CHAPTER III

PRESENTATION OF ANALYSIS AND TEST RESULT

3.1 Effective Width to Diagonal Ratio (w/d)

For non integral infilled frames, the concept of equivalent diagonal strut is probably the most suitable analogy. Providing the width of the equivalent diagonal strut, thus problem can be solved.

A finite element method is used to find stress and displacement of the infill. Using displacement at loaded conner of the infill to calculate width of the equivalent diagonal strut by mean of elementary strength of materials. The effective width values calculated by this method are compared to the one calculated by Smith's method.

Smith (17, 18, 19, 20, 21) applied finite different approximation to the biharmonic equation, then the stress function was solved by regular program.

The comparision of such methods of effective width is shown in Table 6, 7 and Table 8 , they indicated the same order of majority and the discrepancies can be expected in the range of 5 % to 20 %. Since the equivalent strut theory is an approximate theory, some difference can be expected.

It should be noted that the effective width increase with the contact length which normally related to the characteristic of the infilled frame.

The effective width of a rectangular panel will be smaller than a square panel and longer the length smaller the effective width.

Hence the effective width of the infill depends also upon the geometry of the panel.

Compare an effective width calculated by proposed method to the one calculated by the Smith's method (17, 18, 19, 20, 21), they showed pretty good agreement each other. Otherwise the effective width can be expressed in term of λh and may written as Eqs. (2.13a through c) or can be plotted against λh under various L'/h' ratio as shown in Fig. 12.

3.2 Lateral Stiffness

Reinforced concrete portal frame with local produce brick infill were tested (24) with various length to height ratio. (1.0, 1.5)

For square infilled frame, predicted stiffness by proposed method which calculated on the basis of uncracked transformed sections gives conservative value as shown in Table 9 However there are some difference when they were compared to the test results and the difference is in the range from -5 % to + 13 %.

The prediction using "one third rule" for an equivalent strut suggested by Holme's (3, 4) gives smaller lateral stiffness than that from experiment or by the proposed method.

If the lateral stiffness is considered as only brick panel acting as a cantilever shear wall which Benjamin (1) has suggested.

The lateral stiffness will be smaller than the experimental one and the ratio of experiment to prediction is varied from 1.32 to 1.1.

On the other hand an affect of boundary frame is considered as a composite with infill, then the lateral stiffness will consist of infill associated with beam and column members. This concept may be derived in two approaches;

First approach, the lateral stiffness can considered as uncracked transformed column and beam section, introduced by Wagih M. (25) and the method predict lateral stiffness higher than the experimental one.

By the way, this method gave the prediction stiffness higher than other method for this series of frame.

Second approach suggest by Meli, R (22), the frame is cracked under sidesway and the lateral stiffness will considered the crack transform section of the frame. This method gives less lateral stiffness than the one of un-crack section, however it still be higher than the Benjamin's (1) method.

For Infilled frame of square shape as shown in Table (9), the lateral stiffness from experiment (24) were smaller than the prediction.

However the prediction especially the proposed method calculated lateral stiffness more conservative than the other methods.

For rectangular infilled frame where length to height ratio in 1.5 as shown in Table 9 lateral stiffness calculated by proposed method is very closed to the experimental value, the discrepancy is around $\pm$ 8 % .

Another series of test (2) for local produce brick infilled frame having length to height ratio 1.0, 1.5 and 2.0

The predicted lateral stiffness was about twice of the experiment for the proposed method and was about three times for Benjamin (1) method, finite element method (2) and Wagih method (25).

It should be noted that the prediction by proposed method gave better agreement with the test than the other methods especially for rectangular panel of height to length ratio 1:2 while the other was 2-3 times difference.

3.2a Lateral Stiffness of Brick Infill and Bare Frame

When the frame is very flexible, brick infill can be used to increase the lateral stiffness, only frame itself can resists very small lateral forces and show larger deformation. As shown in Table 12 one can see that brick infill give higher lateral stiffness than bare frame in range of 2.5 to 17 times. The analysis of lateral stiffness based on uncracked transformed section and effective width of equivalent strut in Table 6, 7, 8 and Fig 12 to be use.

The great load-carrying capacity of infilled frame is due to the development of considerable frame action and due to the confinement of the infill. The latter develops high diagonal forces but reduced lateral deformation.

3.3 Ultimate Load

The ultimate load of the infilled frame can be predicted by the equivalent strut theory. First suggested by Holme (3) which considered that the ultimate load, the shortening of equivalent strut is defined at the compressive strain of material exceed the failure.

This study would also propose the method to calculate the ultimate lateral load for the infilled frame by mean of Holme's concept.

The ultimate loads using the effective width in the proposed method for an infilled frame of length to height ratio equal to 1, give the larger load than the test (24) by factor of about 1.97 to 2.31. This comparision was shown in Table 13.

The predicted load obtained by Holme's (3) "the one third rule" was larger than test about 1.64 to 2.02 times and by effective width of Smith (17, 18, 19, 20, 21) was also larger in the factor of 1.26 to 1.59 times.

For infilled frame of length to height ratio equal to 1.5, the ultimate load using the proposed method is larger than the test about 2.39 times and the Holme's (3) exceed test 2.03 times.

The ultimate load predicted by Smith's method (17, 18, 19, 20, 21) was about 1.5 of the one from the test (24) value.

Some discrepancy on the ultimate load is due to the development failure between wall and the frame. Meli (22) stated that first cracks occur diagonally at about center of the panel when the load exceed the cracking load and extend as diagonal line to each corner of the panel. At failure, panel will silp along the diagonal crack by mechanism of shear failure (22) this development will also confirm by experiment (2, 24).

The ideal of compressive failure at an equivalent strut may be different due to the brick panel under direct compression test of brick wall.

Test of brick infill was under confined condition from boundary frame but the material proportion was under unconfined brick panel test.