# FAARFIELD 1.4

## Design Examples – Rigid

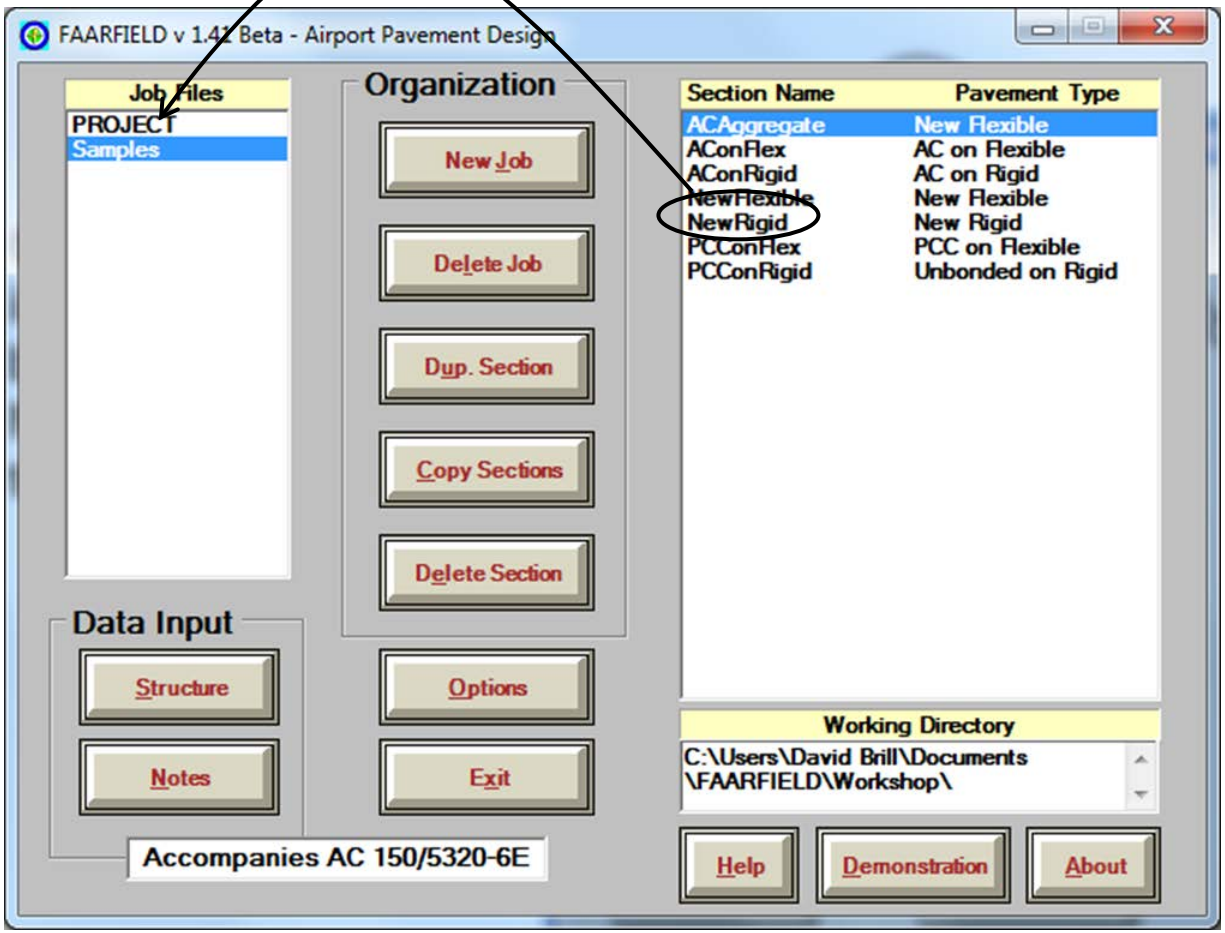
Presented to: XI ALACPA Seminar on Airport Pavements and IX FAA Workshop, Santiago de Chile

By: David R. Brill. P.E., Ph.D.

Date: 3 September, 2014

# New Rigid Example Set-Up

**Create a new section in job <u>PROJECT</u> by dragging section NewRigid in <u>Samples</u> to <u>PROJECT</u>.**

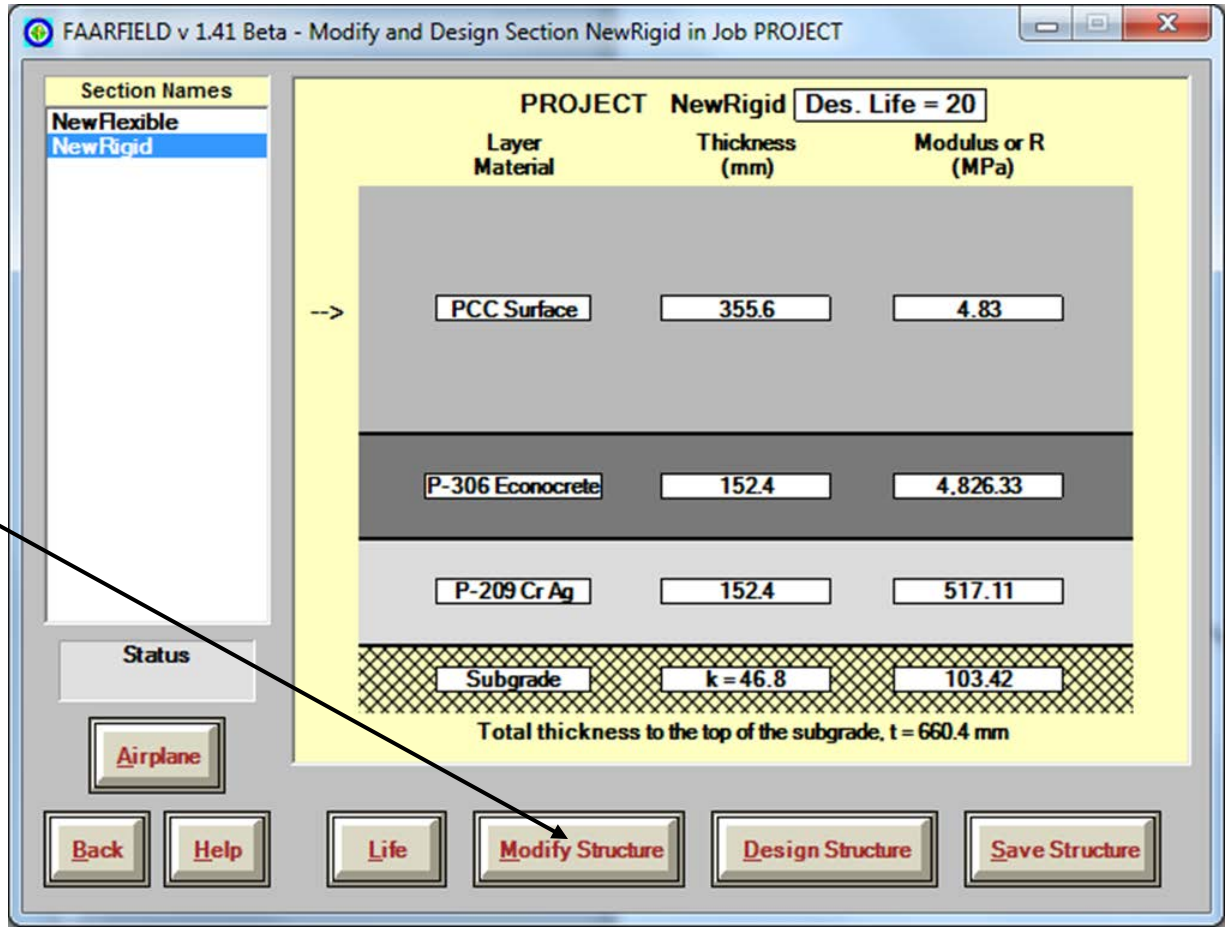


# New Rigid Pavement Design Example

- **Pavement Structure:**
  - PCC Slab, P-501, R = 4.85 MPa psi
  - Cement-Treated Base, P-304, 150 mm thick
  - Crushed Aggregate Base, P-209, 200 mm thick
  - Subgrade *k* = 27 MPa/m
- **Traffic Mix:**
  - 10-Aircraft Mix includes B777, A340, A380
  - Same traffic mix as flexible example.

