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Some Theoretical Aspects of Fire Induced Flows Through Doorways in a Room-Corridor Scale Model

James G. Quintiere and Karen DenBraven

Center for Fire Research
National Engineering Laboratory
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Final Report

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U.S. DEPARTMENT OF COMMERCE, Juanita M. Kreps, *Secretary*

Dr. Sidney Harman, *Under Secretary*

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NATIONAL BUREAU OF STANDARDS, Ernest Ambler, *Director*

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SOME THEORETICAL ASPECTS OF FIRE INDUCED FLOWS THROUGH DOORWAYS IN A ROOM-CORRIDOR SCALE MODEL

James G. Quintiere and Karen DenBraven

Abstract

Fire induced flows were measured in a 1/7th scale model room-corridor by measuring velocity and temperature profiles in the room and corridor exit doorways. The corridor exit door width was varied by a factor of 10 as an experimental parameter while the average fire room temperature was held constant. The applicability of an orifice flow model to predict the doorway flows was examined. The ratio of measured to theoretical mass flow rate, defined as the flow coefficient, was found to vary with door width and flow direction. The coefficient ranged from 0.4 to slightly greater than 1. No explanation has been developed to account for this variation.

Key words: Corridor; experiment; room; scale-model; theory; compartment fires; buoyancy flows; flow coefficients.

1. INTRODUCTION

It has been found fruitful to study fire induced flows in a scale model facility. The model consisted of two compartments separated from each other and the surroundings by two doorways - representing a room and an adjoining corridor (figure 1). The first study with this facility indicated the occurrence of four alternating horizontol flow layers in the corridor [1]. A subsequent study by McCaffrey and Quintiere [2] illustrated complex three dimensional flows in the corridor, and demonstrated that the multi-layer corridor flow pattern also occurs in a full-scale counterpart similar to the model. A more recent study [3] further illustrated these corridor flow patterns through visualization techniques, and demonstrated some limitations of theoretical flow models in coping with the prediction of these flows.

Several theoretical approaches have been made to predict fire induced flows between compartments. One approach relies on solution of the field equations and a suitable turbulent model [4]. Another approach relies on a model that depicts the flow into an upper hot layer of uniform temperature with a lower cold layer [5]. The doorway flows are treated as orifice-like flows as described by Prahl and Emmons [6]. The latter approach of reference [5] requires a knowledge of doorway flow coefficients, and a quantitative prediction of flow rates entrained into the jets of flow issuing through the doorways. Neither approach has been sufficiently developed to permit appropriate comparison with experimental measurements.

This paper examines the applicability of the orifice-flow two-layer fluid concept for doorway flows measured in the room-corridor scale model. The independent variable in this study was the width of the corridor exit doorway. Consequently, the flow characteristics will be expressed as a function of the exit doorway width. The theoretical model for the doorway flow rates is developed as a function of the temperature distributions, from which the flow coefficients are determined.

2. EXPERIMENTAL DESIGN AND ANALYSIS

Experiments were done in a small (1/7) scale model corridor. The model was 0.35 m wide by 0.35 m high by 1.3 m long, with a variable width (corridor exit) door opening at one end (figure 2). Within the model, a 0.35 m long burn room was set up at the end opposite the exit doorway. A 0.076 m by 0.140 m porous plate diffusion flame gas burner was placed on the centerline along the wall opposite the room entrance to simulate a room fire. A small pitot-static tube was placed in each of the doorways for velocity measurement along a vertical traverse, 0.14 m from the side wall, with thermocouples attached to record temperatures. All thermocouples were made from fine 5 mil (0.127 mm diameter) chromel-alumel wire, and were aligned horizontally facing into the flow. Thermocouples were also placed within the room and the corridor, 0.04 m from the sides.

The corridor model was supported above the laboratory floor so that the exit doorway did not have a floor that extended beyond the corridor. However, a floor was added for some cases with no significant change in the results. The most significant effect of the surroundings on the results was caused by the laboratory ventilation conditions. At times "windy" room conditions prevailed which necessitated terminating the run. On those occasions, the laboratory ventilation system was shut down resulting in relatively "still" room conditions, and a new run was initiated.

During an experiment, the burner was lit, and the room and corridor were allowed to heat until the ceiling layer in the room reached a stable temperature of 330 ± 30 °C. (Maintaining a constant room temperature tends to minimize the effect of temperature on flow.) Vertical traverses were then made in the doorways, room, and corridor with the pitot tubes and thermocouples.

Data were recorded for the inflow in increments of 0.013 m from the corridor floor up to the neutral plane as indicated by a zero reading by the pitot tube, i.e. zero velocity. These measurements were only taken on or near the doorway centerline. Data for the outflow were recorded in a similar manner using a pitot tube and thermocouples. Centerline measurements were taken in increments of 0.013 m, and in addition measurements off the centerline were taken every 0.025 m (figures 3 and 6). Exit doorway opening width was varied from 0.034-0.35 m for both inflow and outflow, while the room doorway height and width remained constant.

To obtain estimates of the orifice coefficient C, the ratio of experimental to theoretical mass flow rates were calculated. Experimental velocities and mass flow rates were obtained from the doorway temperature and pitot tube data. Theoretical velocities and mass flow rates were calculated from measured temperatures as indicated in the following analysis.

2.1. Doorway Flow into a Compartment

Bernoulli's equation was applied to a streamline starting from rest outside the doorway to a position downstream of the doorway where the streamlines are parallel (this can be considered a vena contracta). This is illustrated in figures 4 and 5, where the velocity at the vena contracta of the jet is given by

$$v_j(y) = C_v \sqrt{\frac{2(p_o - p_i)}{\rho_o(y)}} \tag{1}$$

here ρ_o is the density of the incoming fluid. The pressure in the jet is equal to the pressure p_i in the stagnant fluid surrounding the jet. C_v, the viscous coefficient, is close to 1 for pipe flows.

Then taking the pressure distribution to be hydrostatic, p_o, the corresponding pressure outside the doorway at y for fluid with no motion or, alternately, the stagnation pressure in the doorway at position y, can be expressed as

$$p_o(y) = p_n + g \int_o^y \rho_o(y)dy \tag{2}$$

and p_i, the static pressure just inside the doorway at y associated with the static fluid surrounding the vena contracta of the incoming jet, is given as

$$p_i(y) = p_n + g \int_o^y \rho_i(y)dy \tag{3}$$

where y increases from the neutral plane down, and p_n is the pressure at the neutral plane, (the height at which $p_i = p_o$).

ρ_i is the density of the stagnant fluid surrounding the jet.

Analogous to the development of orifice flow theory, the jet cross sectional area A_j at the vena contracta is related to the doorway inflow area A by a contraction coefficient C_c, i.e.

$$A_j = C_c\ A \tag{4}$$

The assumption was made that the contraction coefficient is constant and uniform over the flow field for each streamtube between the door and the jet. By conservation of mass for each horizontal layer of streamtubes, this leads to

$$v(y) = C_c\ v_j(y) \tag{5}$$

The accuracy of this assumption will be examined by comparing the theoretical results for v with measured values.

Combining equations (1) and (5) yields

$$v(y) = C \sqrt{\frac{2g \int_o^y (\rho_o(y) - \rho_i(y))dy}{\rho_o(y)}} \tag{6}$$

where $C = C_v C_c$.

Assuming a perfect gas for air,

$$\rho T = \rho_\infty T_\infty \tag{7}$$

where ρ_∞ and T_∞ are reference state values.

Substitution in equation (6) yields

$$v(y) = C\sqrt{\frac{2g\ \rho_\infty\ T_\infty \int_0^y \left(\frac{1}{T_o(y)} - \frac{1}{T_i(y)}\right) dy}{(\rho_\infty\ T_\infty/T_o(y))}} \tag{8}$$

or

$$v(y) = C\sqrt{2g\ T_o(y) \int_0^y \left(\frac{1}{T_o(y)} - \frac{1}{T_i(y)}\right) dy} \tag{9}$$

Since the measurements were in the form of T as a function of the distance z from the floor a change of variables was made such that

$$v(z) = C\sqrt{2g\ T_o(z) \int_z^{z_n} \left(\frac{1}{T_o(z)} - \frac{1}{T_i(z)}\right) dz} \tag{10}$$

where z is measured from the floor and z_n is the height of the neutral plane.

For this experiment, T_o was the temperature in the doorway entrance to the room or corridor, and T_i was the temperature in the corner of the appropriate compartment. Therefore, to calculate flows into the corridor exit, T_2 and T_3 were used. Simpson's 1/3 rule was applied to carry out the required numerical integration. This method requires an odd number of data points. For locations along the vertical traverse where only an even number of data points were available, the last two values at the upper limit of the integral were averaged to create another data point between the two which was then used to complete the calculation. The mass flow rate was determined by integrating the mass centerline velocity ρv over the height of the inflow. The experimental mass flow is

$$\dot{m}_{exp} = W \int_0^{z_n} \rho_o(z)\ v_{exp}(z)\ dz \tag{11}$$

where W is the doorway width. Likewise the theoretical mass flow is

$$\dot{m}_{th} = W \int_0^{z_n} \rho_o(z) \frac{v(z)}{C} dz \tag{12}$$

From these mass flow calculations, the flow coefficient for the inflow was calculated.

$$C = \frac{\dot{m}_{exp}}{\dot{m}_{th}} \tag{13}$$

2.2. Doorway Flow from a Compartment

The theoretical velocities in the outflow were calculated by assuming that the flow just outside of the opening is of a uniform pressure over a horizontal slice and equal to the surrounding pressure p_o at the same height (figure 6). From Bernoulli's equation

$$v_j = C_v \sqrt{\frac{2(p_i - p_j)}{\rho_j}} \tag{14}$$

where p_i is the stagnation or upstream pressure at height y inside the compartment

$( )_j$ denotes the position in the jet emerging from the opening where $p_j = p_o$.

Again, if the neutral plane has pressure p_n, and assuming horizontal velocity only so that the vertical pressure variation is hydrostatic, then

$$p_i = p_n - g \int_0^y \rho_i \, dy \tag{15}$$

where y is the distance increasing upward from the neutral plane, and

$$p_o = p_n - g \int_0^y \rho_o \, dy \tag{16}$$

so that

$$p_i - p_o = g \int_0^y (\rho_o - \rho_i)\, dy \qquad (17)$$

Since $\rho_j = \rho_i$ (the density in the compartment just upstream of the doorway) the combination of equations (14) and (17) gives

$$v_j(y) = C_v \sqrt{\frac{2g \int_0^y (\rho_o - \rho_i)\, dy}{\rho_i}} \qquad (18)$$

Also, if there is a contraction in the jet, as in orifice pipe flow, then

$$A_j = C_c A. \qquad (19)$$

If this contraction coefficient is uniform over the exit jet then

$$v = C_c v_j, \qquad (20)$$

and if $C = C_v C_c$, then equations (18) and (20) give

$$v(y) = C \sqrt{\frac{2g \int_0^y (\rho_o - \rho_i)\, dy}{\rho_i}} \qquad (21)$$

Or since $\rho_i = \rho_o T_o / T_i$

$$v(y) = C \sqrt{2g\, T_i(y) \int_0^y \left(\frac{1}{T_o(y)} - \frac{1}{T_i(y)} \right) dy} \qquad (22)$$

which can be compared to equation (9) for inflow.

