December 3rd, 2023

2B Track: CTB Exam & Track Manual Review

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STUDY GUIDE #1

FISHER TRACKS

ASBA 2023

AMERICAN SPORTS BUILDERS ASSOCIATION

This is not a session on teaching the test to become a Certified Track Builder. It is our intent to teach to the test.

History of the Test:

A. Applied Measurement Professionals
   1. 1998
   2. 2010
      a. Combined with tennis
         1) Core Section
      b. Overlap such as project administration subbase and base work
      c. Current professional standard:
         1) objectivity—free from bias
         2) reliability—dependable, stable, and consistent when administered on different occasions
         3) validity—appropriate and accurate
   3. Redone with new questions in 2019

Determining Test Contents:

A. Detailed Content Outline
   1. Potentially problematic tasks for the minimally competent practitioner
   2. Recall
   3. Application
   4. Analysis
B. Track Test Blueprint-5 Sections/all weighted

The Modified Angoff Procedure

A. Test takers are judged by comparing their performance to an absolute standard.
B. A minimally competent practitioner has been developed
   1) 75%
C. A minimally competent ASBA Track Builder has 3 years of full time experience and has accumulated the minimum 100 points of eligibility and the necessary references by verifying experience and eligibility.
D. It is not necessary to be competent in all facets; it is not necessary to know the answer to every question. The test is designed for those that have strengths in different areas to still pass if they can meet the minimally competent criteria. You may be the top striper in the country but have little to do with such things as administration of a track construction project let alone base construction, for example. You may be someone very heavy in administration and contract review and have little to do with the actual

field work. It is not necessary to be an expert in all facets to pass the test; this is not what a Certified Track Builder designation is all about.

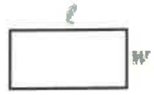
We are going to walk you through a process that many of us face almost every day of our work week. We are going to break this down and therefore some of you may feel it is very elementary. There may be questions that arise that are very easy to punch out through an engineering calculator. We are trying to break this down to the elementary level because, without a keen understanding of the basics, it is hard to extrapolate to a unique problem that can occur at any time on an existing or yet to be built project.

The exam is open book and there is a 4-hour time limit. Use the new book-2019. There are no two-way devices allowed in the exam room such as cell phones, laptops, IPads, etc. All scratch paper will be handed out at the time of the exam and picked up upon completion.

How to take the Test:

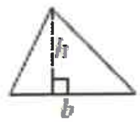
A. Read thoroughly
B. Answer what you know first
C. Answer sheet follows questions
D. No penalty for guessing!

Rectangle • Area (A) = Width (w) x Length (l)



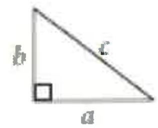
$A = \ell w$

Triangle • Area (A) = ½ Base (b) x Height (h)



$A = \frac{1}{2}bh$

Right Triangle • Pythagorean Theorem • $c^2 = a^2 + b^2$



$c^2 = a^2 + b^2$

Circle • Area (A) = πr^2
Circumference (C) = $2\pi r$
$\pi = 3.1416...$

$A = \pi r^2$
$C = 2\pi r$

LENGTH			
Unit	Abbr.	SI/ metric	Imperial
Millimeter	mm	.001 m	.00328084 ft
Centimeter	cm	.01 m	.0328084 ft
Meter	m	-	3.28084 ft
Kilometer	km	1000 m	.621 mi
Inch	in	2.54 cm	-
Foot	ft	.3048 m	.0833 ft
Yard	yd	.9144 m	3 ft

LENGTH	
Centimeters & Feet cm / 30.48 = feet ft x 30.48 = cm	Meters & Feet m x 3.28084 = ft ft x .305 = m
Centimeters & Millimeters cm x 10 = mm mm x .1 = cm	Meters & Yards m x 1.09361 = yd yd x .914 = m
Millimeters & Feet mm / 304.8 = ft ft x 304.8 = mm	Kilometers & Yards km x 1093.6 = yd yd x .00091 = km

AREA			
Unit	Abbr.	SI/ metric	Imperial
Square Millimeter	mm^2	-	.00155 in^2
Square Centimeter	cm^2	100 mm^2	.00107639 ft^2
Square Meter	m^2	10,000 cm^2	10.7639 ft^2
Square Kilometer	km^2	1,000,000 m^2	.386 mi^2
Square Inch	in^2	6.4516 cm^2	-
Square Foot	ft^2	.0929 m^2	144 in^2
Square Yard	yd^2	.836 m^2	9 ft^2

AREA	
Sq. Centimeters & Sq Ft. cm^2 x .155 = ft^2 ft^2 x 929 = cm^2	Sq. Meters & Sq. Yards m^2 x 1.196 = yd^2 yd^2 x .836 = m^2
Sq. Meters & Sq. Feet m^2 x 10.7639 = ft^2 ft^2 x .093= m^2	Sq. Yards & Sq. Feet yd^2 x 9 = ft^2 ft^2 x .1111 = yd^2

WEIGHT
Pounds & Kilograms lb x .454 = kg kg x 2.205 = lb

The following calculation values are recommended for a proper balance of accuracy and workable measurements. Some common measurements used in track design and construction include:

20cm = 0.656' or 7.87"	Distance from the start of lane 1 to the measure line (flush curb rule).
30cm = 0.984' or 11.81"	Distance from the start of lane 1 to the measure line (raised curb rule).
0.3048m = 1'	Meter equivalent of 1 foot
1.0668m = 3.5' or 42"	Width of standard lane (except IAAF)
1.2192m = 4.003' or 48"	Width of standard lane (IAAF)
1m = 3.28084'	Feet equivalent of 1 meter
π = 3.1416	Calculation used for curve distances
400m = 1312.336'	Measure line distance in lane 1

The results of calculations should be expressed to the nearest 0.0001m (metric) or to the nearest 0.001' (imperial). These may be rounded to the nearest 0.001m or 0.01' or construction and marking. No minus tolerances are permissible for any race distance.