# Change Pavement Structure

**In Structure window, click on Modify Structure**



# Change Pavement Structure

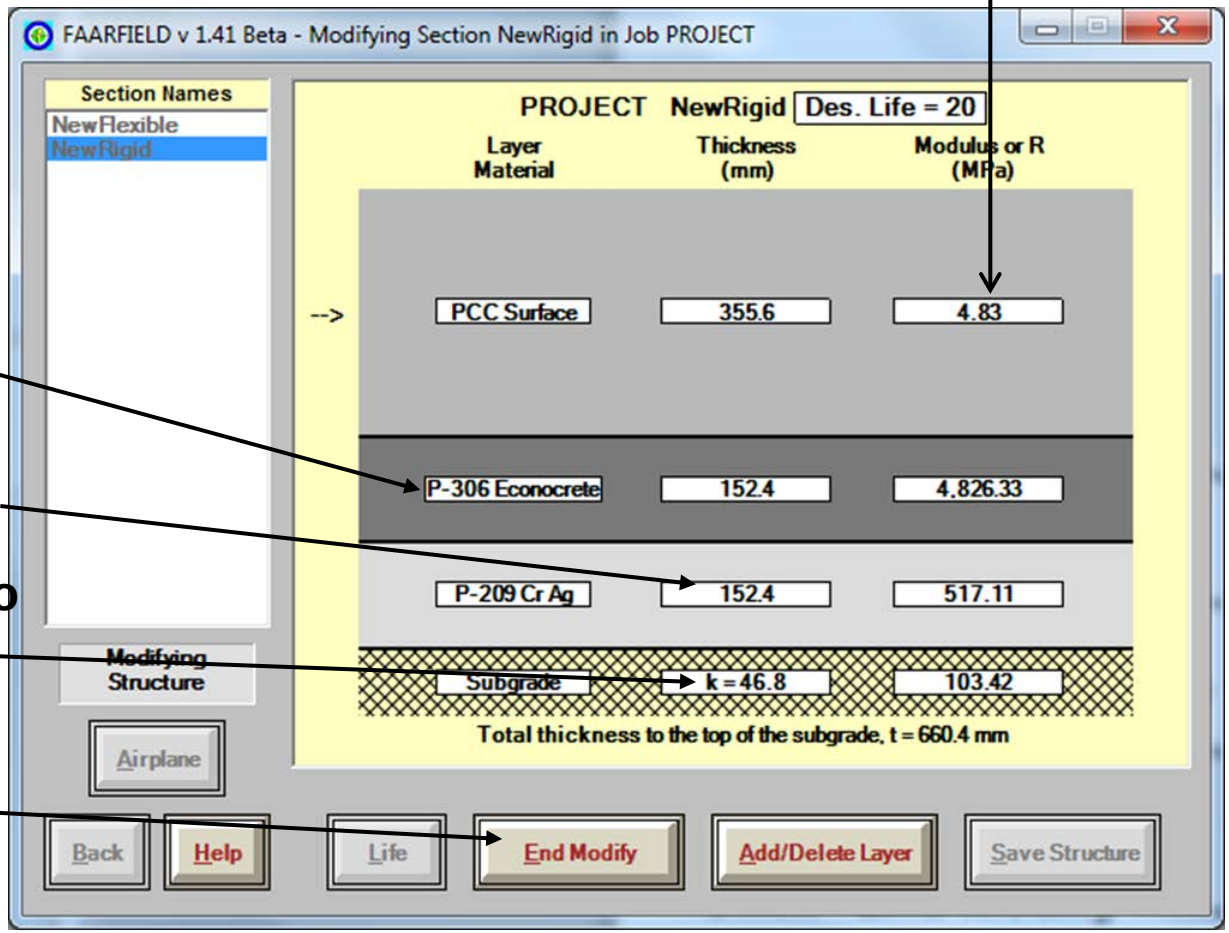
**Change *R* to 4.85 MPa**

**Change base layer to 150 mm CTB, P-304**

**Change P-209 layer thickness to 200 mm.**

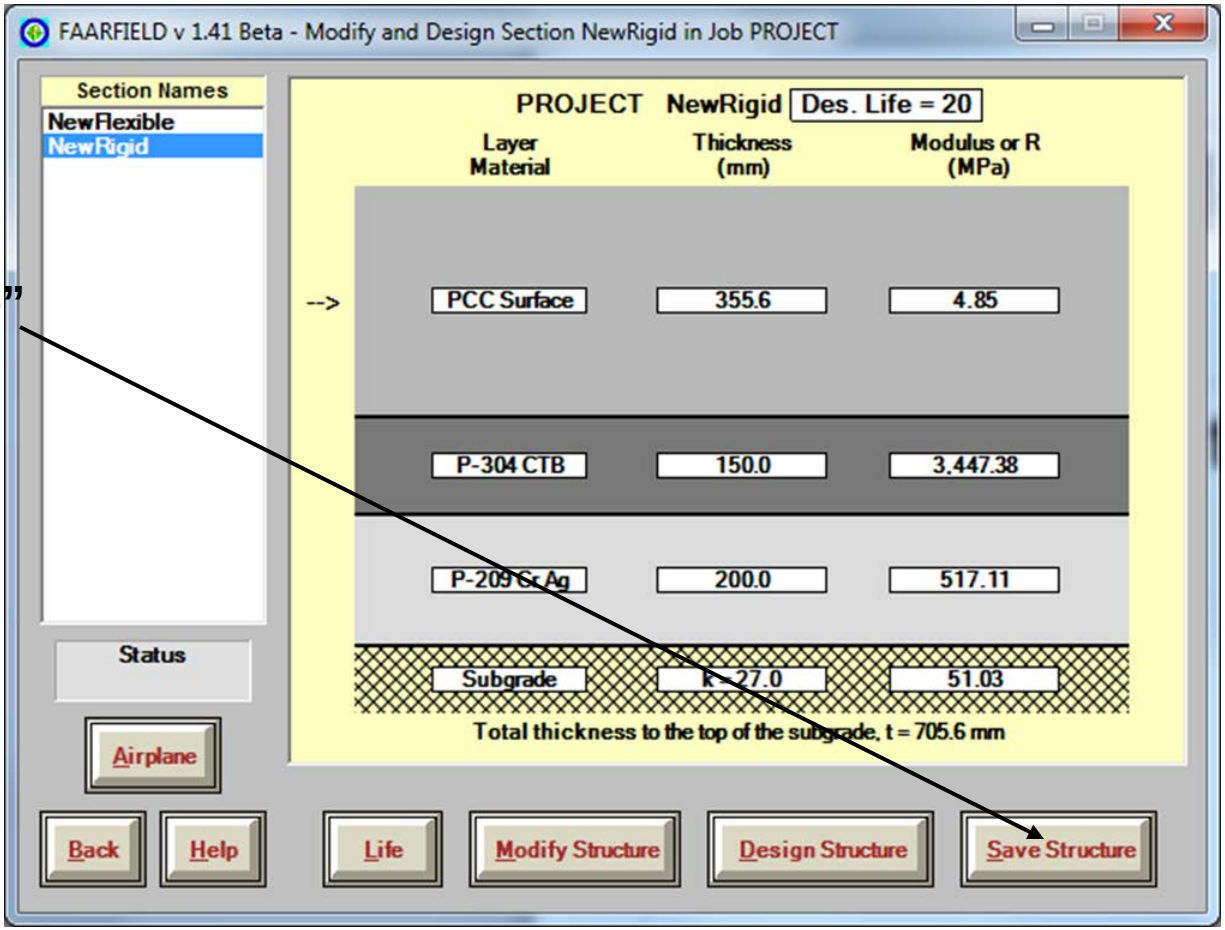
**Change subgrade *k* to 27 Mpa/m**

**Click "End Modify"**



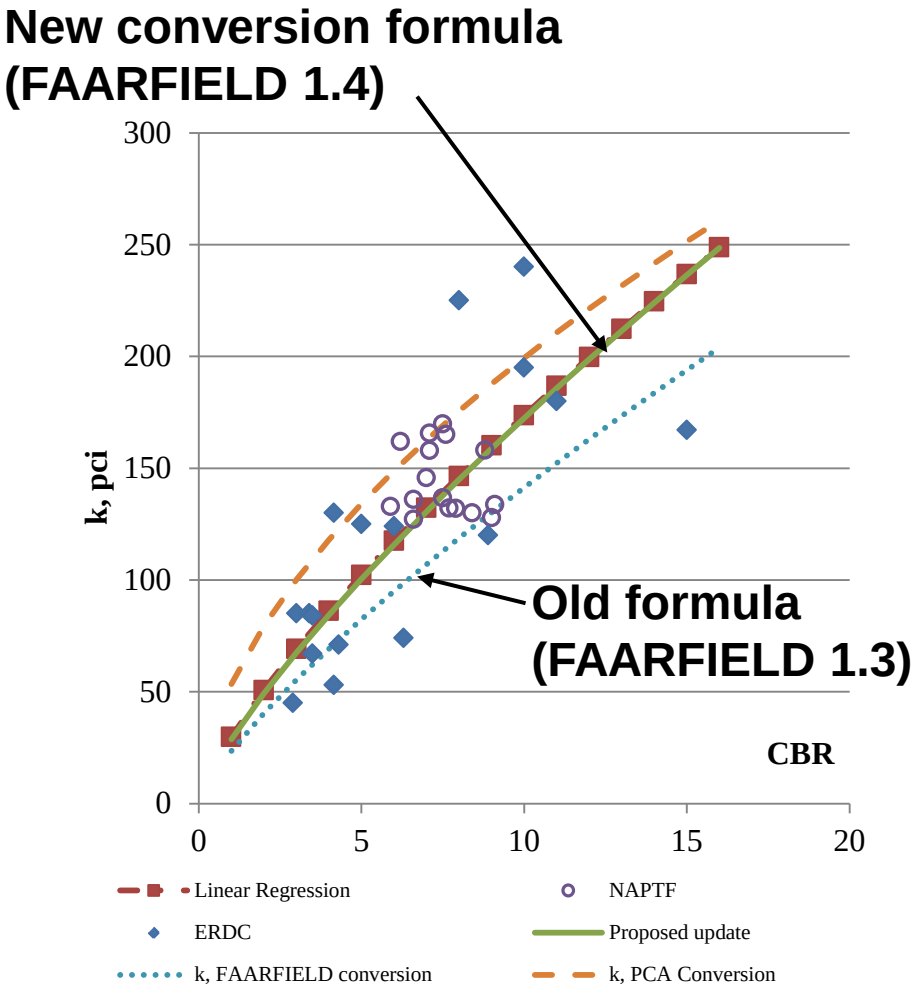
# Change Pavement Structure

**Click "Save Structure"**



# Converting Subgrade *k*-Value to *E*

- **FAARFIELD automatically converts *k* to *E*, and vice-versa.**
- **The new conversion formula used in FAARFIELD 1.4 is:**
  **$k = 28.6926 \times CBR^{0.7788}$**
  **where: CBR = *E* / 1500**
  **(*E* in psi, and *k* in psi/inch).**
- **Improved agreement with field correlations.**
- **Less conservative than previous formula when converting from CBR data.**

