1967

A Survey of the Relative Merits of All-Weather Tracks and Traditional Tracks

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A SURVEY OF THE RELATIVE MERITS OF ALL-WEATHER TRACKS AND TRADITIONAL TRACKS

A Thesis

Presented to

the Graduate Faculty

Central Washington State College

In Partial Fulfillment

of the Requirements for the Degree

Master of Education

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by

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August, 1967

APPROVED FOR THE GRADUATE FACULTY

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ACKNOWLEDGMENTS

The writer wishes to express his sincere appreciation to Dr. Everett A. Irish, committee chairman, for his time, supervision, and guidance during the formulation of this study. Acknowledgment is also accorded to Dr. Daryl Basler and L. Dean Nicholson for their time and assistance and for serving on the graduate committee.

A special note of thanks to the writer's wife Hazel, whose help and sacrifice made this possible.

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CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

In recent years, the development of new materials has created a problem in the selection of track surfaces. High schools and universities are faced with the choice of installing higher priced all-weather tracks or the traditional track surfacing. This study will evaluate the comparative costs, in installation and maintenance, of the two methods over a projected twenty year period.

I. THE PROBLEM

Statement of the Problem

The purpose of this study is to investigate and compare the advantages and disadvantages of all-weather and traditional track surfaces. Factors to be considered are: (1) installation and maintenance costs; (2) need for repairs and projected life; (3) utilization of the track; (4) satisfaction with track surface; and (5) evaluation of tracks. It is a further problem to develop a questionnaire to be sent to schools to determine the basis for their selection of track surfacing.

Need for the Study

There is a growing interest throughout the nation in the use of the all-weather track. Because of the added cost involved in the installation, many schools cannot justify the choice of this type of track. The lack of research in the area has made this justification more difficult. There is a real need for more conclusive evidence to support the long-range advantages of installing a more durable track.

Limitations

The limitations of this study are as follows: (1) track and field events areas were the only ones considered. No attempt was made to include playing surfaces for other sports, although all-weather surfaces are being used for other activities; (2) questionnaires were sent only to schools and universities in the United States; (3) no attempt was made in this paper to arrive at a plan for installing or maintaining track surfaces; (4) Astroturf was not included in this study because, as of this writing, it has not been used for a track surface. Proponents of Astroturf do, however, indicate that it is a suitable surface for track and field; and (5) the sample was representative but the size of the sample and possible bias on the part of the

respondents may have influenced the data.

II. DEFINITIONS OF TERMS

All-Weather Track

The types of track surfaces are known by a number of brand names, such as Grasstex, Tartan, Perma-track, Cor-Karpet, and Rubber-Asphalt. The surface material may be classified into four groups: (1) fibrous asphalt composition, (2) rubber-asphalt-sand hot mix, (3) rubberized asphalt cold mix, and (4) a synthetic resin material.

Installation

This term is defined as the original cost of installing a track.

Maintenance

Maintenance refers to the annual costs involved in keeping a track in readiness for use.

Traditional Track

Traditional track refers to the type of track surface, most widely used, and consisting of cinders, crushed brick, clay, dirt or grass.

Cost Comparison

This refers to the parallel of the total average costs of installing and maintaining the different tracks.

CHAPTER II

REVIEW OF LITERATURE

Until recently schools faced with the problem of installing a track were limited in their choice of track surfacing. The only selection to be made was from cinders, crushed brick, clay or a combination of these three materials. Modern technology has improved and widened the options, and the criteria for a good track has changed with the initiation of all-weather surfacing. A good track, according to Bennett, (1:1) should have a durable surface, be compact and resilient, with the ability to resist the forces of wear and runners' shoes. This track should be of weather resistant material which will shed water or be porous enough to let water percolate down through it, prevent wind erosion, and should have a base unsusceptible to frost. The surface should be easily maintained and be reasonable in cost. According to coaches and athletes who have used the various kinds of all-weather tracks, this type of construction meets all requirements applied to it from the definition stated above.

Since the installation at the University of Florida in 1959 of the first all-weather track known by the brand name Grasstex, all publications have extolled the merits

and presented no shortcomings. It is interesting to note that nothing has been written in recent years about traditional track surfaces.

Bill Bowerman aptly described the optimum track in his article "Track Surface of the Future." He states:

> Would you like to have a track surface that works equally well with regulation spikes, rubber soles or indoor spikes; a surface that defies weather and makes it possible for the competitor to compete in any situation; a surface that is virtually maintenance free and one on which lines can be painted, similar to highways markings and then forgotten for several years? This is the track surface of tomorrow, and tomorrow is sooner than you think (2:32).

His description seems to forecast the new developments in track surfacing.

The advantages of the all-weather track are numerous and according to a survey conducted in 1962:

> . . . the recurring theme was a saving in maintenance and the greater track usuage resulting from the rubber track. The second most important factor seemed to be the increased safety and improved performance of the runners (7:30).

