STATIC PILE LOAD TEST MANUAL

Geotechnical Control Procedure GCP-18

July 1999

GEOTECHNICAL ENGINEERING BUREAU
New York State Department of Transportation
State Campus, Albany, New York 12232

INTRODUCTION

This manual presents uniform procedures for statewide conduct and reporting of results of static pile load tests, in conformance with NYSDOT specifications requirements. These tests have three primary objectives:

- To establish load-settlement relationships in the pile-soil system,
- To determine capacity of the pile-soil system, and
- To determine load distribution in the pile-soil system.

These tests will confirm design assumptions or help modify those assumptions, possibly reducing or extending proposed pile length. Three types of static load tests are described:

1. ***The Incremental-Static-Load Test*** to determine load-settlement relationships and load distribution.

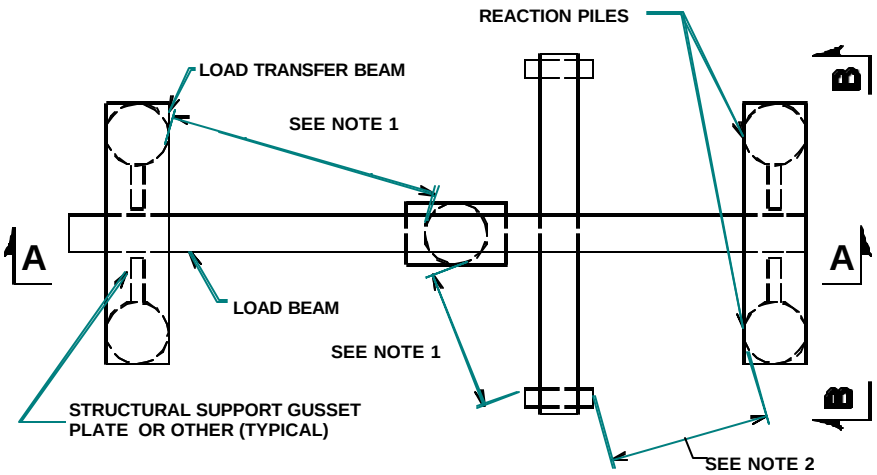
2. ***The Constant-Rate-of-Penetration Test*** for quick determination of the capacity of the pile-soil system, and

3. ***The Quick Load Test***, also for rapid determination of pile-soil system capacity.

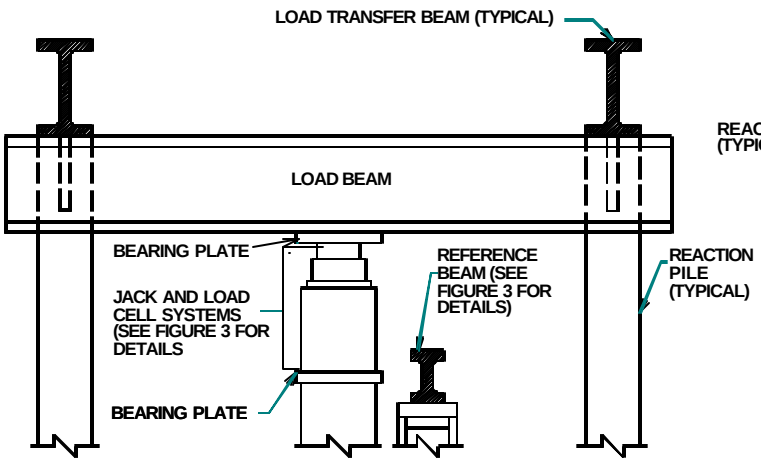
The Contractor is required by the testing specification to engage the services of a Professional Engineer licensed in New York State, experienced in all aspects of pile load testing and acceptable to the Deputy Chief Engineer (Structures), identified here as "the DCES," to perform the load tests and to prepare a final report of test results, as outlined here in Chapter VI. The Contractor's agreement with the Professional Engineer should provide for additional technically qualified personnel to be at the test site at all times during testing to assure that loads are being maintained and to record data.

Figure 1. Typical setup for a reaction frame

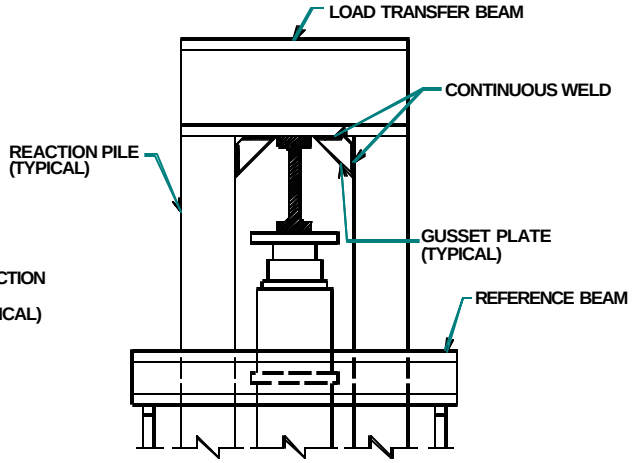
PLAN (not to scale)



SECTION A-A



SECTION B-B



NOTES

1. The minimum distance between the face of the test pile and the face of any supports for reaction loads or measurement systems shall be three meters or ten test pile diameters whichever is greater.
2. The minimum distance between the face of any reaction supports and any supports for the measurement system shall be three meters or ten test pile diameters whichever is greater.
3. The load beam for a reaction frame may bear on the load transfer beams with no connections. The load beam may need stiffeners at the points of bearing. The beam may need truss work or stiffening (not shown) to prevent excessive bending and resulting ram extension in excess of

seventy-five (75) percent of the maximum travel of the jack.

I. PILE TEST LOADS AND LOAD APPLICATION SYSTEMS

A. TYPES OF REACTION LOAD

Applied the load to the pile by jacking against a reaction with one or more hydraulic jacks. The reaction is provided by one of the following two methods, or a variation approved in writing by the DCES.

1. Reaction Frame

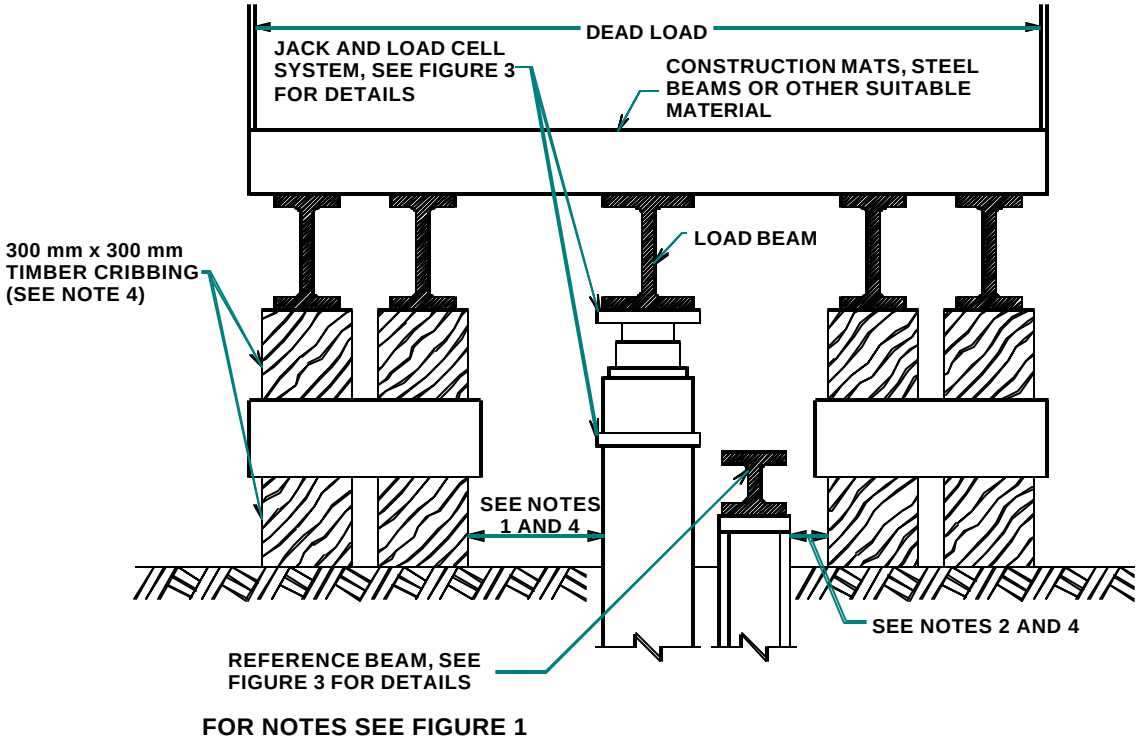
Drive two or more reaction piles, after the test pile, for the reaction frame (Fig. 1). Locate these supports not less than 3 m or 10 pile diameters (whichever is greater) from the test pile or reference beam supports. Measure these distances between the faces of the test pile and reaction piles. Select girders of sufficient strength and section for the load and load-transfer beams that are attached to the upper ends of the anchor piles. Design the reaction frame to resist four times the pile design load shown on the plans, without undergoing a magnitude of deflection exceeding 75 percent of maximum travel of the jack.

2. Weighted Box or Platform

Construct a test box or test platform (Fig. 2) over the test pile, supported on cribbing or on other piles installed after the test pile. Located these not less than 3 m or 10 pile diameters (whichever is greater) from the test pile or reference beam supports. Measure these distances between the test pile face and the nearest face of the cribbing or pile supports. A greater spacing between the cribbing supports and test pile or reference system may be required to prevent foundation stresses caused by the cribbing from affecting the test. If this greater spacing is not feasible due to space or other limitations, a pile-supported platform or reaction frame may be necessary. Load the test box or platform with earth, sand, concrete, water, pig iron, or other suitable material to a total weight of at least four times the pile design load shown on the plans.

3. Tie-downs

Figure 2. Typical setup for a dead load reaction



Tie-downs or anchors may be used to supplement or replace the reaction loads. Design the anchors with sufficient free length so as not to interfere with the load test pile or the reference system.

4. Alternative Methods

The Contractor may request approval to apply the reaction load by another method. In that case, submit in writing a summary of the alternative loading system with appropriately detailed drawings for approval by the DCES.

B. LOAD APPLICATION SYSTEM

Apply load with one or more hydraulic jacks, having a capacity of at least four times the pile design load shown on the plans. Use jacks with a minimum travel of 150 mm, but not less than 25 percent of the test pile's maximum cross-section dimension. Equip the jack(s) with spherical bearing plates, to bear firmly and concentrically against the pile bearing plate and load-beam bearing plate. Use an automatic load-maintaining pump with manual supplement to control load application. Use a pressure gage for the

jack so that the pressure reading corresponding to the pile design load shown on the plans is between one-fourth and one-third of maximum gage pressure. Place a load cell (either electric or hydraulic, unless one or the other is specified in the contract documents) as shown in Figures 1 and 2 to measure strains for load monitoring during the load test. Arrange and construct the elements of the load-application system as follows:

1. Cut off the pile butt and cap it so as to provide a level bearing surface perpendicular to the pile axis. Use a steel plate for H-piles and empty cast-in-place piles, or a neat cement paste for concrete piles, timber piles, or cast-in-place piles filled with concrete.