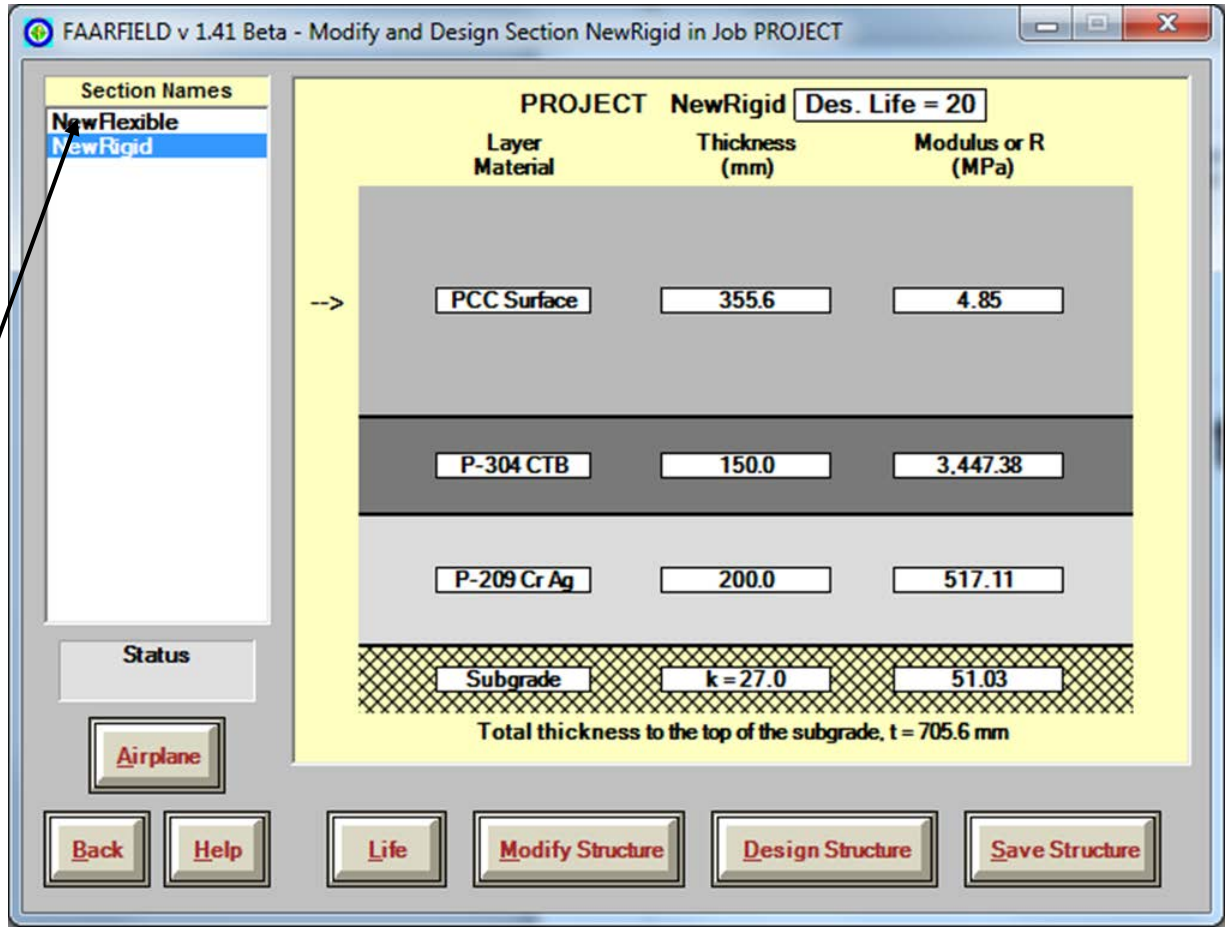


# Enter Traffic Mixture

**Same traffic mix as flexible example.**

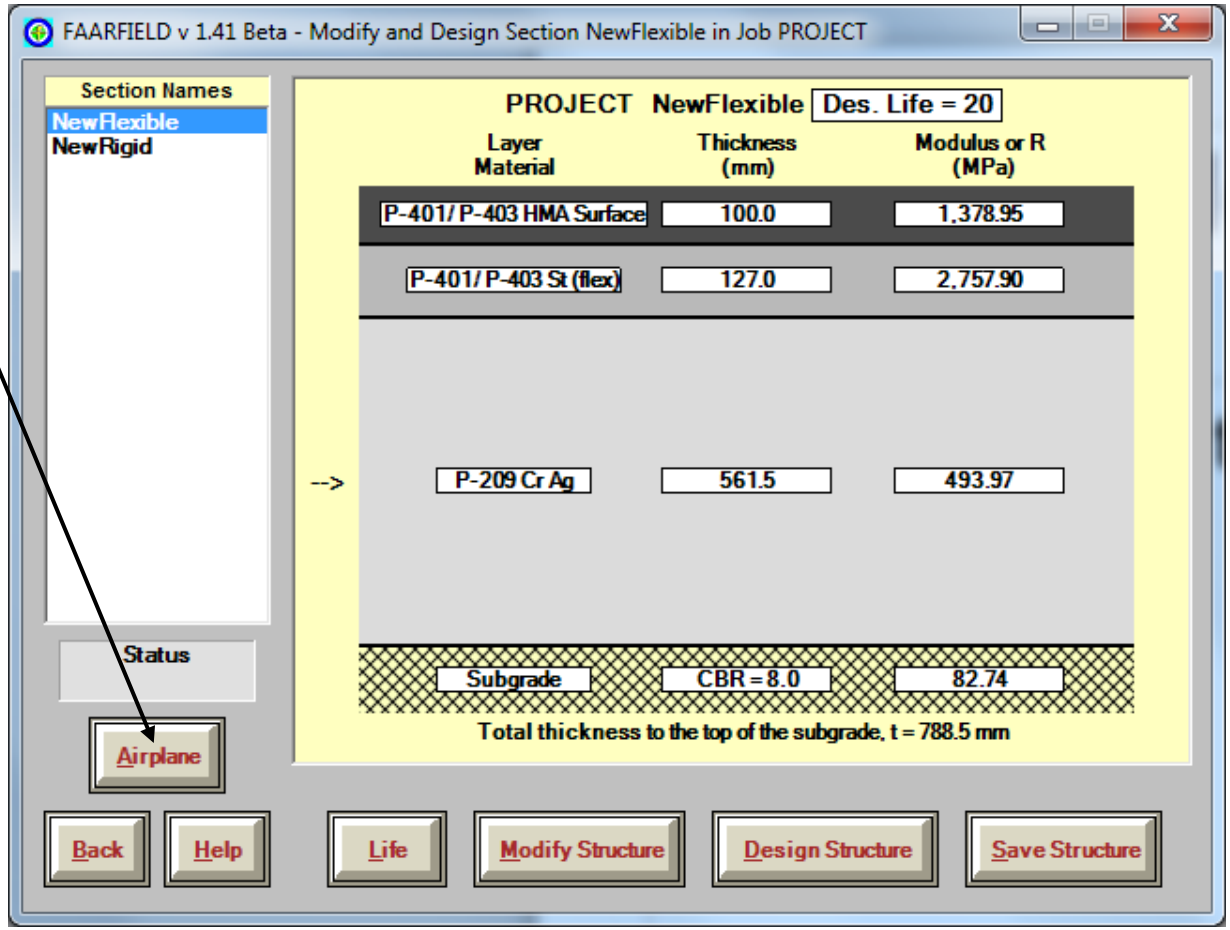
**Use the "Float" Function.**

**Click on section "NewFlexible" to display the previous flexible design.**



# Enter Traffic Mixture

**Click on "Airplane" in section NewFlexible.**

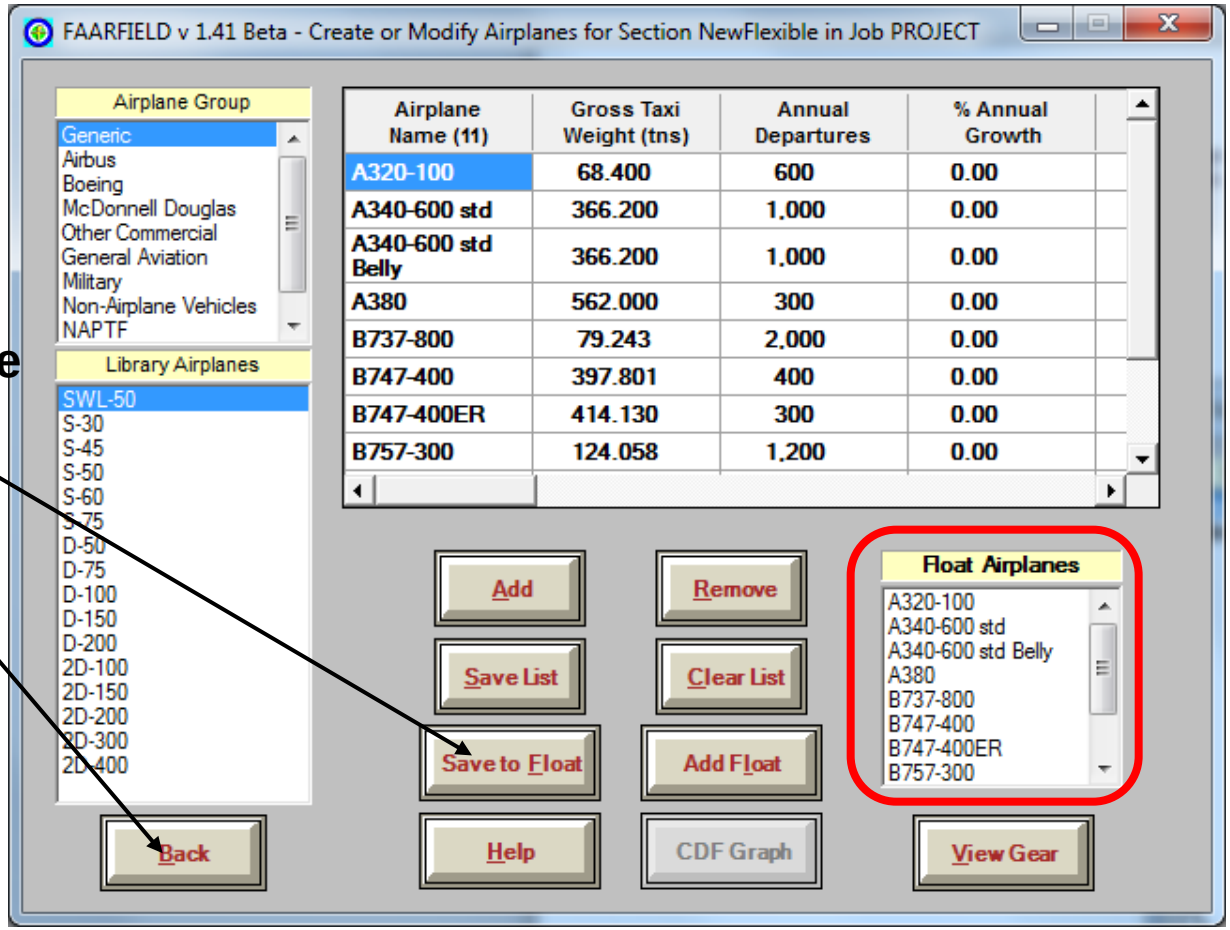


# Enter Traffic Mixture

**Click on "Save to Float." This stores the entire airplane list in memory.**

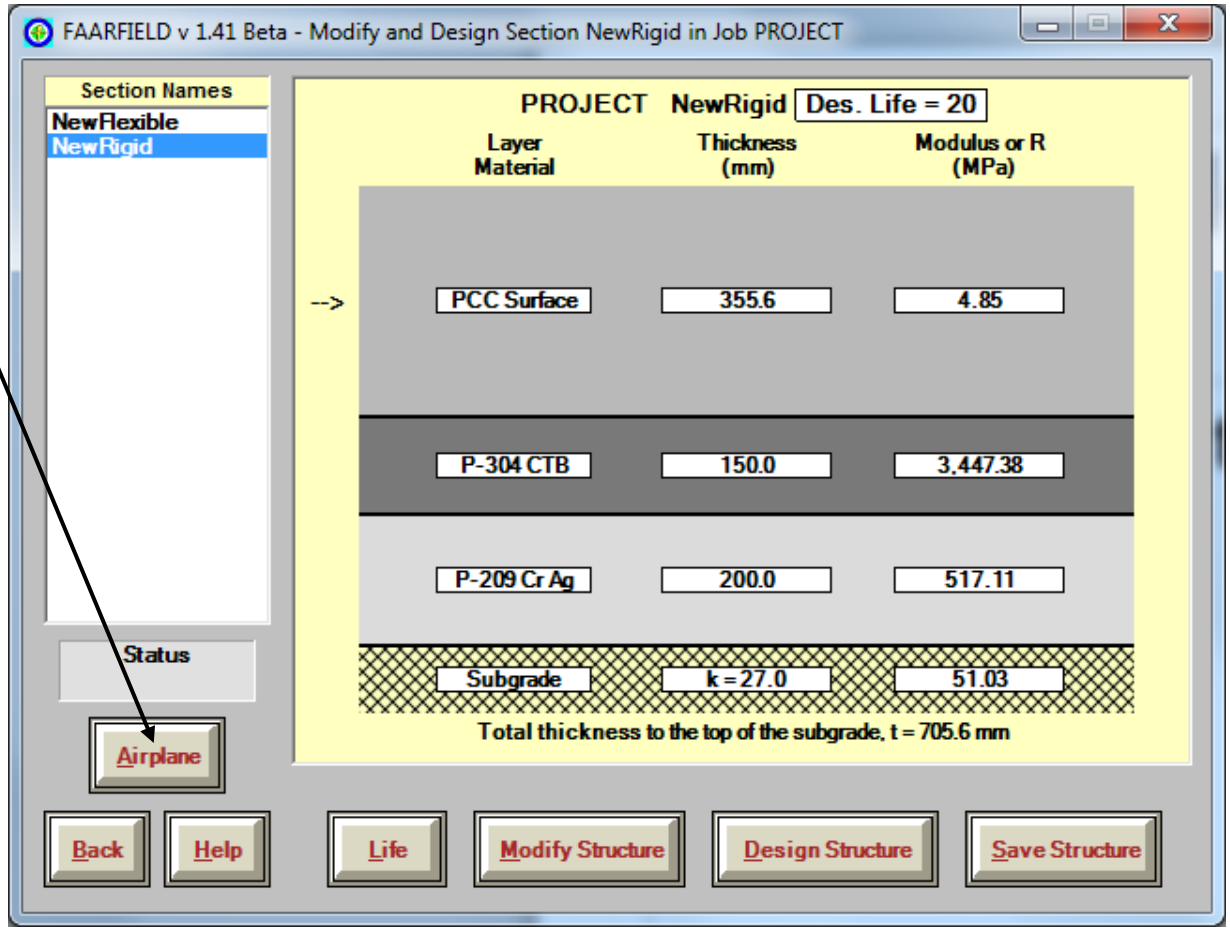
