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# CRITERIA FOR THE AIR LEAKAGE CHARACTERISTICS OF BUILDING ENVELOPES: FINAL REPORT

# CRITERIA FOR THE AIR LEAKAGE CHARACTERISTICS OF BUILDING ENVELOPES

## FINAL REPORT

Prepared for

CANADA MORTGAGE
AND
HOUSING CORPORATION

TROW INC.

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## TABLE OF CONTENTS

# CRITERIA FOR THE AIR LEAKAGE CHARACTERISTICS OF BUILDING ENVELOPES

## EXECUTIVE SUMMARY

A procedure for estimating the moisture accumulation in building envelopes due to air leakage has been developed. It is based on the calculated, steady state thermal conditions resulting from anticipated, incremental changes in the indoor to outdoor temperature difference for a given locality.

Monthly "bin" data, initially intended for energy analysis, are utilized in a computer program to calculate the thermal conditions within a particular envelope for specific indoor conditions, and the amount of condensation expected to accumulate in the envelope is determined on the basis of the psychrometric processes involved and the physical arrangement and moisture absorption characteristics of the materials involved.

Opinions as to the moisture performance of materials, judgements on the factors influencing air leakage through building envelopes, and values for the appropriate coefficients for use in the computer program, were obtained from a group of selected experts using a Delphi technique

Based on this information, the procedure was used to establish criteria for the air leakage characteristics required of some representative exterior envelopes to avoid problems from concealed condensation. These limiting criteria were based on the conditions whereby a material within the envelope just reached a moisture content above which deterioration was likely to occur.

Suggestions are advanced as to possible simplification and to refinement of the procedure, methods for determination of suitable coefficients, and the application of the procedure to the development of construction details and design principles.

**CRITERIA FOR THE AIR LEAKAGE CHARACTERISTICS OF BUILDING ENVELOPES**

**FINAL REPORT**

## 1.0 PURPOSE AND SCOPE

The overall objective of this project was to develop a set of criteria for the air leakage characteristics required of exterior envelopes of buildings to avoid problems from concealed condensation.

The project involved four phases; the development of an analytical model based on published information, the development of decision logic trees applicable to low- and high-rise housing, refinement of the trees through the application of the Delphi technique, and establishment of the criteria with a procedure for further development.

The report on Phase 1 described the analytical model for air flow through the building envelope and some of the assumptions to be made. The model was proposed as a means for estimating the rate of accumulation and rate of removal of moisture resulting from air exfiltration based on the temperature gradient through the envelope, the dewpoint temperatures of the indoor and outdoor air, and the rate of air flow through the envelope.

The report on Phase 2 described the decision logic tree and its application to the prediction of the moisture conditions in the envelope due to indoor air exfiltration. The approach taken considered the psychrometric processes and principles involved and their application to predicting the rates of moisture accumulation during a month by month annual cycle. Consideration was given to the effects of drainage and of moisture storage for the building materials currently used in the exterior envelopes of low- and high-rise residential buildings.

The concepts, assumptions, and simplifications involved were discussed with a select group of experts at CMHC on September 5, 1989 and comments on the assumptions made in developing the decision logic tree were offered. Further refinements were made to the computer model and preliminary calculations undertaken for six Canadian cities.

On the basis of these calculations, and the expert comment, three rounds of questions were circulated to a group of experts using a Delphi method to obtain a consensus as to the appropriate factors and coefficients for establishing air leakage requirements for residential construction.

This final report applies the results of the Delphi rounds and the computer program to provide a set of criteria for airtightness requirements for low- and high-rise residential buildings based on limiting the moisture content reached by the materials involved. Suggestions are advanced as to possible simplification and to refinement of the procedure, methods for determination of suitable coefficients, and the application of the procedure to the development of construction details and design principles.

## 2.0 THE PREDICTION OF MOISTURE CONDITIONS IN THE ENVELOPE

The procedure that is employed for estimating the amount of condensation that will accumulate in a building envelope due to air leakage is based on the calculated, incremental, steady state temperature conditions within the envelope for a given indoor temperature, and the month by month outdoor temperature conditions for a particular locality.

The calculation procedure assumes that steady state conditions are attained as the air passes over each condensing plane on its way through the envelope. This represents a situation involving low flow rates and long convoluted flow paths, whereby the maximum amount of condensation will occur. Greater rates of air flow or shorter flow paths through the envelope will fall short of attaining equilibrium conditions and could, in this respect, be considered as less severe and not as representative of a limiting or most critical situation from the standpoint of moisture accumulation. Such situations are less amenable to description or calculation, although they may represent the actual situation more closely.

Monthly "bin" temperature data in two degree Celsius increments are employed as a basis for calculation in a computer program which determines the number of hours in a month and the extent that the temperature of each potential condensation plane within the envelope is above and below the dewpoint temperature of the air in contact with it. These "bin" data are also used to calculate the corresponding maximum theoretical stack effect pressure difference acting over a one storey height.

When the exfiltrating room air moving outward through the envelope contacts a surface that cools it below its dewpoint temperature, condensation will occur and the amount deposited for a given rate of air leakage, will be equal to the difference in moisture content between the room air and the dehumidified air flowing onward, multiplied by the length of time involved. The accumulated moisture is either absorbed or drains from the surface. The number of hours during which the wetted surface rises above the dewpoint temperature of the air flowing over it is considered as a drying period.

The same processes are considered to occur at each potential condensing plane that is outward in the envelope, with the dewpoint temperature of the air coming into contact with the surface being determined by the temperature and moisture conditions at the previous plane. If the previous plane is non-absorbent, and has provision or capability for drainage, the maximum dewpoint of the air leaving it will be limited by the previous dewpoint temperature or by the temperature of the plane, whichever is lowest. If moisture has been stored, the maximum dewpoint of the leaving air can be equal to the temperature of the absorbent plane until the stored moisture is evaporated.

The procedure is based on the rate of exfiltration due to the maximum, theoretical, outward acting pressure due to stack effect over a one storey height, for selected indoor conditions, as determined by the coincident indoor to outdoor air temperature difference. This pressure is directly related to the number of storeys, but can also be affected by the characteristics of the air leakage paths through the envelope, the variation in leakage area with height, wind action, the air leakage characteristics of internal separations, and the operation of mechanical air handling systems.

The opinion of a selected group of experts on these factors was solicited using a form of Delphi technique.

## 3.0 ESTABLISHING FLOW COEFFICIENTS - THE DELPHI TECHNIQUE

The basic equation governing the rate of air flow through a building envelope expresses the relationship between the pressure difference acting across the envelope and the cross sectional area of the leakage openings involved. The relationship is influenced primarily by the exponent of the pressure difference in the equation :

$$\text{FLOW RATE} \approx \text{AREA OF OPENING} \times (\text{PRESSURE DIFFERENCE})^{n}$$

where n is between the values of 0.5 and 1.0

A Delphi technique was used to canvass the opinion of a group of experts as to the most appropriate exponent to use (Appendix A). The value of 0.7 emerged as the average for both low-rise and high-rise housing.

A linear relationhip of stack effect with height applies to situations where the envelope leakage area is uniform with height , such as in high-rise buildings where few leakage openings occur through the roof. In low-rise, wood-frame housing however, the leakage area through the ceiling/roof assembly can be a significant portion of the total, and the pressure difference acting outward at the top storey walls and ceiling will be reduced in accordance with the ratio between the leakage area of the ceiling and the remainder of the envelope.

The Delphi panel canvassed was strongly of the opinion that the equivalent leakage area of the walls, windows, and doors will be greater than that of the ceiling in low-rise housing. Under such circumstances, for low-rise housing, the expected maximum outward acting pressure difference would be less than that related simply to building height (number of storeys).

Panel opinion was split almost equally as to whether the operation of exhaust fans should be considered. Their estimates of the negative pressure developed from exhaust fan operation ranged between zero and ten Pascals, with an average estimate of 3 Pa.

Panel opinion was also split in regard to the importance of chimney operation in adjusting the pressure difference.

The panel was strongly in favour of considering the effect of wind for both low- and high-rise buildings, and were in favour of using the monthly average wind velocity, with consideration given to the increase in wind velocity with height.

## 4.0 APPLICATION OF THE COEFFICIENTS

Wind action will tend to increase the outward acting pressures on the leeward faces of a building and to decrease the outward acting pressures across the windward face. There is the question as to whether the occurence of maximum pressures due to winds will coincide with the lowest outdoor temperatures (maximum stack effect pressures). There is also the question of the relative magnitude of the increase in outward pressure due to wind and the reduction in outward pressure due to exhaust fan operation and distribution of leakage openings.

Recognizing that the magnitude of suction pressures acting over the leeward face of a building will vary with wind direction and time, a first approximation of the additional outward acting pressure could be based on the average wind velocity experienced and an average pressure coefficient . For low-rise buildings in most urban locations in Canada this additional outward acting pressure will be about the same order of magnitude as the reduction in outward acting pressure resulting from exhaust fan operation or the variation in leakage area with height. For low-rise buildings, estimation of the outward acting pressure based on stack effect alone seems a reasonable approximation.

The action of wind on high-rise buildings will be more significant, with wind velocities increasing with height and localized suction pressures being more severe. On the other hand, maximum stack effect pressures will be significantly affected by the airtightness of floor separations and interior doors and partitions, so that the outward acting pressure due to stack effect at the top of the building will be much less than that based on the number of storeys.

Until further information on the coincidece of wind and outdoor temperature and on the influence of internal separations is available, it is suggested that estimates based on stack effect alone can serve as a logical first step, to be modified in accordance with the characteristics of the particular building and local climate.

The procedure as developed thus provides a means to estimate the amount of condensation to be expected in a specific building, in a particular location, for any given indoor air conditions and leakage area. By establishing a maximum limit for the amount of moisture that can be tolerated in a particular envelope, the corresponding maximum tolerable, leakage opening area can be determined. Expert opinion on these moisture limits was also sought using a Delphi approach.

## 5.0 ESTABLISHING MOISTURE LEVELS - THE DELPHI APPROACH

The indoor air temperature conditions in a residential occupancy will likely be within a comfort envelope such as that of ASHRAE Standard 55-1981, namely between 20° C and 26° C, and between dewpoint temperatures of 1.7° C and 16.7° C winter to summer. The indoor air dewpoint temperature will tend to be higher than that outdoors due to the contribution of indoor moisture sources. Humidification will add to the indoor humidity in winter, and in summer, dehumidification through air-conditioning may reduce the indoor humidity.

The Delphi panel were intially asked for a single estimate of the indoor temperature and relative humidity likely to be maintained in a residential occupancy in winter, and on the suggestion of some participants, subsequently asked for an estimate of such conditions for five different climate regions; West Coast, Prairies, Ottawa, Toronto, and East Coast. The results are tabulated in Appendix A. The opinion of the Delphi panel was also solicited in regard to the moisture characteristics of the common materials used in envelope construction.

The amount of moisture capable of being absorbed and stored in the material of a condensation plane will depend on the type and amount of material involved, as well as its surface characteristics, duration of wetting, and other factors.

The first two Delphi rounds were used to obtain estimates of the maximum moisture absorption likely to occur when specific materials were continuously wetted on one face. The final round was used to obtain opinion on the critical moisture content above which specific materials would experience serious deterioration. The results are tabulated in Appendix A.

## 6.0 ESTABLISHING APPROPRIATE CRITERIA

The criteria implicit in most current codes is for an "effective air barrier" located to "prevent condensation" within the building envelope. Strictly interpreted, this requirement would not permit any exfiltration of indoor air when its dewpoint is above the temperature of any condensing surface within the envelope.

An alternative approach would require that the air tightness of the envelope be restricted to that which will "avoid problems from concealed condensation". This could involve the establishment of limits on the amount of condensation occuring within the envelope, or limits on the maximum moisture content reached by materials within the envelope, or limits on the length of time during which conditions conducive to problems developing, would be experienced.

The provision for drainage to outside is possible, if not inherent, in all envelope designs with the exception of dead flat ceiling/roof constructions. It does not seem reasonable to base criteria on the generic disadvantage of one particular construction, however, and even then, the difficulties in establishing the amount of moisture that could be tolerated would be substantial. For example, how could one establish the amount of moisture that could be allowed to drip through a ceiling without it constituting a problem? In any event, it would be necessary to determine how much of the moisture condensing within the envelope would be absorbed by the materials on which it condensed.

The problems of most concern to the industry are those involving the deterioration or degredation of the materials used in construction when they are exposed to moisture. Organic materials will be susceptible to microbiological attack when at or above some critical moisture content, and when temperatures are above freezing. Inorganic materials will be susceptible to deterioration when they are saturated with moisture and exposed to temperatures below freezing. Materials such as gypsum may deteriorate when exposed to wetting or, if faced with organic materials, may be subject to mildew or microbiological attack, and perhaps delamination. If the moisture contents of the materials making up a building envelope do not exceed such critical levels, moisture problems should not be experienced.

With these moisture content levels established, the procedure developed can be used to determine the leakage opening area that will just keep the materials within a particular envelope below a critical moisture content, for any indoor air conditions, and for any locality for which weather data are available.

As an example, the leakage opening areas that would result in a material in six common wall constructions just reaching a critical moisture content were calculated, using the computer program, for five climatic regions in Canada for the pressure differences due to stack effect over a single storey height. These leakage areas, expressed in square centimeters per square metre of enclosure area are listed below, as transcribed from the computer output provided in Appendix B. The materials reaching a critical moisture content are underlined.

LIMITING LEAKAGE OPENING AREAS
(centimetre)$^2$ / (metre)$^2$ per storey

| WALL 1 | WALL 2 | WALL 3 | WALL 4 |
| --- | --- | --- | --- |
| Gypsum Board | Gypsum Board | Gypsum Board | Gypsum Board |
| Insulation | Insulation | Insulation | Insulation |
| Waferboard | Gypsum Sheath | Glass Fiber | Polystyrene |
| Hardboard | Brick | Hardboard | Hardboard |
| MONTREAL | | | |
| 0.42 | 0.97 | 0.11 | 0.11 |
| TORONTO | | | |
| 0.44 | 1.0 | 0.12 | 0.12 |
| WINNIPEG | | | |
| 0.29 | 0.66 | 0.09 | 0.09 |
| EDMONTON | | | |
| 0.34 | 0.77 | 0.10 | 0.10 |
| VANCOUVER | | | |
| 0.57 | 1.4 | 0.12 | 0.12 |

The limiting leakage rate suggested at the Building Science Insight '86 Seminar for buildings with indoor air conditions of 27% to 55% relative humidity at 21° C was 0.10 Litres per second at 75 Pa. Using the same pressure difference exponent of 0.7, this limiting value can be expressed as a leakage area of 0.064 (centimetre)$^2$ per (metre)$^2$.

