"Practically, we are using skill and technology almost 30 years ago to construct residential buildings nowadays". Some practitioners in the construction professionals have that comment.

What have been changed within these few decades in the construction of residential buildings? Most people regard the Mei Foo Sun Chuen Development along the previous Lai Chi Kok Bay starting from the mid 60s was a watershed, both in the property development and construction prospective. Before that, low-rise to medium-rise, single detached buildings were constructed as residential purposes in majority. The rationale behind was straight-forward, it did not involve a huge amount of capital in the development. Besides, that scale of involvement could bypass a lot of complicated legal procedures in the acquisition of land, and thus it was well within the management and finance capability of the developers, which were still considered to be quite green and inexperienced in property development at that period of time.

With the rapid development of the bank system and the introduction of various form of house mortgage schemes, developers were then able to increase their investment by committing in residential projects of much larger scale. Besides Mei Foo, the Nam Fung Sun Chuen in Quarry Bay, or the Chi Fu Fa Yuen in Pokfulam, are the typical examples. This is the simple-explained story on the development side. How about in the construction aspects?
CONSTRUCTION METHODS FOR CONTEMPORARY RESIDENTIAL BUILDING PROJECTS

What is meant by traditional construction method? In a broader sense, when most of the works in a production process are done by human operatives; or every single item of operation, or every square metre of observable output, has to be finished by human hands; or where the majority of works are required to be handled by skilled labour; or where the introduction of mechanical plant or sophisticated tools cannot yield significant increase of output; or identical items of work are to be done repeatedly at each production sequence or location, all these are indicators that the production is being carried out in a rather traditional manner. In this way, it is not surprising that the ways we employ to building residential buildings are still regarded as traditional. The photos being selected in this article help to justify this statement.

It is sometimes quite astonishing to the international world that in a modern city like Hong Kong, the way we build is still quite primitive when compare to the western-world standard. Bits and pieces of environmentally unfriendly timber panels using as formwork in a very large scale and extent; labour intensive operations such as in the erection of formwork, fixing of reinforcing steel bars, placing of concrete, or other wet work like bricklaying or plastering, are still dominating at most working locations within construction sites in Hong Kong. In the western societies in Europe or in the North America, construction processes are already highly industrialized in which most of the site works are being replaced by much simpler off-site fabrication and on-site installation. System formwork is being used in most situations.
There is nothing wrong by using traditional ways to build, for, at least, it is cheaper, more reliable, free of unforeseeable risk during construction, and, after all, there is no immediate substitution in the market to provide cost competitive options in construction. Occasionally, some pioneers in the industry are trying to use more advanced concepts and systems to construct, such as by the introduction of more advanced formwork systems like the aluminum form, slip-form or the jump form, or in some rare cases using certain prefabricated components. Yet, these are only exceptions of a few, far beyond can be described as common trends.