Note: Distances are rounded up to ensure that the distance is not less than 400m.

Slope Notation

Running tracks must be constructed in a single plane but are sloped (preferably to the inside) to facilitate drainage. Slopes will typically be noted as straight percentages. On occasion it may be helpful to convert slope percentages to inches per feet or to a ratio. Below are some typical slope conversions used in the design and construction of tracks:

Percentage	Inches per Feet	Ratio	Sample Use
0.1%	1" in 83.33'	1:1000	Maximum downward longitudinal slope measured over the full length of the track oval in running direction
0.4%	1" in 20.833'	1:250	Maximum downward slope in the direction of the cross bar on high jump for all but NFHS
1%	1" in 8.33'	1:100	Maximum cross-slope on track oval for all but NFHS (slope to the inside is preferred for NCAA and required for USATF)
2%*	1" in 4.17'	2:100	Maximum cross-slope on track oval for NFHS (slope to the inside is preferred)

**ASBA recommended slope for tracks without governing body limitations to facilitate drainage.*

400 Meter Standard World Athletics Track

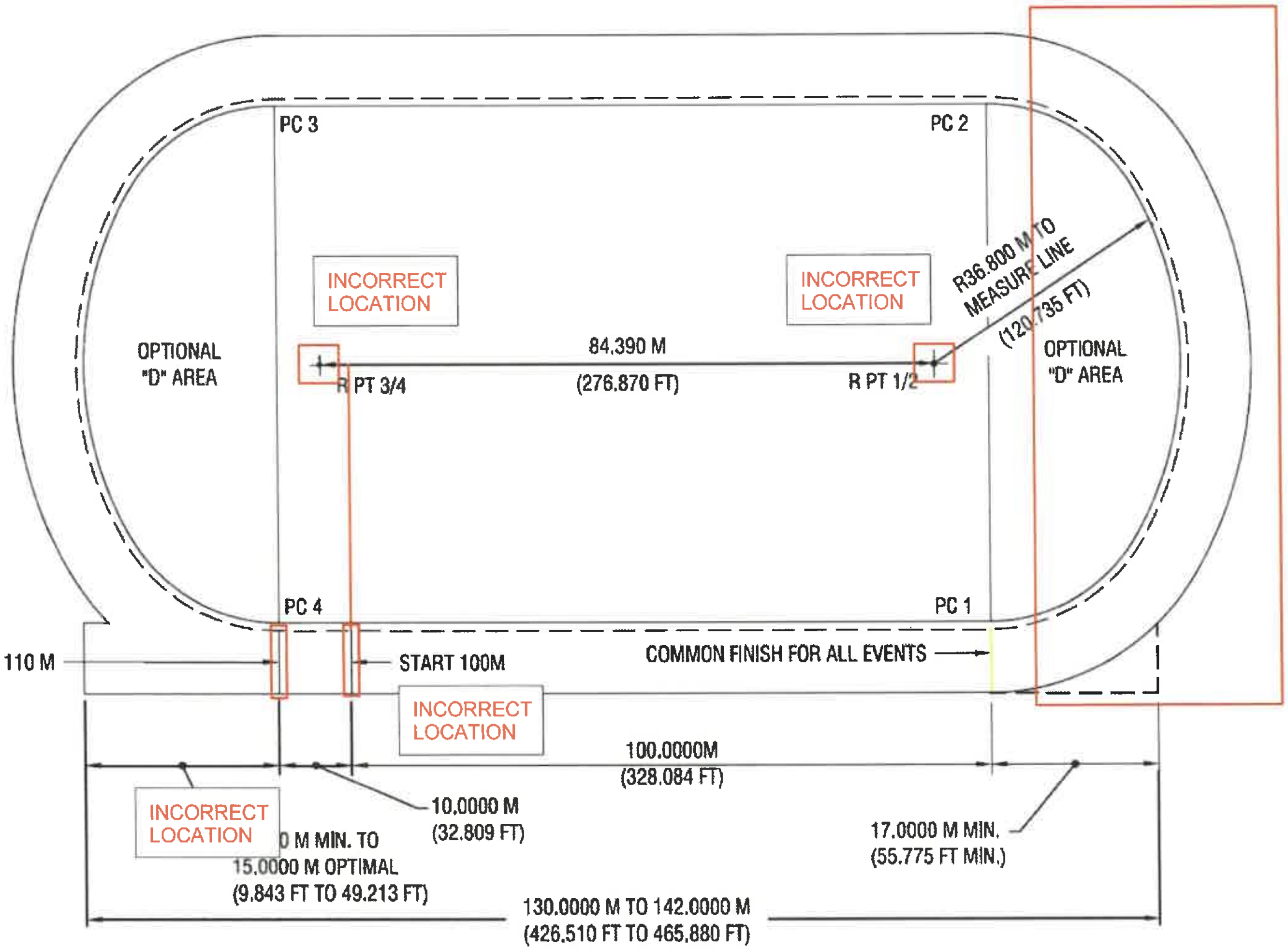
*Current Design as found in 2023 Track Construction Manual and ASBA Diagram App

*Double-Bend Graphic used in lieu of World Athletic Track design with Radii at the wrong curvature

*Distance between Radius Points at 84.390m (correct) with start of 100/110m in wrong location

*Radius Monuments not at PC's as should be

*Many firms use these drawings as a starting point and misinformation can cause construction delays in the event there is a need to correct a design flaw



