FAST TRACK TO HIGHER PRODUCTIVITY
PARTNERSHIP FOR PRODUCTIVITY
YONGNAM TACKLES ICONIC STRUCTURES WITH BIM

RECOGNITION FOR MULTI-SKILLED WORKERS
We would love to hear from you if you would like to share any best practices and latest technologies that could improve construction productivity. Please email us at bca_enquiry@bca.gov.sg

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Dear reader,

Life is never without its challenges. Here at the Building and Construction Authority (BCA), our challenge lies in getting the tradition-bound construction industry to embrace better and more productive methods.

As with other aspects of life, the first step to resolving any difficulty is awareness. This is especially so for smaller construction firms which may not aware of the government funding available to them. And this is where our friendly account managers at the Construction Productivity Centre come in, to raise awareness of the financial assistance schemes that firms can take advantage of to offset the cost of acquiring more productive equipment or methods.

An example of a firm which was open to the help available from BCA is Santarli Construction. They applied for the Construction Productivity and Capability Fund (CPCF) to buy equipment that allowed them to improve productivity and reduce business cost. They were pleasantly surprised that the whole process from application to reimbursement took mere three months. Find out how your firm can do this too in this issue.

At BCA, we are constantly looking for ways to help the industry address their business challenges. To this end, we recently launched the new Multi-skilling Scheme. Beginning 1 July, experienced workers who are able to juggle different work tasks can now be accredited for their multiple skills. Having multi-skilled workers will give firms more flexibility to deploy workers; otherwise, longer project durations may result. I’d encourage you to step forward to see how you can benefit from the latest initiative.

Help is always at hand, if firms know where to look. Take it from local steel fabricator Yongnam Engineering and Construction Pte Ltd, which utilised Building Information Modelling (BIM) technology to minimise design clashes and improve precision during fabrication. This helped the firm to raise its productivity and work quality.

As you can see, there are many avenues in place to help those who are keen to start or are already on their productivity journeys. If you are one of them, do contact BCA’s Construction Productivity Centre and we’ll do our best to work with you on the way forward.

Dr John Keung
Chief Executive Officer
The Mechanisation Credit (MechC) scheme, launched in 2010 by the Building and Construction Authority (BCA), facilitates construction firms to improve their construction productivity through mechanisation.

Local player Santarli Construction Pte Ltd once had a mindset that the MechC scheme’s application process would take between six months and a year to be completed.

After applying, the builder had an entirely different experience.

Its MechC account manager from BCA’s Construction Productivity Centre guided the firm on the application process. In three months, the company received its grant.

“We were pleasantly surprised when the whole process, from application to disbursement of the grant, took such a short time,” said Mr John Gan, Project Director of Santarli Construction.

Mr Gan said that the information provided on the MechC website is clear and the examples helped the firm clarify its doubts on the documents required.

“The documents were also easy to prepare and the MechC account managers were very helpful,” he added.

With the support of MechC, the company purchased four total stations to reduce manpower and achieve greater efficiency in its site surveying process.

Since it was set up in 1983, Santarli Construction has been advocating innovation, productivity and technology adoption so as to thrive in a competitive industry. Mr Gan’s belief is that the earlier a company invests in technology, the sooner it can reap its benefits.

The local player has worked on a wide range of building and civil engineering projects. These projects include commercial, residential, institutional and industrial projects, as well as challenging land reclamation works.

Santarli Construction is now looking at investing in other equipment such as an aerial working platform and a biometric authentication system.

**Santarli Construction Pte Ltd**

<table>
<thead>
<tr>
<th>Business:</th>
<th>General building and civil engineering contractor</th>
</tr>
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<tbody>
<tr>
<td>Equipment purchased with MechC:</td>
<td>&gt; 4 total stations</td>
</tr>
<tr>
<td>Equipment leased with MechC:</td>
<td>&gt; 2 tower cranes</td>
</tr>
</tbody>
</table>
| Benefits: | > Increased productivity  
> Reduced manpower  
> Reduced error in manual operations |
HOW SANTARLI CONSTRUCTION GOT ITS GRANT IN 3 MONTHS

The Application Process

1. Application Form Submission
   - Before applying, Santarli Construction consulted BCA on the kinds of equipment that MechC supports. A list is also available on the BCA website.
   - Santarli Construction submits the MechC form and other necessary documents.

2a. Application Evaluation
   - A BCA account manager assesses the applications.

2b. Equipment Purchase
   - Santarli Construction proceeds to purchase 2 total stations.

3a. Letter of Offer
   - Santarli Construction receives and accepts the Letter of Offer by sending it back to BCA.

3b. Productivity Data Collection
   - Santarli Construction collects the necessary productivity data.

