Integrated Project Delivery Case Study

This project was delivered within a 5 year service agreement which allowed the owner and an integrated design and construction team to develop a highly collaborative relationship which illustrates key elements of early contractor involvement, shared risk and trust that are principles of IPD. The Hudson's Hope project serves to demonstrate how an IPD-like relationship can be established that allows the project team to overcome the construction challenges arising from its remote location and deliver tangible value to the owner.

Location: Hudson's Hope, British Columbia

Gross floor area: 3,866 m^2 (41,600 ft^2)

Design charrettes started: March 2013

Construction started: May 2014

Target completion: February 2015

Actual completion: April 2015

Target cost: $10,470,952.06 (~$254.77sf)

Final cost: $11,332,560.99 (~$272.40 sf)

Number of RFIs: 75

Number of Change Orders: 20

Project Manager: BC Hydro Properties

Users: BC Hydro Generation

Design Team (architecture, structural, mechanical, electrical): Omicron

Construction Management Team: Omicron

Module Supplier: Guerdon Enterprises LLC

BC Hydro worker housing, Hudson's Hope, BC.

This remote housing project is for BC Hydro employees who work at the two large hydro-electric dams on the Peace River. It is situated in Hudson's Hope (population 1,012) in the northeast of the province where the climate can be severe and the seasonal "window" for construction is short.

BC Hydro initiated this project to replace existing worker's housing which was at the end of its useful like span (Figure 1 next page). BC Hydro considers this project as a small project, with a construction value of about $10 million. The project consisted of a 2-storey apartment building with 20 units configured either as one bedroom plus den or two bedroom units, and 10 semi-detached 3 bedroom townhouse units. The scope also included site works including parking (surface and underground) and an outdoor recreation area (next page). The project started in March 2013 and was handed over to the client group in April 2015.

The project was initiated to attract employees to relocate to Hudson's Hope and so BC Hydro wanted to emphasize long-term liveability and provide amenities that support employees choosing to work there. The design prioritized good quality, durable accommodation for a range of BC Hydro employees, from families to single workers. For example, consideration was given to the fact that people living in the north tend to enjoy outdoor activities, such as snowmobiling, fishing, hunting etc. and so spaces were provided to park trailers, RVs, snow machines, and so on.

Project organization

The existing 50+ year old housing on the site could not be salvaged (Figure 1). The new buildings were built on a clear portion of the site, and the existing buildings were then demolished to make room for parking (Figure 2).

Figure 1 Pre-existing townhouse units to be replaced (© Omicron).

BC Hydro is a public crown corporation with a wide range of assets across the province.

In addition to hydroelectric facilities, thermal power plants and associated transmission lines, BC Hydro also has numerous supporting field offices, service buildings and staff housing located across the province. To manage these assets, BC Hydro required the services of a dedicated department to manage and develop on an ongoing basis

BC Hydro Properties (BCHP) was formed in 2008 to be responsible for the development, management, fund-raising and procurement of BC Hydro's building assets. BCHP effectively operates similarly to a private land developer, receiving requests from different BC Hydro departments, who then, in practical terms, serve as a "client group".

Figure 2 Project site plan (© Omicron)

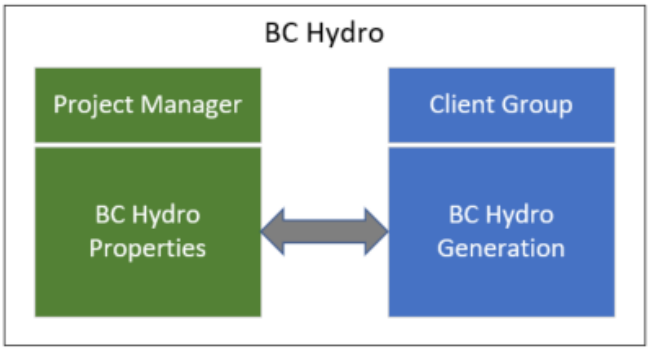
Figure 3 Exterior and interior views of the completed Hudson's Hope project (© Omicron).

Figure 4 Images of the Hudson's Hope project under construction (© Omicron).

For the Hudson's Hope housing project, the client group was the BC Hydro Generation department.

BCHP works closely with client groups to assess their building needs and develop a business case, often considering factors such as options for leasing, renovating or new buildings; long term building requirements; the location, size and development costs; and how the client group's department might change the way it operates in the foreseeable future (Figure 5).

