

# Effect of Contract Mowing on Massachusetts Maintenance Costs

ROBERT W. O'BRIEN, Assistant Highway Landscape Supervisor, Massachusetts  
Department of Public Works

• THE Massachusetts Department of Public Works through the Roadside Section of its Maintenance Division considers itself among the forerunners, nationally, in the establishment of contract mowing procedures and standards as a result of 10 years of experience and analysis in this method of turf control. This report summarizes the reasons for the undertaking, its history, present practices, and proof of its economic practicability as an antidote for any who find the grass "maintenance squeeze" increasingly burdensome.

## BACKGROUND

Following World War II it became increasingly evident that the U.S. highway systems were inadequate and that concentration on their expansion was inevitable. As the Department's program unfolded, particularly assisted by the Federal Interstate System, with the policies of wider layouts and retention of scenic quality, the management of grassed areas loomed increasingly overpowering in the maintenance-dollar picture.

Before 1953, all grass mowing along Massachusetts highways was accomplished by Department personnel augmented by the employment of temporary summer labor and the rental of mowing equipment. This procedure was necessary as the permanent labor organization was based on the minimum required for year-round daily physical maintenance and snow and ice control activities. Also, with the exception of specialized equipment that cannot be easily rented it is not economical to own equipment unless it can be used at least 80 percent of the year. These basic concepts initiated a thorough exploration into the economic desirability of supplementing the permanent labor forces with contract methods.

Spiraling mowing expenditures in the early 1950's precipitated formulation of contract procedures. The factors evident for consideration (since proved to be the keys conducive to savings under contract) were the contractors' profit motive, their specialized experience, and ownership of the latest equipment in sufficient quantity. State forces were subject to the drawback of regulating inexperienced summer help, forced to suffer with the sporadic, often ill-timed, hiring of vitally needed equipment, and the inefficiency of being only part time on mowing because frequent occasions required their being away temporarily on other maintenance projects. Because grass growth in the warmer months is totally resistant to postponement, major relief, if not total salvation, was seen in substituting for the necessary working personnel and their administration, a minimum of directed supervision and a maximum delegation of responsibility. The latter has become greatly simplified by the development of highly effective contract special provisions. The Department has since gained decidedly in efficiency and standards as well as economy from this working procedure which is adapted to keep an even pace with the ever-expanding State highway system.

In the long quest for the most practical solution to this problem, a performance-type contract has evolved which clearly outlines the responsibility and performance expected in the special provisions (Appendix) and guarantees, under bond, satisfactory accomplishment. Each contract requires a pattern of mowing by items to include all grass growth within the full width of the right-of-way along the entire length of the contract section. This places the responsibility of determining the physical extent of the work on the contractor before bidding, and eliminates controversy in wording of job descriptions.

The Department's problem of supervision is reduced to a minimum because periodic inspections suffice.

The Department in 1953 awarded 14 pilot contracts for mowing along 77 miles of selected divided highways specifying 10 cuts of medians, islands, etc., under Item 1, and 5 cuts of roadsides for a minimum width of 10 feet under Item 2. These early contracts did specify reel and cutter bar use under the respective items, a stipulation since discarded, permitting the use of any type of equipment that produces a clean, sharp cut without damage to the turf. This initial venture of 14 proposals drew a total of 32 bids from 12 different contractors, and the resultant successes in economy and performance laid the ground work for development of this procedure Statewide.

In 1954 a third item of mowing was introduced to cover the area beyond the limit of Item 2 mowing, making provision for the contract mowing of all grass between right-of-way lines for the entire length of each contract. These items have since then been identified as the following:

**Item 1. Lawn-Type Mowing.**—Designated to accomplish fine grass mowing. Cut required to leave a stand of 1½ in. during May, June, and October, and 2½ in. during July, August, and September.

**Item 2. Roadside Hay Mowing.**—Designated to accomplish rough mowing of roadside areas. Cut required to leave a stand of 3 in.

**Item 3. Hay Mowing.**—Designated to accomplish hay mowing of all turf areas between the limits of Item 2 and right-of-way line. Cut required to leave a stand of 3 in.

Application of these items (Fig. 1) to conditions encountered at median, interchange, roadside areas, slopes, and at guardrail locations at fill and cut cross-sections have been through time and experience designed to accomplish the following.

Divided Highways

**Item 1. Lawn-Type Mowing.**—11 cuts per season. All flat, to, and including 4:1 slopes on median strips, interchange bowl areas, dividing strips at ramps, traffic islands and rotaries for a maximum distance of 30 ft from all roadways.

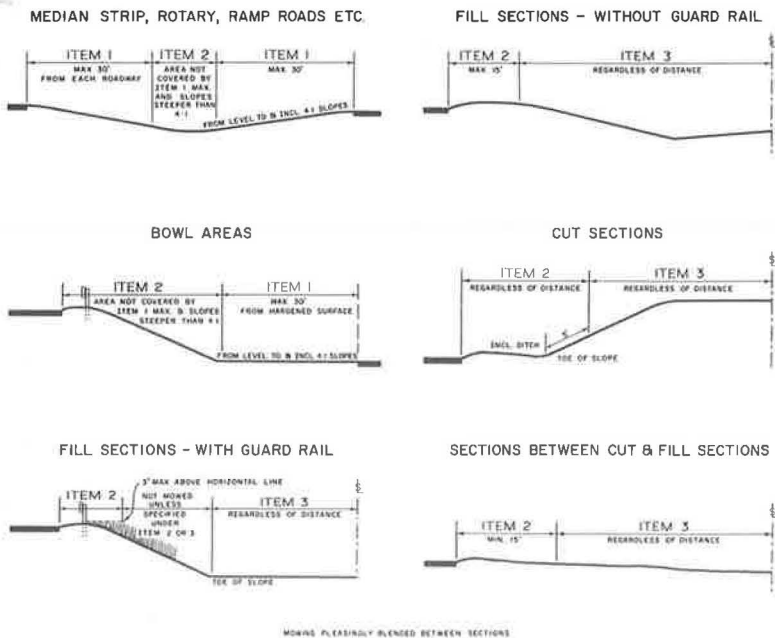


Figure 1. Application of mowing items to various topographies encountered on highway. Limits extend only to line of natural growth or areas planted for reduction of mowing.

Item 2. Roadside Hay Mowing. —5 cuts per season. The following mowing limits must be pleasingly blended:

- a. All slopes from 4:1 and steeper and uncut areas beyond the maximum width of Item 1 in the previously described areas.
- b. All roadside grassed areas at fill sections without guardrail for a maximum width of 15 ft as measured from the edge of grass growth nearest the road surface.
- c. All roadside grassed areas at fill sections with guardrail from the edge of grass growth nearest the roadways to the guardrail and from back of the guardrail sufficiently beyond the slope crown so that no uncut grass extends more than 3 in. above a horizontal plane as extended from the ground at the guardrail.
- d. All roadside grassed areas at cut cross-sections from the edge of grass growth nearest the roadway to the toe of the slope (including ditch) regardless of width, plus a 5-ft cut on the slope.
- e. All roadside grass areas between cut and full sections for a maximum distance of 15 ft from grass growth nearest the roadway.

Item 3. Hay Mowing. —One cut per season. All grassed areas from the outside limits of Item 2 to the right-of-way line.

#### Undivided Highways

Item 2. Roadside Hay Mowing. —5 cuttings (same as preceding Item 2, b, c, d, and e).

Item 3. Hay Mowing. —One cut per season (same as preceding Item 3).

Items 2 and 3 are varied somewhat in specific locations in accordance with adjacent land use such as church, memorial, and historical sites where Item 2 may be extended beyond its normal limit to the right-of-way line.

#### DEVELOPMENT OF SPECIAL PROVISIONS AND CONTRACT PROCEDURES

Massachusetts, as most of New England, experiences an average grass growth of 25 in., which statistic was the basic guide in establishing the frequencies of mowing under the preceding items. After years of actual field experience, perhaps the most important consideration given to cutting schedules is the knowledge that frequent cutting is far more economical than infrequent cuttings which necessitate expensive hay pick-up operations. It is the Department's experience that grass in Item 1 and Item 2 mowing areas, if allowed to reach a height that requires a cut of over 5 in., will produce more clippings than can be decomposed without causing matting damage to turf or without the necessity of removing the clippings.

Item 1, lawn-type mowing, was established in 1953 at 10 cuttings per season. For respectable turf control, however, it was found that this had to be increased to 15 cuttings in 1954 to combat the faster growing weeds. Then, in 1957, as a result of the effective introduction of 2, 4-D weed killer, it was possible to reduce to 11 cuttings per season. The financial advantage to mowing costs realized from this material is discussed later.

Item 2, roadside hay mowing, areas are also treated with 2, 4-D weed killer to increase the standard of appearance, but this has no influence on the minimum number of annual cuttings required. Cuttings from this item were increased from 3 in 1953 to 5 in 1957 for a higher standard of roadside appearance and to eliminate the necessity of hay pick-up.

