CHAPTER 3

LITERATURE REVIEW

3.1 INTRODUCTION

A composite slab consists of profiled steel decking (or sheeting) as the enduring formwork to the base of the concrete slabs spanning between the beam supports. During the construction stages, the sheeting plays a vital role. Before the concrete casting, the concrete would act as a platform for the workmen and also their equipment. At the time of casting, the sheeting performs as a formwork. Once the concrete is hardened, the two components have developed into a composite system, where the sheeting would behave as the reinforcement. In this chapter, the various literatures studied and investigated by many researchers on the steel concrete composite slabs are presented. The brief report on the various methods, experiments are also presented in this paper.

3.2 LITERATURE REVIEW

Marimuthu et al. (2007) have studied on the composite deck slabs to evaluate the shear–bond characteristics (m-k) values related to embossed profiled sheets. Researchers have considered with 18 numbers of specimens by using M20 grade of concrete are shown in Figure 3.1, for evaluating the m–k values with the various types of shear spans were taken into account. Three sets were taken for short as well as for long span and the length accommodated by the short span are 320 mm, 350 mm, 380 mm and for long
span 380 mm, 950 m and 1150 mm respectively. The specimens were applied with a cyclic loading of about 5000 cycles at a rate of 0.1 mm/s; this is being carried out till the ultimate load. The readings were noted at an interval of about 5s. From the investigation, it was observed that long shear span tries to fail due to the shear bond and flexural respectively. Based on the results, it was concluded that the slip (horizontal movement), can be controlled by varying its depth, width and by changing the position of the embossment by incorporating the stud connectors at the end of the member. In this paper, they have used the trapezoidal profile sheet, but where for any profile sheet it has to be verified with the help of m–k values using BS5950: Part4. It was also noted that the load carrying capacity of slab will not be affected by using the cyclic loading. The failure due to the longitudinal shear will be the predominant in the composite deck slab.

(Source: Marimuthu et al. 2007)

Figure 3.1 Schematic view of experimental set-up and support arrangements
Saravanan et al. (2012) have investigated on the composite slab to identify the strength of the longitudinal shear. Around 18 numbers of specimens with three sets were cast and tested with respect to the short and long spans. The experimental set-up are shown in Figure 3.2. The short span length used were 350 mm, 400 mm, 450 mm and for long span were 850 mm, 950 mm and 1050 mm respectively. The simply supported along with hinge and roller supports were used by providing cyclic loading of about 5000 cycles. The frequency for both the specimen ranges from 0.5 $W_q$ to 1.5 $W_q$ and further monotonic loading were used at a rate of loading of about 0.25 mm/min. The trapezoidal profile sheet along with rectangular dishing type embossment provided at the web and flange portion. By using Regression analysis, the m–k values were determined. It was noted that catastrophic failure was absent. To have a reliable design, the safe depth, width and position of embossment have to be provided. It was noted that the longitudinal shear failure was one of the most of the important failure for identifying theoretically to compare with the flexural and vertical failures. In this paper, they have used the four point bending test for the experimental work.

(Source: Saravanan et al. 2012)

Figure 3.2 Experimental set-up
Lakshmikandhan et al. (2013) studied the behaviour of Interfaced steel concrete composite deck slabs. Around 9 specimens were used with three sets specimens in each group. In the first group, it is being provided with trough deck along with mechanical shear connector (secondary reinforcement and shear bolts). In the second group, it is being provided with wire mesh for the secondary reinforcement (chicken mesh), whereas in the third group, steel is used for shear interface (steel rods of 10 mm diameter). The two point loading was provided and from the results, it was observed that the strength was observed that the strength and the stiffness of the specimen (mechanical interlock), this performs better than the conventional. It was even observed that by neglecting the mechanical interlocks, the result will be twice when compared with the conventional. The mechanical shear connectors were less slip and delamination was neglected. Due to the presence of slip, there was a failure in the composite slab without shear connectors, which will try to modify the behaviour by brittle and ductile. In the first group, it was identified that there was a negligible slip due to the full shear interaction. In the second and third group, the composite slab was increased by the stiffness and strength of the member. It was observed that there was a non–bending moment for the chicken mesh when compared to the normal secondary reinforcement. There was a flexural mode the composite slab will try to completely fail and due to the interfacial slip, there was a negligible failure. Due to the flexural mode, the slab tries to fail in ductile when compared to the interface bond failure. Also, provides the better results and good resistance with related to the longitudinal shear and uplift de-bonding forces.