The Claim Process

1. Claim Form Submission
   - Having used and collected the productivity data for 4 weeks, Santarli Construction submits the claim form to its BCA account manager.

2. Auditing
   - The BCA account manager checks through all documentations and conducts an audit on the equipment.

3. Letter of Offer
   - Santarli Construction receives the disbursement of the grant through its GIRO account.

Speed Up Your Application

> Be decisive in purchasing your equipment
> Be prompt in submitting complete documents that are required
> Be proactive in communicating and cooperating with your account managers
建设局在2010年推行了机械使用奖励计划 (Mechanisation Credit, 简称 MechC)，目的是为建筑公司消减购买或租用机械器材所需支付的成本。

本地承包商三达利建设私人有限公司 (Santarli Construction Pte Ltd) 原以为 MechC 的申请过程必须花费半年至一年。

通过与 MechC 账户经理密切联系与合作，再附上所需文件后，Santarli Construction 在三个月内就获得了津贴。

Santarli Construction 的工程总监施克表示：“从申请到收到津贴的整个过程既简单又迅速。这让我们感到非常意外。MechC 网站清楚的列出了申请程序，也提供了相关的例子。申请 MechC 时所需附上的文件也容易筹备。加上 MechC 账户经理很乐意为我们解答疑问。这一切都大大的减少了我们申请所面对的问题。”

自1983年成立以来，Santarli Construction 完成了多项建筑与土木工程项目，其中就包括了商业，住宅，公共与工业项目以及拥有挑战性的填海工程。

Santarli Construction 一直提倡技术采纳与革新提高生产力，以便在竞争性的环境下生存。施先生也坚信公司越早投资提升科技，就能越早受益并取得领先优势。

通过 MechC 的援助，Santarli Construction 购买了四部高端全站仪 (total stations)，减少了对人力资源的依赖，并同时提高了工程测量的效率。

Santarli Construction 也正在考虑投资于其它器材，其中就包括了高空作业平台 (mobile aerial platform) 及生物认证系统 (biometric authentication system)。

三达利建设私人有限公司 (Santarli Construction Pte Ltd)

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<th>生意:</th>
<th>&gt; 建筑与土木工程承包商</th>
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<td>&gt; 四部高端全站仪</td>
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<tr>
<td>通过 MechC 租借的器材:</td>
<td>&gt; 两架塔式起重机</td>
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<tr>
<td>受益:</td>
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<td>&gt; 减少人力资源</td>
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<tr>
<td></td>
<td>&gt; 减少人为疏忽</td>
</tr>
</tbody>
</table>
SANTARLI CONSTRUCTION 如何在三个月内获取辅助金

申请过程

1. 提交申请表格
   >> 申请前，Santarli Construction 向建设局查询，有哪些器材可在 MeChC 计划下获得资助。建设局网站也有相关列表
   >> Santarli Construction 呈交 MeChC 申请表格及其它所需文件

2a. 申请评估
   >> 建设局的账户经理进行申请评估

2b. 器材购买
   >> Santarli Construction 购买两部高端全站仪

3a. 申请成功通知书
   >> Santarli Construction 收到建设局的申请成功通知书，并将接洽器材商及建设局

3b. 生产力资料收集
   >> Santarli Construction 收集有关的生产力资料

辅助金领取过程

1. 呈交辅助金领取表格
   >> 收集四个星期的生产力资料后，Santarli Construction 向建设局的账户经理呈交辅助金领取表格

2. 审计
   >> 建设局的账户经理审计所有资料，也对器材进行审计

3. 辅助金发配
   >> Santarli Construction 通过财路 (GIRO) 户口领取辅助金

加快申请过程

> 要果断 购买器材时要果断
> 要快速 快速呈交必要文件
> 要快速 要积极与您的账户经理沟通和配合
Koon Seng Construction Pte Ltd is an A2 grade contractor under the Building and Construction Authority’s (BCA) Contractors’ Registry System. It is the main contractor for the proposed 10-storey residential and 7-storey hotel building development at the junction of New Bridge Road and Cantonment Road.

Cheng Yi Pte Ltd, a smaller contractor, was appointed as the subcontractor for the structural work in this project.

The project posed a few challenges to Koon Seng Construction and Cheng Yi. Firstly, as the proposed construction site sits in a vicinity of residential areas and other hotels, concreting work has to end by 7 p.m. each day. A quick concreting method was required to finish the work early.

Secondly, the building contains unique features such as the use of very thin walls, which makes quality control important.

To tackle their concerns, Koon Seng Construction and Cheng Yi explored solutions on how they could speed up the construction. After much discussion, they decided to adopt the use of self-compacting concrete with system formwork.

