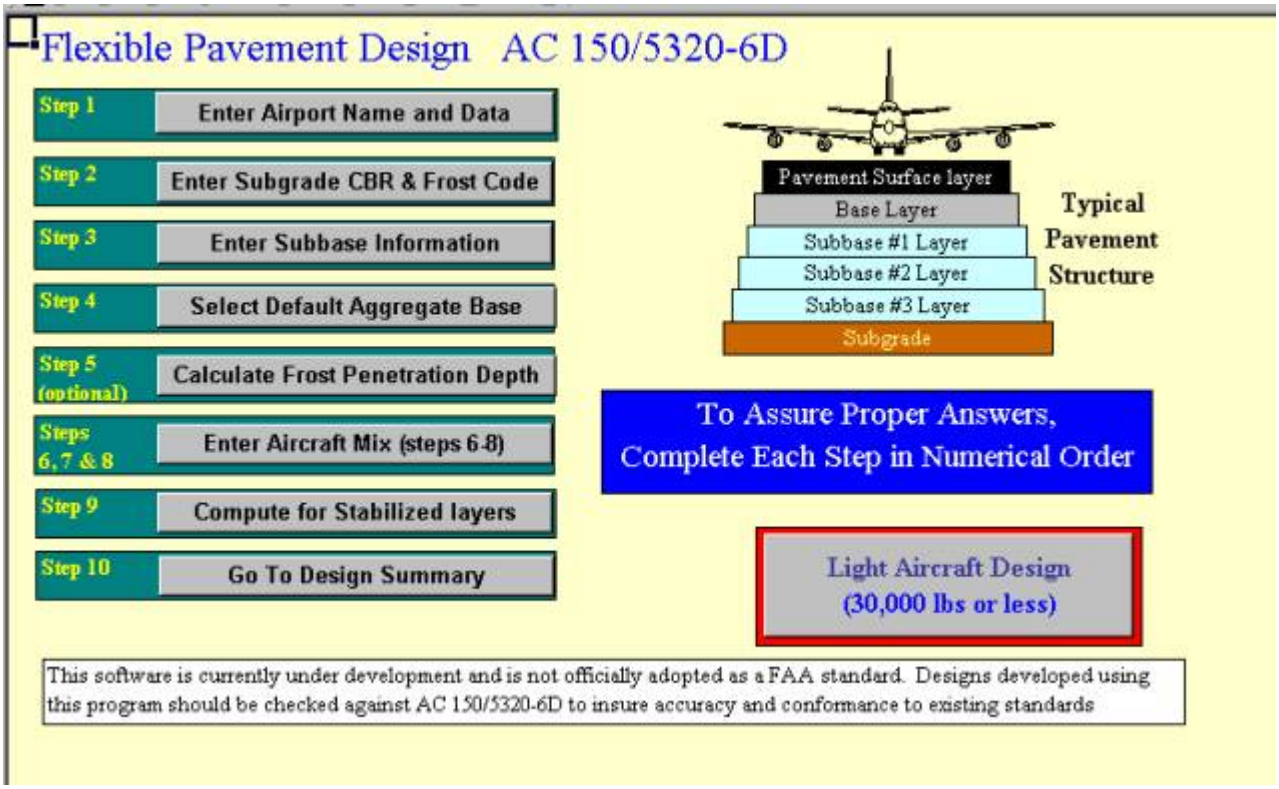
Flexible Pavement Design Spreadsheet: F806FAA.xls

This spreadsheet was designed to produce flexible pavement design thickness' in accordance with FAA Advisory Circular AC 150/5320-6D, Airport Pavement Design and Evaluation.

The spreadsheet breaks the design process into 10 steps and is designed to prompt the user for design input parameters during each step. It is important to complete the design by following the individual steps in numerical order. Since thickness computations are based upon values gathered during each step, completion of the steps in numerical order assures that the proper values are assigned for the respective variables. Once all steps have been completed, the user may go back and modify the input values of any step, then skip directly to step 10 to see the results of the variable change.