Item 3, Hay Mowing, has been maintained at one cutting, as experience has shown the importance, particularly on slope areas, of mowing grass at least once per season to prevent tufting and encourage lateral tillering and root growth for the prevention of erosion. Hay pick-up is not generally practiced on these hard-to-mow areas, as long hay clippings do not tend to mat, and, when left as a mulch material, particularly in areas adjacent to woodlands, encourage natural growth.

Item 3, originally established on a per hour basis of payment, was not conducive to a true performance contract as this required excessive inspections. In 1957, this was revised and payment was made on a per mile cut basis with all grass on both sides of the roadway cut uniformly and completed as the work progressed in one direction, thereby requiring only periodic inspection of completed miles.

#### Schedule of Mowing

Since 1957 the following mowing schedule has been offered in the special provisions as a guide only, and the actual number of cuttings called for to be determined by the growth rate of the grass. In the special provisions a margin for fluctuating the number of cuttings has been reserved under Item 1 in an allowable increase of one or a decrease of three. Frequency under Item 2 is a fixed standard.

The 11 cuttings under Item 1 are scheduled for three during May, two each month during June, July, and September, and one each month during August and October. The 5 cuttings under Item 2 are scheduled for one during each month of May, June, July, August, and September.

Item 3 mowing is scheduled during either July or August as directed, and is completed in conjunction with Item 2 mowing before Labor Day.

#### Trimming Requirements

Between 1953 and 1956, trimming requirements at guardrail locations, delineators, trees, utility poles, ledges, and other structures were varied in an effort to establish the minimum frequency necessary for sustaining a clean and neat appearance within all mowing areas.

Trimming at guardrail locations, without question, is the most difficult, time-consuming, and costly single operation involved in grass mowing, and perhaps the most essential, because a neatly trimmed and exposed guardrail has a direct influence on highway safety.

After three years review it was reluctantly concluded that a minimum of 5 guardrail trimmings per season were necessary to maintain appearance effectively.

By 1956 sufficient experience with the use of various soil-sterilant chemicals was acquired through application by Department forces, so that trimming at guardrails could be entirely eliminated from contract mowing through use of these chemicals under the entire length of a guardrail for a 2-ft strip extending from a point 6 in. in front of the posts to a point 1 ft behind.

Trimming other than around guardrail is still required under Item 1 and 2 mowing in conjunction with each cutting; however, some economies are realized through the limited use of soil-sterilant materials around structures where no damage may occur to desirable plant growth.

In 1957 all trimming was discontinued in Item 3 hay mowing areas, as expense involved in this operation on hard-to-mow, visually distant areas did not appear justified. The contractor must, however, mow as close to obstructions as possible.

#### Control of Mowing

The repetitive nature of this work made it apparent with the increase in number of contracts that closer control on the contractor's activities was necessary as an inducement to maintain quality of work commensurate with desirable standards.

Since 1956 the special provisions have directed the actual cutting period of each required Item 1 mowing to begin on a Monday and be completed within the week, and that Item 2 mowing begin on a Monday and be completed within two weeks.

In the event of uncut and/or untrimmed areas or any unsatisfactory cut and/or trimmed areas remaining after 5:00 PM on Saturday of said week, the inspecting engineer estimates the number of hours that would be required to satisfactorily complete the work with the use of the total normal complement of men and equipment assigned the project by the contractor. A deduction of 2 percent under Item 1 or 1 percent under Item 2 is made from the contractor's unit bid price per complete cut for each hour so estimated.

Contractors are encouraged to complete each cutting sufficiently early to allow time for correcting unsatisfactory conditions before the inspection deadline. Repeated failure to complete cuttings satisfactorily is noted in the contractor's record of performance and referred to when considered for award of future contracts.

Payment for Item 1 and Item 2 mowing is made at the contractor's lump sum bid price per complete cut on completion of each directed cutting.

As two months are allowed for the completion of Item 3 mowing, the adoption of the per mile bid unit of payment allows for partial payment of completed lengths.

### Advertising and Basis of Award

As grass mowing is a seasonal operation, it is imperative that contract proposals be advertised sufficiently in advance of the mowing season to allow the prospective bidders ample time to view all projects or sites on which they are interested in bidding, and also to allow sufficient time for readvertising of a project should it be necessary to reject an original bid.

In Massachusetts where snow may cover the ground the better part of the winter and early spring, only by advertising mowing contracts in November, sufficiently in advance of snowfall, is the Department able to process all contracts well in advance of the date of the first required cutting the following spring.

Experience has shown that when a contractor has his contract in hand no later than February, he is assured of ample time to make realistic preparation for equipment, personnel, and schedule of operations sufficiently in advance of the critically important first cutting when any organizational deficiency might cause complete disruption of desired standards of work during this exaggerated growth period.

To insure complete bidding coverage for the large number of mowing proposals advertised on the same date, contractors are advised to consider each and every proposal on an individual basis, and they will not be awarded more work than their normal or reasonably expanded organization would be capable of undertaking. Under

TABLE 1  
CONDENSATION OF MASSACHUSETTS ANNUAL CONTRACT  
MOWING PROGRAM

Year	Projects	Miles	Final Cost	Total Cost Lineal Mile Per Season	Total Bids Received	Number Of Contractors Awarded Work	Average No Of Cuts Per Contract <sup>a</sup>				
							Item 1 Specified	Item 1 Performed	Item 2 Specified	Item 2 Performed	Item 3 Once Per Year
1953	14	77	35,346.43	459.04	32	5	10	4.0	5	3.0	—
1954	30	240	155,255.75	646.89	142	12	15	12.0	3	3.0	PER HOUR
1955	16	290	211,402.02	728.97	85	11	15	11.5	3	3.3	PER HOUR
1956	20	371	252,874.48	681.60	86	13	15	13.8	4	3.8	PER HOUR
1957	25	492	307,017.83 <sup>b</sup>	624.12	122	11	11	9.6	5	4.8	PER MILE
1958	25	529	261,002.68 <sup>b</sup>	493.39	143	12	11	11.3	5	4.9	PER MILE
1959	33	679	263,286.68 <sup>b</sup>				11	10.8	5	5.0	PER MILE
	20	603	117,414.27	220.92	398	27	—	—	5	4.6	PER MILE
	23	919	44,102.10				—	—	—	—	PER MILE
1960	83	2337	626,649.70 <sup>b</sup>	268.14	310	22	11	11.0	5	5.0	PER MILE
1961	83	2337	555,777.02 <sup>b</sup>	237.81	302	19	11	11.0	5	5.0	PER MILE
1962	86	2396	605,204.47 <sup>c</sup>	252.58	264	15	11	11.0	5	5.0	PER MILE

<sup>a</sup> Tenths reflect incomplected or unsatisfactorily completed cuttings

<sup>b</sup> Mowing - Soil Sterilant, 2, 4-D Urea

<sup>c</sup> Season in progress - only assigned available. Mowing, Soil Sterilant, 2, 4-D Urea and Maleic Hydrizide

this procedure a contractor capable of undertaking only a few jobs may submit bids on many and have greater assurance of being successful low bidder on at least the number of jobs that he is capable of satisfactorily completing within the time allowed. At the same time, the Department has greater assurance of receiving bids on all proposals.

Bids received on a project may vary from 12 or more in centralized areas to only a few in rural areas. Fortunately, it is rare for a proposal to receive only a single bid. The annual total number of bids received (Table 1) reflects a very healthy bidding activity on this work in Massachusetts.

Reflection of Contractors Proficiency

Experience indicates that each time the Department advertised for bids for a type of maintenance work not previously done by contract, problems were created primarily because contractors were not completely familiar with the work. However, these problems were resolved mainly as an increased number of contractors indicated an interest. In this field, as in all others concerned with contract maintenance, the contractors become experienced to the point of specialization over the years, improve their methods and equipment to insure keen competitive bidding, and, from this profit drive assure the availability of a valuable pool of skilled workers for increasing economy and satisfaction.