**Then click "Back"**

**Click "NewRigid" to return to the rigid section.**



# Enter Traffic Mixture

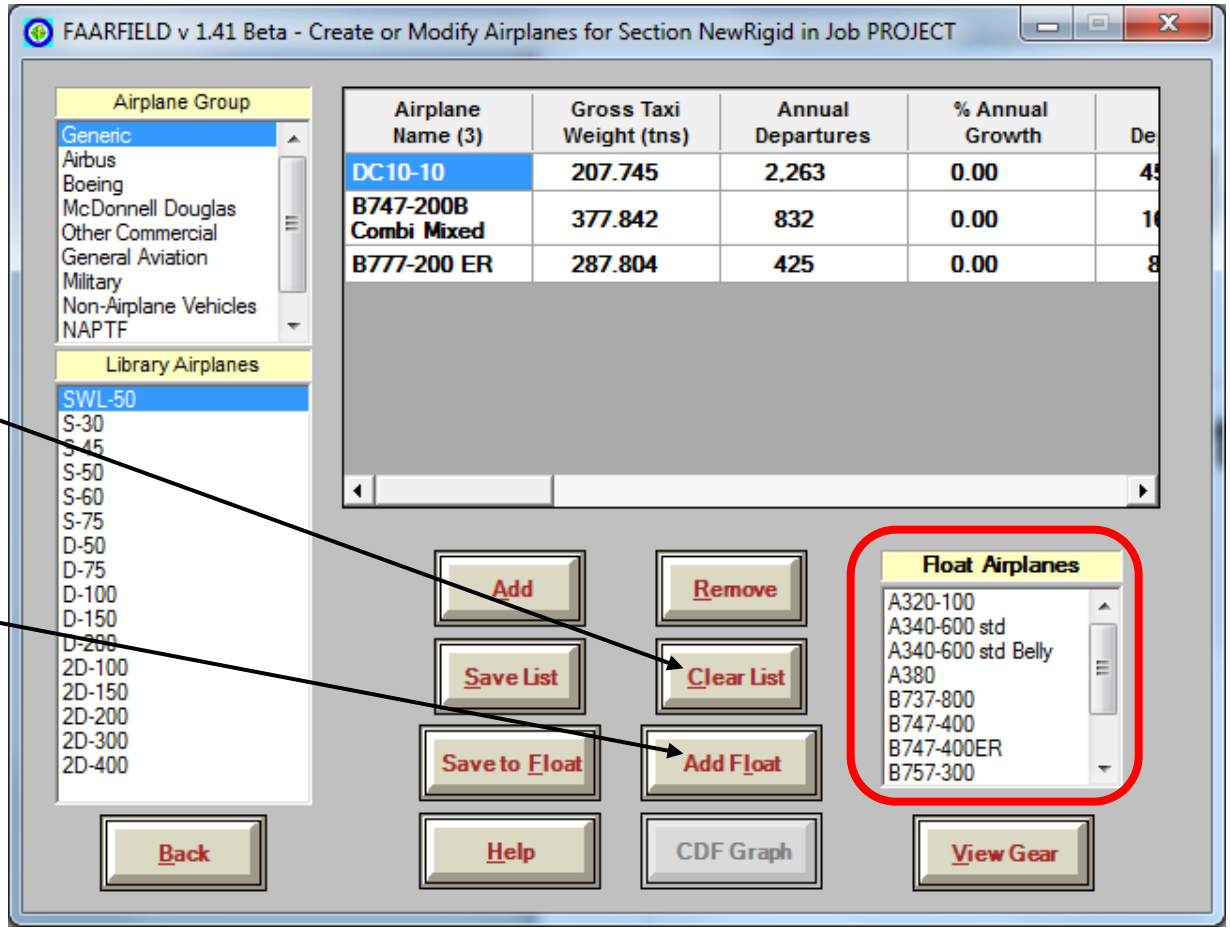
**Click on "Airplane" in section NewRigid.**



# Enter Traffic Mixture

**Hit "Clear List" and Yes to clear the default airplane list.**

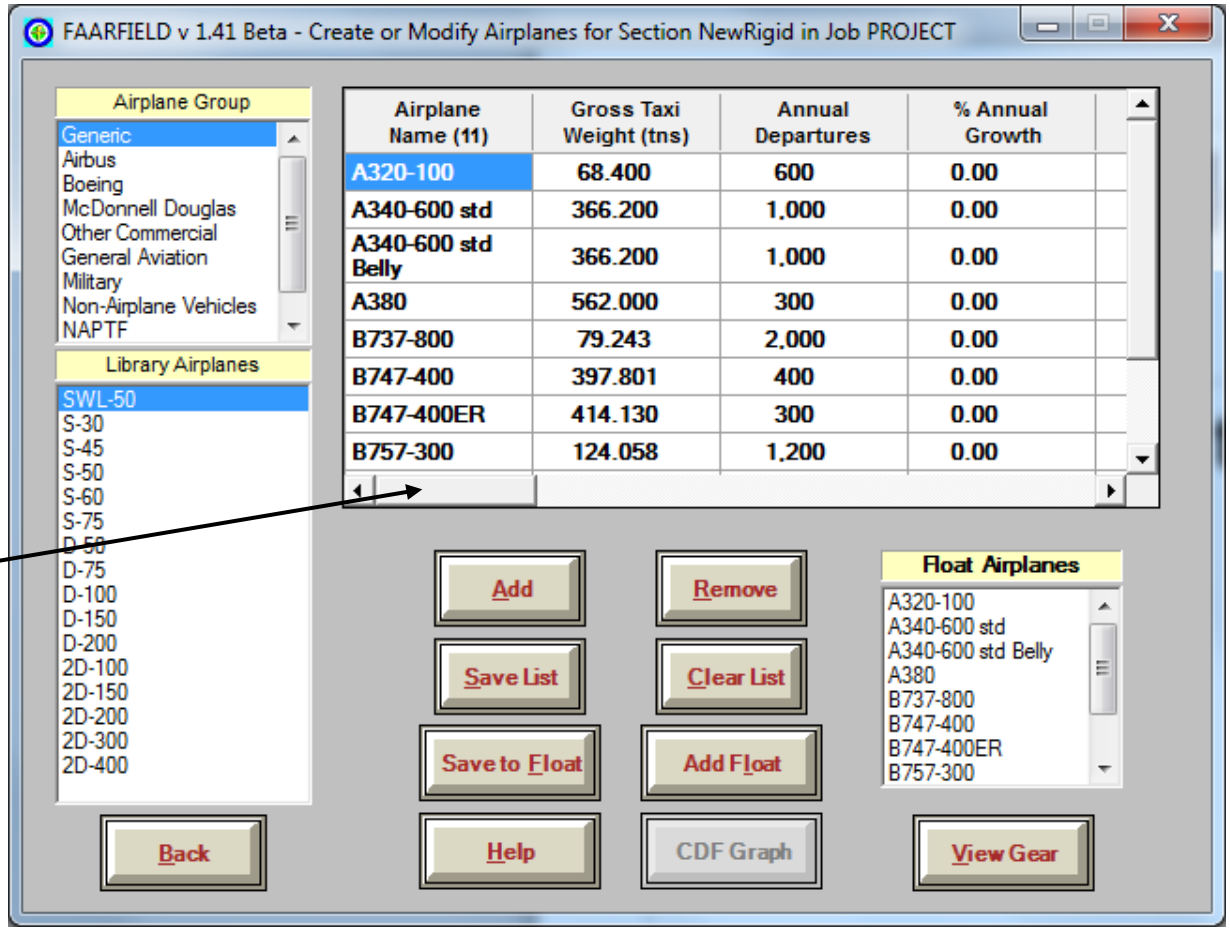
**Then click "Add Float."**



# Enter Traffic Mixture

**The float airplane list now appears in the design aircraft table.**

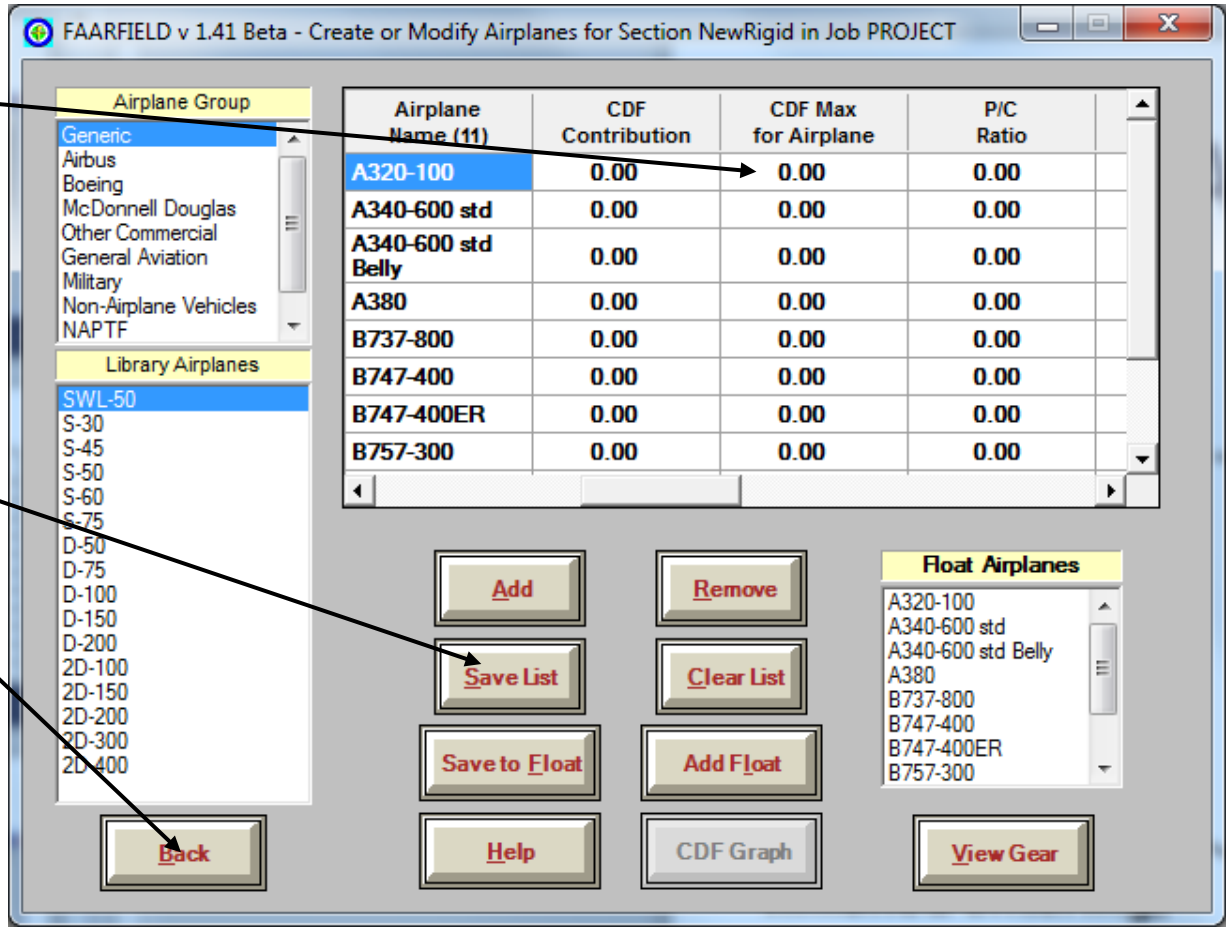
**Scroll over to reveal additional columns of information.**