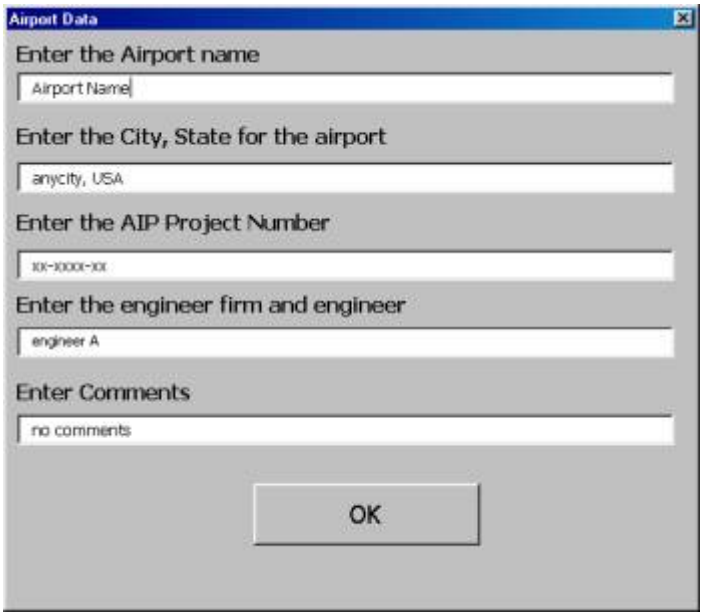


STEP 1. General Information

Provides general project data which is displayed with the design summary.

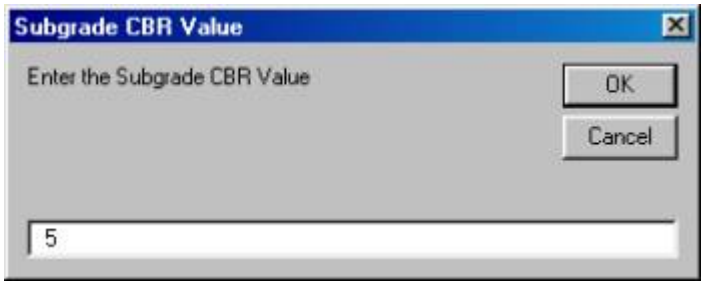
This information is optional and does not affect numerical calculations.

Return to Top



STEP 2. Subgrade CBR

Enter the subgrade CBR value as defined in paragraph 315 of AC 150/5320-6D.



High values of CBR (i.e. >20) may not be appropriate for this design method. Thickness results from high CBR subgrade layers may appear incorrect as the program will default to minimum thickness requirements as identified in 150/5320-6D. Designs performed with high subgrade CBR values may indicate negative subbase layer thickness.

Remember that the CBR design method requires that each layer be an improvement over the layer directly beneath, i.e. the subbase layer CBR must be higher than the subgrade CBR.

Each time the user activates Step 2, the default value in the pop up box will be a CBR of 5. Simply re-enter the desired CBR value and click OK.

If frost consideration is appropriate, the spreadsheet calculates the pavement thickness necessary for a Reduced Subgrade Strength in accordance with paragraph 308 of AC 150/5320-6D.

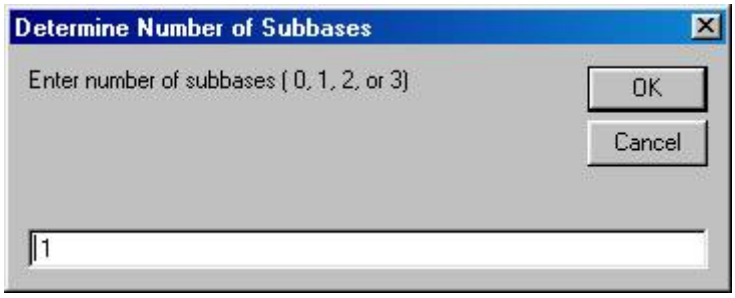
NOTE: The Reduced Subgrade Support method is not permitted for FG-4 soils with the publication of AC 150/5320-6D

If the user wishes to verify designs produce under AC 150/5320-6C, they may do so by manually reducing the subgrade CBR and selecting Non Frost Conditions.

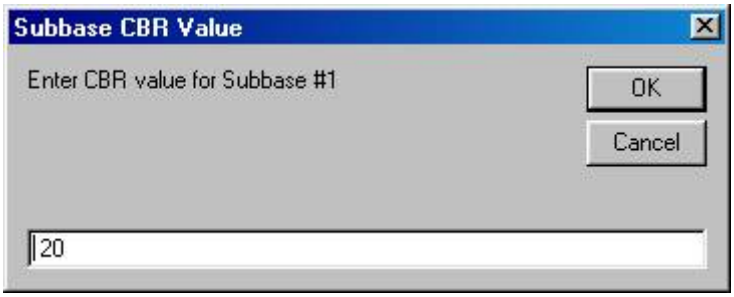
STEP 3. Number of Subbases

Determine the number of subbase layers to be included in the design.