Matthew & Ochlers (2001) studied the effect of composite profile slabs by incorporating the rib shear connectors. They have used 33 samples for conducting pull–out tests to identify the behaviour of the composite deck slabs. By using pull–out tests, the various parameters were determined to study the effect on the chemical and mechanical bond strength and also the cross–
sectional geometry, thickness of profile sheet, surface treatment (grease or non–grease) and embossments. The trapezoidal and re–entrant profile sheets were used for evaluating. The specimens with and without embossment were also investigated. Researchers have used the various dimensions with respect to the breadth of the rib and flange, height of the rib. It was less effective when compared with the embossment and the geometric shape of the profiled sheets. It was observed that there was a linear variation in the embossment provided in the profile sheet and in the surface treated specimens. It was determined that the failure was quite reduced by using mechanical interlocking mechanism. The mechanical bond between profiled sheet and concrete, the slip behaviour of profile sheet, delamination failure are shown in Figure 3.3 to 3.5.

(Source: Holomek et al. 2012)

**Figure 3.3 Mechanical bond. (a) Externally unconstrained sheet; (b) Externally constrained sheet**

Crisinel & Edder (2006), Crisinel & Marimon (2004) and Ferrer et al. (2006) familiarized a new simplified design method for the purpose of composite slabs. Inorder to predict the effect of composite slab the new modified design with the help of small – scale testing. There are around three phases such as first phase provided with Elastic non-cracked (no slip), Elastic or Elasto-plastic cracked (no slip) for the second phase and the third phase provided with Elasto-plastic cracked (with slip). In the compression and
tension member, the behaviour of the steel material was elastic and plastic. In both the zones, the curvature was equal before and later the slip occurs. The shear stress verses slip results from the new simplified approach were incorporated in the new design. Based on these results, the moment curvatures were identified on the composite slabs. With the help of curvature results, the load carrying capacity of the composite deck slab can be predicted. It was noted that the modified design will be useful for ductile as well as non–ductile composite slab. To predict the complex behaviour of composite materials, the pull–out tests can be carried out. It was observed that initially the concrete tries to crack and then it attain the slip between the concrete and sheeting to gain the maximum shear stress. In the transition zone, it was noted that there was a maximum longitudinal movement. For the ductile and non-ductile full scale composite slabs, the moment–curvature at the critical section were stimulated with the help of Finite Element analysis and experimental investigation. For the asymmetrical distribution of the load, the reduction in mechanical connection strength and the cross–section than the critical mid–span sections have to be taken into account. During the pull–out test, the member would be brittle by providing the back–to–back trapezoidal profile, so the embossments are provided at the web and flange.

(Source: Ferrer et al. 2006)

**Figure 3.4 Slip behaviour and Von Mises stress maps for both inwards and outwards embossing directions**
Chen (2003) studied about the composite slabs related to the load carrying capacity with various end constraints. They had considered seven specimens for the one–way composite slab and two specimens for two–way composite member to investigate the shear bond resistance. By the help of two methods the specimens with simply supported conditions were tested with the end anchorage by steel shear connector and by neglecting end anchorage. To improve the compression properties, the behaviour have to be studied by using the steel reinforced concrete and steel fibre reinforced concrete. In the one–way slab, the shear bond slip is 1.065 and for two–way slab it was around 1.165 (mean ratios of vertical shear force to the shear bond resistance). The steel–concrete interface will not develop the full plastic moments in the span due to the shear bond failure in the composite slabs. Based on the tests results, there is an increase in the ultimate load carrying capacity with the help of end anchorage method than the specimen without end anchorage method. It was
observed that the specimens with end anchorage were better than the specimens without the end anchorage method. To transfer the hogging bending for the continuous composite slab, the negative reinforcement is needed. Using the steel reinforced concrete for the simply supported conditions, the behaviour of the member gave the same changes. The analysed prediction results and experimental results were quite closer by using the linear regression analysis. It was observed that there was a failure due to longitudinal shear–bond slip in the one–way slab and two–way slab specimens. The strength of the anchored studs will be the prime factor in prevailing the end constraints condition to the shear bond resistance of the composite slab. The shear bond slip plays a critical role. The geometric shape and Push-out test set-up are shown Figure 3.6 and 3.7 respectively.