They attended a BCA seminar to learn more about government assistance initiatives and discovered that they could tap into the Productivity Improvement Project (PIP) scheme to enhance their building techniques.

With financial assistance from the PIP scheme, Koon Seng Construction and Cheng Yi were able to use self-compacting concrete and system formwork for the project.

Self-compacting concrete does not require the use of mechanical vibrators, which greatly reduces generated noise. This is especially important for construction works situated in residential areas.

The concrete also has a high workability factor and does not require the use of a concrete vibrator to compact it. This results in greater consistency in the concrete, which increases the reliability of the concrete material properties.

Eventually, for the concreting operations, only two workers were used instead of the usual four. As self-compacting concrete is also easier to spread and level, the concreting works were completed speedily. An overall 300% productivity improvement rate was achieved.

Meanwhile, system formwork was used for concrete casting. This helped the builders to meet the tight casting schedule for the thin walls. Two different types of formwork systems with two different suppliers were used in this project.

System formwork was used to construct various floor slabs and structural walls. For the construction of the floor slabs, table form was adopted, while for the construction of the structural walls and lift cores, a large panel formwork system was used.

Through the adoption of formwork systems, a 200% productivity improvement rate was achieved.

The partnership between Koon Seng Construction and Cheng Yi produced solutions which helped speed up the project process.
坤成建筑私人有限公司（Koon Seng Construction Pte Ltd）是新加坡建设局承建商注册表的A2级承包商。此公司也负责一项位于新加坡的民宅及酒店大樓工程的主要承包商。盛义私人有限公司（Cheng Yi Pte Ltd）则是该项目的结构工程分包商。此项目为Koon Seng Construction和Cheng Yi带来了几项挑战。

首先，由于项目位于住宅区及酒店附近，所以在施工团队必须采取一个快速混凝土浇筑的方法，以便在晚上七时前停工。第二，项目的建筑结构设计也包括了独特的特点，如超薄的墙身，因此质量监控非常重要。

为了克服这些挑战，Koon Seng Construction和Cheng Yi共同探讨解决方案，以加快工程进展。最终，双方决定采用自密实混凝土及系统化模板。他们还通过建立局推行的工程生产力提升计划（Productivity Improvement Project scheme，简称PIP）所提供的援助来采纳以上两种技术来提升工程速度。

由于自密实混凝土的流动性高，因此采用自密混凝土无需使用机械振动器来确保混凝土的均匀度。这就大大减少了工程所制造的噪音，对位于住宅区的工程项目非常有益。而且，自密混凝土更容易浇筑及附着，因此只需两名工人完成混凝土浇筑工作，少于平时的四名。这可提高高达200％的工程生产力。

此外，此项目也采用系统化模板来铸成薄墙，缩短了工程所需的时间。加上利用台模板来制造模板及大块模板系统来建造结构墙和升降机架，提升了200％的工程生产力。

Koon Seng Construction与Cheng Yi的密切合作，共同探讨方案是加快工程进度的主要原因。
Basement excavation can now be carried out faster and more easily with the strut-free construction method.

The Constructability Appraisal System (CAS), which recognises builders’ contributions to construction productivity, recognises the strut-free construction method as a productivity-enhancing process. The CAS awards points to builders when they use labour-saving construction methods, systems, processes, plants and equipment.

Unlike the conventional braced basement excavation supporting system, a strut-free system has no need for conventional struts. This allows the excavation work to be carried out in an uncluttered environment free from obstructions. With a neater work space, there is improved work safety.

Workers are also able to manoeuvre easily on site, which speeds up the construction time. Overall constructability and productivity is enhanced.

Depending on the extent of the strut-free basement construction, the Constructability Appraisal System awards up to 4 points under Part A: Structural System in the Constructability Score framework. Builders are required to consult the Building and Construction Authority (BCA) on the actual points to be awarded for such a system.

For more information on the CAS, please visit http://www.bca.gov.sg/BuildableDesign/bdas2011.html

HAPPENINGS

CONNECTING WITH SMES

Reaching out to smaller firms to exchange productivity ideas

The Building and Construction Authority (BCA)’s efforts to reach out to small firms in the industry continue; this time, in the form of a CEO networking lunch with various invited companies.

Held in March, the networking session saw mechanical and electrical (M&E) consultants, developers, government officials and attendees from the Specialist Trade Alliance Singapore (STAS) coming together to gain a deeper understanding of the Construction Productivity and Capability Fund.

During the session, measures to enhance productivity and help industry firms cope with manpower policy changes were shared. Attendees also mingled freely with one another to exchange productivity ideas.