2. To distribute load over the pile's entire cross-section, place a solid steel billet of sufficient thickness (under no circumstances less than 25 mm) as a bearing plate between the capped pile and the jack base.

3. Place the hydraulic jack system (including spherical bearing and load cell) between the bearing plate on the pile and the center of the underside of the load beam.

4. To distribute load over the entire width of the load beam, place another solid steel billet of sufficient thickness (also no less than 25 mm) as a bearing plate between the load beam and the hydraulic jack system.

5. Construct the system so that all components are centered along the pile's longitudinal axis, to ensure application of a concentric axial load.

6. Immediately before starting a load test, verify that at least 25 mm of clear space exists between the upper bearing plate and load beam, or the upper bearing plate and hydraulic jack system.

II. MEASURING APPARATUS AND SITE PROTECTION

Provide apparatus for measuring settlement consisting of a primary system, at least one auxiliary system, and a network of settlement reference points. Establish two fixed independent benchmarks at least 15 m from the test site to monitor the settlement reference points. If desired, the auxiliary system may also be referenced to these benchmarks. Clearly identify all measuring devices, scales, and reference points with numbers or letters to ensure accurate data recording.

A. PRIMARY SYSTEM

1. Measuring Devices (Fig. 3)

Provide one of these primary instrument packages to monitor movement of the pile top:

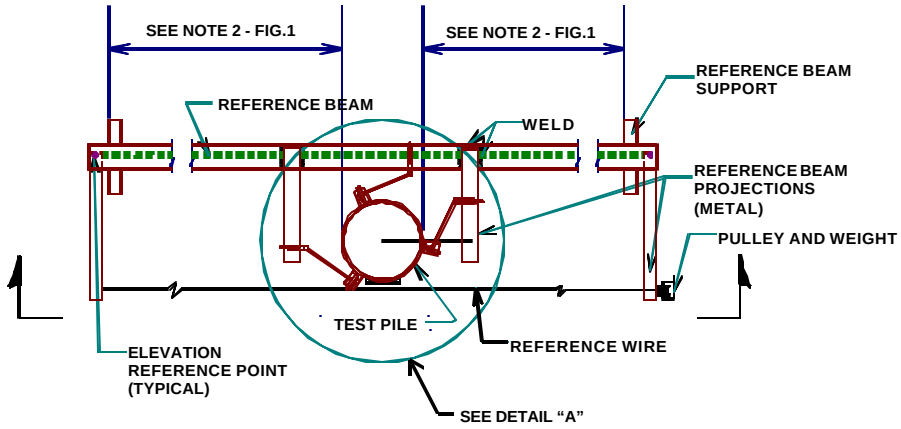
- Three linear variable differential transformers (LVDTs) and a readout unit. Use DC/DC-type displacement transducers having at least 150 mm of travel and a linearity of 0.5 percent or less. Supply a readout unit having a minimum display of 3-1/2 digits, capable of monitoring output from at least three DC/DC-type LVDTs.

- Three dial gages having at least 50 mm of travel, an adequate number of suitable gage blocks to increase the travel to at least an additional 100 mm, and a precision of 30 µm.

Align the measuring devices parallel to the longitudinal axis of the test pile and the axis of load application. Attach the devices to a simply supported reference beam, completely independent of the test pile and loading apparatus. Embed the reference beam supports at least 3 m into the ground, at a horizontal distance of not less than 3 m or 10 pile diameters (whichever is greater) from the closest face of the test pile and from any reaction piles or supports for the weighted box or platform. Maintain a clear distance of 150 to 300 mm from the test pile to the reference beam or any projection used to support a dial. The beam and projections should be at about the same elevation as the attachments to the pile on which the measuring devices will bear. Attach the dial gage supports to the reference beam so as to allow the stem of each device to rest on an attachment to the pile sides. To mount hardware and pile attachments for

Figure 3. Typical setup for measuring systems

PLAN



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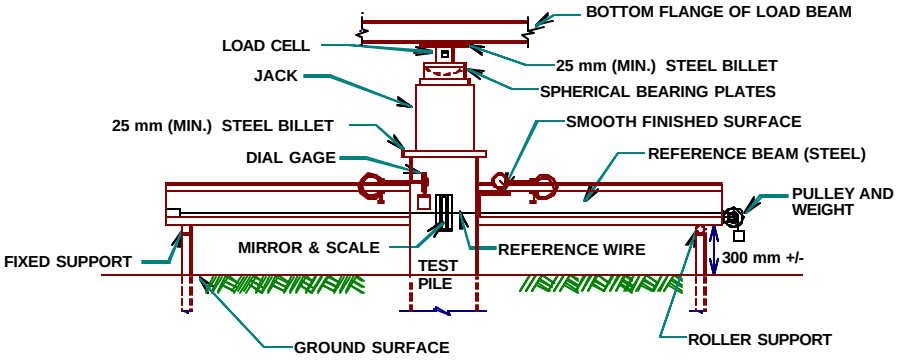
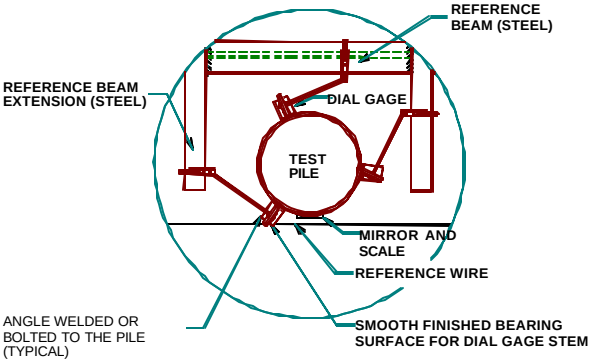
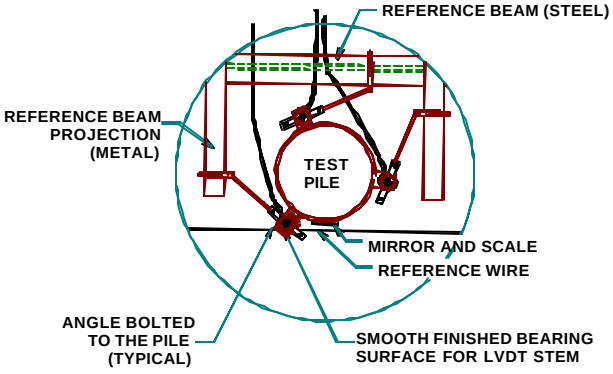


DETAIL A FOR DIAL GAGES



DETAIL A FOR LVDTS



LVDT devices, use such materials as brass, aluminum, or 303 Series stainless steel, to avoid magnetic interference with the instruments. The pile attachments are angles, about 75 x 100 mm with the 100-mm dimension projecting from the pile. For round piles, place these attachments on the perimeter of the pile at a 120E spacing and an equal radial distance. For piles of other cross-section, place the attachments convenient locations as approved by the Engineer. Surfaces on which the gage stems bear should have a smooth finish, such as glass or sheet acrylic, attached by an epoxy or other suitable material approved by the Engineer.

2. Telltale Strain Measurements (Figs. 4, 5, 6)

Strain measurements on the pile to determine elastic shortening of the pile may be required by a special note in the contract documents. Telltales may be required at one or more points along the pile as shown on the plans or designated by the DCES. Attach the telltale measuring devices to the reference beam. The readings will be used to determine net settlement of the point(s) of investigation, from which elastic shortening will be calculated.

B. AUXILIARY SYSTEMS

These measuring systems consist of one or more of the following: wire, mirror, and scale; surveyor's level and target rod; or, as alternatives, electrical or optical levels.

1. Wire, Mirror, and Scale (Fig. 3 Detail A)

Determine pile movement by means of a single strand of wire drawn in front of a graduated scale mounted on a mirror. This scale, at least 150 mm long and machine-divided in graduations of 250 µm, is mounted on a 75- x 150-mm mirror with metal-and-glass bonding adhesive or electrical tape. Attach the mirror directly to the pile, oriented so that the mirror face is parallel to the reference beam. Mount the wire between the ends of the reference beam, with one end fixed and the other placed over a pulley with a weight to maintain tension. Locate the wire so that it is level and within 20 mm of the mirror face.

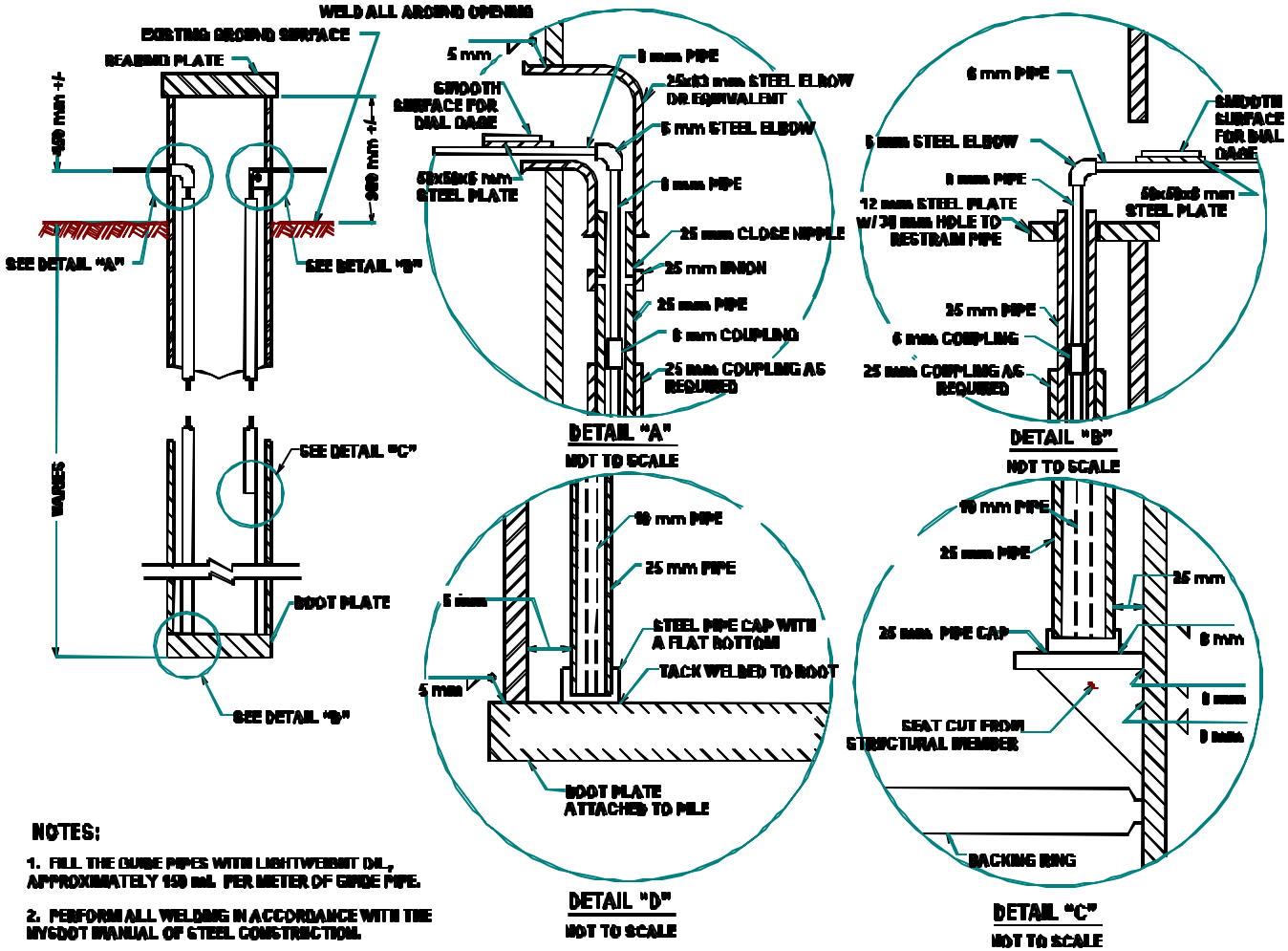
2. Surveyor's Level and Target Rod

Use a level and leveling rod with a vernier target that can be read to 0.5 mm. Determine settlements by readings on the two fixed independent benchmarks, and on an established scale or fixed point on the pile top.