![Figure 3.6 Geometric shape of 3W-DECK sheets](source: Chen 2003)

Pentti Makelainen & Ye Sun (1999) investigated the composite floor system of new profile steel sheet for the behavior of longitudinal shear. The depth of the profile sheet was 153 mm with the stud shear connection. Around twenty seven specimens were used to conduct the push out test with various shapes, sizes, locations of embossments and different steel sheeting thickness.
The cold form profiled sheeting is first embossed with respect to the desired shapes as per the standards and requirements of manufacturer. The depth of the embossment plays a vital role in the steel connection and the minimum depth is of about 2.5 mm. The behaviour of the steel connection tries to get affected when there is a reduction in the young’s modulus. When there is an increase in the depth of embossment, the shear stress and resistance value increases. The vertical separation is quite less due to the penetrated profiled sheet embossments; the profile sheet was brittle and ductile during the testing of the specimen. The m-k value is being incorporated for the composite slab with a longitudinal brittle behavior. It was observed that the new type profiled sheeting along with the longitudinal shear strength of 0.6 N/mm$^2$ can be suggested for composite deck system for further research using push-out tests.

(Source: Pentti Makelainen & Ye Sun 1999)

**Figure 3.7 Push-out test set-up**

Tenhovuori & Leskela (1998) investigated the longitudinal shear resistance of composite slabs. The major factor considered for the study was longitudinal shear connections. In the composite slab gets affected due to the bond failure between the profile sheet and concrete. Using the numerical and experimental data the composite slab is analysed. Non–linear analysis is being
carried out for the numerical method (finite element method). The critical factors are revised for the design and the effects of different important parameters are considered. For the design purpose Eurocode 4 Part 1.1 is adopted. To improve the design and also to minimize the failure in the composite slabs, the complete discussion of present methods are analysed and revised. The occurrence of failure in the composite slabs, the longitudinal shear connection will be the crucial place. In the composite slab, the critical factors will tend to affect the bond failure is discussed in depth.

Calixto et al. (1998) investigated on ribbed decking by full scale testing. The composite slab was completely studied based on the behaviour and strength. The various parameters were considered such as various thickness and depth of slab, shear span length and effect of connecting using end anchorage type were studied. Monotonic loading were adopted for the experimental investigations. The ultimate load as well as the performance was higher in the normal ribbed decking slabs with respect to the end anchorage method. There was a unique behaviour observed in the floor which was constructed by using ribbed decking and stud bolts. It was also noted that there was no drop in the monotonic loading, thus the behaviour of the connection was characterized and also the shear bond failure was observed for all the specimens. As per Eurocode 4, the experimental results were compared with respect to the Partial Shear Connection (PSC) method. To oppose the vertical separation the location of the embossment plays an important role. In this, the researchers have clearly discussed about the mechanical interlocking and frictional interlocking system. The new design procedure was projected and analysed with a reference of existing design procedure. The comparison has been done on the design aspect which gave better correlations factors for the design procedure.
Wright et al. (1987) analyzed the behaviour of composite slabs for the use of floor system in high rise buildings. Experimental investigations were done around 200 specimens; the results were comparison with the current design method. There are three various aspects such as construction phase, composite slab action phase and composite beam action phase. There are three types of failure modes where in the first stage it would behave completely composite, in the second stage the chemical bond tries to break and slip occurs and in the final stage the concrete and profile sheeting tries to collapse due to the mechanical bond. In order to reduce the effect of plate buckling under bending compression, the rolled grooves are used for stiffening in the flanges of the composite slab (construction phase). By providing the embossment in the web of the profile sheet, the composite slabs were stiffened. The study has been carried out on the interface connection between the profile sheet and the concrete to transfer the horizontal shear force in the composite slab action phase. The steel deck and concrete tends to separate vertically due to the action of horizontal shear forces and the imposed bending moment. The vertical separation as well as the horizontal shear can be limited by introducing the new geometry shape and the embossments. In the plastic section, failure of the shear bond would be the major and the modular ratio will not be useful for forecasting the ultimate strength of composite slab. The experimental was carried out as per BS 5950: Part 4. There was not much difference in the slab related to ultimate load carrying capacity due to the discrepancy in the concrete. In the composite slab, the ultimate strength mainly depends on the depth, orientation and position of the embossments. By providing cyclic loading for the composite slab, there was not much difference in the ultimate load carrying capacity of the member. In the evaluation of composite beam action phase the orientation of beam and type of profile sheet plays a major role. Height of the embossment was one of the fundamental parameter which produced the considerable effect on the composite slab. The
recommendations was brought up by suggesting various phases such as span of slab, span of beam and stud connectors for the utmost economy design.

