP DOWN

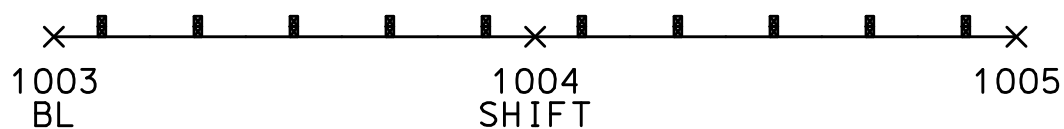
NOTE: DO NOT TAKE STRING LINE ON BACKSIDE OF CURBING

NOTE: IF TOP OF CURB IS NOT 203'd TAKE SHOTS OPPOSITE OF
BOTTOM OF CURB.

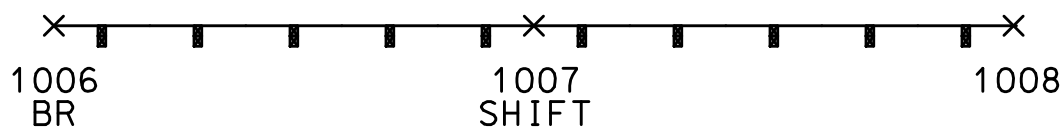
BEAM GUARD RAIL - DOUBLE FACE



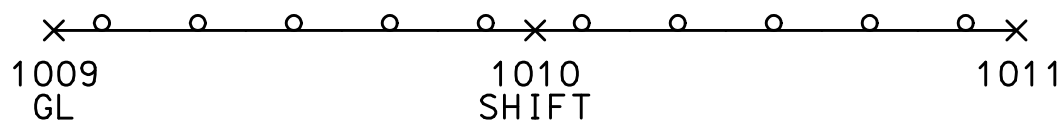
BEAM GUARD RAIL - LEFT



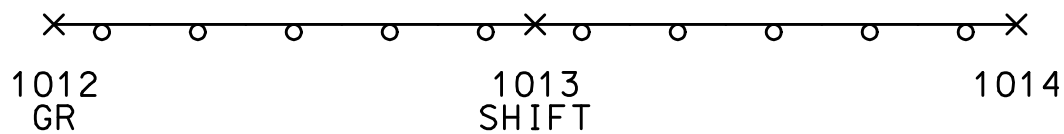
BEAM GUARD RAIL - RIGHT



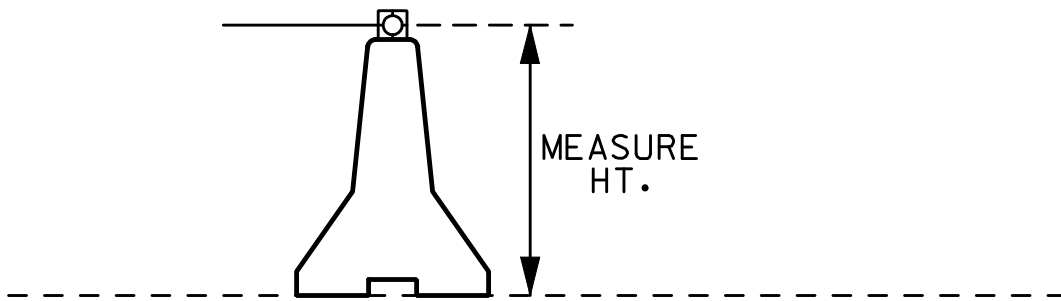
CABLE GUARD RAIL - LEFT



CABLE GUARD RAIL - RIGHT



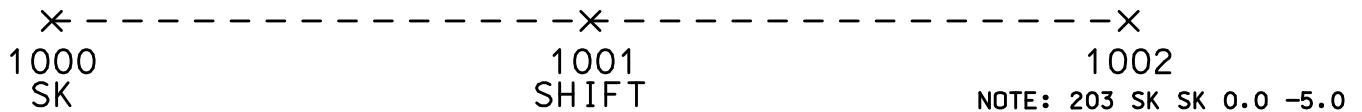
JERSEY BARRIER



NOTE: MEASURE FROM GROUND TO REFLECTOR, USE THIS AS ROD HEIGHT AND LOCATE JERSEY BARRIERS DOWN THE CENTER.

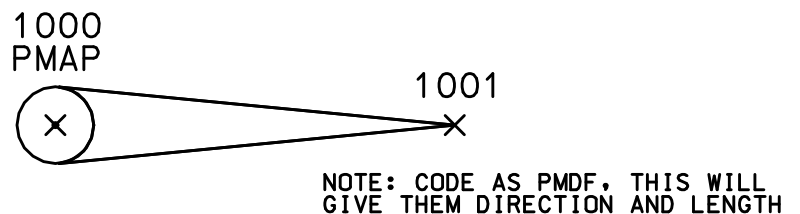
NOTE: TAKE AN "L" STRING AROUND THE BASE OF BARRIER IF ELEVATION DIFFERENT.