Through the session, the various associates under STAS further arranged with BCA to meet up with their members to brief on the CPCF.
Mr Khaw Boon Wan, Minister for National Development, shares how rethinking the kind of materials used for construction can effectively enhance a project’s overall productivity.

The following write-up first appeared on Minister for National Development Khaw Boon Wan’s blog at www.mndsingapore.wordpress.com

Our construction industry has to catch up in terms of productivity. If we benchmark ourselves against Australia, Hong Kong and Japan, we are lagging behind.

There are many reasons for under-performing. Whichever the cause, we must fix the problem and raise our construction productivity.

Greater standardisation and off-site precasting of building components are important strategies. There are also other avenues to complement these efforts, which involve some innovation. Every effort counts.

Take the example of water pipes. A typical Housing and Development Board (HDB) block with 100 flats would use about three kilometres of water pipes. Traditionally, many buildings use copper pipes. These pipes are jointed using welding. This requires skilled labour and is time consuming.

This is an opportunity to improve productivity gain.

HDB now uses a more productive method to join copper pipes. Through a “press fit” method, they crimp together the pipes to be jointed. The press fit method does not involve skilled labour nor high temperatures. It has led to substantial productivity gain. Although this is good, HDB continues to explore the use of other materials to push for higher productivity.

In Europe and the United States, the industry uses the flexible plastic water piping for indoor water piping. The material is cross-linked polyethylene, or PEX for short, which is a durable and light plastic.

Being plastic, PEX is very flexible and needs fewer joints compared to the conventional copper piping system. Installing PEX piping also doesn’t require welding.

These advantages mean the time taken to install PEX piping is 40% less than copper pipes using the conventional welding method. As an illustration, two workers can install PEX piping for three toilets in a day, compared to only two toilets when using copper piping.

One local plumbing contractor, OSK Engineering, is a pioneer in using PEX systems and has received funding support from the Building and Construction Authority’s (BCA) Construction Productivity and Capability Fund. The PEX system is now part of the Public Utilities Board’s approved list of indoor piping systems.

Currently, more than 20 private sector developments including factories, offices, hotels and housing projects are using the PEX system for their indoor piping needs.

BCA will continue to work with the industry, raise awareness and promote labour-saving technologies. Productivity is the way forward for the industry. Every bit counts towards better construction productivity.
Experienced workers who juggle different work tasks can now be accredited for their multiple skills.

On 1 July this year, the Building and Construction Authority (BCA) will launch the Multi-skilling Scheme. The scheme encourages workers who are competent in multiple construction trades to carry out more than one type of work task on site.

The Multi-skilling Scheme complements CoreTrade. The latter caters to workers who specialise in key construction trades. The new scheme thus provides an alternative pathway for the industry to upgrade their experienced workers.

“Contractors with multi-skilled workers will find it easier to deploy their workers according to the project’s manpower needs, as these workers can perform two to three different types of work throughout the construction process,” said Dr Ho Nyok Yong, President of Singapore Contractors Association Limited.
Dr Ho added: “This can help reduce the time required to mobilise workers, which would otherwise result in less time for projects. The Multi-skilling Scheme recognition also provides an avenue for workers to attain a higher-skilled status apart from CoreTrade.”

The move to enhance the quality of the construction workforce through the retention of skilled and experienced workers is part of the Construction Productivity Roadmap launched last year.

In line with the government’s push for productivity-driven economic growth, the Roadmap charts the transformation of the construction industry and aims to realise the vision of a highly integrated and technologically advanced construction sector by 2020.

Similar to the funding for CoreTrade, the Workforce Training and Upgrading (WTU) scheme will co-fund up to 80% of the training and skills evaluation for the second SEC(K) certification leading to the Multi-skilling qualification. For details on the funding qualifying criteria and application process, please visit the WTU website at [http://www.bca.gov.sg/Workforce/wtu.html](http://www.bca.gov.sg/Workforce/wtu.html).

**BCA will begin registering construction workers for the Multi-skilling Scheme from 1 July 2012. Registered workers will have to meet the following stipulated criteria:**

**a. Four years of construction experience in Singapore**

**b. Two acceptable certifications:**

- The first certification can be a Skills Evaluation Certificate (SEC) or SEC(K) conducted by BCA or the Sijil Pelajaran Malaysia (SPM) certification for Malaysian work permit holders.
- The second certificate must be an accepted SEC(K) in a different trade from the first certification.

For registration renewal, multi-skilled workers would be subjected to Continuing Education and Training (CET) requirements every 2 years.