Porter & Ekberg (1975) experimental investigation were compared with the design of composite floor deck slab system. Around 353 full–scale specimens were tested experimentally inorder to forecast the capacity of the shear–bond of the profile steel deck slabs. The shear–bond mode was the initial mode of failure found in the composite deck slabs. Diagonal tension cracks were identified in the concrete, near to the loading points which was followed by the end slip. It was observed from the experiment results that there was sudden horizontal movement due to the shear bond failure in the shear transferring device. From the test results it was identified that the embossment and spot welded wires increases the shear capacity in the composite deck slab. The interface slip at shear span was more in the composite deck slab. The regression constants m and k value was changed by the gauge thickness and the pattern of embossment, and that indicated the definite change. The surface coating of the profiled sheet is the main factors that acts on the composite deck slab related to the shear–bond capacity. Based on the shear span condition, the composite slab changes its complete behaviour. In the long shear span, it was noticed that there was a non–linear and ductile behaviour. The load carrying capacity deceases with the shear span increases. In the composite slab the ultimate load carrying capacity gets affected by the thickness of the profiled sheet. There is an increase in the non–linearity when the thickness of the slab decreases. The ultimate failure load and the end slip can be identified. For the reliable boundary condition the shear bond equation can be highlighted for the new design equation.

Porter et al. (1976) investigated the composite floor diaphragm slab. From the experimental test results a proper recommendation for the design of composite slabs with in plane condition was been proposed. In the
composite diaphragm, the major failures noticed such as shear strength, stability and localized failure. The behavior of composite slab action is due to the interfacial shear parallel and perpendicular to the profile deck sheet and the concrete interface. The failure may occur at the edge of the diaphragm in the arc weld spot, concrete rib and stud connectors. Diagonal cracks occur in the concrete at 45° due to shear strength failure across the slab, when it reaches the tensile limit. In the concrete, from the bottom to the top portion the diagonal cracks were formed. The forces are transferred to the slab through the deck slab where the shear reinforcement is placed. There is a direct shearing occurring in the concrete along the line parallel which would be parallel to deck; this is formed mainly due to the cover of the thin concrete. The shear strength of the concrete will be mainly occurring due to the ultimate shear strength. The failure can occur due to the interfacial shear parallel or perpendicular to the deck corrugation (parallel–longitudinal shear, perpendicular–vertical shear). The inclined face of the wall will be supportive for the concrete to bear the perpendicular failure. In the transverse as well as longitudinal direction, the deck corrugation will react to the stiffness and relative interfacial shear strength. Failure can occur mainly due to direct shearing, buckling or tearing at the deck around the weld. The corrugated sheet with stud fails due to the concrete around the stud portion. If the stud is placed below or parallel to the rib it would fail due to the direct shear at the rib or even it can be under reinforced resembling. The capacity of the composite slab mainly depends on the shear–bond strength of the corrugation. From the experimental results, it was observed that the equation can be derived for the shear bond capacity of composite deck slab. The design equation is framed with respect to the experimental values. The author had also suggested that by using the linear regression analysis the m–k value can be obtained between the slope and the intercept constant for the design equation.
Porter & Ekberg (1971) the behaviour of reinforced concrete floor slab using cold formed steel deck is experimentally investigated. Around 256 specimens were used for testing. It was divided into several groups relating to the specimen, loading and direction the tests are performed. During experimental, there are two types of failures were identified such as bending failure or flexural failure and shear bond failure. Under reinforced failure occurs mainly due to the tensile strain which tries to reach the steel and the over reinforced failure tries to occur in the concrete in the compression mode and finally crushes. The bending failure in the conventional reinforced concrete and the composite slab is quite similar. The magnitude is evaluated with the help of American Concrete Institute Building code. In the composite slab, the shear bond is one of the most important failures. The horizontal slippage and typical shear crack was noticed in the interface of profiled sheet and concrete due to the end slip. For the composite specimens, the ultimate shear capacity is identified by having the experimental values. Shear bond failure occurs mainly due to the rapid drop in the strength. The various factors which affect the composite deck slab and the failure may occur due to the high local loads, which tends the composite deck slab to fail ductile or brittle. From the test results it was observed that the failure of composite deck slab is due to the diagonal crack perpendicular to the profile deck at the edges and due to the end slip. At various points the vertical deflection of the slab was identified. The bending strains were checked on the surface of steel and concrete. The edge point of the slab deals with vertical reactions. Since, shear bond failure in the composite deck slab is more important, this would be quite difficult to identify for the simply supported beam as well as in continuous one-way slab. The design of composite steel deck floor slab is being recommended with respect to the concept of the ultimate shear strength.