ASBA 2023 Track Construction Manual Figure 2-5

400 Meter Standard World Athletics Track

*Design as found in 2019 Track Construction Manual

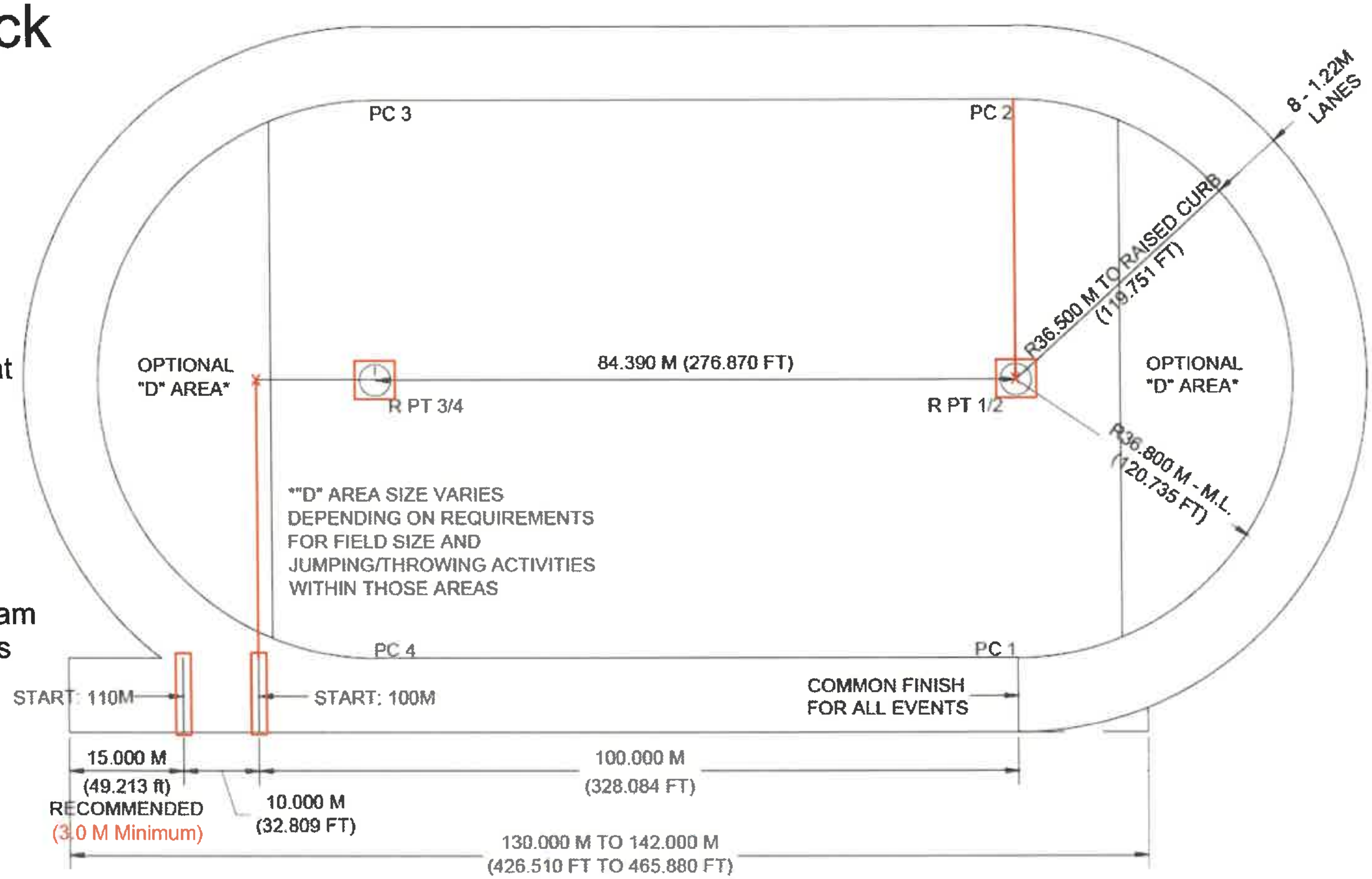
*World Athletic Design Graphic used with Radii following proper 180° curvature

*Distance between Radius Points at 84.390m (correct) with start of 100/110m in correct location

*Radius Monuments at PC's as should be

*Revisions are coming to the diagram app for use until future publications are released with the necessary changes

*A notification will be sent to alert individuals when the diagram app has been updated



ASBA 2019 Track Construction Manual Figure 2-4

Pavement Extension & Safety (Clear) Zones

NFHS - Recommends a 1 meter clear zone, inside/outside

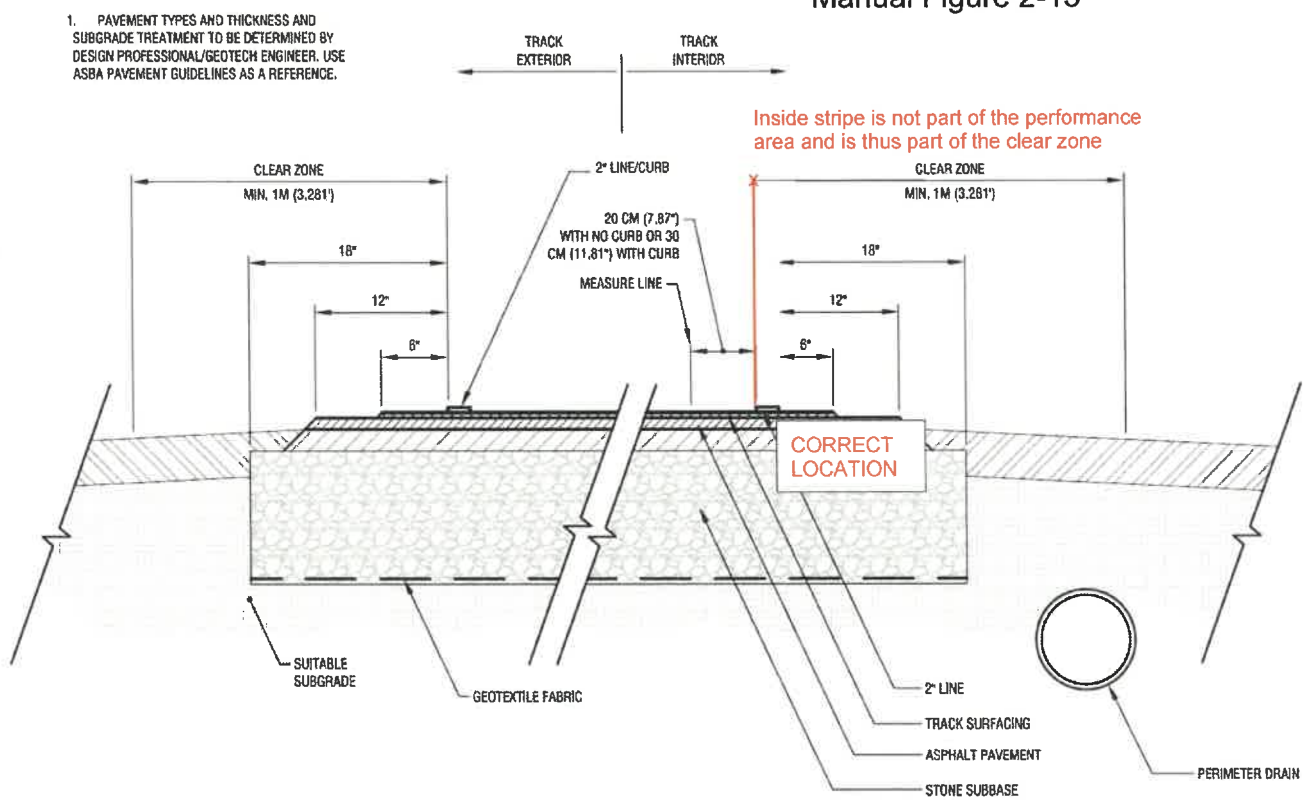
NCAA - Recommends a 1 meter clear zone, inside/outside