As in the case of inflow, experimental velocities were obtained from pitot tube measurements. To calculate the doorway flow coefficient C, experimental and theoretical mass flows were again obtained.

$$\dot{m}_{th} = W \int_0^{H-z_n} \rho_i\, v(y)\, dy \qquad (23)$$

or

$$\dot{m}_{th} = W \int_0^{H-z_n} \left(\rho_o T_o \sqrt{\frac{2g}{T_i(y)} \int_0^y \left(\frac{1}{T_o(y)} - \frac{1}{T_i(y)} \right) dy} \right) dy \tag{24}$$

and

$$\dot{m}_{exp} = \int_0^W \int_0^{H-z_n} \rho_i(y)\ v(y)\ dy\ dx \tag{25}$$

Here, the integration was carried out over the entire region of outflow, since data were available and a uniform mass velocity profile across the doorway width does not appear to be an acceptable assumption. An example of experimental results for the exit outflow, $\rho_i v$, is shown in figure 7. These results correspond to the data given earlier in figure 2. Hence, from the above, the flow coefficient is defined as

$$C = \frac{\dot{m}_{exp}}{\dot{m}_{th}} \tag{26}$$

3. RESULTS

Figure 8 shows the results for doorway mass flow rates taken in these experiments and in previous experiments with the corridor model [1,2]. The results indicate that as the exit width is increased the exit flow increases almost directly, yet the room flow increases only slightly. The difference between the doorway flows represents the net entrainment or recirculation that occurs in the corridor. No adequate theory has been developed to predict this mixing rate.

Figure 9 shows the results of calculations for the flow coefficient C vs Reynolds number. This is compared with the experimental results from Prahl and Emmons for kerosene/water doorway flows [6]. Results appear to agree qualitatively but not quantitatively. The Reynolds number is defined as

$$Re = \frac{\dot{m}_{exp}}{\mu W} \tag{27}$$

where μ is the viscosity at the average temperature of the fluid. In this form the characteristic length dimension is the flow height.

Figure 10 shows the exit doorway coefficients as a function of the exit doorway width ratio (W_E/W_D). These results show the reproducibility of the data for different experiments, and the variation of the flow coefficient with the exit doorway width. No explanation has been developed to account for this variation, nor to explain the higher flow coefficient for the outflow than for the inflow. Also, although not shown in figure 10, the room doorway at a fixed width had a flow coefficient for the flow into the room of about 0.77 for all values of W_E/W_D.

In figures 11-14, measured centerline temperature and velocity profiles, and the results of the calculation of theoretical velocities are presented for four typical experiments, where the corridor exit door opening width (W_E) ranged from 0.071 Δm to 0.35 Δm. The data were taken up to the height of the neutral plane z_n. From the temperature data, it can be seen that, as the exit doorway is narrowed, more hot fluid enters the room doorway. This is equivalent to imagining that the height of the hot upper layer of fluid in the corridor falls below the neutral plane height in the room doorway. The neutral plane is lower for the room doorway than it is for the exit doorway in all cases.

These features are illustrated in figures 15 and 16. The height of an effective hot layer was determined by a fixed temperature (50 °C for the corridor near the exit doorway, and 60 °C for the flow entering the room) or by a tangent-intercept method illustrated in figure 16 for the exit doorway. In general, both methods appear to give the same results. However, the results for the thermal layer given in figure 15b are probably more indicative of the entire corridor. In fact, these results are in agreement with corridor smoke layer heights determined in an earlier study [3]. The thermal heights indicated for the room doorway, except for small W_E/W_D cases, are probably not indicative of the corridor. A thermal layer in the corridor lower than the room doorway neutral plane could result for large W_E/W_D from conduction between the slowly moving hot and cold flows. However, it is more likely to be an incorrect result due to radiant heating of the thermocouple from the hot room and fire.

Since fire induced doorway flow models incorporated in global room fire models have been based on a conception that the fluid is stratified into two zones of uniform temperature, it was of interest to examine our data from this point of view. The corridor doorway inflow was determined using this two-layer temperature model. The equation follows from equations (10) and (12) provided T_i is taken as being equal to T_o up to an effective corridor thermal height z_T. The result is

$$\dot{m}_{calc} = \frac{2}{3} C W \rho_o \sqrt{2g \left(1 - \frac{T_o}{T_i}\right)} (z_n - z_T)^{1/2} (z_n + \frac{z_T}{2}) \qquad (28)$$

The value for T_i was determined as indicated in figure 16 as the maximum temperature of the fluid inside the doorway. The height z_T was determined by the tangent-intercept method, and z_n was determined from the zero velocity position. The value for C was equal to the corresponding value determined from the velocity and temperature data, i.e., equation (13). The results of this calculation were compared to the measured values of flow rate (figure 17). In general, the results are in good agreement, but the value calculated from equation (28) tends to underestimate the experimental flow rate in a few cases by up to 30%.

4. CONCLUSIONS

It is difficult to generalize from the results of this study since the effect of scale may limit its application. However, the following specific conclusions can be made.

1. The doorway flow coefficient appears to vary systematically with doorway width, but no explanation has been developed for this effect. Also, the coefficient appears to be consistently greater for the outgoing flow than the inflow.

2. The theoretical results for velocity are in good agreement with the experimental measurements. This may suggest that a constant flow coefficient can be applied to calculate the velocity distribution.

3. Although a thermal layer does not exist as a discontinuous interface as idealized in a two-layer model, it can be defined from the data. Calculations of mass flow rate based on experimentally determined layer heights did yield results within 30 percent of the measured flows for the exit doorway inflow in this experiment.

5. REFERENCES

[1] McCaffrey, B.J. and Quintiere, J.G. "Fire Induced Corridor Flow in a Scale Model", in CIB Symposium on the Control of Smoke Movement in Building Fires, Vol. 1, pp 33-47. Borehamwood, UK, 1975.

[2] McCaffrey, B.J. and Quintiere, J.G., "Buoyancy Driven Countercurrent Flows Generated by a Fire Source," in Turbulent Buoyant Convection, pp 457-472. Hemisphere Publishing Corp. 1976.

[3] Quintiere, J.G., McCaffrey, B.J., and Rinkinen, W., Fire and Materials, Vol. 2., No. 1, 1978, pp 18-24.

[4] Yang, K.T. and Chang, L.C. "UNDSAFE-I A Computer Code for Buoyant Flow in an Enclosure," University of Notre Dame, Notre Dame, Ind., TR-79002-77-1, March 1977.

[5] Zukoski, E.E. and Kubota, T., "A Computer Model for Fluid Dynamic Aspects of a Transient Fire in a Two Room Structure", California Inst. of Tech., Pasadena, Cal. NBS Grant No. 5-9004, Jan. 1978.

[6] Prahl, J. and Emmons, H.W., Combustion and Flame, Vol. 25, No. 3, Dec. 1975, pp 369-385.

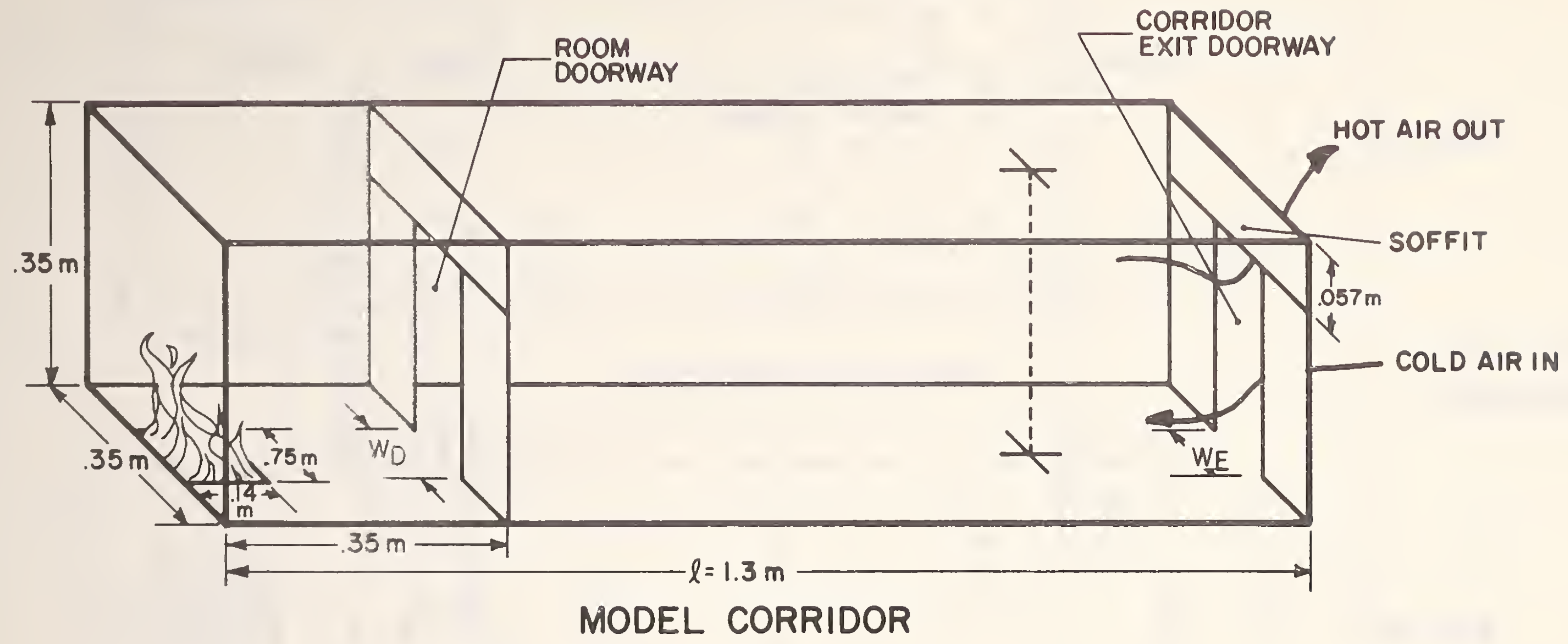

Figure 1. Pictorial of scale model facility

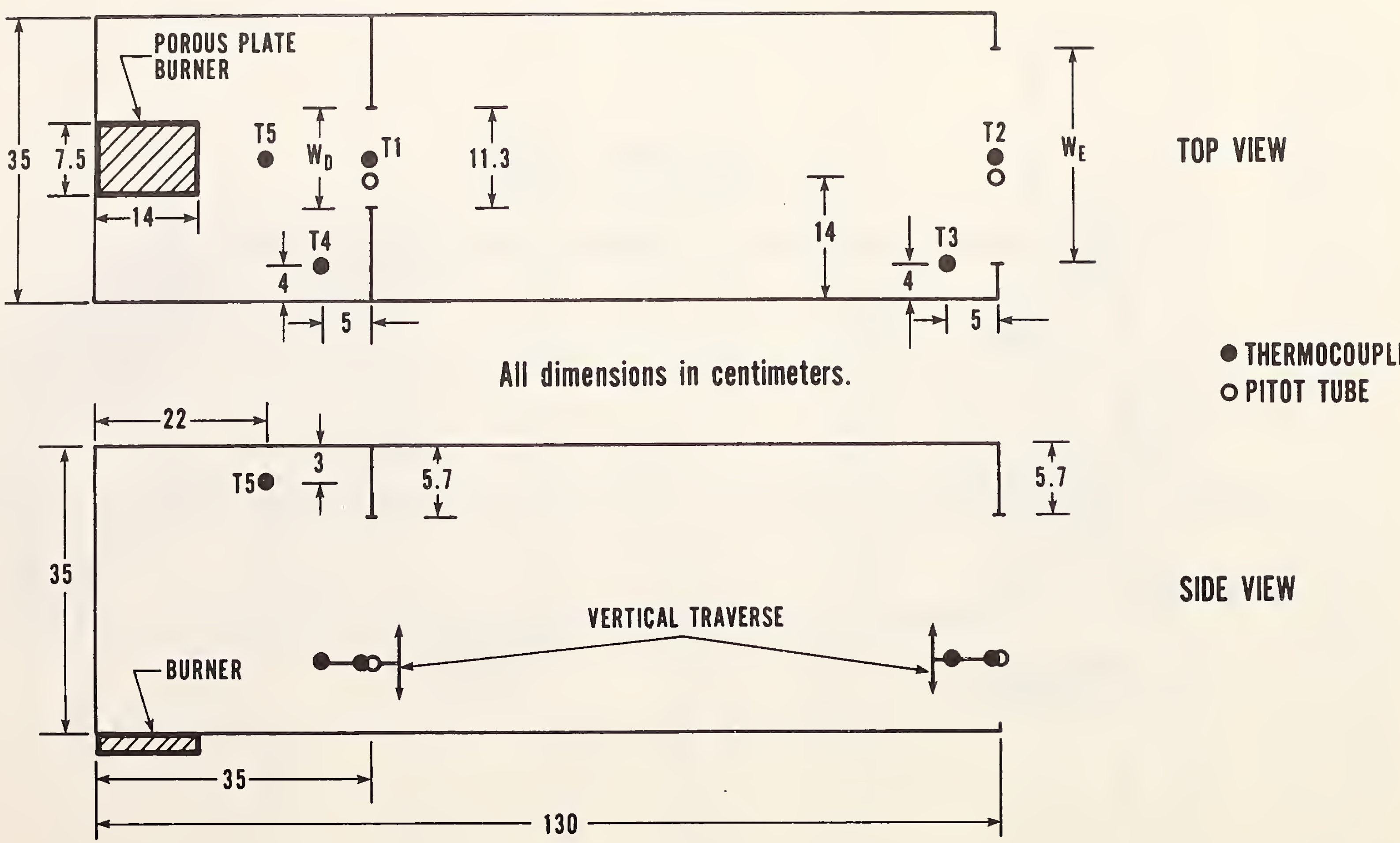

Figure 2. Schematic of one-seventh scale corridor burn-room facility (probes to measure inflow centerline velocities shown only)