3. Alternative Systems

Any other type of electrical or optical gage yielding a precision equivalent to the primary system is acceptable as an alternative, provided prior written approval is obtained from the DCES .

Figure 4. Telltale Details for Pipe Piles



NOTES:

1. FILL THE CURB PIPES WITH LIGHTWEIGHT OIL, APPROXIMATELY 150 mL PER METER OF GUIDE PIPE.
2. PERFORM ALL WELDING IN ACCORDANCE WITH THE MYDOT MANUAL OF STEEL CONSTRUCTION.
3. CONCRETE FILLING IS NOT SHOWN.
4. DETAIL "A" IS FOR PILES FILLED WITH CONCRETE AT THE TIME OF TESTING, WHILE DETAIL "B" IS FOR EMPTY PILES.
5. ALL PIPES SHOWN ARE STANDARD WEIGHT.

C. SETTLEMENT REFERENCE POINTS

Establish reference points on the test pile, at each end of the reference beam, and on each reaction piles (if used). Acceptable locations and materials are as follows:

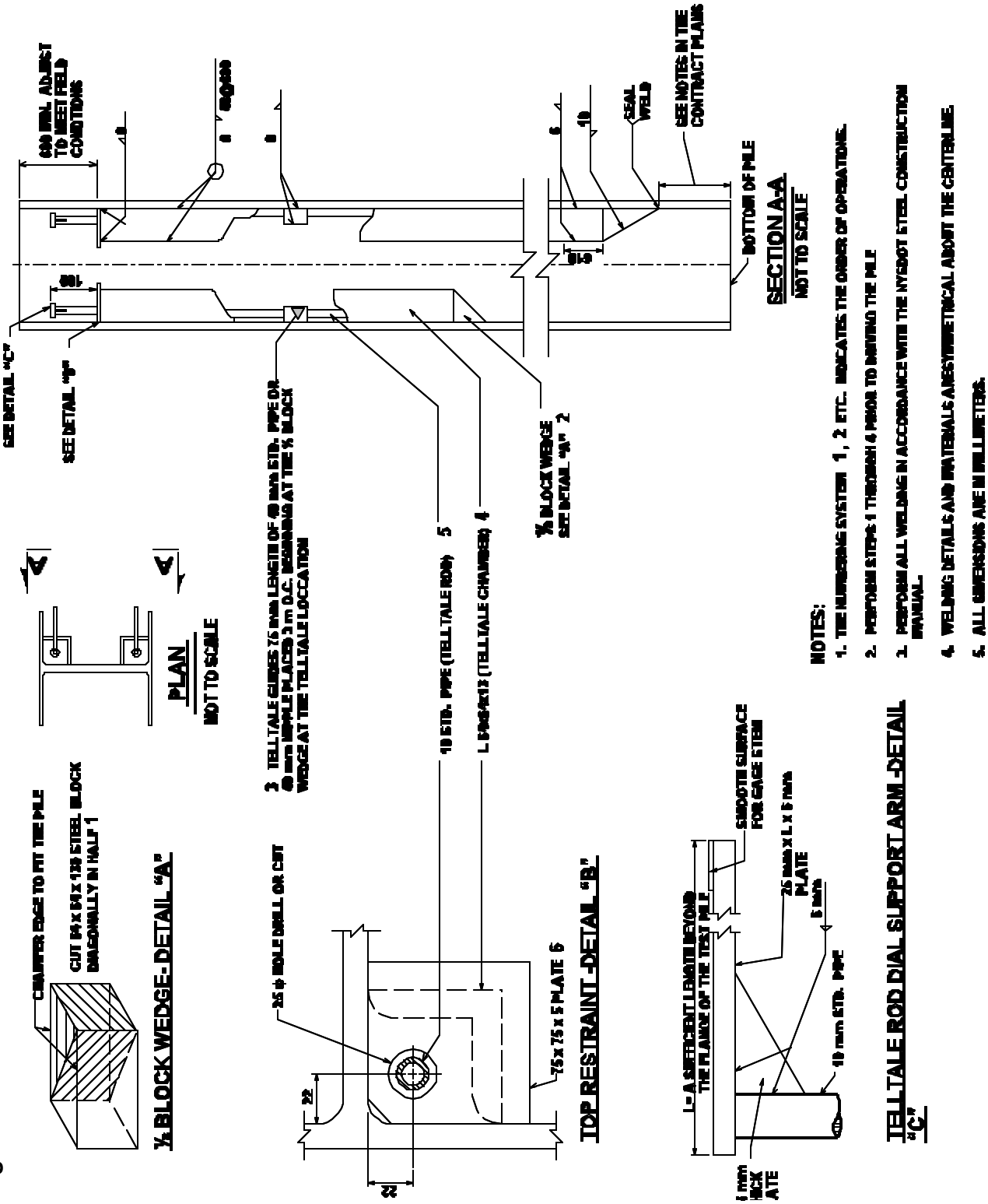
- On the reference beam: round-head bolt, or round bead of weld about 5 mm high
- On the test piles: lug on the side about 25 mm from the top, or bead of weld on the steel billet
- On the reaction piles: cut mark made by a hacksaw, or lug welded to the pile.

The Engineer will establish the elevation of these reference points with respect to the two fixed independent benchmarks.

D. SITE PROTECTION

Provide complete protection at all times for the pile supports and reference beam from wind, direct sunlight, frost action, and other disturbances. Also maintain a temperature of not less than 10º C throughout the duration of the test and provide a thermometer to monitor temperature. To accomplish this, it may be necessary to provide heat and to construct a suitable test enclosure of fiber board, polyethylene, canvas, or other materials acceptable to the Engineer. Provide adequate lighting for the duration of the test.

Figure 5. Telltale Details for H-Piles



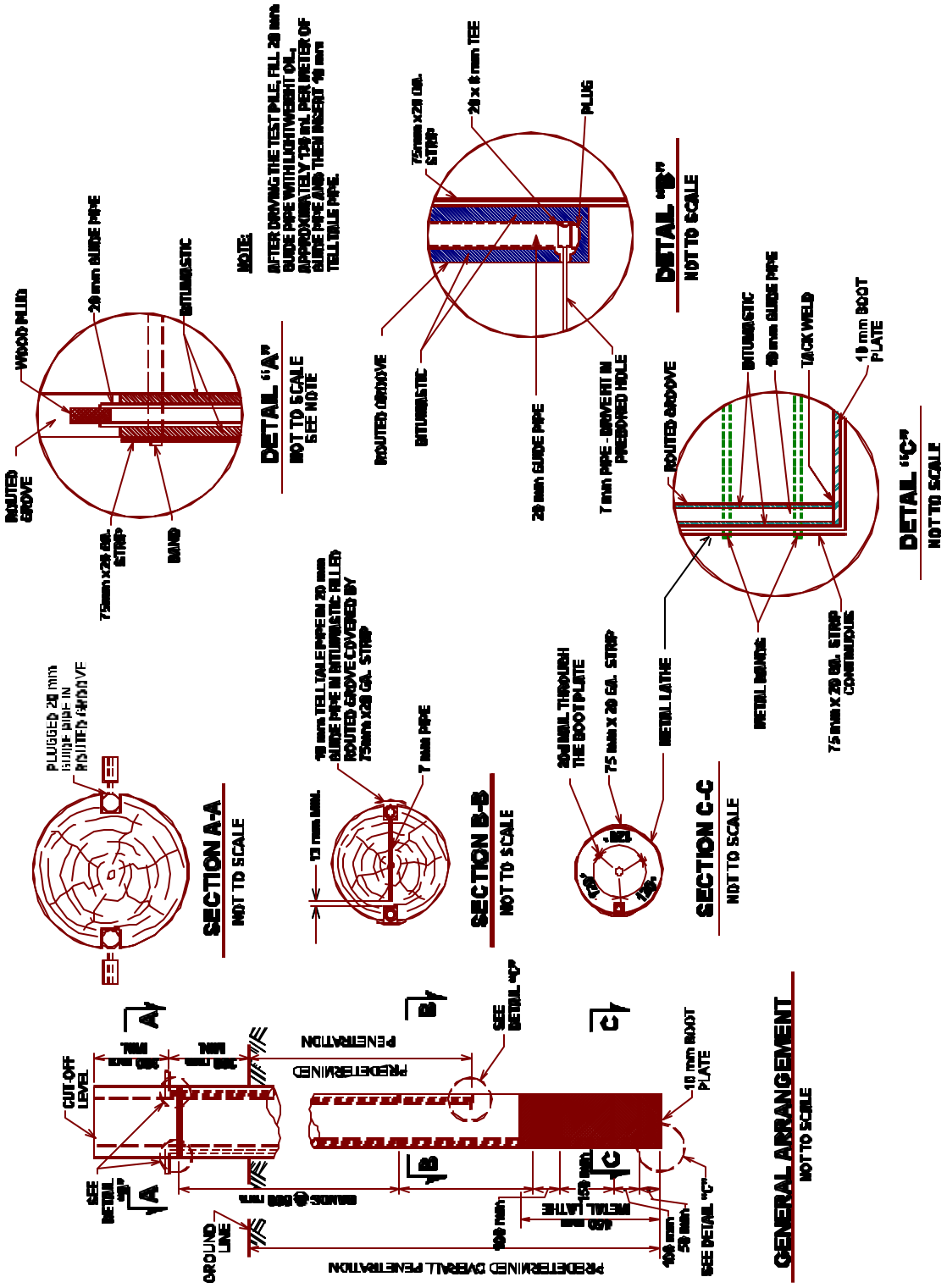


Figure 6. Telltale Details for Timber Piles

III. REQUIREMENTS PRIOR TO TESTING

A. WAITING PERIOD

Observe a minimum waiting period of seven days (or as otherwise defined in the contract documents) between installing the last pile in the load test system and starting the test. Set up the load test system during this period, using one of the reaction load methods described in Chapter I or an approved alternative. Set up primary and auxiliary systems of measurement may during this period.