The spreadsheet can design for a maximum of 3 subbase layers, however, most design requirements do not need the additional layers to provide sufficient pavement strength.



A design with multiple subbase layers tends to over-design the lower layers and under-design the upper layers. This is because the methodology is to determine the total thickness required over the subgrade material then subtract the thickness required over the first improved layer. The thickness of subsequent layers is subtracted from the remaining thickness. For example if a total thickness of 35 inches is required over the subgrade and a thickness of 15 inches is required over a subbase of CBR=20, then the subbase layer would be 35-15= 20 inches thick. This only leaves 15 inches to be distributed to any remaining layers.



Due to construction practicalities and cost feasibility, most typical designs only incorporate one subbase layer.

Enter the CBR value for the subbase material

The user is remined that AC 150/5320-6D assumes a CBR of 20 for Item P-154.

Select the Frost Code for the subbase material

Repeat for each subbase layer selected.

See the figure in the program for order of subbases (#1 is the top most layer)

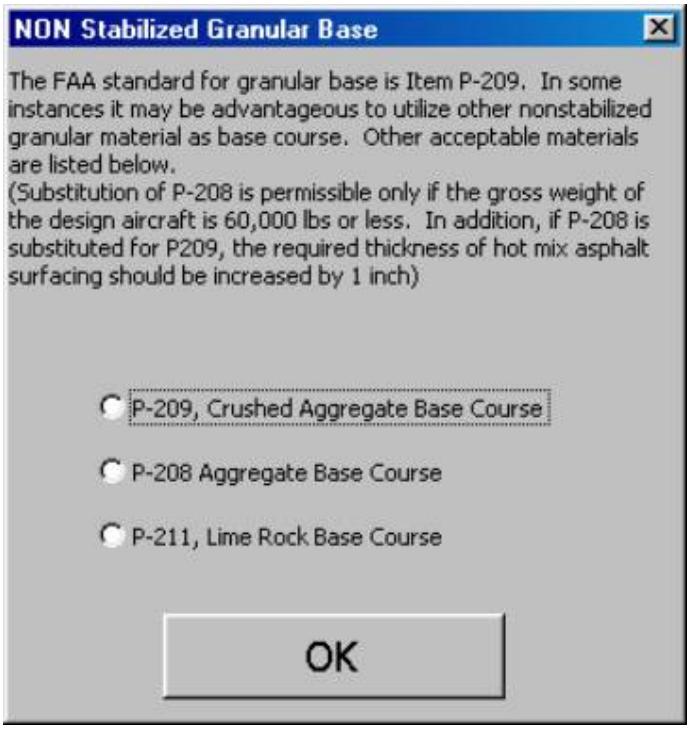
Subbase layers must increase in strength as you move up in the pavement structure.

STEP 4. Default Aggregate Base Material

Item P209 is the default material for granular base. It is assumed that P-209 material can achieve a minimum CBR value greater than 80. This default value cannot be altered in the spreadsheet.

Others base materials, when permitted, will increase the asphalt surface course minimum thickness. If Item P-209 is not the default base material, the minimum thickness of the surface asphalt layer is automatically increased to 5 inches.

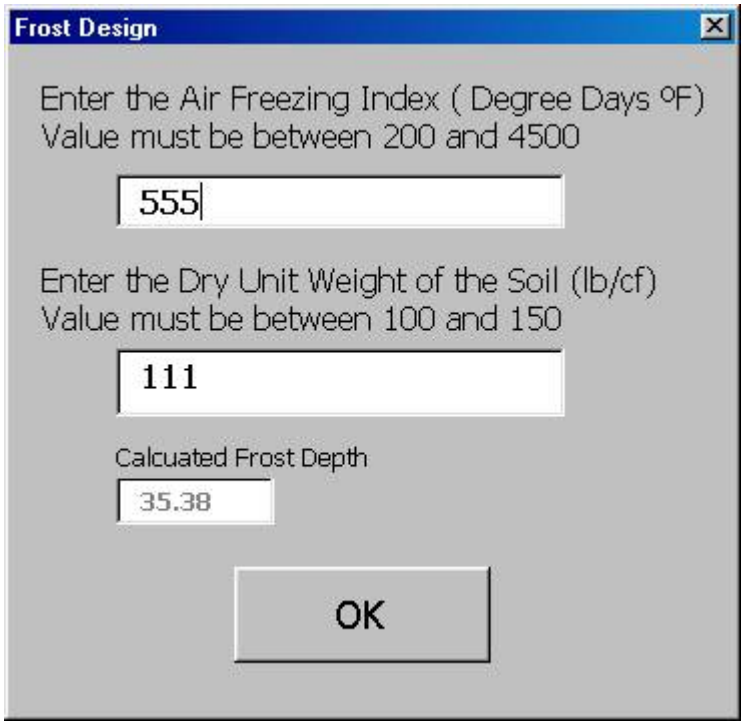
Item P-208 is permitted when aircraft are not expected to exceed a gross weight of 60,000 pounds.



