

**ROANOKE VA**

Latitude = 37.32 N

Longitude = 79.97 W

Period of Record = 1973 to 1996

WMO No. 724110

Elevation = 1175 feet

Average Pressure = 28.78 inches Hg

**Design Criteria Data**

|                                                  | <b>Design Value</b> | Mean Coincident (Average) Values |                         |                        |                             |
|--------------------------------------------------|---------------------|----------------------------------|-------------------------|------------------------|-----------------------------|
|                                                  |                     | Wet Bulb Temperature (°F)        | Humidity Ratio (gr/lb)  | Wind Speed (mph)       | Prevailing Direction (NSEW) |
| <b>Dry Bulb Temperature (T)</b>                  | <b>(°F)</b>         |                                  |                         |                        |                             |
| Median of Extreme Highs                          | 95                  | 74                               | 94                      | 9.8                    | W                           |
| 0.4% Occurrence                                  | 92                  | 73                               | 98                      | 9.2                    | W                           |
| 1.0% Occurrence                                  | 90                  | 73                               | 98                      | 8.8                    | W                           |
| 2.0% Occurrence                                  | 87                  | 72                               | 97                      | 8.7                    | W                           |
| Mean Daily Range                                 | 20                  | -                                | -                       | -                      | -                           |
| 97.5% Occurrence                                 | 22                  | 19                               | 10                      | 9.0                    | WNW                         |
| 99.0% Occurrence                                 | 16                  | 14                               | 7                       | 9.4                    | NW                          |
| 99.6% Occurrence                                 | 12                  | 10                               | 6                       | 9.7                    | WNW                         |
| Median of Extreme Lows                           | 4                   | 3                                | 4                       | 12.5                   | WNW                         |
|                                                  | <b>Design Value</b> | Mean Coincident (Average) Values |                         |                        |                             |
|                                                  |                     | Dry Bulb Temperature (°F)        | Humidity Ratio (gr/lb)  | Wind Speed (mph)       | Prevailing Direction (NSEW) |
| <b>Wet Bulb Temperature (T<sub>wb</sub>)</b>     | <b>(°F)</b>         |                                  |                         |                        |                             |
| Median of Extreme Highs                          | 78                  | 90                               | 127                     | 8.4                    | S                           |
| 0.4% Occurrence                                  | 76                  | 88                               | 118                     | 8.1                    | S                           |
| 1.0% Occurrence                                  | 75                  | 86                               | 115                     | 8.0                    | W                           |
| 2.0% Occurrence                                  | 74                  | 85                               | 112                     | 7.8                    | W                           |
|                                                  | <b>Design Value</b> | Mean Coincident (Average) Values |                         |                        |                             |
|                                                  |                     | Dry Bulb Temperature (°F)        | Vapor Pressure (in. Hg) | Wind Speed (mph)       | Prevailing Direction (NSEW) |
| <b>Humidity Ratio (HR)</b>                       | <b>(gr/lb)</b>      |                                  |                         |                        |                             |
| Median of Extreme Highs                          | 141                 | 84                               | 0.90                    | 8.2                    | S                           |
| 0.4% Occurrence                                  | 124                 | 80                               | 0.79                    | 6.5                    | SSE                         |
| 1.0% Occurrence                                  | 120                 | 79                               | 0.77                    | 6.2                    | W                           |
| 2.0% Occurrence                                  | 116                 | 78                               | 0.74                    | 6.1                    | W                           |
| <b>Air Conditioning/<br/>Humid Area Criteria</b> | <b># of Hours</b>   | T ≥ 93°F                         | T ≥ 80°F                | T <sub>wb</sub> ≥ 73°F | T <sub>wb</sub> ≥ 67°F      |
|                                                  |                     | 32                               | 744                     | 305                    | 1604                        |

**Other Site Data**

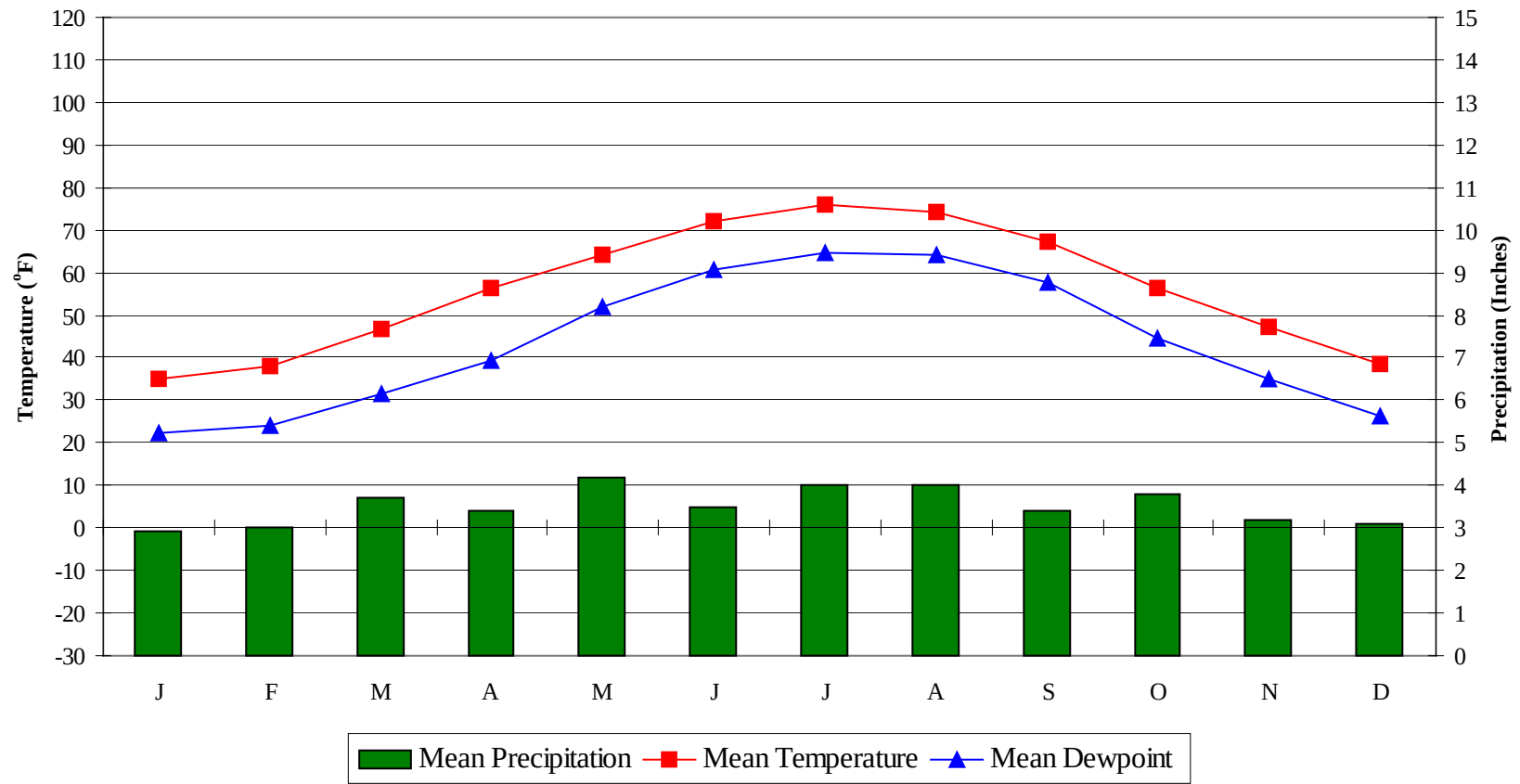
| Weather Region                                   | Rain Rate<br>100 Year Recurrence<br>(in./hr) | Basic Wind Speed<br>3 sec gust @ 33 ft<br>50 Year Recurrence (mph) | Ventilation Cooling Load Index<br>(Ton-hr/cfm/yr) Base 75°F-RH 60%<br>Latent + Sensible |
|--------------------------------------------------|----------------------------------------------|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 7                                                | 3.0                                          | 90                                                                 | 2.1 + 0.7                                                                               |
| Ground Water Temperature (°F)<br>50 Foot Depth * | Frost Depth<br>50 Year Recurrence<br>(in.)   | Ground Snow Load<br>50 Year Recurrence<br>(lb/ft <sup>2</sup> )    | Average Annual<br>Freeze-Thaw Cycles<br>(#)                                             |
| 58.5                                             | N/A                                          | 20                                                                 | 56                                                                                      |

\*Note: Temperatures at greater depths can be estimated by adding 1.5°F per 100 feet additional depth.