World Athletics - 400m track must have 1 meter clear zone on inside, should have 1 meter clear zone on outside and must be level with the surface of the track

*Revisions are coming to the diagram app for use until future publications are released with the necessary changes

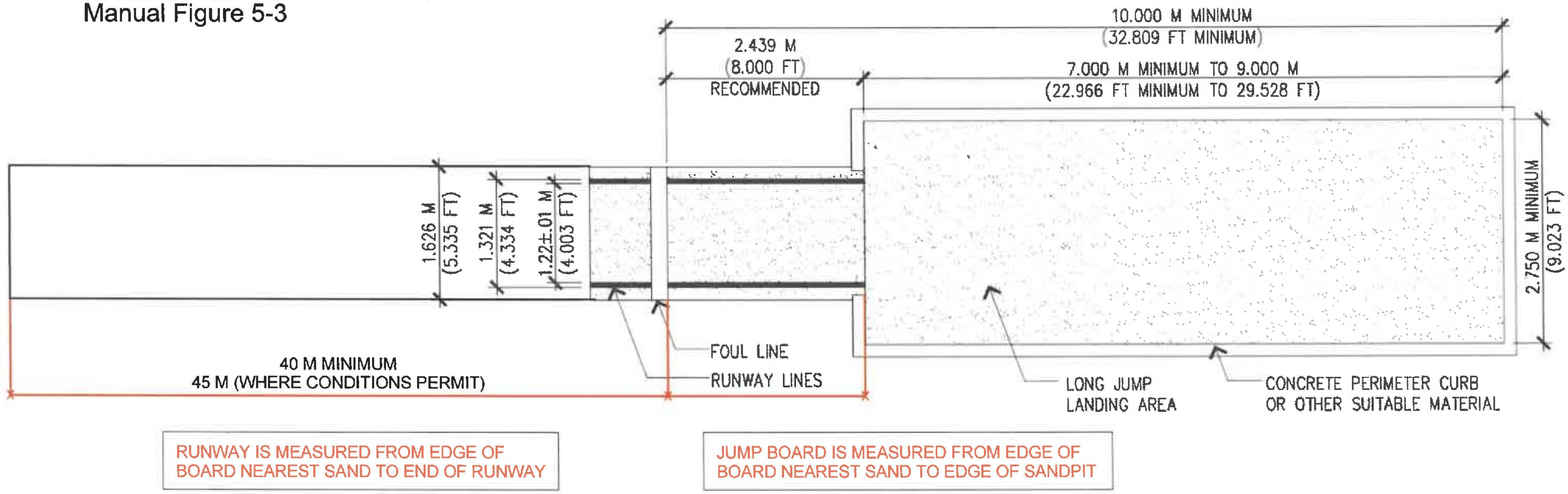
*A notification will be sent to alert individuals when the diagram app has been updated