STEP 5. Frost Penetration

Enter the degree days ºF/day and subgrade unit weight lb/ft

This is an optional step and does not affect pavement thickness calculations. The user should compare the frost depth to the required protection depth. Computation of the frost depth is not necessary when the pavement design is based upon the Reduced Subgrade support method of frost design.

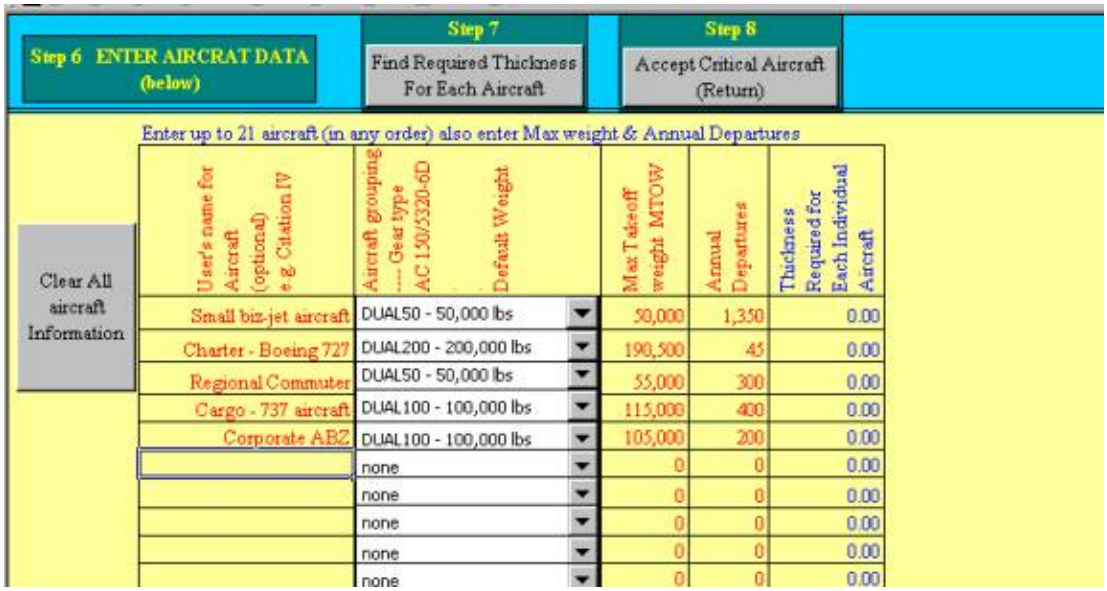


Frost depth information is in tabular form as provided by the Corp of Engineers in 1986. Frost depth values are simple interpolations of the tabular data.

Frost Penetration (Inches)

	Soil Unit Weight lb/cf			
Degree Days	**100**	**115**	**125**	**150**
200	20.5	21.5	23.8	25.5
400	27.5	30.5	35	38.5
600	34	38	44.5	49
800	40	44.5	54	59
1000	45	51	62	69
2000	69.5	79	102	113
3000	92	105	140	156
4000	115	130	177	205
4500	125	145	197	225

STEP 6. Enter Aircraft Data



Selection of Aircraft is limited to aircraft types identified in the original FORTRAN program.

The Spreadsheet is limited to a mixture of 21 individual aircraft. The user may select any combination of aircraft. Aircraft types may be repeated.

The user can assign a local name to an aircraft for ease of identification. Local names can be entered directly into the spreadsheet. This is particularly useful when numerous aircraft are from a common gear configuration but vary in weight.