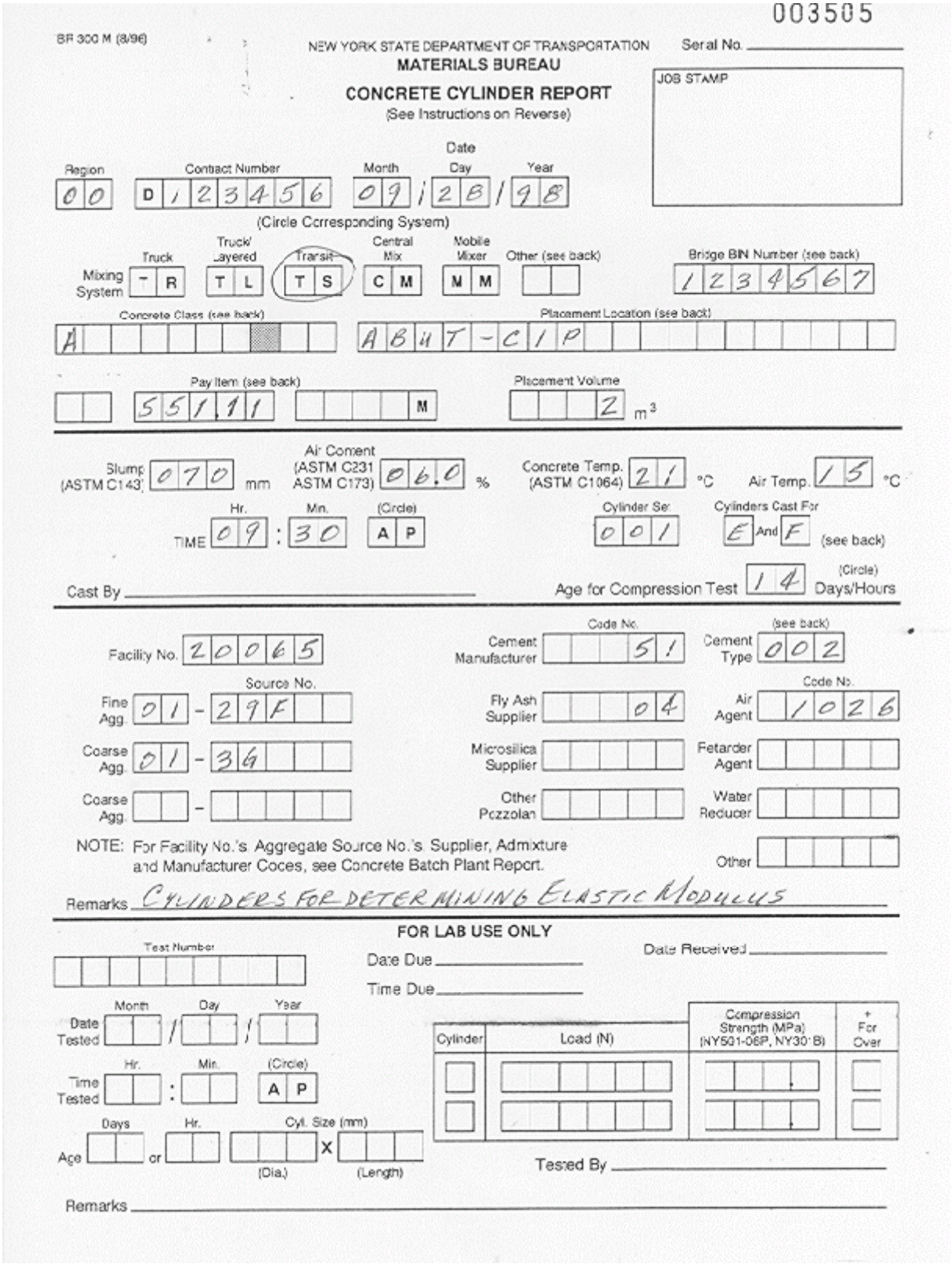
B. CONTROL OF PILE HEAVE

Immediately after the test pile has been installed, establish the elevation of the pile top. Take all necessary precautions to prevent upward movement or rebound of the pile (pile heave) before the load test begins. Pile heave is caused by high pore pressures built up during driving, especially in fine-grained soils. To avoid heave the pile may need to be weighted down until the excess pore pressure has dissipated sufficiently. When testing an empty CIP, it may be advantageous to fill the pile with water to counteract the heave. The Contractor may wish to obtain pile top measurements during the waiting period to detect pile heave. In any case, a final pile-top elevation must be determined before starting the load test. If this elevation differs by more than 5 mm from the pile-top elevation immediately after driving, suspend the load test and immediately notify the DCES. Corrective action may require the Contractor to redrive the pile and provide an additional waiting period before the test, during which pile heave is restrained.

C. SPECIAL PROCEDURE FOR CAST-IN-PLACE PILES

If directed by the DCES, fill cast-in-place piles with concrete and observe a waiting period of at least seven days before load testing. Three sets of concrete cylinders (1 set = 2 cylinders) must be cast in accordance with the Department's Materials Method 9.2 ("Field Inspection of Portland Cement Concrete"). Test in accord with the "Early Open Sequence" designated on Form BR 300M (Fig. 7).

Figure 7. Typical Completed Report on Test of concrete filling for CIP Pile



003505

BR 300 M (8/96)

NEW YORK STATE DEPARTMENT OF TRANSPORTATION

MATERIALS BUREAU

CONCRETE CYLINDER REPORT

(See Instructions on Reverse)

Serial No. _____

JOB STAMP

Region: 00 | Contract Number: D 123456 | Date: Month 09 / Day 28 / Year 98

(Circle Corresponding System)

Mixing System: Truck [R] | Truck/Layered [TL] | Transit [TS] | Central Mix [CM] | Mobile Mixer [MM] | Other (see back)

Bridge BIN Number (see back): 1234567

Concrete Class (see back): A

Placement Location (see back): ABUT-C/P

Pay Item (see back): 551111 M

Placement Volume: 2 m³

Slump (ASTM C143): 070 mm

Air Content (ASTM C231 ASTM C173): 06.0 %

Concrete Temp. (ASTM C1064): 21 °C

Air Temp.: 15 °C

TIME: Hr. 09 : Min. 30 (Circle) A P

Cylinder Set: 001

Cylinders Cast For: E And F (see back)

Cast By _____

Age for Compression Test: 14 (Circle) Days/Hours

Facility No.: 20065

Cement Manufacturer (Code No.): 51

Cement Type (see back): 002

Fine Agg. (Source No.): 01 - 29F

Fly Ash Supplier: 04

Air Agent (Code No.): 1026

Coarse Agg.: 01 - 36

Microsilica Supplier:

Retarder Agent:

Coarse Agg.: -

Other Pozzolan:

Water Reducer:

NOTE: For Facility No.'s Aggregate Source No.'s Supplier, Admixture and Manufacturer Codes, see Concrete Batch Plant Report.

Other:

Remarks: CYLINDERS FOR DETERMINING ELASTIC MODULUS

FOR LAB USE ONLY

Test Number:

Date Due _____

Time Due _____

Date Received _____

Date Tested: Month / Day / Year

Time Tested: Hr. : Min. (Circle) A P

Age: Days or Hr.

Cyl. Size (mm): (Dia.) X (Length)

Cylinder	Load (N)	Compression Strength (MPa) (NY501-06P, NY30-B)	+ For Over

Tested By _____

Remarks _____

Card 1 on this form should include the following statement under "Remarks": "Special Soils Requirement - Report Unit Weight." ("Early Open Sequence" and "Card 1" appear on the back of Form BR 300M.) These test results will be used to determine the modulus of elasticity of the concrete filling.

IV. PROCEDURE FOR THE INCREMENTAL-STATIC-LOAD TEST

A. TEST PROCEDURE

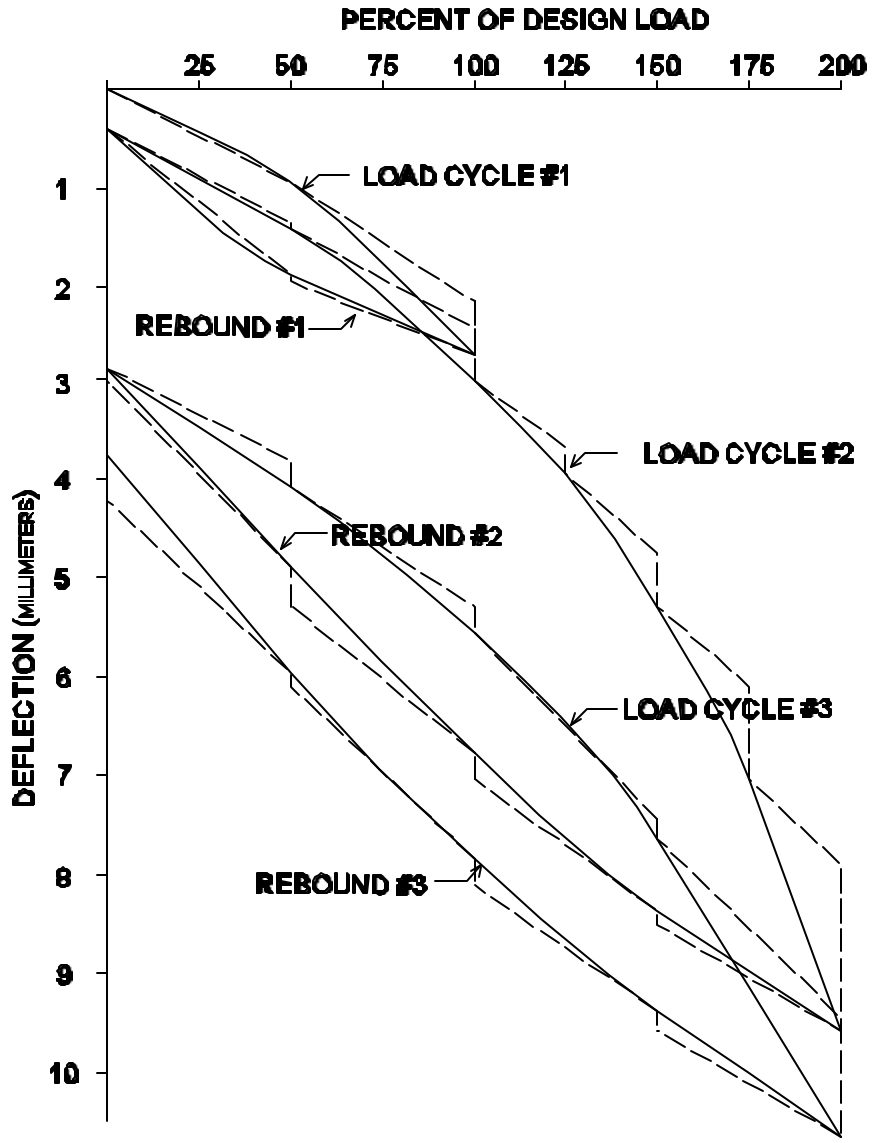
Load and unload the test pile incrementally in three cycles, unless an alternative procedure is specified in the contract documents. Apply each load increment to the pile in as short a period as physically possible. The maximum load applied is twice the pile design load shown on the plans unless failure (as defined here on p. 18) occurs first. The required load, after application of each increment, is expressed as a percentage of the pile design load shown on the plans or specified in the contract documents. Magnitude and sequence of load increments for the three loading cycles are as follows:

Cycle	Percent of Maximum Design Load
1	0,50, 100, 50, 0
2	0, 50, 100, 125, 150, 175, 200, 150, 100, 50, 0
3	0, 50, 100, 150, 200 (24-hr hold), 150, 100, 50, 0

Maintain each load increment until the settlement rate under the applied load, or rate of rebound from the previous load increment, is less than 50 μm in 15 minutes. The minimum period for maintaining a load increment, however, is 30 minutes and an increment may be removed after having been maintained for 2 hours, regardless of rate of settlement or rebound. When 200 percent of the design load has been applied during Cycle 3, provided the pile has not failed, leave this load in place for 24 hours. When the pile has rebounded to zero load at the end of Cycle 3, maintain zero load at least 1 hour. Maintain each load constantly and note any adjustments to the jack in the "Remarks" column on the Time-Settlement Data Sheet (Fig. 8).

If the pile fails before application of the 200-percent load, rebound it to zero load as specified in the table above. Immediately notify the DCES by phone and give all pertinent details of the load test. The DCES will notify the Contractor within one working day whether Cycle 3 is required, and to what maximum load the pile is to be reloaded for Cycle 3 of the loading sequence. The DCES will notify the Contractor within two days as to the need for an additional load test if Cycle 3 of the loading procedure is canceled.

Figure 8. Load Cycles for an Incremental Static Load Test



B. DATA COLLECTION

Before starting the test, record all initial readings and establish the elevations of the settlement reference points. On the Time-Settlement Data Sheet (Fig. 8) supplied by the Engineer, read and record time-settlement data as follows:

1. Top Deflection Measurement

Read movement to the nearest 50 µm before and after application of a new load increment or removal of an increment already in place. After application or removal of all load increments, take readings at 1/2, 1, 2, 4, 8, 15, and 30 minutes, and at 15-minute intervals thereafter for 2 hours or until the next increment is applied or removed. During the 24-hour hold of the 200-percent load, however, take readings every 3 hours after the first 2 hours of readings.

2. Telltale Strain Indicators

Read movement to the nearest 50 µm before and after application or removal of each load increment. During the 24-hour hold, read the telltale immediately after the load is applied, 2 hours later, and every 3 hours thereafter until the load is removed.

3. Auxiliary Systems

a. Wire, Mirror, and Scale

Read to the nearest 0.5 mm before and after each application or removal of a load increment, by visually aligning the top of the wire with both its reflection in the mirror and the scale mounted on the mirror.

b. Rod and Level

Read to the nearest 0.5 mm immediately before and as soon as possible after application or removal of each load increment.

4. Load Readings

Take load readings (in kN) from both the pressure gage on the jack and from the load cell, and record them in the appropriate columns on the Time-Settlement Data Sheet (Fig. 8). Take readings before and after application or removal of each load increment. During the 24-hour hold, take a reading after the load is applied, 2 hours later, and then every 3 hours until the load is removed. Any load adjustments should be noted in the "Remarks" column.

C. SETTLEMENT REFERENCE POINTS

Check settlement to a precision of 0.5 mm on the reference points described in Chapter II, as follows:

1. Immediately before the test,
2. Immediately before rebounding from 100 percent of the design load (all cycles),

3. Immediately before rebounding from 200 percent of the design load (both cycles), and
4. At end of test, after the final rebound reading.

If readings on the reference points vary by more than 2 mm from their initial values, or if a reading on the pile head varies by more than 2 mm from the deflection shown by the primary system, set up the level in another location and check the elevations. Continue this procedure until two sets of consistent level readings are obtained. If these two sets still differ by more than 2 mm from either initial readings on the reference beam, or primary system readings for the point on the test pile, halt the test until the discrepancy has been explained and adjusted.

If discrepancies occur as described in the preceding paragraph, the Engineer will halt the test and notify the DCES by phone. The test may not resume until the system(s) are corrected to the satisfaction of the DCES. If in the DCES opinion these discrepancies have impaired the value of the test in progress, start the test again. No additional payment will be made for correcting the settlement-measuring system(s) nor for portions of any load test unacceptable to the DCES.

D. TERMINATION CRITERIA

Failure load for an incremental static load test is defined as that load at which the load vs. gross settlement curve reaches a slope of 150 µm per kN of applied load. The test may be terminated when failure occurs or a top deflection equal to $B/60 + PL/AE$ is achieved, where:

B is the diameter or width (mm)
P is load (MN)
L is length (m)
A is cross-section (mm^2)
E is modulus of elasticity (GPa).

V. PROCEDURE FOR THE CONSTANT-RATE-OF-PENETRATION TEST

Perform one or more of these tests, as specified in the contract documents, must be performed to determine capacity of the pile-soil system. All provisions of Chapters I, II, and III also apply to this test method.

A. TEST PROCEDURE

Load the pile until either a plunging failure occurs or capacity of the test equipment (minimum of four times design load) is reached. Apply the load so that the pile top exhibits constant rate of deflection with time. Loads may be applied by means of a mechanical loading system, approved by the DCES, causing a constant rate of deflection with time. Control the rate by monitoring one of the primary measuring systems at 15-second intervals. Rate of pile deflection 0 (in millimeters per minute) is determined by the following relationship:

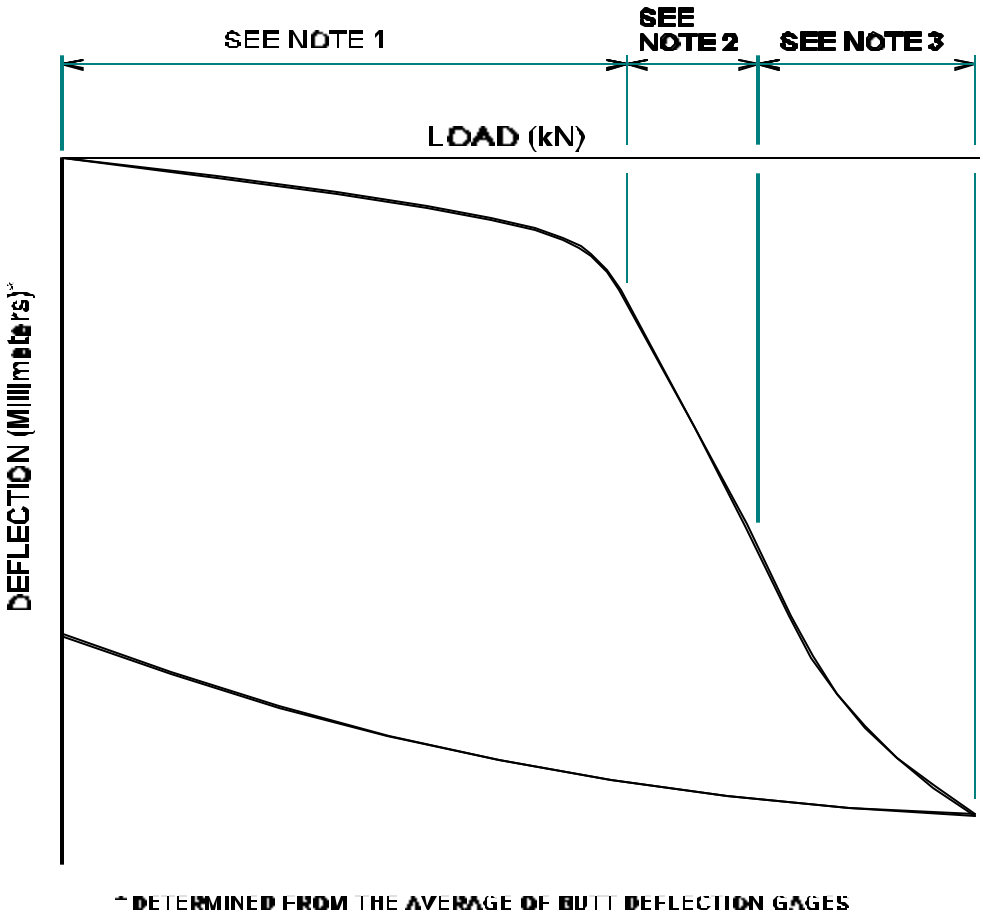
$$0 = 8\ (PL/AE)$$

where 8 = a soil constant (0.1 for cohesionless soils, 0.04 for cohesive soils, or as specified by the DCES),
P = pile design load, MN (as shown on the plans),
L = pile length, meters
A = pile area, square millimeters, and
E = pile modulus of elasticity, GPa.

B. DATA COLLECTION

Record readings on all dial gages, the load cell, and the pressure gage for the jack at 1-minute intervals, on the Time-Settlement Data Sheet (Fig. 8). At some point in the test, a minimal increase in load will stabilize the settlement rate; this point indicates approaching failure of the pile-soil system. Once this load is achieved, continue the test at the same rate 0 for 15 minutes, after which the rate is to be increased to 50 for another 5 minutes.

Figure 9. Example of load application for a constant-rate-of penetration test



After completing this procedure, remove the load in increments of 25 percent of the final load achieved. Maintain the rebound loads for 1 minute, and read and record all the primary measuring systems immediately before removing the next load increment. Measure the pile's final rebound after it has remained at zero load for 1 hour.

C. SETTLEMENT REFERENCE POINTS

Take readings, as a minimum, at the settlement reference points at the beginning and end of the test. Another test may be required if two sets of consistent readings differ by the amount(s) described earlier in "Settlement Reference Points".

D. TERMINATION CRITERIA

Failure load for this test is the load at which the pile penetrates into the ground with a minimal increase in load (a plunging failure). The test may be terminated when failure occurs or a top deflection equal to $B/60 + PL/AE$ is achieved, where:

B is the diameter or width (mm)
P is load (MN)
L is length (m)
A is cross-section (mm^2)
E is modulus of elasticity (GPa).

VI. PROCEDURE FOR THE QUICK LOAD TEST

Perform one or more quick load tests, as specified in the contract documents, to determine the capacity of the pile-soil system. All provisions of Chapters I, II, and III apply to this test method.