SIDEWALK



NOTE: IN BOOK TYPE CONCRETE, ASPHALT, ETC...
IF BOTH SIDES OF SIDEWALK ARE NOT UNIFORM SHOOT
OTHER SIDE INSTEAD OF 203

TRAFFIC SIGNAL MAST ARM POLE

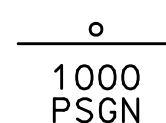
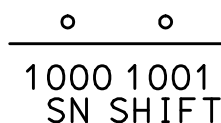
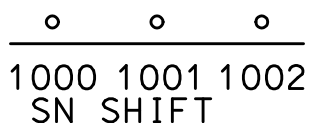


SIGNS

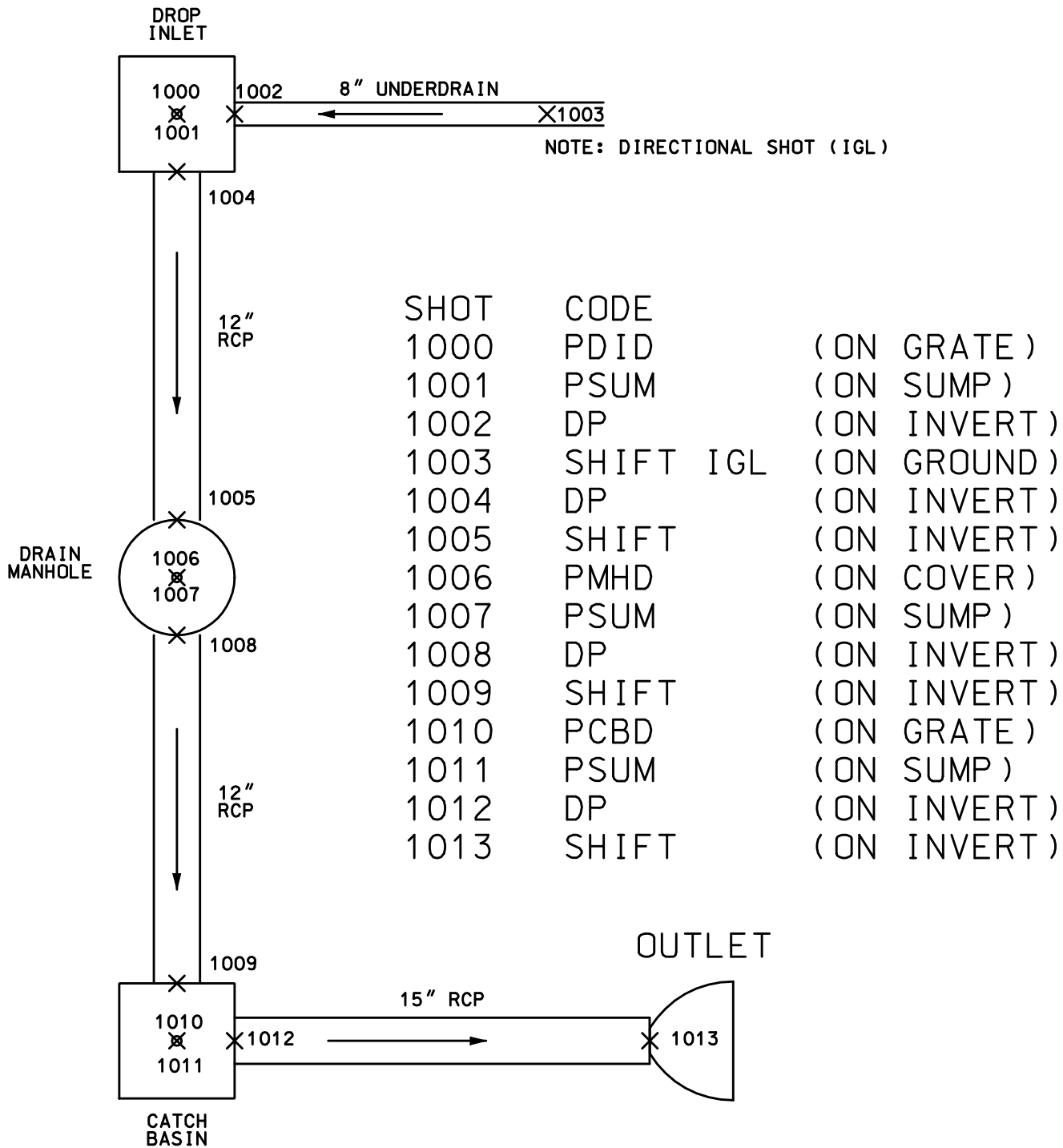
NOTE IN BOOK WHAT THE SIGN READS

TWO OR MORE POST SIGNS

SINGLE POST

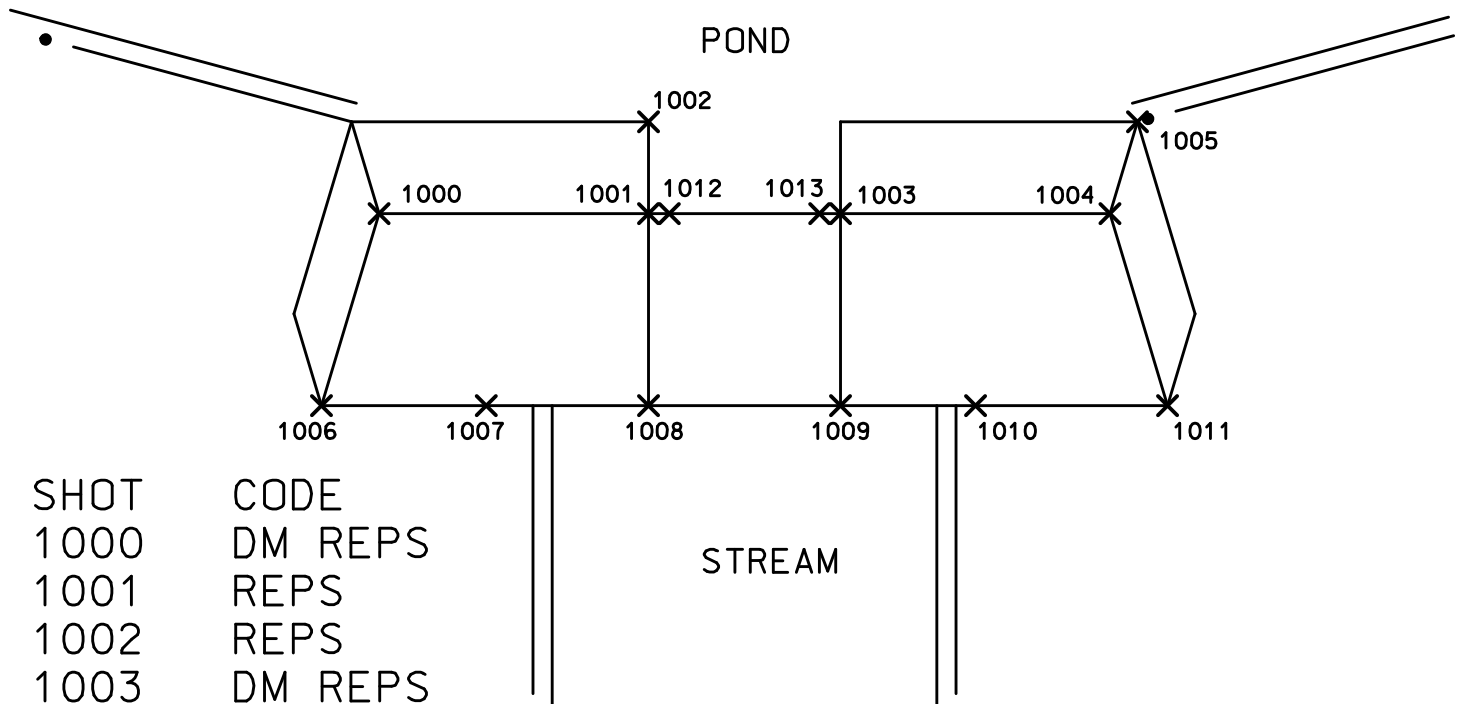


DROP INLET, SUMP, UNDERDRAIN, DRAIN PIPE,



NOTE SIZE & TYPE OF PIPES IN BOOK
NOTE END SECTION TYPE IN BOOK
DO NOT TO LOCATE
NOTE INTERIOR (SMOOTH/CORRIGATED)
FOR PLASTIC PIPE