Figure 5 BC Hydro's internal relationship between the client group and the Properties department



Once a project need has been established, BCHP provides feasibility reports to establish the project requirements, functional program and available options. Once the requested project requirements and options are drafted and a business case is made, the proposed project is presented to BC Hydro's Executive Board for approval.

Upon approval, BCHP continues to work closely with the client group as their project manager during building design, to ensure they are satisfied with the building project outcomes.

BCHP stated that they generally use Design-bid-build, Design-build and Construction Management at Risk project delivery methods. Considering these options, they select the best suited method for the project. While BCHP is familiar with integrated project delivery (IPD), they do not utilize multi-party agreements.

CONTEXT

Framework agreements

The service agreement model under which the Hudson's Hope project was delivered, is not commonly used in Canada. This is despite the fact that, for clients that routinely procure construction works, service agreements (also known as "framework agreements") have been shown to reduce procurement timescales, transaction costs, learning curves, and can also encourage continuous improvement within long-term relationships.[1]

In fact, framework agreements are common practice for procuring public sector capital in other jurisdictions. For example, In the UK, using a standard form of agreement for frameworks published by the Joint Contracts Tribunal (JCT), frameworks allow owners to invite tenders from suppliers of goods and services to be carried out over a period of time on a call-off basis as and when required.

The Hudson's Hope project was delivered within two concurrent 5-year Service Agreements – one was for design services, the other for construction.

In 2008, BCHP issued two Request for Proposals (RFPs) for 5-year service contracts: one for design and the other for construction management (CM) services. BC Hydro opted for this approach because they were planning a number of capital projects and a services agreement would eliminate the inefficiencies associated with issuing RFPs on a project by project basis. In this way, BCHP could have access to professionals for feasibility and pre-project development to define and program a building project, without having to go through a formal procurement each time.

Omicron's design team (consisting of architectural and structural, mechanical and electrical engineering) won the design services contract, and Omicron's Construction Management team was awarded on CM services.

Both the design and construction services agreements were set up such that feasibility and pre-project work was delivered for a lump sum fee, which was always paid, regardless of whether the work got approval from the executive board to proceed or not. Once board approval was obtained, and funds and resources were allocated, Omicron was then contracted to deliver the project under a standard consulting services agreement, (e.g. from the AIBC, RAIC or the Engineers and Geoscientists BC) for the design team, and under a CCDC-5 (CM at risk or CM+) construction management contract using for the construction team. For each discipline, soft costs associated with this follow-up contract were broken out as percentages of projected building cost estimated during the pre-project phase.

Within the RFPs for the services agreements, BC Hydro included specific basic criteria for the design and CM service contracts which set a framework for the collaborative working environment they wished to create.

For example, BC Hydro required that the design team should be comprised of a core group of the architecture, structural, mechanical and electrical disciplines. Similarly, the CM team should cover the full range of services, from estimating to managing construction activities. Other BC Hydro specific requirements included in the RFPs were:

> **Project Portfolio:** BC Hydro required confidence in the applicant to perform across wide range of project sizes, from under 10 million to over 50 million.

BC Hydro's design and construction services agreement delivered by an integrated design and construction firm resulted in a highly collaborative process that exhibited many of the features of Integrated Project Delivery.

Integrated Project Delivery (IPD) is an emerging construction project delivery system that collaboratively involves key participants very early in the project timeline, often before the design is started. It is distinguished by a multiparty contractual agreement that typically allows risks and rewards to be shared among project stakeholders.[2]

[In the applicant interviews for the service agreement RFPs, we asked questions such as, "In the event of] flooding, [if] we lose power, what do you do then? How do you solve it?"

Bashar Amer, Program Manager, BC Hydro Properties

"Of course, these big companies [who apply] have big names, and you know that you are interviewing top 3-4 designers or CMs in Canada. They have established their reputation over many, many years. So, you know they are going to come with right answers [in the interviews, but] you just want to get a good feeling that this is a good fit. Can we work with these companies? and how is, their philosophy, their thinking, their behaviour with clients?"

Bashar Amer, Program Manager, BC Hydro Properties

Building type experience: Applicants needed to demonstrate experience with the range of buildings that BC Hydro normally undertakes. Most projects are industrial and institutional buildings, such as operations facilities, so the Hudson's Hope housing project was a rare exception.

Regional experience: Applicants must have experience and a history of working with the diverse range of climatic and regional conditions where BC Hydro operates across BC.