In addition to these findings, Dr. Barney Steen states:

> With a permanent type surface (1) lines can be painted on, (2) there's no need for screening, floating, or rolling, (3) it doesn't puddle in groove of the inside lane, (4) there's a uniform surface for all contestants, and (5) coaches feel it produces better times (3:46).

Jack Warner continues the list of advantages:

> . . . non-skid qualities, surface consistency regardless of weather, less serious injuries due to spills, and a longer period of use in a Northeastern

> climate. The greatest testimony of all, of course, is the high regard which the athletes have for the surface (6:14).

All track coaches know the frustrations of putting on a track meet and maintaining the track for a level of use. Coaches in areas of inclement weather may find themselves spending more time conditioning the track than they spend with their athletes.

> All this boils down to one important fact: the track coach is relieved of the burden of supervising maintenance details. This permits him to attend to his major functions, developing track men, and keeping meets going on schedule to maintain both spectator and participant interest. This, in turn, was reflected in a higher competitive spirit in track men. We also noted higher student interest in upcoming track meets, and a better status feeling for the often unsung track man (8:22).

Enlarging upon this same theme another coach states:

> Practice and meets are seldom cancelled because of rain and practices can begin earlier in the spring in cold climates because the track is ready to go as soon as the snow leaves the ground. When consideration is made of time and labor costs put into daily upkeep of a cinder-type track and the yearly redressing repairs - the initial expense of an all-weather surface diminishes (1:1).

J. Bruce Turner in his article "Five Years of Utopia" humorously describes how it would be possible to hold polar bear meets, if snow removal was possible, in the wintertime. He further states: "Rain does not regulate and control meets as it has in the past, but helps the all-weather really prove itself" (5:63).

Another survey conducted in 1967 reports: "Thanks to this surfacing, track meets have been held in rain storms, tropical heat and bitter cold" (4:62).

The main purpose of track, of course, is the participant. His morale and well-being should be uppermost in the minds of those who are installing tracks.

> Morale of the participants is increased and mental condition is improved while using all-weather resilient tracks. Footing is always good, thus preventing injury from slipping. Some coaches report that this type of surface seems to increase confidence in the runners because there is no fear of cinder-imbedded injuries in spills. The resilient feature of the surface helps prevent the common complaint of track men - shin splints (1:3).

Performance is another factor to be considered in the installation of a track. A number of authorities have determined that:

> . . . all-weather track guarantees that if the athlete improves physiologically, his performance will also improve as far as running time, jumping and vaulting height or his jumping distance are concerned (5:56).

> Test measurements indicate that it produces a fractional increase in the runners stride due to the full traction that it affords (4:63).

> Ideal track conditions exist for every meet, with each lane offering the same consistency and the records of the runners will not be affected, because the running surface is consistant (5:56).

The above contentions seem to be supported by the fact that Baltimore's Overlea High School, which has an

all-weather track, has been selected for the site of the Maryland State High School Track and Field Championships for the last five years. "An average of six or more state records have been broken each year indicating that there is a difference" (5:79).

Of primary concern should be the physical well-being of the athlete. On a cinder track, the physician's dilemma was and still is the removal of cinders from wounds after a fall. It is not unusual for cinders to leave a tattoo effect which is permanent. With an all-weather track the loss of the first layer of skin is about the worst thing that can happen in a spill. The tracks' resilience makes falling less dangerous, and its non-slip characteristics elimate hazards. Spike wounds are not as serious as they have been in the past, since quarter-inch and three-eighth inch spikes are now adequate. Instead of the usual deep wound, scratches are about the only thing that can happen to a runner from spikes (5:79).

It appears that coaches and experts in the field are agreed on the desirability of all-weather track surfacing. The general concensus of opinion tends to be that, although an all-weather track involves a greater initial cost, its many advantages make it a sound investment.

CHAPTER III

PROCEDURES AND SOURCES OF DATA

Letters were sent to manufacturers of all-weather tracks to obtain a list of schools that had installed their particular type of track. Inquiries were sent to the following firms: (1) Chevron Asphalt, Grasstex; (2) 3M Company, Tartan; and (3) Eastern Rock Products Inc., Cor-Karpet. Included, also, in this survey were schools with rubber-asphalt track surfaces, usually constructed by local firms and not known by any patented brand name. The names of these schools were found in publications.

From the lists, thirty-six schools in the United States were chosen to obtain a sampling and thirty-six schools in Washington and Oregon with traditional tracks were chosen for a comparison.

A questionnaire was constructed to be sent to the schools. Points covered in the questionnaire were: (1) installation costs; (2) maintenance and related costs; (3) repair and replacement; (4) length of time track is used; (5) number of participants using track; (6) degree of satisfaction with; and (7) track preference.

The information from the returned questionnaires was analyzed and compiled into five tables. Table I encompasses the range and average of installation and maintenance costs for each category in the sample. Table II includes anticipated repairs and projected life of the tracks. Table III deals with the utilization, and Table IV the degree of satisfaction. Table V contains the evaluations of the tracks.