# Viewing Airplane Information

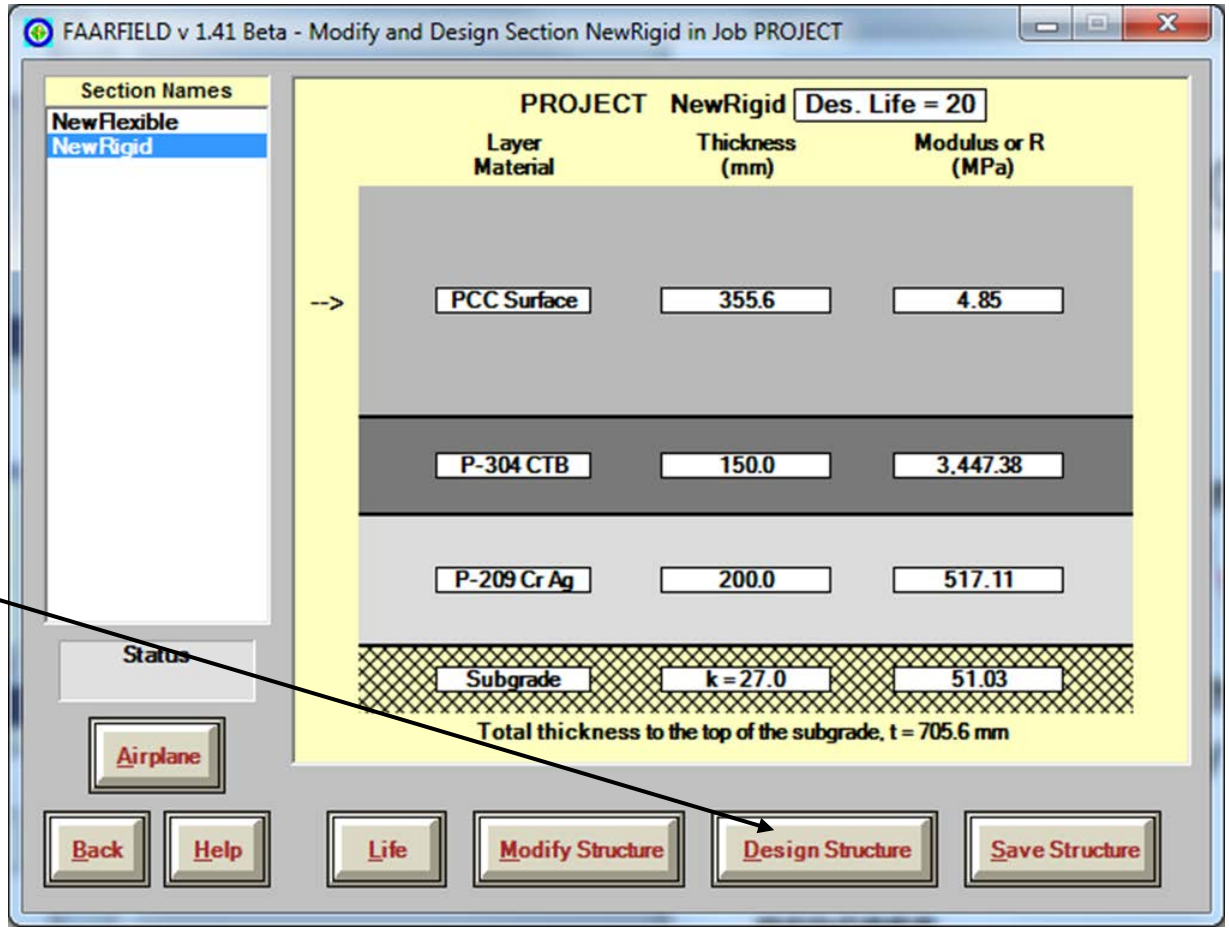
**Values in CDF and P/C ratio columns will be zero when airplanes are first entered.**

**Save the list when finished, then click the Back button.**



# Run the Design

Click “Design Structure”

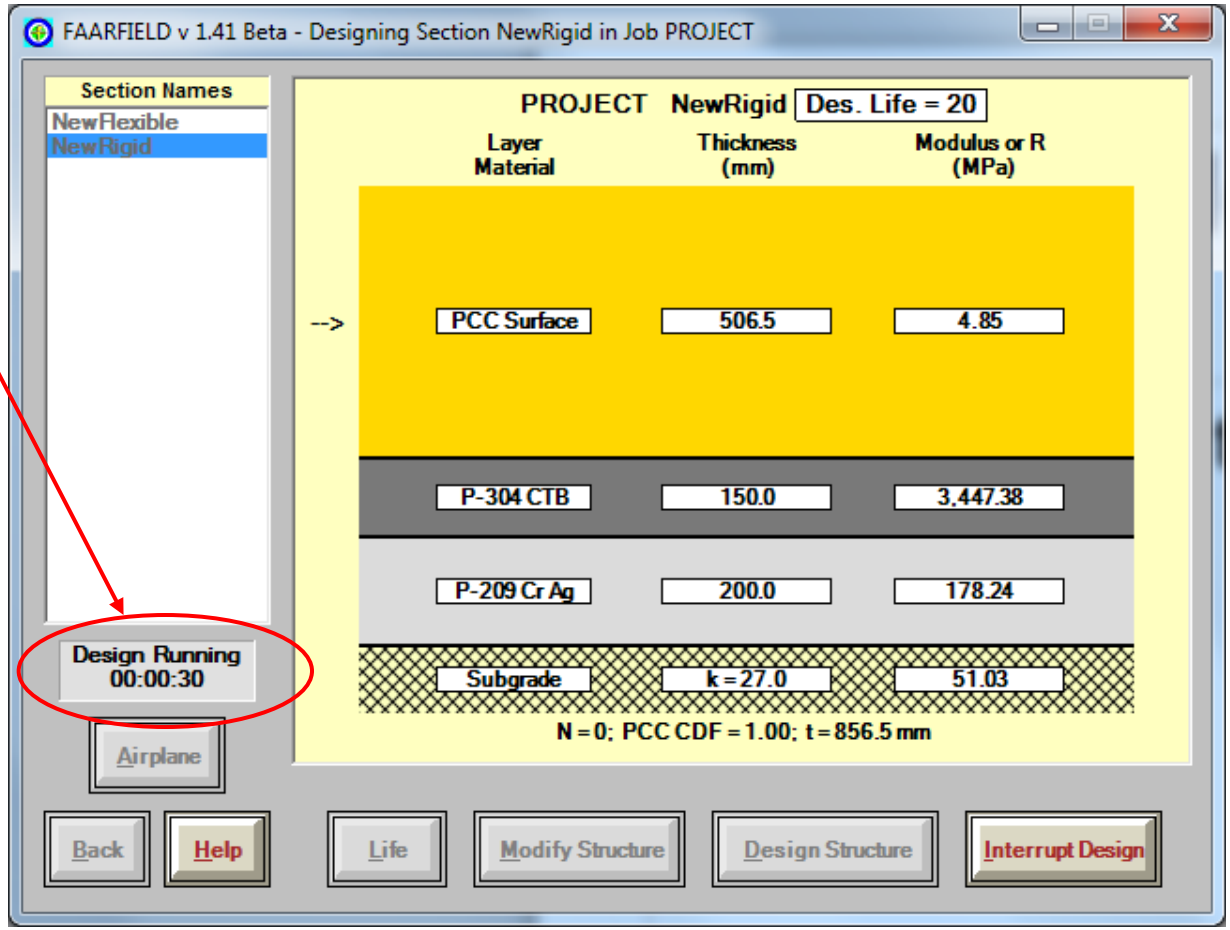


# Running the Design

**During the design process, the "Design Running" clock will appear.**

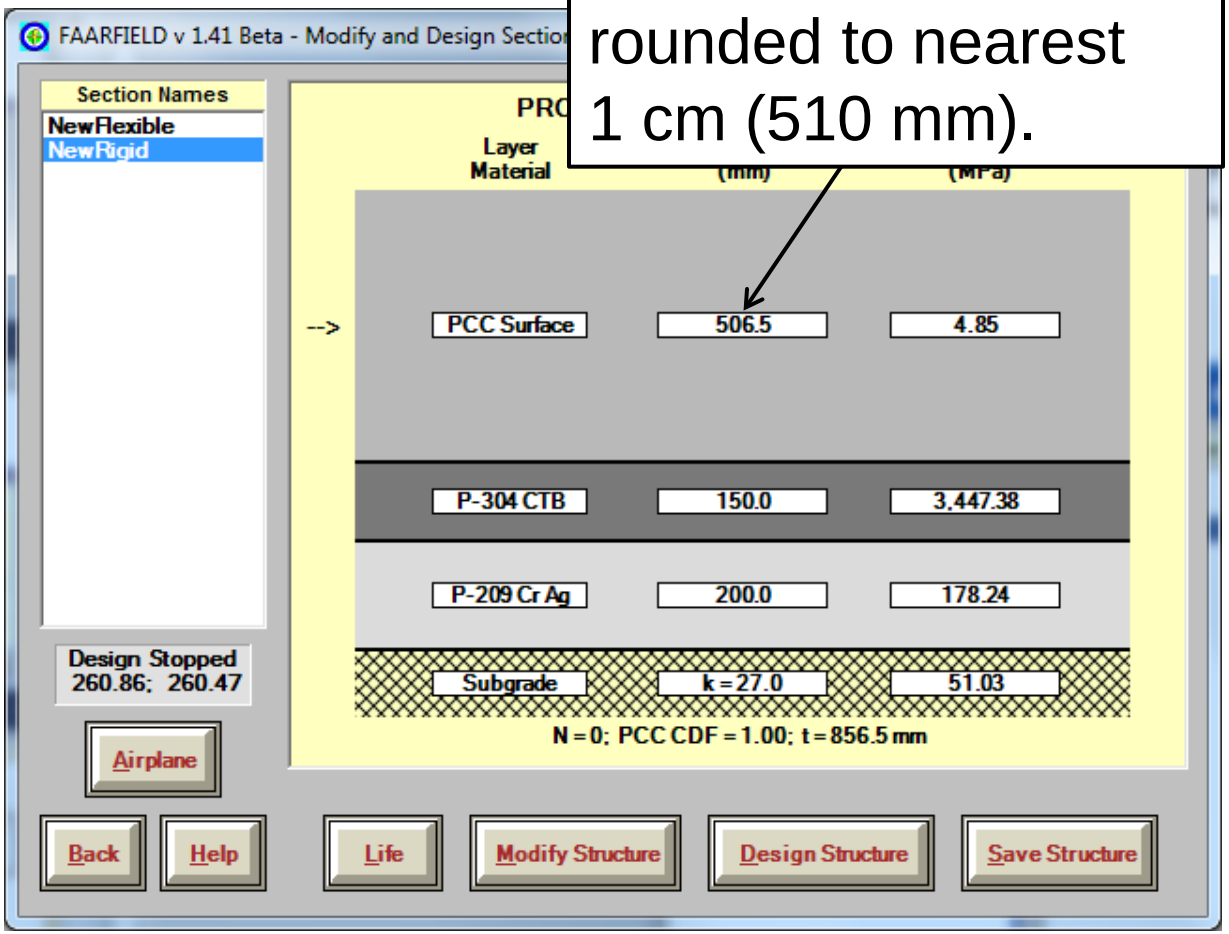
**For rigid designs, the design will normally take a few minutes. Don't interrupt the process.**

**The screen display will change with each iteration.**



# Final Design

Thickness should be rounded to nearest 1 cm (510 mm).