Hotline: 6730 4500  Fax: 6259 4317
Email: bca_multiskill@bca.gov.sg
Website: [http://www.bca.gov.sg/MultiSkilling/MultiSkill_Main.html](http://www.bca.gov.sg/MultiSkilling/MultiSkill_Main.html)
新计划将配合建筑业技工注册计划（CoreTrade），培训出多名拥有多项建筑技能的技工。

有经验的技工从事不同类型工作的技工现在可受官方认可。

今年7月1日，建设局将推行多技能计划（Multi-skilling Scheme）。此计划将鼓励拥有多项建筑技能的技工在工地从事不同类型的工作。

Multi-skilling Scheme 将配合 CoreTrade。CoreTrade 是为从事主要建筑技能的技工而设计。新计划因此将提供另类途径，让建筑业者协助他们的有经验技工进行自我提升。

新加坡承包商协会主席何玉荣博士表示：“拥有多技能技工的承包商现在将能更容易按人力需求为技工分配工作，因为这些技工能够从事两到三项不同类型的工作。”
“这可节省动用技工的时间，并因此能在更短的时间内完成建筑工程。除了 CoreTrade 以外，Multi-skilling Scheme 的认可也为技工提供一个自我提升的途径。”

此计划的目的是为了通过挽留有经验技工，提高建筑业人力资源的素质。计划也是去年推行的建筑生产力发展蓝图的一部分。

有鉴于政府积极推进行由生产力驱动的经济发展，此路线图包含了建筑业的改造计划，并指望在2020年前实现一个极度综合及科技先进的建筑业愿景。

与建筑业技工注册计划 (CoreTrade) 相同，人力培训及提升奖励计划 (WTU) 将资助第2项 SEC(K) 技能考核证书高达80%的培训与技能评估费用。拥有第2项 SEC(K) 技能考核证书是得到 Multi-skilling 证明书的先决条件之一。欲知资助标准和申请详情，请浏览人力培训及提升奖励计划 (WTU) 网页 http://www.bca.gov.sg/Workforce/wtu.html

建设局将从2012年7月1日起，开始为 Multi-skilling Scheme 进行登记程序。注册的员工必须符合以下条件：

a. 拥有4年本地建筑工作经验；以及

b. 拥有两项受认可的证明书：

- 第一项证明书可以是由建设局分发的技能证书 (SEC) 或 SEC(K) 技能考核证书。持有工作准证的马来西亚公民可提交马来西亚教育证书 [Sijil Pelajaran Malaysia (SPM)]。
- 第二项证明书必须是和第一项证明书不同的 SEC(K) 证明书。

若要更新登记，多技能技工每两年必须符合延续教育与培训 (Continuing Education & Training，简称 CET) 的条件。

欲知详情，可通过以下方式与我们联络：
热线：6730 4500 传真：6269 4317
电邮：bca_multiskill@bca.gov.sg
网站：http://www.bca.gov.sg/MultiSkilling/MultiSkill_Main.html
Measuring and calculating project productivity with the Building and Construction Authority’s (BCA) Electronic Productivity Submission System (ePSS) can now be more reliable and efficient with the use of biometric authentication systems.

A biometric system accurately monitors and collects on-site manpower data. After generating the data, the biometric system is able to upload it easily into the ePSS. With such a seamless process, there is no longer a need for staff to manually enter manpower information into the ePSS. This results in reduced manpower and a more efficient data collection process.

Builders who utilise biometric systems have noted how they are able to closely monitor on-site manpower with little effort. They can also easily check the identities of workers for security purposes.

Other wide-ranging benefits of biometric systems include integrating companies’ human resource and payroll systems for enhanced administration processes.

Biometric technologies come in many forms, including fingerprint, hand punch and facial recognition. The purchase of biometric authentication systems may be supported with the Mechanisation Credit (MechC) and Productivity Improvement Projects (PIP) schemes under the Construction Productivity and Capability Fund (CPCF).

For more information on ePSS and biometric authentication systems, please contact Ms Ng Geok Kuan at 6325 5068 or email bca_epss@bca.gov.sg

About the Electronic Productivity Submission System (ePSS)

Besides serving as a benchmark for the industry, productivity data can help builders assess their project performance and set improvement targets for their ongoing and future projects.

BCA assists builders with monthly productivity data collection with the ePSS. The system can be assessed at http://www.bca.gov.sg/epss

Under the Building Control (Buildability) Regulations 2011, all builders are required to submit monthly construction productivity data to BCA for projects with a gross floor area of 5,000m² or more.
In the preceding article, we emphasised the usefulness of measuring project productivity. We also encouraged the use of biometric systems to help facilitate builders’ submission of productivity data.

What happens after the data is submitted?

The Building and Construction Authority (BCA) analyses it and publishes the yearly Industry Overall Productivity Indicator. It also includes a breakdown of project productivity for different building categories.