The RFP for 5-year service contract was issued Canada-wide, which led to a shortlist of applicants. BC Hydro Properties then performed extensive interviews that included scenario-based problem-solving questions. Through such interviews, BC Hydro could achieve several critical due diligence items. In particular, the applicants' experience could be verified, and BC Hydro could assess how well the team would work together and how they will behave with the client groups.

Given the team would be working with each other and BC hydro for 5 years, it was critical that the project team should not only "get along well", but also be able to continuously improve the effectiveness of their collaboration over that time.

Due to BC Hydro's large organizational size, the expected level of sophistication of the projects, and the significant procurement needs for every project, it is common for BC Hydro to create custom agreements to suit their unique requirements. Creating 5-year service agreement was not considered outside the normal course of business. Yet it provided great benefit to BC Hydro by providing BCHP and the various client groups access to full design and construction expertise while they developed their building program.

BC Hydro Properties awarded 5-year service contract to Omicron to perform both the design and the CM.

Omicron is a Canadian pioneer in offering integrated development, design and construction services. Founded in the late 1990's on a belief that designers and builders can work together in a more integrated way to deliver a better experience for clients and employees, Omicron has become one of the largest integrated development, design and construction firms in Canada.

Although Omicron's integrated firm structure was not considered an advantage in the team selection process, BCHP noted that it was a significant element of success for the projects they subsequently completed. Omicron's integrated team resulted in efficient pre-project space planning following the design development and construction, leading to more successful outcomes.

Omicron

Headquartered in Vancouver, Omicron's fully integrated approach means their workforce of over 130 architects, interior designers, structural, mechanical and electrical engineers, construction managers and superintendents, and development specialists all work together under one roof. Senior staff believe that this collaborative structure gives Omicron an advantage in terms of responsiveness and efficiency while offering a better client experience.

The Omicron personnel working on BC Hydro projects considered the concept of "open office" to be a critical element of success. Professionals from design to construction could quickly and easily reach out to their co-located colleagues to discuss ideas, resolve issues and coordinate solutions.

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BCHP's project managers, and Omicron's design and CM teams formed the project team responsible for all of the projects delivered under the service agreements.

Some of the advantages that the team gained from the term-based service agreements are similar to those achieved through IPD and include:

1. **Early involvement with the full design and construction team:** Omicron's design and CM personnel were part of the project team from the beginning. This allowed them to participate in the feasibility assessment, in the building programming, as well as options analysis. They could also support the project team with their expertise before committing to a building project. Early involvement also reduced the likelihood of potential miscommunications among the project participants, and misinterpretations of the client group's needs. Additionally, having the owner, designer, and builder working together early in the process helped to resolve issues, when they are easier and less costly to resolve.

2. **Responsive and streamlined project processes:** Having a project team handling all building projects together over 5 years allowed them to build a working relationship that ultimately improved the project outcomes over that period of time. For example, the project team learned about each other's practices and expectations over each project which progressively helped them to streamline their processes to work together more efficiently. The project team could solve problems holistically, inclusive of all requirements, from building envelope to energy performance, to mechanical and electrical integration, to constructability, cost and scheduling.

3. **Efficient information sharing and joint decision-making:** Because of the core project team was involved from the very inception of the project, all members of the project team had an equal understanding of the project, and they also contributed in the decisions. Another advantage of having project team from the beginning in this project was that the reasoning and rational behind the decisions, the pricing and cost assumptions, were all known by the entire project team.

4. **Understanding the "Hydro Way":** The effective collaborations were not limited to building projects. Through the term-based service commitment, the Omicron design and CM teams had the chance to become proficient with the working processes, standards, and rules in BC Hydro projects.

BCHP was aware that certain risks would always be unforeseeable, or beyond the control of the project team. So, when changes to the contract were identified, BCHP worked closely with Omicron to find the best solution with consideration of the cost-benefit analysis of any design revisions versus the hard cost savings on-site.

Any substantial changes after 100% design development drawings were issued (or any change requests coming from the client) would be considered a change order.

"The fact that [under using construction management project delivery] we can transfer the risks very quickly from us to the CM is a huge [benefit for us]."

Bashar Amer, Program Manager, BC Hydro Properties

"We went through and developed a list regarding the [project's guiding] principles. [We} modified that list of guiding principles more than once and it is always been really effective when we get off-topic or kind of lose sight of decision, we go back to those rules."

