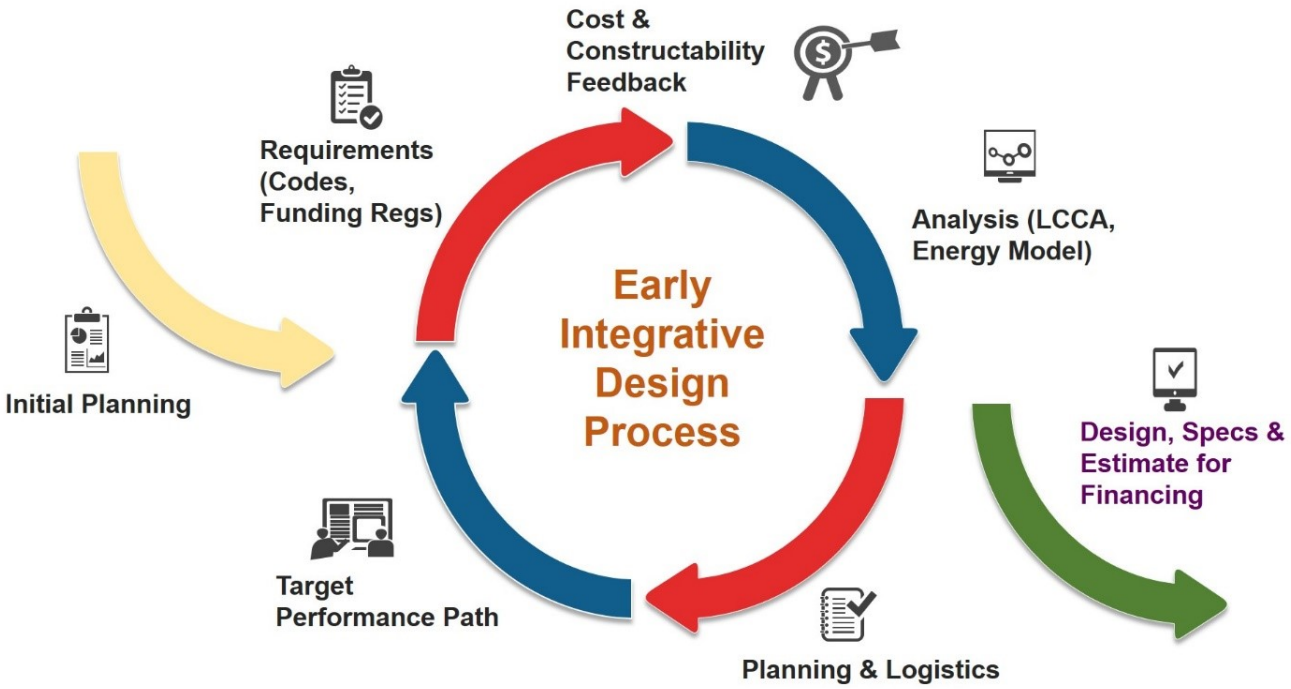
The Housing Development Consortium of Seattle-King County

GUIDELINES FOR
EARLY INTEGRATIVE DESIGN

Part of a series highlighting techniques for designing & building better affordable housing



HOUSING DEVELOPMENT consortium

Exemplary Buildings Program

Advancing Ultra-Efficient Buildings in Affordable Housing

CONTENTS

OVERVIEW: EBP'S GUIDELINES SERIES

The Housing Development Consortium of Seattle-King County (HDC) launched its Exemplary Buildings Program (EBP) as a regional collaborative effort targeting nothing less than transformation of the affordable housing market. Why? Because the interrelated crises of climate change, equity, and housing demand both boldness and urgency. We believe it's possible to create equitable access to healthy, safe housing that is ***both*** affordable ***and*** ultra-efficient. The EBP task force has defined a comprehensive set of performance standards and building practices designed to reduce the overall premium (the additional costs of implementing ultra-efficiency) to the point where the premium can be financed through the operational savings generated. These standards are available at exemplarybuilding.housingconsortium.org.

EBP's Design Charrettes. Meeting those performance goals depends on broad engagement and a relentless focus on best practices. Both of those were featured in the design charrettes EBP convened soon after launch. Each intensive session brought together recognized thought and practice leaders in one of several technical areas: Balanced Ventilation with Heat Recovery; Domestic Hot Water; Early Integrative Design; Solar Integration; and Wall Assemblies. Charrette participants, including experts from the EBP task force, rigorously sifted through all of the current and emerging technologies, analyzing each in the context of changing construction practices and local construction culture, the Puget Sound region's marine climate, codes and regulations, and cost.

EBP's Guidelines Series. Each charrette produced a set of practical guidelines—such as those presented in this document—to support teams early in their design and pricing efforts, helping them to streamline the process of building exemplary buildings. The path to achieving cost efficiency includes standardization, training, and partnerships with suppliers. A fundamental purpose of EBP is to present approaches that are repeatable so that cost efficiencies can be accomplished at scale with partner suppliers and subcontractor familiarity.

It is important to note that EBP's guidelines are not restricted to developments striving to meet the full set of "exemplary" criteria. In fact, our hope is that they can be used to improve affordable multifamily housing more generally.

We hope these guidelines facilitate the affordable housing sector's ability to achieve construction cost efficiency, quality, and durability while pursuing the performance goals of the Exemplary Buildings Program and the specifications for projects in King County, Washington. Performance data from the program's demonstration projects will be used to continually refine the guidelines and update these publications.

EBP's Partners. We're grateful for the time and exceptional talent of the charrette participants and for the generosity of our program funders and charrette sponsors. Their commitment to this vision is vital.

Marty Kooistra
Executive Director, Housing Development Consortium of Seattle-King County (HDC)

EXECUTIVE SUMMARY

Each set of guidelines in HDC's Exemplary Buildings Program brings forward new ideas and practices to benefit a project team in designing and constructing the best affordable housing with limited resources. The impact of good early decisions is great, since 80% of major decisions take place in the initial phase.

Early Integrative Design (EID) enables the effective adaptation to change in an industry that often relies on doing what was done before as the default path. The speed of change today requires early adaptation to changes in: resident needs, technical solutions, systems and products, funding opportunities, future code developments, and lessons learned by others. A key goal of EID is to help make decisions that balance capital and maintenance costs with long-term operating efficiencies and the benefits of health, comfort, and durability.

Key concepts covered in these EID guidelines include:

- **Owner pre-design planning and the power of TRUST in teamwork.**
- **Design charrettes – early and often.**
- **Iterative nature of a successful design process.**
- **Process guide to assist teams in staying on track.**
- **Focus on cost efficiency.**
- **A case study of success in early integrative design.**

Efforts have been made to present information that is true and accurate. Since every building has unique circumstances, design and construction teams will need to independently verify the information provided here. We hope this document proves useful as a resource to assist with the design of high-performance affordable housing developments. HDC's Exemplary Buildings Program is a work in progress, and we hope to incorporate new strategies in the future. Stay tuned.

Joe Giampietro, RA, CPHC
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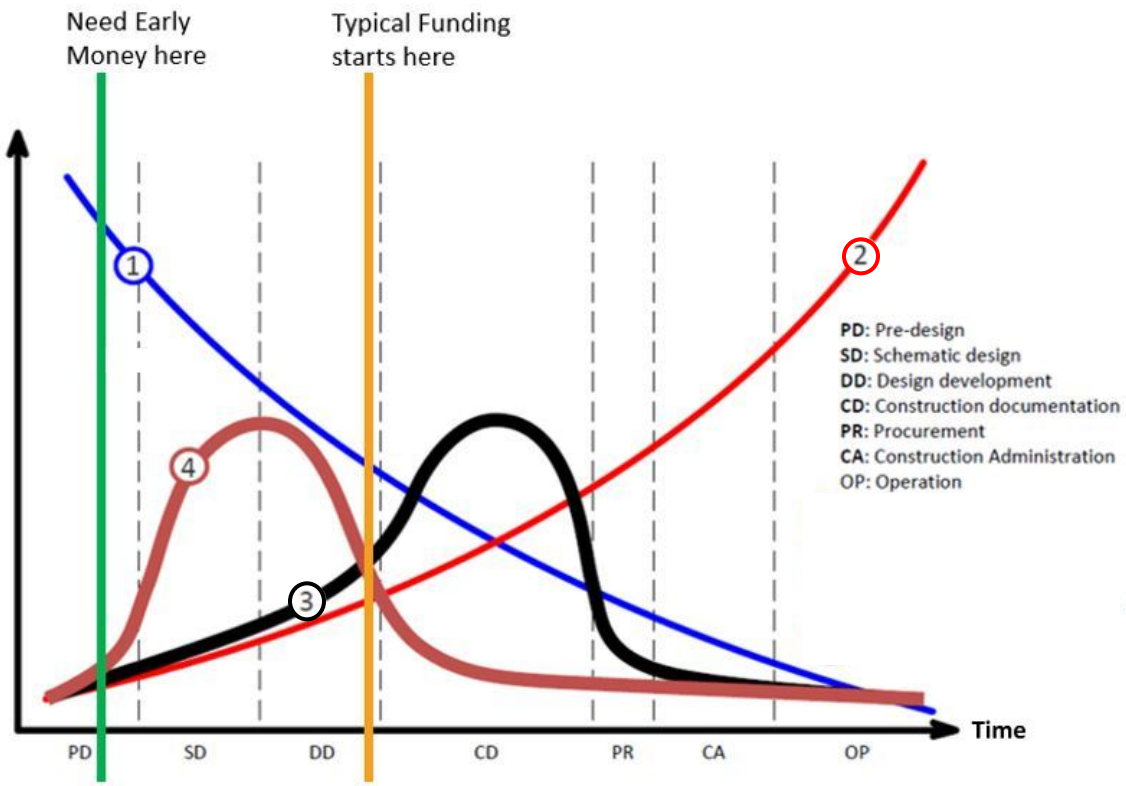
EARLY INTEGRATIVE DESIGN

This section provides an overview of the key principles and practices of an early integrative design (EID) process, contrasting it with more conventional design approaches.

