FACADE PANEL SYSTEM AND METHOD OF ERECTING A MULTI-STOREY STRUCTURE AND FACADE

TECHNICAL FIELD

This disclosure relates to multi-storey structures having an external facade. The disclosure has particular application to multi-storey parking structures and buildings having an external facade and is described in that context.

BACKGROUND ART

Multi-storey structures such as vehicle parking garages are known to utilise facade elements that are affixed to a multi-storey structure after erection of the structure. Known vehicle parking garages include wheel stops and crash barriers that are fixed to the floor or facade after erection of the structure. The fixing of the wheel stops, or crash barriers are typically drilled into floors that are concrete and fixed by mechanical fasteners. This arrangement may weaken the concrete and provide an entry point for moisture which can lead to corrosion of steel reinforcing and the bolting system, thereby making the structure susceptible to failure.

It is to be understood that, if any prior art is referred to herein, such reference does not constitute an admission that the prior art forms a part of the common general knowledge in the art in Australia or any other country.

SUMMARY

~~Disclosed is~~ According to a first aspect of the present invention, there is provided a facade assembly for a vehicle parking structure having at least one floor for supporting vehicles thereon, the facade assembly being formed separately from the floor and comprising a facade panel arranged to form part of an exterior of the structure. The facade assembly includes at least one support member extending inwardly of the panel ~~and into the structure in use~~ for connection with a floor of the structure. The support member is arranged to include one or more attachments suitable for a vehicle parking structure such as a wheel stop and/or a crash barrier extending upwardly from the support member.

The facade panels may be located around the perimeter of a ground level or an upper level of a structure. An advantage of the facade panel is its modularity. The facade panel is prefabricated including the at least one support member and arranged to include the one or more attachments. As a result, the facade panel in some embodiments already including the one or more attachments, is easily installed onto an existing structure. Further, the engagement of the one or more attachments to the at least one support member

In some forms the facade panels prevent a person falling from the structure during and after building.

In some forms the at least one support member extends from the facade into the structure. In some forms the support member is positioned such that when construction is completed it is encased in the concrete of the floor.

In some forms the wheel stop includes a protrusion extending upwardly from the support member. The wheel stop allows for construction of a multi-storey car park without requiring wheel stops to be located on the floors of the car park. This reduces costs and labour.

In some forms the facade panel has opposing inner and outer faces, and in use top and bottom edges. In some forms the facade panel comprises a facade framework configured for support of an interior panel.

In some forms, the facade panel is composed of a material sufficiently strong to withstand a vehicle colliding with the facade. In some forms, the facade panels are composed of structural steel. In some forms, the facade panels include ventilation openings. In some forms, the facade panels are in the form of slatted, latticed or perforated steel. In some forms, the facade panels are decorative. For example, the facade panels may be in the form of steel slats. Facades for multi-storey structures such a vehicle parking stations generally are preferred to allow light and air in to reduce the need to extra lighting during the day and air conditioning. In some forms the facade panels are provide an aesthetic or are otherwise decorative allowing the multi-storey structure to have appeal. In some forms, the facade assembly further comprises at least one infill member arranged to be supported on the at least one support member and span between the at least one support member and an adjacent support member mounted to the structure.

~~Also disclosed is~~ According to a second aspect of the present invention, there is provided a modular facade system for a vehicle parking structure having at least one floor for supporting vehicles thereon, the facade system comprising a plurality of facade assemblies according to any preceding claim, wherein the facade assemblies are arranged in side by side arrangement to form at least part of ~~the~~ an external facade of the structure, the respective support members of the assemblies extending inwardly ~~of~~ from the ~~external~~ facade ~~and being~~ panels to be connected to the at least one ~~or more~~ floor~~s~~ of the structure.

In some embodiments, the vehicle parking structure is multi storey and the facade assemblies are arranged to be disposed both side by side and one on top of another to form at least part of the external facade of the multi-storey parking structure.

~~Also disclosed is~~ According to a third aspect of the present invention, there is provided a vehicle parking structure comprising at least one ~~or more~~ floor~~s~~ for supporting vehicles thereon and an exterior facade formed at least in part by ~~the modular facade system disclosed above~~ a plurality of facade assemblies as defined in the first aspect, the facade assemblies being arranged in side by side arrangement with their facade panels forming at least part of the exterior facade and their support members extending inwardly therefrom and being connected to the at least one floor.

Also disclosed is a method of erecting a vehicle parking structure comprising at least one floor, the method comprising using the modular facade system ~~disclosed above~~as defined in the second aspect, to form at least part of the external facade with the support members being connected to the at least one floor, preferably by being cast into the floor.