The Indicator serves as an important productivity benchmark for the local construction industry. In Table 1 and Table 2, you can find out how the local construction industry fared in 2011 in terms of productivity.

A project is deemed to be more productive if more square metres of a floor area can be constructed per man-day. A higher productivity figure indicates better project productivity.

The overall productivity figure for the industry in 2011 is 0.386 m² per man-day. Overall, the industry’s productivity has improved when we compare the figures over the past three years.

In the preceding article, we emphasised the usefulness of measuring project productivity. We also encouraged the use of biometric systems to help facilitate builders’ submission of productivity data.

How did the local construction industry fare in 2011 in terms of productivity? Build Smart finds out.

<table>
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A local steel fabricator firm uses BIM technology to confront the building of intricate structures such as the ArtScience Museum and Sands SkyPark

More than 10 years ago, steel fabricator Yongnam Engineering and Construction Pte Ltd, a core company of Yongnam Holdings Ltd, began adopting the Building Information Modelling (BIM) technology. This makes it one of the pioneer BIM adopters in Singapore.

With more than 30 years of experience in the local construction company, Yongnam is a leading local engineering and construction services provider. Its key business areas are in structural steel works, specialist civil engineering and mechanical engineering.

With strong support from the senior management to utilise BIM, Yongnam invested in BIM infrastructure, including software and hardware acquisition, as well as in-house capability building.

Today, Yongnam has around 30 engineers and draftpersons who are well versed in BIM software. More than 95% of Yongnam’s projects are modelled and documented using Tekla software.

The company’s investment in BIM has paid off. Using BIM to remodel projects and communicate with engineering teams such as Arup Singapore and AECOM, Yongnam has been able to tackle iconic and challenging building projects more seamlessly.

These projects include the ArtScience Museum, Sands SkyPark, Marina Bay Sands Crystal Pavilion and International Cruise Terminal.

Documentation of these projects also turned out to be an easier process with the BIM-generated models. Snapshots of various clashes could be taken from the models during the early stages and sent to the engineers. In this way, conflicts were identified before the fabrication and on-site installation phases.

When asked about the most challenging project Yongnam encountered, Mr Takashi Watabe, Engineering Director of Yongnam, said: “Singapore is in a fortunate location with the lowest risk of major natural disasters such as typhoons and earthquakes. Thus, we have the luxury of constructing unique architectural forms. This may create some complexities to the fabrication, but we find these challenges interesting. The BIM tool has helped a lot in the process.”

For some of its projects, Yongnam has integrated the BIM model and data information with its production line for automation. This not only helps in minimising waste, but also improves precision during fabrication. For example, data information for some 24,000 members will be generated for the fixed roof profile-cutting of the Singapore Sports Hub.

Moving forward, Yongnam plans to further expand the automation process by directly linking the BIM model and its data information to the fabrication machines during production.
PROJECT SHOWCASE
Yongnam harnessed BIM for the following projects:

**ArtScience Museum**
This unique steel structure, which measures 165m in height and resembles an open lotus that cups the sky, consists of 10 elements including columns, compression rings dia-grid and tension rings. The total steel tonnage processed by BIM is estimated to be 5,000 tonnes.

With BIM, Yongnam was able to:
- Identify the complexity of the fabrication
- Generate key data for the fabrication
- Identify connection problems between members
- Reconcile cladding skin of the structure
- Detail complex nodes for compression, tension rings, radial and finger trusses

**Sands SkyPark**
This 340m long and 40m wide aerial park structure is constructed atop three high-rise towers. The structure comprises of a building frame steelwork on top of each tower, two link bridges and one cantilever bridge. The total tonnage of steel developed is estimated to be 8,000 tonnes.

With BIM, Yongnam was able to:
- Reconcile the setting out of the building and bridge structures
- Detail the setting out of soffit cladding support members
- Develop the setting out of the dimensions of spa facilities

**Singapore Sports Hub**
This spherical steel dome has a diameter of 312m and is 82m tall. In addition to the fixed roof, there is a 200m x 82m movable roof to cover the pitch. The amount of steelwork associated with the fixed roof is estimated to be 10,000 tonnes.

With BIM, Yongnam was able to:
- Generate CHS profile cutting data
- Design and set out internal walkways
- Understand the welding sequence of complex nodes
- Generate key data (coordinates) for fabrication
- Generate key data for erection

**International Cruise Terminal**
This is a roof structure for a terminal building and an associated car park. The entire complex measures approximately 300m long and 90m wide. The total volume of steelwork for this project is about 1,700 tonnes.