Early: Be open to new approaches

The **EARLY** portion of a project, pre-design, has the seeds of success to realize project goals. As illustrated in the diagram below, the ability to influence sustainability and efficiency is front-loaded. Before assuming past practice is the best path forward, teams should explore whether new approaches might take best advantage of opportunities for whole-systems interactions.



Graphic originated by Patrick MacLeamy, AIA/HOK

In this figure:

- **Line** (1) shows the declining ability to impact cost and capabilities of a project over time.
- **Line** (2) shows the increasing cost of design changes late in a project timeline.
- **Line** (3) shows the level of effort put forth over time in a traditional design process.
- **Line** (4) shows the level of effort put forth over time in the preferred design process.

Integrative: Team decisions using a whole-systems approach

INTEGRATED DESIGN PROCESS		CONVENTIONAL DESIGN PROCESS
Inclusive from the outset	vs	Involves team members only when essential
Front-loaded — time and energy invested early	vs	Less time, energy, and collaboration exhibited in early stages
Decisions influenced by broad team	vs	More decisions made by fewer people
Iterative process	vs	Linear process
Whole-systems thinking	vs	Systems often considered in isolation
Allows for full optimization	vs	Limited to constrained optimization
Seeks synergies	vs	Diminished opportunity for synergies
Life-cycle costing	vs	Emphasis on up-front costs
Process continues through post-occupancy	vs	Typically finished when construction is complete

Source: Busby Perkins + Will and Stantec Consulting, *Roadmap for the Integrated Design Process* [Developed for the BC Green Building Roundtable, 2007].

An **INTEGRATIVE** process starts with clearly defined project goals and objectives. The first step is defining the process, the communication rules, and the decision responsibilities that allow the team to function effectively. One process guide that has been proven to help balance the goals of cost-efficiency with high performance is Target-Value Design (TVD). As described by Lean Projects Consulting (see Exhibits for details), TVD outlines a process of design practice that delivers surprising value based on the following principles:

1. **Design to an estimate** *vs. estimating a design.*
2. **Design what is constructible** *vs. evaluating constructability of a design.*
3. **Work together to produce decisions** *then design to those decisions.*
4. **Carry solution sets far into design** *vs. narrowing choices to proceed with design.*
5. **Work in pairs or larger groups** *vs. working alone in separate rooms.*

Team Trust: Building trust in the project team

One of the challenges that nonprofit affordable housing development faces is that it is quite common for a new team to be formed each time a project comes together. Not only are there new firms and organizations but staff within as well. This means that there can be huge learning curve to understanding the styles, philosophies and organizational cultures represented in an early collaborative design effort.

At minimum we recommend that time is dedicated to surfacing all those important process matters as the team first meets and begins its work. Team members should be encouraged to create a safe space for participants to share their aspirations and reservations about the project and what they need to get from as well as what they will give to the success of the project. Certainly, everyone should share what their non-negotiables are related to working together.

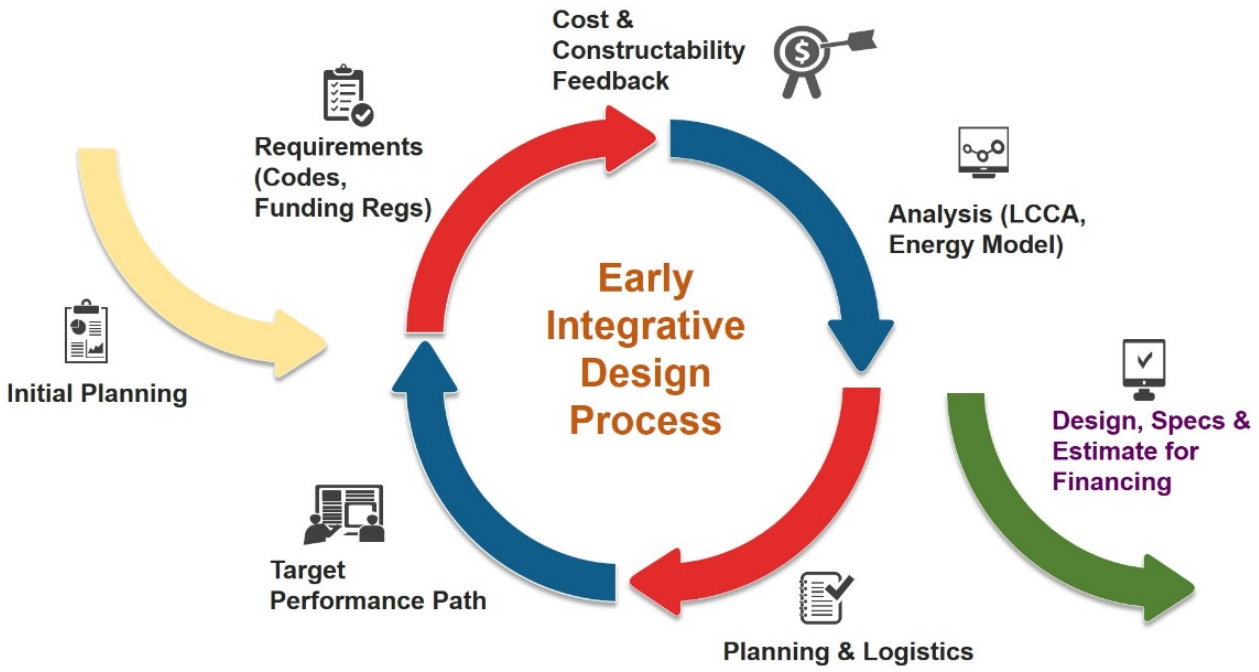
All of this is predicated on a basis of trust. There are many tools and tactics for helping groups build trust. If you desire assistance with this, please reach out to the Exemplary Buildings Program task force. You can connect with them at https://exemplarybuilding.housingconsortium.org/contact-us/.

Relationships are the most important currency in getting your building from inception to certificate of occupancy in a way that yields the best quality homes and enduring memories of how great…***how exemplary***…the effort was.

EARLY INTEGRATIVE DESIGN PROCESS GUIDE

Overview of EID and Its Three Main Phases

The figure below maps the main elements—and iterative nature—of the early integrative design process.



The EID process modeled in this figure can be thought of as comprising three main phases:

1. **Pre-Design.**
2. **Schematic Design.**
3. **Design Development & Construction.**

Appendix A of this document presents EBP's guidelines for early integrative design in the form of a user-friendly, easy-to-print reference tool designed for use by project teams. The remainder of this document, including the reference tool, are organized around the three EID phases listed above.

The Value of an Early Integrative Design Process Guide

Successful early integrative design depends on a team's ability to manage project complexity early and often. The goal of this document is to highlight important questions, considerations, and deliverables considered "best practice" in pursuing a cost-efficient, high-performance affordable housing development. These guidelines do not cover all of the activities that might be undertaken over the course of early design or project development but are intended to align with a typical affordable housing development process, regardless of the final performance path chosen.

General Goals for Utilizing EID Guidelines

1. Intentional goal setting and team building.
2. Integrated scheduling between disciplines (financing, permitting, design-build process).
3. Solicitation of experts to provide best-practice recommendations and performance-focused analysis.
4. Early focus on cost efficiency to ensure funding success.

PRE-DESIGN PHASE / EARLY CONCEPTUAL PHASE

Pre-design is a key phase for building consensus around a project's goal to pursue a high-performance path. Success is enhanced by four commitments, which are discussed below.

Selecting the right team and champion(s).

If a project is going to pursue an exemplary building path, it is recommended to select together a team that has experience in designing and constructing high-performance multifamily projects. Outlining how that team will be selected, the proposed contracting structure, and an initial outline of roles and responsibilities will help focus initial design and pricing efforts. Having a champion or champions step forward at this stage to lead the EID process can be critical in achieving project goals around high performance.

Identifying the financing path and its alignment.

The project's financing path and the ways it will align with the design, permitting, and pre-construction activities should be considered. It is important to have early conversations about the proposed total cost of the project and potential cost or resource limitations. It is also important to identify the predevelopment costs associated with implementing an early integrative design process to pursue an exemplary building. Many owners are concerned about the costs of investing in additional design or preconstruction services to support an EID process. However, it should be acknowledged that EID can be a tool to help projects hit cost targets and it can also prevent costly design and construction changes at later stages of the project.