In some embodiments, the modular facade system is installed after forming the one or more floors of the structure.

In some embodiments, the modular facade system is erected before forming the more or more floors of the structure.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments will now be described by way of example only, with reference to the accompanying drawings in which

Fig. 1 is a cross-sectional view of an embodiment of a multi-storey structure under construction;

Fig. 2 is a cross sectional view of an embodiment of a facade assembly including a support member mounted to the multi-storey structure of Fig. 1;

Fig. 3 is a cross-sectional exploded view of the multi-storey structure of Fig. 2, further through the construction process;

Fig. 4 is a cross-sectional view of the multi-storey structure of Fig. 2 during construction;

Fig. 5 is a cross-sectional view of the multi-storey structure of Fig. 4, further through the construction process;

Fig. 6 is an isometric view of the facade assembly of the second embodiment of the disclosure;

Fig. 7 is a cross sectional view of a further embodiment of a facade assembly including a support member of the disclosure in use; and

Fig 8 is an isometric view of the facade assembly of Fig. 7.

DETAILED DESCRIPTION

In the following detailed description, reference is made to accompanying drawings which form a part of the detailed description. The illustrative embodiments described in the detailed description, depicted in the drawings and defined in the claims, are not intended to be limiting. Other embodiments may be utilised and other changes may be made without departing from the spirit or scope of the subject matter presented. It will be readily understood that the aspects of the present disclosure, as generally described herein and illustrated in the drawings can be arranged, substituted, combined, separated and designed in a wide variety of different configurations, all of which are contemplated in this disclosure.

Referring now to Fig. 1, disclosed is a multi-storey building 10 such as a vehicle parking structure, the structure having a facade 13. Construction of the structure 10 is normally completed through erecting a scaffolding 2 and/or a perimeter screen 4; building the internal portion of the structure up floor by floor; and fixing facade panels ~~12~~11 to the internal portion of the structure ~~12~~10. The multi-storey structure 10 comprises a plurality of facade assemblies 12 forming an outer facade 13 of the multi-storey structure. The floors 14 of the multi-storey structure are contained within the facade 13.

Now referring to Figs. 2 and 3, each facade panel 11 includes opposing inner and outer faces 20, 21. Each panel also includes in use top and bottom edges 30, 31. The facade assemblies 12 include a panel engagement section 15 which is configured to allow the facade panel 11 to be engaged with a facade panel above or below within the outer facade 13 and is positioned at the inward face and the top and bottom edges 30, 31 of the panels.

The facade assemblies 12 further include at least one support member 17 which is adapted to connect or engage a floor 14 with the facade panel ~~12~~11. The support member 17 is located to extend inwardly from the interior face 20 of the facade panels 11 and a floor connection plate 26 extends from the at least one support member 17 at either end.

In the illustrated embodiment, the at least one support member 17 is located intermediate the top edge 30 and bottom edge 31 of the facade panels 11. In alternative embodiments, the support member 17 may be located proximal to or at the top and bottom edges 30, 31 of the panels ~~12~~11.

The at least one support member 17 includes one or more attachments. In the illustrated embodiment, the at least one support member 17 is in the form of one support member and the attachment is in the form of a wheel stop 32. The wheel stop 32 extends

upwardly in use from the support member 17 to contact the wheels of a vehicle when it is being parked. The wheel stop 32 is designed to be low profile so it does not damage the underside or from of a vehicle. The wheel stop 32 may be attached to the support member by any means, such as bolts, plates, welding or any suitable means. The wheel stop 32 may also be integrally formed with the support member 17. The wheel stop 32 provides impact resistance to protect the facade panels 11 from being damaged when cars are being parked. It is understood that the wheel stop 32 will be repeatedly impacted by cars and must be able to withstand the impact. A benefit of the disclosed wheel stop 32 is that it is attached to the facade assembly 12 rather than being drilled into the concrete. The weakness created in the concrete through drilling is all together avoided in the present disclosure. As a result, the wheel stop 32 and the facade panel together have structural integrity and a longer life span requiring less replacement.