Owing to some inherited difficulties in the development process, and the often encountering of very complex site environment that can hardly be found elsewhere in the developed countries (people will usually avoid these kind of difficult sites), the challenges that Hong Kong builders faced in construction are enormous. Motivated by the huge market, developers tend to acquire site as large as possible in order to maximize the efficacy and profit in a development. These kind of large sites often incorporate with complex supplementary facilities like shopping mall, carpark spaces, or leisure, recreation or community facilities. As a result, sites with building areas 100,000 sq m or above can be found everywhere. The Tierra Verde at the MTR Tsing Yi Station or The Discovery Park in Tsuen Wan, or the Sherwood Court in Tin Shui Wai, are some recent examples. The demand of expertise in making technical coordination simply over-rides the actual difficulties that encountered in the construction and engineering sides.
To build higher and higher is again inevitable in order to squeeze the development potential from a piece of land. Residential buildings with height up to 50 storeys can be seen all over the territory of Hong Kong. Tall buildings do impose a lot of structural constraints and this results to, in association with the retaining of an interesting external look or to provide the usual partitioning patterns as required by buildings of residential nature, limited structural forms can be employed. In practice, we use shear walls (load-bearing walls) with complicated layout arrangement to construct for this structural form can be more effective in taking the tremendous loads of tall building, especially when typhoon must be taken into account in the climatic environment of Hong Kong. This can indirectly answer why more advanced system formwork, which is a key to rationalize the construction process, cannot be used extensively in residential building projects. Besides, system formwork will become very expensive when the scale and speed of works are crucial factors for it has to provide a significant number of sets of formwork in order to achieve that target.
On the Hong Kong Island side where it is usually congested and hilly, very difficult sites are sometimes developed with residential towers constructed on locations with physical environment which can hardly be considered as efficient and economical from the point of construction. As a result of this, complicated and expensive site formation works, associated with intricate foundation, ground stabilization, slope retaining and permanent access provisions, are to be incorporated into the development. These are often nightmares to builders, for the works called for a numbers of expertise under the role of consultants or specialist sub-contractors, and involved numerous critical engineering and construction activities, which demand unimaginable inputs in terms of project planning, resources management and financial commitments, as well as in the assurance of quality and safety. In the 80's the Kornhill in Quarry Bay, in the early 90's the Tregunter and Dynasty Court in the Mid-Level of Central, or more recently The Belcher's at Kennedy Town, are typical examples.
In response to the earlier statement, it is unfair to conclude that little changes and advancement have been introduced in the construction of buildings of residential nature. Changes are two-sided phenomena; they should be interactive, depending on a number of factors such as supply and demand of skill and labor, competition within the market, or the development of new and supporting products and technology etc. As the labor costs are escalating rapidly since the beginning of the 90's, and the growing popularity of more reliable and effective construction plants and tools, construction sites have in fact undergrowth a limited mechanization process. The provision of tower crane and other cranage systems, the use of concrete booster equipment in the concrete placing operation, or the introduction of a wide variety of powered or hand tools in works, are yielding results in most sites. The Hong Kong's way of mechanization is obviously insufficient, but at least it has improved certain aspects in production, such as in minimizing the demand of human workers being consumed in some very laborious works. Working on the same line, limited prefabrication or off-site produced components are being used more frequently, such as for bathroom or kitchen fitting-out items. However, the uses are mainly limited to non-structural elements.
One more point that worth to mention is the significant improvement in the quality of the management composition in construction sites. Thanks to the drastic increase in the supply of well-trained personnel as a result of better construction management and engineering education provided by various institute, most of the staff working in a construction firm nowadays, including those resident on site, are processing appropriate building or engineering qualifications. This capacity of staff helps the builders to perform much better in an efficient and professional manner, and provide a much stronger ability in the tackling of ever increasing complex and difficult jobs.
Though the way we build is still relatively traditional without the introduction and use of exactly advanced technology and construction system, my conclusion is, builders in Hong Kong are still handling pretty good and efficient in the application of the existing practice to accomplish really difficult targets. As mentioned before, the scale and complexity of jobs have already imposed unimaginable constraints in construction. Besides, in order to address to the concerns by general public on quality, safety or environmental issues, government has introduced a lot of stringent regulations these few years. New statutory procedures, which include the revised registration scheme for registered contractor, Technical Memorandum for Supervision Plans, Code of Practice for Site Safety Supervision, or Environmental Permit as required under the Environmental Impact Assessment Ordinance, are becoming mandatory that control not only the physical side of a construction job but also the quality of the management structure. In this respect, the performance of builders is in general proved to be highly professional, that earned for them honor and reputation in the building industry.
An artistic vision of the Tierra Verde when fully completed. The twelve residential building towers, with height ranging from 47 to 52 storeys, are seated on the podium of the Tsing Yi Station of the Mass Transit Railway Airport Railway on a 5.4 hectare site. Besides using as station facilities, the podium also provided more than 58,000 sq m of shopping spaces and other services facilities that formed a practical selling point for the residential development above.
A 6-staged series showing the critical construction status of the Tierra Verde project. Stage1, photo taken in mid 1995, when the superstructure of the podium of the Tsing Yi Station was just commenced.
Stage 2, the construction of the podium structure at its mid-way. The overall layout of the podium can now be roughly identified. Observe also the station platform of the Airport Railway along the central axis of the podium which is under construction.
Stage 3, the structure of the podium basically completed. The "root" of columns (starter columns) as seen on the podium deck will later support the twelve residential towers. The portions in black color are areas with waterproofing works being done.
Stage 4, the rising of the residential towers. For typical structural arrangement of this type of construction with the layout of the podium (underneath structure) highly deviated from the residential towers (upper structure), a transfer structure usually in the form of a thick plated will be introduced in order to distribute the vertical loads of the upper structure evenly to the supporting elements underneath. The said transfer plate can be seen on the left of this row of residential blocks.
Stage 5, bird eye's view of the Tierra Verde under construction. The conveniently provided external traffic link can clearly be observed.
Stage 6, the peak period of the construction at early 1998 with all the 12 residential towers in active progress. The station facilities within the podium structure were required to complete and hand over in advance for the operation of the Airport Express on June 1998.
An artistic vision of the Belchers'. The complex when completed, will have a podium structure of 11 levels, which stretched from the Belcher Street up to Pokfulam Road with a level difference of about 65m.
As seen in December 1998, site formation works were carried out at its peak in the Belchers' site. The works at this stage were done in a multi-layered manner. On top of the slope, the column supports and the tie beams/transfer plate for the 3 residential towers, in the middle layer the rock cutting and the bored pile foundation works, and on the low ground the general clearance and the sub-structure works for the podium structure, were being carried out at the same time. This made the layout and temporary access arrangement within the site becoming extremely complex.