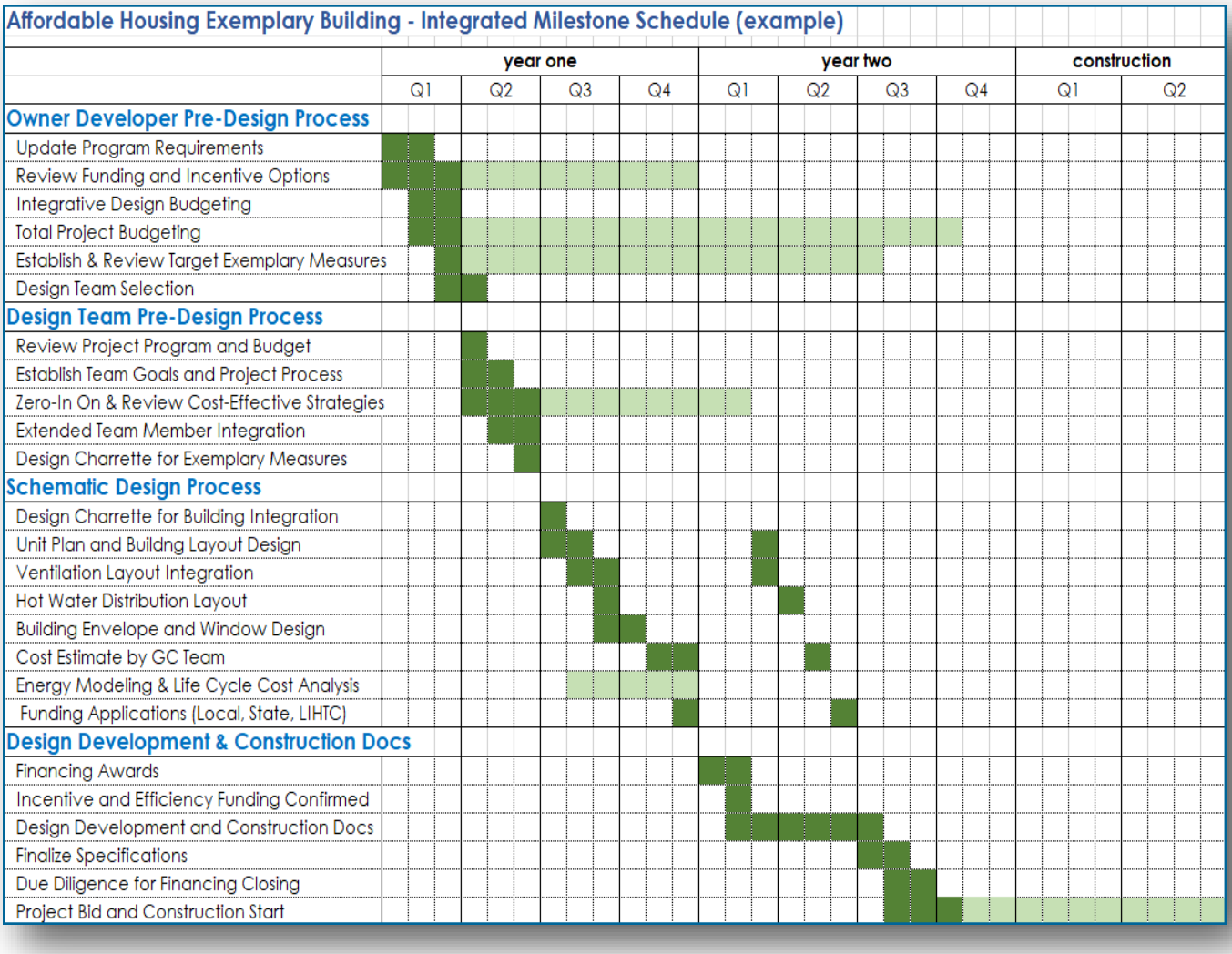
Aligning with certification or incentive programs.

Most affordable housing projects in Washington state are required to comply with Washington state's Evergreen Sustainable Development Standard (ESDS) in order to utilize public funding programs and the Low-Income Housing Tax Credit (LIHTC) program administered by the WA State Housing Finance Commission. In addition to outlining certain green building options, ESDS includes integrative design requirements and guidelines to aid projects in confirming a desired green building path. It is important for project team members to be familiar with the ESDS program and requirements related to early integrative design, mandatory building components, and deliverables at different stages of the preconstruction and construction phases. A link to the ESDS program details is provided in the References & Additional Resources list at the end of this document.

Developing an integrative schedule.

An integrative schedule can be an effective tool in gaining shared understanding of how a project's exemplary building path aligns with design, permitting, construction pricing, and financing efforts. This prevents surprises and allows a project to put itself in the best position possible to align the goals of exemplary building with the constraints of affordable housing financing programs.

Developing an integrative schedule and updating it quarterly allows the full team to identify and plan for critical path design, permitting, and preconstruction milestones and deadlines. Specifically, it allows a team to identify the timing of specific integrative design activities and estimating to ensure that initial financing efforts are as informed and accurate as possible. An example is provided below.



SCHEMATIC DESIGN PHASE / EARLY DESIGN DEVELOPMENT PHASE

Once a project team has decided to pursue an exemplary building path, it is recommended to engage in some level of schematic design and cost/benefit analysis prior to submitting a project's initial public financing application. Key focus areas at this stage include:

Schedule.

Update the integrative schedule to identify key deliverable and deadlines related to taking an exemplary building through the public financing process.

Technical guidance.

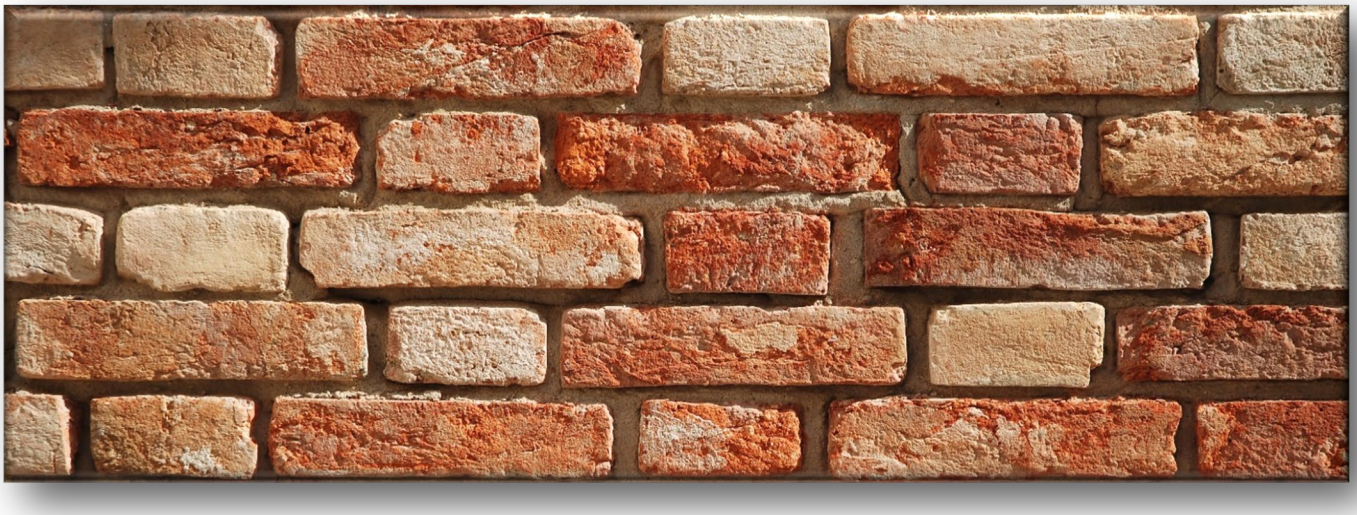
Solicit at least a high level of technical guidance from general contractors and consultants.

Cost efficiency and constructability.

Conduct an intentional analysis of cost efficiency and constructability with the general contractor and architect. Optimization and standardization of unit design and building layout can create more "room" in the budget for a project to afford high-performance systems or building components.

Funding and code.

Revisiting funding program criteria and building code changes is key to understanding and controlling costs in preparation for the general contractor's estimating efforts.



BEYOND SCHEMATIC DESIGN

The focus of this document is ***early*** integrative design, taking a project through schematic design and early design development. That being said, we've included some reminders of what to focus on during a project's last stage of preconstruction—the development of permit set drawings, construction drawings, and final specifications.

Most importantly, continued management of the integrative schedule is key to staying on top of the financing and permitting processes related to starting construction. For exemplary building specifically, it's necessary to make sure all requirements related to the exemplary building path (certification or incentive programs) are incorporated into the final drawings, specifications, and contract pricing.

As the project enters the construction period, it's critical that projects stay on top of what is needed to ensure that what is actually built meets the requirements of incentive or certification programs. The construction team must proactively engage with the property management team to reaffirm exemplary building goals and requirements for operations. Building commissioning is a vital step to ensure that equipment is operating as intended and designing an education program for staff and residents is also a recommended best practice.