## 7.0 CONCLUSIONS AND RECOMMENDATIONS

The initial request for proposal for this project was, " to develop a rational formula for determination of appropriate requirements for air barriers from experience, literature review, or research." This final report, in accordance with the accepted proposal, offers a set of " criteria established by the pilot study and a model and procedure capable of use by agencies wishing to apply the method to a broader and more statistically significant selection of experts, or to conduct a further series of rounds in order to refine the criteria."

The criteria established by the pilot study are listed above, based on the Delphi rounds described in Appendix A and as obtained from the computer model calculations and procedure as documented and provided in diskette format in Appendix B.

The following suggestions and recommendations are also offered, in keeping with the initial proposal, as to "subject areas where more research or analysis would be desirable" and "as to how future guidelines, standards and codes might be formulated.

- Adaptation and development of the computer model to include moisture transfer by vapour dffusion and the determination of vapour barrier (permeance) requirements.

- Development of "bin" data for other regions of Canada.

- Development and evaluation of a simpler, manual calculation procedure, based on average monthly temperatures, through comparison with results from the computer "bin" data method.

- Development of construction details and design principles most likely to eliminate or avoid problems from concealed condensation.

- Adaptation of the computer model to determine limiting air leakage values based on moisture conditions and time of exposure of materials within the envelope.

- Experimental determination of the rate of absorption and absorption capacity of building materials when wetted on one face.

- Use of the Delphi technique to obtain expert opinion on the conditions and time of exposure necessary for the deterioration of materials in building envelopes.

- Comparison of experimentally observed moisture condensation and accumulation in representative building envelopes to those predicted by the computer models.

## ABSTRACT

A procedure for estimating the moisture accumulation in building envelopes due to air leakage has been developed. It is based on the calculated, steady state thermal conditions resulting from anticipated, incremental changes in the indoor to outdoor temperature difference for a given locality. Monthly "bin" data, at two degree Celsius intervals, are utilized in a computer program to calculate the thermal conditions within a particular envelope for specific indoor conditions, and the amount of condensation expected to accumulate in the envelope is determined on the basis of the psychrometric processes involved and the physical arrangement and moisture absorption characteristics of the materials involved.

The calculation procedure is based on the assumption that the air flowing through the envelope comes into thermal and moisture equilibrium with the surfaces that it contacts. This represents the condition when the maximum amount of moisture will be condensed from the air and absorbed by the surface, and hence is appropriate as a basis for establishing limiting criteria. If the air was assumed to flow through the envelope more rapidly, or by means of a shorter, more direct path, it would not be cooled as much, less moisture would be condensed, and less time would be available for absorption of the moisture by the materials involved.

The program calculates the coincident, maximum stack effect pressure difference, acting over a unit storey height, to determine the rate of air flow through the envelope for each temperature "bin". When applied to the actual number of storeys, this also represents a maximum condition insofar as stack effect is concerned. It is suggested that the less predictable effects of wind, air leakage of internal separations, the distribution of leakage openings, and exhaust fan operation tend to offset each other, and need not be considered except as a subsequent modifier in considering specific buildings.

The limit chosen to establish the maximum leakage opening area criteria is based on a material within an envelope reaching a critical moisture content above which deterioration or degredation occurs. A Delphi technique was employed to obtain the collective opinion of a panel of selected experts as to appropriate coefficients to be used in the program and the critical moisture content levels for a number of current building materials.

Using these values, the procedure was employed to determine the applicable, limiting leakage opening areas for four representative wall constructions for seven climate regions of Canada.

# APPENDIX A

# THE DELPHI ROUNDS

## TO THE PARTICIPANT

As a basis for establishing limiting criteria for the air leakage characteristics of building envelopes to avoid problems from condensation, a procedure for estimating the moisture conditions that are likely to occur in a building envelope has been developed.

Your expert opinion is solicited as to the most appropriate assumptions and coefficients to employ in this estimating procedure. Your assessment will be combined with those of a number of other experts and the results returned for your reassessment in two additional rounds in order to obtain a consensus.

You are requested to review the enclosed description of the procedure and to return a completed copy of the attached questionnaire as soon as possible. Any additional comments or suggestions would be welcome.

Please return the completed questionnaire and comments to the attention of Gustav Handegord, TROW Consulting Engineers, preferably by Fax: (416) 793-0641.

# DESCRIPTION OF THE PROCEDURE

A procedure for estimating the amount of condensation that will accumulate in a building envelope due to air leakage has been developed. It is based on the calculated, steady state temperature conditions within the envelope for a constant indoor temperature and the month by month outdoor temperature conditions for a particular locality. Monthly "bin" temperature data is employed as a basis for calculation in a computer program which determines the number of hours in a month that the temperature of each potential condensation plane within the envelope is above and below the dewpoint temperature of the air in contact with it. These "bin" data are also used to calculate the corresponding stack effect pressure difference for a one storey height.

When exfiltrating room air moving outward through the envelope contacts a surface that cools it below its dewpoint temperature, condensation will occur and the amount deposited for a given rate of air leakage, will be equal to the difference in moisture content between the room air and the dehumidified air flowing onward, multiplied by the length of time ("bin" hours) involved. The accumulated moisture is either absorbed or drains from the surface. The number of hours during which the wetted surface rises above the dewpoint temperature of the air flowing over it is considered as a drying period.

The same processes are considered to occur at each potential condensing plane that is outward in the envelope, with the dewpoint temperature of the air coming into contact with the surface determined by the temperature and moisture conditions at the previous plane. If the previous plane is non-absorbent, and has provision or capability for drainage, the maximum dewpoint of the leaving air will be limited by the previous dewpoint temperature. If moisture has been stored, the maximum dewpoint of the leaving air can be equal to the temperature of the absorbent plane until the stored moisture is evaporated.

The procedure can thus be used to predict the amount of condensation likely to occur at a condensation plane within the envelope of a building in a particular locality as a result of air exfiltration due to stack effect, provided that the indoor air conditions and the air leakage characteristics of the envelope are known.

The amount of moisture capable of being absorbed and stored in the material of a condensation plane will depend on the type and amount of material involved, as well as its surface characteristics, duration of wetting, and other factors. Organic materials will be susceptible to microbiological attack when at their peak moisture content, and when temperatures are above freezing. Inorganic materials will be susceptible to deterioration when they are saturated with moisture and exposed to temperatures below freezing. Materials such as gypsum may deteriorate when exposed to wetting or, if faced with organic materials, may be subject to mildew or microbiological attack, and perhaps delamination.

If the moisture contents of the materials making up a building envelope do not exceed these critical levels, moisture problems should not be experienced.

With these moisture content levels established, the procedure outlined can be used to determine the limiting normalized leakage area for a building in a particular locality that will just keep materials within the envelope below saturation, thus avoiding moisture problems.

## FACTORS TO BE ASSESSED

There are a number of factors which will influence these conditions and determine the exfiltration rates.

The indoor air temperature conditions will likely be within a comfort envelope such as that of ASHRAE Standard 55-1981, namely between 20° C and 26° C, and between dewpoint temperatures of 1.7° C and 16.7° C winter to summer. The indoor air dewpoint temperature will tend to be higher than that outdoors due to the contribution of indoor moisture sources. Humidification will add to the indoor humidity in winter, and in summer, dehumidification through air-conditioning may reduce the indoor humidity.

The rate of air exfiltration, per unit area of envelope, will be dependent on the relationship between the normalized leakage area involved and the outward acting air pressure difference. This relationship will be primarily dependent on the characteristics of the leakage paths, with the exponent for the pressure difference ranging between 0.5 and 1.0.

For low-rise, single detached or semi-detached houses, the normalized leakage area of the exterior ceilings and walls can be determined by blower door testing with the window and door leakage isolated or otherwise accounted for. If ceilings and walls cannot be isolated from each other, uniformity of distribution of leakage openings must be assumed.

In non wood-frame multiple occupancy residential buildings, exterior wall leakage areas can be measured directly or by multiple unit pressurization with window and door leakage isolated. Flat roof constructions incorporating a reinforced concrete slab can be assumed to have negligible leakage.

The pressure difference causing exfiltration due to stack effect will depend on the indoor to outdoor temperature difference, the distribution of leakage openings, and the height of the building.

For medium- to high-rise multiple occupancy buildings with concrete roof decks, the distribution of leakage openings will likely be uniform with height. since minimum roof leakage would be expected. The neutral pressure plane should occur at mid-height and the maximum outward acting pressure would be experienced at at the top of the building and will be equal to one-half of the total stack effect.

In low-rise wood-frame buildings where significant leakage occurs through the top floor ceiling, the level of the neutral pressure plane will depend on the ratio of ceiling leakage area to wall and door/window leakage area, modified by other non-dampered openings such as for chimneys, ducts, and flues. The question arises as to the height to be assumed in determining the maximum pressure due to stack effect. Where the ceiling leakage area is equal to the wall leakage area, the neutral pressure plane could be assumed to be at 3/4 of the building height.

The effects of wind on the pressure difference acting across top floor ceilings and walls will be influenced by the wind velocity and direction. Climatological data are available on these factors and pressure differences acting across components can be estimated for representative buildings, façades, and heights, for different upstream topography. The conditions producing the maximum augmentation to outward acting air pressure will occur at the leeward façade of the uppermost floor of buildings which extend above their surroundings.

For low-rise buildings in an urban setting, the effect of wind is more difficult to predict, and in all cases the frequency of occurrence of winds with temperature conditions conducive to condensation, is not readily established.

The operation of exhaust fans will tend to reduce any outward acting pressure differences, and unless deliberately utilized to control envelope condensation or to provide continuous ventilation, may be indeterminate. The effect of operational chimneys however, might be estimated on the basis of the predicted on-time determined from the calculated space heating requirements, indoor to outdoor temperature difference, and heating system capacity.

*PLEASE ENTER OR CIRCLE YOUR ANSWER*

In calculating the equivalent leakage area (ELA) for a building envelope, what value should be used as the exponent for the pressure difference factor?

[ ]

What level of temperature and relative humidity is likely to be maintained in a residential occupancy in winter?

[ ° C and %rh ]

Should the leakage through the top floor ceiling be considered in estimating the height of the neutral pressure plane in low-rise wood-frame housing?

Yes No

Should the effect of wind be considered in calculating the limiting envelope leakage area for walls in high-rise housing?

Yes No

Should the effect of wind be considered in calculating the limiting leakage area for envelopes in low-rise housing?

Yes No

Should the effect of operation of exhaust fans be considered in calculating the limiting envelope leakage area for high-rise buildings?

Yes No

Should the effect of operation of exhaust fans be considered in calculating the limiting envelope leakage area for low-rise buildings?

Yes No

Should the effect of chimney operation be considered in calculating the limiting envelope leakage area for low rise buildings?

Yes No

*PLEASE ENTER YOUR ANSWER*

What is your estimate of the moisture absorption capacity of the following materials, expressed as a percentage by weight?

| | |
|---|---|
| Wood sheathing (lumber) | % |
| Plywood sheathing | % |
| Fiberboard sheathing | % |
| Gypsum Sheathing | % |
| Wafer board sheathing | % |
| Expanded polystyrene | % |

What is your estimate of the moisture absorption capacity of the following materials, expressed as a percentage by weight?

| | |
|---|---|
| Wood siding | % |
| Plywood | % |
| Hardboard siding | % |
| Stucco | % |
| Brick masonry | % |
| Precast concrete | % |
| Lightweight concrete masonry | % |

TO THE PARTICIPANTS OF ROUND TWO

A Summary of the responses received for Round One is attached, indicating the range and arithmetical average of numerical values suggested and the number of "yes" and "no" answers provided to the questions. You are requested to review these results and to provide your considered responses to the enclosed, second round questionaire.

Please note that some of the questions are new or have been modified.

Please Fax a copy of your completed questionnaire to the attention of Gustav Handegord, TROW Consulting Engineers. Fax: (416) 793-0641.

*PLEASE ENTER OR CIRCLE YOUR RESPONSES*

In calculating the equivalent leakage area (ELA) for a WOOD-FRAME WALL, what value should be used as the exponent for the pressure difference factor?

[ ]

In calculating the equivalent leakage area (ELA) for a MASONRY WALL of a high-rise residential building, what value should be used as the exponent for the pressure difference factor?

[ ]

What levels of temperature and relative humidity are likely to be maintained in a residential occupancy in winter?

[ °C and %rh ]

Should the equivalent leakage area (ELA) of the top floor ceiling in a low-rise wood-frame house be considered as LESS than, EQUAL to, or GREATER than the equivalent leakage area of the walls, windows and doors?

LESS EQUAL GREATER

Should the AVERAGE wind velocity for the month be used in calculating the limiting envelope leakage area for walls?

Yes No

Should the INCREASE IN WIND VELOCITY WITH HEIGHT be considered in calculating the limiting leakage area for envelopes in high-rise housing?

Yes No

What is your estimate of the negative pressure created by the operation of an exhaust fan in a residential occupancy?

[ Pa ]

*PLEASE ENTER YOUR ANSWER*

What is your estimate of the maximum moisture absorption likely to occur when the following materials are continuously wetted on one face, expressed as a percentage by weight?

| | |
|---|---|
| Wood sheathing (lumber) | % |
| Plywood sheathing | % |
| Fiberboard sheathing | % |
| Gypsum Sheathing | % |
| Wafer board sheathing | % |
| Expanded polystyrene | % |

What is your estimate of the maximum moisture absorption likely to occur when the following materials are continuously wetted on one face, expressed as a percentage by weight?

| | |
|---|---|
| Wood siding | % |
| Plywood | % |
| Hardboard siding | % |
| Stucco | % |
| Brick masonry | % |
| Precast concrete | % |
| Lightweight concrete masonry | % |

It has been suggested that the indoor temperature and humidity levels for residential occupancies will vary with the region in Canada. What is your estimate of the temperature and relative humidity likely to be maintained in residential occupancies in the following regions?

WEST COAST

°C and %rh

PRAIRIES

°C and %rh

OTTAWA

°C and %rh

TORONTO

°C and %rh

EAST COAST

°C and %rh

## SUMMARY OF RESPONSES TO ROUND ONE

In calculating the equivalent leakage area (ELA) for a building envelope, what value should be used as the exponent for the pressure difference factor?

| MIN - 0.65 | AVE - 0.725 | MAX - 0.8 |
|---|---|---|

What level of temperature and relative humidity is likely to be maintained in a residential occupancy in winter?

| MIN - 21°C 30% | AVE - 6.8°C dewpoint | MAX - 22°C 60% |
|---|---|---|

Should the leakage through the top floor ceiling be considered in estimating the height of the neutral pressure plane in low-rise wood-frame housing?