The residential towers are located on top of the 11-level podium structure. In order to accommodate the level differences especially where the main structure is close to the slope, the provision of complicated supporting columns and tie beams are required. The photo shows the falsework erected to one of the tower to facilitate the construction of the inclined tie beams and the 3m thick transfer plate.
View towards the future podium top level seeing the approximate extent and scale of the project. The structure under construction on the left is only part of the future podium. It will eventually extend until it covers the entire surface of the slope on right. The superstructure as seen in the background are the first 3 residential towers of Phase I, which is scheduled for completion by March 2001, including the podium and the shopping mall within. Sitting on top of the podium, 3 more towers will be constructed as the Phase II of the project, which is anticipated to complete by end of 2001.
Within the Belchers', there is a very vast podium structure with building areas more than 22,000 sq m. In order to maximize the use of space and minimize costs in the cutting of the rocky slope, the podium structure is so arranged in a recessing design with the areas of the upper levels larger and the lower levels gradually retreating to accommodate the approaching slope. To do so, very complicated phasing and sectioning arrangement have to be provided in the construction process, both to the formation of slope and to the construction of the podium structure.
Typical layout of the formwork for the residential tower before the placing of concrete. As explained in the former text, residential buildings in Hong Kong trend to use rather traditional formwork system using timber panels of smaller size such that it can be operated manually. The one use in the Belchers' is a typical example of the said.
A view of the work-front at the top of the on-going superstructure. At this stage, the formwork has been properly erected, reinforcement fixing for walls, beams and floors are almost completed. Probably in the early morning the next day, concreting work can be carried out that marks the completion of a typical floor.
The Waterfront under construction as seen on the deck of the Kowloon Station podium. The project will build 6 residential tower blocks of 46 storeys high each.
Though quite a contemporary first class residential development project in its design, the Waterfront still employs rather traditional method to build. The reason is straight forward: it is cheaper, reliable, free of unforeseeable risk during construction, and no substitute in the market to provide competitive options in construction.
Closer look seeing the construction of 2 residential towers in lapsed phasing. For construction planning with two or more detached tower blocks are to be built, the phasing arrangement is important for it can provide much flexibility in resources planning such that manpower and plant facilities can be more efficiently scheduled to achieve better result in terms of cost and speed of works.
The external view of the Royal Peninsula with its superstructure soon to top-out by end of 1999.
On the 15,070 sq m site, three detached residential towers ranging from 35 to 42 storeys high, together with a 2-level basement use as carpark, will be built. This photo exhibits the complexity of the site when by that time the superstructure for the residential towers had just been started while the basement structure was still expanding outward with complicated phasing and sectioning fronts.
Seeing the layout of a section of the residential towers at an elevated position.
One distinguish design feature of the Royal Peninsula is its curvy external wall that give certain elegant feeling when compare to usual building form that resembles rectangular blocks. This increases certain difficulties in the design and erection of formwork. However, as for traditional timber formwork system, such irregularity can flexibly be catered for. This photo shows how timber form is arranged to accomplish such requirements.
Typical set-up detail of a section of external wall formwork. The appearance of this kind of timber panel type formwork usually has a shabby look especially when it has been reused after some times. A properly maintained set of formwork can be reused for about 12 to 15 times. The approximate 900mm space between the form and the bamboo scaffold is planked with timber board and used as a simple work platform to facilitate the erection of formwork as well as for the placing of concrete.
Detail of the formwork for typical scissors-type staircases. Formwork for staircases is regarded as the most difficult part of formwork in building for it is virtually a 3-dimensional temporary structure comprising of inclined soffits for the flights, suspended panels for the stair risers and the side walls, as well as other bracing members and boards for the stiffening of the staircase hood.
The interior view of the top-most structure with wall and floor form in position. The tubular scaffold orange in color are called props which are used to support the floor form and the superimposing load during the concreting process. The props can only be removed until the concrete has developed certain strength and be able to take up its own weight.
Similar view into the interior with the wall formwork being removed. Usually the formwork panels of wall can be struck on the next day after casting such that the panels can be reused immediately on the floor above. However, horizontal running floor slab will deflect and create tremendous bending, it is required to support for some days more by props until it can take up its own weight.
The same location with the floor forms and props completely being removed. After the clearance of the area, bricklaying can be carried out to form the internal partitions.
The cleared interior with the bricklaying materials ready for the soon carrying out of the partitioning works. Note the electrical conduit already positioned within the future alignment of the partition walls. Hollow concrete blocks forming the partition will embed all these conduits for the running of electrical wires for power supply points or light switches etc.
The laying of the concrete block to form the partitions. Note the temporarily positioned door frames which will be housed firmly inside the wall by the use of fixing lugs.
The partitioned interior pending for the carrying out of internal plastering works. The frame of the aluminium window has already been positioned onto the window opening on the external facade.
For internal plastering work, usually a 3-coat system is employed for block or concrete surfaces. The first 2 coats of plaster are called the under-coat and top-coat, which is of cement and sand mixed plaster. The under-coat is to cover up the irregularity of the background surface while the top-coat is to provide the actual plane and flatness for the finished surface. The last coat is called the finishing coat, the most common material used is the cement/lime/sand mixed plaster, however, gypsum plaster is growing its popularity nowadays for its high quality and perfect smoothness. The purpose of the finishing coat is to provide a smooth surface for further receiving of other finer finishes such as wall paint or wall paper. Note that the window frame has already been grouted here during the plastering process.
Workers are applying the finishing coat to the wall and ceiling surfaces inside a residential flat. The material used in this project is gypsum plaster. The plaster can be easily distinguished by its slightly pinkish appearance. Note the trestle erected by the workers for the ceiling plaster work. Since plastering work is done indoor free from falling object, workers usually do not wear hard-hat in order not to obstruct their vision for the carrying out of work on the ceiling level.
The interior of a standard residential flat with internal plastering work being completed. The following works to be done is the flooring and wall decoration.
A typical mock-up sample prepared on site to demonstrate the future finish of the external facade.
Building services requirements for residential building are relatively much simpler than buildings of commercial nature. Except for the main service risers, most of the pipe-run services are buried inside concrete, either in wall or floor. The photo shows a plumber connecting sections of copper pipe, which is part of the water supply system for a residential flat.
Arrangement for a pressure and leakage test to the water supply system for the residential units before concreting work takes place.
A look of the floor with the build-in services and reinforcement in position before concreting. At the top of the photo, a temporary platform with the concrete skip on it can be seen. This indicates that all works on the spot are ready in general and concreting work will take place soon.
The Manhattan Height (using a kind of aluminium formwork system for wall and floor)