Luttrell (1986) investigated the composite slabs for the prediction of strength with various methods. The profile sheet was used for the composite
slab. The modified design procedure was adopted for the design of composite slab with embossments. To improve the interlocking system the embossment where provided in the profile sheet. The tensile force and vertical separation can be noticed at the shear span due to the mechanical and adhesive bond. The embossments are provided at the web portion to resist the slip and vertical separation of composite slab. For the strength of composite slab member around 75 specimens were tested and evaluated. In this paper, researchers have also concentrated on vertical oriented embossments and the type of horizontal embossments. The restrained webs are forced away by the lug overriding forces due to the development of slipping in concrete. When there is an increase in overriding resistance, there will be an increase in deck thickness and lug height. The overriding resistance decreases due to the increase in web flexibility or height of the web. The major part will be the embossment or lug orientation. When compared with the horizontal embossment, the vertical orientated embossment gives the better strength. With the help of shear connector, the force is being transferred to the concrete. By transferring the force, the embossment intensity factor and height increase. If the webs are provided with the same embossing pattern, the shallow webs shall give the better result. This involves both adhesive and mechanical bond. There will be smaller deflection related to the higher loads and also leads to cracks in the stiffer system. Due to impact loading, there will be a sudden collapse of adhesive bond. The system tries to fail the adhesive bond in the form of Domino fashion. If the concrete seems to be reasonable, then the lever arm would be affected and there will be a loss in shear. In the embossed deck, the mechanical adhesive mix resists the shear slip. Based on this, for the evaluation of flexural strength the formula is derived.

Lee et al. (2001) experimentally investigated the behaviour of negative moment of cold-formed steel deck and the concrete composite deck slab system. Around 10 specimens were used for testing with various
thickness and reinforcement ratio, which leads to hogging moment. The negative moment capacity was determined by having the simple analytical model which was composed by the experimental values. The steel exhibits with a greater durability related to the hogging moment capacity in the steel deck. As per BS 8110, the stress–strain for concrete is used, to have an idealised elastic-plastic stress strain reaction. To simulate the perfect bending condition at the support the concrete and profile deck were utilized. To determine the moment curvature relationship, the displacement transducers were located at various points and at the middle of the span and at the supports. The load deflection curves can be found in the mid-span of the structure at the early stage. The flexural cracks are formed in the composite slabs at the moment region. The concrete tries to crush initially by the steel, where the slab behaves completely under reinforced. From the experimental values, the moment curvature curves and the moment capacity of slabs were determined. The ductile behaviour will be more when there is an increase in the diameter of the reinforcing bar and even there will be the presence of hogging effect. The ductility of the slab depends on the amount of steel reinforcement. With respect to the experimental and numerical investigation moment curvature can be identified. The experimental results indicate the slabs are ductile and capable of redistributing moment from negative to positive regions.