Each floor is typically constructed by laying a system of formwork, and a system of reinforcing bars. Concrete is then poured into the formwork to embed the reinforcing bars. The support member 17 may also comprise a connection member 25 in the form of a hook. In the illustrated embodiment, the hook is encased in concrete. The hook 25 may also interconnected with the system of reinforcing bars laid to support the concrete. The connection members 25 extends from one of the connection plates 26 and may be welded, bolted or otherwise engaged with the connection plate 26. The connection plates 26 (one may be located at either end of the support member 17) may be engaged with the support member 17 by means of bolts, welding, a plate or any other means. Alternative connection means are available or in some non-illustrated forms the connection member 25 may be integral with or welded to the panel 11. In further alternative embodiments, the connection member to connect the support member to the floor may simply be another connection means such as plates and bolts, welding or any other means. Further, the connection member may be embedded into the concrete and then removably fixed to the support member of the facade assembly.

Also shown in Figs. 3 and 4 is a connection 15 between a facade panel 11 and an adjacent upper or lower facade panel 11 is shown. The connection may be bolted 40 and may include a plurality of plates 41 as shown in the figure or may be welded or otherwise connected. In alternative embodiments alternative attachment means may be used.

Figs. 4 and 5 illustrate a worker standing on one of the floors interior the structure and the facade panels ~~12~~11 are mounted to the structure. The scaffolding or perimeter screen is not shown in these Figures.

Now referring to Fig. 6, the support member 17 is shown on separate from the facade assembly 12. In general, the support member extends between two opposing ends 70, 71, and two opposing sides 72, 73. The connection members 25 extending outwardly from one of the sides 72. The plates 26 form the opposing sides. The support member 17 also includes top 75 and bottom 76 members that are generally rectangular and formed as one member. However, the support member 17 may be formed from slats that extend between the sides or the ends or a combination of both. The slats may be included between the top and bottom members, or without the top and bottom members. The slats may act as stiffening ribs designed to hold the shape of the support member 17. When the support member 17 is at least partially hollow, it may be filled with concrete when the floor is filled with concrete to integrate the facade assembly 12 into the floor and the structure. In non-illustrated alternative embodiments, the support member may also include or be formed of mesh, latticed or perforated steel to allow drainage or for any decorative purpose. In this way, any of the members used to form the support member may be formed of mesh, latticed or perforated steel.

The support member 17 may formed from steel or any other material sufficiently strong to support the facade panels ~~12~~11 being mounted to the floors 14 of the structure 10.

A further embodiment of a facade assembly 12 is shown in Figs. ~~8, 9 and 10~~7 and 8. Like reference numerals are used for like features. The primary difference between the first embodiment and the second embodiment of the facade assembly is that a further attachment is illustrated in the second embodiment. In particular, the facade panel 11 further includes an attachment in the form of a crash barrier 36 which is engaged with the support member 17. The crash barrier 36 may be built-in. The crash barrier 36 may be engaged with the facade assembly 12 by means of welding, bolting or any other construction means. The crash barrier 36 and facade panel 11 are sufficiently strong to withstand a collision by a vehicle. In alternative embodiments, the crash barrier may extend inwardly from the facade panel. The facade assembly 12 disclosed has the benefit of allowing the parking structure to be built without requiring additional fall protection or a crash barrier.

In general, the facade panel 11 may be in any form. In some forms, the facade panel comprises slats extending vertically up the facade panel with spaces in between the slats to allow ventilation and light flow. The facade panels may further include cross-beams providing support to the facade panels. The panels may further include upper and lower webs for further support. In some forms the cross-beams and upper and lower webs are on the inside such that the external face of the panels is aesthetically pleasing.

CLAIMS

1. A facade assembly for a vehicle parking structure having at least one floor for supporting vehicles thereon, the facade assembly being formed separately from the floor and comprising:

a facade panel arranged to form part of an exterior of the structure;

wherein the facade assembly further comprises at least one support member extending inwardly of the panel ~~and into the structure in use~~ for connection with ~~a~~ the floor of the structure; the support member being arranged to include one or more attachments~~.~~ suitable for a vehicle parking structure such as

~~2. A facade assembly as defined in claim 1, wherein the one or more attachments is in the form of~~ a wheel stop ~~extending upwardly from the support member.~~

~~3. A facade assembly as defined in claim 1 or 2 wherein one of the attachments is in the form of~~ and/or a crash barrier extending upwardly from the support member.

~~4. A facade assembly as defined in any one of the preceding claims, wherein the one or more attachments is integrally formed with the support member or fixed to the support member by welding or mechanical fasteners.~~

~~5~~2. A facade assembly as defined in ~~any one of the preceding claims~~ claim 1 or 2, wherein the facade ~~panel~~ assembly is fixed to at least one floor of the structure.

~~6~~3. A facade assembly as defined in claim ~~5~~2, wherein the support member is arranged to overlay the at least one floor of the structure.