# PCC Stresses for Rigid Design

- **FAARFIELD 1.4 compares maximum edge stress and interior stress for all airplanes.**
- **The <u>larger</u> value is used in design.**
- **Output file *NikePCC.out* lists stress values:**

```
      Aircraft No. 5  B737-800

PCC SLAB Edge HOR STRESS    PCC SLAB Interior HOR STRESS
              245.3775                  236.6298
PCC SLAB HOR STRESS
              245.3775
```

```
      Aircraft No. 11  B787-8

PCC SLAB Edge HOR STRESS    PCC SLAB Interior HOR STRESS
              324.2925                  398.8099
PCC SLAB HOR STRESS
              398.8099
```

**B737-800:**
**Design Stress = Edge Stress**

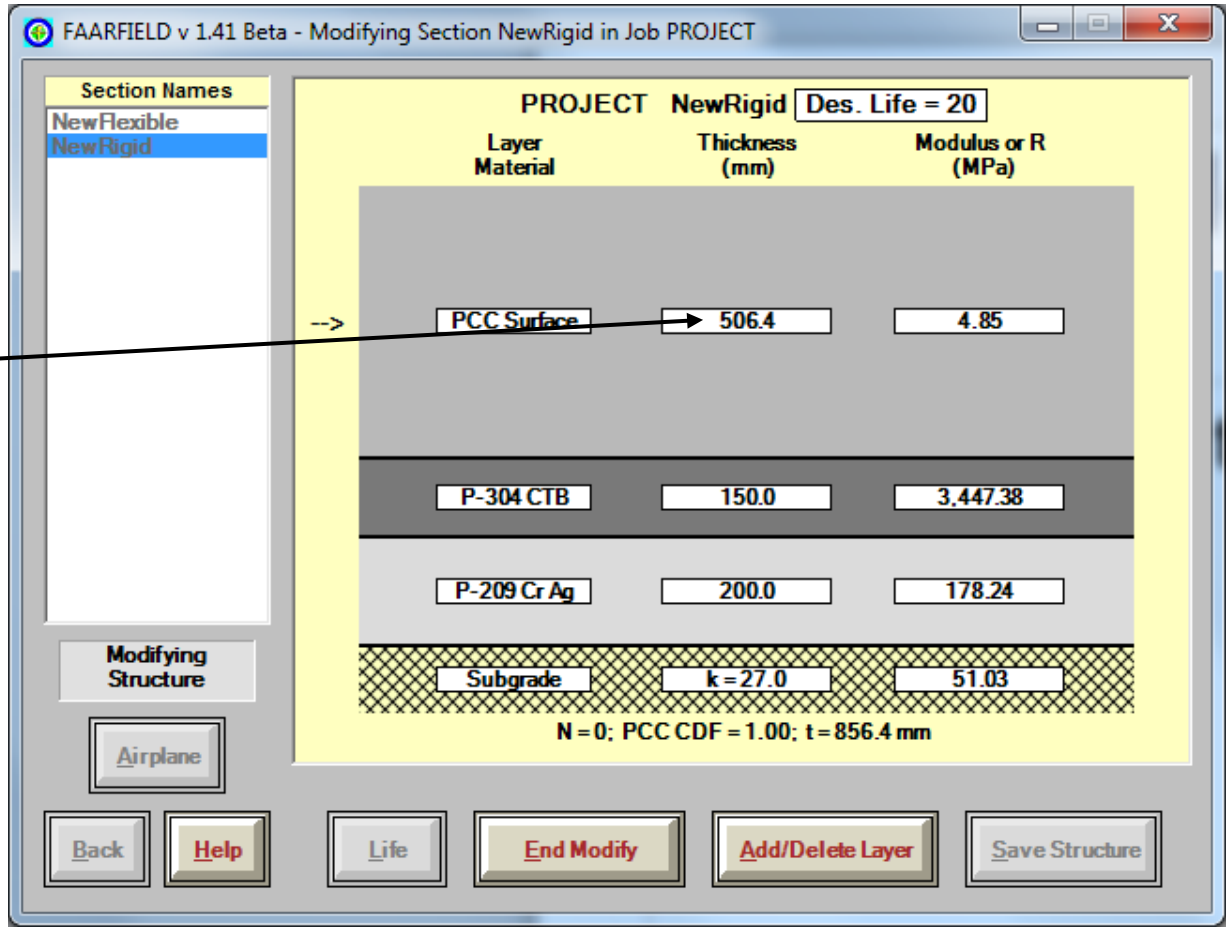
**B787-8:**
**Design Stress = Interior Stress**

# PCC Overlay Design

- **PCC overlay will be placed on an existing PCC slab.**
- **Assume the previous traffic mix.**
- **Existing PCC slab:**
  - 360 mm P-501, *R* = 4.85 Mpa.
  - SCI = 80 for existing slab.
- **New slab: assume *R* = 4.5 Mpa.**
- **All other design inputs same as previous example.**