External view of the Manhattan Height during its construction.
The Manhattan Height (using a kind of aluminium formwork system for wall and floor)

Layout of the work-front of a typical floor. One special feature in the planning of work in this project is that the contractor employed a 2-phase arrangement for the placing of concrete. This is quite common for building with larger floor area for it is not easily manageable to have the formwork erection, steel fixing and concreting done in a single-go. As can be seen in the photo, concreting to the floors and walls are being carried out in the foreground, while the portion on the back is just with the formwork preliminarily erected without the placing of reinforcement. The background will be carried out in a phased manner with a lapse of 2 to 3 days' time.
The Manhattan Height (using a kind of aluminium formwork system for wall and floor)

Closer detail of the aluminium formwork system for walls before the erection of the floor soffit. Note the neat alignment and stiff looking appearance of the form in general when compares to usual timber forms.
The Manhattan Height (using a kind of aluminium formwork system for wall and floor)

Detail showing a section of formwork in the form of hanging panel that shapes the edge beam and planter box at the external facade of the building.
Detail look at a section of the aluminium form for the external wall which has been properly aligned ready for concreting.
Looking into the interior of the system with the wall and floor forms properly erected and aligned. The one employed in the Manhattan Height project is an "all-aluminium" system, with the wall and floor forms all constructed in alloyed aluminium. It is in fact more common in the industry that aluminium form is used either for wall or floor only instead of a full system.
Example of using more advanced method to build – residential Development in Stubb's Road, Hong Kong (using Jump Form System)

Detail look at the formwork arrangement for the staircase. It is quite an improved set-up in terms of appearance and rigidity when compare to the one as shown previously making use of traditional timber panel arrangement.
Some forward-looking developers and contractors are in fact draining resources to improve technology to build by allowing projects to be carried out using pioneered techniques such as the one as shown here. The project is using a kind of Jump Form the first time in private residential project in Hong Kong. (refer also to topic "Common Formwork Systems" of Construction and Contract News, issue No. 1, 1999.)
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Seeing the overall layout of the Jump Form with the wall position clearly be indentified. As it can be observed, the working environment on the floor deck is neatly arranged with working spaces properly provided such that construction works can be done in a more production-line like manner. One special feature of this system is that it is designed for casting all the load bearing walls both internally or externally at a same time instead of casting separately in two staggered stages as most other systems do. The curvy shaped wall also adds difficulty in the using of this formwork system.