ASBA 2023 Track Construction Manual Figure 2-13



Long Jump/Triple Jump Runway & Pit Plan

ASBA 2023 Track Construction
Manual Figure 5-3



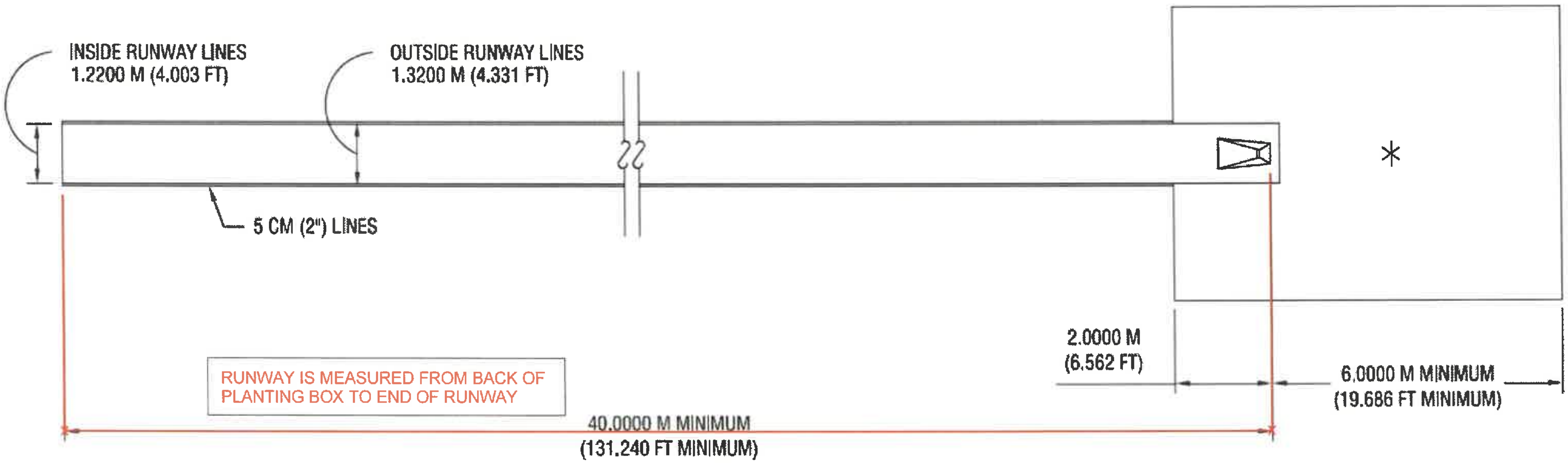
- NFHS
  - Runway should be 130' minimum and 147' 6" (45m) where conditions permit
  - Long Jump Foul Line Suggested Distance
    - Girls: 2.5m (8')
    - Boys: 3.7m (12')
  - Triple Jump Foul Line Suggested Distance
    - Girls: 7.3m (24')
    - Boys: 9.8m (32')

- NCAA
  - Runway shall be at least 40 meters
  - Long Jump Foul Line Suggested Distance
    - Woman: 1m minimum, no more than 3m
    - Men: 1m minimum, no more than 3m
  - Triple Jump Foul Line Suggested Distance
    - Women: 8.5m, 11m recommended
    - Men: 11m, 12.5m recommended

- World Athletics
  - Runway shall be at least 40 meters, 45 m for major international competitions
  - Long Jump Foul Line Suggested Distance
    - Woman/Men: 2m standard, 3m for major international competitions
  - Triple Jump Foul Line Suggested Distance
    - Women: No less than 11m
    - Men: No less than 13m