Lastly, a potential final integrative effort to consider is a one-year post-occupancy walk-through with team members to assess whether the building is operating as intended and to document lessons learned to apply to future projects. If this is the intent, it's ideal to build the post-occupancy walk-through into the budget and contract of the architect and necessary consultants (e.g., mechanical, electrical, and plumbing). This ensures it doesn't become an add after the project is "finished."

APPENDIX A:

EBP'S EARLY INTEGRATIVE DESIGN GUIDELINES

This appendix summarizes EBP's early integrative design guidelines in the form of a best practice reference guide. The guidelines support integrative design efforts allowing affordable housing developments to pursue a high-performance path in the most cost-effective and planful way possible.

The recommended considerations and deliverables are not intended to be a comprehensive list, but rather a road map to help align team members in their goal-setting and design-vetting process. Although focus areas are listed sequentially, in some cases they may occur concurrently or in a different sequence than what is outlined here.

Guidelines for EID's Pre-Design Phase

The first phase in early integrative design for exemplary multifamily affordable housing buildings is early conceptual design, or **Pre-Design.**

PRE-DESIGN FOCUS 1	**INITIAL OUTREACH to the EBP task force, local utilities, and/or other industry experts, seeking to identify best practice in high performance for affordable multifamily housing. All project team members should consider prioritizing tracking of high-performance design, construction, and financing on a regular basis, outside of any specific project.**

UNDERSTAND CURRENT UTILITY INCENTIVE PROGRAMS. THIS INCLUDES:

- Understanding which high-performance measures are being incentivized.
- Understanding measurement requirements, *i.e.*, energy use intensity (EUI) or other quantitative measurement options and the difference between performance-based and prescriptive requirements.
- Confirm the amount of funding associated with each measure and how the funding is disbursed to the project (i.e., is it a reimbursement at the end of the project?)
- Confirm eligibility criteria such as affordability requirements and what type of entities are eligible to receive funding.
- Submittal requirements, who will manage those submittals, and timing.

UNDERSTAND CURRENT GREEN CERTIFICATION PROGRAMS OR EXEMPLARY BUILDING TARGETS, INCLUDING:

- High-level specifications.
- Permanent financing opportunities to support high performance.
- Predevelopment financing opportunities to support integrated design efforts.

RESEARCH PROVEN BEST PRACTICE FOR HIGH-PERFORMANCE AFFORDABLE MULTIFAMILY HOUSING. SOURCES INCLUDE:

- Case studies, including the initial demonstration projects for the Exemplary Buildings Program.
- Operational data from previous high-performance building in the same market or within your own portfolio.

PRE-DESIGN FOCUS 2	**INTERNAL ORGANIZATIONAL DIRECTION AND PROGRAMMATIC GOALS.**

DETERMINE OPERATIONAL CHALLENGES IN EXISTING PORTFOLIO.

- What types of inefficiencies exist in current utility consumption? Identify opportunities for improvement.

CLARIFY ORGANIZATIONAL GOALS AROUND SUSTAINABILITY AND HIGH PERFORMANCE.

- Balance the desire to reduce utility costs with goals around conservation and reducing carbon emissions.

START TO DEFINE SUCCESS:

- Consider specific performance targets, such as a percentage reduction in water usage, net zero carbon, or percentage improvement in EUI compared to existing portfolio.

DECISION POINT:

- Based on sustainability goals and resources available, owner makes initial decision to pursue an Exemplary Building.

Guidelines for EID's Pre-Design Phase (continued)

PRE-DESIGN FOCUS 3	INITIAL PROJECT TEAM SELECTION; ROLES & RESPONSIBILITIES.

DETERMINE PREFERRED PROJECT TEAM STRUCTURE DURING PRECONSTRUCTION FOR GENERAL CONTRACTOR (GC), DESIGN TEAM, AND OWNER.

- Identify who is needed to manage the following tasks:
  - *analyze performance options*
  - *outline initial specifications*
  - *manage initial site due diligence and conceptual design exploration*
  - *provide initial construction pricing support to incorporate into initial public financing efforts*

CONSIDER A SELECTION PROCESS THAT ENSURES PROJECT TEAM IS EXPERIENCED IN BUILDING HIGH-PERFORMANCE AFFORDABLE HOUSING.

- Architect and general contractor with relevant experience.
- Previous collaborative experience with both architect and GC.
- Building performance analyst capable of evaluating specific system design options for cost and benefit (to both capital cost and life cycle cost).
- Check selection process against funder requirements.
- Analyze fee structure and proposals to align with early integrative design scope, schedule, and available funding.

DETERMINE CONTRACTUAL AND DECISION-MAKING RELATIONSHIPS BETWEEN PARTIES.

- Owner:
  - *What are the roles and responsibilities within the owner's development team, consultants, and other departments?*
  - *Who has decision-making authority?*
- Identify which parties will be contracted under the owner, under the architect, and under the GC. (This should align with the selected design-build [D/B] path).
  - *Building performance consultant.*
  - *Energy modeling or other consultants needed to pursue performance path.*
  - *Structural engineer.*
  - *Civil or landscape engineers.*
  - *Mechanical, electrical, and plumbing (MEP).*

OUTLINE ROLES & RESPONSIBILITIES DURING PRECONSTRUCTION.

- Is a high-performance champion identified to lead the exemplary building efforts?
- Who will take the lead on meeting scheduling, meeting notes, and other documentation activities?
- Intentional conversation about expectations of services and deliverables to support integrated design for a high-performance building.
- What are the options for managing the D/B process?

OUTLINE VALUES THAT WILL DEFINE INTEGRATIVE PROCESS (CODE OF CONDUCT).

IN COLLABORATIVE PROCESS WITH FULL TEAM, CONSIDER FORMALLY OUTLINING PROJECT GOALS IN A PROJECT CHARTER OR SIMILAR DOCUMENT.

Guidelines for EID's Pre-Design Phase (continued)

PRE-DESIGN FOCUS 4	INITIAL CONCEPT DESIGN DEVELOPED.

CONFIRM DEVELOPMENT CAPACITY OF SITE.

IDENTIFY SITE CONDITIONS AND CONSTRAINTS.

IDENTIFY SPACE PROGRAMMING AND OCCUPANCY NEEDS, e.g.:

- Unit mix, occupancy habits, parking demands, laundry needs, and community room needs.

PRE-DESIGN FOCUS 5	FINANCING PATH AND INITIAL OUTREACH TO FUNDERS.

PRECONSTRUCTION.

- Identify Rough Order of Magnitude (ROM) scope of work and Sources & Uses associated with pursuing an Exemplary Building path prior to secure funding. Funds expended at this stage are at risk until some portion of permanent funding is secured.

  Examples of potential costs include:
  - *Building performance consultant.*
  - *Architect.*
  - *General contractor.*
  - *D/B subconsultants.*
- Identify Sources & Uses for entire predevelopment period.
  - *How much will it cost to get the project to the start of construction?*

PERMANENT FINANCING AND ESTABLISHING COST TARGETS.

- Initial assessment of funding program criteria related to performance.
  - *Washington State Housing Finance Commission (WSHFC).*
  - *State of Washington Ultra-High Energy Efficiency (UHEE).*
  - *Local funders.*
- Is there a risk the criteria will change over the course of design development?
- What other funding criteria need to be considered? (e.g., total development cost limits)
- Initial outline of permanent sources available to fund high-performance measures.
- Initial estimate of total project sources and uses.
- Initial estimate of target construction cost for high-performance project. See recommendation for Target-Value Design above (more detail provided in Exhibits).
- What are the financial constraints related to the proposed project?
  - *How are utilities paid? Utility allowance utilized?*
  - *Will the project have debt service paid from cash flow? If so, can utility savings be used to leverage additional debt?*
- Schedule pre-application meeting(s) with funder(s). Consider bringing design and construction team to meeting.

Guidelines for EID's Pre-Design Phase (continued)

PRE-DESIGN FOCUS 6	INTEGRATED MILESTONE SCHEDULE FOR DESIGN, PRE-CONSTRUCTION, AND FINANCING.

HIGH-LEVEL, INTEGRATED OUTLINE OF CRITICAL DESIGN, PERMITTING, AND FINANCING TIMELINES.

- Discuss risk areas around financing, alternate scenarios.
- Outline construction pricing needs and target dates to provide design & specs to inform pricing and delivery of estimates.
- Include drop-dead decision dates (as outlined by GC, sustainability consultant, and architect) in schedule.
- Outline permitting risk areas (i.e., zoning issues).

IDENTIFY WHO WILL DEVELOP AND OWN THIS SCHEDULE.

PRE-DESIGN FOCUS 7	COMMUNITY AND ENTITLEMENT PROCESS.

SCHEDULE INITIAL PRE-APPLICATION MEETING WITH LOCAL LAND USE AND PERMITTING OFFICIALS.

LAND USE AND DESIGN REVIEW PROCESS.

- Can the EBP features be used to qualify for Priority Green Expedited reviews?
- Does current design review process influence the project's performance path or other construction-related objectives?

Examples: Design review standards/preferences for window glazing; exterior modulation.

BUILDING CODES.

- How does the current or proposed energy code affect your desired performance path?
- Look at potential code updates that could impact your performance path.
- If there are choices to meet energy code performance, utilize the expertise of the project team to identify the current recommended best path for affordable multifamily housing.