Yes - 4 No - 1

Should the effect of wind be considered in calculating the limiting envelope leakage area for walls in high-rise housing?

Yes - 4 No - 1

Should the effect of wind be considered in calculating the limiting leakage area for envelopes in low-rise housing?

Yes - 4 No - 2

Should the effect of operation of exhaust fans be considered in calculating the limiting envelope leakage area for high-rise buildings?

Yes - 3 No - 2

Should the effect of operation of exhaust fans be considered in calculating the limiting envelope leakage area for low-rise buildings?

Yes - 2 No - 3

Should the effect of chimney operation be considered in calculating the limiting envelope leakage area for low rise buildings?

Yes - 2 No - 3

## SUMMARY OF ANSWERS TO ROUND ONE

What is your estimate of the moisture absorption capacity of the following materials, expressed as a percentage by weight?

| | | | |
|---|---|---|---|
| Wood sheathing (lumber) | MIN - 35% | AVE - 71% | MAX - 100% |
| Plywood sheathing | MIN - 25% | AVE - 51% | MAX - 100% |
| Fiberboard sheathing | MIN - 40% | AVE - 113% | MAX - 200% |
| Gypsum Sheathing | MIN - 10% | AVE - 35% | MAX - 80% |
| Wafer board sheathing | MIN - 15% | AVE - 51% | MAX - 100% |
| Expanded polystyrene | MIN - 0% | AVE - 47% | MAX - 150% |

What is your estimate of the moisture absorption capacity of the following materials, expressed as a percentage by weight?

| | | | |
|---|---|---|---|
| Wood siding | MIN - 20% | AVE - 48% | MAX - 100% |
| Plywood | MIN - 15% | AVE - 43% | MAX - 100% |
| Hardboard siding | MIN - 15% | AVE - 20% | MAX - 25% |
| Stucco | MIN - 6% | AVE - 23% | MAX - 60% |
| Brick masonry | MIN - 5% | AVE - 13% | MAX - 30% |
| Precast concrete | MIN - 2% | AVE - 8% | MAX - 15% |
| Lightweight concrete | MIN - 15% | AVE - 34% | MAX - 80% |

TO THE PARTICIPANTS OF ROUND THREE

A Summary of the responses received for Round Two is attached for your information.

This third round questionnaire deals with limiting moisture contents relating to the deterioration of a variety of materials.

Please Fax a copy of your completed questionnaire to the attention of Gustav Handegord, TROW Consulting Engineers. Fax: (416) 793-0641.

What is your estimate of

The moisture content above which serious deterioration of the following materials may begin to occur?

expressed as a percentage by weight

| | |
|---|---|
| Wood | % |
| Plywood | % |
| Fiberboard | % |
| Wafer board | % |
| Hardboard | % |
| Gypsum Sheathing | % |
| Expanded polystyrene | % |

What is your estimate of

The moisture content above which serious frost damage to the following materials may occur?

expressed as a percentage by weight

| | |
|---|---|
| Stucco | % |
| Brick masonry | % |
| Precast concrete | % |
| Lightweight concrete masonry | % |

## SUMMARY OF RESPONSES TO ROUND TWO

In calculating the equivalent leakage area (ELA) for a WOOD-FRAME WALL, what value should be used as the exponent for the pressure difference factor?

| | | |
|---|---|---|
| MIN - 0.6 | AVE - 0.7 | MAX - 0.725 |

In calculating the equivalent leakage area (ELA) for a MASONRY WALL of a high-rise residential building, what value should be used as the exponent for the pressure difference factor?

| | | |
|---|---|---|
| MIN - 0.6 | AVE - 0.7 | MAX - 0.8 |

What levels of temperature and relative humidity are likely to be maintained in a residential occupancy in winter?

converted to dewpoint temperature

| | | |
|---|---|---|
| MIN - minus 6° C | AVE - 4.8° C | MAX - 14° C |

Should the equivalent leakage area (ELA) of the top floor ceiling in a low-rise wood-frame house be considered as LESS than, EQUAL to, or GREATER than the equivalent leakage area of the walls, windows and doors?

LESS - 5 EQUAL - 3 GREATER - 1

Should the AVERAGE wind velocity for the month be used in calculating the limiting envelope leakage area for walls?

Yes - 8 No - 1

Should the INCREASE IN WIND VELOCITY WITH HEIGHT be considered in calculating the limiting leakage area for envelopes in high-rise housing?

Yes - 8 No - 1

What is your estimate of the negative pressure created by the operation of an exhaust fan in a residential occupancy?

| | | |
|---|---|---|
| MIN - 0 Pa | AVE - 3 Pa | MAX - 10 Pa |

What is your estimate of the maximum moisture absorption likely to occur when the following materials are continuously wetted on one face, expressed as a percentage by weight?

| | | | |
|---|---|---|---|
| Wood sheathing | MIN - 40% | AVE - 62.5% | MAX - 100% |
| Plywood sheathing | MIN - 30% | AVE - 48% | MAX - 80% |
| Fiberboard sheathing | MIN - 60% | AVE - 140 % | MAX - 300% |
| Gypsum Sheathing | MIN - 20% | AVE - 44% | MAX - 75% |
| Wafer board sheathing | MIN - 20% | AVE - 61% | MAX - 100% |
| Expanded polystyrene | MIN - 0% | AVE - 96% | MAX - 200% |

What is your estimate of the maximum moisture absorption likely to occur when the following materials are continuously wetted on one face, expressed as a percentage by weight?

| | | | |
|---|---|---|---|
| Wood siding | MIN - 25% | AVE - 49% | MAX - 100% |
| Plywood | MIN - 20% | AVE - 49% | MAX - 75% |
| Hardboard siding | MIN - 10% | AVE - 25% | MAX - 40% |
| Stucco | MIN - 5% | AVE - 22% | MAX - 50% |
| Brick masonry | MIN - 10% | AVE - 20% | MAX - 30% |
| Precast concrete | MIN - 5% | AVE - 14.5% | MAX - 25% |
| LW conc. masonry | MIN - 10% | AVE - 31% | MAX - 60% |

It has been suggested that the indoor temperature and humidity levels for residential occupancies will vary with the region in Canada. What is your estimate of the temperature and relative humidity likely to be maintained in residential occupancies in the following regions?

converted to dewpoint temperature

WEST COAST

| | | |
|---|---|---|
| MIN - 4° C | AVE - 9.7° C | MAX - 15° C |

PRAIRIES

| | | |
|---|---|---|
| MIN - minus 6° C | AVE - 2.6° C | MAX - 6.5° C |

OTTAWA

| | | |
|---|---|---|
| MIN - 0° C | AVE - 4.8° C | MAX - 12° C |

TORONTO

| | | |
|---|---|---|
| MIN - 3° C | AVE - 6.5° C | MAX - 9° C |

EAST COAST

| | | |
|---|---|---|
| MIN - 4° C | AVE - 10° C | MAX - 15° C |

*PLEASE ENTER YOUR ANSWER*

What is your estimate of the moisture absorption capacity of the following materials, expressed as a percentage by weight?

| | |
|---|---|
| Wood sheathing (lumber) | % |
| Plywood sheathing | % |
| Fiberboard sheathing | % |
| Gypsum Sheathing | % |
| Wafer board sheathing | % |
| Expanded polystyrene | % |

What is your estimate of the moisture absorption capacity of the following materials, expressed as a percentage by weight?

| | |
|---|---|
| Wood siding | % |
| Plywood | % |
| Hardboard siding | % |
| Stucco | % |
| Brick masonry | % |
| Precast concrete | % |
| Lightweight concrete masonry | % |

TO THE PARTICIPANTS OF ROUND TWO

A Summary of the responses received for Round One is attached, indicating the range and arithmetical average of numerical values suggested and the number of "yes" and "no" answers provided to the questions. You are requested to review these results and to provide your considered responses to the enclosed, second round questionaire.

Please note that some of the questions are new or have been modified.

Please Fax a copy of your completed questionnaire to the attention of Gustav Handegord, TROW Consulting Engineers. Fax: (416) 793-0641.

*PLEASE ENTER OR CIRCLE YOUR RESPONSES*

In calculating the equivalent leakage area (ELA) for a WOOD-FRAME WALL, what value should be used as the exponent for the pressure difference factor?

[ ]

In calculating the equivalent leakage area (ELA) for a MASONRY WALL of a high-rise residential building, what value should be used as the exponent for the pressure difference factor?

[ ]

What levels of temperature and relative humidity are likely to be maintained in a residential occupancy in winter?

[ ° C and %rh ]

Should the equivalent leakage area (ELA) of the top floor ceiling in a low-rise wood-frame house be considered as LESS than, EQUAL to, or GREATER than the equivalent leakage area of the walls, windows and doors?

LESS EQUAL GREATER

Should the AVERAGE wind velocity for the month be used in calculating the limiting envelope leakage area for walls?

Yes No

**Should the INCREASE IN WIND VELOCITY WITH HEIGHT be considered in calculating the limiting leakage area for envelopes in high-rise housing?**

Yes No

What is your estimate of the negative pressure created by the operation of an exhaust fan in a residential occupancy?

[ Pa ]

*PLEASE ENTER YOUR ANSWER*

What is your estimate of the maximum moisture absorption likely to occur when the following materials are continuously wetted on one face, expressed as a percentage by weight?

| | |
|---|---|
| Wood sheathing (lumber) | % |
| Plywood sheathing | % |
| Fiberboard sheathing | % |
| Gypsum Sheathing | % |
| Wafer board sheathing | % |
| Expanded polystyrene | % |

What is your estimate of the maximum moisture absorption likely to occur when the following materials are continuously wetted on one face, expressed as a percentage by weight?

| | |
|---|---|
| Wood siding | % |
| Plywood | % |
| Hardboard siding | % |
| Stucco | % |
| Brick masonry | % |
| Precast concrete | % |
| Lightweight concrete masonry | % |

It has been suggested that the indoor temperature and humidity levels for residential occupancies will vary with the region in Canada. What is your estimate of the temperature and relative humidity likely to be maintained in residential occupancies in the following regions?

WEST COAST

| |
|---|
| ° C and %rh |

PRAIRIES

| |
|---|
| ° C and %rh |

OTTAWA

| |
|---|
| ° C and %rh |

TORONTO

| |
|---|
| ° C and %rh |

EAST COAST

| |
|---|
| ° C and %rh |

## SUMMARY OF RESPONSES TO ROUND ONE

In calculating the equivalent leakage area (ELA) for a building envelope, what value should be used as the exponent for the pressure difference factor?

| | | |
|---|---|---|
| MIN - 0.65 | AVE - 0.725 | MAX - 0.8 |

What level of temperature and relative humidity is likely to be maintained in a residential occupancy in winter?

| | | |
|---|---|---|
| MIN - 21°C 30% | AVE - 6.8°C dewpoint | MAX - 22°C 60% |

Should the leakage through the top floor ceiling be considered in estimating the height of the neutral pressure plane in low-rise wood-frame housing?

Yes - 4 No - 1

Should the effect of wind be considered in calculating the limiting envelope leakage area for walls in high-rise housing?

Yes - 4 No - 1

Should the effect of wind be considered in calculating the limiting leakage area for envelopes in low-rise housing?

Yes - 4 No - 2

Should the effect of operation of exhaust fans be considered in calculating the limiting envelope leakage area for high-rise buildings?

Yes - 3 No - 2

Should the effect of operation of exhaust fans be considered in calculating the limiting envelope leakage area for low-rise buildings?

Yes - 2 No - 3

Should the effect of chimney operation be considered in calculating the limiting envelope leakage area for low rise buildings?

Yes - 2 No - 3

## SUMMARY OF ANSWERS TO ROUND ONE

What is your estimate of the moisture absorption capacity of the following materials, expressed as a percentage by weight?

| | | | |
|---|---|---|---|
| Wood sheathing (lumber) | MIN - 35% | AVE - 71% | MAX - 100% |
| Plywood sheathing | MIN - 25% | AVE - 51% | MAX - 100% |
| Fiberboard sheathing | MIN - 40% | AVE - 113% | MAX - 200% |
| Gypsum Sheathing | MIN - 10% | AVE - 35% | MAX - 80% |
| Wafer board sheathing | MIN - 15% | AVE - 51% | MAX - 100% |
| Expanded polystyrene | MIN - 0% | AVE - 47% | MAX - 150% |

What is your estimate of the moisture absorption capacity of the following materials, expressed as a percentage by weight?

| | | | |
|---|---|---|---|
| Wood siding | MIN - 20% | AVE - 48% | MAX - 100% |
| Plywood | MIN - 15% | AVE - 43% | MAX - 100% |
| Hardboard siding | MIN - 15% | AVE - 20% | MAX - 25% |
| Stucco | MIN - 6% | AVE - 23% | MAX - 60% |
| Brick masonry | MIN - 5% | AVE - 13% | MAX - 30% |
| Precast concrete | MIN - 2% | AVE - 8% | MAX - 15% |
| Lightweight concrete | MIN - 15% | AVE - 34% | MAX - 80% |

TO THE PARTICIPANTS OF ROUND THREE

A Summary of the responses received for Round Two is attached for your information.

This third round questionnaire deals with limiting moisture contents relating to the deterioration of a variety of materials.

Please Fax a copy of your completed questionnaire to the attention of Gustav Handegord, TROW Consulting Engineers. Fax: (416) 793-0641.

What is your estimate of

The moisture content above which serious deterioration of the following materials may begin to occur?

expressed as a percentage by weight

| | |
|---|---|
| Wood | % |
| Plywood | % |
| Fiberboard | % |
| Wafer board | % |
| Hardboard | % |
| Gypsum Sheathing | % |
| Expanded polystyrene | % |

What is your estimate of

The moisture content above which serious frost damage to the following materials may occur?

expressed as a percentage by weight

| | |
|---|---|
| Stucco | % |
| Brick masonry | % |
| Precast concrete | % |
| Lightweight concrete masonry | % |

## SUMMARY OF RESPONSES TO ROUND TWO

In calculating the equivalent leakage area (ELA) for a WOOD-FRAME WALL, what value should be used as the exponent for the pressure difference factor?

| MIN - 0.6 | AVE - 0.7 | MAX - 0.725 |
|---|---|---|

In calculating the equivalent leakage area (ELA) for a MASONRY WALL of a high-rise residential building, what value should be used as the exponent for the pressure difference factor?

| MIN - 0.6 | AVE - 0.7 | MAX - 0.8 |
|---|---|---|

What levels of temperature and relative humidity are likely to be maintained in a residential occupancy in winter?

converted to dewpoint temperature

| MIN - minus 6° C | AVE - 4.8° C | MAX - 14° C |
|---|---|---|

Should the equivalent leakage area (ELA) of the top floor ceiling in a low-rise wood-frame house be considered as LESS than, EQUAL to, or GREATER than the equivalent leakage area of the walls, windows and doors?