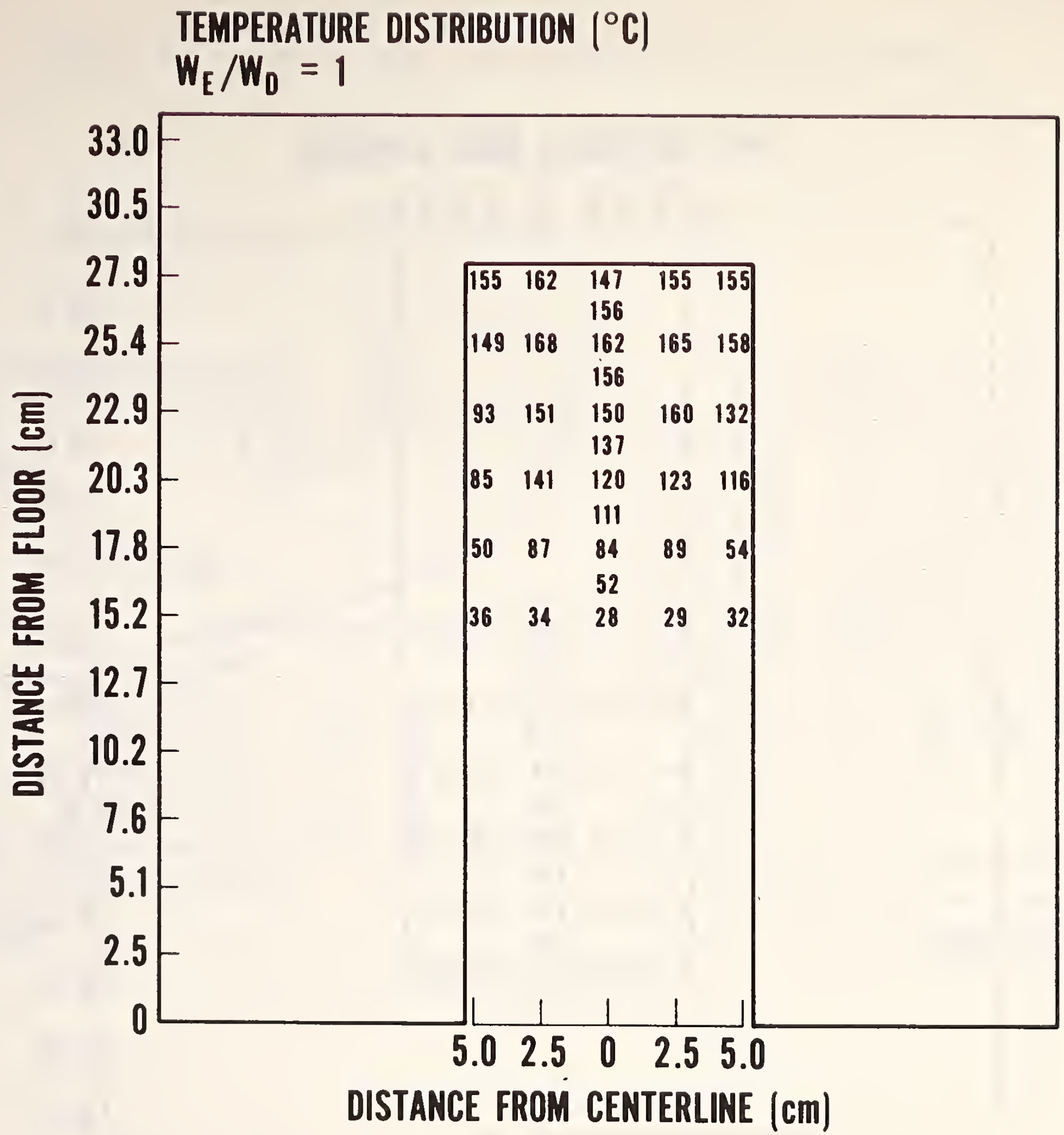

Figure 3a. Temperature data for the flow out of the corridor

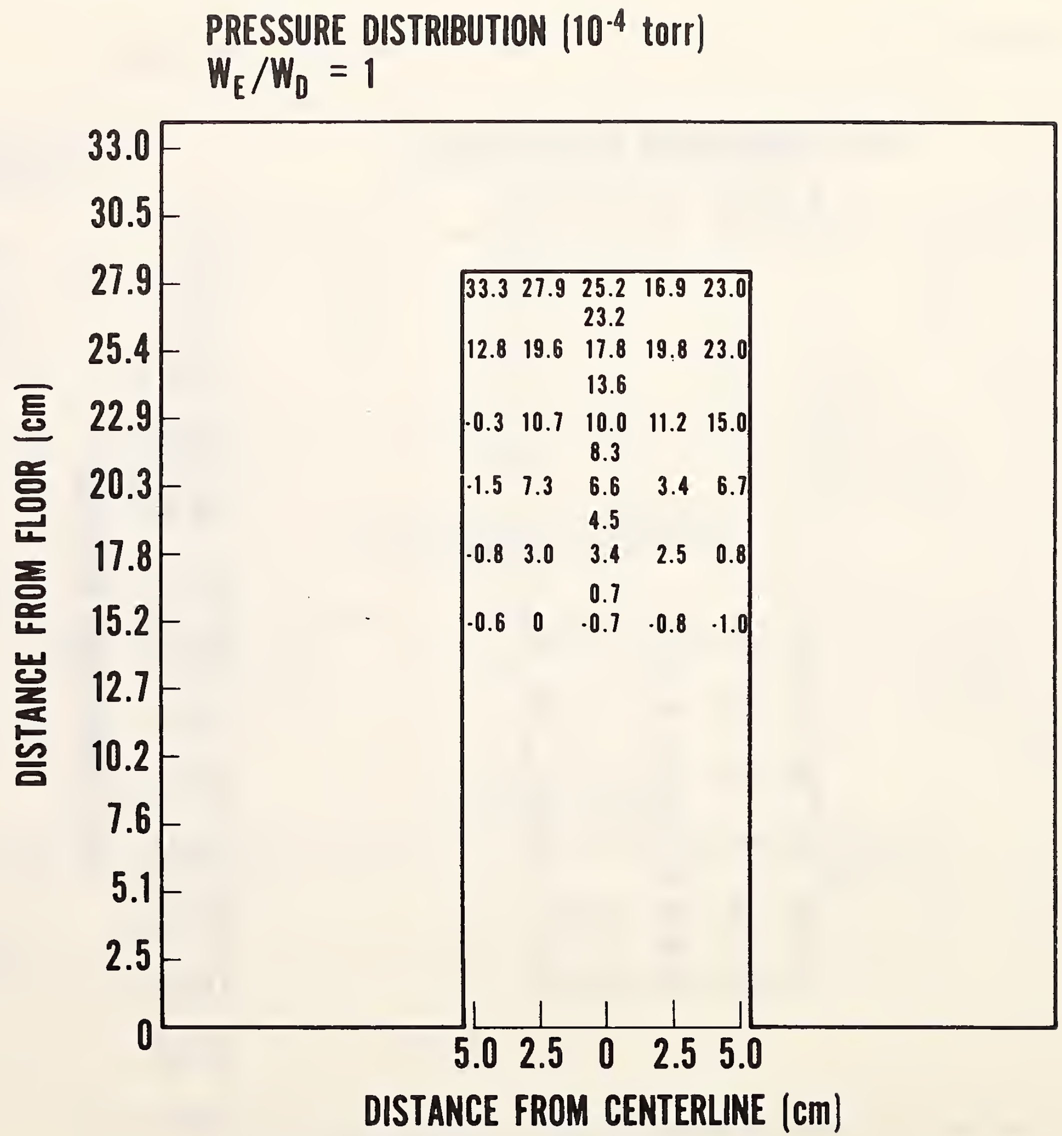

Figure 3b. Pressure data for the flow out of the corridor

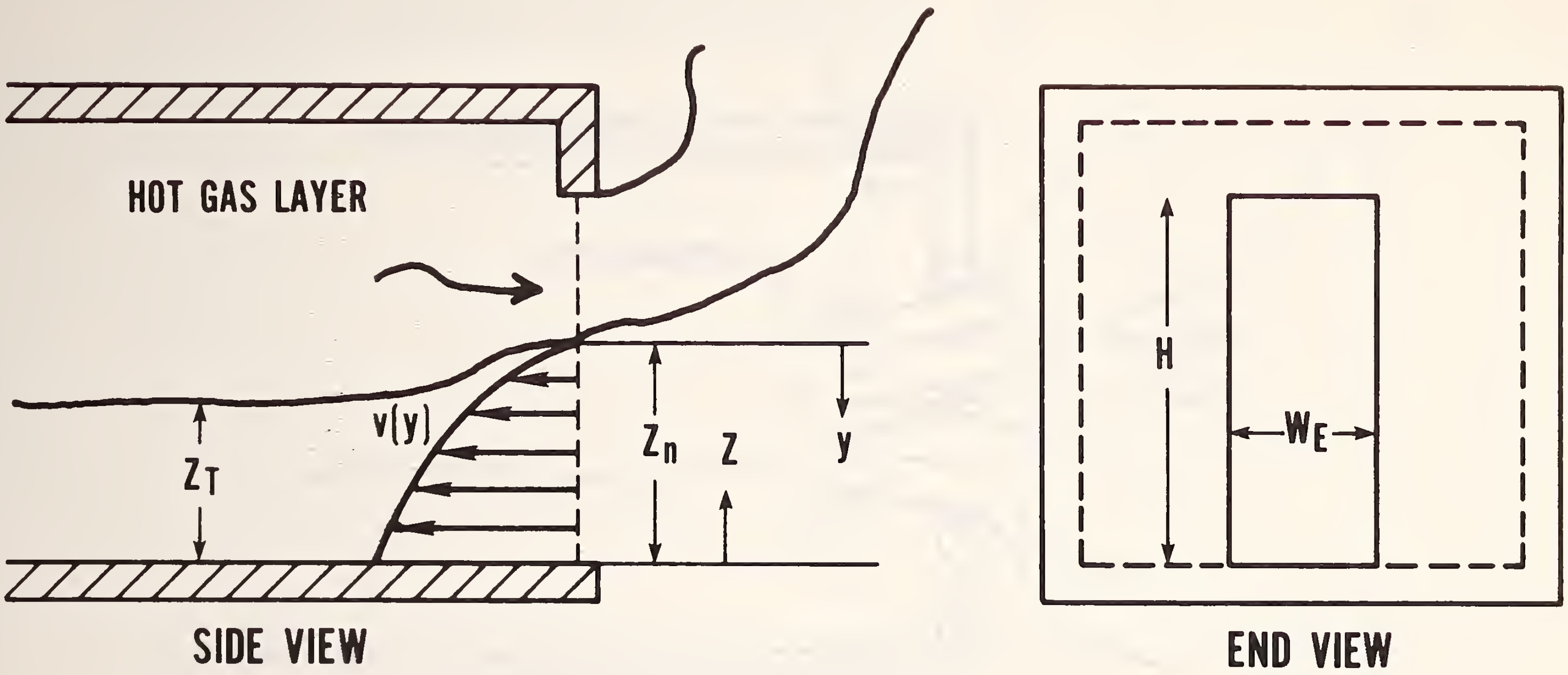

Figure 4. Calculation of inflow velocities

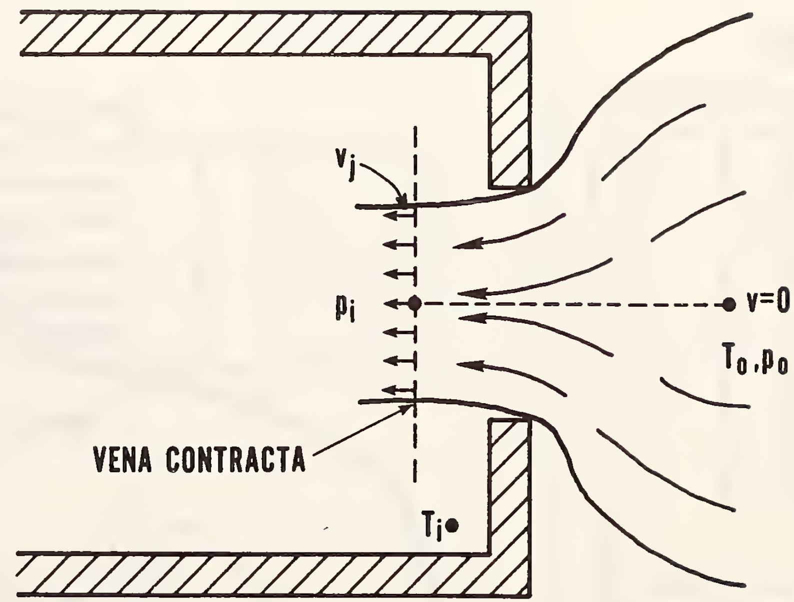

Figure 5. Diagram of vena contracta for inflow (horizontal section)