Hedaoo et al. (2012) studied the comparison between the experimental and analytical studies of the composite decks. Around 118 numbers of specimens were used for testing purpose. The longitudinal shear bond strength will be evaluated in the composite slab by using m–k values and PSC method. As per Eurocode 4–Part 1.1 the specimens were prepared. As per IS 1079 (1994), IS 456 (2000) and ASTM A653 (2008) the quality of the sheets were finalized. As per ASCE (1985) to minimize the effect of shrinkage and temperature, the mild steel reinforcement bars was used. The cracks
started too developed from the support conditions to the point of loading. From the bottom to the top of the surface, the diagonal cracks were developed. At the initial stage, the end slip was formed and gradually tries to increase till the ultimate failure. The curves represent the de-bonding of the profile and concrete in the composite deck slab. Due to the position of the load, there was a movement towards the mid span of the specimen when there was a decrement in the load carrying capacity of the composite deck slab. When compared with the cyclic loading and static loading, the behaviour and the influence will be slightly lesser to the static loading. The shear bond failure occurs without any intimation. When there is an increase in the length of shear span, the design load of the slab gets decreased as well as the longitudinal shear stress decreases. The effects of load carrying capacity in the composite slabs were completely neglected in the cyclic loading when compared to the static loading. Due to the shear span condition in the longer as well as shorter direction, there was a decrement in the failure due to the ultimate load in the composite slab. According to the shear span condition the composite slab failure take place at the shear bond. Holomek et al. (2012) and Holomek & Bajer (2012) studied the behaviour of composite slabs under different types of loading conditions. Using four point loading and the vacuum test, the specimens were tested. Along with the full scale modelling, the small scale testing was carried out to study the behaviour of the embossed profiled sheet, which deals with the numerical modelling. The load carrying capacity of the member mainly relates with the point of loading.

Gholamhoseini et al. (2014) carried out an experimental and numerical investigation on composite deck slab using four types of profile deck. On the composite slab, two types of loading were applied. From the experimental results, it was observed that there was an occurrence of bond slip failure between the concrete–steel. Due to the shear-bond failure the flexural
capacity of composite slab reduced. When the numerical and experimental values were compared it was found that the results were quite satisfactory.

Abbas et al. (2015) experimental investigations were carried out on the composite slab for the shear bond capacity. The embossments were provided on the corrugated profile sheet to increase the bond between the profile and concrete. In order to neglect the shrinkage and creep in the concrete member, the mesh reinforcement was added. On the side of the rib around four numbers of shear studs were provided by anchoring it. From the experimental results, there was an increase in the load carrying capacity of the material by incorporating the additional shear studs along with the mesh typed reinforcement to minimize the cracking. To determine the shear as well as the capacity of the composite slab with the profiled sheet locally available materials were used. The experiment was carried out by the researcher around 10 specimens were tested by using three point loading Ong & Mansurt (1986). And, also the slabs were caste with and without the end anchorage method, to determine the empirical relationship between the concrete and steel sheeting. The review was conducted by the researcher for the existing design to determine the shear bond capacity and new empirical relationship was proposed.

Tse & Chung (2008) and Tse & Chung (2006a,b) studied the web crippling behaviour of composite slab using cold-formed profile deck. The failure may occur due to web crippling during the construction, which is critical failure in the composite slab. Based on the support conditions, the hogging moment will be greater which was predicted using the web crippling of the profile deck slab specimens. In this paper, the researchers have studied the behaviour of laterally re–entrant decking slabs. The experimental work was carried out by applying the concentrated load. Around 104 numbers of specimens were tested for the web crippling failure mode with re–entrant
profiled decking, using the nominal yield strength about 235 and 550 N/mm$^2$. It was compared with the design resistance, which was obtained from the design rules from the codal provision. A detailed experimental investigation has been carried out on the laterally restraint profile decking for the concentrated loading condition. It was observed that the buckling and spreading of sheets while testing and the failure mode should be taken into account during the development of new design procedure for the composite slab. In this study, the specimens are provided with the effective lateral restraints to activate the resistance of crippling for the profiled decking. The web crippling was evaluated and compared with the codified design rules given in BS5950: Part 6, Eurocode 3: Part 1.3, the experimental results were 20 percentage to 40 percentage greater than codes. Whereas, the North America Specification mainly depends on the various factors viz., the steel grades and thicknesses, the load bearing lengths as well as the loading conditions. To improve the efficiency as well as the reliability, the new design has to be incorporated using the re-entrant profile decking. The huge sets of experimental data are used to standardize the finite element models and design expressions for the successive study.