With BIM, Yongnam was able to:
- Reconcile building cladding with steel structure
- Reconcile roof cladding with steel structure
- Detail the connections between steel and concrete
荣南 (YONGNAM)
采用BIM挑战
地标建筑的建设

本地一家钢铁制造业者利用BIM技术克服复杂的建筑工程，如艺术科学博物院及金沙空中花园

早于10年前，荣南控股有限公司 (Yongnam Holdings Ltd) 的核心公司，钢铁制造业者荣南建筑工程 (私人)有限公司 (Yongnam Engineering and Construction Pte Ltd)，便开始采用建筑信息模型(Building Information Modelling，简称BIM)技术。Yongnam因此在新加坡成为BIM技术的先锋。

Yongnam拥有在本地建筑业超过30年的经验，是工程及建筑业的领先者，公司的主要业务包括结构钢工程、专业土木工程及机械工程。

在获得高层管理层的大力支持下，Yongnam投资建立BIM基础设备，包括购买软件及硬件，以及建立内部能力。

今天，Yongnam共有30位精通BIM软件的工程师及建筑师团队。Yongnam有超过95%的工程项目采用Tekla软件来进行建模及文档工作。

Yongnam已从BIM的投资获得了回报。Yongnam能采用BIM来为建筑重新构造模型，以及与其它参建同项目的团队如Arup Singapore及AECOM沟通。Yongnam因此能更有效地克服具地标性及挑战性的建筑工程。

这些建筑工程包括艺术科学博物院、金沙空中花园、金沙水晶坊及国际游轮中心。

通过BIM生成的建筑模型，这些建筑工程的文档过程也变得更容易。各项可能在施工时才发现的建筑冲突可在工程的早期阶段，如钢材制造及装置阶段前，被辨认出来。这样一来，就减少了整改工作的可能性，也减少了施工时的不便。

被问及Yongnam所接受过最具挑战性的工程时，Yongnam工程部门董事Takashi Watabe说：“新加坡处于非常幸运的地理位置，大型自然灾害，如台风及地震，的风险极低。因此，我们有机会建设独特的建筑物。虽然这可能为钢铁制造过程带来挑战，不过我们觉得这些挑战非常有意思。BIM技术也帮我们克服这些挑战。”

在某些工程中，Yongnam结合了BIM模型资料及生产线，使生产线自动化，这不仅减低浪费，也在钢铁制造过程中提高准确性。

Yongnam未来计划继续通过BIM模型资料及钢铁制造机器的结合，进一步推广自动化生产线。
工程项目展示
荣南建筑在以下工程中采用 BIM 技术：

### 艺术科学博物馆
这个独特的钢铁结构有165米高，类似于一朵朝天开放的荷花。它包含10项元素，包括钢柱、压缝环、斜拉架及张力环。BIM 处理的总钢铁数量预计达5,000公吨。

通过 BIM，荣南可
> 鉴定钢铁制造的难度
> 为钢铁制造收集关键资料
> 凸显出部件连接问题
> 调和建筑的熔覆表层
> 详细显示压缩与张力环，以及径向与手指桁架的复杂节点

### 新加坡体育城
这个球形钢铁穹顶有82米高，直径有312米长。除了固定屋顶以外，也有200米 x 82米的移动屋顶覆盖着球场。固定屋顶使用的总钢铁数量预计达10,000公吨。

通过 BIM，荣南可
> 收集CHS型材切割的资料
> 设计及列明内部走廊
> 了解复杂节点的焊接顺序
> 收集钢铁制造的关键资料（坐标）
> 收集结构竖立的关键资料

### 金沙空中花园
这个空中花园结构有340米长及40米宽，设立于三座高楼的顶部。此结构在每座高楼顶部包含一架钢铁建筑结构，另外也包括两座连接桥梁以及一座悬臂桥。总钢铁数量预计达8,000公吨。

通过 BIM，荣南可
> 调和建筑及桥梁结构的列明
> 详细显示拱腹熔覆支撑部件的列明
> 制定水疗设施尺度的列明

### 国际游轮中心
这是游轮中心及相关停车场的屋顶结构。整座建筑大约300米长及90米宽。项目使用的总钢铁数量大约是1,700公吨。

通过 BIM，荣南可
> 调和建筑熔覆与钢铁结构
> 调和屋顶熔覆与钢铁结构
> 详细显示钢铁及混凝土的连接
NEW:

DEMOLITION COURSE FOR RENOVATION WORKS

The course will train workers to identify key structures and update them on new demolition tools.

Renovation works for Housing and Development Board (HDB) units often require some form of demolition to non-load-bearing reinforced concrete structural elements. The demolition process can be hazardous if workers are not knowledgeable in the area.