A new low bidder must satisfy the Department that he has sufficient equipment (owned or available), personnel, and a supervisor with at least two years' experience in this kind of work before being considered for award. As few new bidders realize the actual amount of work involved in highway mowing or the many other problems to be contended with (such as traffic and travel trash litter), they are seldom awarded more than one job their first year. This policy allows both the contractor and the Department to evaluate true ability and interest in this field while minimizing the possi-

TABLE 2  
CONTRACTOR BIDDING ACTIVITY

Contractor	(= # b)										Total of Bidding Abstract
	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	
A	2	4	2	B	2	1	2	B	-	-	8
B	2	2	3	5	8	2	1	1	B	B	10
C	2	B	-	-	-	-	-	-	-	-	2
D	1	1	1	B	1	B	3	B	-	-	8
E	2	4	1	1	B	B	B	-	-	-	7
F	3	1	B	B	-	-	-	-	-	-	4
G	2	1	B	1	B	B	B	-	-	-	7
H	6	1	-	1	3	1	14	B	-	-	7
I	1	-	-	-	-	-	-	-	-	-	1
J	2	1	-	-	-	-	-	-	-	-	1
K	1	-	-	-	-	-	-	-	-	-	1
L	3	2	B	B	2	B	B	-	-	-	7
M	1	-	-	-	-	-	-	-	-	-	1
N	1	1	2	B	B	-	-	-	-	-	5
O	2	1	B	-	-	-	-	-	-	-	2
P	1	2	1	B	1	4	4	8	3	-	8
Q	2	2	B	B	1	1	1	5	8	-	2
R	1	1	2	B	3	1	1	1	5	8	5
S	1	1	2	1	B	B	B	1	-	-	4
T	1	1	B	B	-	B	1	-	-	-	4
U	1	1	B	B	-	B	-	-	-	-	2
V	1	1	B	B	-	B	-	-	-	-	2
W	1	1	B	B	-	B	-	-	-	-	2
X	1	1	B	B	-	B	-	-	-	-	2
Y	2	2	B	B	7	3	1	-	-	-	5
Z	2	2	5	10	16	18	21	-	-	-	6
AA	1	B	3	3	3	4	4	-	-	-	6

Contractor	(= # b)										Total of Bidding Abstract
	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	
BA	1	5	6	13	18	24	-	-	-	-	6
CA	1	1	3	1	1	2	-	-	-	-	3
DA	1	4	B	8	5	3	1	6	1	-	3
EI	2	B	3	3	3	1	-	-	-	-	4
FI	1	2	B	B	-	-	-	-	-	-	4
GI	1	2	B	B	-	-	-	-	-	-	2
HI	1	1	1	1	1	1	-	-	-	-	2
II	1	2	3	3	2	B	-	-	-	-	6
JI	1	1	1	1	1	1	-	-	-	-	3
KI	1	1	1	B	1	1	1	1	1	-	4
LI	1	1	1	2	B	B	B	B	B	-	4
MI	1	1	1	6	4	8	8	1	1	-	4
NI	1	1	1	1	1	1	1	1	1	-	4
OI	1	1	1	1	1	1	1	1	1	-	3
PI	1	1	1	1	1	1	1	1	1	-	2
QI	1	1	1	1	1	1	1	1	1	-	1
RI	1	1	1	1	1	1	1	1	1	-	1
SI	1	1	1	1	1	1	1	1	1	-	1
TI	1	4	-	-	-	-	1	1	1	-	2
UI	1	3	4	4	2	2	3	4	2	-	3
VI	1	6	6	4	8	8	4	4	8	-	4
WI	1	1	1	1	1	1	1	1	1	-	2
XI	1	1	1	1	1	1	1	1	1	-	3
YI	1	1	1	1	1	1	1	1	1	-	3
ZI	1	1	1	1	1	1	1	1	1	-	1
A2	1	1	1	1	1	1	1	1	1	-	1
B2	1	1	1	1	1	1	1	1	1	-	1

<sup>a</sup> Numerals indicate number of contracts awarded per year.  
<sup>b</sup> Letter B indicates unsuccessful bidding activity.

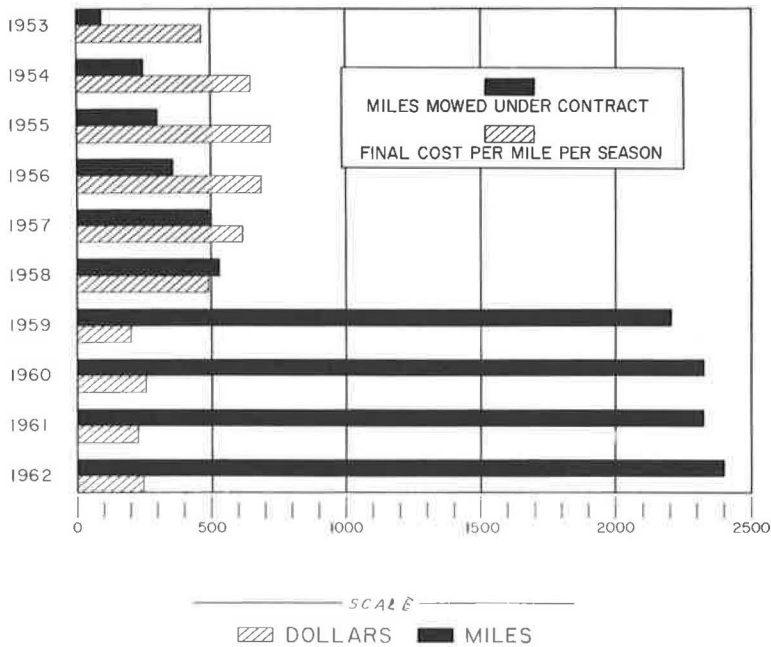


Figure 2. Annual expansion of highway miles under contract mowing program and the final cost per mile per season.

TABLE 3  
1962 ROADSIDE ACREAGE RECORD

	Median Strip, Rotary etc.	Roadside	Interchange	Total	Percent
Item I Mowing	966.2	14.3	487.7	1,468.2	7.3%
Item II Mowing	378.6	5,404.3	754.3	6,537.2	32.4%
Item III Mowing	23.4	2,404.8	206.7	2,634.9	13.0%
<b>TOTAL MOWING ACRES</b>	<b>1,368.2</b>	<b>7,823.4</b>	<b>1,448.7</b>	<b>10,640.3</b>	<b>52.7%</b>
Non-Grass Areas (Natural Growth, Ledge, etc.)	857.5	7,818.0	875.0	9,550.5	47.3%
<b>GRAND TOTAL ACRES</b>	<b>2,225.7</b>	<b>15,641.4</b>	<b>2,323.7</b>	<b>20,190.8</b>	<b>100.0%</b>

bility of contractor failure. In 10 years of contract mowing, only one contractor has failed to the point that the Department had to undertake the work and assess all costs against the bonding company.

After satisfactorily completing a contract and having become familiar with the entire procedure of work, supervision, and payment, a contractor is considered in the future for award of as many contracts as his equipment and organization are capable of handling.

Record of contractor's activities (Table 2) is kept only after award of initial mowing contract. This record reflects the development of contractors in this field, indicating by year their initial award and subsequent bidding or award activity. Awards are not entirely based on low bids, as occasionally a second or third low bidder must be reached when a lower bidder has been awarded all the work he is capable of undertaking and completing satisfactorily within the mowing season.

Beginning in 1953 with the original five successful bidders, this record has expanded by an annual increase of at least three new successful bidders to today's total of 54 individual contractors who have been awarded one or more contracts. Though many of the contractors may not submit successful low bids each succeeding year, only 8 have failed to submit bids at least one year following initial award. Interest and contractor development over the years have resulted in at least 20 experienced mowing contractors bidding this work each year since 1960.

## COST ANALYSIS

### Reduction in Annual Cost per Mile

Although contract mowing economics reflected in a unit of cost per mile does not account for the amount of work performed in any given mile, it is, nevertheless, a reasonable barometer indicating the influence of the development of special provisions, contractors, and allied activities which contribute to over-all grass maintenance.

In 1953 late award of the initial 14 contracts covering 77 miles of highway, and during severe summer drought, reduced the number of accomplished cuttings under reel-type mowing from the specified 10 to 4, and under cutter bar mowing from 5 to 3. The total final cost of this work was \$35,346.46 or \$459.04 per mile per season.

On completion of this mowing, the Department conducted an extensive study on the comparative costs of mowing by contract and force account. At that time, figures indicated that the average force account cost per mile per season would be \$613.17 for the work accomplished by contract at \$459.04. Total force account mowing costs were estimated in the vicinity of \$1,000,000 per year in Massachusetts.

Contract mowing was expanded in 1954 to cover 240 miles of highway under 30 contracts. Work performed included 12 Item 1 cuttings, 3 Item 2 cuttings and all Item 3 mowing at a final cost of \$155,255.75 or \$646.89 per mile per season, representing an increase of only \$187.85 more per mile per season than that paid for the very limited amount of work performed in 1953.

Favorable operational results, and cost evaluations and interest shown by contractors encouraged annual expansion of this program until in 1958 all mowing on the then total of 529 miles of major highways was accomplished under 25 contracts at an ultimate cost of \$261,002.08 or \$493.39 per mile.

This represented a seasonal reduction of \$153.50 per mile over the 1954 costs, reflecting many improvements gained through the development of both the special provisions and contractors. However, the greatest influence on this economy was the introduction of weed killer and soil sterilant chemicals to mowing areas in the 1957 season.

### Beneficial Contribution of Applied Chemicals

Weed killer 2, 4-D applied to all Item 1 mowing areas allowed a reduction in the number of annual cuttings required under this item from 15 to 11 without sacrifice of appearance. This operation, since developed as an annual contract maintenance function, includes the combined application of urea 45 percent nitrogen fertilizer for the rejuvenation of turf areas chemically weeded. The annual cost of this combination spray is approximately \$12.00 per acre for two treatments per season. The elimination of a minimum of three Item 1 mowings represents a definite saving of at least \$15.00 per acre per season. Other acreage costs are discussed later. This saving



is further extended. After two successive years of treatment, areas are placed under a biennial spray program.

Also in 1957 the use of soil-sterilant chemicals applied to the entire length of all guardrails in contract mowing areas allowed the Department to eliminate the necessity of trimming at these locations. Contract application methods have also been designed for this operation, which today is extended to all guardrails on State highways under a three-year rotation program.