Korey Roberts, Senior Project Director, Omicron

5. **Transparency:** Omicron's integrated team assisted BC Hydro by establishing the unit rates (for labour and materials, etc.) throughout the design process, which resulted in the project's cost being as close as possible to the true market. The integrated design and construction team eliminated the risks typically carried as a price premium on the general contractor's or CM's bid. This "risk premium" arises from the CM accounting (or "padding") for potentially missing information or misinterpretation of intent. In the case of the Hudson's Hope project, the risk premium was minimized because the CM team who was bearing the construction risks, participated in the design and had the opportunity to thoroughly review and revise issues prior to accepting the packages for public tender.

6. **Value-based decision-making**: the CM team's responsibility spanned from the start of the feasibility study (pre-project) to the end of the first year of operation (typical warranty period, post- occupancy) which incentivised Omicron to make longer term, forward-looking decisions. This is not typically possible in design-bid-build project delivery. Further, Omicron and BC Hydro developed joint "guiding principles" that set out expectations, goals and rules that the team could fall back on when questions came up. This informal document performed a similar function to "decision matrices" commonly used in IPD projects. This "living document" was revised by the project team over the course of the 5-year service agreement.

7. **Predictability of schedule:** The project was publicly tendered via bid "packages", which allowed parts of the project scope to be procured in parallel, thereby speeding up the process. For example, the prefabricated and site work/foundations packages were issued first, while the building envelope was still in development. This arrangement provided flexibility to accommodate the region's short construction window.

8. **Predictability of cost:** During the design phase, the CM team actively provided cost estimates and construction advice to the project team generated from subcontractors and suppliers via detailed quantity take-offs. Even though they were not compensated for early consultation, key subcontractors and suppliers provided feedback on the design strengths, weaknesses, missed opportunities, and issues as they developed. The downstream benefit to subcontractors was that by incorporating these improvements, workload was reduced, and costs were controlled. However, Omicron could only offer this level of service after years of building up a good working relationship with a range of subcontractors.

A flexible selection process to hire subconsultants and subcontractors allowed the core project team to select local professionals who could contribute valuable regional expertise.

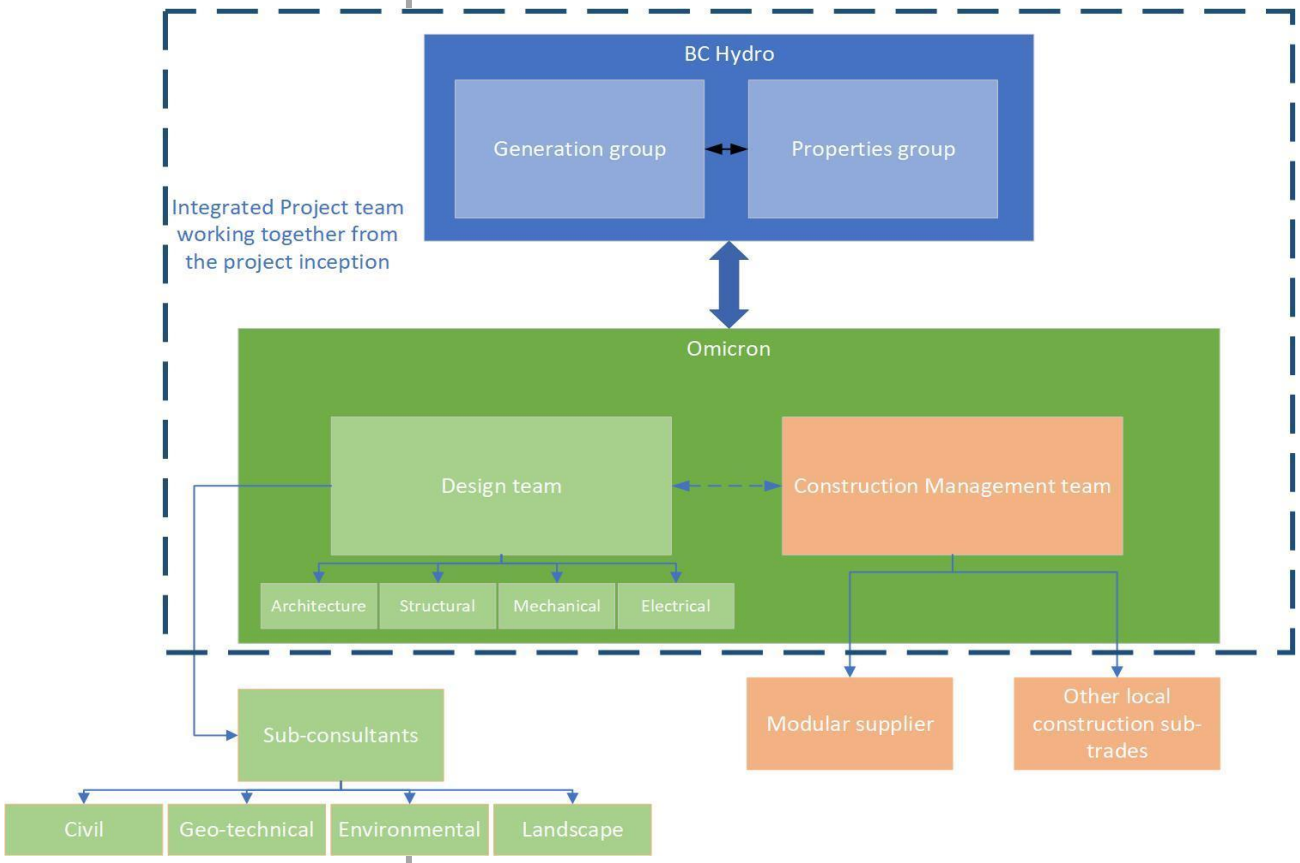
To hire the sub-consultants and subcontractors for the Hudson's Hope project, the CM team issued a call for pre-qualifications using the CCDC-11 standard form. This qualification call involved both subcontractors with existing relationship with Omicron, as well as new subcontractors, such as those based in the Hudson's Hope.