The program will prompt the user for aircraft weight and annual operations. Since each gear type is based upon a reasonable anticipated weight for the gear configuration, the program will limit the permissible weight range. If desired, the user may over-write these values directly in the spreadsheet. The user is cautioned to observe the weight limitations and select gear configurations appropriately. Greater thickness requirements will result from overloading a small gear versus under loading a larger gear. For example, a dual wheel aircraft weighing 125,000 pounds could be input as a DUAL100 or a DUAL150 aircraft.

STEP 7. Find Required Thickness For Each Aircraft

Step 7 finds and displays the required pavement thickness for each aircraft in the mixture and determines the most demanding (critical) aircraft.

This step is provided for the user's information and may be skipped as it is repeated by step 8.

This step is particularly useful when analyzing the impact of one design variable. Suppose the user wants to see the impact of increasing weight while keeping annual departures constant. By entering the same aircraft multiple times and varying the weight, the user can immediately see the change in thickness required for each change in weight. Likewise, any variable can be changed while holding other variables constant.

STEP 8. Accept Critical Aircraft

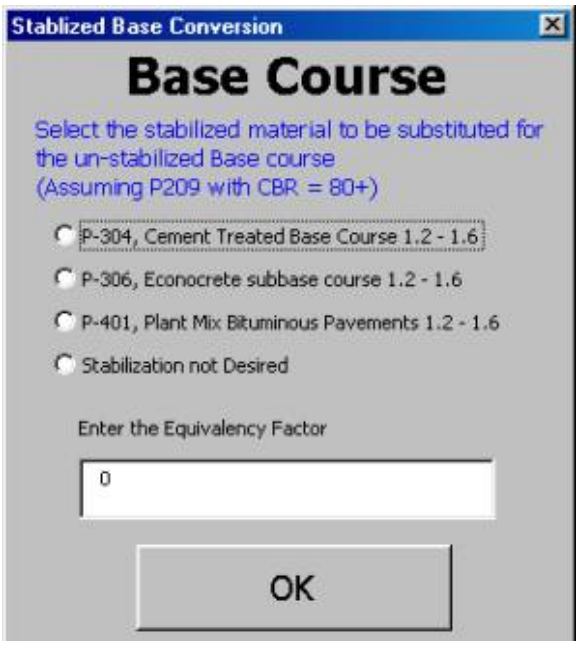
Repeats step 7 and performs final calculations
Returns the user to the main screen