The economy of this operation cannot be overemphasized in its dollar savings value to the maintenance budget. A single soil-sterilant application, which effectively controls all vegetative growth for a minimum of two years, costs approximately \$45.00 per mile of guardrail, represents less than one-tenth of the minimum cost of accomplishing hand trimming of an equal area for the same period.

Though the application of 2, 4-D weed-killer, urea fertilizer, and soil sterilants provide desired results for at least a two-year period, reduced to an annual consideration, the expenditure of approximately \$27,000 for materials and application of these chemicals has resulted in a spectacular savings of \$220,000 to over-all grass maintenance costs.

In 1959 due to the high standards attained and the economies realized, this method of turf management was expanded to cover the entire State highway system through inclusion of all nondivided highways, which contain comparatively fewer grassed areas requiring only Item 2 and 3 mowing.

Through 1959, contract proposal assignments were for lengths on specified auto routes, and the Department was faced at that time with the complicating feature of disagreement between connecting contractors as to responsibility at intersections and grade separations. In 1960 proposals were revised to coincide with the geographical limits of the established area of a foreman's section, and this clear definition of the highway facilities contained therein precluded any overlapping of responsibility. This provided considerable supervisory advantage. Even though work is being accomplished by contract method, the section foreman must exercise interest in all physical maintenance work being performed within his individual area of responsibility. His familiarity with this work and his daily observations greatly assist the engineer in over-all inspection. Use of this relatively static quantity facilitated and improved bidding. Contractors over the years could more easily familiarize themselves with the demands of a particular proposal area, solidifying their judgment in bidding, which since 1959 has averaged \$245.00 per mile per season, representing an annual budget of approximately \$600,000 for the mowing of all grass on the entire State highway system.

Final cost per lineal mile figures (Table 1) beginning with 1957 represent the total annual sum of all activities (contract and hired equipment) contributing to the maintenance of grass within contract areas. Before this date, force account maintenance records were not sufficiently detailed to segregate costs accurately, although analysis of past expenditures reveals that more than one-fourth of the total physical maintenance budget is needed for roadside work; and that approximately one-third of this is absorbed by grass maintenance activities.

#### Comparison of Savings Based on Acreage Analysis

As analysis based on lineal miles (Table 1) and (Fig. 2) does not provide the unit of accuracy necessary for segregated roadside activity costs, a record of all acreage on State highway layout, exclusive of hardened surface, shoulder and bridges, has been maintained since 1960. This record (Table 3), annually revised to absorb changing land use and new mileage, presently totals 20,190.8 acres of roadside layout, of which 10,640.3 or 52.7 percent are grassed areas, normally requiring annual maintenance.

Of this total 20,190.8 acres, 1,468 or 7.3 percent are Item 1 mowing areas, 6,537.2 or 32.4 percent are Item 2 mowing areas, and 2,634.9 or 13.0 percent are Item 3 mowing areas. The remaining 9,550.5 acres or 47.5 percent of the total layout are either non-grassed areas such as ledges, where natural growth exists, or planting has been accomplished for the reduction of mowing.

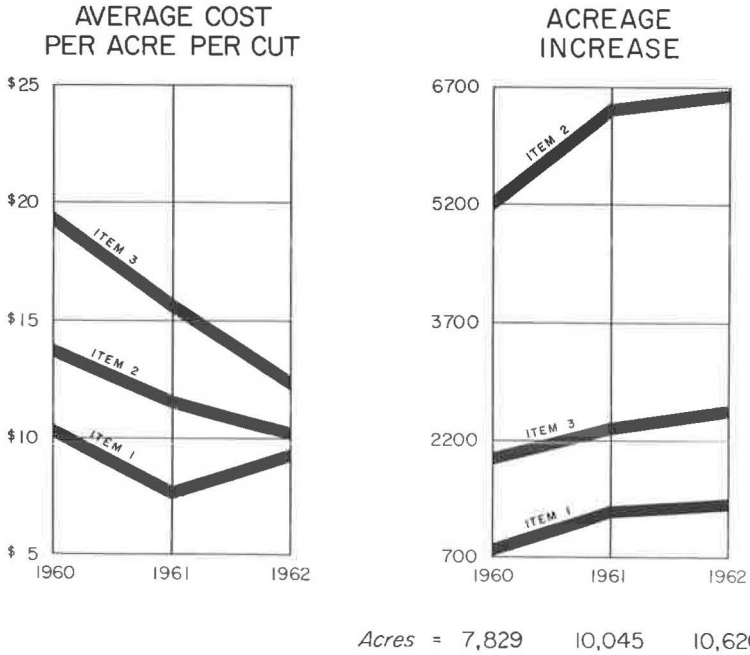


Figure 3. Three-year analysis of contract mowing per acre per cut.

**TABLE 4**  
**THREE YEAR ANALYSIS OF CONTRACT PER**  
**ACRE PER CUT<sup>a</sup>**

ITEM 1		
YEAR	ACREAGE	COST PER CUT
1960	773	\$10.13
1961	1,296	7.79
1962	1,393	9.08
ITEM 2		
YEAR	ACREAGE	COST PER CUT
1960	5,149	\$13.11
1961	6,362	11.50
1962	6,597	10.26
ITEM 3		
YEAR	ACREAGE	COST PER CUT
1960	1,907	\$19.12
1961	2,387	15.81
1962	2,630	12.66

<sup>(a)</sup>Contract bid prices per complete cut of Item 1 and Item 2 and bid price per mile of Item 3 converted to cost per cut of existing grassed acreage within Item areas.

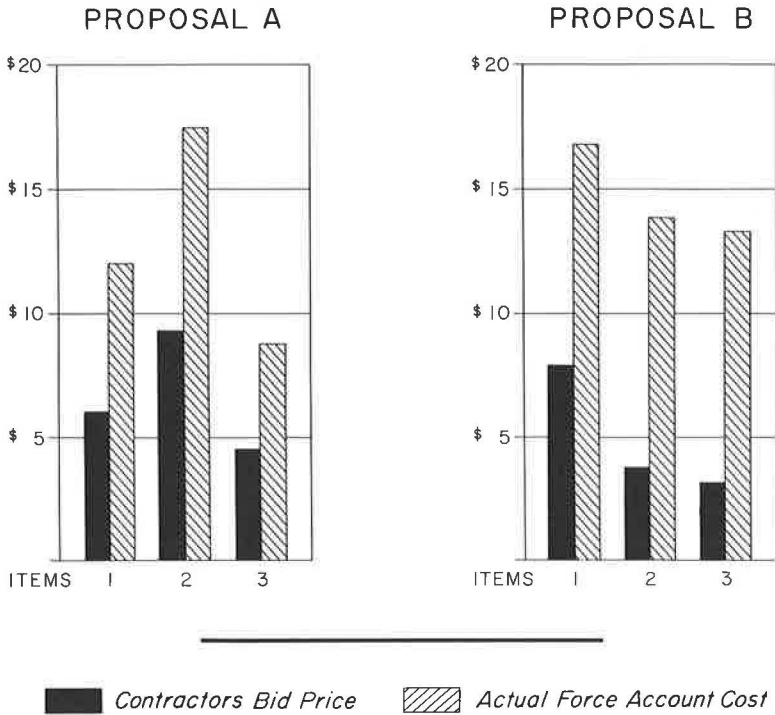


Figure 4. 1961 comparative cost per acre per cut study of contract vs force account mowing.

TABLE 5  
CONTRACT VS FORCE ACCOUNT COMPARATIVE COST  
STUDY ANALYSIS OF TOTAL COST  
PER ITEM

PROPOSAL A (16.2 MILES)

<u>Item</u>	<u>Force Account Cost</u>	<u>Contract Bid Price</u>	<u>Acres</u>
1	\$ 7,878.23 (64.8%)	\$ 4,200.00 (64.3%)	93.7
2	2,934.58 (24.2%)	1,600.00 (24.5%)	8.6
3	1,348.16 (11.0%)	729.00 (11.2%)	150.1
	\$12,160.97 (100%)	\$ 6,529.00 (100%)	252.4

PROPOSAL B (23.4 MILES)

<u>Item</u>	<u>Force Account Cost</u>	<u>Contract Bid Price</u>	<u>Acres</u>
1	\$ 5,554.53 (38.7%)	\$ 2,600.00 (51.4%)	40.9
2	7,596.19 (52.9%)	2,150.00 (42.5%)	111.4
3	1,203.84 ( 8.4%)	312.00 ( 6.1%)	92.3
	\$14,354.50 (100%)	\$ 5,062.00 (100%)	244.6

*Force Account figures represent actual costs of accomplishing work. Contract bid price represents what work would have cost if accomplished by contract method.*

The geographical division of the total 10,640.3 grassed acres is 1,368.2 of medians, 1,448.7 of interchanges and 7,823.4 of roadsides.

A single mowing of all grass within an average mile representing 4.5 acres or a width of 40 feet is being accomplished this year at a contract cost of only \$48.11 per mile.

A study of acreage data applied to the unit bid prices received for each item of mowing on all contracts for a three-year cost per acre per cut analysis (Fig. 3) further substantiates the economic necessity of this work being performed under competitive contracting.