COMMUNITY FEEDBACK.

- Are there required community outreach activities, and when will they occur? *(Note: The earlier, the better)*. Could that outreach impact the proposed design or exemplary building goals?

PRE-DESIGN FOCUS 8	INITIAL COST-BENEFIT ANALYSIS FOR EXEMPLARY BUILDINGS.

USE LIFE CYCLE COST ANALYSIS WHERE APPROPRIATE TO HELP CONFIRM PERFORMANCE PATH. This analysis may shift to a later stage or not be undertaken at all, but it can be a helpful tool in outlining the costs and benefits associated with different building components.

WORK WITH THE DESIGNER AND GENERAL CONTRACTOR TO IDENTIFY AND ASSESS HIGH-LEVEL LIFE CYCLE COSTS FOR KEY BUILDING COMPONENTS WHICH HAVE SIGNIFICANT IMPACTS ON DESIGN, COST, AND PERFORMANCE, SUCH AS:

- Air handling and conditioning for units.
- Air handling and conditioning for shared spaces.
- Domestic hot water systems: equipment options and plumbing run strategy.
- Water use reduction strategies: low-flow fixtures, water catchment and reuse, greywater.
- Renewable energy options such as solar PV array and hot water pre-heat.

See the SHA Sawara case study in Appendix B for an example of early integrative analysis of venting and renewable energy strategies.

Guidelines for EID's Pre-Design Phase (continued)

PRE-DESIGN FOCUS 9	SELECTING THE PERFORMANCE PATH.

HIGH-LEVEL SUMMARY OF PROPOSED SCOPE COSTS, AND BENEFITS.

CONFIRM ORGANIZATIONAL SUPPORT THROUGH PRESENTATION OF CONCEPT DESIGN AND PERFORMANCE PATH TO INTERNAL STAKEHOLDERS AND LEADERSHIP; GET BUY-IN TO MOVE FORWARD.

GET BUY-IN FROM ENTIRE TEAM TO MOVE FORWARD WITH SCHEMATIC DESIGN AND INTEGRATIVE COST/BENEFIT PRICING OF AN EXEMPLARY BUILDING.

PRE-DESIGN FOCUS 10	INITIAL AGREEMENTS AND COMMITMENTS.

IDENTIFY AGREEMENTS WITH:

- Utility providers.
- Preconstruction funders or technical assistance providers (*i.e.,* EBP's MOU).

UNDERSTAND TERMS OF THE AGREEMENTS.

- Performance targets.
- Third-party studies or reports.
- Reporting.
- Performance requirements.
- Program or project milestones or deadlines.

PRE-DESIGN DELIVERABLES

- ☐ 1. INITIAL PROJECT TEAM, WITH ROLES AND RESPONSIBILITIES OUTLINED.
- ☐ 2. DOCUMENTED PROJECT VISION, GOALS, AND VALUES.
- ☐ 3. HIGH-LEVEL, INTEGRATED SCHEDULE.
- ☐ 4. LINE-ITEM PRE-DEVELOPMENT BUDGET ASSOCIATED WITH PURSUING HIGH-PERFORMANCE PATH.
- ☐ 5. AGREEMENTS OR MOUs WITH INCENTIVE PROGRAMS.

NOTE: ESDS v4 requires a Project Priorities Survey which aligns with many of the considerations above.

Guidelines for EID's Schematic Design Phase

As mentioned above, the schematic design phase is a key step to solicit technical expertise and refine the cost-benefit analysis associated with pursuing an exemplary building. In order to manage the potential cost premium associated with pursuing high-performance building improvements, it is imperative that a project's baseline unit design and building layout aim to be as cost efficient as possible. One approach to consider is the **Cost Efficient Design and Construction (CEDC)** initiative by Walsh Construction. It includes a specific set of strategies and recommendations for wood frame construction to reduce waste in construction systems (see Exhibits for more detail).

A Short List of Key Guiding Principles of CEDC:

1. Minimize number of different unit plans.
2. Standardize kitchen and bathrooms.
3. Minimize areas of circulation.
4. Design units and window openings on a 2-foot module.
5. Reduce overall apartment width to reduce exterior envelope and reduce structural spans.
6. Avoid unnecessary exterior modulation or upper-level stepping.
7. Optimized window size with glazing percentage under 25%.
8. Reduce structural spans, cantilevers, and the use of steel.
9. Avoid individual unit amenities like laundry or balconies and make them common amenities.
10. Optimize the floor-to-floor height to achieve dimension efficiency with finish materials.

By employing both Target-Value Design and CEDC measures, project teams can focus resources on the long-term performance of building envelope, heating, and venting & plumbing systems, i.e., ultra-efficient measures.

Guidelines for EID's Schematic Design Phase (continued)

SCHEMATIC DESIGN FOCUS 1	CLARIFYING DESIGN GOALS.

CLARIFY GENERAL BUIDLING DESIGN GOALS AND CONSTRAINTS.

- Common-area needs.
- Approach to parking, landscaping, circulation, and security.
- Non-residential areas and access between.
- Thermal comfort.
- Acoustical goals.

CLARIFY EFFICIENT DESIGN GOALS AND CONSTRAINTS. *(See CEDC above and in Exhibits)*

IS THERE A TOTAL COST TARGET AND/OR SPECIFIC COST TARGETS FOR SPECIFIC BUILDING MEASURES THAT CAN BE SHARED WITH PROJECT TEAM?

SCHEMATIC DESIGN FOCUS 2	UPDATED INTEGRATED SCHEDULE; TARGETED MEETINGS AND CHARRETTES.

AGREE ON DESIRED INVOLVEMENT OF SUB-CONSULTANTS AND ON INPUTS FROM CONSTRUCTION TRADES.

AGREE ON A PROGRAM OF TARGETED MEETINGS AND CHARRETTES TO REVIEW AND EVALUATE SUCCESS OF DESIGN PROPOSED TO MEET PROJECT GOALS AND BUDGETS.

- Confirm appropriate sequencing, design development, review periods, and key decision deadlines.
- How are specifications developed, especially related to high performance?

IDENTIFY DETAILED OPTIONS FOR VALUE ENGINEERING AND WISH LIST ITEMS FOR PRICING.

IDENTIFY DECISION-MAKING RESOURCES.

- What studies, tools, and reports will be utilized?
- Determine who will manage.
- Set deadlines for deliverables.

SOLICIT EXPERTISE IN AN ORGANIZED AND TIME-EFFICIENT MANNER. Consider expertise- or division-focused meetings rather than large-group meetings. A list of recommended gathering for an EID effort focused on high performance could include:

- Drawings reviewed by structural engineer.
- If pursuing a specific green building certification, meet and set up timeline for certification process.
- Utilities coordination—create a timeline and identify responsible parties for working with local utility providers regarding permitting and entitlement requirements.
- Targeted meetings with design team, general contractor, and key consultants or subcontractors.
    - *Building envelope consultant, HVAC, electrical, and building performance consultant (recommend including commissioning agent)*
        - *What is the approach to energy modeling/energy studies?*
    - *Civil engineer, landscape architect, plumbing subcontractor*
    - *Drawings reviewed by framing subcontractor*

Guidelines for EID's Schematic Design Phase (continued)

SCHEMATIC DESIGN FOCUS 3	DISCUSS/UPDATE DECISION-MAKING CRITERIA.

DEVELOP CRITERIA TO ASSESS HIGH-PERFORMANCE IMPROVEMENTS SUCH AS.

- Is it technically feasible and functionally appropriate?
- What are the cost impacts?
  - *Initial cost, related design costs, and offset cost impacts.*
  - *Longer-term impact on operating costs, maintenance costs, and replacement costs.*
- Impact on performance and on achieving performance targets.
- Impact on other building components or systems.
- Qualitative aspects of operations and maintenance on residents and staff.

SCHEMATIC DESIGN FOCUS 4	OTHER UPDATES RELATED TO PURSUING PERFORMANCE PATH.

IS THE PREFERRED PATH STILL ALIGNED WITH UTILITY INCENTIVE OR GREEN CERTIFICATION PROGRAMS, AND ARE THERE ANY OUTSTANDING DELIVERABLES?

ANY APPLICABLE LAND USE, BUILDING CODE, OR ENERGY CODE POLICIES THAT COULD IMPACT PROPOSED DESIGN?

SCHEMATIC DESIGN FOCUS 5	CHECK IN ON FINANCING CRITERIA.

HAS ANYTHING CHANGED IN PROPOSED FUNDING CRITERIA?

- Alignment with the WA Evergreen Sustainability Development Standard integrative planning requirements or other applicable sustainability-related actions required for the project's financing efforts.
- Confirm that mandatory requirements haven't changed.
- Revisit the optional requirements to increase competitiveness of application.

SCHEMATIC DESIGN FOCUS 6	PREPARE FOR FINANCING PROCESS.

CONFIRM UPDATED PERFORMANCE PATH.

CONFIRM SCHEMATIC DESIGN.