Pre-qualification was handled early on, i.e., during early interactions with the local authority, to build relationships with the subcontractors. Omicron noted that even when subcontractors were not successful, the knowledge and relationships gained often endured and provided value in future projects.

Omicron's depth of integration across architecture, engineering and construction shows that projects as small as Hudson's Hope can benefit from a highly collaborative process while yielding significant benefits for the owner.

- Capturing the design and construction scope within the same firm allowed easy and effective communication between individual team members, providing the means to quickly and efficiently solve issues with as little process waste as possible.
- The ability to carry the lessons learned and experiences gained from a project within a single entity ensured learning curve advantages can actually be exploited in the next project.
- Within a team that is internally integrated, overhead costs of integration, such as trust building, workflow streamlining and communication plans, were minimized as the firm would have made such investment (and proven their ability to work together) prior to the service contract.

Figure 6 Project team structure



PROCESSES

Building Information Modelling (BIM)

The use of BIM – 3D modelling of the design – can potentially provide IPD project teams with the opportunity to pursue a truly collaborative approach to design, construction and ongoing management of an asset.

Life-cycle cost analysis (LCCA)

LCCA is a method for assessing the total cost of facility ownership. It considers all costs of acquiring, owning, and disposing of a building or building system. LCCA is especially useful when project alternatives that fulfill the same performance requirements but differ with respect to initial costs and operating costs, have to be compared in order to select the one that maximizes net savings.[3]

The Hudson's Hope project had limited use of 3D modelling systems. While BIM was used by the architectural team, Omicron did not need to implement the full capabilities of BIM because of the small size and simple residential nature of the project.

However, the 3D model was useful for visualization and for certain aspects of coordination. Also, to encourage local contractors to get involved with the Hudson's Hope project, the use of sophisticated technology was kept to a minimum.

Generally, the project utilised common industry coordination practices, such as clear areas of scope on the project (e.g. corridor ceiling interstitial spaces are for mechanical runs), PDF reviews or CAD underlays. This extended to the US-based modular supplier, who join the team during the construction documentation phase.

A life-cycle costing (LCC) approach was taken to the project design and specification of products and materials.

BC Hydro expected the Hudson's Hope housing units to have a useful service life span of approximately 75 years in the harsh northern climate of north-eastern BC. As a result, the exterior finishes were specified to be durable with low-maintenance requirement. Given the remote location and challenging climate, it was decided to use simple, proven HVAC equipment and off-the-shelf items throughout the project, so maintenance would be minimized and simple to perform. Interior finishes were also selected to be durable, but also had to be attractive and desirable to occupants, at a reasonable cost.

Balancing initial costs with long-term durability and low operating costs was challenging given high material labour prices due to the remote location harsh climate conditions in Northern BC. Overlaid on these constraints was the short building season. As a result, a modular solution was deemed the optimal approach for this project.

TEAMWORK

No need or time for training on a fast-paced project

The Hudson's Hope residential building typologies are well known, and the building components and systems were purposefully selected to be easy to understand and maintain. No specific training for the project team was required (or could be included given the tight time frame), other than a visit to the US-based modular supplier to gain familiarity with their processes, workflow and capabilities.