CHAPTER IV

ORGANIZATION AND ANALYSIS OF DATA

The sample group of thirty-six schools in the United States that had installed all-weather tracks included twenty-eight high schools, three colleges, four universities and one school for the blind. The universities and the colleges were selected because they were the first to install all-weather tracks and the only ones who had used the more expensive types. The school for the blind was chosen because the author was interested to see how their track was utilized. They did not, however, return the questionnaire. Twenty-nine of the schools, or 81 per cent, replied to the questionnaire. In the group which responded were twenty-three high schools, two colleges and four universities.

The control group was made up of thirty-six high schools in Washington and Oregon with traditional track surfaces. The questionnaire was sent to these schools and thirty-one replied, for an 86 per cent return.

I. INSTALLATION AND MAINTENANCE COSTS

All-Weather Tracks

Twenty-three of the schools in the sample had

installed Grasstex tracks, consisting of twenty high schools, one college and two universities. The oldest track had been in use for eight years and six were only three years old, making the average age 4.8 years. The most expensive installation cost was $55,000 and the least expensive, $13,000. Installation expenses averaged $28,004 with a median of $29,000. Maintenance outlay per year was $252 on the average. This information is shown in Table I, located on page 15.

Rubber-asphalt surfaces were used by three high schools, ranging in age from one to seven years, for an average age of five years. The most costly construction in this group was $15,000, dropping to $13,000, and averaging $14,000. The median figure was also $14,000. One school did not answer the question since their cost was not known. There had been no money spent on repairs or maintenance on any of these tracks. Table I shows this information.

One university and one college had installed Tartan tracks in 1965 which had been in use only one year. The University of Delaware spent $100,000 and Boston College's outlay was $85,000. The average cost of the two installations was $92,500 and the median the same. These tracks were so new that no maintenance had been necessary, but

none was anticipated by the respondents. Table I depicts this information.

Colgate University was the only school in the study that had invested in a Cor-Karpet track. This track was put into use in 1964 at a cost of $40,000. No money had been expended on repairs at this writing.

Traditional Tracks

High schools with cinder tracks numbered twenty-one. The oldest two were twenty-six years old and the newest four were only three years old. Average age of the cinder tracks was 10.5 years. Installation costs ranged from $40,000 to $2,000, but some of the older tracks were put in by Works Progress Administration labor, which resulted in lower expenditures. This may have brought down the average cost which was $10,666. Three schools did not answer this question since the cost was not known. The median for this sample was $6,000. Maintenance costs went from a high of seven hundred dollars a year to a low of zero dollars per year, averaging $309. This is shown in Table I.

There were five crushed-brick tracks included in the study. They were from sixteen to three years old and averaged 6.8 years. The cost of installing these tracks extended from $20,000 down to $5,000, averaging $10,400 with a median of $10,000. Maintenance payments were between

$200 and $1,000 per year, for a $480 average, as shown in Table I.

Crushed lava was the track surface chosen by two of the schools in this group. One track was nineteen years old and the other seven years old, or an average of thirteen years in use. Both of these tracks cost $6,000 to install making the highest and lowest cost, average and median the same. The average maintenance disbursement was $500 annually. This information is shown in Table I.

Two schools had clay tracks which were constructed in 1953 and 1955, the average age being twelve years. One track cost $4,000 to install and the other $2,000, with an average and median expenditure of $3,000. Maintenance costs averaged $400 yearly. Table I depicts this information.

Decomposed granite was chosen by only one of the schools. This track was four years old and had been installed for $5,000. The yearly maintenance cost, as shown in Table I, was $200.

TABLE I

RANGE AND AVERAGE OF INSTALLATION
AND MAINTENANCE COSTS

Type of Track	Schools Reporting	Average Age	Highest Cost	Lowest Cost	Average Cost	Median	Average Maintenance
Grasstex	23	4.8	$55,000	$13,000	$28,004	$29,000	$252
Rubber-Asphalt	3	5	$15,000	$13,000	$14,000	$14,000	0
Tartan	2	1	$100,000	$85,000	$92,500	$92,500	0
Cor-Karpet	1	2	$40,000	$40,000	$40,000	$40,000	0
Totals	29	4.3			$32,071	$30,000	$200
Cinder	21	10.5	$40,000	$ 2,000	$10,666	$ 6,000	$309
Crushed Brick	5	6.8	$20,000	$ 5,000	$10,400	$10,000	$480
Crushed Lava	2	13	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$500
Clay	2	12	$ 4,000	$ 2,000	$ 3,000	$ 3,000	$400
Decomposed Granite	1	4	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$200
Totals	31	9.6			$ 9,536	$ 6,000	$352

Of the twenty-nine schools who responded to the questionnaire in the all-weather group, the average track age was 4.3 years. Average cost of installing these tracks was $32,071 and the median was $30,000. Maintenance expenditures averaged at $200 per school year. Table I shows this information.

In the traditional track group, with thirty-one schools reporting, average track age was 9.6 years. The average cost of installation was $9,536 and the median $6,000 per school. It cost an average of $352 per year to maintain the track surfaces at these schools. This information is shown in Table I.

