TO:

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ENGINEERING INSTRUCTION

NEW YORK STATE DEPARTMENT OF TRANSPORTATION

SUBJECT: IMPLEMENTATION OF NEW VIBRATORY COMPACTION SPECIFICATIONS

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APPROVED:

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Deputy Chief (Facilities) / Deputy Chief (Construction)

Attached are new specifications providing for the use of vibratory rollers in lieu of the conventional system noted in Part II, Section 8.

The major changes include the following:

1. A vibratory roller may be substituted for all three presently required rollers --- breakdown, intermediate (pneumatic) and finish on all bituminous concrete pavement courses.

2. A vibratory roller must be used to compact the base course when placed in one thick lift.

Some contracts let between February 8, 1973 and June 1973 have or will contain a Special Note allowing thick lift base course construction if vibratory equipment is used.

Contracts let after June 1973 will contain two Special Notes allowing vibratory compaction for all courses (See Attachment #1) and also will permit thick lift base course construction. Please note that conventional compaction methods will continue to be allowable except where contractors elect to place base course material in lifts exceeding 4".

The following instructions pertain to the incorporation of these Special Notes into on-going contracts:

1. On-going Contracts (No Special Notes in Proposal)

   a. The Contractor may elect to continue the work under the existing contract provisions.

   b. The Contractor may request approval to adopt the new specifications (Attachment #1) by way of an Order-on-Contract. Orders-on-Contract to use vibratory compaction should be accompanied by a comparative cost analysis supporting an adjustment in contract bid prices. (See Attachment #2)

In addition, comparative cost analyses will also be required for approvals to increase lift thicknesses. Since each such analysis is highly dependent upon individual project circumstances, no standard format is attached. However, significant savings are expected to be agreed upon before approvals are granted.

2. On-going Contracts that contain a Special Note, "BASE COURSE ASPHALT CONCRETE - THICK LIFT CONSTRUCTION USING VIBRATORY COMPACTION" dated January 23, 1973

   This note allows the use of vibratory compaction only for base course construction. Contractors may request approval to adopt the Specifications for total vibratory compaction (Attachment #1). Orders-on-Contract to use vibratory compaction for other bituminous concrete items should be accompanied by a comparative cost analysis supporting an adjustment in contract bid prices. (Attachment #2)

3. Future Contracts containing new specifications for total vibratory compaction

   a. Special Note provisions will apply.

All approved rollers for all the above specifications will be listed on an "Approved Equipment List."

Four (4) vibratory rollers have been tested and, to date, are in accordance with the new specifications:

ROLLER	MODEL
BROS	SPV-735-A
GALION	VOS-84
RAYGO	404B
VIBRO-PLUS	CA-25A

Other rollers meeting the requirements of this specification will be evaluated on an individual basis. If acceptable, these additional rollers will be approved and added to the list by the Deputy Chief Engineer (Construction) upon recommendation of the Deputy Chief Engineer (Technical Services).

MDG/JS/RNS/LG
Attachments

ATTACHMENT #1

SPECIAL NOTE

BITUMINOUS CONCRETE COMPACTION USING VIBRATORY COMPACTION

The Contractor may, at his option, substitute one vibratory roller, meeting the requirements contained within this specification, in lieu of the conventional three (3) roller compaction train stipulated in the Specifications. Using this optional procedure, no other compaction equipment is required. One vibratory roller shall be provided for each nominal 12 foot lane of paving. The vibratory rollers shall be of a type that are specifically designed and intended for the compaction of bituminous concrete and shall be approved by the Deputy Chief Engineer, Construction Subdivision, prior to use.

Vibratory rollers shall meet the following requirements:

REQUIREMENTS FOR VIBRATORY ROLLERS

TOP, BINDER, BASE COURSES

Drum Width	84 inch (minimum).
Unit Static Force (at the drum)	120 lbs. per linear inch of drum width (minimum).
Unit Dynamic Force (at the drum)	225 lbs. per linear inch of drum width, computed at operating frequency, (minimum).
Unit Total Applied Force (at the drum)	350 lbs. per linear inch of drum width, computed at operating frequency, (minimum).
Unit Static Force (at the drive wheel)	240 lbs. per linear inch of the drive wheel width (minimum).
Vibration Frequency	1700 - 2400 VPM - Top and Binder Courses. 1400 VPM (minimum) - Base Course, all lifts.
Amplitude	.035 inch - .100 inch.

Additional Requirements for the Compaction of Base Courses, all lifts:

Unit Total Applied Force (at the drum)	275 lbs. per linear inch of drum width, computed at 1500 VPM frequency, (minimum).

Vibratory roller drive wheels shall be pneumatic.

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If vibratory compaction equipment is used, the Contractor shall furnish, for the exclusive use of the Engineer, one vibrating reed tachometer for each two vibratory compaction units or a minimum of one tachometer per project, whichever is greater. The vibratory reed tachometer shall have a frequency range of 1000 VPM to 4000 VPM with a minimum reed interval of 50 VPM between 1000 VPM and 2000 VPM, and a minimum reed interval of 100 VPM between 2000 VPM and 4000 VPM.

The rollers shall operate at a uniform rate of speed not to exceed 3 miles per hour.