Pole Vault Event Area
Runway & Landing Zone

ASBA 2023 Track Construction
Manual Figure 5-4

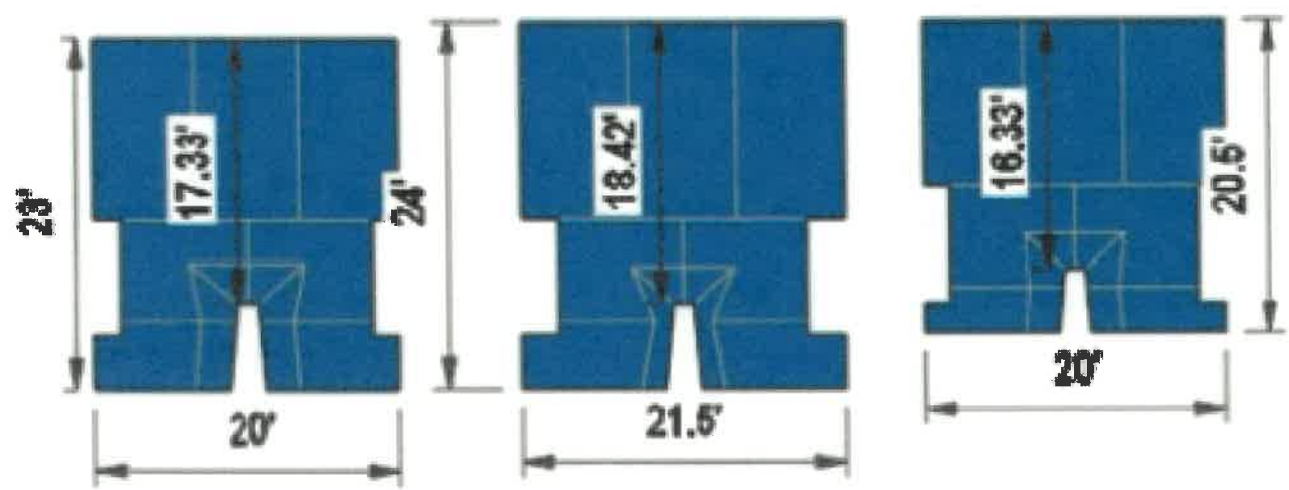


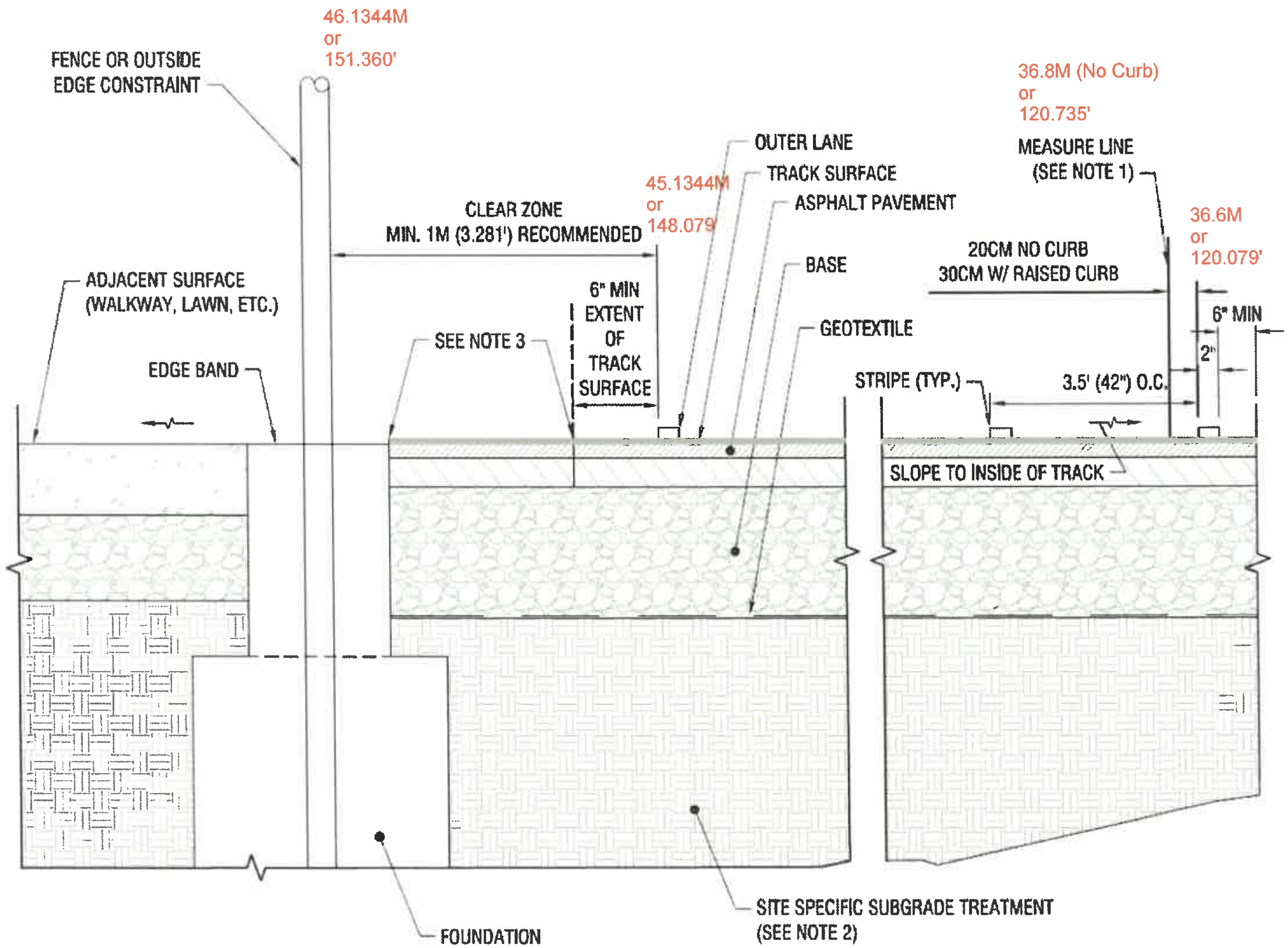
- NFHS
  - Runway should be 130' minimum and 147' 6" (45m) where conditions permit
  - Landing System a minimum of 19' 8" wide by 20' 2" deep. Dimension of landing surface in back of vaulting box to back of landing system shall be 16' 5" (5m)
  - It is recommended that any excess material such as asphalt or concrete that extends out from beneath the landing pad be removed.

- NCAA
  - Runway shall be at least 40 meters long
  - Landing pad measurement beyond the vertical plane of back of vaulting box shall be at least 6 meters wide by 5 meters deep
  - Designated landing pad platform surfaces extending beyond the dimensions of the landing pad, shall be padded

- World Athletics
  - Runway shall be at least 40 meters, 45 m where possible
  - Landing Area shall not be smaller than 6 m long x 6 m wide x .80m high for major international competitions.
  - For other competitions, landing area should measure not less than 5 m long x 5 m wide.

Pole Vault Event Area
Landing System Examples





Calculating the estimated location and distance around for fencing a track facility (8 Lane)

Using the ML, indentify the location of the lane lines. The fencing is recommended to be a minimum 1m (3.28084') from the outside of the outer most stripe.

Again using the ML, calculate the length of straight.

$\frac{400M - (36.8x3.141592)x2}{2}$ = 84.39m

$\frac{1312.336' - (120.735x3.141592)x2}{2}$ = 276.870'

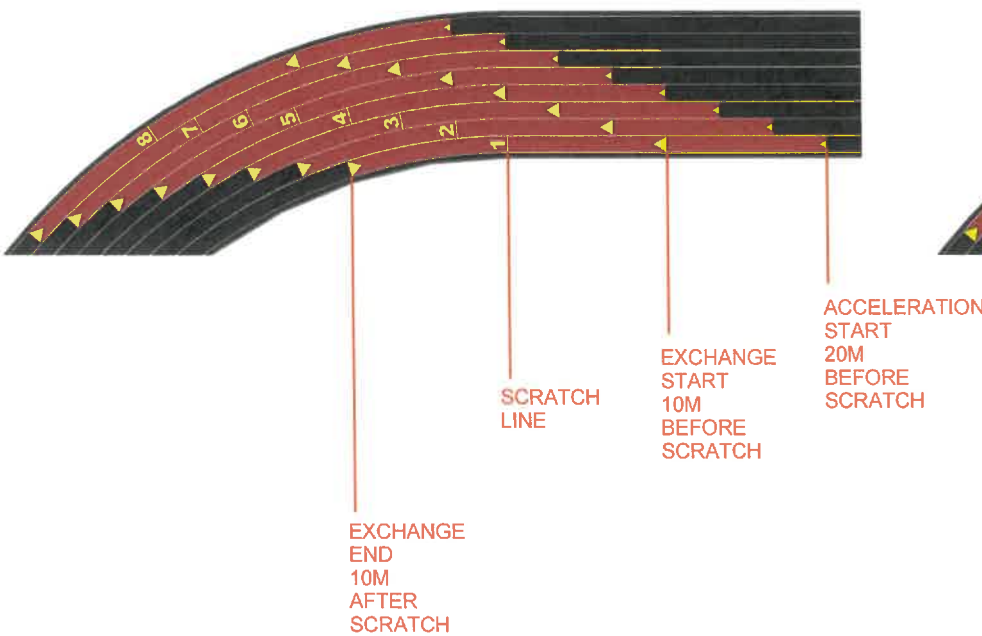
Knowing the recommended location of the fence, multiply that number by Pi (3.141492) then multiply by 2 to find the linear distance of fencing needed around the radius. Add this number to the Length of Straight (x2) to determine the estimated amount of fencing required.