II. REPAIRS AND PROJECTED LIFE

Traditional Tracks

The maintenance of a traditional track surface usually involves the dragging and leveling of the area several times a year. Floating and screening are necessary to make the surface as consistant as possible. The lines are then applied, usually before each home track meet. The number of times the above mentioned renovations are necessary depends on the climate in which the track is located. In a dry climate, once during the season may be adequate and in a rainy region it may be

necessary to repeat the process three or four times a year.

Of the thirty-one coaches involved, eleven reported that they personally did none of the maintenance work, which would seem to speak highly of their school systems. Coaches in thirteen of the schools did 50 per cent or more of the upkeep, and seven of these did 70 per cent or more of the work. It would appear that these thirteen men were spending much of their coaching time in maintenance. The average amount of track maintenance done by the coaching staff was 33 per cent. This information is shown in Table II, located on page 20.

The length of time before repairs were necessary on the traditional tracks averaged 4.9 years. The range was from one to ten years, with many reporting that they had added a little surfacing each year, postponing major repairs. This question was not answered in nine returns, which might have indicated that they did not know when or if their schools would make repairs. Some coaches noted that if yearly maintenance were sustained, major repairs could be delayed. Table II shows this information.

The range of time before replacement was needed in the traditional track group was from one to twenty years, with an average of 12.8 years. Eighteen in this

group did not answer the question. Table II shows the years of use before replacement was needed in the traditional track group.

All-Weather Tracks

The only maintenance associated with an all-weather track is an occasional sweeping or blowing off of dirt. Of the twenty-nine schools, twenty-one coaches said they did none of the maintenance and three stated they did 50 per cent, which was the highest percentage stated. The coaches in these schools did an average of 8 per cent of the track upkeep, and this is shown in Table II.

The repair of an all-weather track usually involves recoating the surface to fill in the spike marks and repainting the lines on the asphalt type track. The resin type of surface requires little, if any, resurfacing. The range of time in which repairs were needed was from three to ten years, averaging 5.7 years. Six of the respondents said that they did not know how long it would be before repairs were needed. This information is shown in Table II.

No one could estimate exactly how long an all-weather track would last because none of them had been replaced. Five coaches stated their surfaces would

probably last twenty years, one said twenty-five and one said thirty years. Twenty-one reported they did not know what the life of their track would be. The average time, as shown on Table II, before anticipated replacement was 22.1 years.

TABLE II

REPAIRS AND PROJECTED LIFE

	Traditional	All-Weather
Percent of maintenance performed by coach	33%	8%
Years of use before repair	4.9	5.7
Years of use before replacement	12.8	22.1

III. UTILIZATION

Traditional Tracks

Twenty-five of the thirty-one high schools with traditional tracks indicated that their tracks were utilized by other schools, presumably by others in their district. Six stated that no schools other than themselves used their tracks.

Track use by physical education classes was cited in thirty instances and one school did not permit physical education classes the use of their track. The span of time the tracks were utilized ranged from three to twelve months of the year, with an average of 5.9 months. The number of students involved in the use of the tracks went from two hundred to two thousand, averaging 854 annually. These figures are shown in Table III, located on page 23.

All-Weather Tracks

Of the twenty-nine schools with all-weather surfaces, twenty reported that other schools shared the use of their tracks and nine indicated that they were the only users.

Physical education classes utilized the track in twenty-four cases and at five schools this was not

allowed. Track usage, in these schools, ranged from two to twelve months annually. Six schools stated that their track was in service twelve months per year. The average period of time the all-weather tracks were used was 7.5 months. Students participating in the use of the all-weather tracks each year ranged from two hundred to a high of six thousand at one school. The average use annually was 1,864. This is shown in Table III.

TABLE III

UTILIZATION

Number of	Traditional	All-Weather
Tracks utilized by other schools	25	20
Tracks not utilized by other schools	6	9
Tracks used by physical education classes	30	24
Tracks not used by physical education classes	1	5
Average months used	5.9	7.5
Average number of participants using track	854	1,864

IV. DEGREE OF SATISFACTION

Traditional Tracks

In the traditional track group, seventeen of the coaches were not satisfied with their present tracks as opposed to twelve who were satisfied. Two did not answer the question. Nine respondents said that they would replace their surfaces with the types they already had and twenty stated they would not. Two coaches failed to answer the question. This is shown in Table IV, page 25.

All-Weather Tracks

Coaches with all-weather tracks in twenty-six of the schools approved of their present track surfaces; one did not and two did not answer. Twenty-five seemed convinced of the merits of their particular tracks and would replace with the same materials. Three schools did not answer. Table IV shows this information.