LESS - 5 EQUAL - 3 GREATER - 1

Should the AVERAGE wind velocity for the month be used in calculating the limiting envelope leakage area for walls?

Yes - 8 No - 1

Should the INCREASE IN WIND VELOCITY WITH HEIGHT be considered in calculating the limiting leakage area for envelopes in high-rise housing?

Yes - 8 No - 1

What is your estimate of the negative pressure created by the operation of an exhaust fan in a residential occupancy?

| MIN - 0 Pa | AVE - 3 Pa | MAX - 10 Pa |
|---|---|---|

What is your estimate of the maximum moisture absorption likely to occur when the following materials are continuously wetted on one face, expressed as a percentage by weight?

| | | | |
|---|---|---|---|
| Wood sheathing | MIN - 40% | AVE - 62.5% | MAX - 100% |
| Plywood sheathing | MIN - 30% | AVE - 48% | MAX - 80% |
| Fiberboard sheathing | MIN - 60% | AVE - 140 % | MAX - 300% |
| Gypsum Sheathing | MIN - 20% | AVE - 44% | MAX - 75% |
| Wafer board sheathing | MIN - 20% | AVE - 61% | MAX - 100% |
| Expanded polystyrene | MIN - 0% | AVE - 96% | MAX - 200% |

What is your estimate of the maximum moisture absorption likely to occur when the following materials are continuously wetted on one face, expressed as a percentage by weight?

| | | | |
|---|---|---|---|
| Wood siding | MIN - 25% | AVE - 49% | MAX - 100% |
| Plywood | MIN - 20% | AVE - 49% | MAX - 75% |
| Hardboard siding | MIN - 10% | AVE - 25% | MAX - 40% |
| Stucco | MIN - 5% | AVE - 22% | MAX - 50% |
| Brick masonry | MIN - 10% | AVE - 20% | MAX - 30% |
| Precast concrete | MIN - 5% | AVE - 14.5% | MAX - 25% |
| LW conc. masonry | MIN - 10% | AVE - 31% | MAX - 60% |

It has been suggested that the indoor temperature and humidity levels for residential occupancies will vary with the region in Canada. What is your estimate of the temperature and relative humidity likely to be maintained in residential occupancies in the following regions?

converted to dewpoint temperature

WEST COAST

| | | |
|---|---|---|
| MIN - 4° C | AVE - 9.7° C | MAX - 15° C |

PRAIRIES

| | | |
|---|---|---|
| MIN - minus 6° C | AVE - 2.6° C | MAX - 6.5° C |

OTTAWA

| | | |
|---|---|---|
| MIN - 0° C | AVE - 4.8° C | MAX - 12° C |

TORONTO

| | | |
|---|---|---|
| MIN - 3° C | AVE - 6.5° C | MAX - 9° C |

EAST COAST

| | | |
|---|---|---|
| MIN - 4° C | AVE - 10° C | MAX - 15° C |

## SUMMARY OF RESPONSES TO ROUND 3

What is your estimate of

The moisture content above which serious deterioration of the following materials may begin to occur?

expressed as a percentage by weight

| | | | |
|---|---|---|---|
| Wood | MIN -.22% | AVE - 39% | MAX - 100% |
| Plywood | MIN - 22% | AVE - 30% | MAX - 50% |
| Fiberboard | MIN - 15% | AVE - 35% | MAX - 80% |
| Waferboard | MIN - 10% | AVE - 22% | MAX - 30% |
| Hardboard | MIN - 10% | AVE - 20% | MAX - 30% |
| Gypsum Sheath. | MIN - 10% | AVE - 30% | MAX - 95% |
| Expanded PStyrene | MIN - 50% | AVE - 81% | MAX - 100% |

What is your estimate of

The moisture content above which serious frost damage to the following materials

may occur?

expressed as a percentage by weight

| | | | |
|---|---|---|---|
| Stucco | MIN - 10% | AVE - 16% | MAX - 30% |
| Brick masonry | MIN - 8% | AVE - 16% | MAX - 25% |
| Precast concrete | MIN - 8% | AVE - 19% | MAX - 40% |
| Lightweight concrete | MIN - 6% | AVE - 32% | MAX - 70% |

## APPENDIX B

## THE COMPUTER PROGRAM

**EMPTY - Instructions For Use**

1. EMPTY comes as two diskettes. One contains the program itself in a compiled and ASCII format. The second diskette contains the weather data files.

2. Both copies should be copied onto your hard drive, if you have one and excuted from there.

3. To run the program access the drive containing EMPTY and type EMPTY. Then hit **return** and the program will commence.