ROANOKE VA

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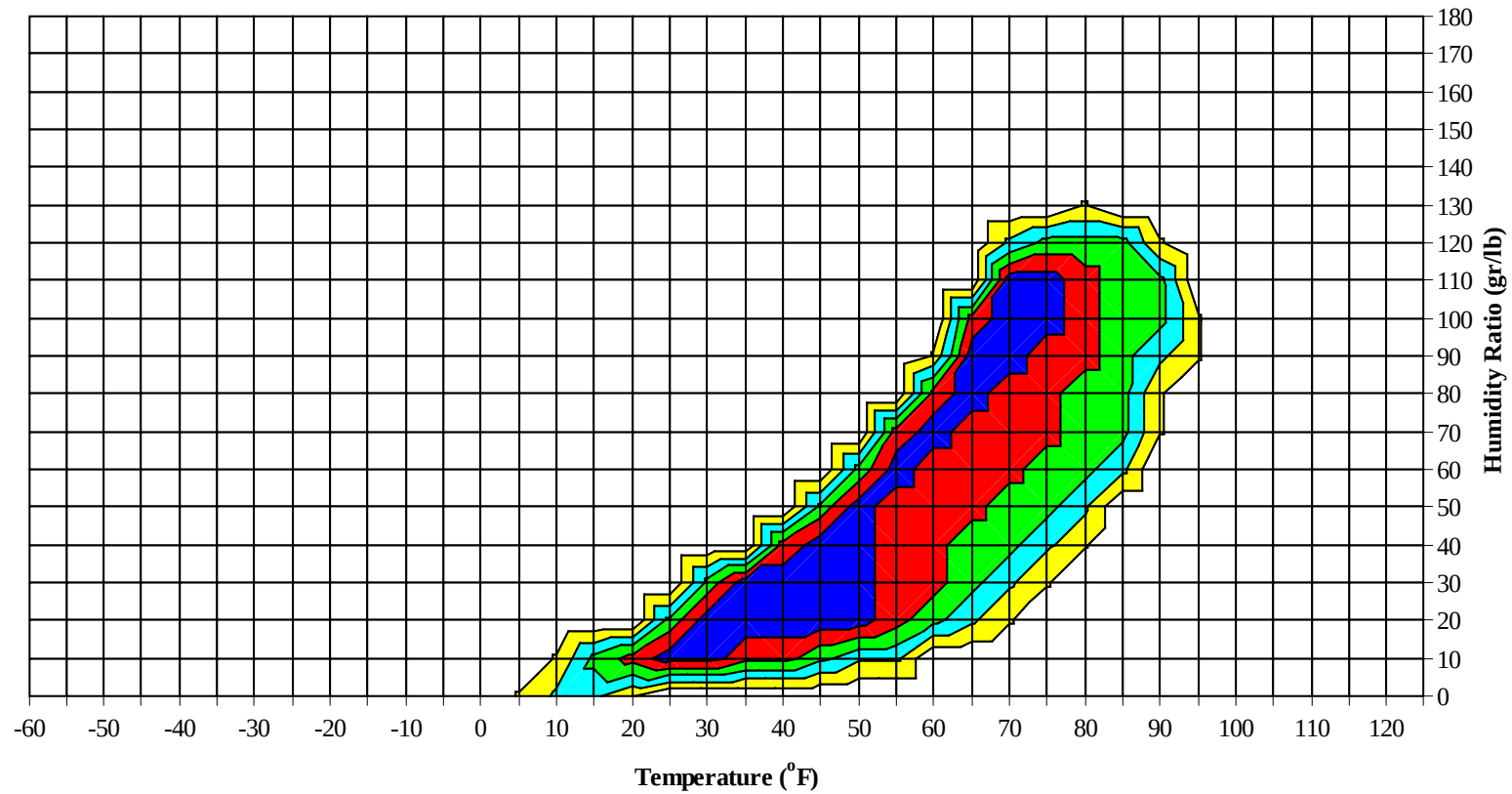
### Average Annual Climate



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### Long Term Psychrometric Summary

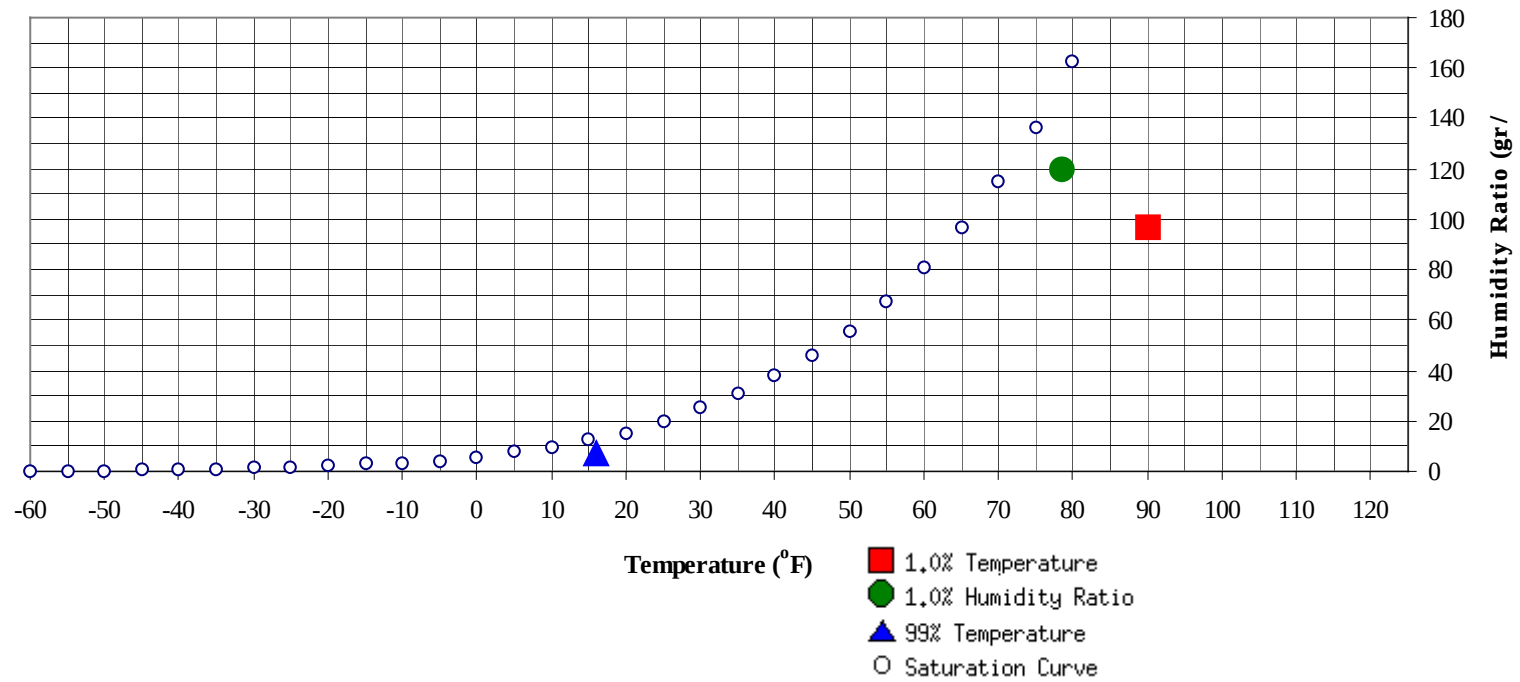


- 50% of all observations
- 80% of all observations
- 95% of all observations
- 97.5% of all observations
- 99% of all observations

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### Psychrometric Summary of Peak Design Values



|              | (°F) | MCHR<br>(gr/lb) | Enthalpy<br>(btu/lb) | 1.0% Humidity<br>Ratio | (gr/lb) | MCDB<br>(°F) | MCWB<br>(°F) | MC Dewpt<br>(°F) | Enthalpy<br>(btu/lb) |
|--------------|------|-----------------|----------------------|------------------------|---------|--------------|--------------|------------------|----------------------|
| 99% Dry Bulb | 16   | 7.3             | 5.0                  |                        | 119.7   | 78.6         | 73.2         | 71.1             | 37.6                 |

|               | (°F) | MCHR<br>(gr/lb) | MCWB<br>(°F) | Enthalpy<br>(btu/lb) |
|---------------|------|-----------------|--------------|----------------------|
| 1.0% Dry Bulb | 90   | 97              | 72.6         | 36.9                 |

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**Dry-Bulb Temperature Hours For An Average Year (Sheet 1 of 5)**

Period of Record = 1973 to 1996

| Temperature<br>Range<br>(°F) | January             |                |                |              |                          | February            |                |                |              |                          | March               |                |                |              |                          |
|------------------------------|---------------------|----------------|----------------|--------------|--------------------------|---------------------|----------------|----------------|--------------|--------------------------|---------------------|----------------|----------------|--------------|--------------------------|
|                              | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) |
|                              | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          |
| 100 / 104                    |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 95 / 99                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 90 / 94                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 85 / 89                      |                     |                |                |              |                          |                     |                |                |              |                          |                     | 0              |                | 0            | 61.5                     |
| 80 / 84                      |                     |                |                |              |                          |                     |                |                |              |                          |                     | 3              | 1              | 3            | 62.5                     |
| 75 / 79                      |                     | 0              |                | 0            | 60.0                     |                     | 1              | 0              | 1            | 58.7                     |                     | 6              | 2              | 9            | 59.2                     |
| 70 / 74                      |                     | 1              | 0              | 1            | 57.6                     |                     | 3              | 1              | 4            | 55.5                     | 1                   | 10             | 6              | 17           | 56.5                     |
| 65 / 69                      |                     | 2              | 1              | 3            | 54.9                     | 0                   | 6              | 3              | 9            | 52.6                     | 3                   | 18             | 13             | 34           | 54.1                     |
| 60 / 64                      | 1                   | 6              | 3              | 10           | 52.7                     | 2                   | 12             | 6              | 21           | 51.1                     | 7                   | 27             | 21             | 56           | 51.4                     |
| 55 / 59                      | 2                   | 12             | 7              | 21           | 48.1                     | 6                   | 16             | 13             | 34           | 47.8                     | 13                  | 32             | 32             | 77           | 48.4                     |
| 50 / 54                      | 6                   | 18             | 15             | 39           | 44.6                     | 10                  | 24             | 23             | 56           | 44.8                     | 32                  | 38             | 42             | 112          | 45.2                     |
| 45 / 49                      | 15                  | 31             | 24             | 69           | 40.6                     | 18                  | 28             | 26             | 72           | 40.4                     | 36                  | 36             | 36             | 108          | 40.9                     |
| 40 / 44                      | 25                  | 37             | 38             | 101          | 36.8                     | 26                  | 33             | 32             | 91           | 36.6                     | 42                  | 35             | 37             | 115          | 36.9                     |
| 35 / 39                      | 48                  | 47             | 47             | 141          | 32.7                     | 35                  | 35             | 36             | 106          | 32.1                     | 42                  | 23             | 30             | 96           | 32.5                     |
| 30 / 34                      | 49                  | 43             | 45             | 137          | 28.5                     | 45                  | 32             | 39             | 116          | 28.3                     | 38                  | 13             | 20             | 71           | 28.4                     |
| 25 / 29                      | 42                  | 24             | 31             | 98           | 23.8                     | 35                  | 19             | 26             | 80           | 23.7                     | 22                  | 3              | 6              | 32           | 23.8                     |
| 20 / 24                      | 23                  | 13             | 17             | 53           | 19.1                     | 24                  | 10             | 13             | 46           | 19.0                     | 7                   | 1              | 1              | 9            | 19.3                     |
| 15 / 19                      | 17                  | 7              | 11             | 36           | 14.7                     | 15                  | 3              | 5              | 23           | 14.7                     | 2                   | 1              | 1              | 4            | 14.4                     |
| 10 / 14                      | 13                  | 3              | 5              | 21           | 10.3                     | 7                   | 1              | 1              | 10           | 10.0                     | 1                   | 0              | 0              | 2            | 11.3                     |
| 5 / 9                        | 5                   | 1              | 2              | 8            | 5.4                      | 1                   | 0              | 0              | 2            | 6.5                      | 0                   |                |                | 0            | 8.0                      |
| 0 / 4                        | 1                   | 1              | 1              | 3            | 0.5                      | 0                   | 0              | 0              | 0            | 0.3                      |                     |                |                |              |                          |
| -5 / -1                      | 1                   | 0              | 0              | 1            | -3.5                     |                     |                |                |              |                          |                     |                |                |              |                          |
| -10 / -6                     | 0                   | 0              | 0              | 1            | -8.0                     |                     |                |                |              |                          |                     |                |                |              |                          |
| -15 / -11                    | 0                   |                | 0              | 0            | -11.2                    |                     |                |                |              |                          |                     |                |                |              |                          |