(46.1344Mx3.141592)x2 = 289.8709M
84.39Mx2 = 168.78M
289.8709M+168.78M = 458.6509M

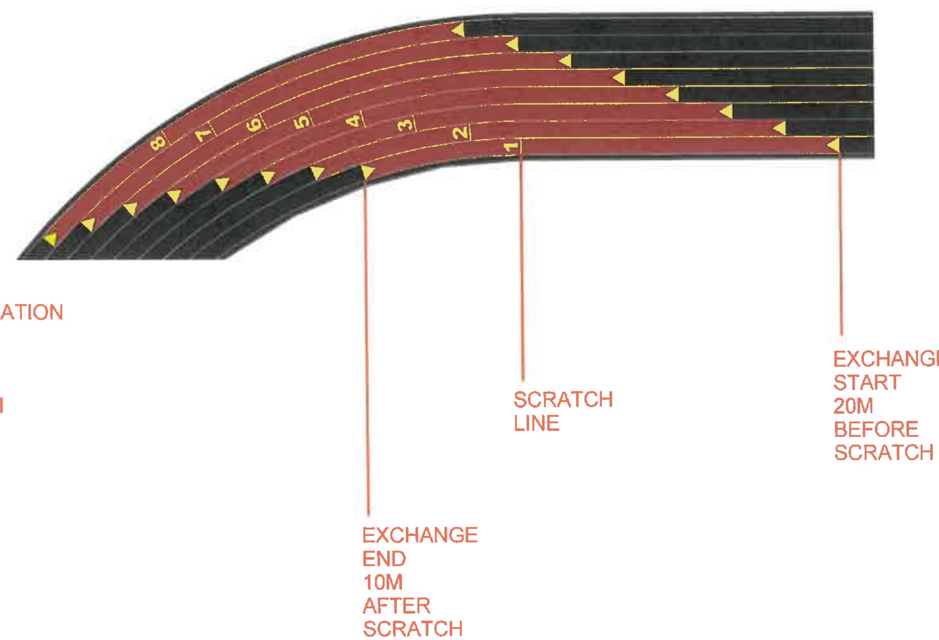
(151.360'x3.141592)x2 = 951.023'
276.87'x2 = 553.74'
951.023'+553.74' = 1504.763'

ADJUST FOR TRANSITION/CHUTE DETAIL

4 x 100 (2nd Exchange Zone)
PRIOR TO RULE CHANGE



4 x 100 (2nd Exchange Zone)
POST RULE CHANGE



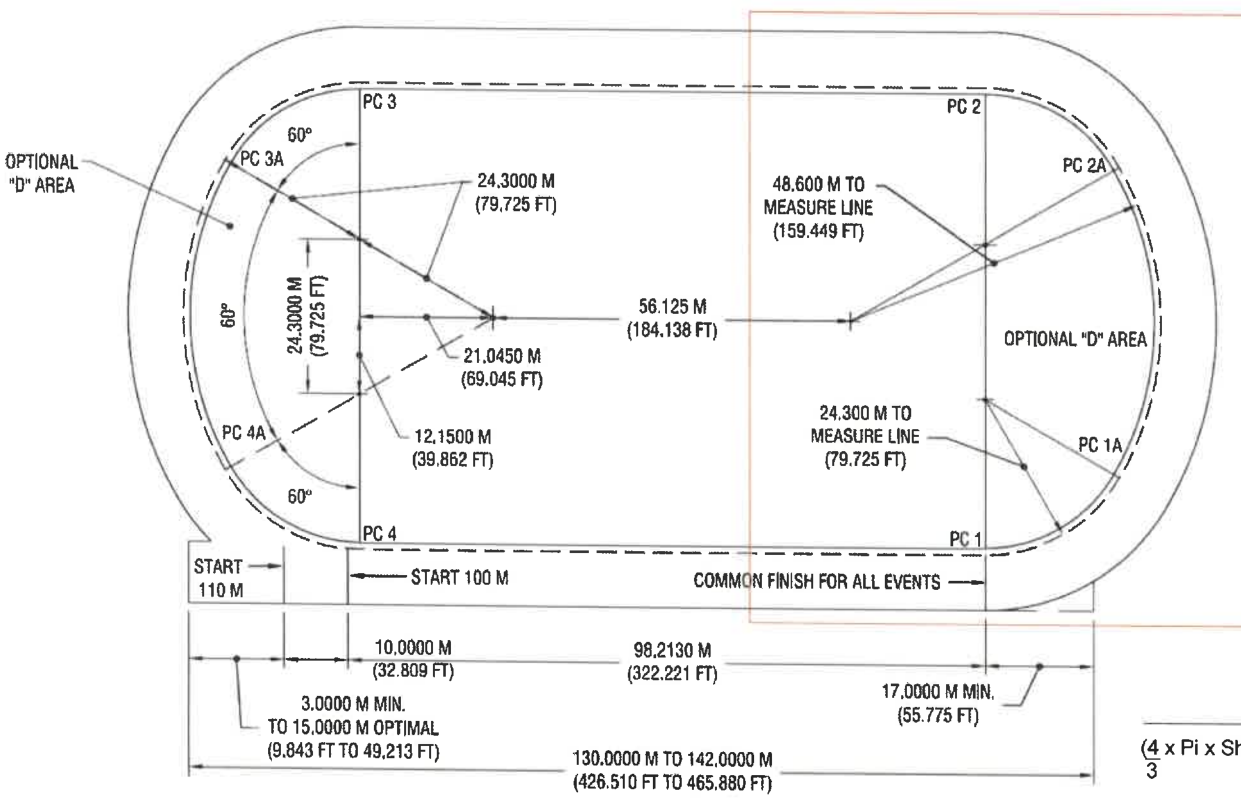
Exchange Zones: Acceleration & Scratch Lines