TABLE IV

DEGREE OF SATISFACTION

Number	Traditional	All-Weather
Satisfied with present track surface	12	26
Not satisfied with present track surface	17	1
Would replace with same track surface	9	25
Would not replace with same track surface	20	1

V. EVALUATION OF TRACKS

Question 15 in the questionnaire asked if the individual would replace his present track surfacing with the same material. If the answer was negative, this led to question 16 which asked, if not satisfied, what his preference would be. In the traditional track group, eight preferred rubber-asphalt, five chose Grasstex, and five selected an all-weather surface, but did not indicate a specific type. One respondent selected the Tartan track, one decided upon crushed lava and one selected to stay with cinder type. Ten did not answer and it was presumed that they were satisfied with their present tracks. In the all-weather group only three replied to this question. There was one preference for rubber-asphalt, one for Grasstex and one for Tartan. The twenty-six who did not answer seemed to indicate their preference for their own track surface. Table V, located on page 28, shows this.

The last question was a hypothetical one to determine the respondents' choice of track surfacing if cost were not a factor. In the traditional group, ten selected rubber-asphalt, ten chose Grasstex, four picked the general category of all-weather surfaces, two

specified Tartan and two elected to remain with their present tracks, crushed lava and cinders. Three did not respond to the question. Of the all-weather sample, four selected rubber-asphalt, fourteen gave Grasstex as their option, one said only an all-weather track and seven singled out Tartan. The remaining three schools in the group did not answer this question. This information is shown in Table V.

TABLE V

EVALUATION OF TRACKS

Traditional Track Group	Rubber Asphalt	Grasstex	All Weather	Tartan	Crushed Lava	Cinder
Track preferred	8	5	5	1	1	1
First Choice	10	10	4	2	1	1
All-Weather Track Group						
Track preferred	1	1		1		
First Choice	4	14	1	7		

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

I. SUMMARY

The purpose of this study was to investigate and to compare the advantages and disadvantages of all-weather and traditional track surfaces. Questionnaires were sent to seventy-two schools, with sixty returned to determine if the all-weather surface was of such a superior nature to justify the higher cost. Factors considered were: (1) installation and maintenance costs; (2) need for repairs and projected life; (3) utilization of the track; (4) satisfaction with the track surface; and (5) evaluation of the tracks. Comments were elicited from the respondents concerning the advantages and disadvantages of their particular type of surfacing.

II. CONCLUSIONS

The average installation cost for the thirty-one traditional tracks in the study was $9,536, compared to an average in the all-weather group of $32,071. According to these figures, therefore, an all-weather track is initially 3.4 times more expensive than a traditional

track. Six of the schools in the traditional surfacing group, however, recorded installation costs of $4,000 or less. These low figures seem totally unrealistic and result from the employment of Works Progress Administration labor and volunteer community help. If these six schools are deleted from the group, the adjusted average installation cost for a traditional track becomes $11,455. Included in the all-weather group were three schools that had tracks costing $55,000 or more, an outlay obviously beyond the capability of most public school systems. When these schools are removed from the sample, the average all-weather construction figure is $26,320. Using the adjusted averages, it follows that an all-weather track costs only 2.3 times as much as a traditional track. Most schools might consider even the adjusted average price of an all-weather track too high unless they used rubber-asphalt, with an average cost of $14,000. This surface is the most economical in the group and costs only $4,464 more than the average traditional track, or $2,545 more than the adjusted figures.

The average amount of money used yearly for maintenance costs on a traditional track was $352, with a projected twenty year outlay of $7,040. Coaches in

this group, though, do 33 per cent of the track upkeep, resulting in an adjusted cost of $528 annually, or $10,560 for a twenty year period. The average maintenance on an all-weather track involved $200 a year and $4,000 for twenty years. The coaches in these schools do 8 per cent of the maintenance work, making the adjusted average $217 per year extending to $4,340 in twenty years.

Adding the average construction cost of $9,536, and the $7,040 projected twenty year maintenance cost, the total expense of installing and maintaining a traditional track is $16,576. If the adjusted averages are used the total is $22,015. When the average installation outlay of $32,071 is added to the average twenty year maintenance cost in the all-weather sample, a total of $36,071 is reached. With the adjusted averages this amount is reduced to $30,660.

Using the original figures, it appears that the all-weather track costs twice as much to install and maintain for twenty years as the traditional track. The adjusted averages, however, present a truer picture. These figures of $22,015 for traditional track and $30,660 for the all-weather surface show that the latter is only 1.4 times as costly as the first.

The maintenance of a traditional track involves a large outlay of labor to prepare and maintain the surface. If the coaches do 33 per cent of the maintenance on these tracks, as indicated, they are spending a considerable part of their coaching time on non-coaching duties. It would appear that these athletes are not getting the training that their counterparts with all-weather tracks are receiving. In the all-weather group, whose tracks require very little upkeep, the coaches do an average of only 8 per cent of the maintenance. These coaches, therefore, seem to have more time to do the job they are paid for, that is, training track men.

A comparison between repair and replacement needs of the two types of tracks cannot be drawn because the all-weather surfaces have not been in use long enough. No one can accurately estimate how long these tracks will last before extensive repairs or replacements are needed. Twenty-one of the twenty-nine respondents in the all-weather group said they did not know what the life span of their tracks would be. Even the traditional track group was generally uncertain of the projected life of their surfaces, with only thirteen of the thirty-one answering this question.