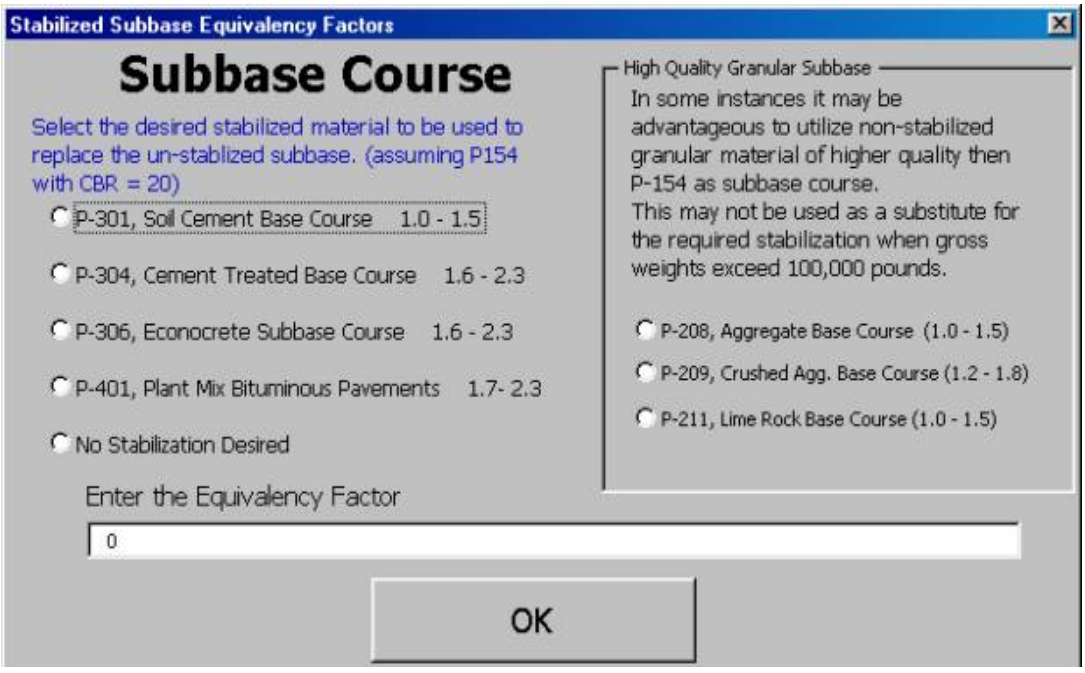
STEP 9. Compute for Stabilized Layers

This step allows the user to specify equivalency factors for stabilized layers. Acceptable equivalency factor ranges are provided.

Conversions are restricted to the base and the first subbase layer. Within the program, conversions are for the entire layer. The user may elect to make partial conversions by hand.

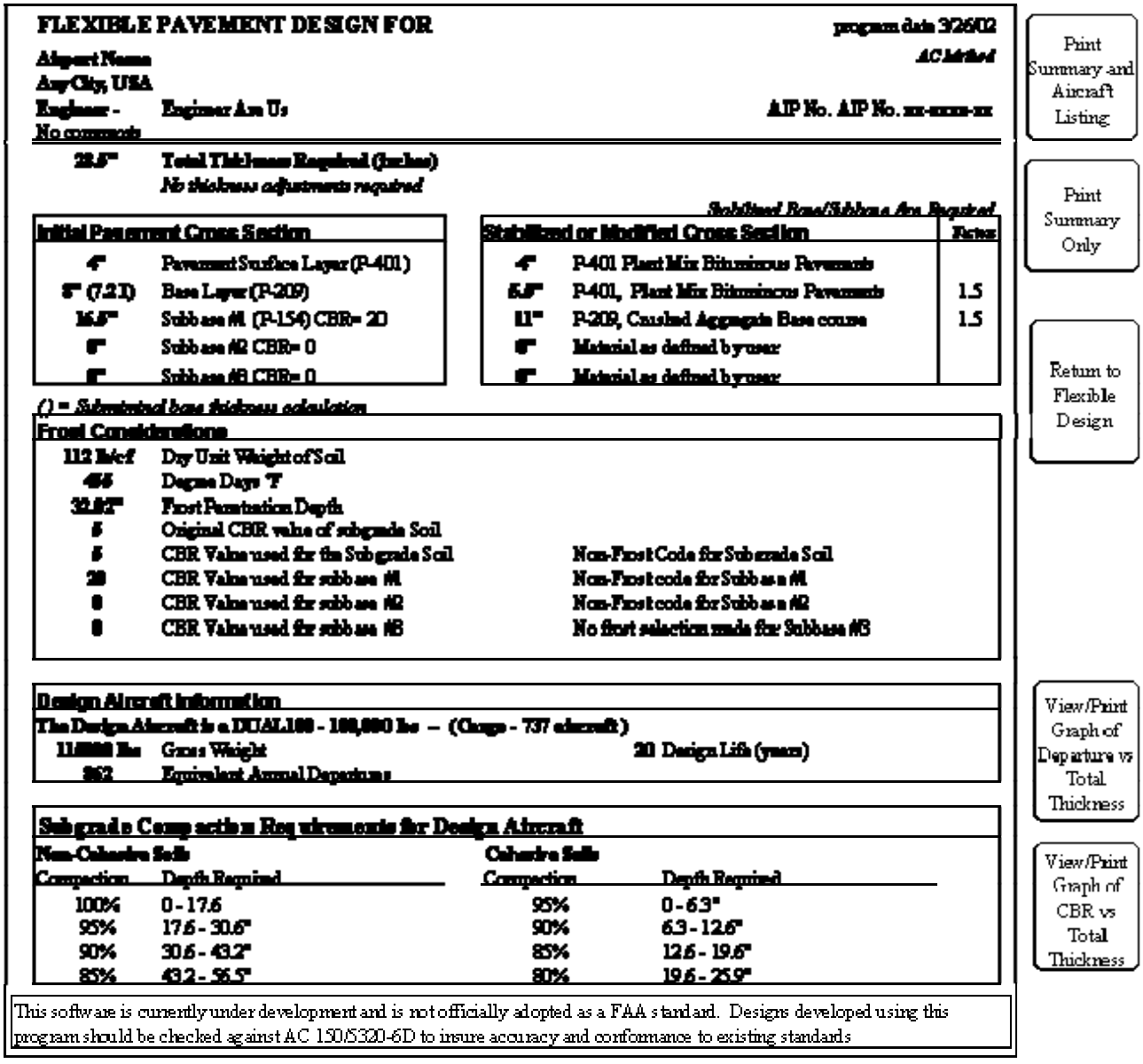
Conversion factors have limited ranges in accordance with AC 150/53320-6D.