**Caution:** This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.

ROANOKE VA

WMO No. 724110

**Dry-Bulb Temperature Hours For An Average Year (Sheet 2 of 5)****Period of Record = 1973 to 1996**

| Temperature<br>Range<br>(°F) | April               |                |                |              |                          | May                 |                |                |              |                          | June                |                |                |              |                          |
|------------------------------|---------------------|----------------|----------------|--------------|--------------------------|---------------------|----------------|----------------|--------------|--------------------------|---------------------|----------------|----------------|--------------|--------------------------|
|                              | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) |
|                              | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          |
| 100 / 104                    |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 95 / 99                      |                     |                |                |              |                          |                     |                |                |              |                          |                     | 1              | 0              | 1            | 74.9                     |
| 90 / 94                      |                     | 1              | 0              | 1            | 62.6                     |                     | 2              | 0              | 2            | 70.2                     |                     | 11             | 2              | 13           | 73.0                     |
| 85 / 89                      |                     | 5              | 1              | 6            | 63.8                     |                     | 10             | 3              | 13           | 69.3                     | 0                   | 36             | 11             | 47           | 71.2                     |
| 80 / 84                      |                     | 10             | 4              | 14           | 62.0                     | 0                   | 29             | 10             | 39           | 66.8                     | 1                   | 61             | 28             | 90           | 69.3                     |
| 75 / 79                      |                     | 18             | 9              | 27           | 59.7                     | 1                   | 45             | 22             | 68           | 64.3                     | 12                  | 59             | 48             | 119          | 67.3                     |
| 70 / 74                      | 2                   | 30             | 21             | 52           | 57.8                     | 9                   | 53             | 42             | 104          | 61.8                     | 48                  | 43             | 65             | 157          | 65.7                     |
| 65 / 69                      | 10                  | 36             | 33             | 78           | 55.3                     | 38                  | 42             | 56             | 137          | 60.1                     | 80                  | 22             | 52             | 153          | 63.3                     |
| 60 / 64                      | 30                  | 38             | 41             | 108          | 53.1                     | 62                  | 34             | 51             | 147          | 56.8                     | 55                  | 7              | 24             | 86           | 59.0                     |
| 55 / 59                      | 36                  | 34             | 37             | 106          | 49.5                     | 51                  | 20             | 33             | 104          | 52.5                     | 28                  | 1              | 7              | 36           | 54.4                     |
| 50 / 54                      | 42                  | 32             | 35             | 108          | 45.4                     | 45                  | 10             | 20             | 75           | 48.4                     | 12                  | 0              | 2              | 14           | 50.1                     |
| 45 / 49                      | 47                  | 23             | 32             | 101          | 41.5                     | 26                  | 3              | 9              | 38           | 44.0                     | 3                   |                | 0              | 3            | 45.3                     |
| 40 / 44                      | 35                  | 9              | 16             | 61           | 37.1                     | 13                  | 0              | 1              | 14           | 39.1                     | 1                   |                |                | 1            | 42.2                     |
| 35 / 39                      | 25                  | 4              | 8              | 38           | 32.8                     | 4                   |                | 0              | 4            | 34.9                     |                     |                |                |              |                          |
| 30 / 34                      | 11                  | 2              | 3              | 16           | 29.3                     | 0                   |                |                | 0            | 31.7                     |                     |                |                |              |                          |
| 25 / 29                      | 2                   | 0              | 0              | 3            | 24.7                     |                     |                |                |              |                          |                     |                |                |              |                          |
| 20 / 24                      | 0                   |                |                | 0            | 18.9                     |                     |                |                |              |                          |                     |                |                |              |                          |
| 15 / 19                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 10 / 14                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 5 / 9                        |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 0 / 4                        |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| -5 / -1                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| -10 / -6                     |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| -15 / -11                    |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |

**Caution:** This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.

ROANOKE VA

WMO No. 724110

**Dry-Bulb Temperature Hours For An Average Year (Sheet 3 of 5)****Period of Record = 1973 to 1996**

| Temperature<br>Range<br>(°F) | July                |                |                |              |                          | August              |                |                |              |                          | September           |                |                |              |                          |
|------------------------------|---------------------|----------------|----------------|--------------|--------------------------|---------------------|----------------|----------------|--------------|--------------------------|---------------------|----------------|----------------|--------------|--------------------------|
|                              | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) |
|                              | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          |
| 100 / 104                    |                     | 1              | 0              | 1            | 74.1                     |                     | 0              | 0              | 1            | 74.5                     |                     |                |                |              |                          |
| 95 / 99                      |                     | 7              | 2              | 9            | 73.8                     |                     | 3              | 1              | 4            | 73.9                     |                     | 0              | 0              | 0            | 70.7                     |
| 90 / 94                      |                     | 28             | 8              | 35           | 73.4                     |                     | 20             | 4              | 25           | 73.3                     |                     | 6              | 1              | 7            | 72.7                     |
| 85 / 89                      | 0                   | 57             | 21             | 79           | 72.3                     | 0                   | 48             | 16             | 64           | 72.3                     |                     | 17             | 3              | 20           | 71.2                     |
| 80 / 84                      | 4                   | 67             | 44             | 115          | 70.8                     | 1                   | 66             | 35             | 101          | 70.8                     | 0                   | 35             | 13             | 48           | 69.1                     |
| 75 / 79                      | 29                  | 53             | 63             | 144          | 69.4                     | 17                  | 57             | 58             | 133          | 69.0                     | 3                   | 47             | 27             | 76           | 67.3                     |
| 70 / 74                      | 97                  | 29             | 78             | 203          | 68.0                     | 80                  | 36             | 85             | 201          | 67.7                     | 28                  | 56             | 57             | 141          | 65.6                     |
| 65 / 69                      | 76                  | 7              | 25             | 108          | 64.7                     | 90                  | 12             | 39             | 142          | 64.6                     | 58                  | 39             | 54             | 152          | 62.7                     |
| 60 / 64                      | 31                  | 0              | 7              | 39           | 60.1                     | 43                  | 2              | 9              | 54           | 60.2                     | 57                  | 25             | 45             | 127          | 58.6                     |
| 55 / 59                      | 9                   |                | 1              | 10           | 55.7                     | 13                  | 0              | 2              | 15           | 55.5                     | 41                  | 9              | 25             | 74           | 54.1                     |
| 50 / 54                      | 2                   |                |                | 2            | 51.3                     | 3                   | 0              | 0              | 3            | 51.0                     | 32                  | 3              | 12             | 47           | 49.7                     |
| 45 / 49                      | 0                   |                |                | 0            | 47.5                     | 1                   | 0              | 0              | 1            | 46.8                     | 15                  | 1              | 4              | 19           | 44.9                     |
| 40 / 44                      |                     |                |                |              |                          | 0                   | 0              |                | 0            | 43.4                     | 5                   |                | 1              | 6            | 41.4                     |
| 35 / 39                      |                     |                |                |              |                          |                     |                |                |              |                          | 1                   |                | 0              | 1            | 37.1                     |
| 30 / 34                      |                     |                |                |              |                          |                     |                |                |              |                          | 0                   |                |                | 0            | 34.0                     |
| 25 / 29                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 20 / 24                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 15 / 19                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 10 / 14                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 5 / 9                        |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 0 / 4                        |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| -5 / -1                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| -10 / -6                     |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| -15 / -11                    |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |

**Caution:** This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.

ROANOKE VA

WMO No. 724110

**Dry-Bulb Temperature Hours For An Average Year (Sheet 4 of 5)****Period of Record = 1973 to 1996**

| Temperature<br>Range<br>(°F) | October             |                |                |              |                          | November            |                |                |              |                          | December            |                |                |              |                          |
|------------------------------|---------------------|----------------|----------------|--------------|--------------------------|---------------------|----------------|----------------|--------------|--------------------------|---------------------|----------------|----------------|--------------|--------------------------|
|                              | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) |
|                              | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          |
| 100 / 104                    |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 95 / 99                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 90 / 94                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 85 / 89                      |                     | 1              | 0              | 1            | 69.0                     |                     |                |                |              |                          |                     |                |                |              |                          |
| 80 / 84                      |                     | 9              | 1              | 10           | 65.8                     |                     | 0              |                | 0            | 63.6                     |                     |                |                |              |                          |
| 75 / 79                      | 0                   | 22             | 5              | 27           | 63.5                     |                     | 4              | 0              | 4            | 60.7                     |                     | 0              |                | 0            | 60.0                     |
| 70 / 74                      | 2                   | 36             | 14             | 52           | 60.6                     | 0                   | 11             | 2              | 13           | 59.1                     | 0                   | 2              | 0              | 2            | 60.1                     |
| 65 / 69                      | 8                   | 39             | 29             | 76           | 58.5                     | 3                   | 20             | 9              | 33           | 57.7                     | 0                   | 6              | 2              | 8            | 57.2                     |
| 60 / 64                      | 31                  | 48             | 48             | 127          | 55.7                     | 9                   | 30             | 24             | 63           | 54.5                     | 3                   | 11             | 7              | 21           | 54.2                     |
| 55 / 59                      | 39                  | 39             | 46             | 124          | 51.6                     | 16                  | 33             | 31             | 79           | 50.5                     | 8                   | 17             | 11             | 36           | 50.4                     |
| 50 / 54                      | 47                  | 30             | 45             | 122          | 47.1                     | 30                  | 41             | 35             | 106          | 46.0                     | 12                  | 28             | 17             | 57           | 45.3                     |
| 45 / 49                      | 45                  | 15             | 35             | 95           | 42.9                     | 38                  | 37             | 41             | 117          | 41.7                     | 21                  | 35             | 29             | 86           | 41.1                     |
| 40 / 44                      | 38                  | 6              | 18             | 62           | 39.2                     | 43                  | 32             | 42             | 117          | 37.2                     | 29                  | 42             | 42             | 113          | 36.8                     |
| 35 / 39                      | 26                  | 1              | 6              | 33           | 35.1                     | 42                  | 19             | 32             | 93           | 33.1                     | 50                  | 45             | 51             | 146          | 32.8                     |
| 30 / 34                      | 10                  | 0              | 1              | 12           | 30.8                     | 34                  | 8              | 18             | 61           | 28.7                     | 50                  | 32             | 41             | 124          | 28.6                     |
| 25 / 29                      | 2                   |                | 0              | 2            | 26.4                     | 18                  | 2              | 6              | 25           | 24.8                     | 31                  | 17             | 26             | 74           | 23.8                     |
| 20 / 24                      |                     |                |                |              |                          | 6                   | 0              | 1              | 7            | 20.5                     | 23                  | 8              | 12             | 44           | 19.4                     |
| 15 / 19                      |                     |                |                |              |                          | 1                   |                | 0              | 1            | 15.6                     | 13                  | 3              | 5              | 21           | 14.9                     |
| 10 / 14                      |                     |                |                |              |                          | 0                   |                |                | 0            | 11.8                     | 5                   | 1              | 1              | 7            | 10.5                     |
| 5 / 9                        |                     |                |                |              |                          |                     |                |                |              |                          | 2                   | 1              | 1              | 3            | 5.3                      |
| 0 / 4                        |                     |                |                |              |                          |                     |                |                |              |                          | 1                   | 0              | 0              | 1            | 0.1                      |
| -5 / -1                      |                     |                |                |              |                          |                     |                |                |              |                          | 0                   | 0              |                | 0            | -3.9                     |
| -10 / -6                     |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| -15 / -11                    |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |

**Caution:** This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.



**ROANOKE VA**

WMO No. 724110

**Dry-Bulb Temperature Hours For An Average Year (Sheet 5 of 5)**

**Period of Record = 1973 to 1996**

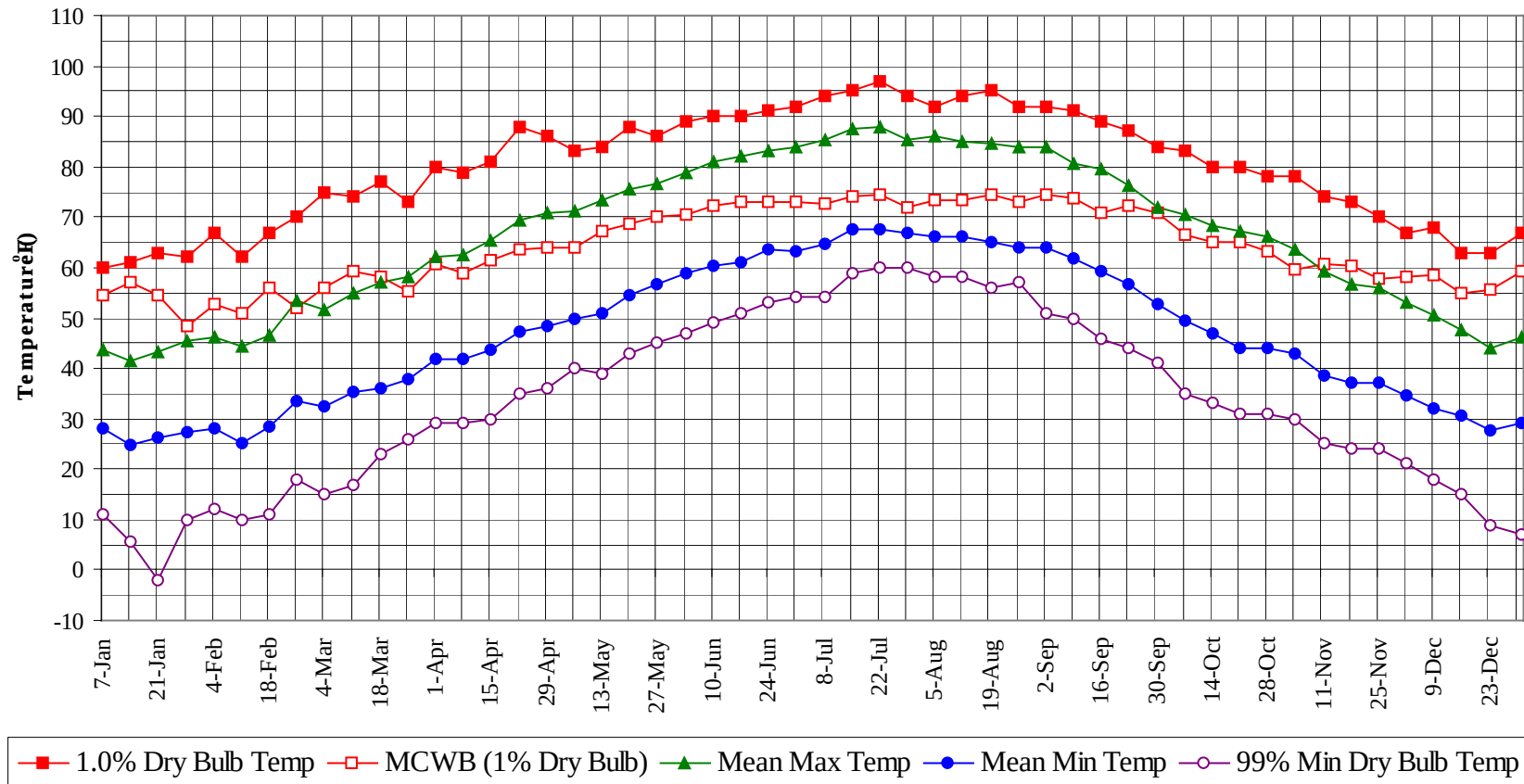
| Annual Totals                |                     |                |                |              |                          |
|------------------------------|---------------------|----------------|----------------|--------------|--------------------------|
| Temperature<br>Range<br>(°F) | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) |
|                              | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          |
| 100 / 104                    |                     | 1              | 0              | 1            | 74.3                     |
| 95 / 99                      |                     | 11             | 3              | 14           | 73.8                     |
| 90 / 94                      |                     | 67             | 16             | 82           | 73.0                     |
| 85 / 89                      | 1                   | 173            | 56             | 229          | 71.6                     |
| 80 / 84                      | 7                   | 279            | 134            | 420          | 69.4                     |
| 75 / 79                      | 62                  | 311            | 234            | 607          | 67.1                     |
| 70 / 74                      | 266                 | 310            | 370            | 947          | 65.1                     |
| 65 / 69                      | 365                 | 248            | 317            | 930          | 61.3                     |
| 60 / 64                      | 332                 | 241            | 285            | 858          | 56.2                     |
| 55 / 59                      | 261                 | 212            | 243            | 716          | 51.1                     |
| 50 / 54                      | 272                 | 224            | 246            | 743          | 46.3                     |
| 45 / 49                      | 264                 | 209            | 237            | 710          | 41.6                     |
| 40 / 44                      | 258                 | 195            | 228            | 682          | 37.2                     |
| 35 / 39                      | 273                 | 175            | 212            | 660          | 32.8                     |
| 30 / 34                      | 240                 | 130            | 167            | 537          | 28.6                     |
| 25 / 29                      | 153                 | 66             | 96             | 315          | 23.9                     |
| 20 / 24                      | 84                  | 32             | 45             | 161          | 19.2                     |
| 15 / 19                      | 48                  | 14             | 23             | 85           | 14.8                     |
| 10 / 14                      | 27                  | 5              | 8              | 41           | 10.3                     |
| 5 / 9                        | 8                   | 2              | 3              | 13           | 5.5                      |
| 0 / 4                        | 3                   | 1              | 1              | 5            | 0.4                      |
| -5 / -1                      | 1                   | 0              | 0              | 1            | -3.6                     |
| -10 / -6                     | 0                   | 0              | 0              | 1            | -8.0                     |
| -15 / -11                    | 0                   |                | 0              | 0            | -11.2                    |