4. The program is menu driven and simple to use. When the program requests the drive containing the weather files simply enter the letter of the drive, e.g., C or A etc.

```
rem *** AIR LEAKAGE MODEL
rem *** Programmed by Louis Reginato
rem *** 89/07/01
rem *****************
rem ** Variables used
rem *****************
rem
rem absorb(i,1) = absorbed water in component at plane 1
rem absorb(i,2) = absorbed water in component at plane 2
rem atpres = atmospheric pressure
rem cond4 = condensation at plane 2
rem cond5 = condensation at plane 2 when plane 1 is dry
rem cond4(i) = summation of condensation at plane 2
rem cond5(i) = summation condensation at plane 2 when plane 1 dry
rem condendr(i,1) = water draining from plane 1
rem condendr(i,2) = water draining from plane 2
rem dbocc(i,j) = dry-bulb occurrences in hours of a temperature bin
rem evap1(i) = evaporation from plane 1
rem evap2(i) = evaporation from plane 2
rem evap4 = evaporation from plane 2
rem evap5 = evaporation from plane 2 when plane 1 is dry
rem evap4(i) = summation of evaporation from plane 4
rem evap5(i) = summation of evaporation from plane 5 when plane 1 is dry
rem intemp = interior temperature
rem indew = interior dewpoint temperature
rem k1 = lower bound of temperatuer bin
rem k2 = upper bound of temperature bin
rem larea = leakage area
rem massfl(i) = mass flow for month i
rem maxabs = maximum water storage of component (kg)
rem mon$(i) = array storing months
rem net(i) = net accumulation at plane 1 (cond - evap)
rem outemp = outdoor temperature
rem pressdiff(i) = pressure difference across wall
rem tempsh1 = temperature at plane 1 that corresponds to inputted lower
rem          bound of temperature range of bin data.
rem tempbr1 = temperature at plane 2 that corresponds to inputted lower
rem           bound of temperature range of bin data.
rem w1 = humidity ratio at first condensation plane
rem w2 = humidity ratio at second condensation plane
rem water(i,1 or 2) = water to be absorbed vby plane 1 or 2
rem wallbr(i) = resistance to plane 2
rem wallrt(i) = total resistance of wall type
rem wallshr(i) = resistance to plane 1
rem win = interior humidity ratio
rem wnet1 = humidity ratio at plane 1 x number of hours of occurence (db
rem         for one temperature bin (condensation)
rem wnet2 = humidity ratio at plane 2 x number of hours of occurence (db
rem         for one temperature bin (condensation)
rem wnet3 = humidity ratio at plane 1 x number of hours of occurence (db
rem         for one temperature bin (evaporation)
rem wnet4 = humidity ratio at plane 2 x number of hours of occurence (db
rem         for one temperature bin (can be either evaporation or conden
rem         depending on the outdoor temperature).
rem wnet5 = humidity ratio at plane 2 x number of hours of occurence (db
```

```
rem          for one temperature bin (used to calculate the evaporation f
rem          plane 2 when plane one is dry)
rem wnet1(i) to wnet5(i) = the summation of the above for one month.
rem *******************
rem
1 CLEAR:CLS
  ON ERROR GOTO 40000
  false%=0:true%=not false:dim mon$(24):dim shdew(12,12):dim brdew(12,12
  DIM water(24,2)
  DIM OUTEMP(12)
  DIM DBOCC(35,7),CWB(35,7),DBBIN(35,2),WBOCC(35,7),CDB(35,7)
  DIM DBO(12,35,7),CBO(12,35,7),K1(12,35),K2(12,35)
  DIM WBBIN(35,2),TMG(12),HDH(9,7),DHB(9),CDH(9,7),SOLM(35),HRSOL(35)
  DIM SOLD(5),HWND(4,7),WSP(7),DBAV(7),WBAV(7),WDIR$(4,7),CITY$(11),FLNS
  DIM HR(35,7),HDHR(35,7),CDHR(35,7),TMP(35),HHH(7),CCC(7)
  dim w(35),wnet1(24),wnet2(24),wnet3(24),wnet4(24),wnet5(24),absorb(24,
  dim isum(24),condendr(24,2),cond(24,2),evap5(24),cond5(24),evap4(24),c
  dim massfl(24),evap2(24),evap1(24),net(24)
  dim cond11(24),evap11(24),wnetdry1(24)
  dim typ$(12),potrothr(24),maxabs1(8),maxabs2(8)
  wallrt(1) = 2.55:wallshr(1) = 2.31:wallbr(1) = 2.45
  wallrt(5) = 3.59:wallbr(5) = 3.49
  wallrt(3) = 3.8:wallshr(3) = 2.3:wallbr(3) = 3.7
  wallrt(4) = 3.6:wallshr(4) = 2.3:wallbr(4) = 3.5
  wallrt(2) = 2.67:wallshr(2)=2.31:wallbr(2) = 2.56
  wallrt(6) = 3.8:wallbr(6) = 3.7
  wallrt(7) = 2.8:wallbr(7) = 0.44
  wallrt(8) = 4.1:wallbr(8) = 2.4
  mon$(1) = "Jan":mon$(2) = "Feb":mon$(3) = "Mar":mon$(4) = "Apr"
  mon$(5) = "May":mon$(6) = "Jun":mon$(7) = "Jul":mon$(8) = "Aug"
  mon$(9) = "Sep":mon$(10) = "Oct":mon$(11) = "Nov":mon$(12) = "Dec"
  typ$(1)="1.  Typical residential wall, 5/8in waferboard, 1/4in hardboa
  typ$(2)="2.  High Rise, insulation between stds, gyp sheath and brick"
  typ$(3)="3.  Resid wall constr with 2x4 stds and 1 1/2 EPS insul sheat
  typ$(4)="4.  Resid wall constr with 2x4 stds and 1 1/2 glass insul she
  typ$(6)="6.  Standard Residential, with EPS sheathing, 1/4in hdbrd"
  typ$(5)="5.  Conc Blk, 3in batt insul, air spce and brk or precst clac
  typ$(7)="7.  Metal studs (no insul) and insulcrete type cladding"
  typ$(8)="8.  Metal studs, 3 1/2in insul and insulcrete type cladding"
rem *****Initilaization
rem ***** atmospheric pressure
  atpres = 101.325
rem ***** number of hours in month
  monhr = 720
rem ***** maximum absorption of water, kg/m2
  maxabs = 1.60
rem ***************
rem *************** Set up the Main Menu
   LOCATE 1,10:PRINT"AIR LEAKAGE MODEL - Main Menu"
   locate 3,10:print"The following eight wall types can be used in"
   locate 4,10:print"the air leakage model"
   locate 5,10:print"  "
   locate 6,10:print"    LOW RISE RESIDENTIAL"
   locate 7,10:print"1.  Typical residential wall construction with 2 x
   locate 8,10:print"2.  Typical residential wall construction with 2 x
```

```
    locate 9,10:print"3.  Typical residential wall construction with 2 x
    locate 10,10:print"    1 1/2 extruded polystyrene insulated sheathing
    locate 11,10:print"4.  Typical residential wall construction with 2 x
    locate 12,10:print"    1 1/2 Glascad insulated sheathing"
    locate 14,10:print"   HIGH RISE"
    locate 15,10:print"5.  Metal studs (3 1/2in insul) air space and bric
    locate 16,10:print"6.  Conc Blk, 3in batt insul, air space, and brick
    locate 17,10:print"7.  Metal studs (no insul) and insulcrete type cla
    locate 18,10:print"8.  Metal studs, 3 1/2in insul and insulcrete type
    locate 20,10:print"9.  exit to DOS"
rem ******************
rem ** Input routine
rem ******************
10  locate 23,10:print"Select a wall type":locate 23,29,,7,7
20  opt$ = inkey$:if opt$="" then 20
    opt = val(opt$):if opt <1 or opt >9 then 10
    selct = opt
    if opt <>  9 goto 40
    cls:locate 8,22:print"Are you certain (Y/N)"
30  answer$=inkey$:if answer$="" then 30
    if answer$ ="n" or answer$="N" then goto 1
       locate 10,22:print"See you later"
       system
40  locate 23,29:print opt
rem print wallrt(opt);wallbr(opt);wallshr(opt):stop
rem ****************** Input the interior temperatures
45  cls
    LOCATE 1,10:PRINT"AIR LEAKAGE MODEL - Main Menu"
    locate 3,10:input"Input the interior temperature, C deg ";intemp
    locate 4,10:input"Input the interior dewpoint, C deg ";indew
    locate 5,10:input"Input the leakage area, m^2/m^2 ";larea
    locate 7,10:input"Input the number of the month to begin simulation"
    locate 9,10:print"Do you want to change the inputs (y/n)?"
50  answer$=inkey$:if answer$="" then 50
    if answer$ ="Y" or answer$="y" then goto 45
rem *************************
100 rem ********************* lets calculate the other properties
    x = indew:gosub 21010
    win = 0.6219*(svp/1000)/(atpres-svp/1000)
    pv =svp
    x = intemp:gosub 21010
    rh=pv/svp*100
rem ************************
rem ****** find exterior temp that corresponds to plane1 = interior dewp
    if selct > 4 and selct < 9 then
       outemp = intemp -(intemp-indew)*wallrt(selct)/wallbr(selct)
    else
       outemp = intemp - (intemp-indew)*wallrt(selct)/wallshr(selct)
       tempbr = intemp - wallbr(selct)/wallrt(selct)*(intemp-outemp)
    end if
rem ******* assign max absorption values to inside and outside planes
    maxabs1(1)=1.50:maxabs2(1)=.54
    maxabs1(2)=3.05:maxabs2(2)=32.50
    maxabs1(3)=1.60:maxabs2(3)=1.60
    maxabs1(4)=1.60:maxabs2(4)=1.60
```

```
    maxabs1(5)=0.00:maxabs2(5)=.54
    maxabs1(6)=0.00:maxabs2(6)=0.54
    maxabs1(7)=1.60:maxabs2(7)=1.60
    maxabs1(8)=1.60:maxabs2(8)=1.60
rem ***** off to bin computations
    gosub 22010
rem ************************* lets calculate condensation and accumulat
    if monum-1 = 0 then goto 500
    for i = 1 to (monum-1)
        wnetspl(i+12) = wnetspl(i):wnetspl(i)=0
        wnet1(i+12) = wnet1(i):wnet1(i) = 0
        wnet2(i+12) = wnet2(i):wnet2(i)= 0
        wnet3(i+12) = wnet3(i):wnet3(i) = 0
        wnet4(i+12) = wnet4(i):wnet4(i) = 0
        wnet5(i+12) = wnet5(i):wnet5(i) = 0
        evapspl(i+12) = evapspl(i):evapspl(i) = 0
        evapsp2(i+12) = evapsp2(i):evapsp2(i) = 0
        condspl(i+12) = condspl(i):condspl(i) = 0
        condsp2(i+12) = condsp2(i)::condsp2(i) = 0
        evap4(i+12) = evap4(i):evap4(i) = 0
        cond4(i+12) = cond4(i):cond4(i) = 0
        evap5(i+12) = evap5(i):evap5(i) = 0
        cond5(i+12) = cond5(i):cond5(i) = 0
        mon$(i+12) = mon$(i)
        potrothr(i+12)=potrothr(i)
        bght(i+12)=bght(i)
     next i
500 rem *** bin analysis
    for i = monum to (12+(monum-1))
    if selct > 4 then
       wnet2(i) = wnet2(i) + condsp2(i)
       wnet4(i) = wnet4(i) + evapsp2(i)
       evap4(i) = evap4(i) + evapsp2(i)
       goto 501
    end if
    rem ************
    rem **** plane 1
    rem ************
    if absorb((i-1),2) > .0000001 then
       wnet1(i) = wnet1(i) + wnetspl(i)
       wnet2(i) = wnet2(i) + condsp2(i)
       wnet4(i) = wnet4(i) + evapsp2(i)
       evap4(i) = evap4(i) + evapsp2(i)
       evap5(i) = evap5(i) + evapsp2(i)
    else
       wnet1(i) = wnet1(i) + condspl(i) + wnetspl(i)
       wnet2(i) = wnet2(i) + condsp2(i)
       wnet3(i) = wnet3(i) + evapspl(i)
    end if
rem print wnet1(i);wnetspl(i)
501 water(i,1) = wnet1(i):rem print wnet1(1)
    cond(i,1) = water(i,1):rem PRINT COND(I,1)
    net1(i) = cond(i,1)
    if wnet3(i) > 0 then
       evap1(i) = wnet3(i)
```

```
         net1(i) = cond(i,1)-wnet3(i)
      end if
      absorb(i,1) = absorb((i-1),1)+net1(i)
      if absorb(i,1) > maxabs1(selct) then
         condendr(i,1) = absorb(i,1)-maxabs1(selct)
         absorb(i,1) = maxabs1(selct)
      end if
      if absorb(i,1) < 0 then
         absorb(i,1) = 0
      end if
      rem *************************
      rem ***** plane2 condensation
      rem *************************
      water(i,2) = wnet2(i):rem print wnet1(1)
      cond(i,2) = water(i,2)
      net2(i) = cond(i,2)
  rem determine condensation/evaporation
      cond(i,2) = water(i,2)-cond4(i)
      evap2(i) = evap4(i)
      net2(i) = cond(i,2)-evap2(i)
      if selct > 4 then goto 599
  rem  if the moisture content of the material in plane 1 = 0
  rem  then moisture removal from plane two based on interior W
       if absorb(i,1) < .00002 then
          evap2(i) = evap5(i)
          cond(i,2) = wnet2(i)-cond5(i)
          absorb(i,2) = absorb((i-1),2) - evap2(i)+cond(i,2)
          if absorb(i,2) < 0 then
             absorb(i,2) = 0
          end if
          goto 600
       end if
  599  absorb(i,2) = absorb((i-1),2)+net2(i)
  600  if absorb(i,2) > maxabs2(selct) then
          condendr(i,2) = absorb(i,2)-maxabs2(selct)
          absorb(i,2) = maxabs2(selct)
       end if
       if absorb(i,2) < 0 then
          absorb(i,2) = 0
       end if
  700 next i
  rem ****lets print the stuff out
  cls
  print "Wall type = ";
  print typ$(selct)
  print " "
  print "             Plane 1 - kg/m^2          ¦             Plane 2 - kg/m^2
  print "MON";" ";" ";"Conden";"   ";"Evap";"    ";"Drain";"  ";" Absorb";
  print " ¦ ";" Conden";"   Evap    ";"Drain";" ";" Absorb"
  print "-----------------------------------------------------------------------
  print "                                       ¦  "
  for i = monum to (12+(monum-1))
      print mon$(i);
      print "  ";
      print using "##.####";cond(i,1);
```

```
    print "  ";
    print using "#.####";evap1(i);
    print "  ";
    print using "#.####";condendr(i,1);
    print  "  ";
    print using "#.####";absorb(i,1);
    print " | ";
    print using "##.####";cond(i,2);
    print "  ";
    print using "#.####";evap2(i);
    print "  ";
    print using "#.####";condendr(i,2);
    print "  ";
    print using "##.####";absorb(i,2)
rem    print " ";
rem    print using "###";potrothr(i);
rem    print " ";
rem    print using "###";bght(i)
next i
    print "  "
    print "interior temp = ";
    print using "##.##";intemp;
    print " deg C";
    print "                         ";city$(nc)
    print "interior dewpoint = ";
    print using "##.##";indew;
    print " deg C"
    print "leakage area = ";
    print using "#.######";larea;
    print " m2/m2";
locate 22,40:print "Max absorb plane1 = ";
locate 22,60:print using "##.##";maxabs1(selct)
locate 23,40:print "Max absorb plane2 = ";
locate 23,60:print using "##.##";maxabs2(selct)
locate 24,1:input "Another run (y/n)";anrn$
if anrn$ = "Y" or anrn$ = "y" then
   restore
   clear
   goto 1
else
   cls
   print"          See you later alligator"
   system
end if
21000 rem ******************** calculate vapour pressure
21010 rem ******************** IF TEMPERATURE < 0 DEG CELSIUS
      TE = X
      TE = TE+273.15
      IF TE > 273.15 GOTO 21190
      C1 = -5674.5359#
      C2 = 6.3925247#
      C3 = -9.677841E-03
      C4 = .00000062215701#
      C5 = .0000000020747825#
      C6 = -9.484024E-13
```

```
      C7 = 4.1635019#
      LNSVP = C1/TE+C2+C3*TE+C4*TE^2+C5*TE^3+C6*TE^4+C7*LOG(TE)
      SVP = EXP(LNSVP)
      GOTO 21310
rem ********************
rem ********************  IF TEMPERATURE > 0 DEG CELSIUS  ************
21190 C8 = -5800.220651#
      C9 = 1.3914993#
      C10 = -.048640239#
      C11 = .000041764768#
      C12 = -.000000014452093#
      C13 = 6.5459673#
      LNSVP = C8/TE+C9+C10*TE+C11*TE^2+C12*TE^3+C13*LOG(TE)
      SVP = EXP(LNSVP)
21310 RETURN
22010 REM ** BIN WEATHER DATA READER. THIS PROGRAM REQUIRES DATA TO BE I
      REM ** FROM FILES CREATED BY BINGEN PROGRAMS (SI UNITS).
      REM ** READ CITY NAMES AND FILE NAMES FOR THIS DISKETTE.
      FOR I=1 TO 11:READ CITY$(I):NEXT I
      FOR I=1 TO 11:READ FLN$(I):NEXT I
      FOR J=1 TO 12:READ TMG(J):NEXT J
      CLS:INPUT"Which disk drive contains the bin data files (A, B, C, e
220   CLS:PRINT"****** BIN WEATHER DATA FOR CANADIAN & NORTHWEST CITIES
      PRINT:PRINT"SELECT APPROPRIATE CITY BY NUMBER, AS FOLLOWS:"
225   FOR I=1 TO 11:PRINT TAB(5);i;"... ";CITY$(I):NEXT I
      PRINT:INPUT NC:IF NC>11 THEN 225
      CTY$ = left$(city$(NC),3)
      OPEN"I",#2,DD$+":"+CTY$
      FOR  I = 1 TO 12
           INPUT#2,BGHT(I)
      NEXT
      CLOSE#2
      OPEN"I",#1,DD$+":"+FLN$(NC)
      REM ** INPUT BEGINS ONE MONTH AT A TIME.
      kend = 12
      SUM(MON) = 0
      cls
      FOR MON=1 TO KEND
rem   cls
      INPUT#1,TITL$
      PRINT TITL$
      REM ** READ DRY-BULB BINS.
      FOR I=1 TO 35
      INPUT#1,K1
      K1(MON,I)=K1
rem ******* lets calculate the pressure diff, flow and mass flow
      tout = k1 + 273:tint = intemp + 273
      pressdiff(i) = abs(0.0342*1.5*101325*(1/tout-1/tint)):
      spvol = 287.1*(intemp+273.15)/(atpres-pv/1000)/1000
      kcoeff=1000*(.6*2^.5/((1/spvol)^.5))
      q(i) = kcoeff*l?area*pressdiff(i)^.7
      massfl(i) = q(i)/spvol*3600*.001
rem **** find temp of plane 1 based on temp interval lower base
      if selct > 4 then goto 227'only one plane for condensation
      tempsh1 = intemp - wallshr(selct)/wallrt(selct)*(intemp-k1)
```

```
        x = tempsh1:gosub 21010
        w1 = 0.6219*(svp/1000)/(atpres-svp/1000):rem print tempsh1,indew,c
   rem **** find temp of plane 2 based on temp interval lower base
   227  tempbr1 = intemp-wallbr(selct)/wallrt(selct)*(intemp-k1)
        x = tempbr1:gosub 21010
        w2 = 0.6219*(svp/1000)/(atpres-svp/1000)
   rem ****
        IF I=1 THEN 230
        IF KB-K1<>3 THEN 235
   230  INPUT#1,K2
        FOR J=1 TO 7
            INPUT #1,DBOCC(I,J),CWB(I,J)
            'add the number of hours to determine the potential for rot
            if selct > 4 and j = 7 and tempbr1 > 0 and tempbr1 < indew the
               potrothr(mon) = potrothr(mon)+dbocc(i,j)
            end if
            if j = 7 and tempsh1 > 0 and tempsh1 < indew then
               potrothr(mon) = potrothr(mon)+dbocc(i,j)
            end if
            if k1 > intemp and j = 7 then
               x = cwb(i,j):gosub 21010
               wprime = 0.622*(svp/1000)/(atpres - svp/1000)
               wout = wprime - 1.005*(k1 - cwb(i,j))/(2500 - 2.3*cwb(i,j))
   rem evaporation from plane 2
               ' print wout,w2
               if wout < w2 then
                  evapsp2 = (w2 - wout)*dbocc(i,j)
                  wnetsp4 = evapsp2
                  if selct > 4 then
                     goto 233
                  else
                      wnetsp1 = (w2 - w1)*dbocc(i,j)
                  end if
               else
   rem if outside air very humid then wout>w2 and condensation will occur
                  condsp2 = (wout - w2)*dbocc(i,j)
                  if selct > 4 then
                     goto 233
                  else
                     wnetsp1 = (w2- w1)*dbocc(i,j)
                  end if
               end if
               wnetspdry = (w1 - wout)*dbocc(i,j)
               if wnetspdry < 0 then
                  condsp1 = abs(wnetspdry)
               else
                  evapsp1 = abs(wnetspdry)
               end if
               goto 233
            end if
   rem calculate condensation at planes 1 and 2
   231      if j = 7 and outemp >= k1 then
               if selct > 4 then
                  wnet2 = (win-w2)*dbocc(i,j)
               else
```

```
               wnet2 = (w1-w2)*dbocc(i,j)
               wnet1 = (win-w1)*dbocc(i,j):rem print i,wnet1,win,w1
            end if
         end if
         rem calculate evaporation at planes 1 and 2
232      if j = 7 and outemp <= k1 then
         rem net accumulation of moisture
            if selct > 4 then
               wnet4 = (w2-win)*dbocc(i,j):
               goto 233
            else
               wnet4 = (w2-w1)*dbocc(i,j)
               wnet3 = (w1-win)*dbocc(i,j)
            end if
         rem evaporation if plane 1 is dry
            wnet5 = (w2-win)*dbocc(i,j)
         rem wnet4 < 0 then condensation, i.e., w1 > w2
            if wnet4 < 0 then
               cond4 = wnet4
         rem wnet > 0 then evaporation, i.e., w2 > w1
            elseif wnet4 > 0 then
               evap4 = wnet4
            end if
         rem wnet5 > 0 then evaporation, i.e., w2 > win
            if wnet5  > 0 then
               evap5 = wnet5:rem print evap5
         rem wnet5 < 0 then condensation, i.e., win > w2
            elseif wnet5 < 0 then
               cond5 = wnet5
            end if
         end if
233   NEXT J
      goto 2
      print using "###.#";k1;
      print " ";
      print using "#.###";massfl(i);
      print " ";
      print using "###.##";tempsh1;
      print " ";
      print using "#.######";w1;
      print " ";
      print using "###.##";tempbr1;
      print " ";
      print using "#.######";w2;
      print " ";
      print using "#.######";wout;
      print " ";
      print using "###";dbocc(i,7);
      print " ";
      print using "##.####";wnet2;
      print " ";
      print using "##.####";wnet1
2     wnetsp1(mon) = wnetsp1(mon)+wnetsp1*massfl(i)' accum at pln1 when
      wnet1(mon) = wnet1(mon)+wnet1*massfl(i)' cond at plane 1 (+)
      wnet2(mon) = wnet2(mon)+wnet2*massfl(i)' cond at plane 2 (+)
```

```
        wnet3(mon) = wnet3(mon)+wnet3*massfl(i)' evap at plane 1 (+)
        wnet4(mon) = wnet4(mon)+wnet4*massfl(i)' net evap/cond at pln2 (-
        wnet5(mon) = wnet5(mon)+wnet5*massfl(i)' net evap/cond at pln2 if
        evapsp1(mon) = evapsp1(mon)+evapsp1*massfl(i)' evap at pln1 (pln2
        evapsp2(mon) = evapsp2(mon)+evapsp2*massfl(i)' evap at pln2 (+),
        condsp1(mon) = condsp1(mon)+condsp1*massfl(i)' cond at pln1 (pln2
        condsp2(mon) = condsp2(mon)+condsp2*massfl(i)' cond at pln2 (wout
        evap4(mon) = evap4(mon)+evap4*massfl(i)' evap at pln2 (+)
        cond4(mon) = cond4(mon)+cond4*massfl(i)' cond at pln2 (-)
        evap5(mon) = evap5(mon)+evap5*massfl(i)' evap at pln2 (pln1 dry)
        cond5(mon) = cond5(mon)+cond5*massfl(i)' evap at pln2 (pln1 dry)
goto 5
locate i,1:print using "##.##";wnetsp1(mon);
     print using "##.####";wnet1(mon);
     print using "##.####";wnet2(mon);
     print using "##.####";wnet3(mon);
     print using "##.####";wnet4(mon);
     print using "##.####";wnet5(mon)
locate i+12,1:print using "##.##";evapsp1(mon);
      print using "##.####";evapsp2(mon);
      print using "##.####";condsp1(mon);
      print using "##.####";condsp2(mon);
      print using "##.####";evap4(mon);
      print using "##.####";cond4(mon);
      print using "##.####";evap5(mon);
      print using "##.####";cond5(mon)
rem   print wnet4(mon);wnet4
rem   print evapsp2(mon);evapsp2;massfl(i)
rem      print typ$(selct)
rem   print evap4(mon);evap4
5     INPUT#1,SOLM(I)
      DBBIN(I,1)=K1:DBBIN(I,2)=K2
      NDBB=I:KB=K1
      wnet1=0:wnet2=0:wnet3=0:wnet4=0:cond4=0:evap4=0:evapsp1 = 0
      evapsp2=0:wnet5=0:cond5=0:evap5=0:condsp2=0:condsp1=0:evapsp2=0
      wnetsp1=0
      NEXT I
      INPUT#1,K1
      REM ** READ WET-BULB BINS.
235   NWBB=0:KB=DBBIN(1,2)+1
      FOR I=1 TO 35
      IF I>1 THEN INPUT#1,K1
      IF K1<0 OR INT(K1)<K1 THEN 240
      IF K1>KB-1 THEN 240
      FOR J=1 TO 7
      INPUT#1,WBOCC(I,J),CDB(I,J):NEXT J
      WBBIN(I,1)=K1
      NWBB=I:IF K1=0 THEN 250
      KB=K1:NEXT I:GOTO 250
240   DBAV(1)=K1:FOR K=2 TO 7:INPUT#1,DBAV(K):NEXT K:GOTO 260
      REM ** READ AVERAGE VALUES.
250   FOR K=1 TO 7:INPUT#1,DBAV(K):NEXT K
260   FOR K=1 TO 7:INPUT#1,WBAV(K):NEXT K
      FOR K=1 TO 5:INPUT#1,SOLD(K):NEXT K
      FOR K=1 TO 7:INPUT#1,WSP(K):NEXT K
```

```
        REM ** READ WIND FREQUENCY CATEGORIES.
        FOR I=1 TO 4
        FOR J=1 TO 7
        INPUT#1,HWND(I,J):KK$="("
270     X$=INPUT$(1,#1)
        IF X$=CHR$(13) THEN 270
        IF X$<CHR$(34) THEN 275
        KK$=KK$+X$:GOTO 270
275     KK$=KK$+")":WDIR$(I,J)=KK$
        NEXT J:NEXT I
        IF MON=13 THEN INPUT#1,TITL$:PRINT TITL$
        REM ** READ DEGREE HOURS.
        FOR I=1 TO 9
        INPUT#1,DHB(I)
        FOR K=1 TO 7
        INPUT#1,HDH(I,K),CDH(I,K)
        NEXT K:NEXT I
        wnet1 = 0:wnet2=0:wnet3=0:wnet4=0:wnet5=0:conden4=0:evap4=0:evap5=
        wnetsp1 = 0:evap1 = 0:cond1 = 0:condsp1=0:condsp2=0:evapsp1=0:evap
        cond4=0:cond5=0:wnetspdry=0:wnetsp4=0:wout=0:w1=0:w2=0:potrothr=0
        if i = 4 then stop
        goto 4
3       a$=inkey$:if a$="" then goto 3
        if a$="N" or a$="n" then
           stop
        end if
4       NEXT MON
        rem for i = 1 to 12 :print wnet1(i):next i:stop:print wpart2(i):st
        close#1
        return
32002 DATA "EDMONTON, ALBERTA","VANCOUVER, B.C.","WINNIPEG, MANITOBA","T
32003 DATA "MONTREAL, QUEBEC","BOISE, IDAHO","GREAT FALLS, MONTANA","MED
32004 DATA "PORTLAND, OREGON","SEATTLE, WASHINGTON","BISMARCK, NORTH DAK
32005 DATA EDMONTON.ALB,VANCUVER.-BC,WINNIPEG.MAN,TORONTO.ONT
32006 DATA MONTREAL.QUE,BOISE.-ID,GRTFALLS.-MT,MEDFORD.-OR
32007 DATA PORTLAND.-OR,SEATTLE.-WA,BISMARCK.ND
32010 DATA 1,2,5,8,9,12,13,16,17,20,21,24
40000 if err = 75 then A$ = "        PATH/FILE ACCESS ERROR":GOTO 41000
      if err = 76 then A$ = "             PATH NOT FOUND":GOTO 41000
      if err = 71 then A$ = "             DISK NOT READY":GOTO 41000
      if err = 72 then A$ = "             DISK MEDIA ERROR":GOTO 41000
41000 CLS:LOCATE 12,20:PRINT A$
      LOCATE 15,22:PRINT"HIT ANY KEY TO RETURN TO MAIN MENU"
41010 ANSWER$=INKEY$:IF ANSWER$ = "" THEN 41010
REM   CLEAR
      RESUME 1
```