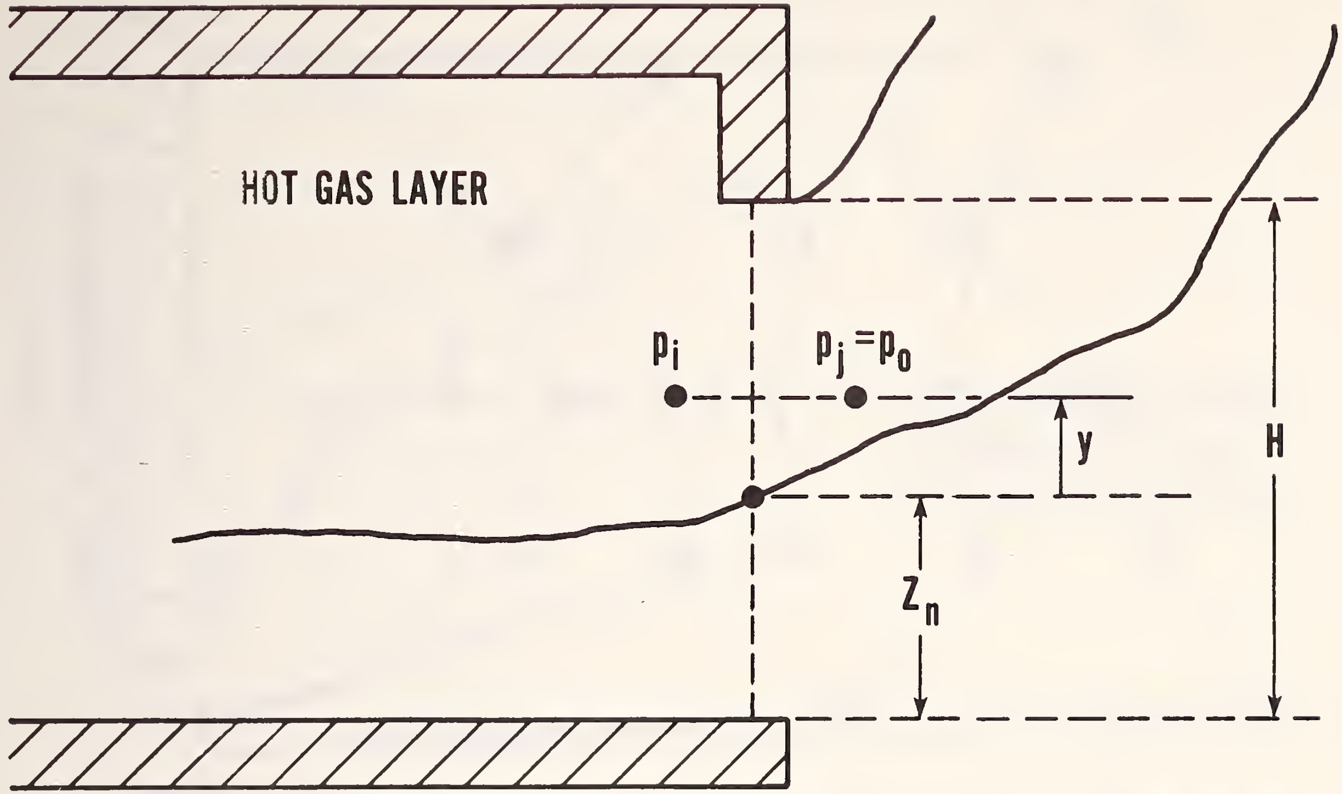

Figure 6. Calculation of outflow velocities

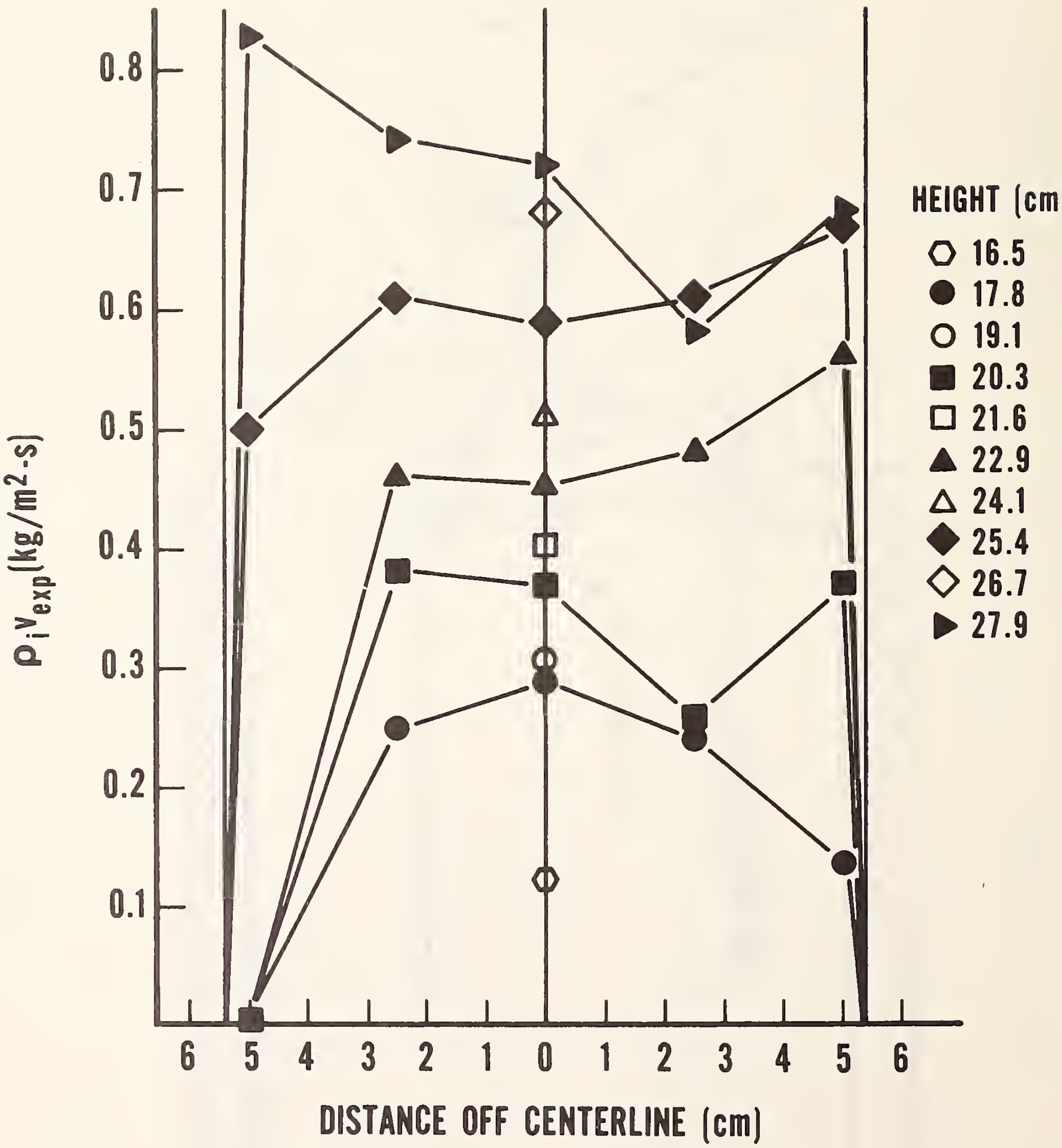

Figure 7. Mass flow rates for flow out the exit doorway

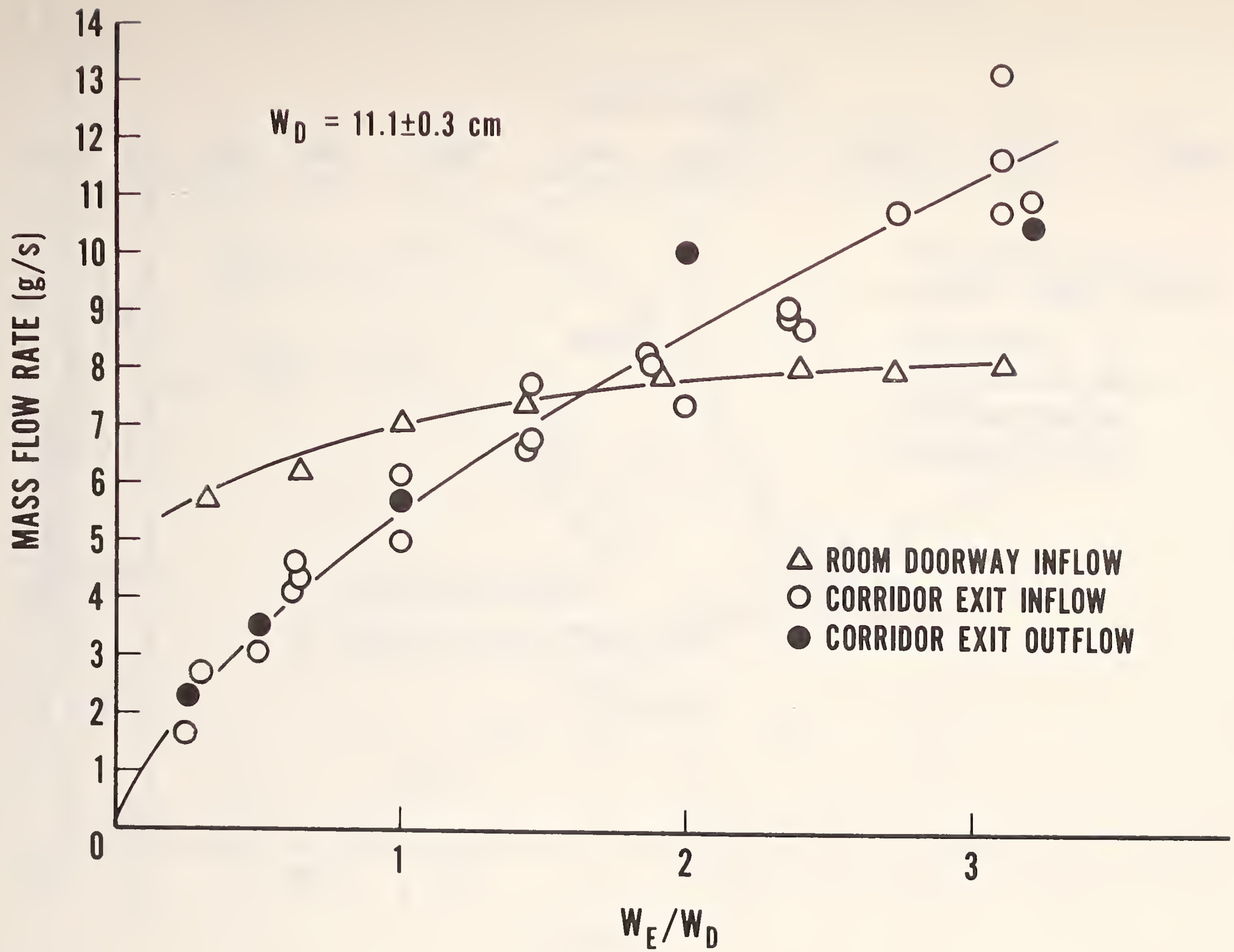

Figure 8. Experimental mass flow vs corridor exit door width (W_E/W_D)