**Caution:** This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.

ROANOKE VA

WMO No. 724110

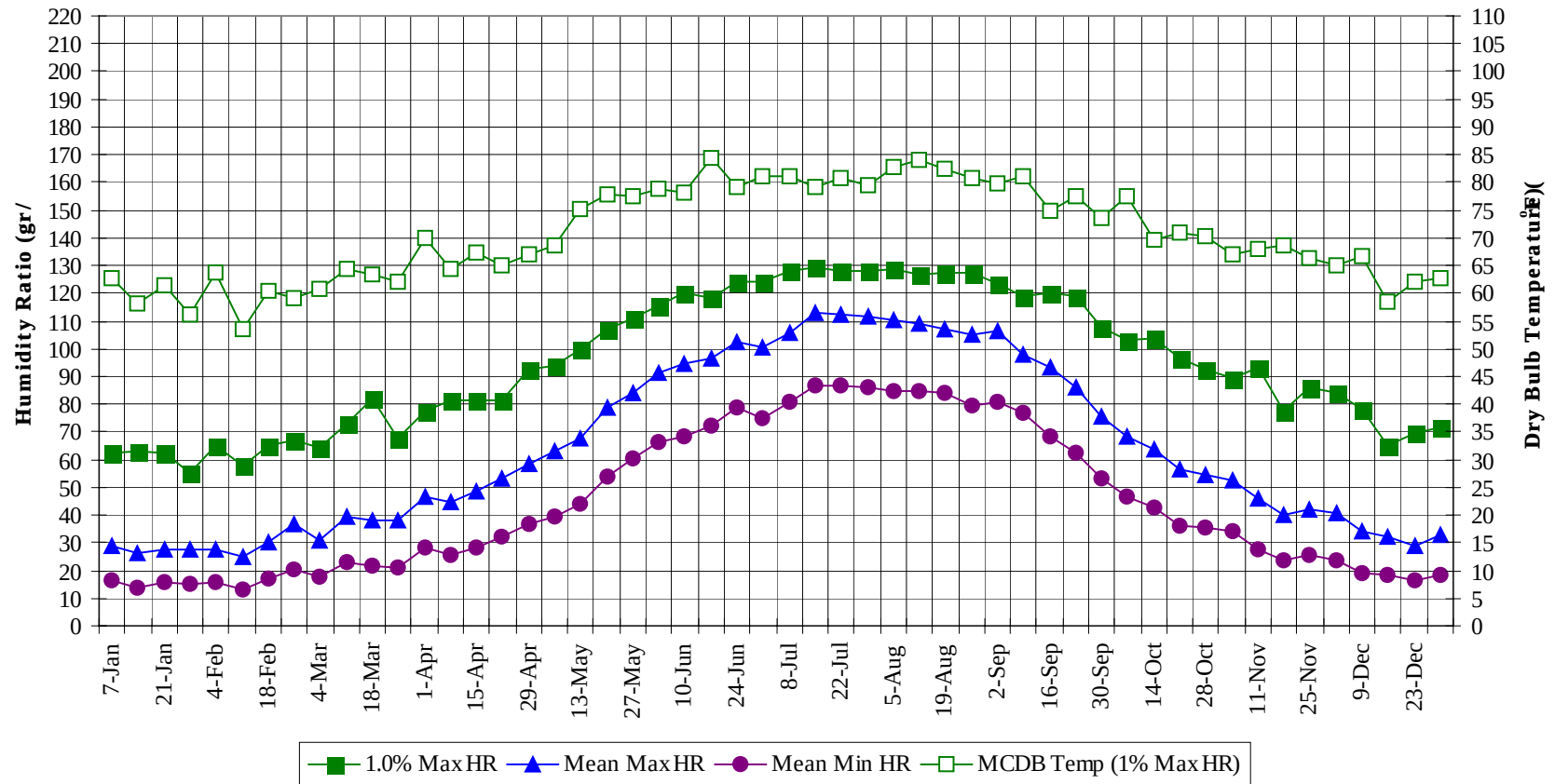
### Annual Summary of Temperatures



ROANOKE VA

WMO No. 724110

### Long Term Humidity and Dry Bulb Temperature Summary



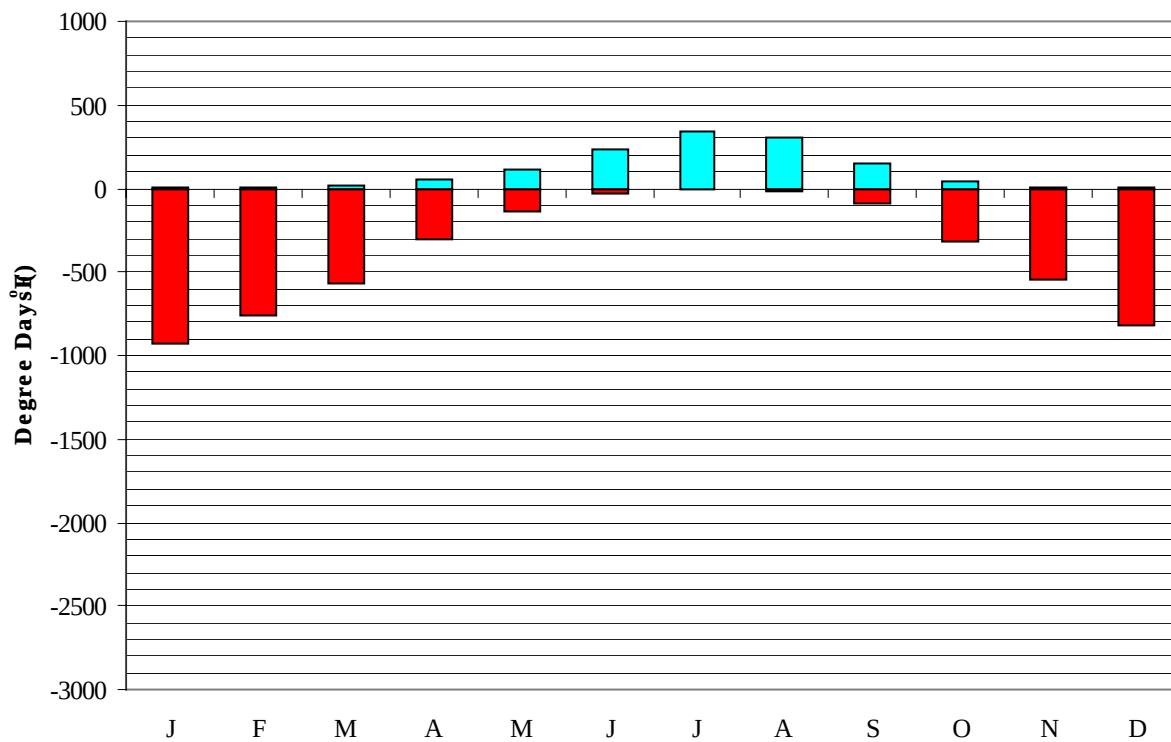
**ROANOKE****VA****WMO No. 724110****Long Term Dry Bulb Temperature and Humidity Summary**