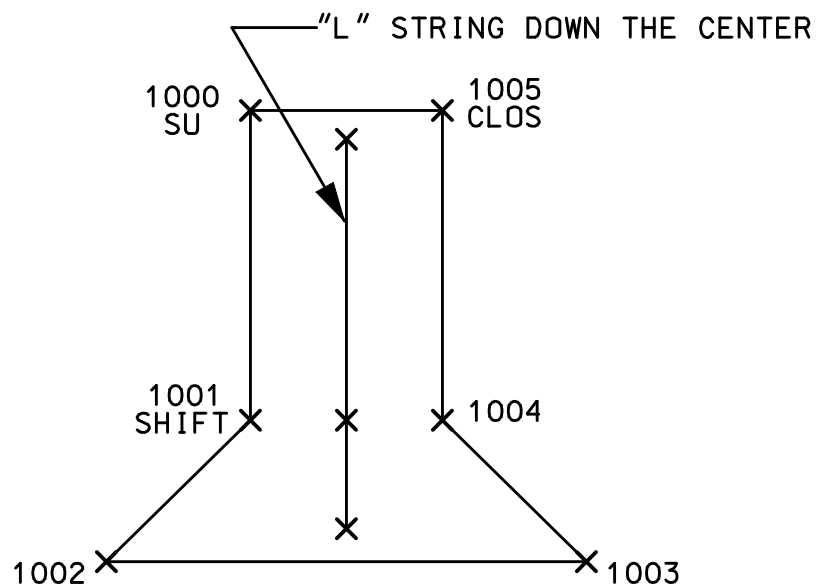
TOP OF DAM & BOTTOM OF DAM



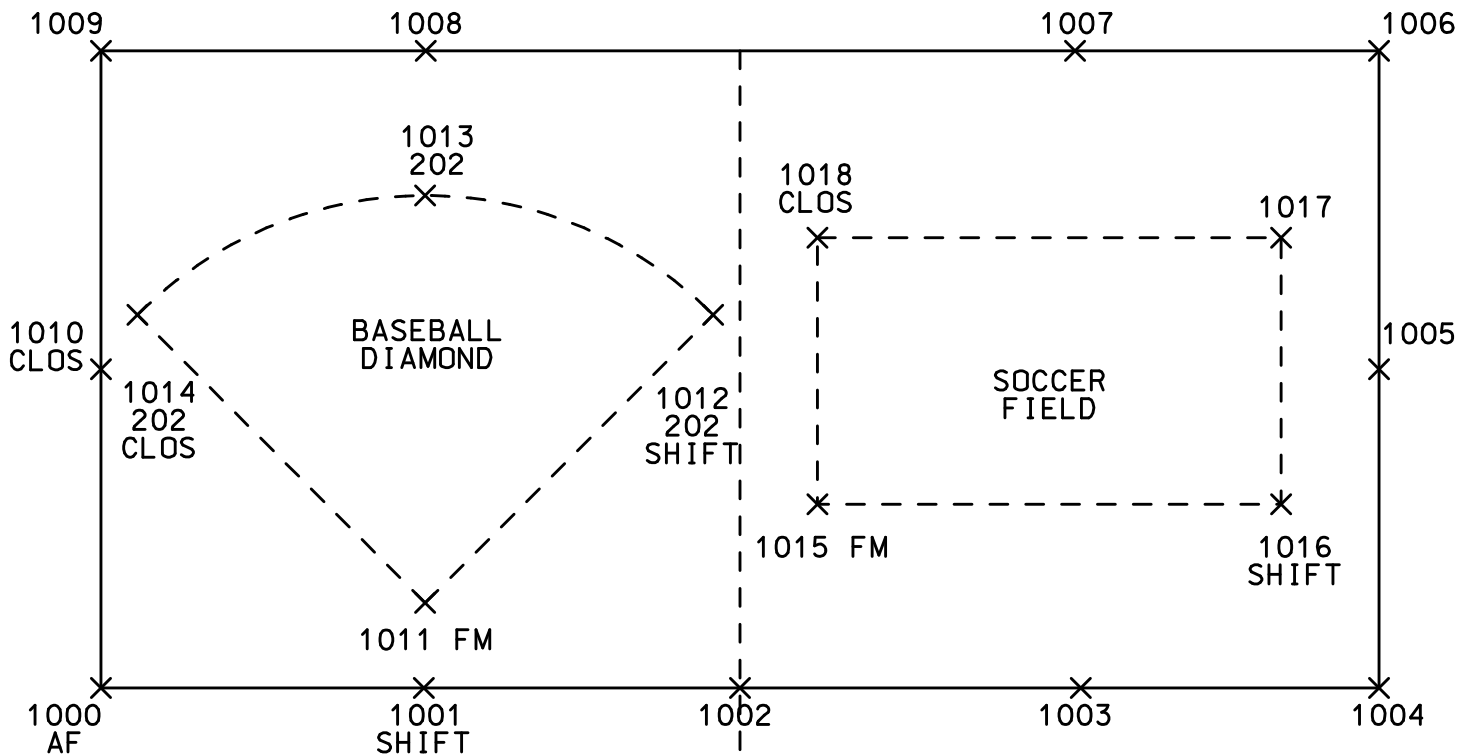
SHOT	CODE
1000	DM REPS
1001	REPS
1002	REPS
1003	DM REPS
1004	REPS
1005	REPS
1006	DB
1007	SHIFT
1008	ENTER
1009	ENTER
1010	ENTER
1011	ENTER
1012	FM
1013	SHIFT