A. TEST PROCEDURE

Load the pile, in increments, until either a plunging failure occurs or a top deflection equal to $B/60 + PL/AE$, as defined earlier. Increments are equal to 10 percent of the design load, unless otherwise directed by the DCES. Initially these increments may be 20 percent of the design load, but should be decreased to the minimum once the design load is reached, or when the 2- and 5-minute readings differ.

Maintain each load increment for 5 minutes. Continue loading the pile until either a plunging failure occurs or maximum deflection is achieved. After completing this procedure, remove the load in increments of 25 percent of the final load achieved. Maintain the rebound loads for 1 minute, and read and record all the primary measuring systems immediately before removing the next load increment. Measure the pile's final rebound after it has remained at zero load for 1 hour.

B. DATA COLLECTION

Read and record time-settlement data sheet (Fig. 8) supplied by the Engineer, as follows:

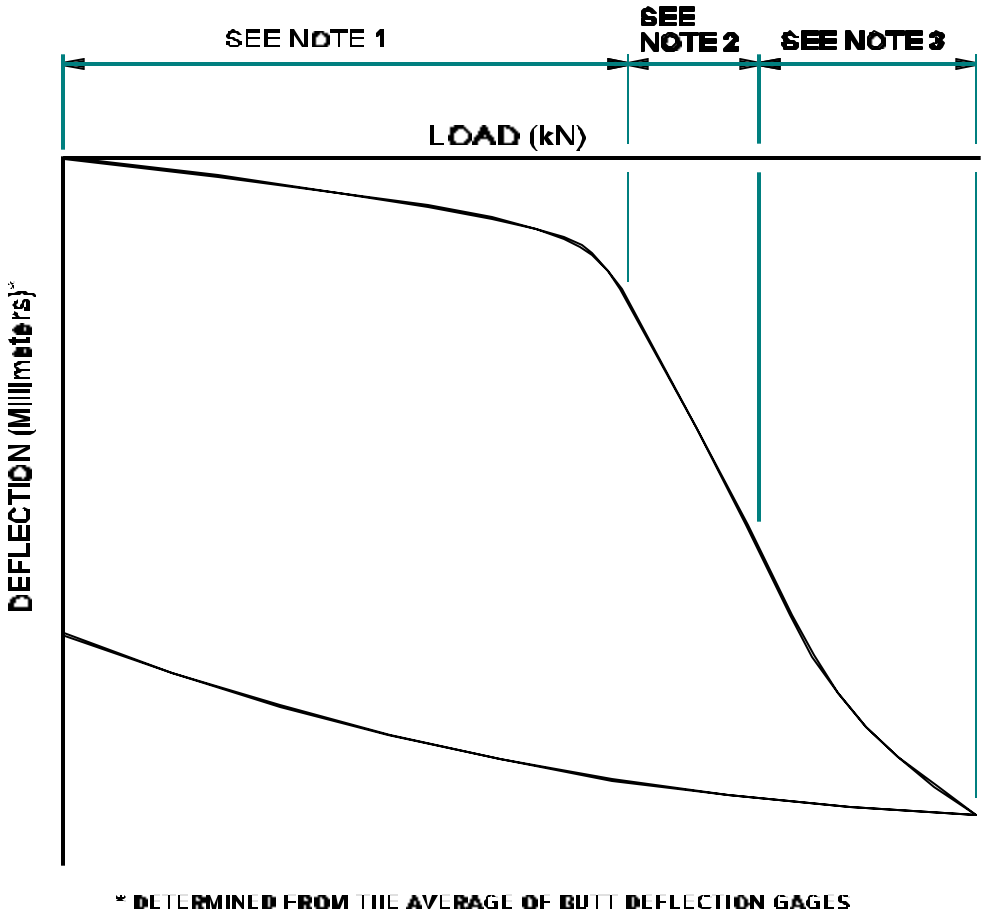
1. Top Deflection Measurement

Read movement to the nearest 50 µm immediately before and after application of each load increment. Additionally, take readings at 1/2, 1, 2, and 5 minutes.

2. Telltale Strain Indicators

Read movement to the nearest 50 µm immediately before and after application or removal of each load increment.

Figure 8. Example of load application for a constant-rate-of penetration test



3. Auxiliary Systems

a. Wire, Mirror, and Scale

Read to the nearest 0.5 mm immediately before and after application or removal of each fifth load increment, by visually aligning the top of the wire with both its reflection in the mirror and the scale mounted on the mirror.

b. Rod and Level

Read to the nearest 0.5 mm immediately before and as soon as possible after application or removal of each tenth load increment.

c. Settlement Reference Points

Take readings, as a minimum, at the settlement reference points at the beginning and end of the test. Another test may be required if two sets of consistent readings differ by the amount described earlier under "Settlement Reference Points."

C. TERMINATION CRITERIA

Failure load for this test is that at which the pile penetrates into the ground with a minimal increase in load (a plunging failure). The test may be terminated when failure occurs or a top deflection equal to $B/60 + PL/AE$ is achieved, where:

B is the diameter or width (mm)
P is load (MN)
L is length (m)
A is cross-section (mm^2)
E is modulus of elasticity (Gpa).

VII. REPORTS AND CERTIFICATION

Pile load tests require the following documentation:

1. Pre-driving report,
2. Post-driving report,
3. Certification of the loading system, and
4. Final report.

A. PRE-DRIVING REPORT

Submit this report to the DCES for review and approval. The review must be completed within five working days. After the DCES has approved details of this report in writing, the test pile may be installed. Include the following information in the pre-driving report:

1. For driven piles, provide a description of the driving equipment on Form BD 138 (Fig. 9).

2. For non-driven piles, see appropriate specifications for information to be submitted before installation.

3. A description of the method of testing, including

- Type and amount of dead-load reaction, or size and description of the reaction frame and location of reaction piles,
- Method of supporting the reference beam and measuring devices, showing distances from the test pile and anchor piles or supports, or a reaction and its height above ground,
- Capacity of pressure gages and hydraulic jacks.

Figure 11 Form for Description of Pile and Driving Equipment

BD138 6/96 (Metric)
NYSDOT

PILE AND DRIVING EQUIPMENT DATA

P.I.N.: _____ Contract No.: _____ Pile Driving Contractor/Subcontractor (Piles Driven By): _____

Project: _____ _____

County: _____ _____

_____

HAMMER

Manufacturer: _____ Model: _____

Type: _____ Serial No.: _____

Rated Energy: _____ (kJoules) @ _____ Length of Stroke (m)

HAMMER CUSHION (Capblock)

Material: _____ Area: _____ (cm^2)

Thickness: _____ (mm)

Modulus of Elasticity: _____ (MPa)

Coefficient of Restitution: _____

Helmet Bonnet Drivehead

Weight: _____ (kN)

PILE CUSHION (For concrete piles only)

Material: _____ Area: _____ (cm^2)

Thickness: _____ (mm)

Modulus of Elasticity: _____ (MPa)

Coefficient of Restitution: _____

	1	2	3	4
Structure Name:				
Substructure:				
Pile Information:				
Material:				
Weight/m (kg/m):				
Length in Leads (m):				
Ultimate Load (kN):				
Splice Description:				
Toe Treatment Description:				

DISTRIBUTION (1 COPY EACH)

___ Deputy Chief Engineer (Structures)
___ Regional Director
___ Engineer in Charge

Submitted By: _____ Date: _____

Phone/Fax: _____ / _____

B. POST-DRIVING REPORT

This report includes items to be transmitted to the Engineer and included in the final report. The Engineer also transmits the following information by phone and/or fax to the DCES before beginning the pile load test:

For all foundations:

- Embedded length of pile
- Length of pile tested
- Actual rate of hammer operation during test pile driving.

For driven foundations:

- Test pile driving or re-driving records, including blows per decimeter throughout the length driven and final driving resistance in blows per decimeter for the last 0.5 m of driving
- Methods employed by the contractor to prevent pile rebound immediately after driving

For non-driven foundations

- Actual or estimated cross-section of the column
- A copy of the inspector's report of the installation

C. CERTIFICATION OF THE LOADING SYSTEM

Calibrate the hydraulic system, jack(s), and pressure gage(s) within 14 days of starting the test. Calibration includes readings for loading and unloading. Loading system accuracy must be within 5 percent of the load applied. The Contractor submits calibration data to the DCES before any load testing, including a copy of the jack certification and load calibration curve in the final report.
No re-calibration of these elements is required for more than one load test on the same project, provided that the following conditions are satisfied:

1. Equipment that has been calibrated and approved is not removed from the project for use elsewhere until all load tests are completed,

2. The calibrated equipment is carefully stored and properly maintained between tests in a manner approved by Engineer,

3. The calibrated equipment is secure and unaltered while awaiting use on a specific project,

4. The period between load tests using the approved calibrated equipment on the same project does

not exceed one month, and

5. Readouts are determined to be within the required accuracy criteria.

Acceptance of the calibration data is necessary prior to performing the tests.

D. FINAL REPORT

Prepare a final report for each load test containing the following information:

1. Identification of the test pile,

2. A description of the test apparatus and the loading and deflection-measurement procedures used,

3. A copy on the time-settlement data collection sheets exactly as filled out in the field. Typical completed forms are shown in Figure 10 (re-copied or typed sheets will not be acceptable),

4. A graphic representation of test results in the form of load-settlement curves (Fig. 11), including gross and net settlement of top and telltales. Include curves for load-settlement vs. time (Fig. 12) so that elastic properties of the supporting soils may be determined,

5. Remarks concerning any unusual events or damage to the pile during driving or load testing,

6. Miscellaneous data, including;
   a. Structure for which piles are to be installed,
   b. Maximum pile design load shown on the plans,
   c. Date pile was installed,
   d. Copy of the pile-driving record,
   e. Dates of pile testing,
   f. Copy of Form BR 300a (Fig. 5), if required,
   g. Report on calibration of jack(s) and gage(s),
   h. Plot of jack calibration results,
   i. Elevation of ground water during test, if possible,
   j. Description of soil, based on the boring log of the nearest drill hole, and
   k. Records of level read, taken as previously described in connection with settlement reference points.

Upon completion, forward six copies directly to the DCES for analysis. Upon receipt, five working days will be allowed for review, after which the DCES will forward the findings to the Regional Director. If the static load test results in a failure (as previously defined) at a load less than twice the design load, a final report is still required; in that event the DCES may order an additional static load test.

Figure 12. Typical Time-Settlement Data Sheet for an Incremental Static Load Test

N.Y.S.D.O.T. GEB (8/98)

PILE LOAD TEST
TIME-SETTLEMENT DATA SHEET

JOB STAMP

D123456 Highway Bridge
Example Co. Replacement Project
PIN 1234.56 Town of Example
XYZ Construction Co.