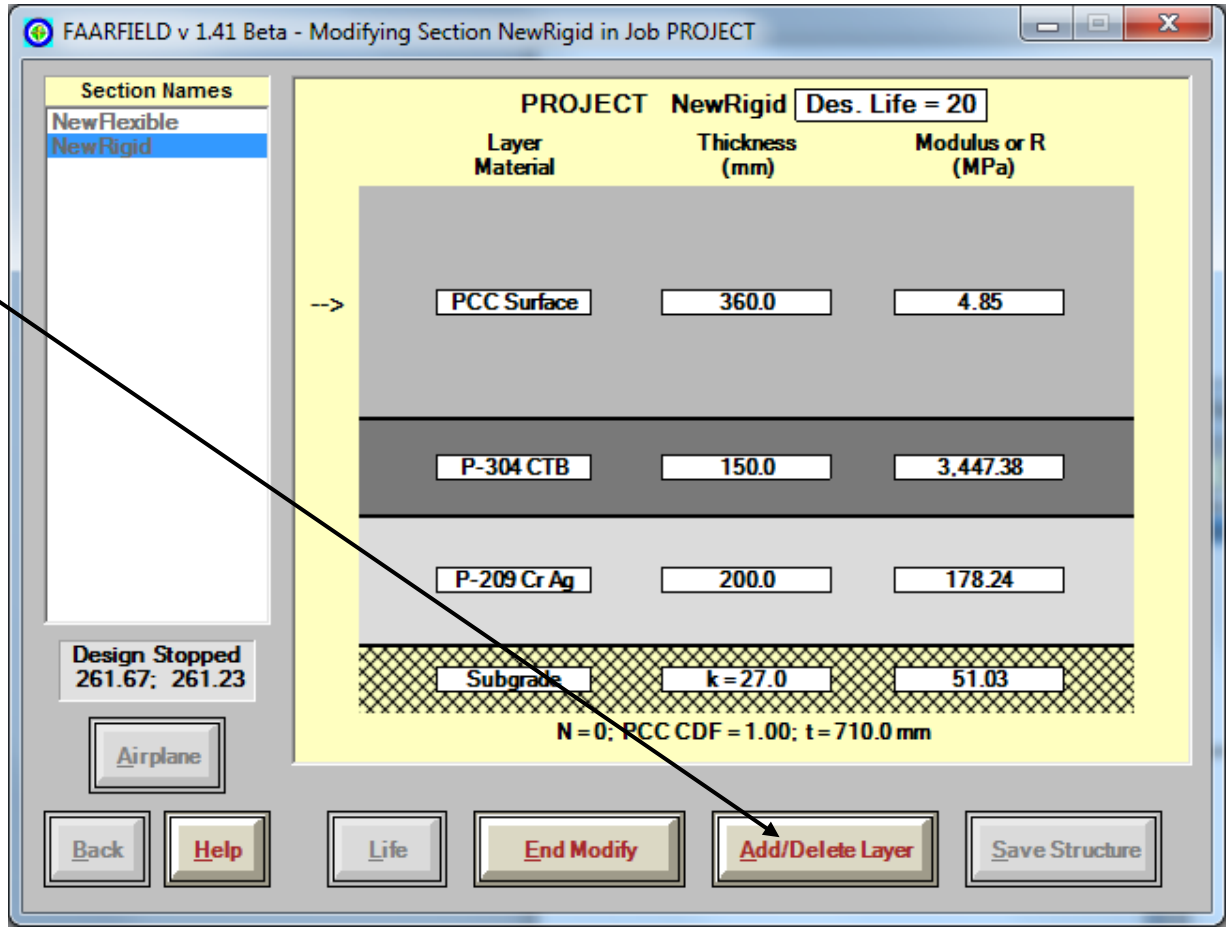
# Adding an Overlay

**In "Modify" mode, change the thickness of the P-501 concrete layer to 360 mm.**



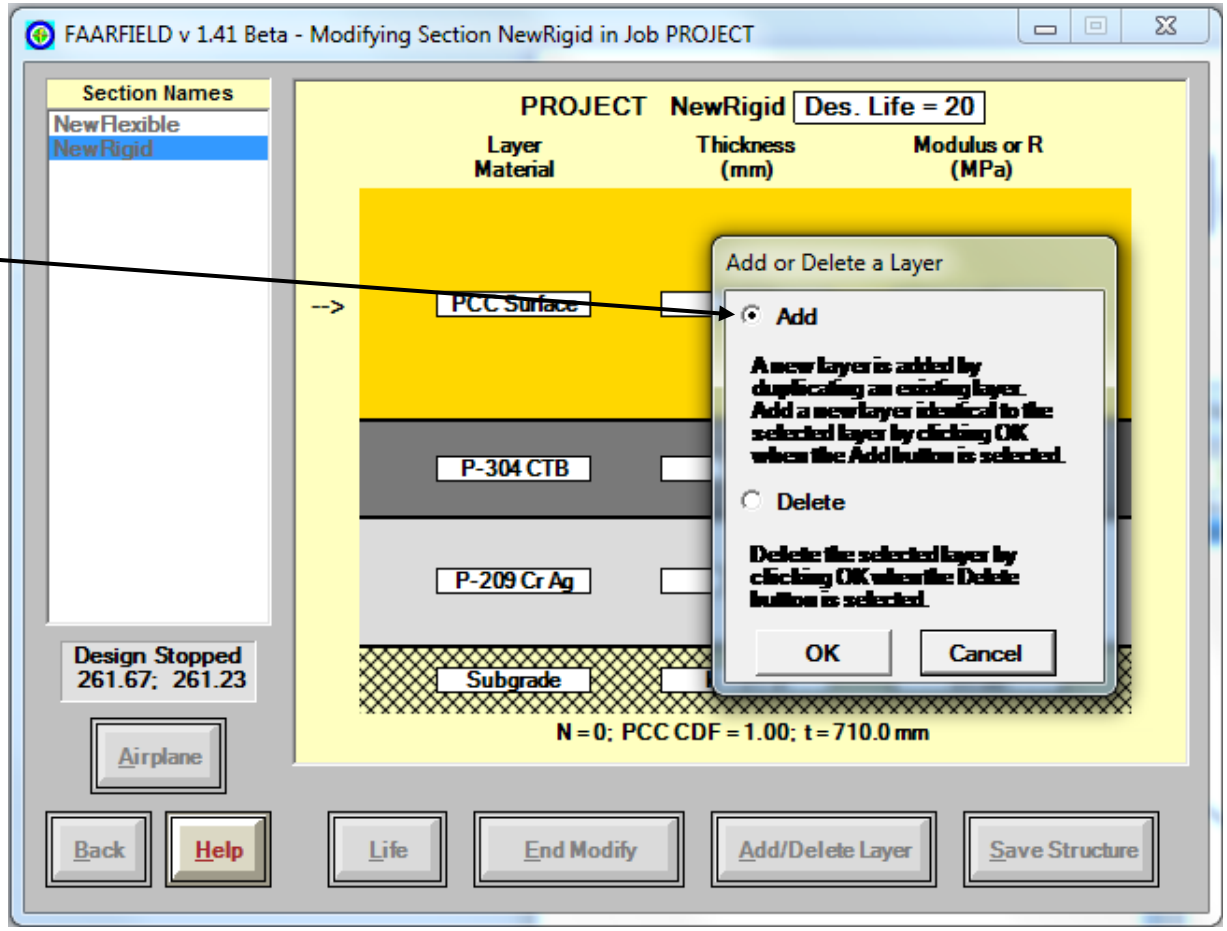
# Adding an Overlay

**Next, click on "Add/Delete Layer."**



# Adding an Overlay

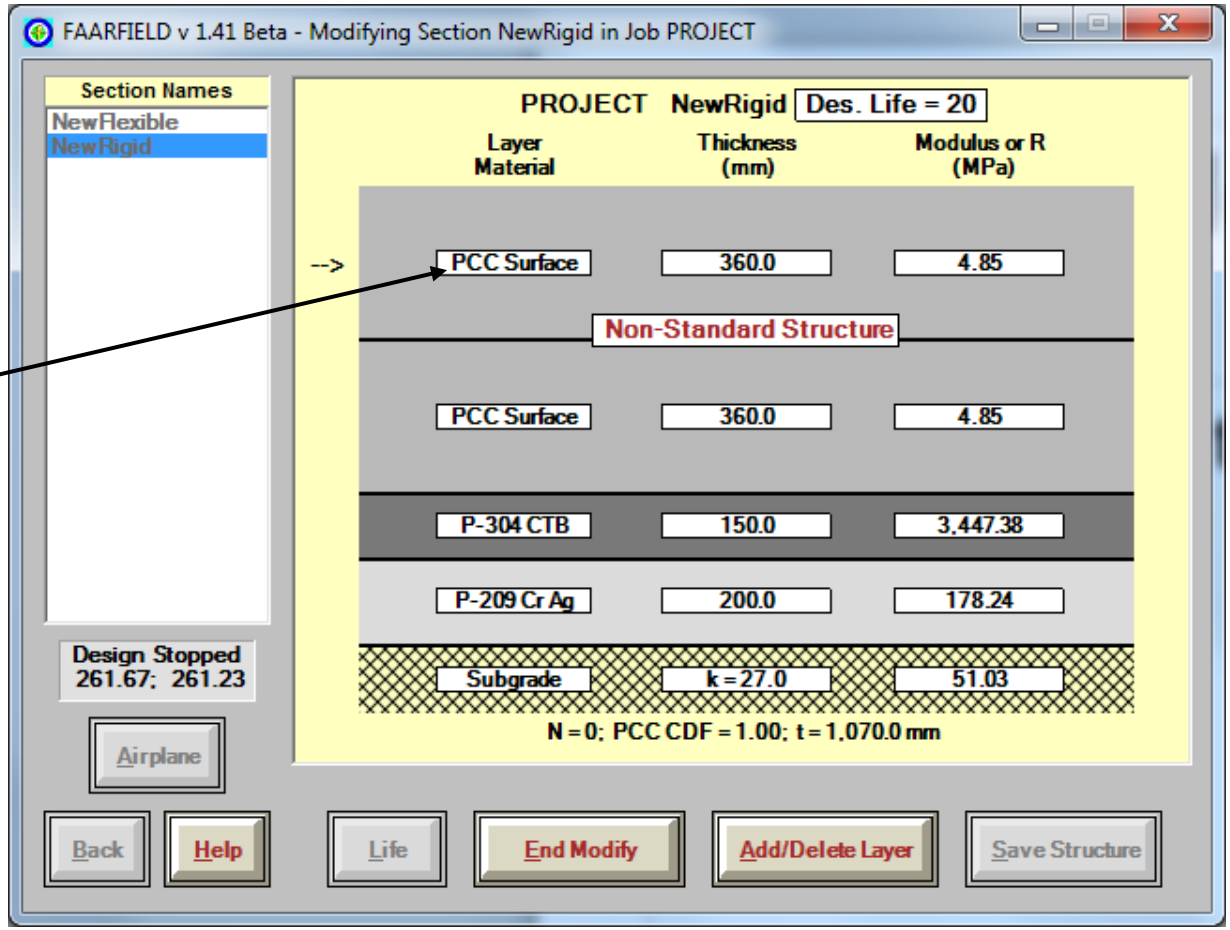
**Click on the PCC Surface layer and select "Add" from the dialog box.**



# Adding an Overlay

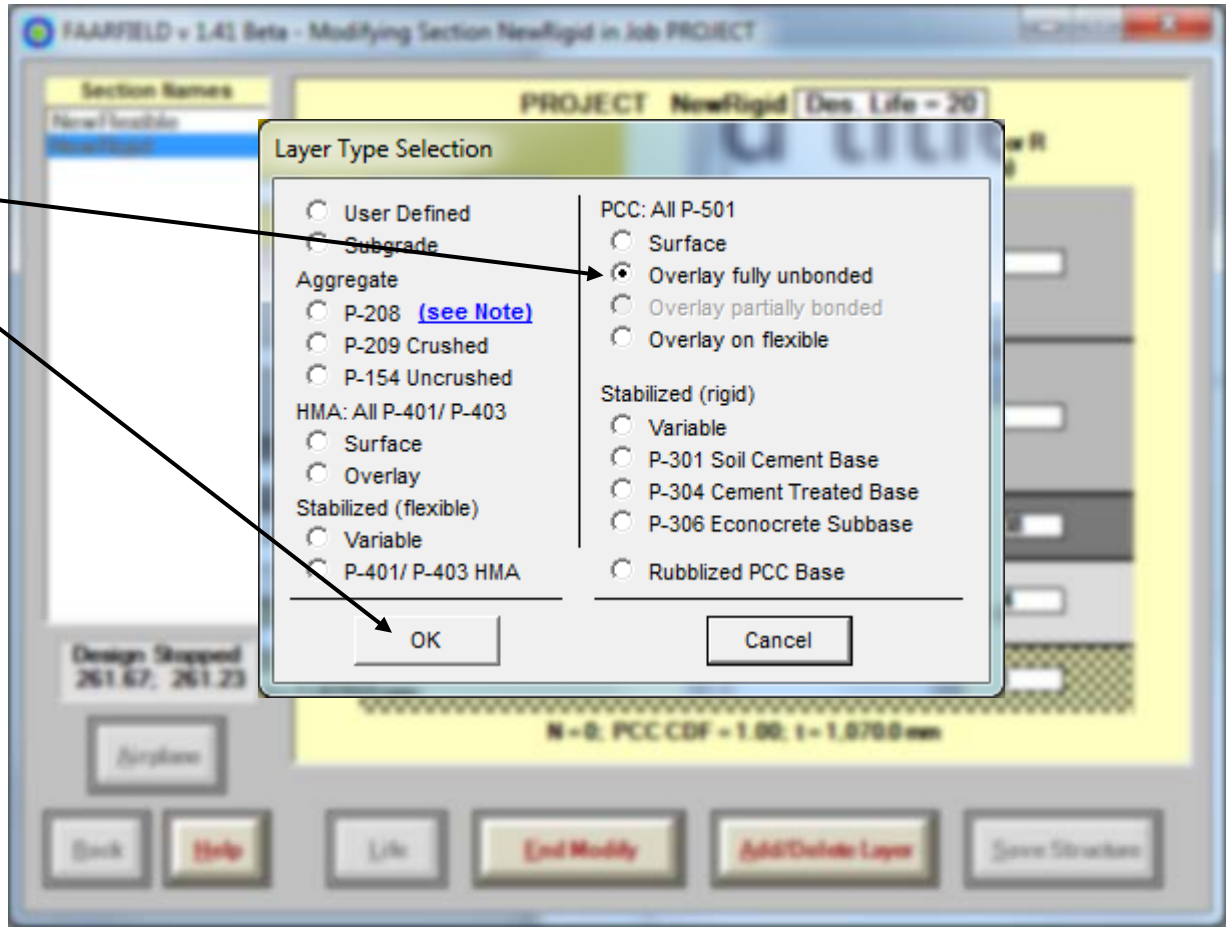
**The screen will display a message "Non-Standard Structure."**