An all-weather track is used an average of 1.6 months more a year than a traditional track due to the fact that the all-weather surface is always ready to use and is not affected by inclimate weather. The average number of participants using the traditional tracks is 854 per year as compared to 1,864 for the all-weather tracks. On the average, 2.2 times as many people utilize an all-weather track. One respondent commented that a disadvantage of his school's all-weather track was that too many people wanted to use it!

Only 41 per cent of the traditional track group were satisfied with their surfaces while 96 per cent of the all-weather group expressed contentment with their tracks. Thirty-one per cent of those with traditional tracks and 96 per cent with all-weather tracks thought they would use the same surfacing material again.

Of the sixty respondents, fifty-eight preferred the all-weather surface and only two chose to remain with the traditional track materials. In the matter of choice, regardless of cost, the proportion was the same. The opinion of the overwhelming majority of coaches was that the all-weather surface was unquestionably superior and desirable.

The fact is undeniable that an all-weather track costs much more to install and maintain for a twenty year period than a traditional track. If, however, the intangible benefits are subtracted from this cost, the price does not seem prohibitive. These intangible considerations include such factors as: (1) the additional time a coach has to spend in the training of athletes; (2) the extra months the track can be utilized; (3) the greater number of participants who can be accommodated; (4) the increased safety, with fewer and less severe injuries; (5) the psychological benefits for the competitors; (6) the elimination of many meet and practice cancellations because of weather conditions; (7) the consistent surface in all lanes; (8) the faster times that can be attained; and (9) the beauty that such a track adds to a school campus.

It seems clear, after studying the results of this survey, and reading the comments of the respondents, that there is a great preference for the all-weather track surfacing. In the future, if this is a representative sampling, most schools will be installing the new surfaces when possible. As this trend continues, the increased use of all-weather materials should bring prices down, making these tracks more available and feasible for most schools.

III. RECOMMENDATIONS

Since this study began, several new types of all-weather surfacing have been produced and a greater number of schools have installed all-weather tracks. It is recommended that further studies be made of all-weather surfaces, including these new surfaces and a broader base, to see if additional facts warrant the purchase of this type of surface. It is further recommended that studies be made of all-weather surface use on play and school grounds.

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APPENDIX A

QUESTIONNAIRE

West High School
13th and High
Bremerton, Washington
March 30, 1966

Dear Sir:

I am a graduate student at Central Washington State College and also an assistant Track Coach at West High in Bremerton, Washington. A few years ago we rebuilt our track and tried to convince our administration that we should install some type of all-weather track, but to no avail. We were unable to back up our arguments with any concrete facts and so our track is just as bad in wet weather as it was before.

My Masters Thesis proposal is "A Survey of the Relative Merits of All-Weather Tracks and Traditional Tracks" and I hope to prove, with facts and figures, which of the two types is superior. The enclosed questionnaire is my means of collecting the necessary facts to reach a conclusion.

The questionnaire will only take a few minutes of your time and while the results may not help your school or mine, some district may be able to benefit from them.

Your cooperation would be greatly appreciated and if you desire a copy of the findings check below.

Thank you.

Sincerely yours,

E. P. Furseth
West High School
Bremerton, Washington

I would like a copy of the results._____

QUESTIONNAIRE

1. What type of surface does your track now have? (Please circle)

   Cinder Crushed Brick Gravel Grasstex Rubber-asphalt

   Other_____

2. How much did it cost to install your track? (Please circle until you have arrived at the total - for example, if your track cost $12,000, circle the 10,000 and the 2,000.)

   $1,000 $2,000 $3,000 $4,000 $5,000 $6,000 $7,000

   $8,000 $9,000 $10,000 $20,000 $30,000

3. In what year was your track installed?_____

4. How much is spent per year on maintenance? (Please circle until you have arrived at the total)

   $100 $200 $300 $400 $500 $600 $700 $800 $900

   $1,000 $2,000 $3,000 $4,000

5. What per cent of the maintenance is done by the coaching staff? (Please circle)

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. In how many years will major repairs be required? (Please circle)

   1 2 3 4 5 6 7 8 9 10

7. In how many years will replacement be required? (Please circle)

   1 2 3 4 5 6 7 8 9 10 11 12 13 14

   15 16 17 18 19 20

8. Is your track utilized by other schools? Yes____ No____

9. Is your track used by P. E. Classes? Yes____ No ____

10. How many months per year is your track used? (Please circle)

    1 2 3 4 5 6 7 8 9 10 11 12

11. How many students per year use your track? (Please circle until you have arrived at the total)

100 200 300 400 500 600 700 800 900 1000

2000 3000

12. What are the advantages of your track?
Please comment--

13. What are the disadvantages of your track?
Please comment--

14. Are you satisfied with track surfacing? Yes____ No____

15. Would you replace your present track surfacing with the same material?

Yes____ No____

16. If not satisfied, what would be your preference?

_____

17. If cost were not a factor, what would be your first choice of a surfacing?

_____

APPENDIX B

RESULTS OF QUESTIONNAIRE

ADVANTAGE OF ALL-WEATHER TRACKS

Comments from questionnaires of those who had all-weather track surfaces.[1]

I. TARTAN

1. Never gets hard - never gets soft. Run on it with all kinds of spikes including football and baseball shoes. Drive trucks on it. Seems indestructable yet soft as a carpet.
2. No maintenance. No repairs. Resilient no matter what the temperature. Indestructable.