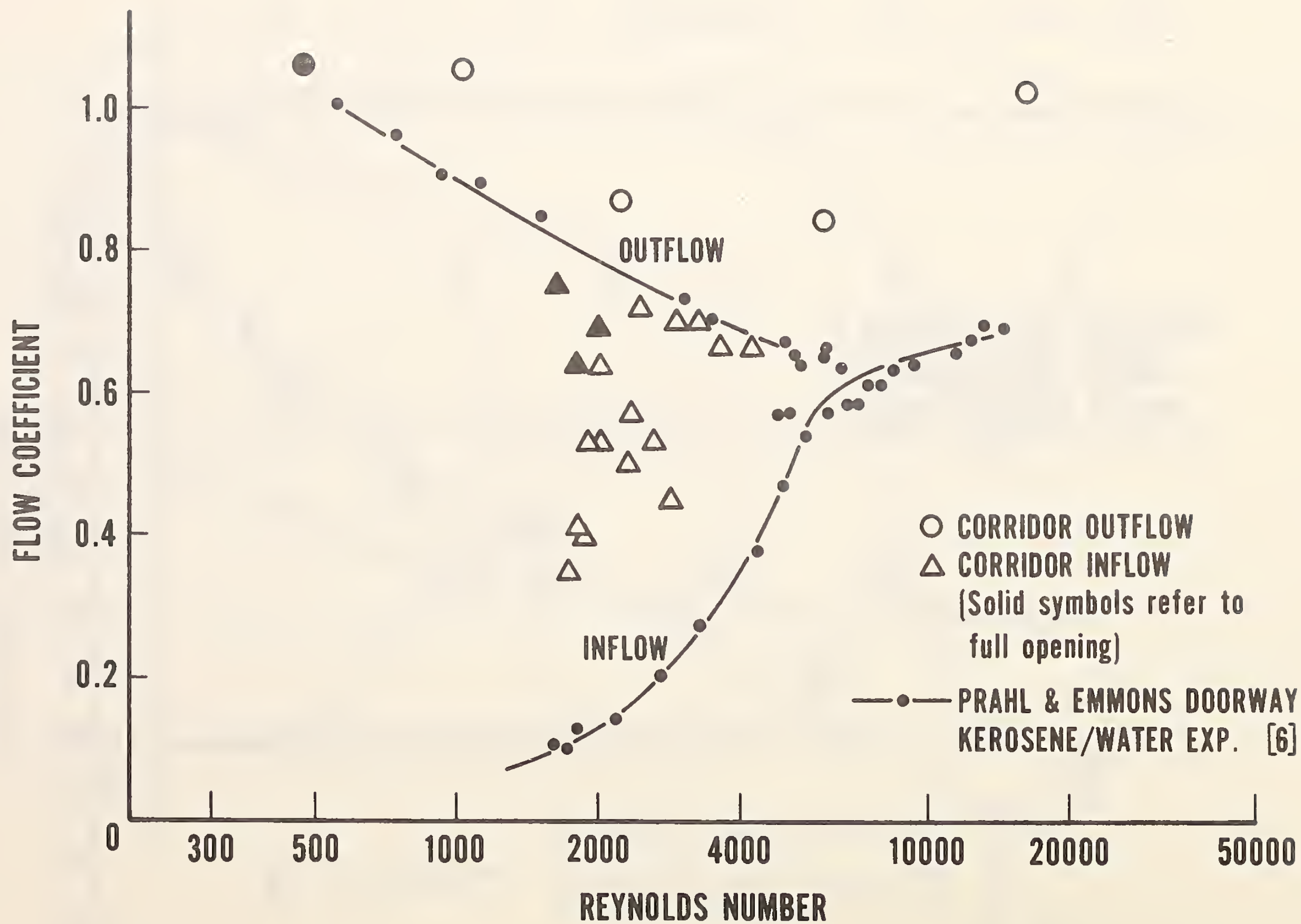

Figure 9. Orifice flow coefficient vs Reynolds number

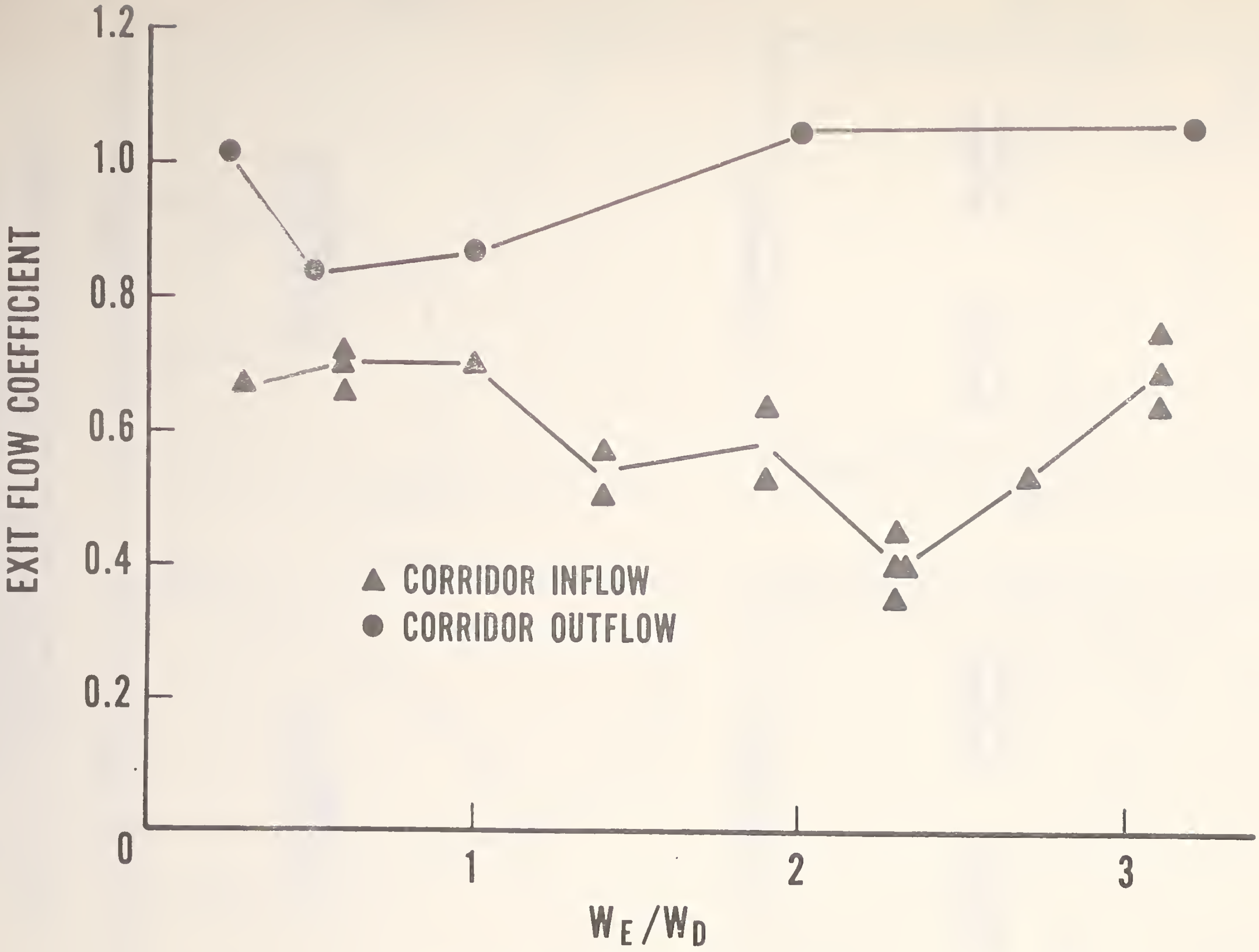

Figure 10. Orifice flow coefficient for exit doorway vs corridor exit door width (W_E/W_D) for inflow and outflow