Since 1960 (Table 4) the Item 1 cost per acre per cut has been reduced from \$10.13 to \$9.08; Item 2 cost per acre per cut from \$13.11 to \$10.26; and Item 3 cost per acre per cut from \$19.12 to \$12.66.

During this three-year period 2,791 acres of mowing area were added to maintenance responsibility, and the Statewide contract mowing cost has been reduced by more than \$20,000.

#### Special Study of Contract vs Force Account Mowing Costs

By 1961 this Department's contract mowing procedures had been developed until it was felt that these methods effected a sound turf management program under which a high degree of both turf protection and pleasing turf appearance was achieved.

The standard of maintenance of grassed areas was at a point where it was again desirable to obtain accurate comparative costs between contract and force account mowing, and following receipt of bids for the 1961 contract mowing, two proposals, selected at random, were rejected so that the work might be accomplished by force account methods.

To insure that force account cost data, accumulated throughout the season, be comparable with contract cost figures, all contract mowing special provisions were followed.

Only costs normally related to the contractor were considered, and charges normally absorbed by the Department under contract mowing, such as raking and pickup of the area, hay pickup when necessary, final inspection of each cutting, engineering and clerical overhead charges, were not included in the charges against this work.

At the completion of this work, detailed weekly reports of force account mowing costs were analyzed on the basis of work units accomplished in comparison to prices that would have been paid to the low bidder of each project at the unit price submitted.

Reduced to a seasonal cost per mile, the contract price of \$292.70 was comparable with the current average statewide contract cost, whereas the actual per mile cost of \$669.58 for accomplishing this work by force account methods was comparable to the analysis of force account costs made in 1953.

Both study areas were under normal programing of weed killer, fertilization, and soil-sterilant spraying, although their costs are not represented in the mowing analysis figures.

Figure 4 shows the similarity between the contractor's evaluation of costs per acre per cut of each item and the graduated Department force account costs on both projects.

Problems encountered in force account performance of this work were basically the reason for this Department's original exploration into the feasibility of performing this work by contract method back in the early 1950's.

Results of this comparative cost study (Table 5) substantiate the analysis of mowing costs made before doing this work by contract, and show that the over-all costs of grass mowing have been, through this method, reduced by at least 50 percent, while at the same time providing a uniform standard of mowing and a far more uniform and clean roadside appearance throughout the State highway system than had previously been accomplished with force account mowing.

## CONCLUSION

### Value of Standards

The desirability of a standard for grass mowing has been apparent to the AASHO Committee on Maintenance and Equipment for some time, and through the efforts of its subcommittee on Highway Maintenance Standards, a set of standards developed as a guide for roadside mowing was approved and ordered printed as a guide by the Executive Committee on June 19, 1962. These guide standards are very similar to those under which the Department's contract mowing procedures have been developed.

The true values in accomplishing many roadside activities by contract method under such standards go beyond budgetary economics in that an efficient high standard of roadside maintenance produces the uniformity, pleasing appearance, and safety that is expected by the general public of today's modern highway system.

### Summary of Influence in Mowing Economy

The pursuit of economy in grass maintenance is an expanding and never-ending challenge. The Department is presently engaged in its second year of contract application of growth inhibitor maleic hydrazide to 2,790 acres of Item 1 and Item 2 mowing within 19 mowing contract areas. Through the use of this chemical, the number of mowings called for within these areas under Item 1 have been reduced from 11 to 4 and under Item 2 from 5 to 2. This undertaking, in its infancy as contract mowing was in 1953, is costing more per acre treated than would a full schedule of mowing, reflecting the present high cost of the chemical in comparison to the low prices being paid for contract mowing. As optimism is the essence of progress, the additional expense is felt to be more than justified, as knowledge gained and refinement of procedures may place at the Department's disposal another tool whose potential influences on future maintenance savings are today not fully understood.

Although the title of this paper indicated a discussion of only contract mowing, the influence of chemical turf control is so inextricably entwined with the advantages from contract mowing in the Massachusetts program, it was necessary that its features be included as well to present a true picture of all influences contributing to the overall economy of the grass maintenance program.

As long as the contracting industry shows competitive interest as favorably as today, it is the intent of the Massachusetts Department of Public Works to continue mowing all grass on the State highway system by contract method. It is hoped that this brief synopsis of the Department's efforts has highlighted the tremendous savings made possible through the development of contract procedures.

## *Appendix*

### SPECIAL PROVISIONS

#### FOREWORD

The work to be done hereunder shall conform to the Massachusetts Department of Public Works Standard Specifications for Highways and Bridges 1953 Edition, the Amendments, Addenda, Uniform Special Provisions and Supplementary Uniform Special Provisions for Bridges included in a Pamphlet entitled "Amendments and Addenda, June 1961," and the Special Provisions included hereinafter. The said Standard Specifications were approved by the Board of Commissioners on January 26, 1954.

Such other Amendments and Addenda, as may be included herewith, are hereby specifically made a part of the Special Provisions of this contract as fully and to the same effect as if they had been set forth at length herein.

References in the following Special Provisions, unless otherwise stated, are to the aforesaid "Standard Specifications" and "Amendments and Addenda." In case of conflict between these Special Provisions and the aforesaid Standard Specifications, Amendments, Addenda, Uniform Special Provisions, and Supplementary Uniform Special Provisions, these Special Provisions shall take precedence and shall govern.

The enforcement of the requirements of any of these Special Provisions shall not be construed as waiving any of the rights of the Party of the First Part contained in any of the other provisions of this contract.

#### PROCUREMENT OF LABOR (Supplementing Article 63)

Attention is directed to the assistance which is available from the State employment services in the recruitment of workers in all occupations and skills. Contractor may obtain assistance in such employment of labor first from the local labor market and, when the required workers are not so available, he may obtain such assistance through the nation wide clearance system of the U.S. Employment Service.

#### CONSTRUCTION STAKINGS (Supplementing Article 34)

All the requirements of Article 34 as amended regarding employment by the Contractor of engineering personnel or the furnishing and setting of stakes by him are hereby waived by the Department for this project. The Department will furnish all engineering necessary to maintain lines and grades and accurate control for the work.

CLASS I BITUMINOUS CONCRETE PAVEMENT TYPE I-1, shall be constructed as required in accordance with the Plans, the relevant provisions of Section B-18 as revised April, 1961 and included in Pamphlet entitled "Amendments and Addenda," June, 1961.

Compensation for this work will be made at the contract unit price per ton under Item B18-1.

JUNE 1961

SPECIAL PROVISIONS

for

MOWING GRASSED AREAS ALONG STATE HIGHWAYSSCOPE OF WORK

The work to be done under this contract shall consist of mowing all grassed areas as outlined in these special provisions located within the State Highways right-of-way layout including street approaches between such points or stations as are designated in the itemized proposal included hereinafter.

All interchange areas to the Limits of all adjoining ramps within the State Highway Layout, between the described Limits of each route as indicated on the Proposal page, shall be included in their entirety, unless specific exclusion is noted. The intersecting State Highway from the Limits of all adjoining ramps in both directions, to the end of the State Highway Layout shall also be included in all instances where the intersecting State Highway has not been described in some mowing proposal. Special conditions relating to individual projects are also outlined on the itemized proposal pages.

Information relative to Limits of the State Highway Layouts involved may be obtained at the Department's District Offices, the location of which are listed following these Special Provisions.

The work shall be done in accordance with these Special Provisions and the relevant provisions of the Department's General Requirements and Covenants included in Division I of the Standard Specifications for Highways and Bridges, 1953 Edition.

All roadside, median strip, bowl, dividing strip, rotaries, and/or traffic islands, grassed areas shall be completely mowed under either Items 1, 2 and/or 3 as follows irrespective of previous mowing treatment.

MEDIAN STRIPS:

- A. All flat or rolling slopes from level to and including  $\frac{1}{4}$  to 1 slopes shall be mowed under Item 1 for a maximum width of 30 feet from the edge of the hardened surface of each roadway.
- B. All moderately steep slopes from  $\frac{1}{4}$  to 1 to and including 2 to 1 slopes and those uncut areas of slopes flatter than  $\frac{1}{4}$  to 1 not covered by the maximum width for Item 1 mowing shall be mowed under Item 2.
- C. All slopes steeper than 2 to 1 shall be mowed under Item 2.

BOWL AREAS (areas completely enclosed by roadways at interchanges:)

- A. All flat or rolling slopes from level to and including  $\frac{1}{4}$  to 1 slopes shall be mowed under Item 1 for a maximum width of 30 feet from the edge of the hardened surface of the roadway.
- B. All moderately steep slopes from  $\frac{1}{4}$  to 1 and including 2 to 1 slopes and those uncut areas on slopes flatter than  $\frac{1}{4}$  to 1 not covered by the maximum width for Item 1 mowing shall be mowed under Item 2.
- C. All slopes steeper than 2 to 1 shall be mowed under Item 2.