| Week<br>Ending | 1.0%<br>Temp (°F) | MCWB @<br>1% Temp (°F) | Mean Max<br>Temp (°F) | Mean Min<br>Temp (°F) | 99%<br>Temp (°F) | 1.0%<br>HR (gr/lb) | MCDB @<br>1% HR (°F) | Mean Max<br>HR (gr/lb) | Mean Min<br>HR (gr/lb) |
|----------------|-------------------|------------------------|-----------------------|-----------------------|------------------|--------------------|----------------------|------------------------|------------------------|
| 7-Jan          | 60.0              | 54.5                   | 43.7                  | 28.2                  | 11.0             | 62.3               | 62.6                 | 29.2                   | 16.5                   |
| 14-Jan         | 61.0              | 57.2                   | 41.5                  | 24.8                  | 5.5              | 63.0               | 58.2                 | 26.1                   | 13.9                   |
| 21-Jan         | 63.0              | 54.7                   | 43.2                  | 26.2                  | -2.0             | 62.3               | 61.5                 | 27.6                   | 15.7                   |
| 28-Jan         | 62.0              | 48.3                   | 45.4                  | 27.4                  | 10.0             | 55.3               | 56.2                 | 27.5                   | 15.3                   |
| 4-Feb          | 67.0              | 52.5                   | 46.1                  | 28.2                  | 12.0             | 65.1               | 63.9                 | 27.9                   | 15.7                   |
| 11-Feb         | 62.0              | 51.1                   | 44.2                  | 25.1                  | 10.0             | 58.1               | 53.5                 | 25.0                   | 13.0                   |
| 18-Feb         | 67.0              | 56.1                   | 46.4                  | 28.6                  | 11.0             | 65.1               | 60.3                 | 30.2                   | 16.8                   |
| 25-Feb         | 70.0              | 51.8                   | 53.3                  | 33.7                  | 18.0             | 67.2               | 59.0                 | 36.5                   | 20.1                   |
| 4-Mar          | 75.0              | 56.1                   | 51.5                  | 32.4                  | 15.0             | 64.4               | 60.9                 | 31.1                   | 17.6                   |
| 11-Mar         | 74.0              | 59.1                   | 54.9                  | 35.5                  | 17.0             | 72.8               | 64.4                 | 39.4                   | 23.0                   |
| 18-Mar         | 77.0              | 58.3                   | 57.1                  | 36.2                  | 23.0             | 81.9               | 63.3                 | 38.3                   | 21.4                   |
| 25-Mar         | 73.0              | 55.3                   | 58.1                  | 37.7                  | 26.0             | 67.9               | 62.1                 | 37.9                   | 21.0                   |
| 1-Apr          | 80.0              | 60.8                   | 62.2                  | 42.0                  | 29.0             | 77.7               | 70.0                 | 46.5                   | 28.3                   |
| 8-Apr          | 79.0              | 59.0                   | 62.7                  | 41.9                  | 29.0             | 81.2               | 64.3                 | 44.9                   | 25.4                   |
| 15-Apr         | 81.0              | 61.6                   | 65.5                  | 43.7                  | 30.0             | 81.2               | 67.4                 | 48.5                   | 28.0                   |
| 22-Apr         | 88.0              | 63.6                   | 69.3                  | 47.2                  | 35.0             | 81.2               | 65.2                 | 52.9                   | 32.3                   |
| 29-Apr         | 86.0              | 64.1                   | 70.7                  | 48.3                  | 36.0             | 92.4               | 67.0                 | 58.3                   | 36.6                   |
| 6-May          | 83.0              | 63.8                   | 71.4                  | 49.6                  | 40.0             | 93.8               | 68.6                 | 63.1                   | 39.7                   |
| 13-May         | 84.0              | 67.1                   | 73.4                  | 50.8                  | 39.0             | 100.1              | 75.1                 | 67.6                   | 44.3                   |
| 20-May         | 88.0              | 68.8                   | 75.6                  | 54.5                  | 43.0             | 107.1              | 77.9                 | 78.5                   | 54.0                   |
| 27-May         | 86.0              | 70.0                   | 76.5                  | 56.7                  | 45.0             | 111.3              | 77.5                 | 84.4                   | 60.5                   |
| 3-Jun          | 89.0              | 70.6                   | 78.7                  | 58.8                  | 47.0             | 115.5              | 78.9                 | 91.0                   | 66.3                   |
| 10-Jun         | 90.0              | 72.2                   | 81.0                  | 60.3                  | 49.0             | 120.4              | 78.1                 | 94.9                   | 68.3                   |
| 17-Jun         | 90.0              | 72.9                   | 82.0                  | 61.1                  | 51.0             | 118.3              | 84.3                 | 96.5                   | 72.4                   |
| 24-Jun         | 91.0              | 73.2                   | 83.1                  | 63.7                  | 53.0             | 123.9              | 79.2                 | 102.1                  | 78.5                   |
| 1-Jul          | 92.0              | 73.2                   | 84.0                  | 63.3                  | 54.0             | 123.9              | 81.2                 | 100.5                  | 74.9                   |
| 8-Jul          | 94.0              | 72.6                   | 85.4                  | 64.5                  | 54.0             | 128.1              | 81.1                 | 105.9                  | 80.6                   |
| 15-Jul         | 95.0              | 74.1                   | 87.7                  | 67.6                  | 59.0             | 129.5              | 79.2                 | 112.8                  | 86.4                   |
| 22-Jul         | 97.0              | 74.4                   | 87.9                  | 67.7                  | 60.0             | 128.1              | 80.9                 | 112.6                  | 86.9                   |
| 29-Jul         | 94.0              | 71.8                   | 85.5                  | 66.8                  | 60.0             | 128.1              | 79.4                 | 111.9                  | 86.2                   |
| 5-Aug          | 92.0              | 73.4                   | 86.1                  | 66.1                  | 58.0             | 128.8              | 82.9                 | 110.1                  | 84.5                   |
| 12-Aug         | 94.0              | 73.5                   | 85.0                  | 66.0                  | 58.0             | 126.7              | 84.2                 | 109.1                  | 84.7                   |
| 19-Aug         | 95.0              | 74.3                   | 84.5                  | 65.2                  | 56.0             | 127.4              | 82.4                 | 107.2                  | 84.0                   |
| 26-Aug         | 92.0              | 72.9                   | 84.0                  | 64.1                  | 57.0             | 127.4              | 80.7                 | 105.2                  | 79.6                   |
| 2-Sep          | 92.0              | 74.4                   | 84.0                  | 64.0                  | 51.0             | 123.2              | 79.8                 | 106.1                  | 80.9                   |
| 9-Sep          | 91.0              | 73.6                   | 80.8                  | 61.9                  | 50.0             | 119.0              | 81.0                 | 98.1                   | 76.8                   |
| 16-Sep         | 89.0              | 70.9                   | 79.7                  | 59.3                  | 46.0             | 120.4              | 74.9                 | 93.3                   | 68.1                   |
| 23-Sep         | 87.0              | 72.4                   | 76.1                  | 56.7                  | 44.0             | 119.0              | 77.6                 | 86.4                   | 62.5                   |
| 30-Sep         | 84.0              | 70.7                   | 72.1                  | 52.6                  | 41.0             | 107.8              | 73.4                 | 75.3                   | 53.5                   |
| 7-Oct          | 83.0              | 66.3                   | 70.6                  | 49.5                  | 35.0             | 102.9              | 77.5                 | 68.0                   | 46.5                   |
| 14-Oct         | 80.0              | 64.9                   | 68.3                  | 46.8                  | 33.0             | 103.6              | 69.6                 | 63.4                   | 42.7                   |
| 21-Oct         | 80.0              | 64.9                   | 67.2                  | 44.2                  | 31.0             | 96.6               | 70.9                 | 56.3                   | 36.4                   |
| 28-Oct         | 78.0              | 63.3                   | 66.0                  | 44.1                  | 31.0             | 92.4               | 70.3                 | 54.4                   | 35.3                   |
| 4-Nov          | 78.0              | 59.8                   | 63.7                  | 43.0                  | 30.0             | 89.6               | 67.1                 | 52.7                   | 33.9                   |
| 11-Nov         | 74.0              | 60.6                   | 59.2                  | 38.7                  | 25.0             | 93.1               | 67.8                 | 46.1                   | 27.3                   |
| 18-Nov         | 73.0              | 60.2                   | 56.7                  | 37.1                  | 24.0             | 77.7               | 68.6                 | 40.3                   | 23.7                   |
| 25-Nov         | 70.0              | 57.9                   | 55.9                  | 37.1                  | 24.0             | 86.1               | 66.3                 | 42.3                   | 25.9                   |
| 2-Dec          | 67.0              | 58.2                   | 53.0                  | 34.5                  | 21.0             | 84.0               | 65.1                 | 40.7                   | 23.3                   |
| 9-Dec          | 68.0              | 58.6                   | 50.6                  | 32.1                  | 18.0             | 78.4               | 66.8                 | 34.3                   | 19.1                   |
| 16-Dec         | 63.0              | 54.9                   | 47.5                  | 30.5                  | 15.0             | 65.1               | 58.4                 | 32.5                   | 18.5                   |
| 23-Dec         | 63.0              | 55.8                   | 44.2                  | 27.9                  | 9.0              | 69.3               | 62.0                 | 28.8                   | 16.4                   |
| 31-Dec         | 67.0              | 59.3                   | 46.0                  | 29.2                  | 7.0              | 71.4               | 62.8                 | 32.8                   | 18.3                   |

ROANOKE VA

WMO No. 724110

**Degree Days, Heating and Cooling**  
(Base 65°F)



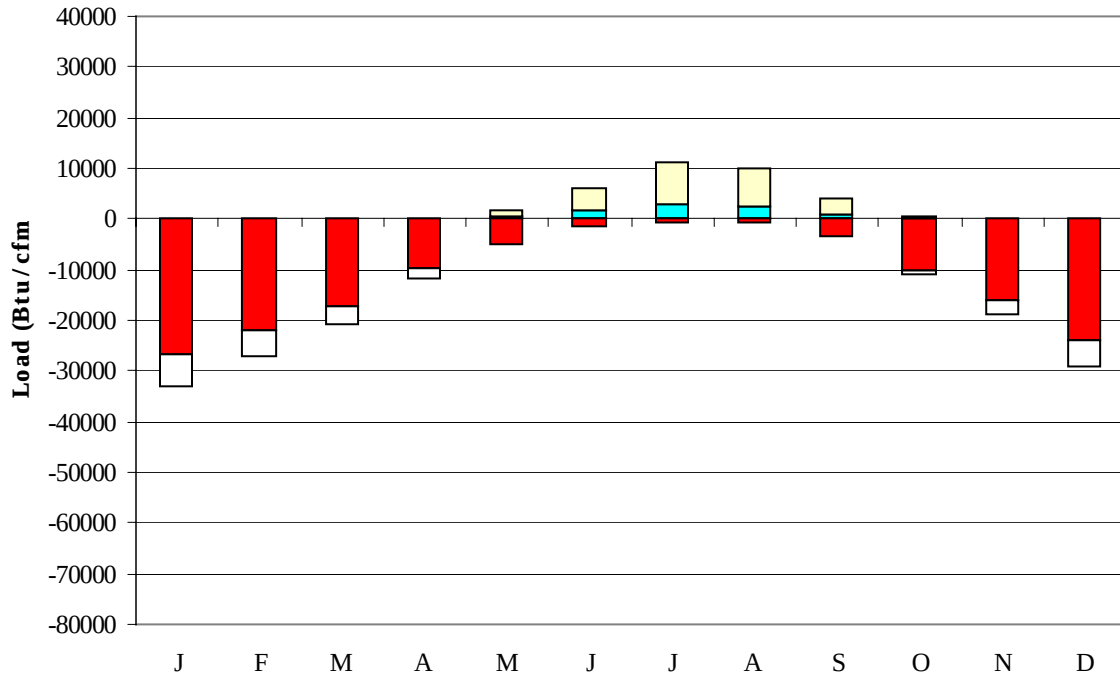
■ Mean Cooling Degree Days ■ Mean Heating Degree Days

|     | Mean Cooling<br>Degree Days (°F) | Mean Heating<br>Degree Days (°F) |
|-----|----------------------------------|----------------------------------|
| JAN | 0                                | 933                              |
| FEB | 2                                | 759                              |
| MAR | 13                               | 573                              |
| APR | 49                               | 311                              |
| MAY | 113                              | 137                              |
| JUN | 236                              | 31                               |
| JUL | 344                              | 8                                |
| AUG | 300                              | 13                               |
| SEP | 149                              | 84                               |
| OCT | 40                               | 312                              |
| NOV | 8                                | 539                              |
| DEC | 1                                | 825                              |
| ANN | 1257                             | 4525                             |