~~7~~4. A facade assembly as defined in either ~~5~~2 or ~~6~~3, wherein the support member is arranged to project beyond an end of the floor of the structure.

~~8~~5. A facade assembly as defined in ~~any 7~~ claim 4, wherein the facade assembly further comprisinges a connection member integrally formed with, or connected to, a distal end of the support member.

~~9~~6. A facade assembly as defined in claim ~~8~~5, wherein the connection member is arranged to be cast into the at least one floor of the structure.

~~10. A facade assembly as defined in claim 8 or 9, wherein the connection member is bolted or removably fixed to the support member.~~

~~11. A facade assembly as defined in any of the preceding claims, the facade panel having opposing inner and outer faces, and in use top and bottom edges.~~

~~12. A facade assembly as defined in any one of claims 1 – 10, the facade panel comprising a facade framework configured for support of an interior panel.~~

~~13~~7. A facade assembly as defined in any one of the preceding claims, wherein the facade assembly further compris~~inges~~ a facade connection means located at a top and/or bottom edge of the facade panel to connect the panel to a like facade panel.

~~14. A facade assembly as defined in any one of the preceding claims, wherein the facade panel is composed of material(s) sufficiently strong to withstand a vehicle colliding with the facade.~~

~~15. The facade assembly as defined in any one of the preceding claims, wherein the facade panel is composed of structural steel.~~

~~16~~8. ~~The~~ A facade assembly as defined in any one of the preceding claims, wherein the facade panels are decorative and/or include ventilation openings~~.~~, preferably

~~17. The facade assembly as defined in any one of the preceding claims, wherein the facade panel is~~ in the form of slatted, latticed or perforated steel.

~~18. The facade assembly as defined in any one of the preceding claims, wherein the facade panel is decorative.~~

~~19~~9. ~~The~~ A facade assembly as defined in any preceding claim, wherein the facade assembly further compris~~inges~~ at least one infill member arranged to be supported on the at least one support member and span between the at least one support member and an adjacent support member mounted to the structure.

~~20. The facade assembly as defined in any one of the preceding claims, wherein the facade panel is configured to act as a fall prevention system during construction of the structure and the permanent facade of the structure.~~

~~21~~10. A modular facade system for a vehicle parking structure having at least one floor for supporting vehicles thereon, the facade system comprising a plurality of facade assemblies according to any preceding claim, wherein the facade assemblies are arranged in side by side arrangement to form at least part of ~~the~~ an external facade of the structure, the respective support members of the assemblies extending inwardly ~~of~~ from the ~~external~~ facade ~~and being~~ panels to be connected to the at least one ~~or more~~ floor~~s~~ of the structure.

~~22~~11. A modular facade system as defined in claim ~~21~~10, wherein the vehicle parking structure is multi storey ~~and~~ having a plurality of floors to support vehicles thereon and wherein the facade assemblies are arranged to be disposed ~~in~~ at each of the plurality of floors in side by side arrangement with the respective support members of the assemblies

extending inwardly of the facade panels to be connected to respective ones of the plurality of floors such that the facade assemblies are disposed both side by side and one on top of another to form at least part of the external facade of the multi-storey parking structure.

~~23~~12. A vehicle parking structure comprising at least one ~~or more~~ floor~~s~~ for supporting vehicles thereon and an exterior facade formed at least in part by a ~~modular~~ plurality of facade ~~system~~ assemblies according to ~~either claim 21 or 22~~ any one of claims 1 to 9, the facade assemblies being arranged in side by side arrangement with their facade panels forming at least part of the exterior facade and their support members extending inwardly therefrom and being connected to the at least one floor.

13. A vehicle parking structure according to claim 12, wherein the support members project beyond an end of the at least one floor so as to extend the perimeter of the parking structure beyond the floor.

14. A vehicle structure according to claim 13, wherein a plurality of infill members are supported by the support members to form an extension of the at least one floor.

~~24~~15. A method of erecting a vehicle parking structure comprising at least one floor, the method comprising using a modular facade system according to either claim ~~21~~10 or ~~22~~11, to form at least part of the external facade with the support members being connected to the at least one floor, preferably by being cast into the floor.

~~25. A method as defined in claim 24, wherein the modular facade system is installed after forming the one or more floors of the structure.~~

~~26~~16. A method as defined in claim ~~24~~15, wherein the modular facade system is erected before forming the ~~more~~ one or more floors of the structure.

~~27. A method as defined in claim 26, wherein at least a portion of the modular facade system is cast into the floor.~~