II. COR - KARPET

1. Non-slip even with rubber soles.
2. Resilient regardless of temperature.
3. Less severe - "strawberry" type injuries in case of falls.
4. Consistent surface in all weather.
5. Little or no actual meet-by-meet maintenance.
6. Permanent lines - color coded.
7. Psychological lift to competitors.
8. Little, if any, loss of work due to weather.
9. We get outdoors at least a month earlier every year.

[1] Not edited

10. We feel that we have one of finest facilities in the country.

III. RUBBER ASPHALT

1. Excellent drainage - not necessary to line (after inital paint job) - better times.
2. All-weather use. Ease in preparing for meets.

IV. GRASSTEX

1. Easy to organize meets.
2. No lining as lines are painted on.
3. Run in any kind of weather.
4. Easier to maintain than cinder track.
5. All-weather.
6. Lines and maintenance.
7. Can run at any time without serious handicap.
8. If a runner falls, he rarely even breaks the skin. In 4 years I have yet to see a mark left on athlete's body after a fall on track.
9. Can hold track meets immediately after rain or during light rain.
10. Can start outdoor training earlier in spring.
11. Lanes are painted on permanently.
12. We have for 34 years held a relay meet on our track. Due to the weather the last two years we could not have held this meet on a cinder track.

13. All the schools we schedule want to come to us (we save on transportation).
14. Easy to clean.
15. Dries quickly.
16. Fast track.
17. Easy to run on - no shin splints.
18. It is always ready for use.
19. Meets need not be cancelled due to rain.
20. Not necessary to spend untold hours marking for meets.
21. No maintenance except for additional weather coat and remarking every 4 to 5 years.
22. No maintenance, ready to use in any kind of weather.
23. Much better times are made than on cinders.
24. Easier on shoes.
25. Maintenance!! It is ready for use year round. You don't have to mark it off before every meet.
26. No maintenance.
27. No lining, rolling, etc.
28. Perfect condition at all times.
29. Each lane identical - no matter how many races have been run.

30. We use the track in our P.E. program during the year.
31. Wet weather does not interfere.
32. No dust on windy days.
33. No marking of lanes required since marking is permanent.
34. Appearance beautifies the campus.
35. No maintenance since it has been built.
36. Can be used almost throughout the whole year.
37. Makes for better running conditions and improves performance.
38. Seldom have to postpone a meet because of weather.
39. Can be used at all times.
40. No preparation necessary for a meet (everything permanently marked).
41. Fastest times in area always recorded on our track.
42. No cinder cuts on falls (we have had no injuries recorded in six years resulting from falls on track).
43. Always ready to go.
44. Small amount of maintenance.

45. Times and performances are practically the same under all weather conditions except snow and ice.
46. Very little, if any, maintenance is necessary.
47. No need to mark hurdle settings, lanes, exchange zones etc. (These are painted on the surface.)
48. All-weather - resilient - once lined - always lined.
49. Fast.
50. Easy on shin - splints.
51. Adds a permanent beauty to athletic setup.
52. Less danger of a fall doing injury - believe it or not this stuff won't skin you.
53. Lines are always there for meets and practice sessions.
54. No maintenance.
55. Rain is no factor.
56. You can use it all summer.
57. Hold summer meets.
58. Cross country uses it in the fall off and on.
59. Elementary can hold track meets on it.
60. Physical Ed can use it.
61. Early spring use.
62. No marking necessary before meets.

63. Rain is not a problem.
64. Slopes to outside - well drained.
65. Sure footing.
66. Little maintenance.
67. Easy to repaint lines when necessary.
68. Lines remain sharp and clear a long time.
69. Starting blocks easily set and removed.
70. No slipping.
71. Lighted with football field lights - night track meets.
72. Used by girls and boys P.E.
73. Same surface daily.
74. Fewer injuries.
75. Always ready to use.
76. All weather.
77. Perfect for practice.
78. No shin splints.

DISADVANTAGES OF ALL-WEATHER TRACKS

Comments from questionnaires of those who had all-weather track surfaces:[1]

I. TARTAN

1. Other than the cost - so far none.

II. COR-KARPET

1. We must change spikes for away meets. This is the only disadvantage I can think of and it is a minor one.

III. RUBBER ASPHALT

1. No disadvantages
2. Only six lane in backstretch.

IV. GRASSTEX

1. I don't see any.
2. Hard on feet and distance men.
3. Initial cost.
4. Must be protected to keep off people with long spikes, high heels or motor vehicles.
5. More leg injuries (shin - splints, thigh pulls etc.)
6. Seems to have slower times in sprints and hurdles.
7. Wears shoes out faster.