SCHEMATIC DESIGN DELIVERABLES

- ☐ 1. BUILDING FORM AND FOOTPRINT ON SITE.
- ☐ 2. WINDOW SIZING.
- ☐ 3. UPDATED OUTLINE SPECIFICATION THAT ENABLES ACCURATE PRICING BY GENERAL CONTRACTOR.
  - ☐ MEP
    - ☐ Heating, cooling, ventilation, and exhaust strategies.
    - ☐ Lighting strategy.
    - ☐ Water heating and distribution system selected.
    - ☐ Renewable energy / solar /gas vs electric strategy.
  - ☐ TARGET-VALUE DESIGN / WISH LIST OPTIONS.
  - ☐ INCLUDE PERFORMANCE-RELATED TARGETS AND REQUIREMENTS.
  - ☐ OPTIONAL: MARKETING 'PACKAGE' FOR THE PROJECT WITH A COMPLETE SUMMARY OF THE COSTS AND BENEFITS OF PURSUING A HIGH-PERFORMANCE PATH.

Guidelines for EID's Design Development and Construction Phase

As the project progresses to the development of the permit and construction drawings, the construction period, and occupancy, it is important to **regularly revisit assumptions and specifications.** This ensures alignment with target design goals, permitting requirements, and financing requirements. Some of the most important factors to assess regularly are listed below.

- ☐ 1. UPDATE SCHEDULE: MILESTONES, DELIVERABLES, REVIEWS, AND FINAL APPROVALS.
- ☐ 2. REVISIT FINAL SPECIFICATIONS AND WISH-LIST ITEMS.
- ☐ 3. IDENTIFY ROLES AND RESPONSIBILITIES OF PROJECT TEAM DURING CONSTRUCTION.
- ☐ 4. CONFIRM REPORTING OR OTHER DELIVERABLES DURING CONSTRUCTION.
- ☐ 5. DEFINE SCOPE OF WORK FOR PROJECT TEAM AND OWNER DURING THE INITIAL 12-24 MONTHS OF OPERATIONS TO ENSURE THAT HIGH PERFORMANCE GOALS ARE BEING REALIZED.
  - ☐ What is commissioning scope?
  - ☐ Will the team perform a post-occupancy evaluation?
  - ☐ Will the building utilize any software or third-party vendors to track performance?
- ☐ 6. DETERMINE WHAT NEEDS TO BE DONE TO PLAN FOR OPERATIONS FOR RESIDENT AND STAFF EDUCATION.
- ☐ 7. CONFIRM MONITORING AND REPORTING REQUIREMENTS DURING OPERATIONS.

Finally, each team should consider a last step in the scheduling and documentation process: outlining a process to discuss lessons learned and to memorialize key design and systems decisions. With this effort, each owner can develop a more institutionalized and standardized approach to their integrative design process to improve both the cost and process efficiency at their next project.

APPENDIX B:

CASE STUDY IN EARLY INTEGRATIVE DESIGN

SAWARA

Seattle Housing Authority

LOCATION	Seattle, WA			
COMPLETION	In service Fall 2023			
PROJECT SIZE	114 UNITS OF AFFORDABLE HOUSING (~126,000 ft^2)			
UNIT TYPE	**1 BR**	**2 BR**	**3BR**	**4BR**
	64 units	27 units	22 units	1 unit

Keys to Early Design Integration at Sawara

1. **A champion: Tom Eanes of SHA**
   a. Value of efficiency-durability
   b. Experience and knowledge
2. **Firm-wide commitment**
   a. Resources
   b. High-performance building
   c. Building life cycle costing
3. **Measurable results**
   a. EUI of 20
   b. Construction budget
4. **Consultant team**
   a. Dedicated
   b. Team chemistry

Sawara EID Team

Developer: Seattle Housing Authority
General Contractor: Marpac Construction
Architect: Ankrom Moisan Architects
Structural: PCS Structural Solutions
Civil: Coterra Engineering
Mechanical/Plumbing: Ecotope
Electrical: Tres West Engineers, Inc.
Energy Code Compliance: O'Brien360
Building Envelope: RDH Building Science, Inc.
Landscape: Siteworkshop
Acoustical: A3 Acoustics
Accessibility: Studio Pacifica
Interiors: Ankrom Moisan Architects

Background

Together, the body of this document and Appendix A presented a rationale and a method for applying EID to the design and development of high-performance multifamily affordable housing. This appendix offers a success story from one of EBP's demonstration projects: Sawara by Seattle Housing Authority**. Early integrative design was essential to the ability of the Sawara project team to achieve its overarching goal: producing the best possible building product while containing costs.**

The data and narrative in the Sawara case study highlight:

- Ways in which the project progressed differently using an EID approach than it would have with a traditional approach.
- Key benefits resulting from the use of EID.
- Lessons learned that can benefit this project team specifically and the affordable housing sector more generally.

Due to the inherent complexities of high-performance projects (component systems, building envelope, structural, mechanical, electrical, and associated code requirements), individual experts are essential. But achieving Sawara's overarching goal also required a shared commitment to integrating individual expertise areas into a simplified system.

"THE SAWARA PROJECT'S SUCCESS IN ADDRESSING SOME CRITICAL DESIGN AND DECISION MATTERS WAS A RESULT OF EARLY INCLUSION OF TEAM MEMBERS, TRUST AND A TRUE SENSE OF TEAMWORK."

Scott Crosby, Ankrom Moisan Architects

EID for Sawara can be broadly characterized as frequent and focused communication between disciplines. Champions who orchestrated the integrated approach were invaluable, and the phrase "Use your Sharpie" reflected the team's prioritization of early system identification and early identification of systems compatibility.

Some of the most critical examples and lessons learned are summarized in the narrative below. Details on each topic area can be found in the data and graphics that conclude the case.

Solar Integration

The incentives to provide energy generation with rooftop PV panels required specific calculations of Kilowatts generated. However, the cost savings of producing this on-site energy had to include increased structural cost to accommodate the weight of the rooftop panels such that the 2 x 8 exterior stud wall spacing could be maintained. This required specific structural analysis and frequent communication between the structural engineer, PV consultant, landscape architect (for required roof vegetation area) and cost estimation by the general contractor. **This level of integration demands teamwork defined by trust, respect, and complete communication. Without a team engaged in a process of early component integration, the rooftop PV system may have been too costly to incorporate.**

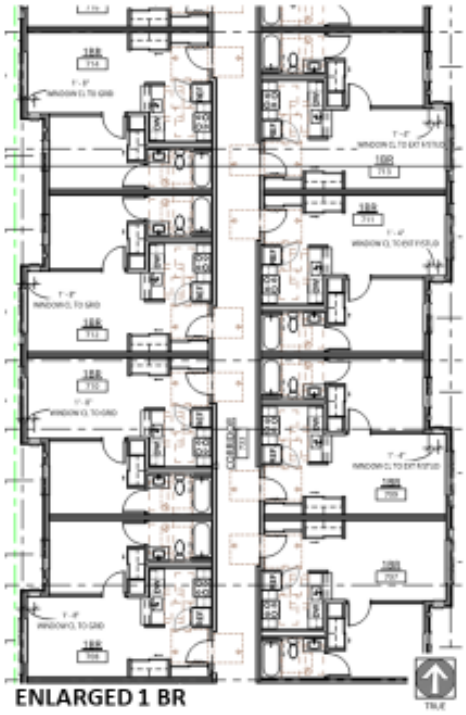
Envelope and Wall Assembly

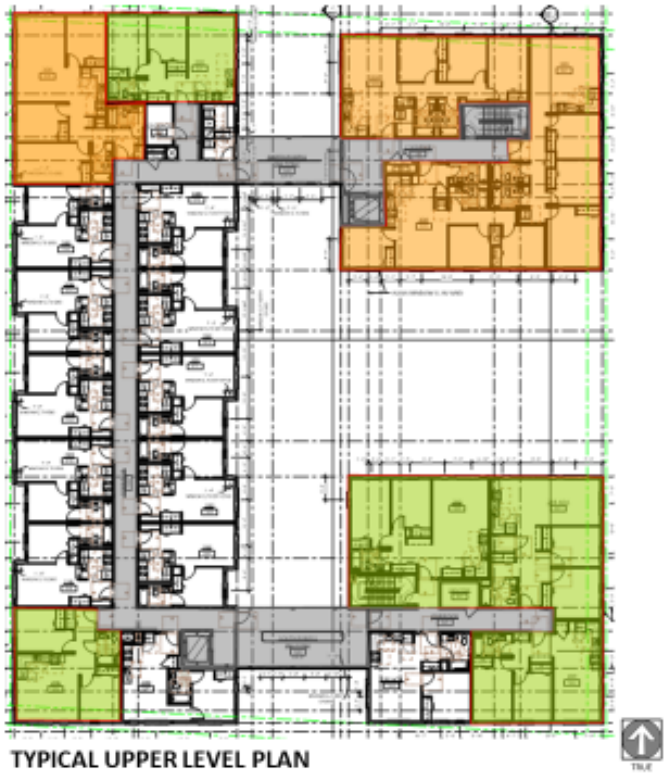
The most critical and expensive component of a high-performance building is the exterior building envelope. For Sawara, the exterior 2 x 8 studs spaced at 24" O.C. was key to achieving an overall exterior wall R-value of 21 at the lowest cost. Increased discipline adhering to the 2' module for the exterior walls including windows and interior walls equates to increased cost effectiveness. **The exterior wall system design charrette—that collected early integrated input from team members with structural, mechanical, building envelope, and energy code compliance expertise—served as the catalyst to achieving the cost-effective outcome.** Building and unit design to limit joist spans and loading of exterior walls allowed for the 24" stud spacing with no exterior shear walls. The resulting completely open cavity between the studs allowed for full insulation. Windows sized and placed to be within the 2' module along with open corner stud detailing all contributed to increased actual insulation and thermal performance.