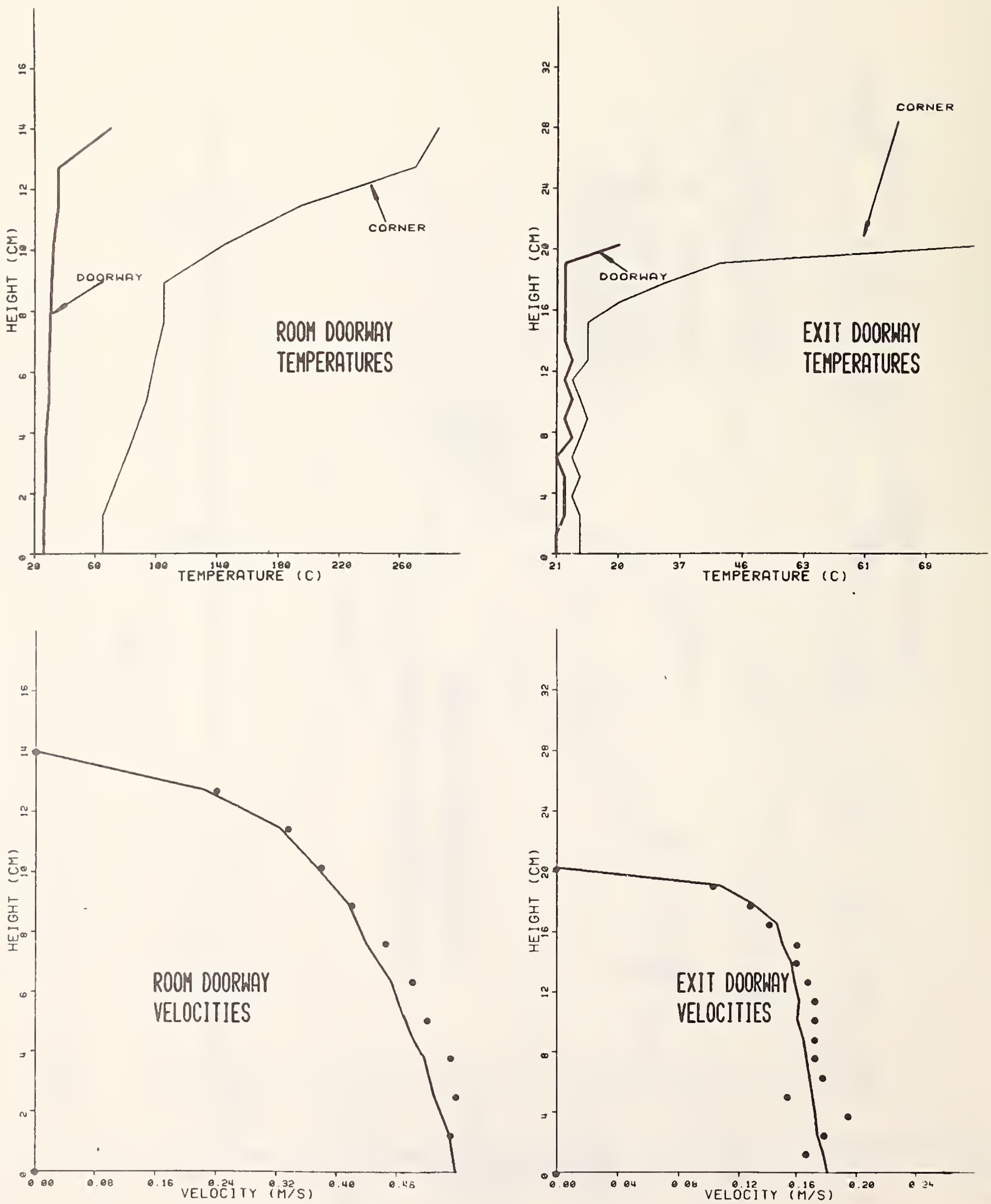

Figure 11. Experimental temperature and velocity results and calculated velocities for $W_E/W_D = 3.1$
● measured velocity —— calculated velocity

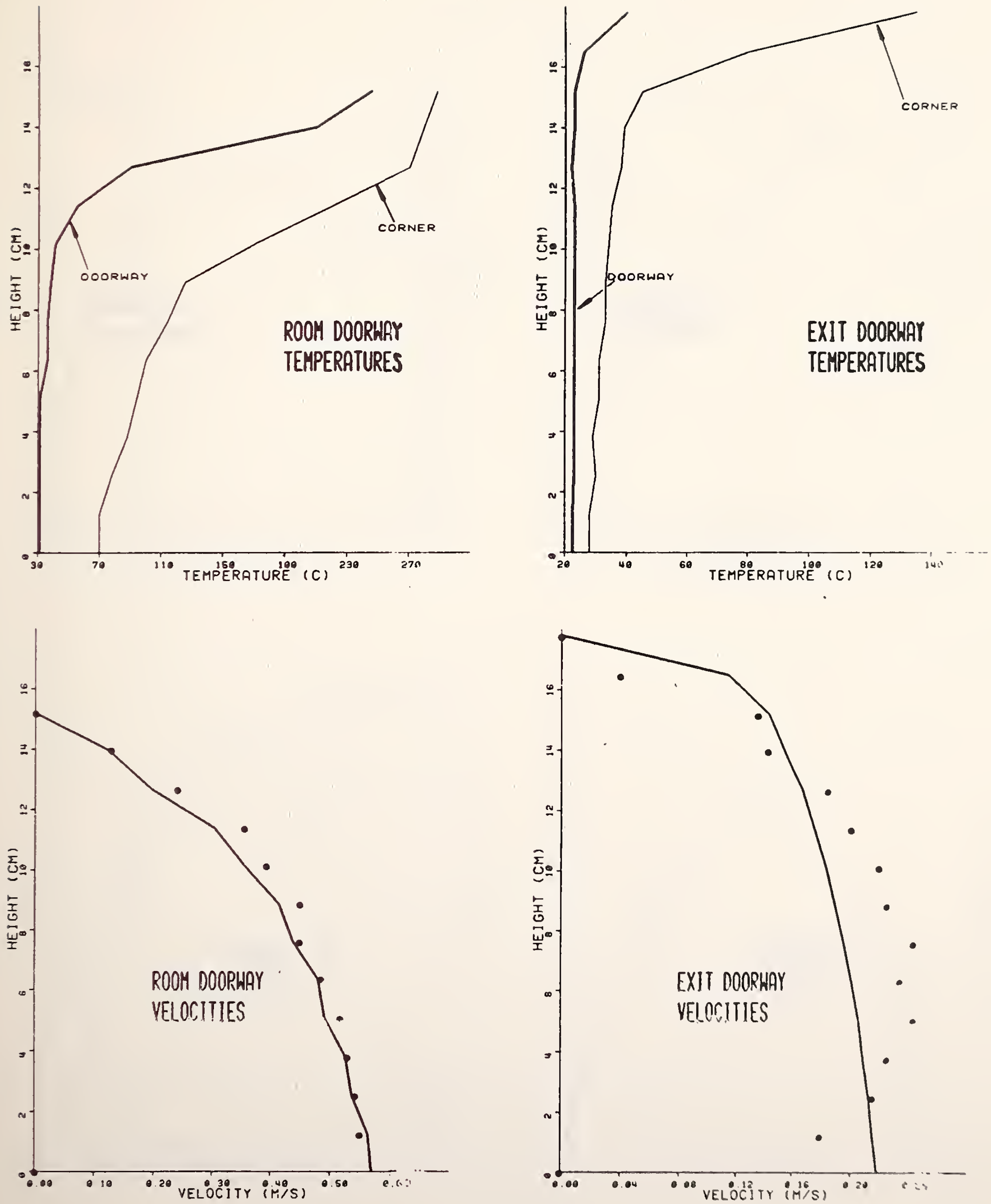

Figure 12. Experimental temperature and velocity results and calculated velocities for $W_E/W_D = 1.9$
● measured velocity —— calculated velocity

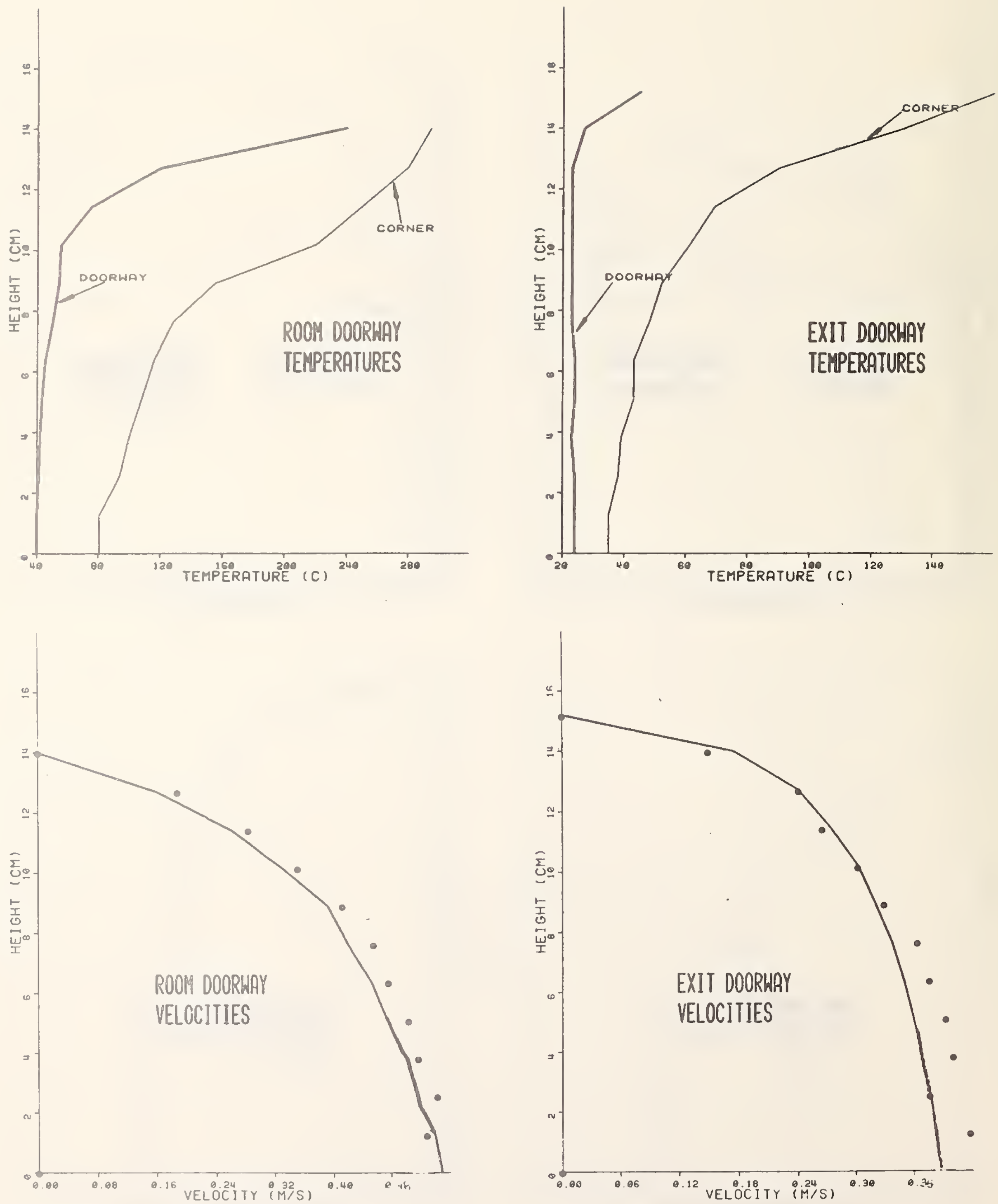

Figure 13. Experimental temperature and velocity results and calculated velocities for $W_E/W_D = 1.0$
● measured velocity —— calculated velocity