NOTE IN BOOK SPILLWAY

SLUICeway

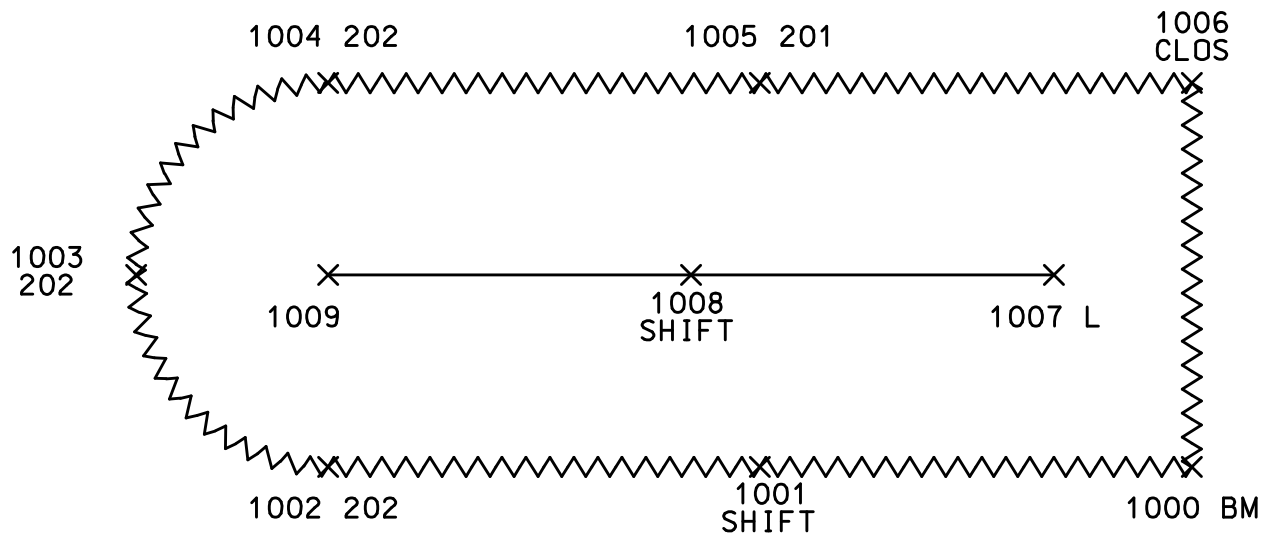


ATHLETIC FIELD

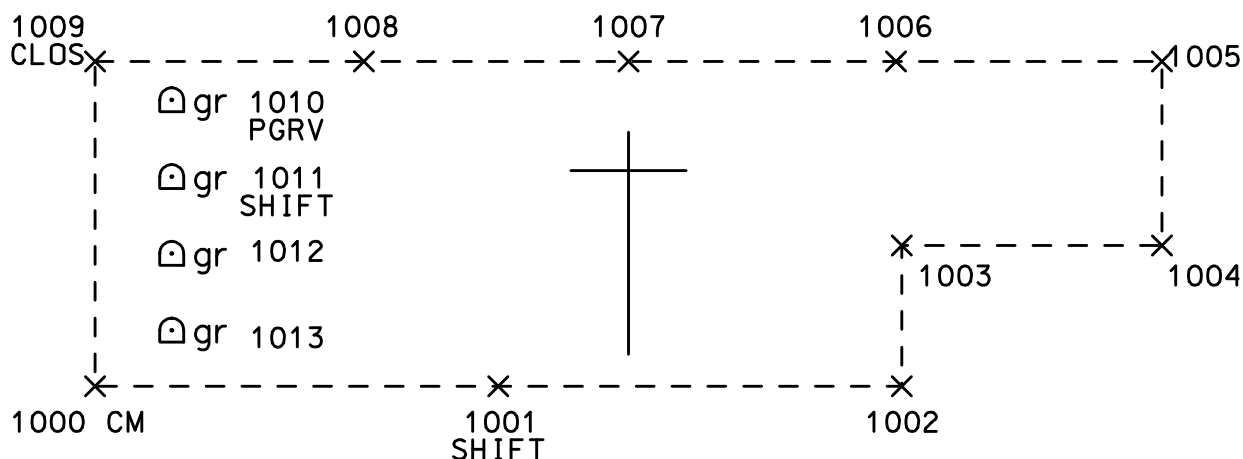


NOTE: LOCATE PERIMETER OF FIELD WITH AF STRING.
LOCATE OTHER FEATURES WITHIN FIELD WITH FM STRINGS AND
DESCRIBE IN BOOK

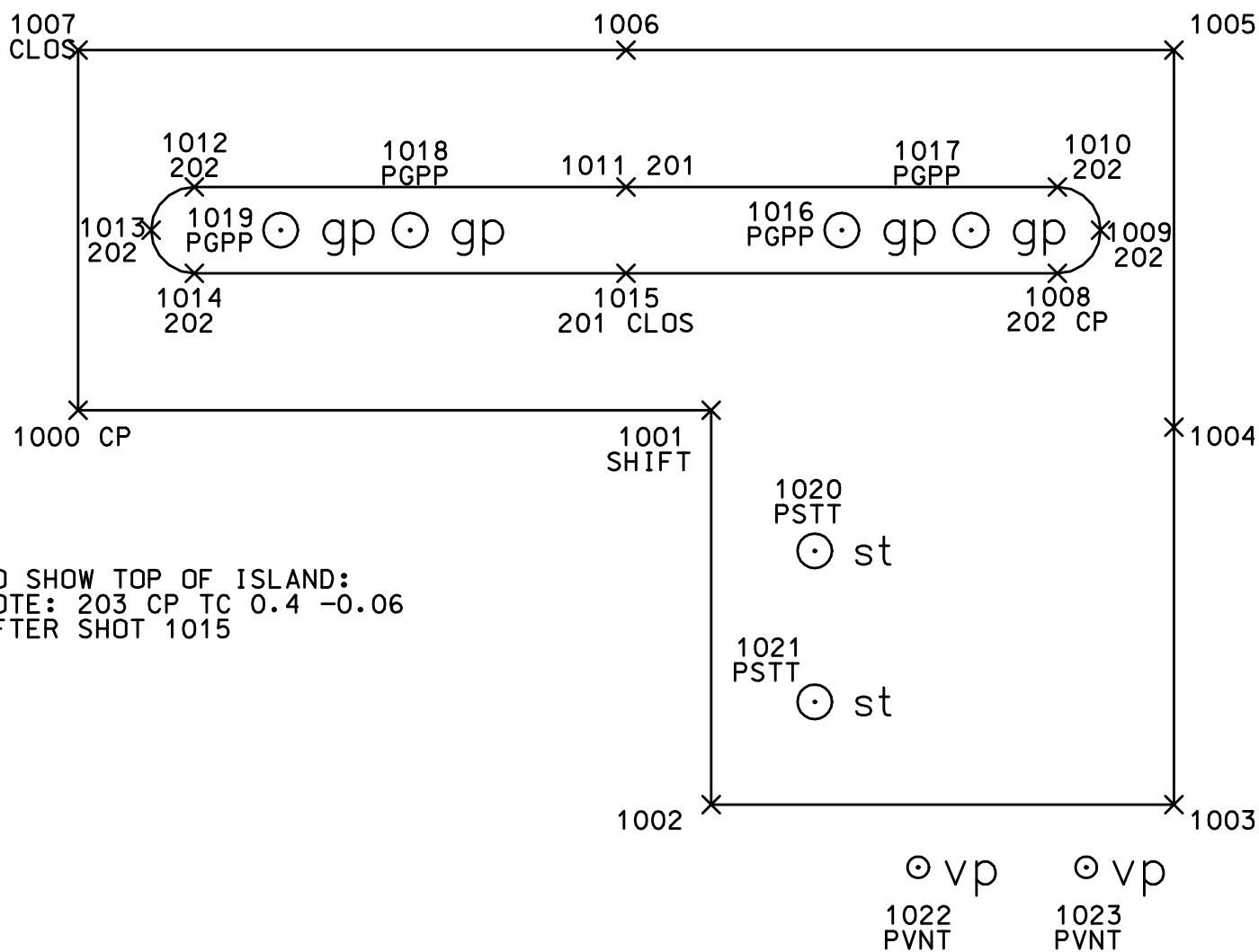
BERM



CEMETERY

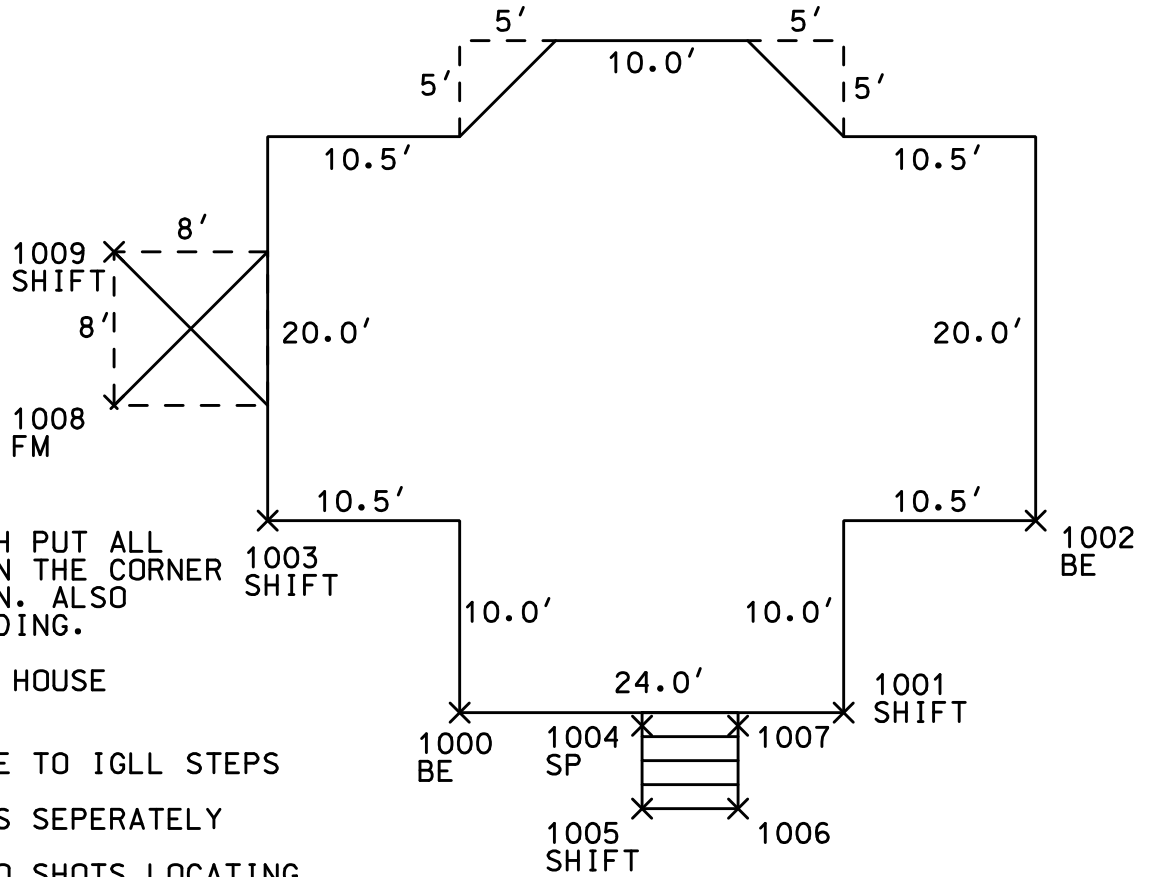