The Big Room According to the Lean Construction Institute, "An effective Big Room supports cross-functional team collaboration by advancing work and bringing the larger team up to speed on the activities of other groups or individuals. It allows teams to understand their impact across clusters or work groups. The Big Room also provides teams with the time to discuss project-wide concerns like budgets, hot topics, or global changes. The term Big Room refers more to the behaviours and actions of the team than the physical space. The Big Room is more than co-location of people; it is about collaborative behaviour and the work they are producing."

In addition to spreading the one-time investment required to start-up a project over numerous projects over 5 years, the team was able to collaborate effectively, merge workflows and processes, and iteratively improve the team's performance and outcomes.

Omicron's integrated office arrangement whereby inter-disciplinary project teams are clustered together functions very similar to a Big Room.

Omicron's office set-up captures the benefits of a Big Room but adds the additional layer of internal relationship advantages. Whereas the Big Room can be considered the formation of a temporary, integrated "building design and construction company" that is specially organized to achieve a specific project's objectives, the Omicron structure functions more like an ongoing, continuously improving collaboration of multiple project-specific "Big Rooms".

So, while the Hudson's Hope project team held regular coordination meetings (which included 4 open-houses held by BCHP for to gather client group feedback on the project design[4]), an important difference to traditional project delivery was that the team could benefit from ongoing informal discussions that were only possible because the design and CM team members sat next to each other.

Omicron also leveraged prior relationships gained internally from previous projects and company-wide experience to jumpstart the Hudson's Hope project. The design and CM team members all knew and trusted each other. This meant the team got up and running on the project fast than would be possible for even an IPD team, where significant time and effort is required at the start for team building.

While the Hudson's Hope project did not specifically champion IPD, the structure the contractual arrangement between BC Hydro and Omicron meant that there was a commitment to long-term collaboration and tangible benefits were realized.

To Omicron's credit, the design and CM team strongly emphasized continuous improvement over the length of the service agreement. Even without the pressure of competing for each BC Hydro project, Omicron noted that the building industry's typically slim profit margins coupled with BC Hydro's clear performance expectations incentivised long-term improvement. The 5 year service agreements contained no formal reward or incentive for this behaviour.

Any performance improvement incentives had to be realized internally within the project team. The drive to improve largely came from the personal and professional motivations of individual team members who saw the benefit of "doing better", cooperating, and putting the best interests of the project first. Not only did the Omicron team find the BC Hydro work enjoyable, but it helped to build high-performing efficient teams within Omicron which, in turn, supported superior outcomes on all future projects.

Figure 7 Modules for the Hudson's Hope project under construction and in transit (© Guerdon)

Working with US-based Guerdon Modular Buildings[5] from Idaho required careful coordination to ensure that the modules had to comply with the Canadian National Building Code (NBC).

Although Guerdon had extensive experience with working in various provinces in Canada and were familiar with the Canadian code, the CSA-approved pre-installed fixtures (bathroom, kitchen, lighting, etc.) were not available in the US, necessitating some rework on the part of the design and CM team to select alternatives.

However, Guerdon impressed the project team by overcoming challenges with delivery logistics to such a remote location by leveraging their experience working with the oil and gas industry in the prairies. For example, services were done by the subcontractors that would complete the connections on-site to alleviate commissioning issues. The modules were delivered from Idaho to Hudson's Hope in 48 hours and then quickly and efficiently installed under the guidance of Guerdon's on-site installation expert.

Despite a transportation distance of almost 2,000 km between the manufacturing plant and construction site, the project team achieved almost "just in time" deliveries of the modules. The apartment modules were installed first. The incoming trucks were conveniently parked at the nearby coffee shop to wait their turn. Then, the modules were unloaded and installed directly form the truck into final position. Because of the just in time sequencing, only 2-3 modules at a time needed to pull in to the coffee shop parking.

Omicron removed agency inefficiencies by having both the design and CM teams within the same firm.

Agency inefficiencies occur in building projects where project teams are composed of many different firms (agencies) with different goals and expectations. This impacts collaboration because of issues with information liability (errors, omissions or misinterpretation) or misalignment of interests. Indeed, the shared risk and reward mechanism in IPD is in place specifically to address this inefficiency incentives collaboration.

INNOVATIVE PRACTICES

Figure 8 Pre-fabricated modules ready for installation (below) and installed (bottom) for the Hudson's Hope apartment building (© Omicron).