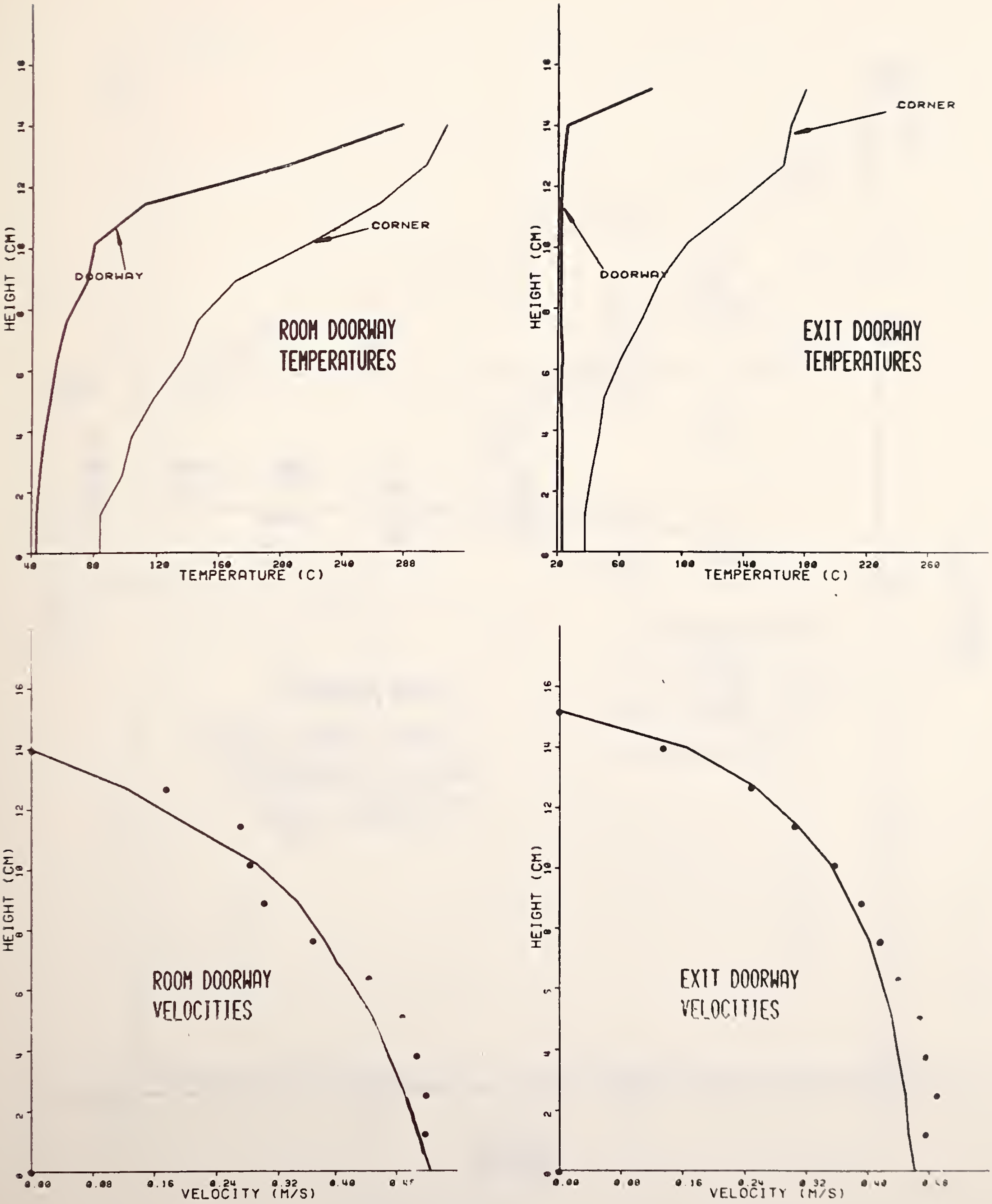

Figure 14. Experimental temperature and velocity results and calculated velocities for $W_E/W_D = 0.6$
● measured velocity —— calculated velocity

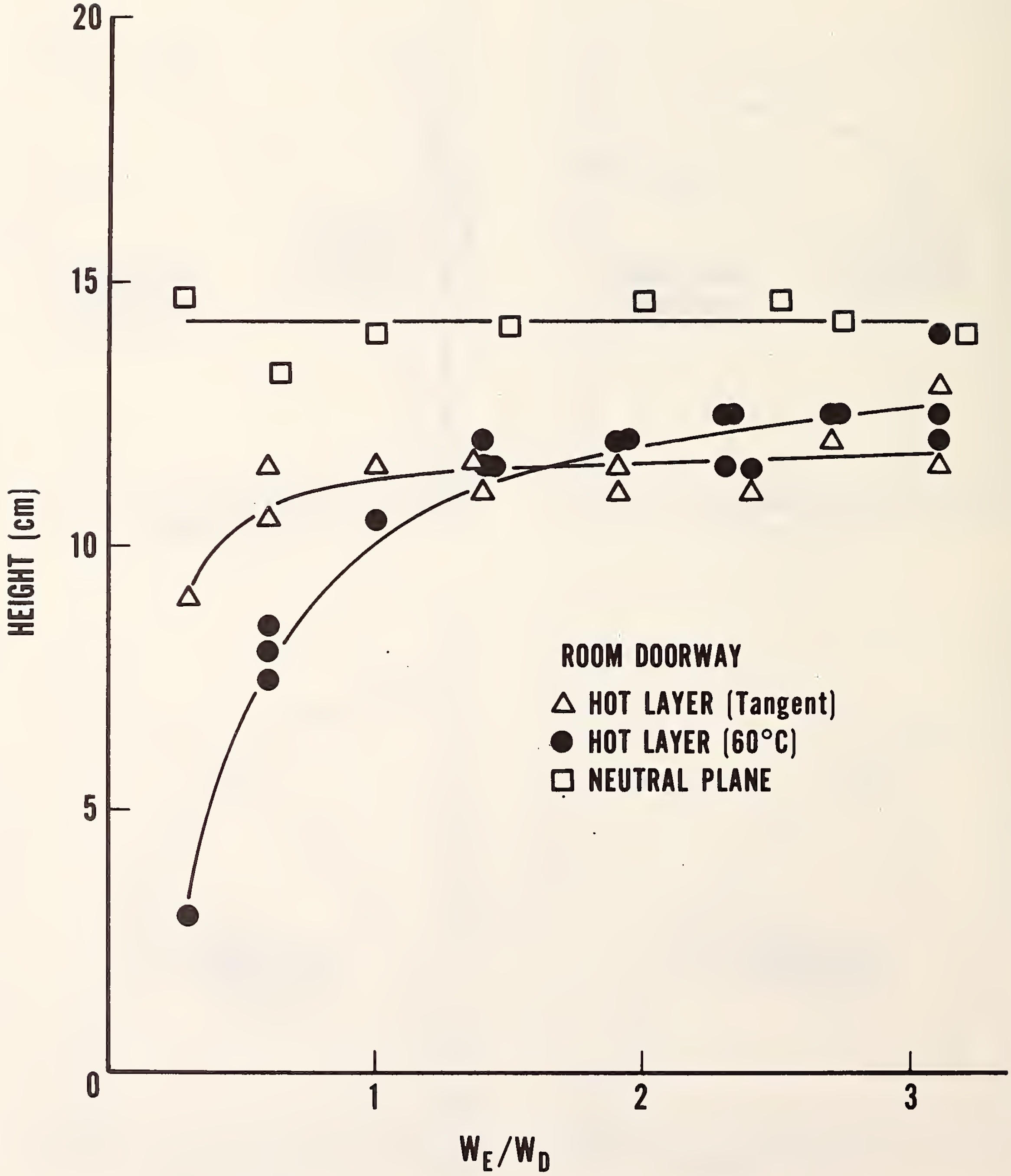

Figure 15a. Neutral plane height and effective height of hot layer based on room doorway temperature vs W_E/W_D

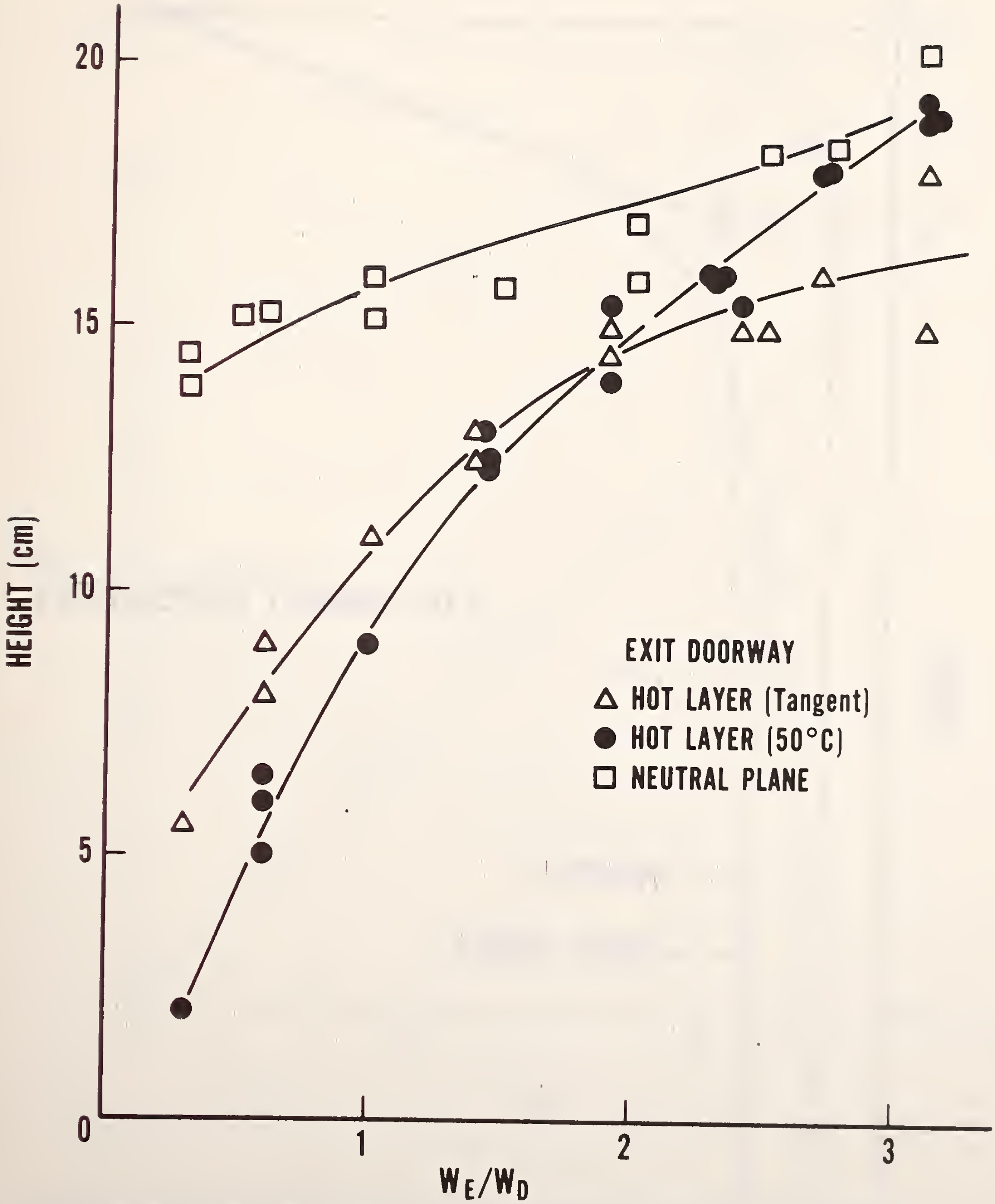

Figure 15b. Neutral plane height and effective height of hot layer based on corridor temperature adjacent to exit doorway vs W_E/W_D