[1] Not edited

8. Only that visiting schools must wear short spikes, but this is not a real problem.
9. Gets a little soft in very hot weather.
10. Gets badly worn at starting points.
11. Other teams must change spikes.
12. Keeping people off the area with spikes heels etc.
13. None.
14. Haven't found any.
15. There must be some preventive maintenance done on it. Our school has done a good job with this and it looks like new. Others in the area have not.
16. None.
17. None.
18. Can't think of any.
19. Visiting teams must have short spikes.
20. We put bleachers on the track - they must have "runners" under all supports to prevent damage to track.
21. When put in gutters were not installed properly.
22. We have to check use of spikes by visitors.
23. Causes some leg, ankle and feet soreness unless workouts are carefully planned.

24. Expensive.

25. None.

26. Too many people want to use it.

27. It gets very warm on the feet in the heat of the day.

28. Not enough grasstex - too hard in cold weather.

29. Needs protection from street shoes and football shoes.

30. None.

ADVANTAGES OF TRADITIONAL TRACKS

Comments from questionnaires of those who had traditional track surfaces.[1]

I. CRUSHED LAVA

1. Drains well.
2. Does not tatoo like coal cinders.

II. CLAY

1. Inexpensive, easily maintained. We depend upon surface drainage.
2. Inexpensive - evacuation and grading and curbing was all that was needed.

III. DECOMPOSED GRANITE

1. It is easy to maintain. We water and drag it once a week.

IV. CRUSHED BRICK

1. Easily maintained.
2. Fairly fast.
3. Quite hard even when wet.
4. Little maintenance.
5. None.
6. It is new.
7. Good running surface.

[1] Not edited

V. CINDER

1. Easy to maintain.
2. Good drainage.
3. Compared to all-weather tracks - none.
4. Compared to other cinder tracks we have the advantage of cement curbs on both sides to prevent growth of grass into track surface.
5. None.
6. We have very little up-keep. This is due to the excellent care of our people in charge.
7. Lower cost - availability of materials.
8. This is a good surfaced track.
9. It is well maintained and has a lot of spring.
10. Easy access - other than that ---
11. None.
12. Fast track in dry weather.
13. Maintenance cost is low over period of years.
14. Our track has held up well under the hard use we give it.
15. None at all.
16. None that I know of.
17. Good drainage.

DISADVANTAGE OF TRADITIONAL TRACKS

Comments from questionnaires of those who had traditional track surfaces.[1]

I. CRUSHED LAVA

1. Requires dragging, rolling and lining.
2. May be soft when very dry.

II. CLAY

1. We need a little more crushed cinders or lava rock to prevent stickiness during the winter.
2. Constant problem of grading and loss of top dressing.

III. DECOMPOSED GRANITE

1. It gets too hard and packed.
2. A hard rain may cause soft spots and leave puddles of water on the track.

IV. CRUSHED BRICK

1. Too hard last part of spring.
2. Does not drain very well under heavy rains.
3. Becomes dusty when dry.
4. Can't run on it when it rains, (poor drainage).
5. Maintenance, lining, keeping jump runways and pits in shape.

V. CINDER

[1]Not edited

1. Drainage.
2. Track is on a clay surface. Drainage takes quite awhile after an extremely heavy rain - even though we have a drain line.
3. Track does not get hard enough for fast times.
4. Must drag and roll in preparation of meets and early season.
5. Lining is always a problem.
6. Maintenance is a continual job.
7. Preparation for meets is time consuming and continual.
8. In early season there is often large portions under water.
9. A large quantity of track workers is used each year.
10. Maintenance costs and time.
11. Poor track.
12. Must be reworked each year.
13. Too old.
14. None that I can honestly state - maybe it is not always as fast as it should be.
15. Requires too many man hours for proper maintenance - weather is an important factor.

16. Very poor drainage even with tile - because of valley soil.
17. Impossible to keep out grass and weeds even though it is killed each year.
18. Difficult to keep it smooth - packed and level.
19. No binder - dries and blows.
20. When freshly wet - it's ooze.
21. Track cinders have no clay binder that was originally contracted for hence the surface is soft and powdery.
22. Poor grade of cinders used - soft and many clinkers.
23. Constant marking is time consuming.
24. Track is slow when wet.
25. Cinder burns are bad when athlete falls.
26. All-weather track wouldn't require the work by coaches to get ready for each meet.
27. Track becomes dusty, when dry.
28. Requires dragging, lining, etc., before each meet.
29. Impossible to keep in shape without additional field help.
30. Coach spends ½ his time on maintenance factor.

31. We have cancelled $\frac{1}{4}$ of our meets over the past 5 years.
32. Necessity of dragging and lining for meets.
33. Poor for meets in wet weather. Same for practice.