To encourage workers to engage in best practices when carrying out demolition, the BCA Academy has come up with a new course to equip workers with the fundamental knowledge and practical skills for demolition work.

The course will train workers to carry out safe and productive demolition processes especially in the renovation of HDB units. Workers will be trained to understand floor layout, erection, section plans, details of the proposed demolition work and proper handling and usage of demolition tools and personal protective equipment.

They will also be trained to identify key structures in order to avoid excessive hacking. New demolition tools, which help to improve on-site productivity, will also be introduced.

This one-day course comprises both theory and practical sessions. An assessment will be conducted at the end of each session.

新课程：
装修拆除工作课程

课程将训练员工如何确认主要建筑结构以及更新他们对于拆除工具的认识。

装修发展局组屋单位的装修工作往往需要拆除非承重钢筋混凝土结构，若员工对拆除过程不熟悉，有可能造成危险。

为了鼓励员工在进行拆除工作时实施最佳实践，建筑局学院设计了新的课程，以便让员工学习关于拆除工程的基本知识及实用技能。

此课程将训练员工如何在装修组屋单位时进行安全与高效的拆除工作。员工将通过课程了解地板布置图、立面、拆换工作的细节以及拆除工具和防护装具的用途与处理。

员工也将学习如何确认主要建筑结构，以避免过度的敲击工作。课程也将向员工介绍最新的拆除工具。这些工具可提高建筑效率。

此课程为期一天，并包括理论及实际训练。训练完毕后将进行测验评估。

FOR MORE INFORMATION ON THE COURSE

Please call BCA Academy at 6248 9999 or email bca_academy@bca.gov.sg

欲知详情，请拨电 6248 9999，或发电邮至 bca_academy@bca.gov.sg

与建设局学院联络。
CONSTRUCTION PRODUCTIVITY AND CAPABILITY FUND (CPCF) COURSES

> Certificate in Interior Finishing Coordination
> Certificate in Pavement Construction and Maintenance
> Certificate in Precast Concrete Construction Supervision
> Certificate in Waterproofing Supervision
> Certificate in Building Measurement
> Certificate in Geotechnical Instrumentation for Supervisors
> Certificate in Levelling and Setting Out
> Certificate Course for Structural Steel Supervisors
> NBQ in Project Supervision
> Higher NBQ in Project Supervision
> Advanced NBQ in Project Supervision
> NBQ in Supervision and Coordination of M&E Works
> Higher NBQ in Supervision and Coordination of M&E Works
> Advanced NBQ in Supervision and Coordination of M&E Works
> NBQ in Operation & Maintenance
> Higher NBQ in Operation & Maintenance
> Advanced NBQ in Operation & Maintenance

16 NEW COURSES ARE NOW AVAILABLE.
UP TO 50% TO 80% OF THE TRAINING COST CAN BE SUBSIDISED UNDER THE CPCF SCHEME.

The additional courses are:

Certificate courses (PMETs)
> Certificate course in BIM Modelling
> Certificate course in BIM Management
> Project Management for Professionals in the Building and Construction Industry (in collaboration with SPM)
> Construction Productivity Management (in collaboration with SCAL)
> Design of Precast Concrete Structures for Engineers
> Workshop on Site Management of Precast Concrete Construction

Trade Diplomas (Foremen / Supervisors)
> Structural Steel Supervision
> Reinforced Concrete Supervision
> Plumbing Technology
> Electrical Technology

Certificate courses (Tradesmen / Foremen)
> Builders Cert in Plumbing and Pipefitting
> SEC(K) in Precast Concrete Components Erection
> SEC(K) in Structural Steel Fitting
> SEC(K) in Interior Drywall Installation
> System Formwork Training
> Mechanical Elevated Work Platform

FOR ENQUIRIES, PLEASE CONTACT:

BCA ACADEMY
TEL: 6248 9999  EMAIL: bca_academy@bca.gov.sg
CONSTRUCTION PRODUCTIVITY AND CAPABILITY FUND (CPCF)

TECHNOLOGY ADOPTION

MECHANISATION CREDIT (MECHC) SCHEME
Provides assistance to companies to defray up to 50% (S$100,000) of machinery cost

PRODUCTIVITY IMPROVEMENT PROJECT (PIP) SCHEME
Provides assistance to companies to defray up to 70% (S$1 million) of the cost for adopting more productive work processes

BUILDING INFORMATION MODELLING (BIM) FUND
Provides assistance to companies to defray up to 50% (S$105,000) of the cost for incorporating BIM into their work processes

For more information, please call the CPCF toll-free hotline at 1800-325 5050 or visit http://www.bca.gov.sg/CPCF/cpcf.html

Building and Construction Authority

We shape a safe, high quality, sustainable and friendly built environment.