DIVIDING STRIPS AT RAMPS, TRAFFIC ISLANDS AND ROTARIES:

- A. All flat or rolling slopes from level to and including  $\frac{1}{4}$  to 1 slopes shall be mowed in their entirety under Item 1.
- B. All moderately steep slopes from  $\frac{1}{4}$  to 1 to and including 2 to 1 slopes shall be mowed under Item 2.
- C. All slopes steeper than 2 to 1 shall be mowed under Item 2.

Median Strips, Bowl Areas, Dividing Strips at Ramps, traffic island and rotaries shall be mowed as outlined above regardless of the presence of guard rail.

All grassed areas regardless of width, in the above described locations and whether continuous in topography or not shall be mowed under either Item 1 or 2. This applies equally to cut sections, fill sections and sections between cut and fill.

ROADSIDES shall be mowed as follows:

Only Items 2 and 3 will be required on roadside grassed areas except at such locations as are outlined on the Proposal page.

AT FILL CROSS SECTIONS

1. With Guard Rail:

- a. From the edge of grass growth nearest the road surface to the guard rail and from back of the guard rail extending away from the road surface to a point sufficiently beyond the break of the slope crown so that no uncut grass on the slope will extend higher than 3-inches above, a horizontal plane as extended from the ground at the guard rail shall be mowed under Item 2.
- b. The balance of the fill slope area will not be mowed under either Item 2 or 3 unless specific sections are so specified on the itemized proposal sheet.
- c. Grassed areas from the toe of the fill slope to the layout line shall be mowed under Item 3.

2. Without Guard Rail:

- a. For a maximum width of 15 feet of grassed area as measured from the edge of grass growth nearest the road surface shall be mowed under Item 2.
- b. Grassed areas from the outside limits of Item 2 mowing to the layout line shall be mowed under Item 3.

AT CUT CROSS SECTIONS

- a. From the edge of grass growth nearest the road surface to the toe of the slope (including ditch) plus a width of 5 feet on the slope regardless of the total width involved shall be mowed under Item 2.
- b. Grassed areas from the outside limits of Item 2 mowing to the top of the slope shall be mowed under Item 3.
- c. Grassed areas from the top of the slope to the layout line shall be mowed under Item 3.

AT CROSS SECTIONS BETWEEN FILL AND CUT SECTIONS

- a. From the edge of grass growth nearest the road surface for a minimum distance of 15 feet shall be mowed under Item 2. (This mowed area must blend with areas mowed at fill and cut cross sections as described above).
- b. Grassed areas from the outside limits of Item 2 to the layout line shall be mowed under Item 3.

Each foot of length on each project will be either in a fill Cross Section, a cut cross section or a cross section between fill and cut sections. Usually a cross section at any particular point extends from the layout line on one side of the road to the layout line on the opposite side of the road. However, as it relates to roadside mowing, each side of the center line of the involved roadway shall be considered separately.

The section shall be considered a CUT cross section from the center line of the roadway to the layout line where the side slope nearest the layout line has been constructed below the original topography of the ground.

The section shall be considered a FILL cross section from the center line of the roadway to the layout line where the side slope nearest the layout line has been constructed above the original topography of the ground.



Regardless of the foregoing limitations grassed areas within the limits of Rest Areas and for a distance not to exceed 15 feet outside the limits of the Rest Area, shall be mowed under Item 2. This shall also apply to truck turnouts.

All other grassed areas not outlined above shall be mowed under Item 3 with the exception of certain slopes on which desirable natural growth, as identified by the District Highway Engineer, has established itself; vines, seedlings and ground cover plants have been established for erosion control; or where mulch has been applied for erosion control and the inducement of natural growth. In such areas the Contractor shall mow only the clear grass area up to the line of natural growth, and/or erosion control plantings, and mulch. Areas shall be mowed where mulch has been applied for the inducement of grass growth.

The Contractor shall not be required to rake or pick up any cut grass.

This contract does not require trimming at guard rail locations, since the total length of guard rail sections from a point 6-inches in front of the posts to a point 1 foot behind the posts will be treated by the Department with chemicals which will render the soil sterile thereby eliminating all vegetative growth. Also this contract does not include trimming in areas mowed under Item 3 but the Contractor shall mow as close to all obstructions as possible.

Neat trimming will be necessary in all areas mowed under Items 1 and 2 around poles, trees, ledges, delineators, utility poles, curbs, piers, abutments and other structures coming within the item area and shall be conducted simultaneously with the mowing during each cutting operation. All curbing shall be trimmed and exposed.

Grassed areas which are saturated with water during certain periods of the year to the point where equipment may not be used without extensive damage to the turf shall not be mowed at the particular time but shall be mowed under the applicable item when dry.

Certain newly seeded areas on new Construction may not require a full schedule of mowing until the establishment of a stable turf.

Certain areas within the limits of locations described on the Proposal page may be under contract for construction or reconstruction and may not require a full schedule of mowing.

The foregoing outline of mowing treatment shall apply to both sides of the specified roadways and the outside areas of interchange, exit and access roadway locations, as well as all median strips, bowl areas, dividing ramps, rotaries and traffic islands.

Grass referred to under this contract shall include areas that consist of all grass, part grass and part succulent weed growth or all succulent weed growth present within the State Highway layouts. Woody growth or brush shall not be classified as grass.

The mileage as indicated on the Proposal page is the approximate number of base line horizontal miles, in either direction, between all described limits of the contract regardless of whether single or double barrel roadway is involved and is furnished as a guide only.

This mileage does not reflect the mileage involved in ramp and approach roadways at interchanges and intersections, rotaries, turnouts, etc., even though work may be required in these areas under these Special Provisions.

Prosecution of Work

No work shall be done under this contract on Sundays or Holidays.

The Contractor shall begin work under the various items and prosecute same in accordance with these Special Provisions and as directed by the District Highway Engineer whose authority is outlined in Article 28 of the Department Standard Specifications.

During the months of MAY, JUNE and OCTOBER, each directed cutting under Item 1 shall be performed in such a manner that the result will provide a stand of mowed grass  $1\frac{1}{2}$  inches tall immediately following cutting, and during the months of JULY, AUGUST and SEPTEMBER, in such a manner that the result will provide a stand of mowed grass  $2\frac{1}{2}$  inches tall immediately following cutting.

As the actual total number of cuttings necessary under Item 1 shall be determined by the growth rate of the grass to be mowed, the District Highway Engineer may direct that the number of cuttings under proposals calling for eleven cuttings be reduced by a maximum of three or that the number of cuttings be increased by a maximum of one, or that under proposals calling for three cuttings the number of cuttings be increased by a maximum of one.

The actual cutting period of each required mowing under Item 1 as specified on the Proposal Page shall be as directed and shall begin on MONDAY and be completed within the week specified.

The first cutting under Item 1 on proposals calling for eleven cuttings shall not begin before the last MONDAY in APRIL and may be delayed until the following week if so directed by the District Highway Engineer. Under such proposals only one cutting under Item 1 shall be made during the month of OCTOBER and shall commence no earlier than the first MONDAY in OCTOBER.

Under proposals calling for only three Item 1 cuttings, such cuttings shall be scheduled as directed by the District Highway Engineer. The tentative schedule appearing in these Special Provisions may be used as a guide.

As the necessary frequency of the number of cuttings of Item 2, as called for on the Proposal Page, shall be determined by the growth rate of the grass to be mowed, the period of each mowing shall be as directed by the District Highway Engineer.

Each cutting under Item 2 shall be performed in such a manner that its results will provide a stand of mowed grass 3 inches tall immediately following cutting.

The prosecution of work, as described under Item 2, shall apply to both proposals calling for five and for two Item 2 Mowings.

Item 3 mowing shall commence at one end of the contract mowing area as directed, and proceed in one direction for the entire length of the project. Item 3 mowing shall be accomplished during either JULY or AUGUST as directed, and shall be completed before Labor Day. Under proposals calling for five Item 2 Mowing, the Item 3 Mowing shall be accomplished in conjunction with Item 2 Mowing. Only those lengths which have been completed and satisfactorily mowed on both sides of the road shall qualify for partial payment under this item.

All cuttings under Item 3 shall be performed in such a manner that its result will provide a stand of mowed grass 3 inches tall immediately following cutting.

Under no circumstances shall the Department be responsible for any damage to the Contractor's equipment due to any obstacles, (stone, sand, debris, etc.) he may encounter during the work to be performed under this contract and the Contractor shall not receive any compensation therefor, in addition to the contract unit price per cutting.

All trimming work, (power, and/or hand equipment), necessary under Item 1 and Item 2 shall be conducted simultaneously with each mowing, and the Contractor will be required to organize his operations accordingly.

The Contractor shall be fully responsible for the supervision and the satisfactory performance of his organization. The Contractor shall be responsible for the completion of all work called for under this contract, as set forth in these Special Provisions and as directed, in a manner satisfactory to the District Highway Engineer.

During the period of mowing operations, the Contractor shall consult the Engineer for inspection and tentative approval of work being accomplished, so that in the event of unsatisfactory work, sufficient time will be available to the Contractor, for re-mowing such areas in order that the total cutting may be completed in a satisfactory manner within the time specified.