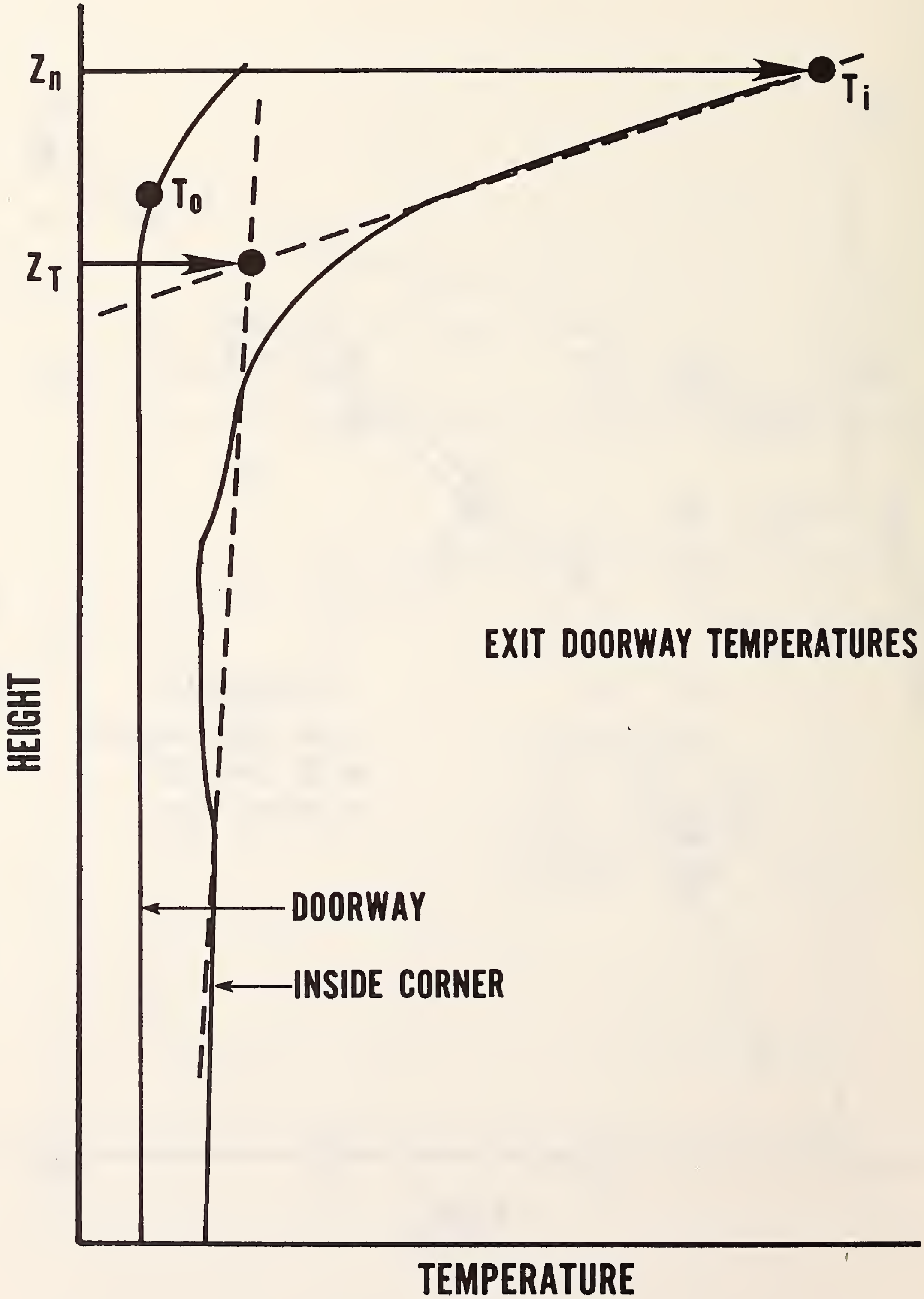

Figure 16. Example of determination of z_T, z_n, T_i and T_o from temperature data

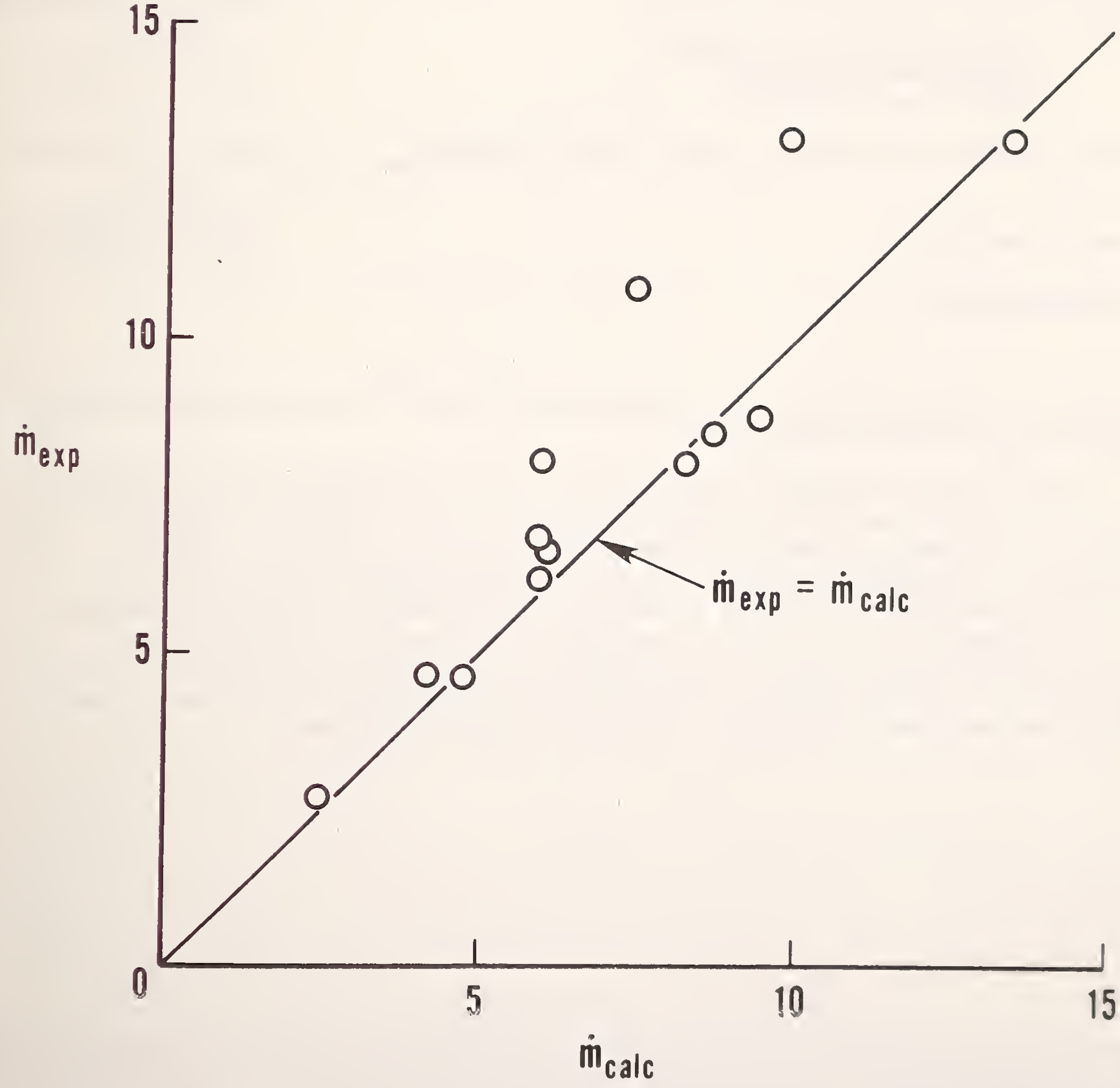

Figure 17. Calculated mass flow rate vs experimental mass flow rate

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12. Sponsoring Organization Name and Complete Address *(Street, City, State, ZIP)* Same as number 9			13. Type of Report & Period Covered Final Report / 14. Sponsoring Agency Code

15. SUPPLEMENTARY NOTES

16. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)*

Fire induced flows were measured in a 1/7th scale model room-corridor by measuring velocity and temperature profiles in the room and corridor exit doorways. The corridor exit door width was varied by a factor of 10 as an experimental parameter while the average fire room temperature was held constant. The applicability of an orifice flow model to predict the doorway flows was examined. The ratio of measured to theoretical mass flow rate, defined as the flow coefficient, was found to vary with door width and flow direction. The coefficient ranged from 0.4 to slightly greater than 1. No explanation has been developed to account for this variation.

17. KEY WORDS *(six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)*
Corridor; experiment; room; scale-model; theory; compartment fires; buoyancy flows; flow coefficients

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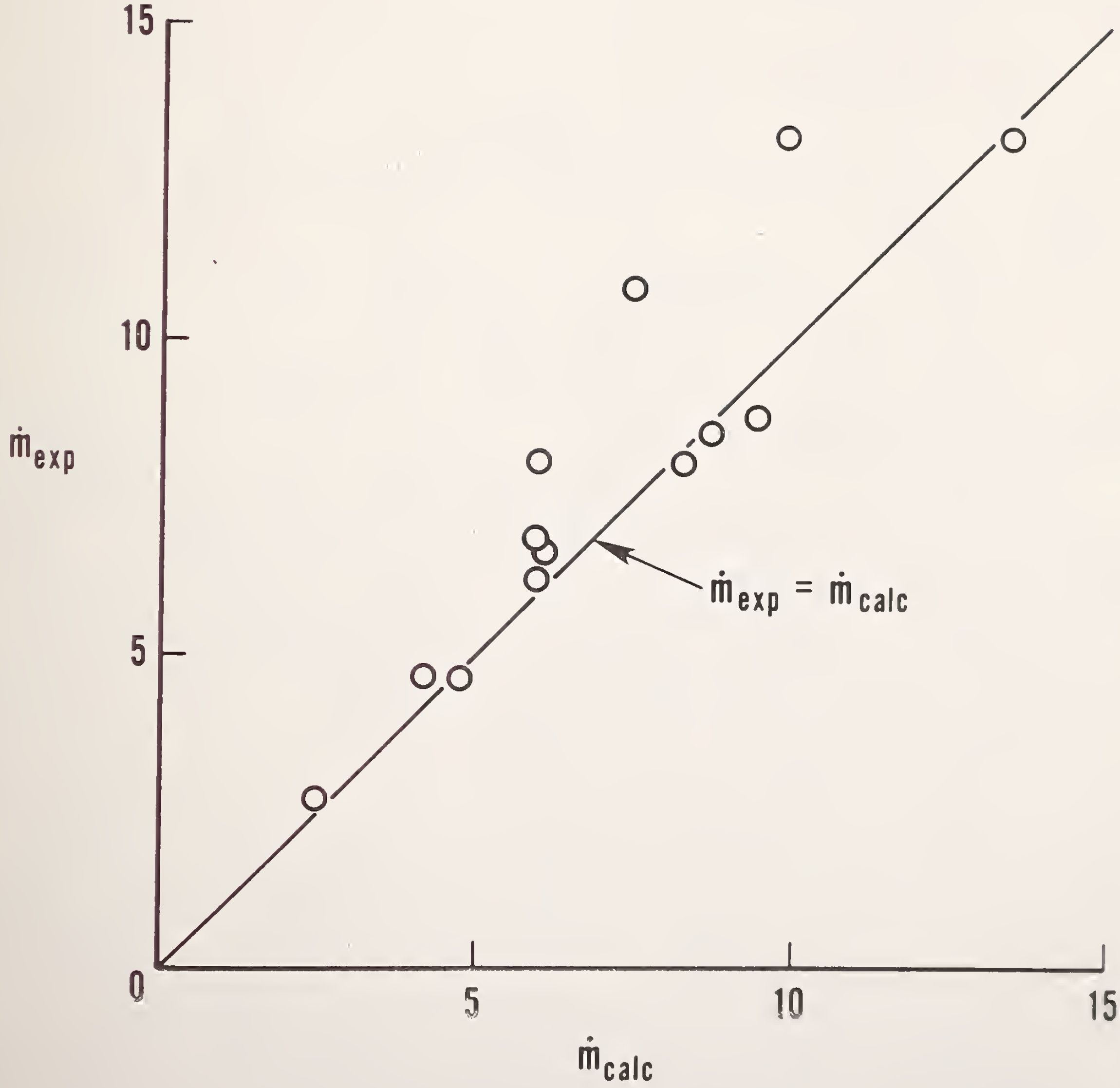

Figure 17. Calculated mass flow rate vs experimental mass flow rate

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Fire induced flows were measured in a 1/7th scale model room-corridor by measuring velocity and temperature profiles in the room and corridor exit doorways. The corridor exit door width was varied by a factor of 10 as an experimental parameter while the average fire room temperature was held constant. The applicability of an orifice flow model to predict the doorway flows was examined. The ratio of measured to theoretical mass flow rate, defined as the flow coefficient, was found to vary with door width and flow direction. The coefficient ranged from 0.4 to slightly greater than 1. No explanation has been developed to account for this variation.

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