CONCRETE PAD, GAS PUMPS, STORAGE TANK FILL CAPS, & VENT PIPES



TO SHOW TOP OF ISLAND:
NOTE: 203 CP TC 0.4 -0.06
AFTER SHOT 1015

BUILDING, PORCH, DECK, & STEPS



NOTE: ON YOUR SKETCH PUT ALL
YOUR SHOT NUMBERS ON THE CORNER
WHERE THEY ARE TAKEN. ALSO
MEASURE UP THE BUILDING.

NOTE: SHOOT AS MANY HOUSE
CORNERS AS POSSIBLE

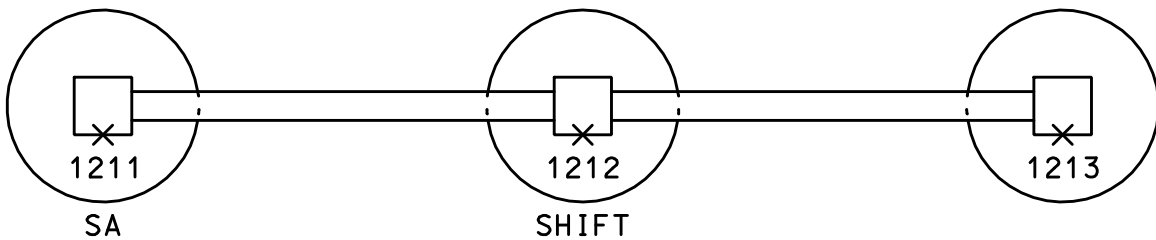
NOTE: YOU DON'T HAVE TO IGLL STEPS