Upon completion of each Item 1 and/or Item 2 Mowing, and on completed lengths of Item 3 Mowing, the Contractor shall notify the Engineer so that a final inspection of the involved area may be made before approval of the item of work.

Repeated failure of the Contractor to perform satisfactorily the work as called for under this contract within the specified periods shall be deemed sufficient reason for the Department to protect its interests in accordance with Article 76.

The following cutting schedules for contracts calling for eleven Item 1 and five Item 2 mowings are tentative guides only as the actual cutting periods will be as directed by the District Highway Engineer:

<u>ITEM 1</u>	<u>MONTH</u>	<u>NUMBER OF CUTTINGS</u>	<u>ITEM 2</u>	<u>MONTH</u>	<u>NUMBER OF CUTTINGS</u>
	MAY	3		MAY	1
	JUNE	2		JUNE	1
	JULY	2		JULY	1
	AUGUST	1		AUGUST	1
	SEPTEMBER	2		SEPTEMBER	1
	OCTOBER	1			

The following cutting schedule for contracts calling for three Item 1 and two Item 2 mowings are tentative guides only as the actual cutting periods will be as directed by the District Highway Engineer:

<u>ITEM 1</u>	<u>MONTH</u>	<u>NUMBER OF CUTTINGS</u>	<u>ITEM 2</u>	<u>MONTH</u>	<u>NUMBER OF CUTTINGS</u>
	MAY	1			
	JUNE	1		June	1
	SEPTEMBER	1		SEPTEMBER	1

If in the opinion of the Engineer, it is necessary at any time in order to maintain the schedule of cuttings under each item, the Contractor shall, when directed, employ such forces and equipment for one or more additional shifts as will be required to take full advantage of all daylight hours to insure the proper completion of the work. The Contractor shall not receive any compensation therefor in addition to the contract unit prices.

Note: It is the intention of the Department to treat all roadside, median strip, ramp road, and traffic island grassed areas, under contract mowing, for a width of 20 feet with weed control chemicals for the elimination of such weed growth. Two applications of chemicals are planned for the season and as these areas may not be mowed for 72 hours before treatment nor 48 hours after treatment it will be necessary for the District Highway Engineer to coordinate these two operations so as to insure the least inconvenience to all parties concerned.

#### Examination of Location

The Contractor must satisfy himself by his own investigation and research regarding all conditions affecting the work and the amount of work to be done, the labor and equipment needed, and make his bid in sole reliance thereon.

#### Rejection of Proposal (Supplementing Article 10)

Proposals containing abnormally low unit prices for Items 1 or 2 and/or 3 thereby making profitable the potential failure to complete portions of the work in lieu of payment of the specified credit, shall be rejected as informal.

#### Competency of Bidders (Supplementing Article 12)

As this contract contains work of a special nature, Contractor to whom the contract will be awarded may be required to furnish the Department with a written statement, indicating that he has the necessary skill, experienced personnel and a qualified supervisor who has had at least two years experience in this kind of work together with a listing of all equipment of his own and equipment available to him which he intends to use in performing the work required under this contract in a satisfactory manner and within the time stipulated.

The low bidder on each proposal will be required to give evidence that he can meet the requirements of Article 12.

A Contractor who is low bidder on more than one proposal will be required to give evidence that he can meet the requirements of Article 12 for all projects collectively on which he is low bidder so that work on all projects will be carried on simultaneously when necessary to complete the work within the specified time.

#### Consideration of Bids (Supplementing Article 14)

This proposal book contains a number of separate projects for the same type of work. Prospective bidders are advised to consider each and every project on an individual basis.

The Department reserves the right to waive any informality in or reject any or all proposals; therefore, low bidders will be considered for award on the basis of bid price, performance record, experience, organization, equipment, etc.

An award will not be made to a Contractor who is not equipped to undertake and complete the work within the specified time.

INSURANCE REQUIREMENTS (Supplementing article 46)

The limits of the several kinds of liability insurance required for this contract are listed as follows:

Public Liability	\$25,000/\$75,000
Property Damage Liability	\$25,000/\$50,000
Protective Public Liability	\$25,000/\$75,000
Protective Property Damage Liability	\$25,000/\$50,000

Attention is directed to amendment to said Article 46 wherein it stipulates that the insurance shall cover all damages to property whether above or below ground.

PROTECTION AND RESTORATION OF PROPERTY (Supplementing Article 55)

The Contractor shall, at his own expense, preserve and protect from injury all property either public or private along and adjacent to the roadway, and he shall be responsible for and repair at his own expense any and all damage and injury thereto, arising out of or in consequence of any act or omission of the Contractor or his employees in the performance of the work covered by the contract prior to completion and acceptance thereof.

The Contractor shall be held liable for all damage done to signs, delineators and all turf areas, desirable natural growth as identified by the District Highway Engineer, seeding shrubs and trees by his equipment and personnel. Damages shall include among other things; skiving, scraping or gouging of trees, shrubs and turf areas; ruts and deep wheel depressions on turf areas; and ruts, deep wheel depressions and wheel slipping damage on slope areas.

Certain areas to be mowed may contain survey stakes which must be preserved. Mowing will be required to within one (1) foot of said stakes but no trimming will be required around them.

EQUIPMENT

The Contractor will be required to furnish equipment that will perform work satisfactorily and shall have before award of any contract sufficient equipment of his own, or furnish proof of its availability to him, which will satisfactorily complete all work called for under this contract.

Equipment necessary for mowing and trimming under this contract may consist of: tractor operated reel, rotary and sickle bar grass cutting machines; power driven walk behind reel, rotary and sickle bar grass cutting machines; power driven hand operated grass cutting machines; manually operated grass cutting machines and hand operated grass cutting tools and any other grass cutting equipment, machines or tools.

Machines referred to in these special provisions are to be considered as any type of equipment applicable for use in mowing and trimming all grass within the limits of the contract area as specified in these special provisions and as directed by the District Highway Engineer.

The equipment furnished by the Contractor must be in good repair and shall be maintained so as to produce a clean, sharp cut to the grass at all times.

Equipment which in any way pulls or rips grass or damages the turf shall not be allowed to operate under this contract. If in the opinion of the District Highway Engineer the Contractor has insufficient equipment of any type on the job to satisfactorily complete the work under the various items within the time specified, the Contractor shall provide additional equipment, as directed by the District Highway Engineer.

NOTE:

The Contractor is reminded that reference to mowing in these Special Provisions does not refer exclusively to that grass cutting which can be accomplished by tractor drawn equipment. Hand and/or other power equipment must be used if necessary to satisfactorily complete the work.

SAMPLE

Mowing Grass  
M-63-12

Example of Special conditions as would be noted on a proposal page under any given Route or Town description.

(Extending Item 2 beyond normal limits)

Note: On Route 128, Needham, from Station 123+00 at the Kendrick Street Overpass, northerly to Station 175+00 approximately 600 ft., north of the R.R. overpass, on the northbound barrel shall be mowed under Item 2 from the grass growth at the edge of the outer roadway to the layout line regardless of the presence of guard rail.

(Entire Proposal Item 1 & 2 areas treated with Growth Inhibitor MH-30. Item quantity would call for three Item 1 and two Item 2 cuts).

Note: All Item 1 and Item 2 grassed areas within the limits of this proposal have been or are to be treated with Maleic Hydrazide (MH-30) and as this chemical inhibits grass growth, it should be noted that the proposal calls for a reduced number of mowings.

Cuttings shall be made by the Contractor only when directed by the District Highway Engineer.

*To the Party of the First Part:*

The undersigned, as bidder, declares that the only persons or parties interested in this proposal as principals are those named herein; that this proposal is made without collusion with any other person, firm or corporation; that he has carefully examined the location of the proposed work, the proposed form of contract, the standard specifications and plans therein referred to and the Special Provisions hereto annexed; and he proposes and agrees, if this proposal is accepted, that he will contract with the Party of the First Part, in the form of the contract referred to herein and to be annexed hereto, to provide all necessary machinery, tools, apparatus and other means of construction, and to do all the work and furnish all the materials specified in the contract, in the manner and time therein prescribed, and according to the requirements of the Engineer as therein set forth, and that he will take in full payment therefor the following unit prices, to wit:

ITEM NO.	QUANTITY	ITEM WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE		AMOUNT		
			DOLLARS	CENTS	DOLLARS	CENTS	
1	11	Cuttings of LAWN TYPE MOWING, at  per complete cut					
2	5	Cuttings of ROADSIDE HAY MOWING, at  per complete cut					
3	21.6	Miles of HAY MOWING, at  per mile					
<b>T O T A L</b>							

ITEM 1 LAWN TYPE MOWINGPER COMPLETE CUTTING

Work under this item, if required under this contract, shall be performed in such areas and in such manner as specified for Item 1 mowing under "Scope of Work" and "Prosecution of Work" with the use of mowing equipment and tools that will satisfactorily cut all grass.

It may be necessary to remove portions or all of the area to eliminate all weeds or grass not cut to the specified height in order to complete each directed cutting in a manner satisfactory to the District Highway Engineer. The Contractor shall not receive additional compensation for removing necessary to produce a satisfactory cutting as directed by the District Highway Engineer.