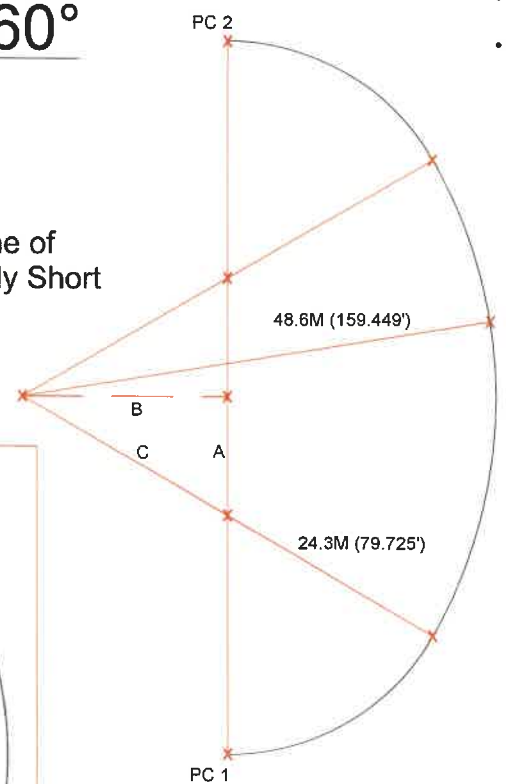
THE RULE CHANGE DOES NOT MOVE THE SCRATCH LINE!

400 Meter Double-Bend Track - 60°/60°/60°

Finding the Length of Straight & Calculating the Measure Line

- If dealing with unknown variables, start by dividing the width across the field between hypothecial measure lines by 3. (Example: If distance between hypothecial measure lines is 72.9m, the Short Radius Measure Line is 24.3m)
- To find Long Radius Measure Line of 60°/60°/60° Double-Bend, multiply Short Radius by 2





- MAJOR BEND NOT TO EXCEED 60°
- THIS LAYOUT IS ONE OF MANY POTENTIAL OPTIONS

A = Short Radius / 2

24.3M / 2 = 12.15M
79.725' / 2 = 39.862'

C = Short Radius

24.3M
79.725'

B = Square Root of c^2-a^2

24.3M²-12.15M²= 442.8675M²
Square Root of
442.8675M= 21.045M

79.725'²-39.862'²= 4767.212'²
Square Root of
4767.212'= 69.045'

By knowing the Measure Lines and the distance of (B), the distance from the long radius monument to the PC, we can calculate the final remaining distance of the LoS between the long radius monuments.

$\frac{4}{3}$ x 3.141592 x 24.3M = 101.7876M

$\frac{2}{3}$ x 3.141592 x 48.6M = 101.7876M

400M - 101.7876M -101.7876M = 196.4248M
196.4248M - (21.045M x 4) = 112.2448M
112.2448M / 2 = 56.1224M DISTANCE BETWEEN LONG RADIUS POINTS

($\frac{4}{3}$ x Pi x Short Radius) + ($\frac{2}{3}$ x Pi x Long Radius) + (2 x LoS) = Lane 1 distance around track (60°/60°/60°)

Sample Question 1

An existing asphalt running track has measurements of 329.5 feet between radius points and 109.4 feet to the measure line. What is the length of the track?

A. 1345.42 feet

B. 1345.39 feet

C. 1346.38 feet

D. 1347.04 feet

Sample Question 2

The quantity of rubber required to install a synthetic surface is 1.86 pounds per square foot at a ½" depth. A running track surface will have a 3/8" depth and will cover 5,300 square yards. How many pounds of rubber will be needed to surface the running track?

A. 22,180.50 pounds

B. 88,722.00 pounds

C. 39,432.00 pounds

D. 66,541.50 pounds

Sample Question 3

High School field event areas are being designed to minimum requirements. Included are 4 long jump/triple jump runways and 2 pole vault runways with 2 (5m x 5m) landing pads. The thickness of asphalt is to be 3". Approximately how many tons of asphalt will be required if the asphalt weighs 330 pounds per square yard?

A. 54 ton

B. 64 ton

C. 61 ton

D. 57 ton

Sample Question 1

Answer – C. 1346.38'
R to R = 329.5'
109.4' to measure line
329.5' x 2 = 659.0'
109.4' x 2 x 3.1416 = 687.382'
659.0' + 687.382' = 1346.382'

Sample Question 2

Answer – D. 66,541.50 pounds
1.86 pounds per Sq. Ft. = ½" thick
3/8" thick = 1.86/4 = .465 x 3 = 1.395 pounds
5300 Sq. Yd. x 9 = 47,700 Sq. Ft.
47,700 Sq. Ft. x 1.395 pounds = 66,541.50 pounds

Sample Question 3

Answer – B. 64 ton
<u>Long Jump/Triple Jump Runways</u>
Minimum is 1.07m x 40m + 12 ft
1 meter = 3.28084 ft
1.07m x 3.28084' = 3.51'
40m x 3.28084' = 131.233' + 12' = 143.233'
3.51' x 143.233' = 502.748 Sq. Ft.
4 runways x 502.748 Sq. Ft. = 2010.98 Sq. Ft.
2010.98 / 9 Sq. Ft. = 223.442 Sq. Yds.
<u>Pole Vault Runways</u>
Minimum is 1.07m x 40m
3.51' x 131.233' = 460.628 Sq. Ft.
2 runways x 460.628 Sq. Ft. = 921.256 Sq. Ft.
921.256 / 9 Sq. Ft. = 102.361 Sq. Yds.
<u>Landing Pads</u>
5m x 5m
16.404' x 16.404' = 269.091 Sq. Ft.
2 pads x 269.091 Sq. Ft. = 538.182 Sq. Ft.
538.182 / 9 Sq. Ft. = 59.798 Sq. Yds.
223.442 + 102.361 + 59.798 = 385.601 Sq. Yds.
385.601 Sq. Yds. X 330 pounds per Sq. Yd = 127,248.33#s
127,249.33 / 2000 = 63.62 tons (Rounded up to 64 tons)