NOTE: LOCATE PORCHES SEPERATELY

NOTE: YOUR FIRST TWO SHOTS LOCATING
A HOUSE OR BUILDING MUST BE
CONNECTING SHOTS

NOTE: LOCATE SILL WITH "PSIL" CODE.
LOCATE SILL AT ALL ELEVATION CHANGES

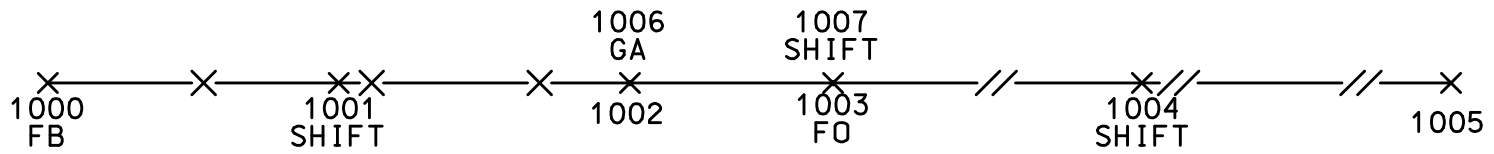
SOUND WALL



LOCATE CENTER LINE OF SUPPORT COLUMN
AT THE ROADSIDE FACE WITH A "SA" CODE
THIS LOCATION WILL BE ON TOP OF THE BASE PLATE