**Click on the top layer material to bring up the "Layer Type Selection" dialog box.**



# Adding an Overlay

**Select "Overlay fully unbonded" and click OK.**

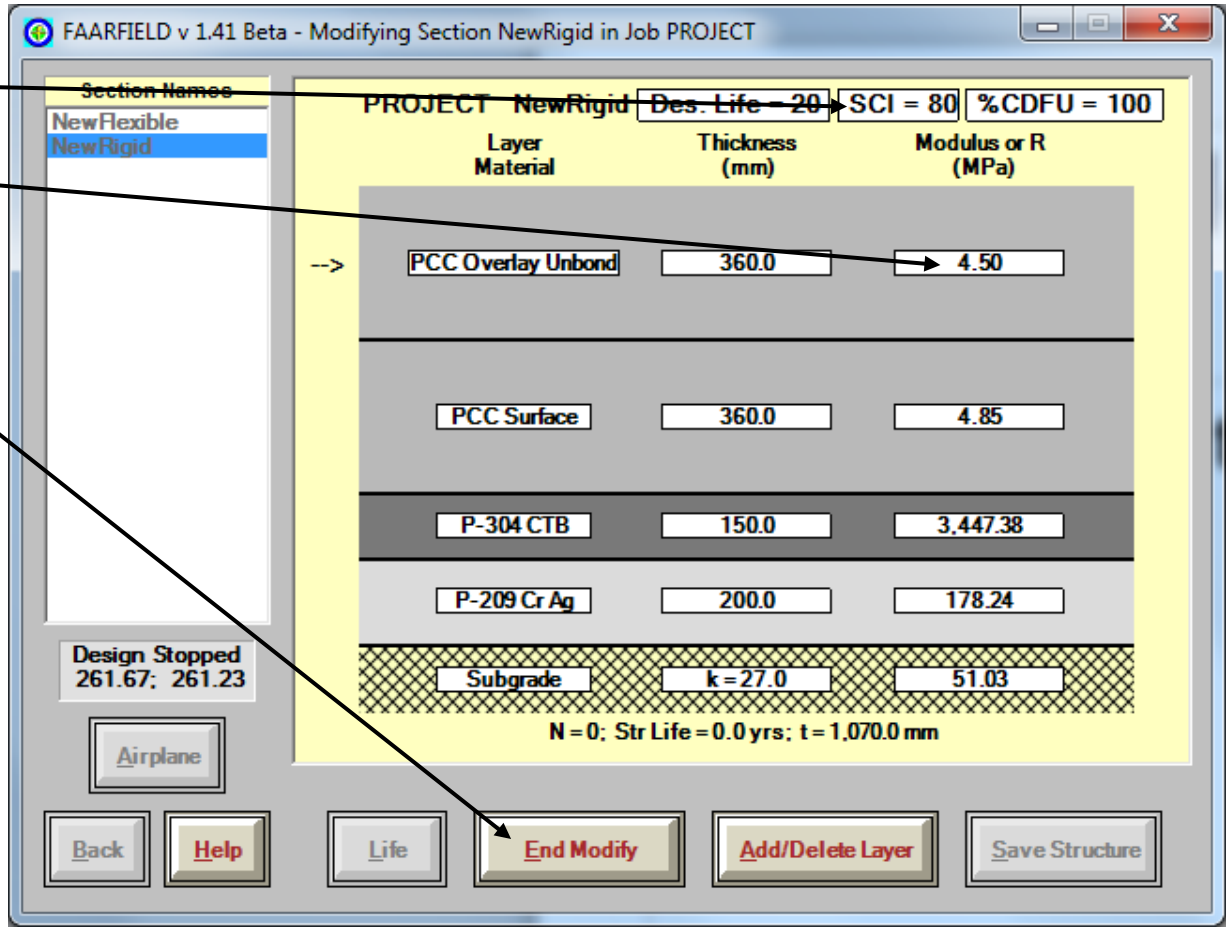


# Adding an Overlay

**Change SCI to 80.**

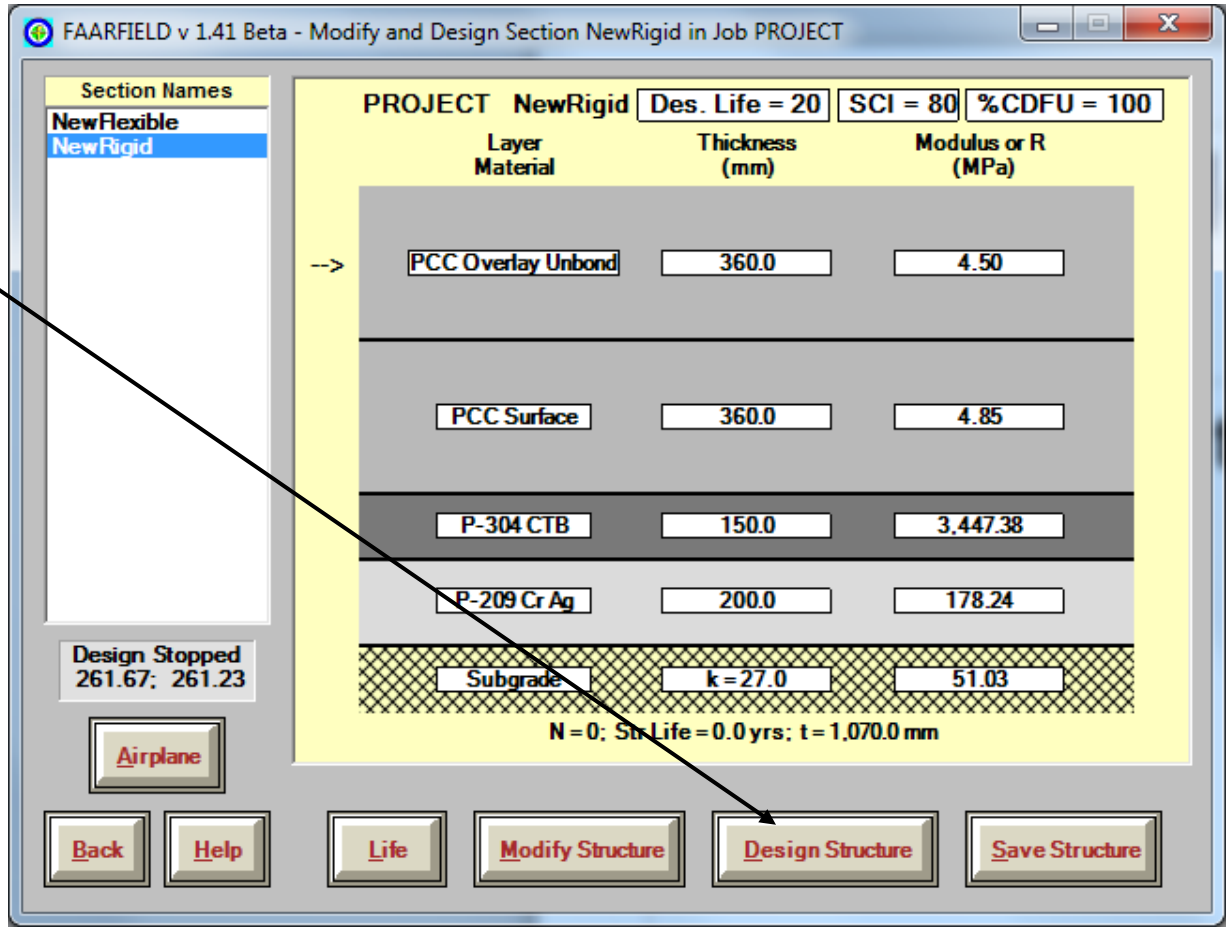
**Change *R* to 4.50 MPa for overlay PCC.**

**Click End Modify.**



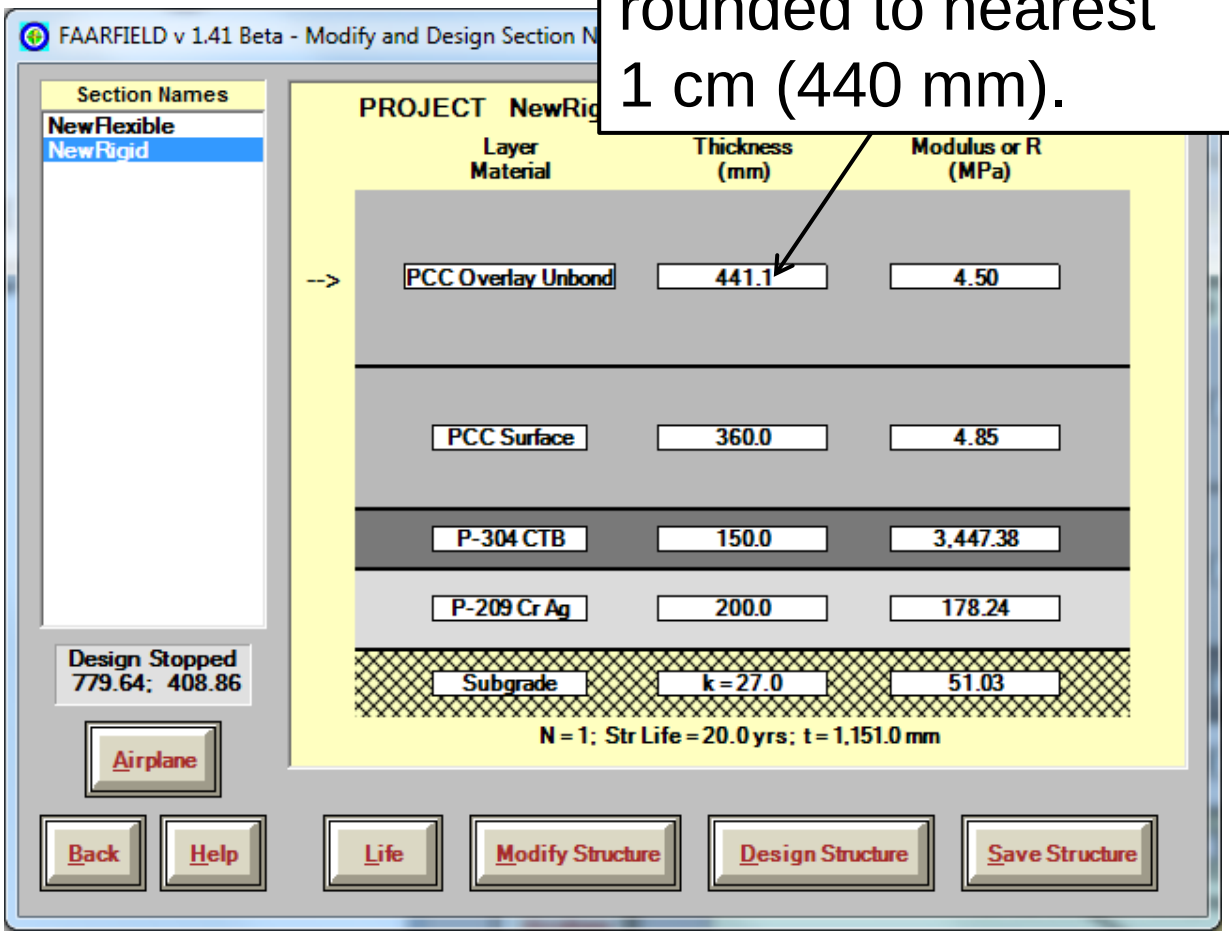
# Design the Structure

**Click Design Structure.**



# Final Overlay Design

Thickness should be rounded to nearest 1 cm (440 mm).



# Thank You! ¡Muchas Gracias!

## http://www.airporttech.tc.faa.gov/

## david.brill@faa.gov

**Acknowledgments:**

**FAA Airport Technology R&D Branch:**
**Dr. Michel Hovan, Branch Manager;**
**Jeff Gagnon, Airport Pavement Section Manager;**
**Dr. Navneet Garg; Al Larkin; Dr. Charles Ishee; Murphy Flynn; Ryan Rutter; Quinn Jia, Wilfredo Villafane**

**FAA Airport Engineering Division:**
**Doug Johnson; Greg Cline**

**SRA International:**
**Jerry Connelly; Dr. Izydor Kawa; Dr. Qiang Wang; Dr. Yuanguo Chen; Dr. Kairat Tuleubekov, Jeff Stein**

**Gemini:**
**Dr. Hao Yin**

**Consultants:**
**Dr. Edward Guo; Dr. Maria Lopez; Roy McQueen; Dr. Shelley Stoffels**