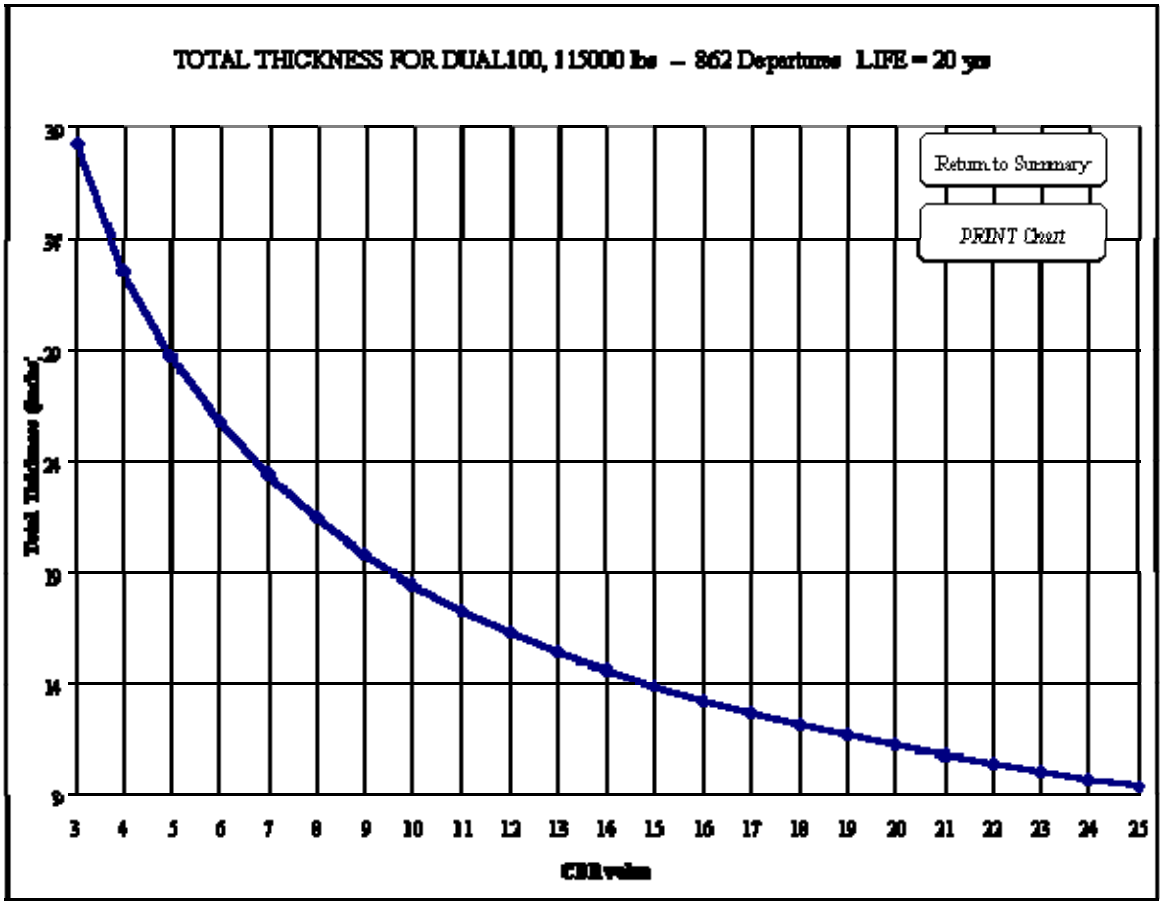
STEP 10. Go To Design Summary

Repeats design calculations (step 8) and takes the user to the summary sheet.
All information regarding the design is displayed on the summary sheet.
The summary display is dynamic and will change depending upon design features. e.g. if a stabilized base is required, a note will appear on the summary sheet to indicate the requirement.



From the summary sheet, the user is permitted to print the summary and/or the aircraft mix.