Abdullah & Easterling (2009) proposed a new method for modelling the horizontal shear bond in steel deck-concrete composite slabs. The accuracy of the horizontal shear bond modelling will be affected mainly by the slab slenderness ratio, which is one of the strength parameter. Force equilibrium method and bending method was developed using the shear-bond stress vs end slip relationship. Based on the method experimental investigation was carried out. Using bending test, two sets of experimental data was taken to plot the shear-bond relationship curves with varying slenderness ratio. These curves were used for the connector elements related to the finite element models to study the behaviour of horizontal shear bond in the composite slabs. From the results, it was observed that due to the slenderness parameter, the
composite slabs under the bending action vary, which mainly depends on the strength of the slab. The single shear bond property which would be safe or unsafe in the results related to the geometry of the slabs. The accuracy of the finite element analyses is based input of material properties for the FEM using different slenderness ratio. The single shear-bond property would be safe for the FE modelling and unsafe related to the geometry of the profile composite deck slab.

Abdullah & Easterling (2011) investigated the new experimental bending test and shear bond modelling of steel deck reinforced concrete (composite) slabs. The main objective was to develop the new elemental bending test method to understand the behaviour of the composite slab. Using the numerical analysis, shear interaction property of the composite slab was evaluated and the behaviour was similar. The small scale testing is done inorder to determine the strength of the actual slab by using the present shear bond (m-k) and Partial Shear Connection prestress concreting methods. To improve the existing prestress concreting design procedure the test data will be incorporated in numerical analysis. The elemental bending test can be used as a replacement for the full-size test. Even in the numerical analysis the elemental bending test data can be used by neglecting the push off type tests. The improvement is identified between the better-quality prestress concreting design procedure and the m-k method. Chen & Xiaoyu Shi (2011) and Chen et al. (2011) investigated the strength of steel-concrete composite slabs with cold-formed profile steel decks. The longitudinal shear-bond strength is normally governed by the steel-concrete interaction at the interface. The m-k method and partial interaction method were based on the full-size tests, the longitudinal shear bond strength were used in the present construction practice. Which is time consuming and quite expensive than other type of constructions. The shear bond interaction between the steel deck and the concrete has a problem, which is related to adhesion and friction. In FE model,
the geometrical and material nonlinearities are considered. The initial FE analysis will be verified by the pull–out tests, when the frictional bond and the cohesion are having better contact. The study is being made on the composite slab in dealing with the flexural bending, the FE analysis are used in the contact model. The FE analysis tests results are compared with the pull out and bending tests related to the composite slabs. Based on the tests results, it was concluded that the method have the capacity of finding out the performance and the load carried by the composite slabs.

3.3 SUMMARY OF LITERATURES

Most of the researchers concluded that the level of shear bond capacity mainly depends on the geometry and the flexibility of the profile sheet, embossments–height, shape, orientation, shear connector and the frequency of connection. The composite deck slabs are so conventional where the behavior of the shear bond would be based on the cold rolling sheeting and concrete. The predominant failure of composite deck slab can be improved by resisting the longitudinal movement of profile sheet and concrete at the steel-concrete interface. A new composite deck slab was proposed by the Burnet & Oehlers (2001) in which the rip shear connector was used for the trough part of the profiled sheet. Stud shear connectors and embossments are provided on either side to improve the stiffness of the composite deck slab system. To have a better composite action in the composite slab stiffeners and ribs are provided at critical points. Based on the trough profile, the longitudinal stiffeners are provided in the member. The interaction between the steel and concrete is provided at the steel-concrete interface. The depth to width ratio of the composite slab is crucial parameter to be considered for the design. In this study profile steel sheet with the longitudinal stiffeners are provided, to study the behavior of each system. To describe the details in complete, the experimental and numerical studies are compared.