Modular construction was selected because of the project's remote location, limited availability of local labour, material costs and harsh climate / short construction window.

During the feasibility phase, the project team prepared a white paper that laid out the options for constructing the Hudson's Hope project and a system based on light wood frame prefabricated modules was selected as the best solution. By completing much of the work off-site, progress can continue year round and the need to procure local labour was minimized. Material transportation cost would also be lower, given the likelihood of a prefabrication plant being located in a more central location.

The level of prefabrication was carefully thought out with the help of a Metro Vancouver based prefabrication plant. However, the prefabrication package was awarded to Guerdon Modular Buildings, located in Idaho, the United States. The level of prefabrication comprised:

- **Modules, exterior & structure:** The apartments were fabricated as two halves for ease of transportation (Figure 8), and townhouses are by storey (i.e. stacked modules). All modules were finished to the level of sheathing and sheathing paper, with the exterior cladding site installed to ensure a continuous weather barrier.
- **Module interiors:** The units were largely finished, including appliances that were lashed down but not hooked up at the time of transportation. All rough-ins were complete to allow quick connection once the modules are installed.
- **Corridors modules**: These modules were approximately 25% complete, to allow for quick service connections and installations with being impeded by finishes.

Site-built elements included:

- **Corridors, stairs and service rooms:** were all site built once the modules were installed.
- **Apartment and townhouse foundations:** were all built in parallel with the prefabrication of the modules, allowing flexibility to accommodate the compressed construction window. This was made possible by tendering the prefab and site works (foundation, earth works, site improvements, etc.) bid packages as early as possible, while envelope design was still occurring.
- **Non-housing elements:** Landscaping and other non-housing unit related items were not prefabricated.

TECHNOLOGY

Omicron's design team prepared 3D virtual models of the building to help BC Hydro and the end users visualize the project.

The 3D models were mainly used for architectural design of plans, sections and elevations. The model was used by all other disciplines as the base for their respective design scope. It was also helpful for gaining approvals from the local authority (Figure 8 and Figure 9).

BIM was not used for design coordination and clash-detection. Because Omicron strived to make the design as simple as possible, a conventional 2D drafting system could be used to complete detailed design (such as wall sections and details). Guerdon was then able to insert their details into Omicron's 2D drawing to prepare their shop drawings then share them with the design team for review (**Error! Reference source not found.**). Coordination, and collaboration was done through typical methods, such as regular meetings and review of underlays and PDF's.

Figure 8 3D model of the town houses(©Omicron)

Figure 9 3D model of the 2-story apartment building (©Omicron)

OUTCOMES AND METRICS

Owners requirements met

All of the owner's requirement were addressed effectively. The 5-year service agreement enabled the project team to build a strong rapport with the owner, and to develop a deep understanding of the owner's needs, way of working and key priorities.

On budget

The estimated project cost was $10,470,952.06 ($254.77/sf) which came at $11,332,560.99 ($272.40/sf). The final project cost of the project was increased by 8.23%.

The reason for the cost increase was that the project team considered the lower price provided by the initial module supplier in their estimate before they went out for a tender. Ultimately, when they went out to market the best price available was 8% more.

2 months behind of schedule

The project was completed in 26 months which was initially scheduled for completion in 24 months. The reason for the longer timeframe was due to finding and scheduling skilled labour. Finding trade contractors (particularly mechanical and electrical) willing to travel is a routine challenge for remote projects.

Operating under a 5 year service agreement offered many benefits to the owner and project team that are similar to the advantages delivered by IPD.

- Bringing all team members together early allowed expectations to be set and strong relationships to form. The team was motivated to "get along" and work well together, as they would be together for the next 4 ½ - 5 years. Factors, issues and challenges that were traditionally isolated between design and construction were considered and addressed before they become a problem.

- Not breaking up the team after every project has significant continuity of service and service improvement advantages. For example, in the past, BC Hydro had spent considerable time "training" project teams on "the Hydro way" which included its particular ways of doing business: rules and regulations; processes and standards.

- The fact that all project team members participated in the design development from the beginning meant that there was universal project "ownership" and all decisions were established collaboratively. Everyone was aware of the design's history and rationale, and there was less incentive to make changes to the design as it matured.

- The 5 year service agreement encouraged continuous improvement because the project team worked on many building projects over the life of the service agreement, there were ample opportunities to learn and improve.