BRIDGE DESIGNATION: BRIDGE No. 12
PILE LOCATION: SOUTH ABUTMENT
PILE NO.: 164
PILE LOAD TEST NO.: 1 (MLT)
PILE TIP ELEVATION: 283.9

DATE: 4/30/98
PREPARED BY: SWC
COMPUTED BY: TJP
CHECKED BY: RWG

ELAPSED TIME	READ TIME	JACK GAGE READ. (kPa)	JACK LOAD (MN)	LOAD CELL READ.	LOAD CELL (MN)	DIAL READINGS - (mm) A	B	C	MEAN (mm)	DEFL. (mm)	TELL TALES - (mm) READ	DEFL	READ	DEFL	REMARKS
10:49	0	0	0	30115	0	2.43	8.16	1.59	4.05	0.00	1.02	0.00	2.85	0.00	WIRE 124.7
							LOAD TO 200 kN								
10:50	0	4890	0.2	30305	0.2	2.88	8.88	2.40	4.72	0.67	1.23	0.21	3.06	0.21	WIRE 124.0
10:50:30	0.5					2.88	8.88	2.40	4.72	0.67	1.23	0.21	3.06	0.21	
10:51	1					2.91	8.88	2.40	4.73	0.68	1.23	0.21	3.06	0.21	
10:52	2					2.91	8.91	2.40	4.74	0.69	1.26	0.24	3.09	0.24	
10:54	4					2.91	8.94	2.40	4.75	0.70	1.26	0.24	3.09	0.24	
10:58	8					2.91	8.94	2.40	4.75	0.70	1.26	0.24	3.09	0.24	
11:05	15					2.91	8.94	2.40	4.75	0.70	1.26	0.24	3.12	0.27	
11:20	30					2.91	8.94	2.43	4.76	0.71	1.26	0.24	3.12	0.27	WIRE 124.0
							LOAD TO 400 kN								
11:30	0	8800	0.4	30476	0.4	3.69	9.69	3.36	5.58	1.53	1.47	0.45	3.48	0.63	WIRE 123.2
11:30:30	.5					3.69	9.69	3.36	5.58	1.53	1.47	0.45	3.48	0.63	
11:31	1					3.69	9.75	3.36	5.60	1.55	1.47	0.45	3.48	0.63	
11:32	2					3.72	9.75	3.39	5.62	1.57	1.50	0.48	3.48	0.63	
11:34	4					3.72	9.75	3.39	5.62	1.57	1.50	0.48	3.51	0.66	
11:38	8					3.72	9.75	3.39	5.62	1.57	1.50	0.48	3.51	0.66	
11:45	15					3.72	9.75	3.39	5.62	1.57	1.50	0.48	3.51	0.66	
12:00	30					3.72	9.75	3.39	5.62	1.57	1.50	0.48	3.54	0.69	WIRE 123.1
							LOAD TO 600 kN								
12:10	0	12800	0.6	30660	0.6	4.87	10.66	4.48	6.67	2.62	1.71	0.69	3.96	1.11	WIRE 122.1
12:10:30	0.5					4.87	10.66	4.48	6.67	2.62	1.71	0.69	3.96	1.11	
12:11	1					4.88	10.67	4.49	6.68	2.63	1.71	0.69	3.96	1.11	

PAGE ___ OF ___

Figure 13. Typical Load-Settlement Data Sheet for either a Constant Rate of Penetration or a Quick Test

N.Y.S.D.O.T. GEB (8/98)

PILE LOAD TEST
TIME-SETTLEMENT DATA SHEET

JOB STAMP

D123456 Highway Bridge
Example Co. Replacement Project
PIN 1234.56 Town of Example
XYZ Construction Co.

BRIDGE DESIGNATION: BRIDGE No. 12
PILE LOCATION: SOUTH ABUTMENT
PILE NO.: 164
PILE LOAD TEST NO.: 1 (CRP)
PILE TIP ELEVATION: 283.9

DATE: 5/4/98
PREPARED BY: SWC
COMPUTED BY: TJP
CHECKED BY: RWG

ELAPSED TIME	READ TIME	JACK GAGE READ. (kPa)	JACK LOAD (MN)	LOAD CELL READ.	LOAD CELL (MN)	DIAL READINGS - (mm) A	B	C	MEAN (mm)	DEFL. (mm)	TELL TALES - (mm) READ	DEFL	READ	DEFL	REMARKS
12:55	0	0	0	30196	0	2.61	3.39	7.05	4.35	0.00	5.16	0.00			WIRE 124.4
	1	3795	0.75	30279	0.15	2.91	3.93	7.62	4.82	0.47	5.34	0.18			
	2	5175	0.20	30343	0.20	3.24	4.32	7.92	5.16	0.81	5.49	0.33			
	3	6728	0.30	30421	0.30	3.57	4.71	8.28	5.52	1.17	5.58	0.42			
	4	7935	0.35	30429	0.35	3.81	4.92	8.52	5.75	1.40	5.73	0.57			
	5	8970	0.40	30515	0.40	4.05	5.14	8.79	6.01	1.66	5.85	0.69			
	6	10005	0.50	30576	0.50	4.32	5.43	9.03	6.26	1.91	6.00	0.84			
	7	11592	0.55	30627	0.55	4.62	5.76	9.39	6.59	2.24	6.09	0.93			
	8	12489	0.60	30668	0.60	4.89	6.00	9.60	6.83	2.48	6.18	1.02			
	9	13628	0.65	30714	0.65	5.13	6.24	9.87	7.08	2.73	6.27	1.11			
13:05	10	14318	0.70	30742	0.70	5.34	6.42	10.05	7.27	2.92	6.36	1.20			WIRE 121.4
	11	15870	0.75	30819	0.75	5.73	6.81	10.44	7.66	3.31	6.51	1.35			
	12	16695	0.80	30855	0.80	5.94	7.02	10.68	7.88	3.53	6.60	1.44			
	13	17940	0.85	30911	0.85	6.21	7.32	10.98	8.17	3.82	6.72	1.56			
	14	18906	0.90	30956	0.90	6.48	7.56	11.19	8.41	4.06	6.81	1.65			
	15	20286	0.95	31020	0.95	6.78	7.89	11.52	8.73	4.38	6.93	1.77			
	16	21390	1.00	31060	1.00	7.05	8.16	11.82	9.01	4.66	7.05	1.89			
	17	22425	1.05	31127	1.05	7.29	8.43	12.06	9.26	4.91	7.17	2.01			
	18	23115	1.10	31171	1.10	7.53	8.64	12.27	9.48	5.13	7.23	2.07			
	19	23946	1.15	31216	1.15	7.62	8.77	12.41	9.60	5.25	7.30	2.14			
13:15	20	24830	1.20	31261	1.20	7.85	9.02	12.65	9.84	5.49	7.39	2.23			WIRE 118.9
	21	25865	1.25	31306	1.25	8.09	9.25	12.90	10.08	5.73	7.48	2.32			
	22	26900	1.30	31350	1.30	8.32	9.50	13.14	10.32	5.97	7.57	2.41			

PAGE ___ OF ___

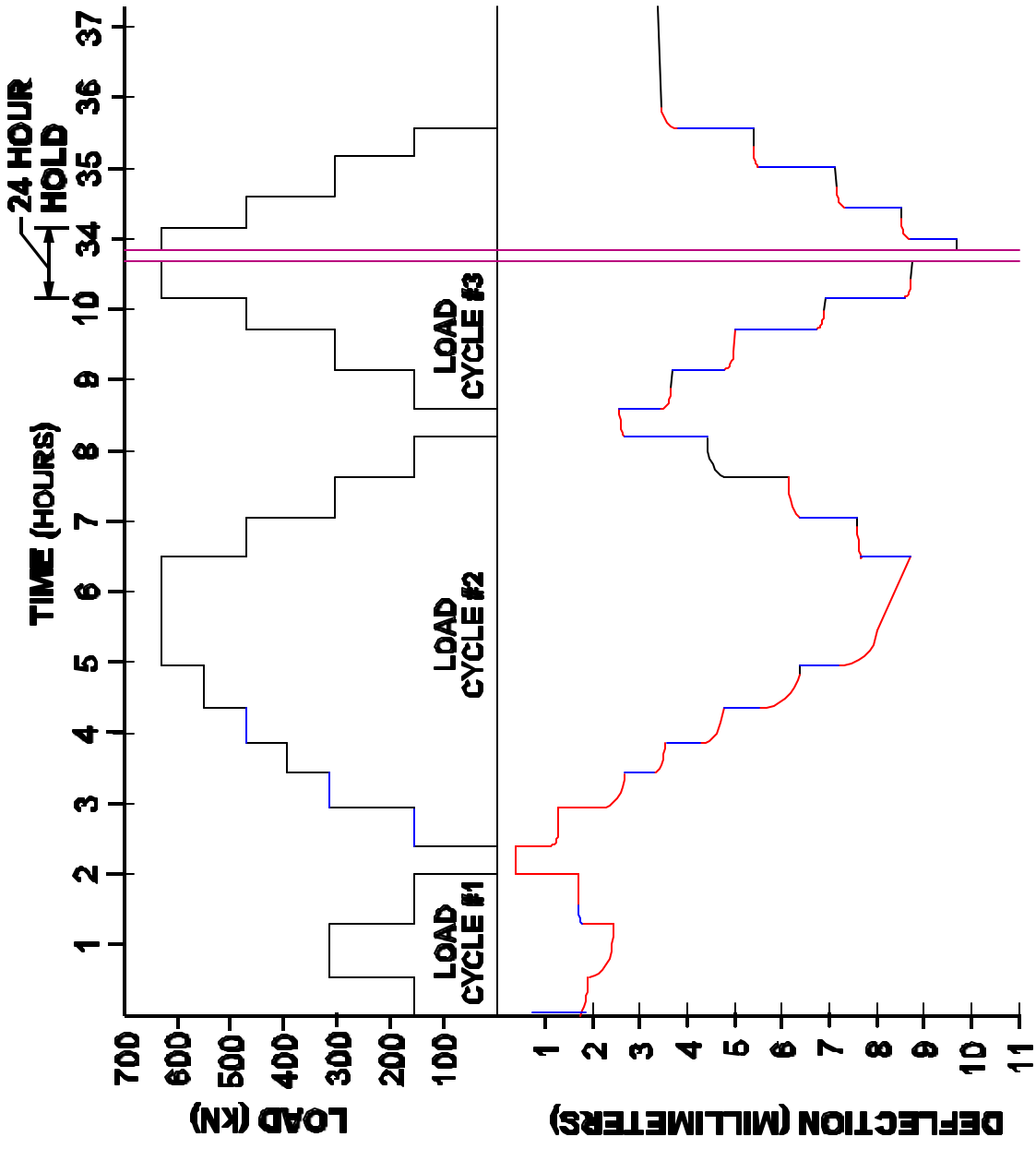


Figure 14. Typical Load Deflection versus Time Plot for an Incremental Static Load Test

Figure 15. Load-Deflection Curve for a Typical Incremental Load Test.