Wall type = 1. Typical residential wall, 5/8in waferboard, 1/4in hardboard

| | Plane 1 - kg/m^2 | | | | Plane 2 - kg/m^2 | | | |
|---|---|---|---|---|---|---|---|---|
| MON | Conden | Evap | Drain | Absorb | Conden | Evap | Drain | Absorb |
| Jun | 0.0013 | 0.2540 | 0.0000 | 0.0000 | 0.0000 | 0.2110 | 0.0000 | 0.0000 |
| Jul | 0.0019 | 0.2343 | 0.0000 | 0.0000 | 0.0000 | 0.1749 | 0.0000 | 0.0000 |
| Aug | 0.0008 | 0.2463 | 0.0000 | 0.0000 | 0.0000 | 0.2089 | 0.0000 | 0.0000 |
| Sep | 0.0031 | 0.2387 | 0.0000 | 0.0000 | 0.0022 | 0.2129 | 0.0000 | 0.0000 |
| Oct | 0.0116 | 0.1612 | 0.0000 | 0.0000 | 0.0123 | 0.1391 | 0.0000 | 0.0000 |
| Nov | 0.0952 | 0.0576 | 0.0000 | 0.0376 | 0.0427 | 0.0000 | 0.0000 | 0.0427 |
| Dec | 0.3531 | 0.0002 | 0.0000 | 0.3906 | 0.0522 | 0.0000 | 0.0000 | 0.0949 |
| Jan | 0.4837 | 0.0005 | 0.0000 | 0.8738 | 0.0494 | 0.0000 | 0.0000 | 0.1443 |
| Feb | 0.4177 | 0.0000 | 0.0000 | 1.2915 | 0.0452 | 0.0000 | 0.0000 | 0.1895 |
| Mar | 0.2261 | 0.0246 | 0.0000 | 1.4930 | 0.0492 | 0.0000 | 0.0000 | 0.2386 |
| Apr | 0.0426 | 0.0948 | 0.0000 | 1.4408 | 0.0375 | 0.0027 | 0.0000 | 0.2735 |
| May | 0.0015 | 0.2385 | 0.0000 | 1.2038 | 0.0238 | 0.0053 | 0.0000 | 0.2920 |

interior temp = 22.00 deg C
interior dewpoint = 4.80 deg C
leakage area = 0.000042 m2/m2

MONTREAL, QUEBEC

Max absorb plane1 = 1.50
Max absorb plane2 = 0.54

Another run (y/n)?

Wall type = 1. Typical residential wall, 5/8in waferboard, 1/4in hardboard

| | Plane 1 - kg/m^2 | | | | Plane 2 - kg/m^2 | | | |
|---|---|---|---|---|---|---|---|---|
| MON | Conden | Evap | Drain | Absorb | Conden | Evap | Drain | Absorb |
| Jun | 0.0025 | 0.2424 | 0.0000 | 0.0000 | 0.0002 | 0.1771 | 0.0000 | 0.0000 |
| Jul | 0.0035 | 0.2232 | 0.0000 | 0.0000 | 0.0000 | 0.1605 | 0.0000 | 0.0000 |
| Aug | 0.0023 | 0.2405 | 0.0000 | 0.0000 | 0.0000 | 0.1692 | 0.0000 | 0.0000 |
| Sep | 0.0068 | 0.2054 | 0.0000 | 0.0000 | 0.0024 | 0.1794 | 0.0000 | 0.0000 |
| Oct | 0.0311 | 0.1549 | 0.0000 | 0.0000 | 0.0088 | 0.1303 | 0.0000 | 0.0000 |
| Nov | 0.1151 | 0.0358 | 0.0000 | 0.0794 | 0.0441 | 0.0000 | 0.0000 | 0.0441 |
| Dec | 0.3255 | 0.0003 | 0.0000 | 0.4045 | 0.0536 | 0.0000 | 0.0000 | 0.0977 |
| Jan | 0.4614 | 0.0002 | 0.0000 | 0.8657 | 0.0539 | 0.0000 | 0.0000 | 0.1516 |
| Feb | 0.3919 | 0.0000 | 0.0000 | 1.2576 | 0.0490 | 0.0000 | 0.0000 | 0.2006 |
| Mar | 0.2436 | 0.0249 | 0.0000 | 1.4764 | 0.0501 | 0.0000 | 0.0000 | 0.2506 |
| Apr | 0.0707 | 0.0759 | 0.0000 | 1.4712 | 0.0392 | 0.0006 | 0.0000 | 0.2892 |
| May | 0.0193 | 0.1546 | 0.0000 | 1.3358 | 0.0267 | 0.0356 | 0.0000 | 0.2803 |

interior temp = 22.00 deg C
interior dewpoint = 6.50 deg C
leakage area = 0.000044 m2/m2

TORONTO, ONTARIO

Max absorb plane1 = 1.50
Max absorb plane2 = 0.54

Another run (y/n)?

Wall type = 1. Typical residential wall, 5/8in waferboard, 1/4in hardboard

| | Plane 1 - kg/m^2 | | | | Plane 2 - kg/m^2 | | | |
|---|---|---|---|---|---|---|---|---|
| MON | Conden | Evap | Drain | Absorb | Conden | Evap | Drain | Absorb |
| Jun | 0.0017 | 0.2189 | 0.0000 | 0.0000 | 0.0003 | 0.1557 | 0.0000 | 0.0000 |
| Jul | 0.0023 | 0.2234 | 0.0000 | 0.0000 | 0.0000 | 0.1398 | 0.0000 | 0.0000 |
| Aug | 0.0006 | 0.2079 | 0.0000 | 0.0000 | 0.0000 | 0.1775 | 0.0000 | 0.0000 |
| Sep | 0.0009 | 0.1782 | 0.0000 | 0.0000 | 0.0019 | 0.1601 | 0.0000 | 0.0000 |
| Oct | 0.0076 | 0.1074 | 0.0000 | 0.0000 | 0.0114 | 0.0916 | 0.0000 | 0.0000 |
| Nov | 0.1462 | 0.0307 | 0.0000 | 0.1155 | 0.0315 | 0.0000 | 0.0000 | 0.0315 |
| Dec | 0.3427 | 0.0004 | 0.0000 | 0.4578 | 0.0329 | 0.0000 | 0.0000 | 0.0644 |
| Jan | 0.4702 | 0.0000 | 0.0000 | 0.9281 | 0.0291 | 0.0000 | 0.0000 | 0.0935 |
| Feb | 0.3487 | 0.0003 | 0.0000 | 1.2766 | 0.0287 | 0.0000 | 0.0000 | 0.1222 |
| Mar | 0.1784 | 0.0009 | 0.0000 | 1.4540 | 0.0355 | 0.0000 | 0.0000 | 0.1577 |
| Apr | 0.0376 | 0.0796 | 0.0000 | 1.4120 | 0.0282 | 0.0000 | 0.0000 | 0.1858 |
| May | 0.0018 | 0.1627 | 0.0000 | 1.2512 | 0.0201 | 0.0105 | 0.0000 | 0.1954 |

interior temp = 22.00 deg C
interior dewpoint = 2.60 deg C
leakage area = 0.000029 m2/m2

WINNIPEG, MANITOBA

Max absorb plane1 = 1.50
Max absorb plane2 = 0.54

Another run (y/n)?

Wall type = 1. Typical residential wall, 5/8in waferboard, 1/4in hardboard

| | Plane 1 - kg/m^2 | | | | Plane 2 - kg/m^2 | | | |
|---|---|---|---|---|---|---|---|---|
| MON | Conden | Evap | Drain | Absorb | Conden | Evap | Drain | Absorb |
| Jun | 0.0001 | 0.2299 | 0.0000 | 0.0000 | 0.0000 | 0.2065 | 0.0000 | 0.0000 |
| Jul | 0.0002 | 0.2438 | 0.0000 | 0.0000 | 0.0000 | 0.2189 | 0.0000 | 0.0000 |
| Aug | 0.0007 | 0.2373 | 0.0000 | 0.0000 | 0.0006 | 0.2059 | 0.0000 | 0.0000 |
| Sep | 0.0045 | 0.1651 | 0.0000 | 0.0000 | 0.0073 | 0.1369 | 0.0000 | 0.0000 |
| Oct | 0.0207 | 0.0972 | 0.0000 | 0.0000 | 0.0180 | 0.0812 | 0.0000 | 0.0000 |
| Nov | 0.1355 | 0.0107 | 0.0000 | 0.1248 | 0.0401 | 0.0000 | 0.0000 | 0.0401 |
| Dec | 0.3492 | 0.0000 | 0.0000 | 0.4740 | 0.0402 | 0.0000 | 0.0000 | 0.0802 |
| Jan | 0.4738 | 0.0002 | 0.0000 | 0.9476 | 0.0359 | 0.0000 | 0.0000 | 0.1161 |
| Feb | 0.2977 | 0.0010 | 0.0000 | 1.2442 | 0.0358 | 0.0000 | 0.0000 | 0.1519 |
| Mar | 0.2387 | 0.0024 | 0.0000 | 1.4805 | 0.0409 | 0.0000 | 0.0000 | 0.1928 |
| Apr | 0.0138 | 0.0665 | 0.0000 | 1.4278 | 0.0351 | 0.0000 | 0.0000 | 0.2279 |
| May | 0.0022 | 0.1940 | 0.0000 | 1.2359 | 0.0244 | 0.0060 | 0.0000 | 0.2464 |

interior temp = 22.00 deg C
interior dewpoint = 2.60 deg C
leakage area = 0.000034 m2/m2

EDMONTON, ALBERTA

Max absorb plane1 = 1.50
Max absorb plane2 = 0.54

Another run (y/n)?