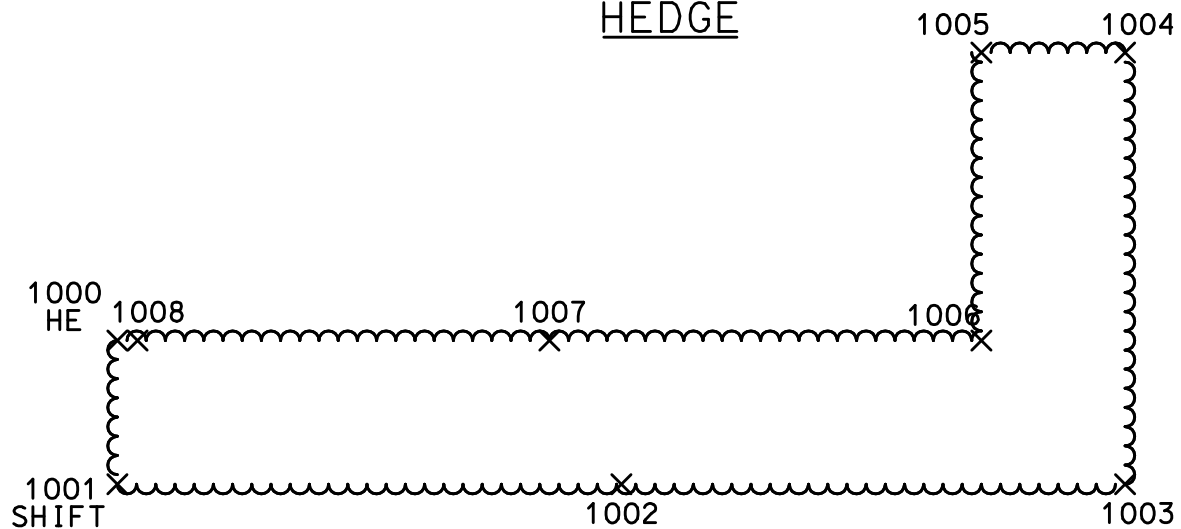
NOTE: SIZE AND MATERIAL OF COLUMN AND FOUNDATION
IN FIELD BOOK

GATE AND FENCES



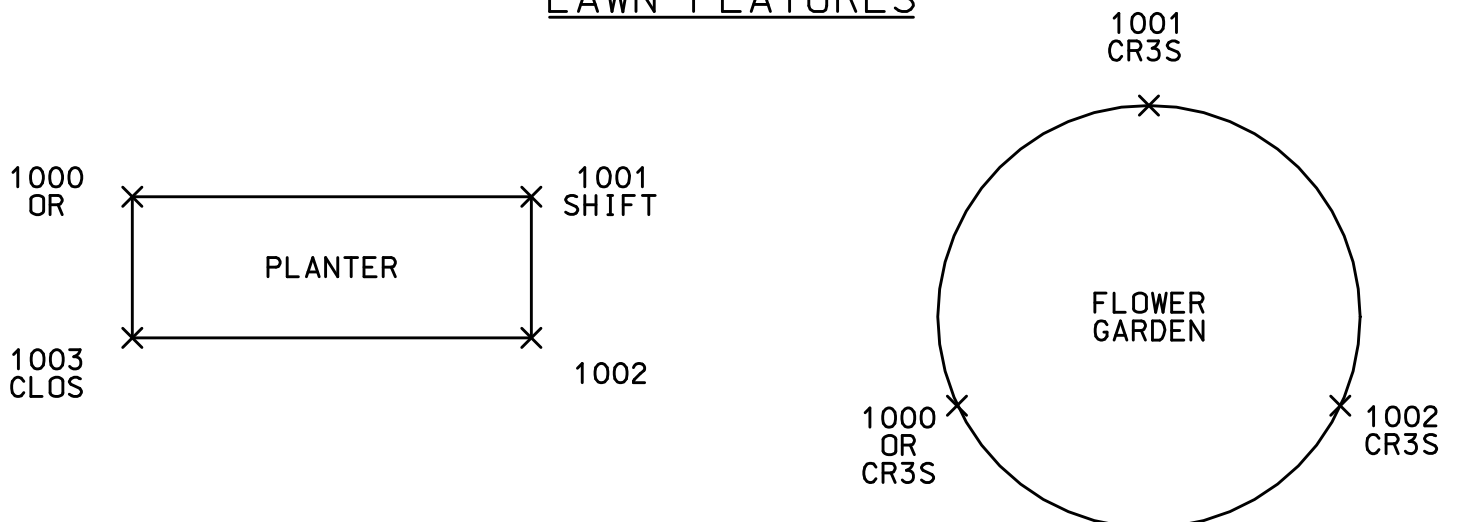
NOTE: HEIGHT AND TYPE OF FENCE IN BOOK

HEDGE



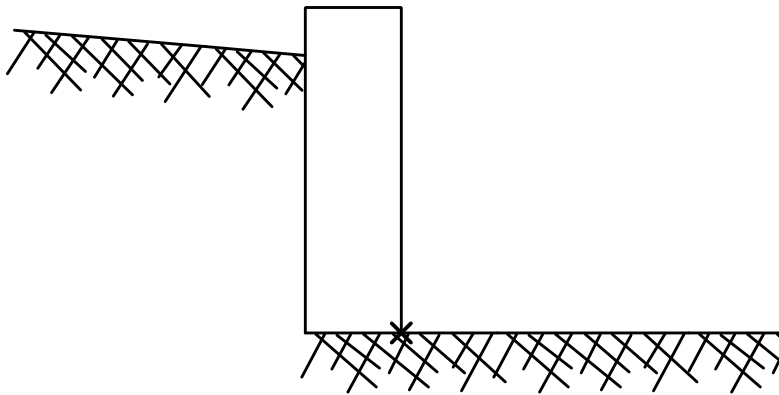
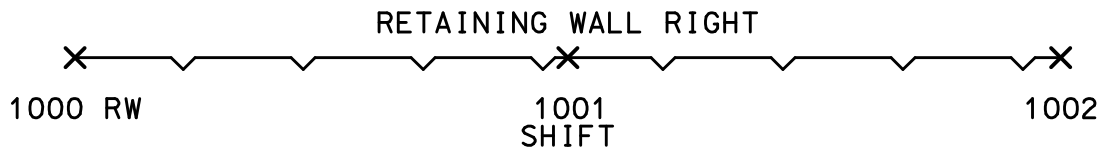
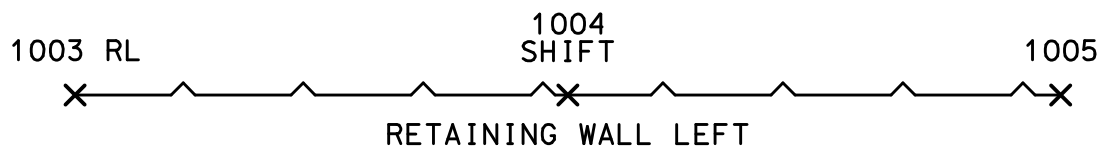
NOTE: HEIGHT AND TYPE OF HEDGE IN BOOK

LAWN FEATURES

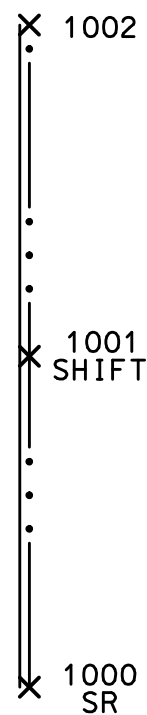
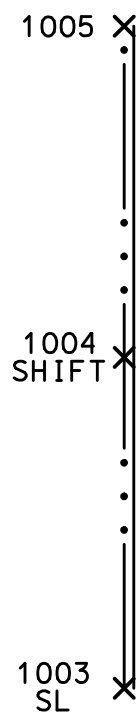