Balanced Ventilation and Air Quality

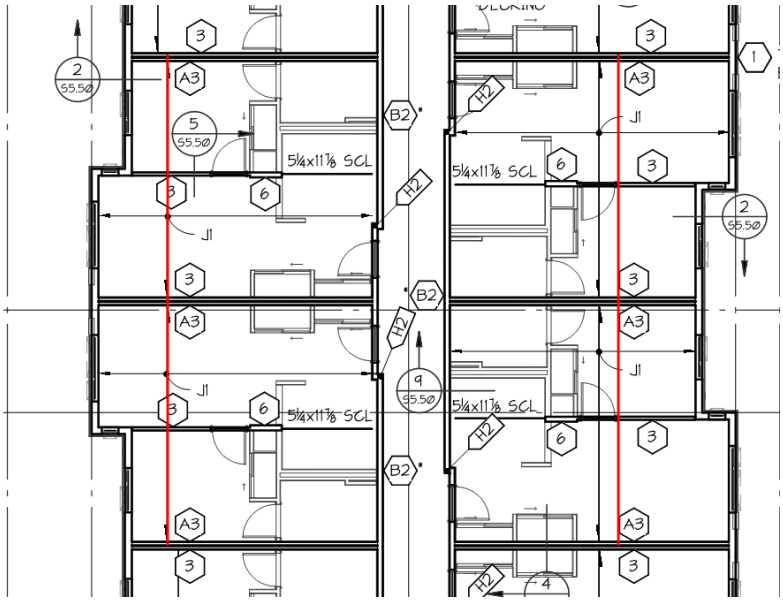
Sufficient quality and quantity of clean indoor air is essential for human health. Unwanted air infiltration is equally detrimental to building health and high-energy performance. Choosing and integrating the systems to provide balanced ventilation with heat recovery presented several challenges to the Sawara team that influenced the exterior design imagery. For operational simplicity, the owner preferred a unitized system with the ERV within each unit. Frequent communications and meetings between the HVAC system designer, structural engineer, building envelope consultant, energy code compliance consultant, and the interior and exterior architectural teams were essential. For example, because the intake and exhaust for the unitized ERV system must be 10' apart and 3' away from operable windows, the exterior imagery was substantially influenced. Likewise, the interior design was greatly impacted by the specific positioning, required access, and location of the ERV along with duct routing in soffits and within the joist bay. **Without early integration and a team approach, incorporating this ERV system could have been a nightmare of extensive—and expensive—design change ripples.**

Sawara Building Plans





Sawara Wall Assembly



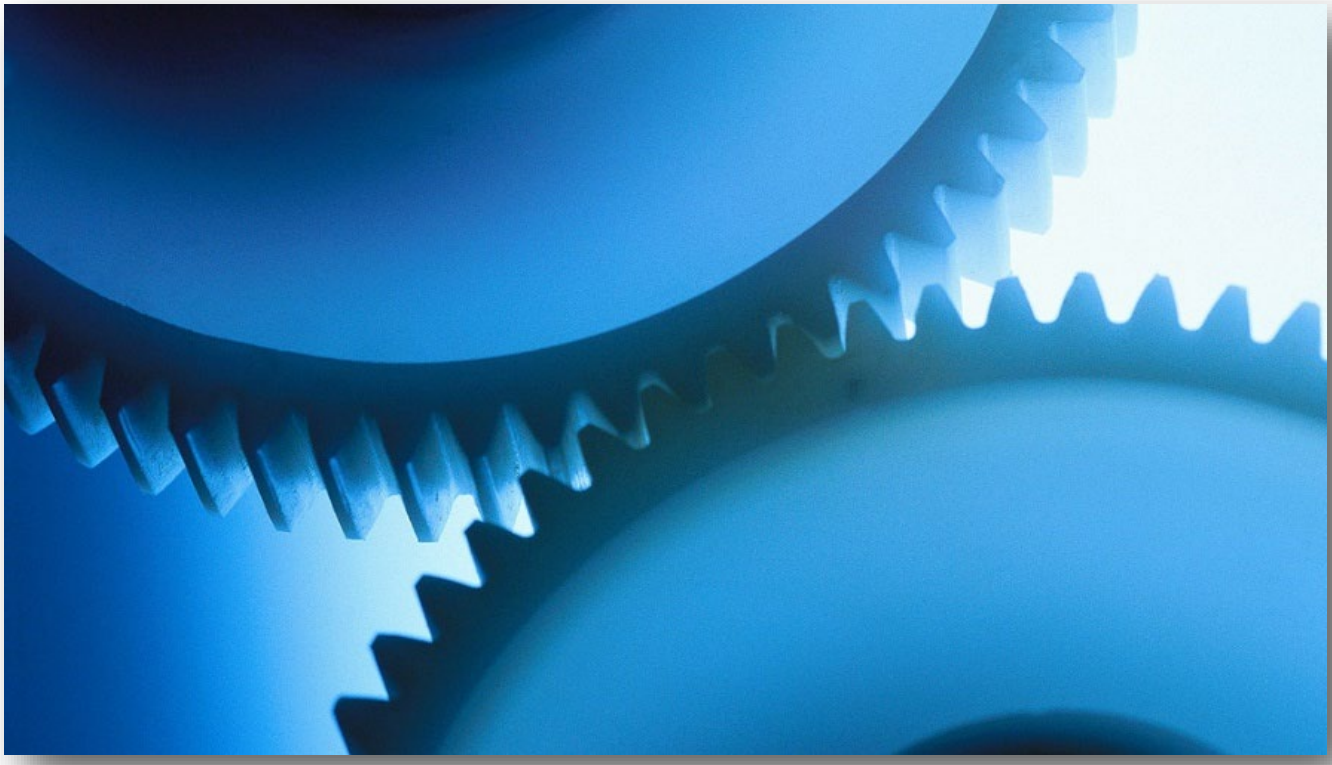
2 X 6 @ 16” O.C WITH OUTSULATION VERSUS 2 X 8 @ 24”

Design Charrette Participants

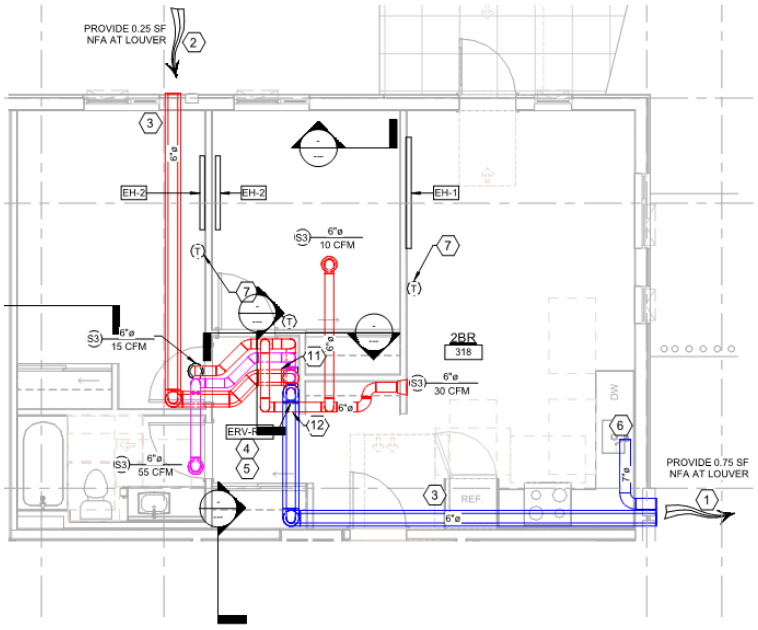
- Ankrom Moisan Architects
- Ecotope
- Marpac Construction
- O'Brien360
- PCS Structural Solutions
- RDH Building Science

Design Charette Discussion Points

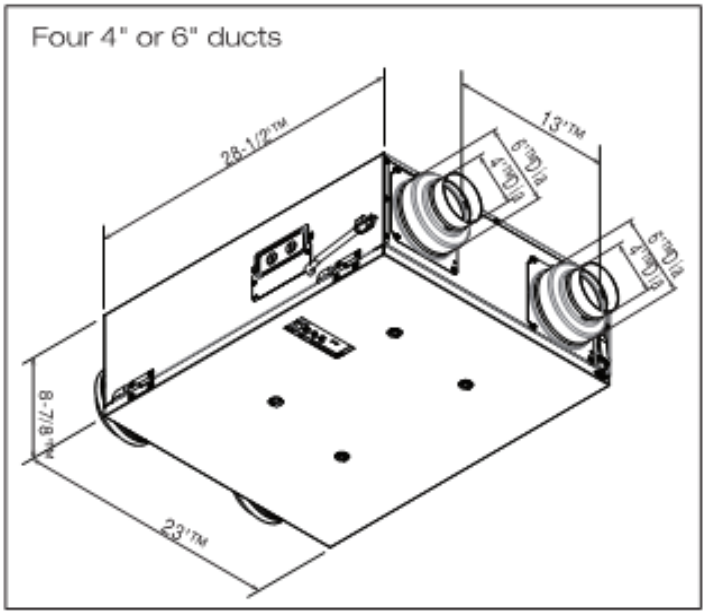
- Percent of wood stud in the walls.
- Sequencing and cost of outsulation.
- Shear walls inboard – no hold down in exterior stud wall cavity.
- Unit design – shorter spans, less load on exterior walls.
- Avoided bearing on exterior wall by joist parallel to long building dimension.
- Building laid out on 2' module from the beginning.
- Windows on 2' grid – window percentage & blank wall zoning code.
- Marpac panelizing exterior walls- exterior wall shop drawings.
- Corner details.
- Cladding attachment.
- HUD noise-reduction requirements–STC rating.