ROANOKE VA

WMO No. 724110

**Average Ventilation and Infiltration Loads**  
**(Outside Air vs. 75°F, 60% RH summer; 68°F, 30% RH winter)**



|     | Average Sensible Cooling Load (Btu/cfm) | Average Sensible Heating Load (Btu/cfm) | Average Latent Cooling Load (Btu/cfm) | Average Latent Heating Load (Btu/cfm) |
|-----|-----------------------------------------|-----------------------------------------|---------------------------------------|---------------------------------------|
| JAN | 0                                       | -26597                                  | 1                                     | -6277                                 |
| FEB | 1                                       | -21844                                  | 0                                     | -5396                                 |
| MAR | 39                                      | -17129                                  | 5                                     | -3674                                 |
| APR | 236                                     | -9929                                   | 55                                    | -1693                                 |
| MAY | 583                                     | -4974                                   | 1135                                  | -206                                  |
| JUN | 1688                                    | -1444                                   | 4329                                  | -2                                    |
| JUL | 2954                                    | -474                                    | 8384                                  | 0                                     |
| AUG | 2355                                    | -701                                    | 7467                                  | 0                                     |
| SEP | 854                                     | -3258                                   | 3288                                  | -18                                   |
| OCT | 123                                     | -10076                                  | 320                                   | -719                                  |
| NOV | 9                                       | -16207                                  | 55                                    | -2750                                 |
| DEC | 0                                       | -23789                                  | 4                                     | -5220                                 |
| ANN | 8842                                    | -136422                                 | 25043                                 | -25955                                |

## Average Annual Solar Radiation – Nearest Available Site

(Source: National Renewable Energy Laboratory, Golden CO, 1995)

City: ROANOKE  
 State: VA  
 WBAN No: 13741  
 Lat(N): 37.32  
 Long(W): 79.97  
 Elev(ft): 1175

Stn Type: Secondary  
 SHADING GEOMETRY IN DIMENSIONLESS UNITS

Window: 1  
 Overhang: 0.457  
 Vert Gap: 0.305

| AVERAGE INCIDENT SOLAR RADIATION (Btu/sq.ft./day), Percentage Uncertainty = 9 |         | Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Year |
|-------------------------------------------------------------------------------|---------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| HORIZ                                                                         | Global  | 730  | 980  | 1310 | 1650 | 1840 | 1960 | 1880 | 1730 | 1430 | 1150 | 790  | 640  | 1340 |
|                                                                               | Std Dev | 51   | 75   | 93   | 149  | 91   | 116  | 129  | 92   | 111  | 88   | 75   | 40   | 31   |
|                                                                               | Minimum | 620  | 790  | 1110 | 1390 | 1610 | 1760 | 1630 | 1550 | 1160 | 1030 | 610  | 560  | 1260 |
|                                                                               | Maximum | 840  | 1160 | 1460 | 2020 | 2030 | 2190 | 2170 | 1880 | 1640 | 1350 | 930  | 730  | 1400 |
|                                                                               | Diffuse | 330  | 440  | 560  | 690  | 830  | 890  | 890  | 790  | 640  | 450  | 350  | 300  | 600  |
| Clear Day                                                                     | Global  | 1020 | 1360 | 1820 | 2260 | 2520 | 2610 | 2530 | 2280 | 1890 | 1440 | 1060 | 900  | 1810 |
| NORTH                                                                         | Global  | 210  | 280  | 360  | 450  | 550  | 620  | 580  | 490  | 390  | 300  | 230  | 190  | 390  |
|                                                                               | Diffuse | 210  | 280  | 360  | 430  | 500  | 540  | 520  | 470  | 390  | 300  | 230  | 190  | 370  |
| Clear Day                                                                     | Global  | 200  | 260  | 330  | 430  | 580  | 680  | 620  | 480  | 370  | 290  | 210  | 180  | 390  |
| EAST                                                                          | Global  | 480  | 620  | 770  | 950  | 1020 | 1070 | 1040 | 970  | 840  | 710  | 520  | 430  | 780  |
|                                                                               | Diffuse | 260  | 340  | 430  | 530  | 600  | 640  | 630  | 580  | 490  | 380  | 280  | 230  | 450  |
| Clear Day                                                                     | Global  | 740  | 940  | 1150 | 1340 | 1410 | 1420 | 1380 | 1300 | 1150 | 940  | 750  | 670  | 1100 |
| SOUTH                                                                         | Global  | 1110 | 1160 | 1120 | 970  | 800  | 740  | 760  | 900  | 1040 | 1230 | 1130 | 1050 | 1000 |
|                                                                               | Diffuse | 360  | 430  | 490  | 540  | 560  | 570  | 570  | 530  | 460  | 380  | 340  | 340  | 480  |
| Clear Day                                                                     | Global  | 1960 | 1980 | 1750 | 1340 | 1000 | 850  | 900  | 1160 | 1530 | 1800 | 1890 | 1900 | 1500 |
| WEST                                                                          | Global  | 490  | 630  | 790  | 950  | 990  | 1040 | 1000 | 960  | 840  | 720  | 520  | 430  | 780  |
|                                                                               | Diffuse | 260  | 340  | 440  | 540  | 610  | 640  | 630  | 580  | 490  | 380  | 280  | 240  | 450  |
| Clear Day                                                                     | Global  | 740  | 940  | 1150 | 1340 | 1410 | 1420 | 1380 | 1300 | 1150 | 940  | 750  | 670  | 1100 |

## Average Annual Solar Heat and Illumination – Nearest Available Site

(Source: National Renewable Energy Laboratory, Golden CO, 1995)

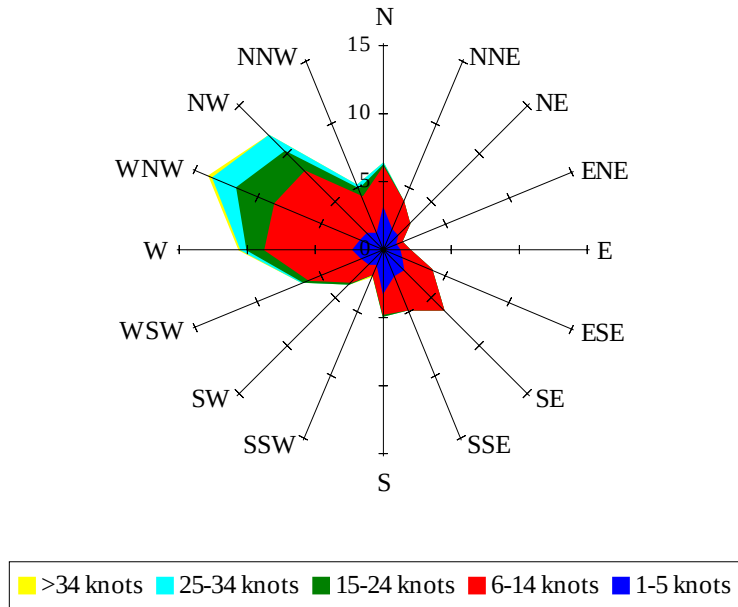
| AVERAGE TRANSMITTED SOLAR RADIATION (Btu/sq.ft./day) FOR DOUBLE GLAZING, Percentage Uncertainty = 9 |          | Jan | Feb | Mar | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct | Nov | Dec | Year |
|-----------------------------------------------------------------------------------------------------|----------|-----|-----|-----|------|------|------|------|------|------|-----|-----|-----|------|
| HORIZ                                                                                               | Unshaded | 480 | 670 | 930 | 1190 | 1330 | 1430 | 1370 | 1250 | 1020 | 800 | 530 | 410 | 950  |
| NORTH                                                                                               | Unshaded | 150 | 190 | 250 | 300  | 360  | 400  | 380  | 330  | 270  | 210 | 160 | 130 | 260  |
|                                                                                                     | Shaded   | 130 | 170 | 220 | 280  | 330  | 360  | 350  | 300  | 250  | 190 | 140 | 120 | 240  |
| EAST                                                                                                | Unshaded | 330 | 430 | 550 | 670  | 720  | 760  | 740  | 690  | 590  | 500 | 360 | 290 | 550  |
|                                                                                                     | Shaded   | 300 | 390 | 490 | 600  | 630  | 670  | 650  | 610  | 530  | 450 | 320 | 270 | 490  |
| SOUTH                                                                                               | Unshaded | 830 | 840 | 770 | 620  | 490  | 450  | 470  | 560  | 700  | 880 | 840 | 790 | 690  |
|                                                                                                     | Shaded   | 810 | 790 | 620 | 430  | 350  | 360  | 360  | 390  | 530  | 790 | 810 | 770 | 580  |
| WEST                                                                                                | Unshaded | 340 | 440 | 560 | 680  | 700  | 740  | 710  | 680  | 590  | 510 | 360 | 300 | 550  |
|                                                                                                     | Shaded   | 310 | 400 | 500 | 600  | 610  | 650  | 620  | 600  | 530  | 460 | 330 | 270 | 490  |