- BCHP gained the benefit of consistency and continuity of service, as the RFP, due diligence and selection process was completed once to cover 5 years of services. In essence, the "project" was to deliver building asset services, and not deliver individual buildings or renovations.

- The 5-year service agreement allowed the project team and BCHP to develop long-term relationships and leverage economies of scale (over multiple projects) to improve trust and collaboration and streamline workflows. There were no legal disputes during the term of the agreement.

- The service agreement provided a mechanism to ensure risk is identified early and managed collaboratively. For example, the CM team assumed construction risk after tender award, but was fully integrated with the design team and the owner since the feasibility stage, be intimately involved in the design prior to the public tender.

At the end of the first 5-year service contract, there was negative market feedback about service agreements of this type.

There was a fear that there could be a potential conflict of interest arising from awarding both contracts to Omicron business units. While BC Hydro noted that the arrangement worked well, and they received tangible benefits of having both teams 'under one roof', they decided to address this issue once Omicron's 5-year service agreement was complete. When BCHP went to market with an RFP for the subsequent 5-year service agreements for design and construction services, it was prohibited from awarding both contracts to a single firm.

While the objective was to reduce the perceptions of a "contract monopoly", BCHP had to set aside the efficiencies afforded by working with a highly integrated team that had been built over the previous 5 years. However, Omicron's CM team is currently working with another design team on the second 5 year service agreement. Omicron believes that many of the collaborative benefits continue to be a part of this contractual arrangement, despite some inefficiency during the early part of the contract as the new team got to know each other and learned to work together.

However, one control imposed within the BC Hydro service agreement was inclusion of a clause that allowed BCHP to replace a team member if they underperform (essentially, a legal "stick" to enforce performance), without a corresponding incentive to exceed performance requirements.

CHALLENGES AND LESSONS LEARNT

Early collaboration with as many of the critical professionals as possible has significant practical benefits including early project buy-in, encouraging ownership of the project, and ensuring all project participants understand the reasoning behind project decisions.

Procurement structure matters. BC Hydro Properties' objective was to manage the crown corporation's building assets effectively – not to successfully build or renovate individual buildings. Therefore, longer term service contracts were used to reduce service uncertainty and increase responsiveness, while gaining some economies of scale and fixed cost advantages with the consultant/construction team.

Some of the advantages with integration are less tangible but yield significant practical benefits. Omicron's in-house integration facilitates quicker decision-making and eases communication lines between the design and construction professionals.

Informal relationships can provide significant value: Omicron's CM team was able to consult with important subcontractors, helping to point the design development in the right direction.

The challenges that face projects in remote locations are significant. For Hudson's Hope, dealing with the harsh climate and limited construction season was less of an issue than finding and scheduling subcontractors and trades.

- Regardless of the benefits of early collaboration, the team must still be attentive to market forces. For example, the original prefabrication supplier did not win the bid package despite being involved during design - their bid was not the lowest. Guerdon's price was the lowest but still significantly more than the original budget due to market changes and their solution required additional coordination to ensure Canadian code and standards compliance.

- Scheduling subcontractors and trades in a buoyant market can be challenging. Costs of housing them, travel, access to materials etc. all have to be factored in.

- Openness, impartiality and transparency become more important when project structures and agreements are focused on collaboration and integration. This means that public RFPs or tenders have to be inclusive (i.e. allow trades to be part of a project team). In the case of Hudson's Hope, the modular builder was an integral member of the project team.

- The structure of service agreements yields IPD-like advantages. However, the size and scope of such contracts need to be carefully thought out. If the scope is very large, then it could limit access to only the largest firms, reducing the pool of qualifying firms and introducing perceptions of bias or unfairness.

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References

1 Framework agreements described by Constructing Excellence, http://constructingexcellence.org.uk/tools/frameworkingtoolkit/why-use-a-framework-agreement

2 Mounir El Asmar, Awad S. Hanna, and Wei-Yin Loh, "Quantifying Performance for the Integrated Project Delivery System as Compared to Established Delivery Systems" © 2013 American Society of Civil Engineers. Sourced from the IPD Alliance, www.ipda.ca

3 Definition according to the Whole Building Design Guide www.wbdg.org/resources/life-cycle-cost-analysis-lcca

4 To make sure the design was fulfilling all the client's requirements, the project team presented design development to the end users at the following development milestsones: 50% schematic design, 100% schematic design, 50% design development, 100% design development to get their inputs and suggestions and incorporated them into design.

5 www.guerdonmodularbuildings.com