When vibratory compaction equipment is used, one roller pass shall be defined as a single coverage of the drum over any point of the pavement per direction of roller travel.

Required Number of Passes:

Pavement Course	Vibrating Passes	Static Passes
Base (All lifts)	4	2
Binder (Regular and Dense)	3	2
Top (All types)	2	2

If excessive drum rebound (inability of pressure waves produced during vibrating passes on the surface to penetrate that surface) occurs during the vibrating passes, as determined by the Engineer, the drum vibration shall be stopped and compaction completed with the required number of static passes.

Longitudinal joints shall be compacted by using one of the pneumatic drive wheels to overlap the joint in 2 passes (with the drum operating static). The rolling sequence for the compaction of the longitudinal joint shall be as directed by the Engineer.

To prevent adhesion of the mixture to the drum, the drum shall be kept properly moistened with water, or water mixed with small quantities of detergent. If required to prevent tire pickup, the pneumatic drive wheels may be coated with a fine mist spray of fuel oil. In all instances, the surface of the pavement shall be protected from drippings of fuel oil or any other solvents used in paving, compaction or cleaning operations.

Other general compaction requirements stipulated in the Specifications shall remain in effect, as directed by the Engineer.

If, in the judgment of the Engineer, unsatisfactory results are being obtained using this optional compaction procedure, the Contractor shall cease using this procedure and progress the work in accordance with the compaction procedure stipulated in the Specifications for these items at no extra cost.

SPECIAL NOTE

BASE COURSE BITUMINOUS CONCRETE - THICK LIFT CONSTRUCTION

The Contractor may, at his option, construct the Type 1A Base Course asphalt concrete in accordance with the Specifications, or in one lift to the compacted thickness shown on the plans provided that vibratory rollers meeting the requirements of the vibratory compaction specifications for base course are used. Using this procedure, no other compaction equipment is required.

If, in the judgment of the Engineer, unsatisfactory results are being obtained using this optional one lift base course placement, the Contractor shall cease using this procedure and progress the work in accordance with the placement procedures stipulated in the specifications for this item. No extra payment will be made for the cost of changing procedures and/or equipment, the cost thereof shall be included in the price bid for the item.

ATTACHMENT #2. PRICE ANALYSIS REQUIRED FOR SUBSTITUTION OF VIBRATORY COMPACTION REQUIREMENTS ON ON-GOING CONSTRUCTION CONTRACTS.

Contractor's requests to incorporate the new vibratory compaction specifications will be approved upon his acceptance of an appropriate credit reflecting savings resulting from deletion of two rollers from the paving train. The credit may be established as a new item or items in addition to the bituminous concrete items involved, entitled, "Cost deduction for Use of Vibratory Compaction for Bituminous Concrete:"

The cost of this new item may be computed on the basis of the following relationship computed separately for Base Course and Top & Binder:

Cost per Ton of Bituminous Concrete =

$$\frac{165 \text{ ft}^2/\text{ton/inch thickness}}{W \times T \times S} \times \left[0.50(Hes - Hev) + (H_L \times OH)\right]$$

Where: W = Width of paving course (An average width based upon estimated tonnages may be utilized for the entire contract)

T = Thickness of paving course (An average depth based upon estimated tonnages may be utilized for the entire contract)

S = Average Paver Speed. (Top & Binder - 1800 ft/hr., Base Course 1200 ft/hr.)

Hes* = Hourly AED Rental cost of standard compaction equipment

Hev* = Hourly rental cost of approved vibrator compaction equipment

H_L = Hourly labor cost for 2 roller operators

OH = 1 + the appropriate profit and overhead factors for the particular contract.

Assumptions:

Weight of bituminous concrete	= 145 lb/ft^3
Paving Speed for Top & Binder	= 30 ft/min
Paving Speed for Base	= 20 ft/min
Average adjustment for duration of equipment use (P. 69 Specifications)	= 0.50

*In the absence of more precise documented data, $10 per hour may be used for (Hes - Hev)

EXAMPLE: Main line - 12' paving widths; 9000 tons 1½" binder, 6000 tons 1" top; 48,000 tons 8" Base.

Ramps - 14' paving widths; 3,000 tons 1½" binder, 2,000 tons 1" top, 16,000 tons 8" Base.

Shoulders - 7' paving widths; 5,000 tons 1" top.

Base course is paved in two 4" courses. Work is performed by a subcontractor.

Top & Binder $W = \frac{12'(9,000 + 6,000) + 14'(3,000 + 2,000) + 7'(5,000)}{9,000 + 6,000 + 3,000 + 2,000 + 5,000} = 11.40'$

$T = \frac{1"(6,000 + 2,000 + 5,000) + 1.5"(9,000 + 3,000)}{6,000 + 2,000 + 5,000 + 9,000 + 3,000} = 1.24"$

Credit $= \frac{165}{11.40 \times 1.24 \times 1,800} \times [0.5(10.00) + (17.10 \times 1.25)] = 0.17$ \$/ton

Base $W = \frac{12' (48,000) + 14' (16,000)}{48,000 + 16,000} = 12.50'$

$T = 4"$

Credit $= \frac{165}{12.50 \times 4.00 \times 1,200} \times [0.5(10.00) + (17.10 \times 1.25)] = 0.07$ \$/ton