| AVERAGE INCIDENT ILLUMINANCE (klux-hr) FOR MOSTLY CLEAR AND MOSTLY CLOUDY CONDITIONS, Percentage Uncertainty = 9 |          |       |      |     |     |     |      |      |     |     |     |
|------------------------------------------------------------------------------------------------------------------|----------|-------|------|-----|-----|-----|------|------|-----|-----|-----|
|                                                                                                                  |          | March |      |     |     |     | June |      |     |     |     |
|                                                                                                                  |          | 9am   | 11am | 1pm | 3pm | 5pm | 9am  | 11am | 1pm | 3pm | 5pm |
| HORIZ.                                                                                                           | M.Clear  | 35    | 71   | 84  | 70  | 34  | 40   | 80   | 99  | 96  | 72  |
|                                                                                                                  | M.Cloudy | 20    | 43   | 50  | 45  | 21  | 26   | 53   | 72  | 69  | 48  |
| NORTH                                                                                                            | M.Clear  | 9     | 14   | 15  | 14  | 9   | 21   | 16   | 17  | 17  | 16  |
|                                                                                                                  | M.Cloudy | 8     | 15   | 17  | 15  | 8   | 14   | 17   | 19  | 19  | 16  |
| EAST                                                                                                             | M.Clear  | 71    | 62   | 15  | 14  | 9   | 70   | 75   | 38  | 17  | 16  |
|                                                                                                                  | M.Cloudy | 25    | 32   | 17  | 15  | 8   | 31   | 44   | 31  | 19  | 16  |
| SOUTH                                                                                                            | M.Clear  | 33    | 68   | 80  | 67  | 32  | 11   | 26   | 42  | 40  | 22  |
|                                                                                                                  | M.Cloudy | 15    | 34   | 40  | 35  | 16  | 10   | 21   | 33  | 32  | 19  |
| WEST                                                                                                             | M.Clear  | 9     | 14   | 16  | 63  | 71  | 11   | 16   | 17  | 46  | 75  |
|                                                                                                                  | M.Cloudy | 8     | 15   | 17  | 34  | 27  | 10   | 17   | 19  | 35  | 43  |
| M.Clear                                                                                                          | (% hrs)  | 36    | 36   | 38  | 36  | 36  | 43   | 38   | 34  | 34  | 36  |
|                                                                                                                  |          | Sept  |      |     |     |     | Dec  |      |     |     |     |
|                                                                                                                  |          | 9am   | 11am | 1pm | 3pm | 5pm | 9am  | 11am | 1pm | 3pm | 5pm |
| HORIZ.                                                                                                           | M.Clear  | 22    | 63   | 85  | 81  | 53  | 12   | 42   | 51  | 36  | 5   |
|                                                                                                                  | M.Cloudy | 13    | 38   | 56  | 54  | 33  | 8    | 24   | 29  | 22  | 4   |
| NORTH                                                                                                            | M.Clear  | 8     | 14   | 17  | 16  | 13  | 5    | 10   | 11  | 9   | 3   |
|                                                                                                                  | M.Cloudy | 6     | 14   | 18  | 18  | 13  | 4    | 10   | 11  | 9   | 2   |
| EAST                                                                                                             | M.Clear  | 54    | 72   | 36  | 16  | 13  | 37   | 44   | 11  | 9   | 3   |
|                                                                                                                  | M.Cloudy | 16    | 33   | 27  | 18  | 13  | 11   | 19   | 11  | 9   | 2   |
| SOUTH                                                                                                            | M.Clear  | 15    | 50   | 71  | 67  | 41  | 31   | 78   | 90  | 71  | 15  |
|                                                                                                                  | M.Cloudy | 7     | 25   | 42  | 40  | 22  | 9    | 29   | 32  | 26  | 5   |
| WEST                                                                                                             | M.Clear  | 8     | 14   | 17  | 47  | 72  | 5    | 10   | 17  | 50  | 21  |
|                                                                                                                  | M.Cloudy | 6     | 14   | 18  | 31  | 34  | 4    | 10   | 13  | 20  | 6   |
| M.Clear                                                                                                          | (% hrs)  | 43    | 43   | 40  | 38  | 41  | 36   | 37   | 37  | 36  | 36  |



### Wind Summary - December, January, and February

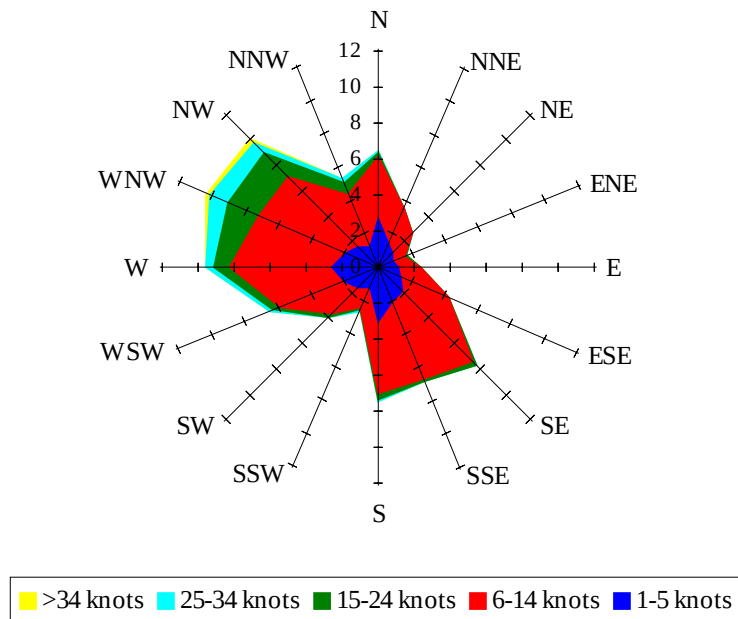
Labels of Percent Frequency on North Axis



Percent Calm = 11.73

### Wind Summary - March, April, and May

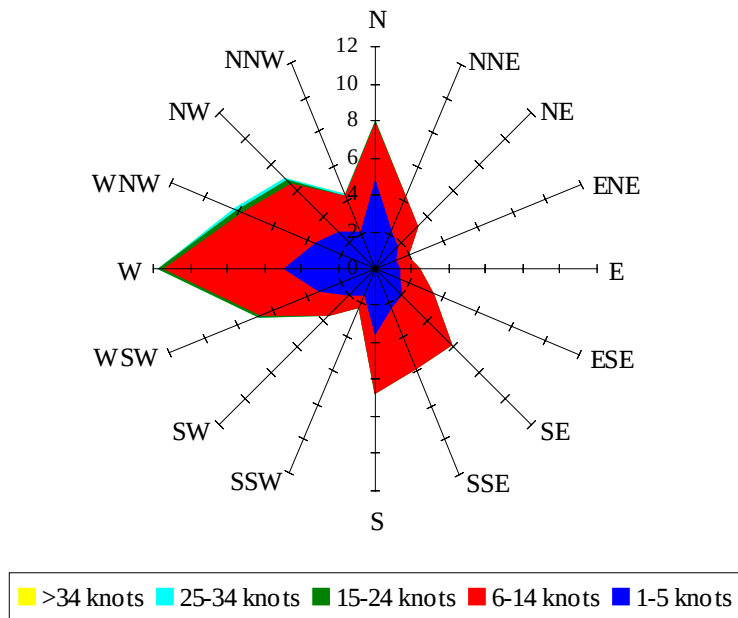
Labels of Percent Frequency on North Axis



Percent Calm = 9.90

### Wind Summary - June, July, and August

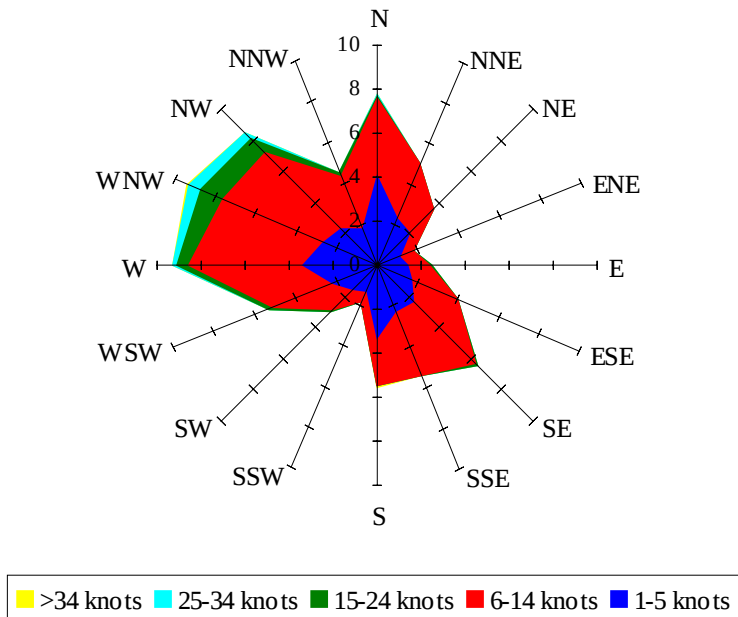
Labels of Percent Frequency on North Axis



Percent Calm = 15.00

### Wind Summary - September, October, and November

Labels of Percent Frequency on North Axis



Percent Calm = 16.60