The user may also elect to view a plot of annual departures versus required total thickness or a plot of CBR versus required total thickness for the design aircraft. These plots provide an indication of how sensitive the design is to changes in CBR or annual departures.


TOTAL THICKNESS FOR DUAL100, 115000 lbs -- 862 Departures LIFE = 20 yrs
Return to Summary
PRINT Chart
Total Thickness (inches)
CBR value
39
34
29
24
19
14
9
3
4
5
6
7
8
9
10
11
12
13
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15
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21
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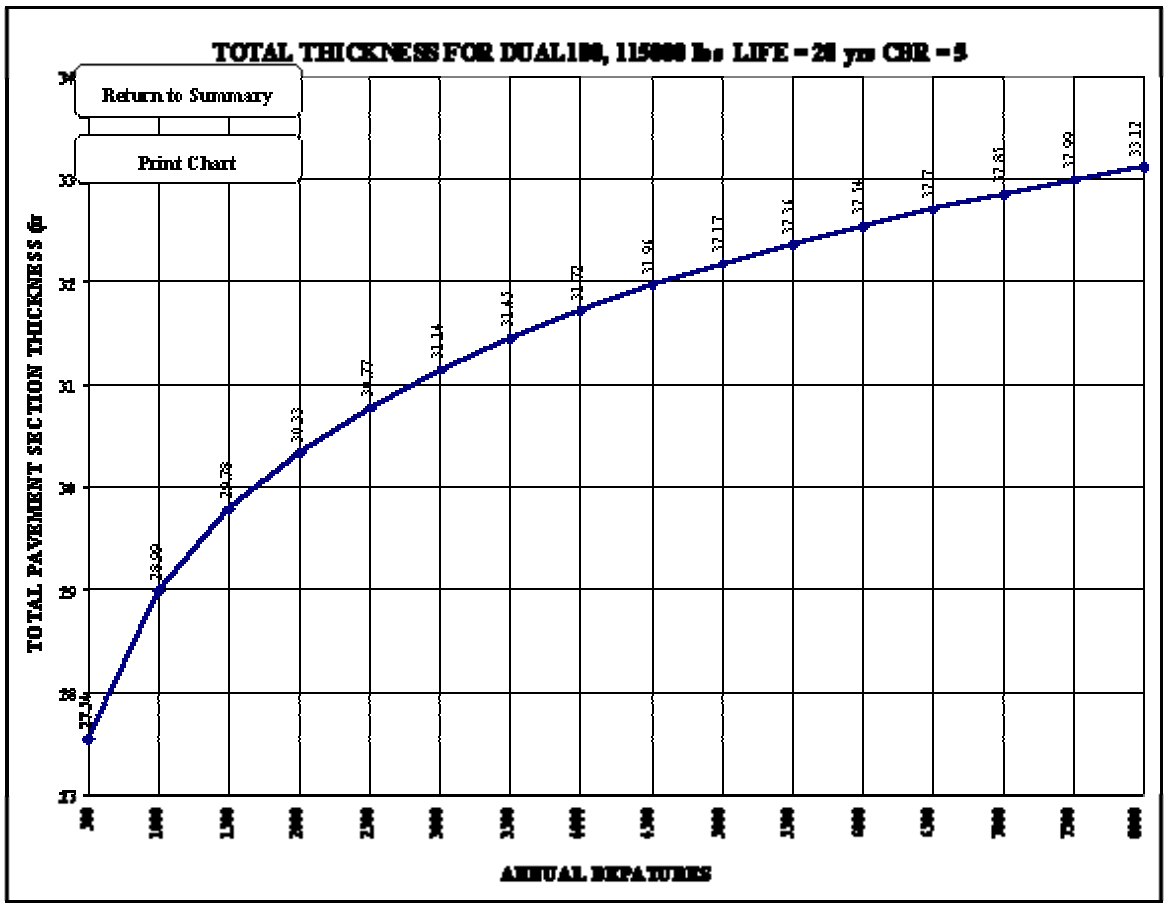
25


TOTAL THICKNESS FOR DUAL100, 115000 lbs LIFE = 20 yrs CBR = 5
Return to Summary
Print Chart
TOTAL PAVEMENT SECTION THICKNESS (in
ANNUAL DEPATURES
27.34
28.99
29.78
30.33
30.77
31.14
31.45
31.72
31.96
32.17
32.36
32.54
32.7
32.85
32.99
33.12