Wall type = 1. Typical residential wall, 5/8in waferboard, 1/4in hardboard

| MON | Plane 1 - kg/m^2 Conden | Evap | Drain | Absorb | Plane 2 - kg/m^2 Conden | Evap | Drain | Absorb |
|---|---|---|---|---|---|---|---|---|
| Jun | 0.0000 | 0.1983 | 0.0000 | 0.0000 | 0.0014 | 0.1726 | 0.0000 | 0.0000 |
| Jul | 0.0002 | 0.2297 | 0.0000 | 0.0000 | 0.0003 | 0.2018 | 0.0000 | 0.0000 |
| Aug | 0.0000 | 0.2486 | 0.0000 | 0.0000 | 0.0001 | 0.2295 | 0.0000 | 0.0000 |
| Sep | 0.0018 | 0.2069 | 0.0000 | 0.0000 | 0.0017 | 0.1818 | 0.0000 | 0.0000 |
| Oct | 0.0644 | 0.0875 | 0.0000 | 0.0000 | 0.0199 | 0.0644 | 0.0000 | 0.0000 |
| Nov | 0.2355 | 0.0218 | 0.0000 | 0.2137 | 0.0529 | 0.0000 | 0.0000 | 0.0529 |
| Dec | 0.3537 | 0.0024 | 0.0000 | 0.5650 | 0.0599 | 0.0000 | 0.0000 | 0.1128 |
| Jan | 0.3934 | 0.0042 | 0.0000 | 0.9541 | 0.0612 | 0.0000 | 0.0000 | 0.1741 |
| Feb | 0.2552 | 0.0019 | 0.0000 | 1.2073 | 0.0523 | 0.0000 | 0.0000 | 0.2264 |
| Mar | 0.2287 | 0.0088 | 0.0000 | 1.4272 | 0.0555 | 0.0000 | 0.0000 | 0.2819 |
| Apr | 0.0977 | 0.0477 | 0.0000 | 1.4772 | 0.0460 | 0.0000 | 0.0000 | 0.3279 |
| May | 0.0211 | 0.1294 | 0.0000 | 1.3689 | 0.0371 | 0.0000 | 0.0000 | 0.3650 |

interior temp = 22.00 deg C
interior dewpoint = 9.70 deg C
leakage area = 0.000057 m2/m2

VANCOUVER, B.C.

Max absorb plane1 = 1.50
Max absorb plane2 = 0.54

Another run (y/n)?

Wall type = 2. High Rise, insulation between stds, gyp sheath and brick

| | Plane 1 - kg/m^2 | | | | Plane 2 - kg/m^2 | | | |
|---|---|---|---|---|---|---|---|---|
| MON | Conden | Evap | Drain | Absorb | Conden | Evap | Drain | Absorb |
| Jun | 0.0050 | 0.6050 | 0.0000 | 0.0000 | 0.0000 | 0.4882 | 0.0000 | 0.0000 |
| Jul | 0.0073 | 0.5467 | 0.0000 | 0.0000 | 0.0000 | 0.4045 | 0.0000 | 0.0000 |
| Aug | 0.0031 | 0.5806 | 0.0000 | 0.0000 | 0.0000 | 0.4832 | 0.0000 | 0.0000 |
| Sep | 0.0061 | 0.5806 | 0.0000 | 0.0000 | 0.0067 | 0.4930 | 0.0000 | 0.0000 |
| Oct | 0.0188 | 0.4260 | 0.0000 | 0.0000 | 0.0353 | 0.3231 | 0.0000 | 0.0000 |
| Nov | 0.1773 | 0.1684 | 0.0000 | 0.0089 | 0.1730 | 0.0000 | 0.0000 | 0.1730 |
| Dec | 0.7214 | 0.0039 | 0.0000 | 0.7264 | 0.2142 | 0.0000 | 0.0000 | 0.3872 |
| Jan | 1.0270 | 0.0048 | 0.0000 | 1.7485 | 0.2042 | 0.0000 | 0.0000 | 0.5914 |
| Feb | 0.8829 | 0.0042 | 0.0000 | 2.6273 | 0.1866 | 0.0000 | 0.0000 | 0.7780 |
| Mar | 0.4499 | 0.0753 | 0.0000 | 3.0019 | 0.2005 | 0.0000 | 0.0000 | 0.9785 |
| Apr | 0.0705 | 0.2588 | 0.0000 | 2.8135 | 0.1515 | 0.0062 | 0.0000 | 1.1238 |
| May | 0.0026 | 0.5920 | 0.0000 | 2.2241 | 0.0953 | 0.0122 | 0.0000 | 1.2070 |

interior temp = 22.00 deg C
interior dewpoint = 4.80 deg C
leakage area = 0.000097 m2/m2

MONTREAL, QUEBEC

Max absorb plane1 = 3.05
Max absorb plane2 = 32.50

Another run (y/n)?

Wall type = 2. High Rise, insulation between stds, gyp sheath and brick

| | Plane 1 - kg/m^2 | | | | Plane 2 - kg/m^2 | | | |
|---|---|---|---|---|---|---|---|---|
| MON | Conden | Evap | Drain | Absorb | Conden | Evap | Drain | Absorb |
| Jun | 0.0087 | 0.5689 | 0.0000 | 0.0000 | 0.0008 | 0.4035 | 0.0000 | 0.0000 |
| Jul | 0.0133 | 0.5133 | 0.0000 | 0.0000 | 0.0000 | 0.3652 | 0.0000 | 0.0000 |
| Aug | 0.0090 | 0.5573 | 0.0000 | 0.0000 | 0.0000 | 0.3852 | 0.0000 | 0.0000 |
| Sep | 0.0115 | 0.4942 | 0.0000 | 0.0000 | 0.0096 | 0.4091 | 0.0000 | 0.0000 |
| Oct | 0.0548 | 0.3951 | 0.0000 | 0.0000 | 0.0351 | 0.2982 | 0.0000 | 0.0000 |
| Nov | 0.2055 | 0.1039 | 0.0000 | 0.1016 | 0.1755 | 0.0000 | 0.0000 | 0.1755 |
| Dec | 0.6430 | 0.0012 | 0.0000 | 0.7434 | 0.2148 | 0.0000 | 0.0000 | 0.3903 |
| Jan | 0.9494 | 0.0007 | 0.0000 | 1.6921 | 0.2178 | 0.0000 | 0.0000 | 0.6082 |
| Feb | 0.8009 | 0.0000 | 0.0000 | 2.4929 | 0.1973 | 0.0000 | 0.0000 | 0.8055 |
| Mar | 0.4756 | 0.0685 | 0.0000 | 2.9000 | 0.1999 | 0.0000 | 0.0000 | 1.0054 |
| Apr | 0.1227 | 0.2043 | 0.0000 | 2.8185 | 0.1557 | 0.0014 | 0.0000 | 1.1597 |
| May | 0.0357 | 0.3887 | 0.0000 | 2.4655 | 0.1056 | 0.0808 | 0.0000 | 1.1844 |

interior temp = 22.00 deg C
interior dewpoint = 6.50 deg C
leakage area = 0.000100 m2/m2

TORONTO, ONTARIO

Max absorb plane1 = 3.05
Max absorb plane2 = 32.50

Another run (y/n)?

Wall type = 2. High Rise, insulation between stds, gyp sheath and brick

| | Plane 1 - kg/m^2 | | | | Plane 2 - kg/m^2 | | | |
|---|---|---|---|---|---|---|---|---|
| MON | Conden | Evap | Drain | Absorb | Conden | Evap | Drain | Absorb |
| Jun | 0.0061 | 0.5123 | 0.0000 | 0.0000 | 0.0010 | 0.3552 | 0.0000 | 0.0000 |
| Jul | 0.0089 | 0.5143 | 0.0000 | 0.0000 | 0.0000 | 0.3186 | 0.0000 | 0.0000 |
| Aug | 0.0025 | 0.4852 | 0.0000 | 0.0000 | 0.0000 | 0.4046 | 0.0000 | 0.0000 |
| Sep | 0.0002 | 0.4337 | 0.0000 | 0.0000 | 0.0063 | 0.3656 | 0.0000 | 0.0000 |
| Oct | 0.0045 | 0.2801 | 0.0000 | 0.0000 | 0.0377 | 0.2097 | 0.0000 | 0.0000 |
| Nov | 0.2922 | 0.0872 | 0.0000 | 0.2050 | 0.1273 | 0.0000 | 0.0000 | 0.1273 |
| Dec | 0.7195 | 0.0031 | 0.0000 | 0.9214 | 0.1349 | 0.0000 | 0.0000 | 0.2622 |
| Jan | 1.0147 | 0.0016 | 0.0000 | 1.9345 | 0.1211 | 0.0000 | 0.0000 | 0.3833 |
| Feb | 0.7405 | 0.0025 | 0.0000 | 2.6724 | 0.1183 | 0.0000 | 0.0000 | 0.5016 |
| Mar | 0.3491 | 0.0110 | 0.0000 | 3.0106 | 0.1436 | 0.0000 | 0.0000 | 0.6452 |
| Apr | 0.0651 | 0.2113 | 0.0000 | 2.8644 | 0.1126 | 0.0000 | 0.0000 | 0.7578 |
| May | 0.0017 | 0.4026 | 0.0000 | 2.4635 | 0.0795 | 0.0238 | 0.0000 | 0.8134 |

interior temp = 22.00 deg C
interior dewpoint = 2.60 deg C
leakage area = 0.000066 m2/m2

WINNIPEG, MANITOBA

Max absorb plane1 = 3.05
Max absorb plane2 = 32.50

Another run (y/n)?

Wall type = 2. High Rise, insulation between stds, gyp sheath and brick

| | Plane 1 - kg/m^2 | | | | Plane 2 - kg/m^2 | | | |
|---|---|---|---|---|---|---|---|---|
| MON | Conden | Evap | Drain | Absorb | Conden | Evap | Drain | Absorb |
| Jun | 0.0002 | 0.5523 | 0.0000 | 0.0000 | 0.0000 | 0.4691 | 0.0000 | 0.0000 |
| Jul | 0.0007 | 0.5772 | 0.0000 | 0.0000 | 0.0000 | 0.4970 | 0.0000 | 0.0000 |
| Aug | 0.0016 | 0.5646 | 0.0000 | 0.0000 | 0.0021 | 0.4676 | 0.0000 | 0.0000 |
| Sep | 0.0025 | 0.4112 | 0.0000 | 0.0000 | 0.0239 | 0.3114 | 0.0000 | 0.0000 |
| Oct | 0.0247 | 0.2584 | 0.0000 | 0.0000 | 0.0615 | 0.1852 | 0.0000 | 0.0000 |
| Nov | 0.2509 | 0.0415 | 0.0000 | 0.2094 | 0.1608 | 0.0000 | 0.0000 | 0.1608 |
| Dec | 0.7183 | 0.0030 | 0.0000 | 0.9247 | 0.1634 | 0.0000 | 0.0000 | 0.3242 |
| Jan | 1.0075 | 0.0037 | 0.0000 | 1.9285 | 0.1474 | 0.0000 | 0.0000 | 0.4716 |
| Feb | 0.6128 | 0.0083 | 0.0000 | 2.5330 | 0.1456 | 0.0000 | 0.0000 | 0.6172 |
| Mar | 0.4752 | 0.0158 | 0.0000 | 2.9925 | 0.1650 | 0.0000 | 0.0000 | 0.7822 |
| Apr | 0.0090 | 0.1909 | 0.0000 | 2.8106 | 0.1393 | 0.0000 | 0.0000 | 0.9215 |
| May | 0.0006 | 0.4779 | 0.0000 | 2.3333 | 0.0964 | 0.0135 | 0.0000 | 1.0043 |

interior temp = 22.00 deg C
interior dewpoint = 2.60 deg C
leakage area = 0.000077 m2/m2

EDMONTON, ALBERTA

Max absorb plane1 = 3.05
Max absorb plane2 = 32.50

Another run (y/n)?

Wall type = 2.  High Rise, insulation between stds, gyp sheath and brick

| | Plane 1 - kg/m^2 | | | | Plane 2 - kg/m^2 | | | |
|---|---|---|---|---|---|---|---|---|
| MON | Conden | Evap | Drain | Absorb | Conden | Evap | Drain | Absorb |
| Jun | 0.0001 | 0.5353 | 0.0000 | 0.0000 | 0.0029 | 0.4256 | 0.0000 | 0.0000 |
| Jul | 0.0007 | 0.5988 | 0.0000 | 0.0000 | 0.0006 | 0.4971 | 0.0000 | 0.0000 |
| Aug | 0.0000 | 0.6455 | 0.0000 | 0.0000 | 0.0003 | 0.5653 | 0.0000 | 0.0000 |
| Sep | 0.0032 | 0.5569 | 0.0000 | 0.0000 | 0.0051 | 0.4486 | 0.0000 | 0.0000 |
| Oct | 0.1274 | 0.2656 | 0.0000 | 0.0000 | 0.0769 | 0.1593 | 0.0000 | 0.0000 |
| Nov | 0.4946 | 0.0712 | 0.0000 | 0.4234 | 0.2269 | 0.0000 | 0.0000 | 0.2269 |
| Dec | 0.7591 | 0.0122 | 0.0000 | 1.1703 | 0.2578 | 0.0000 | 0.0000 | 0.4847 |
| Jan | 0.8551 | 0.0175 | 0.0000 | 2.0079 | 0.2633 | 0.0000 | 0.0000 | 0.7480 |
| Feb | 0.5310 | 0.0095 | 0.0000 | 2.5294 | 0.2247 | 0.0000 | 0.0000 | 0.9727 |
| Mar | 0.4681 | 0.0346 | 0.0000 | 2.9628 | 0.2381 | 0.0000 | 0.0000 | 1.2108 |
| Apr | 0.1913 | 0.1560 | 0.0000 | 2.9981 | 0.1965 | 0.0000 | 0.0000 | 1.4073 |
| May | 0.0376 | 0.3735 | 0.0000 | 2.6623 | 0.1577 | 0.0000 | 0.0000 | 1.5650 |

interior temp = 22.00 deg C
interior dewpoint =  9.70 deg C
leakage area = 0.000140 m2/m2

VANCOUVER, B.C.

Max absorb plane1 =  3.05
Max absorb plane2 = 32.50

Another run (y/n)?