NOTE: TYPE AND DESCRIBE FEATURE IN BOOK

RETAINING WALL

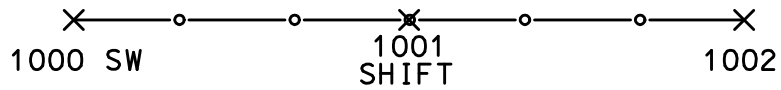


SHORELINE



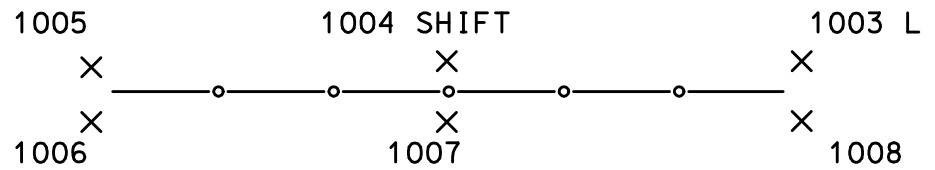
STONEWALL

SHOT	CODE
1000	SW
1001	SHIFT
1002	



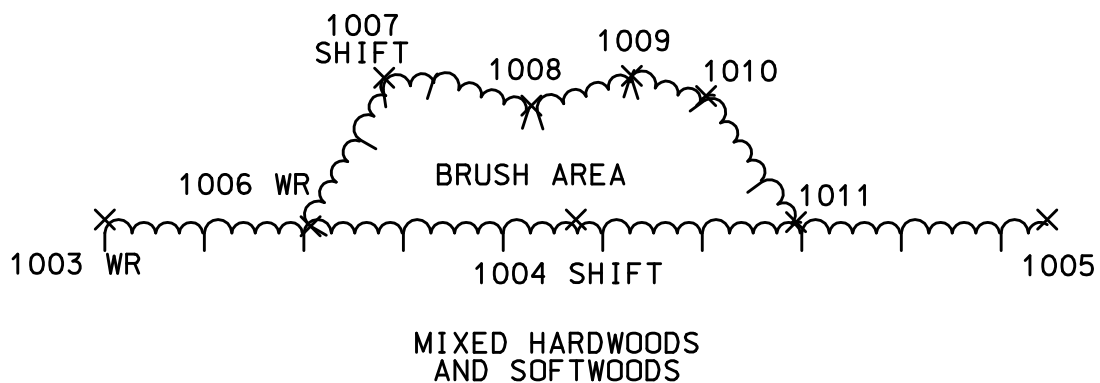
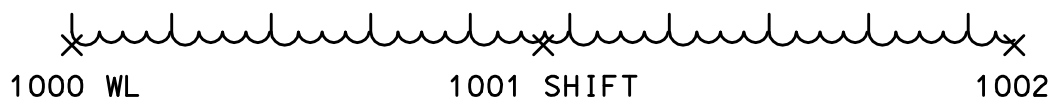
NOTE: 203 SW L 0.0 1.0

NOTE: 203 SW L 0.0 -1.0



NOTE: MAKE SURE WALL TOP IS NARROWER THAN BASE
TAKE "L" STRING AT THE BASE OF WALL

WOODS OR BRUSH Locate at Trunk Line



OFFSET CALCULATION