Each cutting under this item shall be completed within 1 week from the date of beginning, which shall be Monday of a calendar week as directed, and any uncut and/or untrimmed areas or any unsatisfactory cut and/or trimmed areas remaining after 5:00 P. M. on Saturday of said week shall not be paid for.

In the event of such unsatisfactory areas remaining after 5:00 P. M. on Saturday, the Engineer shall estimate the number of hours which would be required to satisfactorily complete the work in said areas with use of the total normal complement of men and equipment assigned to the project by the Contractor. Two per cent of the unit bid price per complete cutting shall be deducted by the Department, for each hour so estimated by the Engineer to complete the work.

Rain or inclement weather shall offer no excuse for failure to complete each cutting within the time allowed except when in the opinion of the Engineer said rain or inclement weather is of such duration and intensity that work may not be performed, an extra day will be allowed for each day not worked as directed.

This work will be paid for at the contract unit price per complete cutting under Item 1 for Lawn Mowing, which price shall include full compensation for all labor, equipment, and necessary tools for this type of mowing, trimming and hand work required, transportation of equipment, tools and men to and from the site of work, operating expenses of equipment and all other incidentals necessary to satisfactorily complete the work.

ITEM 2 ROADSIDE HAY MOWINGPER COMPLETE CUTTING

Work under this item shall be performed in such a manner as specified for Item 2 mowing under "Scope of Work" and "Prosecution of Work", with the use of mowing equipment and tools that will satisfactorily cut all grass.

Work under this Item shall also be performed in such areas as are specified for Item 1 mowing under "Scope of Work" on all projects which have excluded Item 1 from the proposal page.

It may be necessary to remove portions or all of the area to eliminate all weeds or grass not cut to the specified height in order to complete each directed cutting in a manner satisfactory to the District Highway Engineer, The Contractor shall not receive additional compensation for removing necessary to produce a satisfactory complete cutting as directed by the District Highway Engineer.

Each cutting under this item shall be completed within 2 weeks from the date of its beginning, which shall be Monday of a calendar week as directed, and any uncut and/or untrimmed areas or unsatisfactory cut and/or trimmed areas remaining after 5:00 P. M. of the second Saturday shall not be paid for.

In the event of such unsatisfactory areas remaining after 5:00 P. M. on the second Saturday, the Engineer shall estimate the number of hours which would be required to satisfactorily complete the work in said areas with the use of the total normal complement of men and equipment assigned to the project by the Contractor. One per cent of the unit bid price per complete cutting, shall be deducted by the Department, for each hour so estimated by the Engineer to complete the work.

This work will be paid for at the contract unit price per complete cutting under Item 2 for Roadside Hay Mowing, which price shall include full compensation for all labor, equipment and necessary tools required for this type of mowing, trimming and hand work required, transportation of equipment, tools and men to and from site of the work, operating expenses of equipment and all other incidentals necessary to satisfactorily complete the work.

ITEM 3 HAY MOWING

PER MILE

Work under this item shall be performed in such areas and in such a manner as specified for Item 3 Mowing under "Scope of Work" and "Prosecution of Work", with use of mowing equipment and tools that will satisfactorily cut all grass.

It may be necessary to remove portions or all of the area being worked in to eliminate all weeds or grass not cut to the specified height in order to complete this item in a manner satisfactory to the District Highway Engineer. The Contractor shall not receive additional compensation for re-cutting necessary to produce a satisfactory mowing within length being worked on.

The work will be paid for at contract unit price per mile of each completed mile regardless of the volume of work necessary in any particular mile. Each mile of mowing shall include both sides of the roadway. Work must be carried on in one direction and completed as work progresses, with both sides of the roadway kept uniform. Only the actual miles completed and satisfactorily mowed under Item 3 will be paid for.

The contract unit price per mile under Item 3 for Hay Mowing shall include full compensation for all labor, equipment and necessary tools required for this type of mowing, hand work required, transportation of equipment, tools and men to and from the site of the work, operating expenses of equipment and all other incidentals necessary to satisfactorily complete the work.

\* \* \* \* \*



P R O P O S A L

FOR Mowing Grass along State Highways (Rtes. 28, 37, 139 &amp; M)

COMMONWEALTH OF MASSACHUSETTS

LOCATION

The work referred to herein is in the Cities of Brockton and Quincy and Towns of Avon, Braintree, Holbrook, Randolph and Weymouth, Counties of Norfolk and Plymouth.

<u>ROUTE</u>		<u>MILES</u>
28	<u>Avon, Brockton and Randolph</u> From the junction of Albion Street, Brockton, northerly to the junction of North Street, Randolph. Items 1, 2 and 3	<u>4.0</u>
	From Station 149+85, Randolph, at the railroad bridge, northerly to be excluding the Rte. 128 interchange, Randolph. Items 2 and 3	<u>2.6</u>
37	<u>Braintree, Holbrook and Quincy</u> From the junction of West Street, Quincy, southerly to the junction of Royal Avenue, Holbrook, excluding the Route 128 interchange, Braintree. Items 2 and 3	<u>6.2</u>
	From Station 71+45 Holbrook, 700 feet north of Quincy Street southerly to the Brockton-Holbrook Line. Items 2 and 3	<u>1.4</u>
139	<u>Holbrook and Weymouth</u> From the Abington-Weymouth Town Line, northwesterly to the junction of Weymouth Street, Holbrook. Items 1, 2 and 3	<u>2.0</u>
M	<u>(East Main Street) Avon</u> From the Brockton Line northerly to the junction of Rte. 28. Items 2 and 3	<u>0.6</u>
M	<u>(Old Route 128) Braintree and Weymouth</u> From the Weymouth-Hingham Town Line westerly to the junction of Route 37, Braintree, including Rte. 18 Intersection. Items 2 and 3	<u>4.8</u>
	Mowing Items 1, 2 and 3	
	Approximate Total Length	<u>21.6</u>

Example of Special conditions as would be noted on a proposal page under any given Route or Town description.

(Extending Item 2 beyond normal limits)

Note: On Route 128, Needham, from Station 123+00 at the Kendrick Street Overpass, northerly to Station 175+00 approximately 600 ft., north of the R. R. overpass, on the northbound barrel shall be mowed under Item 2 from the grass growth at the edge of the outer roadway to the layout line regardless of the presence of guard rail.

(Entire Proposal Item 1 & 2 areas treated with Growth Inhibitor MH-30. Item quantity would call for three Item 1 and two Item 2 cuts).

Note: All Item 1 and Item 2 grassed areas within the limits of this proposal have been or are to be treated with Maleic Hydrazide (MH-30) and as this chemical inhibits grass growth, it should be noted that the proposal calls for a reduced number of mowings.

Cuttings shall be made by the Contractor only when directed by the District Highway Engineer.

(Weekly Inspection Reports Accompanying Each Partial Pay Estimate)

COMMONWEALTH OF MASSACHUSETTS  
DEPARTMENT OF PUBLIC WORKS

MNT. #111-R

Form C-70

Contract No. \_\_\_\_\_

Week Ending \_\_\_\_\_

Contractor \_\_\_\_\_

M- \_\_\_\_\_ - \_\_\_\_\_

To: Mr. \_\_\_\_\_

District Highway Engineer

Subject: Contract Mowing Inspection Report of Work for Payment.

Mowing was performed as described below along Route(s) \_\_\_\_\_

in \_\_\_\_\_ a total length of \_\_\_\_\_ miles

ITEM 1

Contractor began work \_\_\_\_\_ 19\_\_\_\_, Ended work \_\_\_\_\_ 19\_\_\_\_.

Work (was) (was not) satisfactorily completed within the specified time.  
\_\_\_\_\_ hours are estimated to be required to complete the cutting in accordance  
with the provisions of the Contract.

Number of hours \_\_\_\_\_ x 2% = \_\_\_\_\_ per cent of cutting not completed,  
and to be subtracted from 100 to determine the amount for payment.

Per cent of cutting recommended for payment \_\_\_\_\_.

ITEM 2

Contractor began work \_\_\_\_\_ 19\_\_\_\_, Ended work \_\_\_\_\_ 19\_\_\_\_.

Work (was) (was not) satisfactorily completed within the specified time.  
\_\_\_\_\_ hours are estimated to be required to complete the cutting in accordance  
with the provisions of the Contract.

Number of hours \_\_\_\_\_ x 1% = \_\_\_\_\_ per cent of cutting not completed,  
and to be subtracted from 100 to determine the amount for payment.

Per cent of cutting recommended for payment \_\_\_\_\_.

ITEM 3

Contractor began work \_\_\_\_\_ 19\_\_\_\_, Ended work \_\_\_\_\_ 19\_\_\_\_.

Miles satisfactorily mowed \_\_\_\_\_.

Contractor, (through his representative \_\_\_\_\_,) (was) (was not  
available to be) advised of the reasons for any and all reductions in payments  
covered by this report, the details of which are included in my diary.

Department Representative \_\_\_\_\_  
Signature \_\_\_\_\_

Copy to Contractor mailed \_\_\_\_\_ date \_\_\_\_\_.

Copy to Maintenance Engineer (with pay estimate)