Wall type = 5. Standard Residential, with glass fiber sheathing, 1/4in hdbrd

| | Plane 1 - kg/m^2 | | | | Plane 2 - kg/m^2 | | | |
|---|---|---|---|---|---|---|---|---|
| MON | Conden | Evap | Drain | Absorb | Conden | Evap | Drain | Absorb |
| Jun | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0086 | 0.0000 | 0.0000 |
| Jul | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0148 | 0.0000 | 0.0000 |
| Aug | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0081 | 0.0000 | 0.0000 |
| Sep | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0014 | 0.0028 | 0.0000 | 0.0000 |
| Oct | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0069 | 0.0000 | 0.0000 | 0.0069 |
| Nov | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0349 | 0.0000 | 0.0000 | 0.0418 |
| Dec | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1088 | 0.0000 | 0.0000 | 0.1506 |
| Jan | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1421 | 0.0000 | 0.0000 | 0.2926 |
| Feb | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1235 | 0.0000 | 0.0000 | 0.4161 |
| Mar | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0728 | 0.0000 | 0.0000 | 0.4889 |
| Apr | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0184 | 0.0007 | 0.0000 | 0.5066 |
| May | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0009 | 0.0014 | 0.0000 | 0.5061 |

interior temp = 22.00 deg C
interior dewpoint = 4.80 deg C
leakage area = 0.000011 m2/m2

MONTREAL, QUEBEC

Max absorb plane1 = 0.00
Max absorb plane2 = 0.54

Another run (y/n)?

Wall type = 5. Standard Residential, with glass fiber sheathing, 1/4in hdbrd

| | Plane 1 - kg/m^2 | | | | Plane 2 - kg/m^2 | | | |
|---|---|---|---|---|---|---|---|---|
| MON | Conden | Evap | Drain | Absorb | Conden | Evap | Drain | Absorb |
| Jun | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0002 | 0.0151 | 0.0000 | 0.0000 |
| Jul | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0164 | 0.0000 | 0.0000 |
| Aug | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0179 | 0.0000 | 0.0000 |
| Sep | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0026 | 0.0028 | 0.0000 | 0.0000 |
| Oct | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0115 | 0.0000 | 0.0000 | 0.0115 |
| Nov | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0418 | 0.0000 | 0.0000 | 0.0532 |
| Dec | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1062 | 0.0000 | 0.0000 | 0.1594 |
| Jan | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1433 | 0.0000 | 0.0000 | 0.3027 |
| Feb | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1228 | 0.0000 | 0.0000 | 0.4256 |
| Mar | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0806 | 0.0000 | 0.0000 | 0.5062 |
| Apr | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0264 | 0.0002 | 0.0000 | 0.5324 |
| May | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0069 | 0.0098 | 0.0000 | 0.5295 |

interior temp = 22.00 deg C
interior dewpoint = 6.50 deg C
leakage area = 0.000012 m2/m2

TORONTO, ONTARIO

Max absorb plane1 = 0.00
Max absorb plane2 = 0.54

Another run (y/n)?

Wall type = 5. Standard Residential, with glass fiber sheathing, 1/4in hdbrd

| MON | Plane 1 - kg/m^2 Conden | Evap | Drain | Absorb | Plane 2 - kg/m^2 Conden | Evap | Drain | Absorb |
|---|---|---|---|---|---|---|---|---|
| Jun | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0002 | 0.0172 | 0.0000 | 0.0000 |
| Jul | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0251 | 0.0000 | 0.0000 |
| Aug | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0073 | 0.0000 | 0.0000 |
| Sep | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0010 | 0.0009 | 0.0000 | 0.0001 |
| Oct | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0066 | 0.0000 | 0.0000 | 0.0067 |
| Nov | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0549 | 0.0000 | 0.0000 | 0.0615 |
| Dec | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1184 | 0.0000 | 0.0000 | 0.1800 |
| Jan | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1566 | 0.0000 | 0.0000 | 0.3366 |
| Feb | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1188 | 0.0000 | 0.0000 | 0.4554 |
| Mar | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0683 | 0.0000 | 0.0000 | 0.5237 |
| Apr | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0172 | 0.0000 | 0.0009 | 0.5400 |
| May | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0015 | 0.0033 | 0.0000 | 0.5382 |

interior temp = 22.00 deg C
interior dewpoint = 2.60 deg C
leakage area = 0.000009 m2/m2

WINNIPEG, MANITOBA

Max absorb plane1 = 0.00
Max absorb plane2 = 0.54

Another run (y/n)?

Wall type = 5. Standard Residential, with glass fiber sheathing, 1/4in hdbrd

| | Plane 1 - kg/m^2 | | | | Plane 2 - kg/m^2 | | | |
|---|---|---|---|---|---|---|---|---|
| MON | Conden | Evap | Drain | Absorb | Conden | Evap | Drain | Absorb |
| Jun | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0015 | 0.0000 | 0.0000 |
| Jul | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0031 | 0.0000 | 0.0000 |
| Aug | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0003 | 0.0048 | 0.0000 | 0.0000 |
| Sep | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0039 | 0.0029 | 0.0000 | 0.0009 |
| Oct | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0124 | 0.0000 | 0.0000 | 0.0134 |
| Nov | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0525 | 0.0000 | 0.0000 | 0.0659 |
| Dec | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1168 | 0.0000 | 0.0000 | 0.1826 |
| Jan | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1519 | 0.0000 | 0.0000 | 0.3345 |
| Feb | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0999 | 0.0000 | 0.0000 | 0.4344 |
| Mar | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0842 | 0.0000 | 0.0000 | 0.5186 |
| Apr | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0112 | 0.0000 | 0.0000 | 0.5298 |
| May | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0021 | 0.0018 | 0.0000 | 0.5301 |

interior temp = 22.00 deg C
interior dewpoint = 2.60 deg C
leakage area = 0.000010 m2/m2

EDMONTON, ALBERTA

Max absorb plane1 = 0.00
Max absorb plane2 = 0.54

Another run (y/n)?

Wall type = 5. Standard Residential, with glass fiber sheathing, 1/4in hdbrd

| | Plane 1 - kg/m^2 | | | | Plane 2 - kg/m^2 | | | |
|---|---|---|---|---|---|---|---|---|
| MON | Conden | Evap | Drain | Absorb | Conden | Evap | Drain | Absorb |
| Jun | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0006 | 0.0003 | 0.0000 | 0.0003 |
| Jul | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0001 | 0.0025 | 0.0000 | 0.0000 |
| Aug | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0001 | 0.0001 | 0.0000 | 0.0000 |
| Sep | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0012 | 0.0000 | 0.0000 | 0.0012 |
| Oct | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0238 | 0.0000 | 0.0000 | 0.0250 |
| Nov | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0765 | 0.0000 | 0.0000 | 0.1015 |
| Dec | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1113 | 0.0000 | 0.0000 | 0.2129 |
| Jan | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1221 | 0.0000 | 0.0000 | 0.3349 |
| Feb | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0832 | 0.0000 | 0.0000 | 0.4181 |
| Mar | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0763 | 0.0000 | 0.0000 | 0.4944 |
| Apr | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0355 | 0.0000 | 0.0000 | 0.5298 |
| May | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0096 | 0.0000 | 0.0000 | 0.5394 |

interior temp = 22.00 deg C
interior dewpoint = 9.70 deg C
leakage area = 0.000015 m2/m2

VANCOUVER, B.C.

Max absorb plane1 = 0.00
Max absorb plane2 = 0.54

Another run (y/n)?

Wall type = 6. Standard Residential, with EPS sheathing, 1/4in hdbrd

| | Plane 1 - kg/m^2 | | | | Plane 2 - kg/m^2 | | | |
|---|---|---|---|---|---|---|---|---|
| MON | Conden | Evap | Drain | Absorb | Conden | Evap | Drain | Absorb |
| Jun | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0086 | 0.0000 | 0.0000 |
| Jul | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0148 | 0.0000 | 0.0000 |
| Aug | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0081 | 0.0000 | 0.0000 |
| Sep | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0014 | 0.0028 | 0.0000 | 0.0000 |
| Oct | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0070 | 0.0000 | 0.0000 | 0.0070 |
| Nov | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0351 | 0.0000 | 0.0000 | 0.0421 |
| Dec | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1091 | 0.0000 | 0.0000 | 0.1512 |
| Jan | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1424 | 0.0000 | 0.0000 | 0.2936 |
| Feb | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1238 | 0.0000 | 0.0000 | 0.4174 |
| Mar | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0731 | 0.0000 | 0.0000 | 0.4905 |
| Apr | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0186 | 0.0007 | 0.0000 | 0.5084 |
| May | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0009 | 0.0014 | 0.0000 | 0.5079 |

interior temp = 22.00 deg C
interior dewpoint = 4.80 deg C
leakage area = 0.000011 m2/m2

MONTREAL, QUEBEC

Max absorb plane1 = 0.00
Max absorb plane2 = 0.54

Another run (y/n)?

Wall type = 6. Standard Residential, with EPS sheathing, 1/4in hdbrd

| | Plane 1 - kg/m^2 | | | | Plane 2 - kg/m^2 | | | |
|---|---|---|---|---|---|---|---|---|
| MON | Conden | Evap | Drain | Absorb | Conden | Evap | Drain | Absorb |
| Jun | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0002 | 0.0151 | 0.0000 | 0.0000 |
| Jul | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0164 | 0.0000 | 0.0000 |
| Aug | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0179 | 0.0000 | 0.0000 |
| Sep | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0026 | 0.0028 | 0.0000 | 0.0000 |
| Oct | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0116 | 0.0000 | 0.0000 | 0.0116 |
| Nov | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0421 | 0.0000 | 0.0000 | 0.0537 |
| Dec | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1065 | 0.0000 | 0.0000 | 0.1602 |
| Jan | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1437 | 0.0000 | 0.0000 | 0.3039 |
| Feb | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1232 | 0.0000 | 0.0000 | 0.4271 |
| Mar | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0810 | 0.0000 | 0.0000 | 0.5081 |
| Apr | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0266 | 0.0002 | 0.0000 | 0.5345 |
| May | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0070 | 0.0098 | 0.0000 | 0.5317 |

interior temp = 22.00 deg C
interior dewpoint = 6.50 deg C
leakage area = 0.000012 m2/m2

TORONTO, ONTARIO

Max absorb plane1 = 0.00
Max absorb plane2 = 0.54

Another run (y/n)?

Wall type = 6. Standard Residential, with EPS sheathing, 1/4in hdbrd

| | Plane 1 - kg/m^2 | | | | Plane 2 - kg/m^2 | | | |
|---|---|---|---|---|---|---|---|---|
| MON | Conden | Evap | Drain | Absorb | Conden | Evap | Drain | Absorb |
| Jun | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0002 | 0.0173 | 0.0000 | 0.0000 |
| Jul | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0251 | 0.0000 | 0.0000 |
| Aug | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0073 | 0.0000 | 0.0000 |
| Sep | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0010 | 0.0009 | 0.0000 | 0.0001 |
| Oct | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0067 | 0.0000 | 0.0000 | 0.0068 |
| Nov | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0551 | 0.0000 | 0.0000 | 0.0619 |
| Dec | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1187 | 0.0000 | 0.0000 | 0.1805 |
| Jan | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1569 | 0.0000 | 0.0000 | 0.3374 |
| Feb | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1190 | 0.0000 | 0.0000 | 0.4564 |
| Mar | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0686 | 0.0000 | 0.0000 | 0.5250 |
| Apr | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0173 | 0.0000 | 0.0023 | 0.5400 |
| May | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0015 | 0.0033 | 0.0000 | 0.5382 |

interior temp = 22.00 deg C
interior dewpoint = 2.60 deg C
leakage area = 0.000009 m2/m2

WINNIPEG, MANITOBA

Max absorb plane1 = 0.00
Max absorb plane2 = 0.54

Another run (y/n)?

Wall type = 6. Standard Residential, with EPS sheathing, 1/4in hdbrd

| | Plane 1 - kg/m^2 | | | | Plane 2 - kg/m^2 | | | |
|---|---|---|---|---|---|---|---|---|
| MON | Conden | Evap | Drain | Absorb | Conden | Evap | Drain | Absorb |
| Jun | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0015 | 0.0000 | 0.0000 |
| Jul | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0031 | 0.0000 | 0.0000 |
| Aug | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0003 | 0.0048 | 0.0000 | 0.0000 |
| Sep | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0039 | 0.0029 | 0.0000 | 0.0010 |
| Oct | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0126 | 0.0000 | 0.0000 | 0.0136 |
| Nov | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0528 | 0.0000 | 0.0000 | 0.0664 |
| Dec | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1171 | 0.0000 | 0.0000 | 0.1834 |
| Jan | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1521 | 0.0000 | 0.0000 | 0.3355 |
| Feb | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1002 | 0.0000 | 0.0000 | 0.4357 |
| Mar | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0845 | 0.0000 | 0.0000 | 0.5202 |
| Apr | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0114 | 0.0000 | 0.0000 | 0.5315 |
| May | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0021 | 0.0018 | 0.0000 | 0.5319 |

interior temp = 22.00 deg C
interior dewpoint = 2.60 deg C
leakage area = 0.000010 m2/m2

EDMONTON, ALBERTA

Max absorb plane1 = 0.00
Max absorb plane2 = 0.54

Another run (y/n)?

Wall type = 6. Standard Residential, with EPS sheathing, 1/4in hdbrd

| | Plane 1 - kg/m^2 | | | | Plane 2 - kg/m^2 | | | |
|---|---|---|---|---|---|---|---|---|
| MON | Conden | Evap | Drain | Absorb | Conden | Evap | Drain | Absorb |
| Jun | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0007 | 0.0003 | 0.0000 | 0.0004 |
| Jul | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0001 | 0.0025 | 0.0000 | 0.0000 |
| Aug | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0001 | 0.0001 | 0.0000 | 0.0000 |
| Sep | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0012 | 0.0000 | 0.0000 | 0.0012 |
| Oct | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0240 | 0.0000 | 0.0000 | 0.0252 |
| Nov | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0769 | 0.0000 | 0.0000 | 0.1021 |
| Dec | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1118 | 0.0000 | 0.0000 | 0.2139 |
| Jan | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1225 | 0.0000 | 0.0000 | 0.3364 |
| Feb | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0835 | 0.0000 | 0.0000 | 0.4199 |
| Mar | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0767 | 0.0000 | 0.0000 | 0.4966 |
| Apr | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0358 | 0.0000 | 0.0000 | 0.5323 |
| May | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0097 | 0.0000 | 0.0021 | 0.5400 |

interior temp = 22.00 deg C
interior dewpoint = 9.70 deg C
leakage area = 0.000015 m2/m2

VANCOUVER, B.C.

Max absorb plane1 = 0.00
Max absorb plane2 = 0.54

Another run (y/n)?