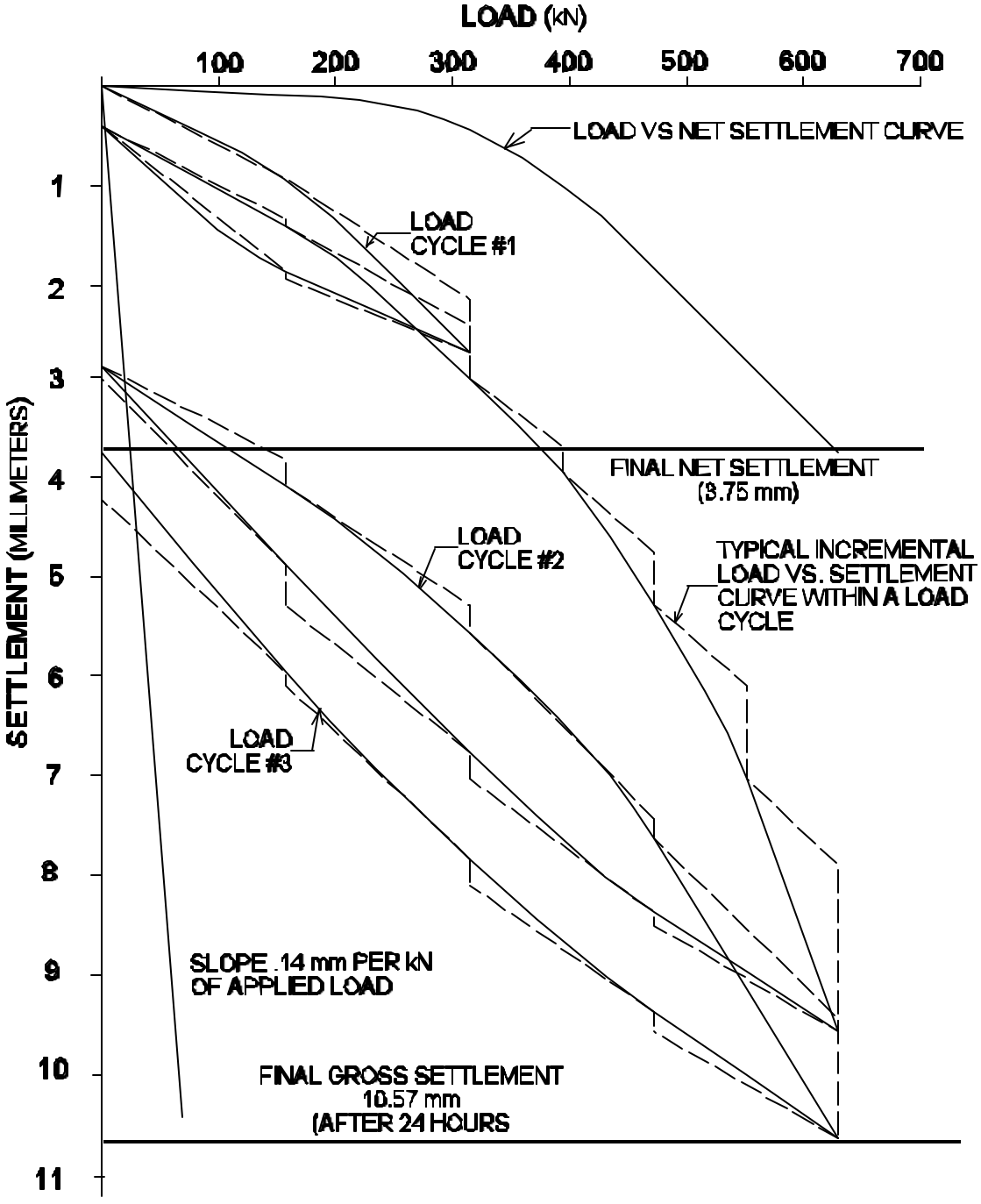


Figure 16. Load-Deflection curve for typical Constant-Rate-of-Penetration test

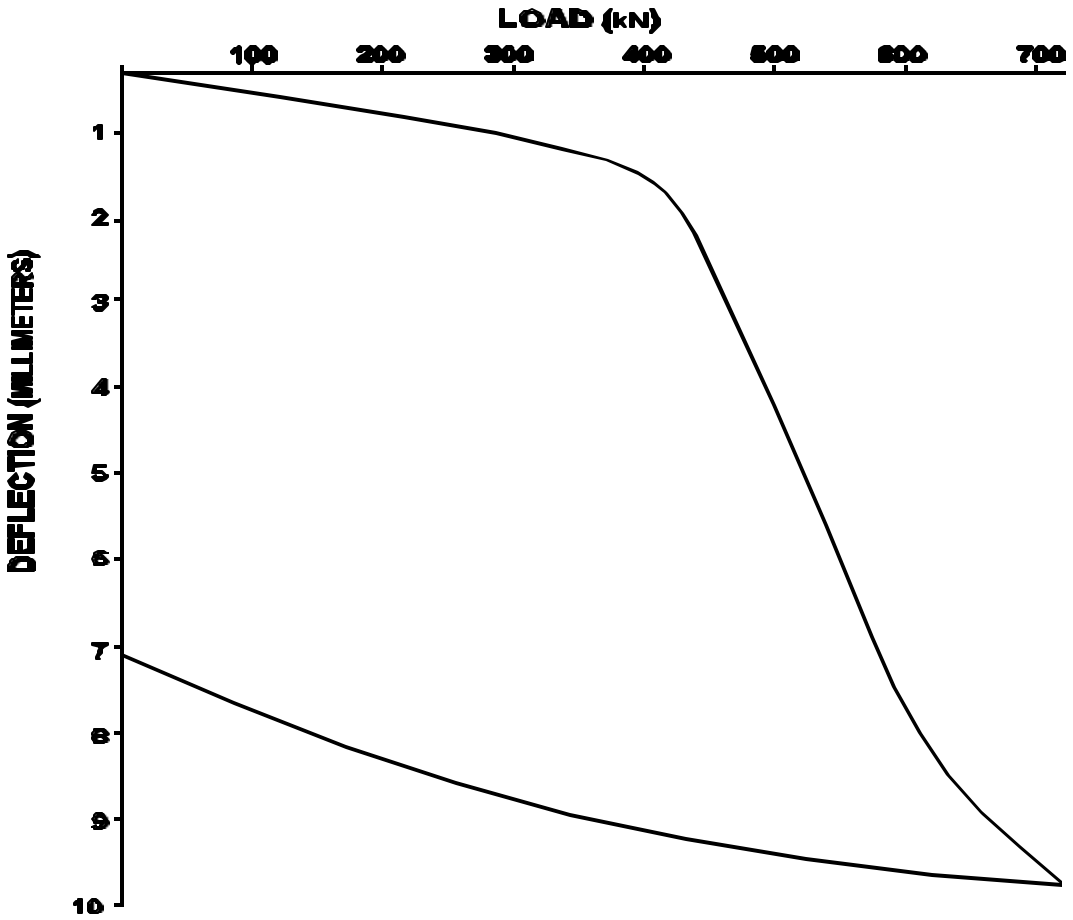
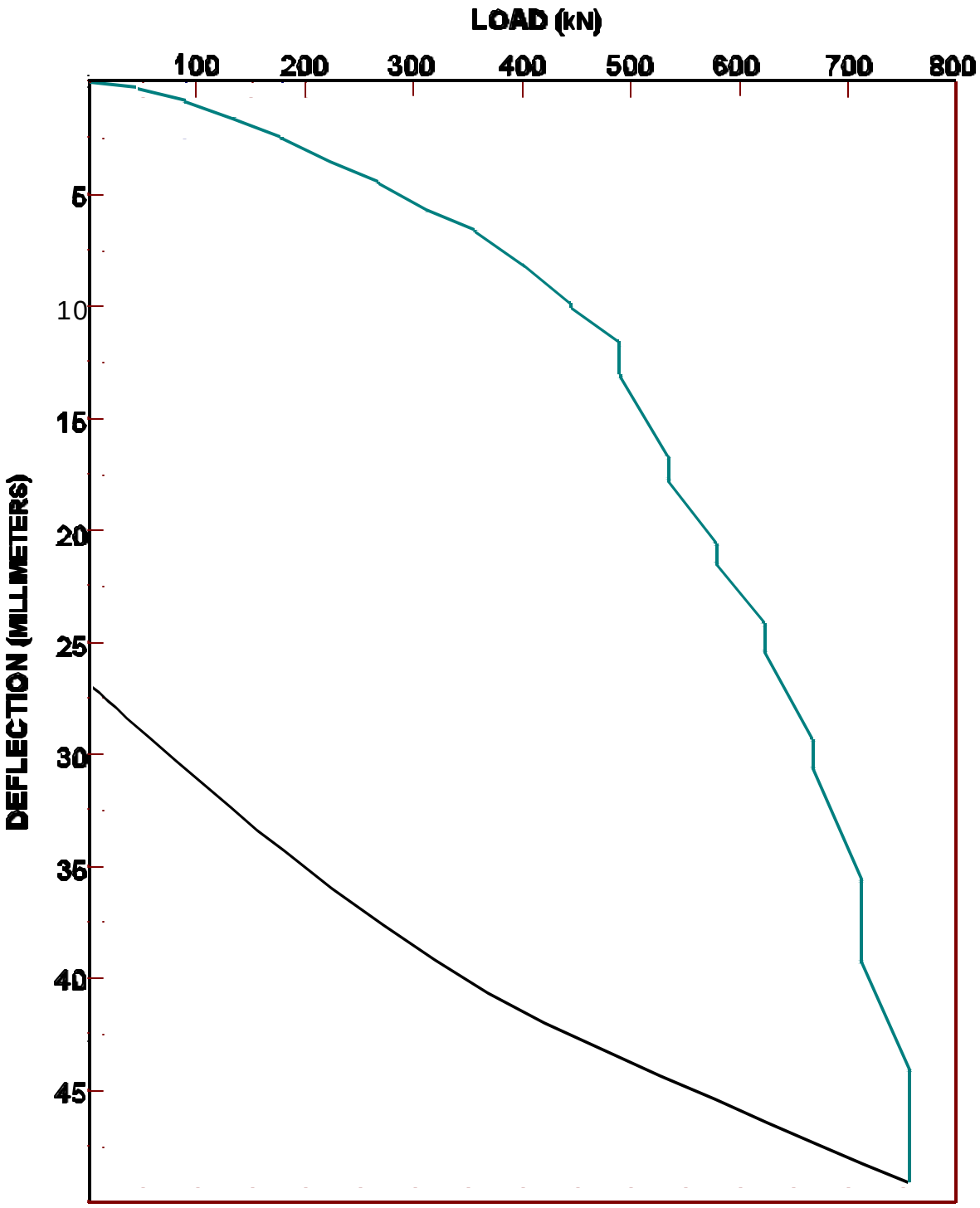


Figure 17. Load - deflection curve for a typical quick test.



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