Sawara ERV

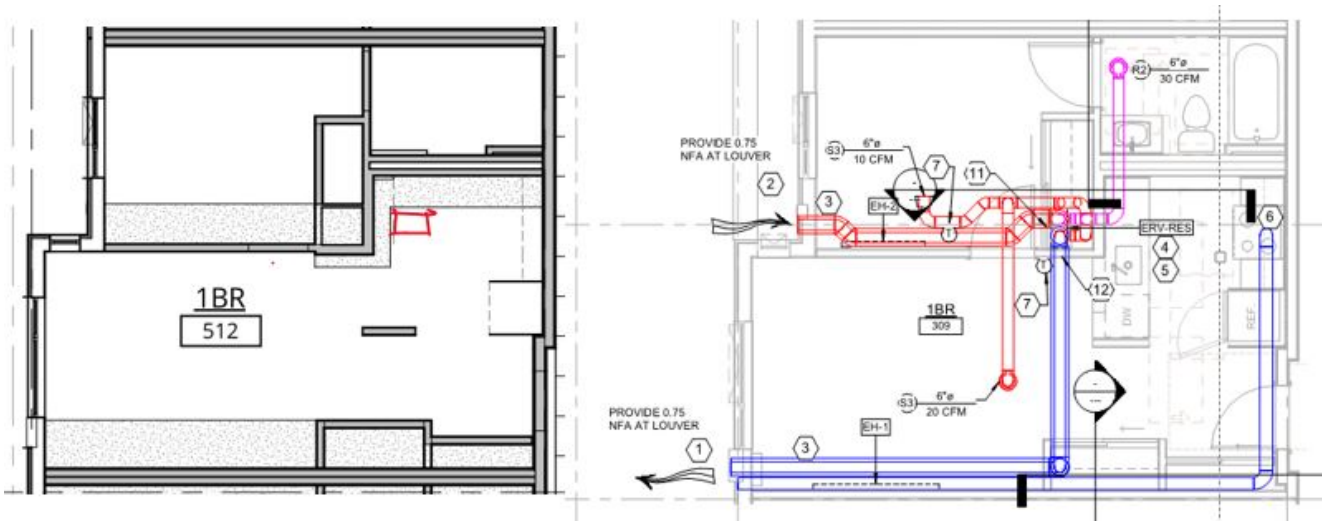


COORDINATION LAYOUT



FV-10VE2 TEMPERATE CLIMATE ERV:
SIZE, CONNECTION POINTS, ACCESS

Sawara ERV (continued)



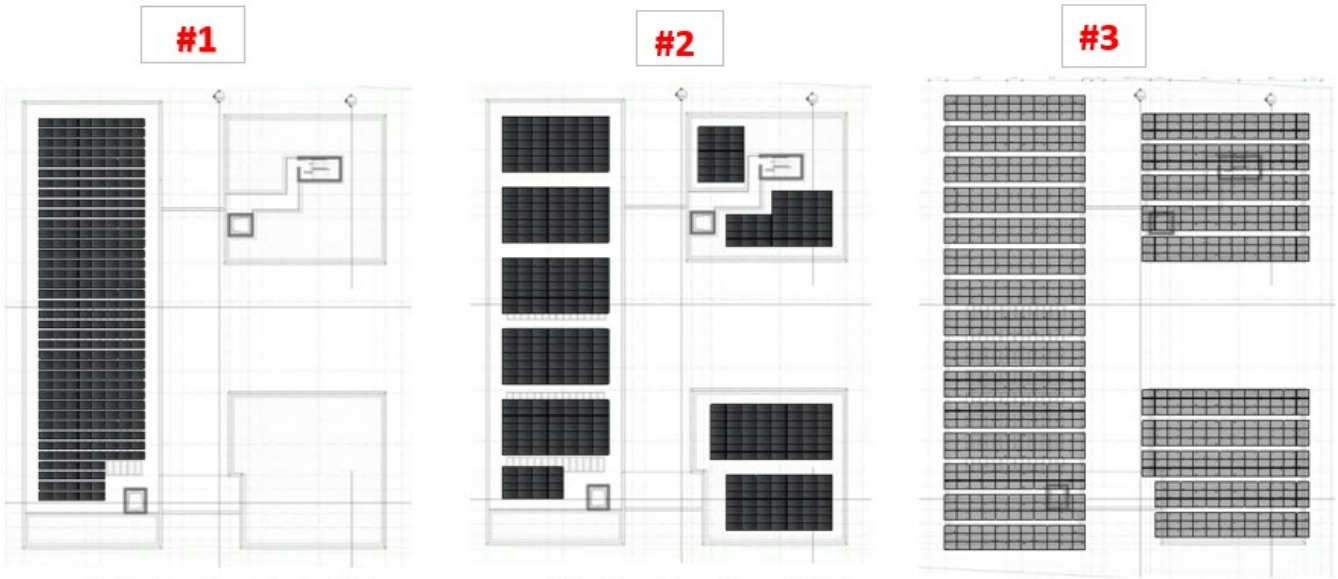
REFLECTED CEILING PLAN **ERV DUCT ROUTING**

ERV Integration Challenges

- Selection- unit system
- Cost
- Size
- Exterior vent locations
    - Requirements
    - 10’ separation
    - Intake exhaust
- Exhaust 3’ from window
- Duct routing
- Soffits
- Sprinkler
- Lighting
- Joist depth
- Ceiling height
- Exterior vent locations

Sawara PV

Yesler Block 7.3 PV Options



(292) 60-cell modules **93kW**
5-degree ballasted

(427) 72-cell modules **157kW**
Sunmodo SunTurf

(879) 60-cell modules **263kW**
Lumos on custom canopy

	SCENARIOS FROM A&R SOLAR		
	#1) Ballasted Array (West Only)	***#2) Low Canopy Array***	***#3) High Canopy Array***
Description	Ballasted system, no penetrations through roofing. Adds ~12 psf to roof loading. Cannot be placed above green roof. Height of building may make this layout	Penetrations through roof membrane. Add 3 psf to roof loading and requires added detail to flashing. Can be placed over green roof	Engineered high canopy structure to float panels over entire roof and to make a statement. Bi-facial panels allows solar generation from both sides of panels
Array Tilt (deg):	5	5	5
PVWatts Output (kWh/kW/year):	984	984	1082
total panels:	292	427	879
System Size (kW):	**93**	**157**	**263**
Output (kWh/year):	91,512	154,488	284,671
Total Utility Savings ($/year):	$9,151	$15,449	$28,467
Approx. Solar Install Cost ($/W):	$2.50	$2.25	$6.00
Added Structural Cost?:	Cost for 12psf dead load?	Add cost for flashing and sleepers?	---
Total Rebate:	$130,200	$219,800	$368,200
Est. Total Net Cost:	**$102,300**	**$133,450**	**$1,209,800**
Est. Payback Period (years):	**11.2**	**8.6**	**42.5**
Solar EUI:	2.6	4.4	8.2
Solar Output/Annual Energy Use (%):	15%	25%	46%
Est. Net EUI (kBTU/sf/yr):	**15.4**	**13.6**	**9.8**

Yesler Block 7.3 PV Options

#1 #2 #3

Sawara PV (continued)

PV Integration Considerations

- Available Roof Area
  - Green roof
  - Mechanical systems
- Impact on Structural systems
  - Gravity loads—exterior wall 2x6 2 X 6 @16” O.C. VS 2 x 8 at 24” O.C.
  - Lateral loads-blocking in roof structure
- Life Cycle Cost Analysis
  - Incentive funding
- Ballasted Versus Tie Down Support System
  - Roof membrane penetrations
  - Roof membrane selection

REFERENCES & ADDITIONAL RESOURCES

Integrative Design Process

- Busby Perkins + Will and Stantec Consulting, *Roadmap for the Integrated Design Process* [Developed for the BC Green Building Roundtable, 2007]. http://greenspacencr.org/events/IDProadmap.pdf

Certification or Incentive Programs

- Washington state's Evergreen Sustainable Development Standard (ESDS): https://www.commerce.wa.gov/building-infrastructure/housing/housing-trust-fund/housing-trust-fund-evergreen-sustainable-development/

STAY CONNECTED

If you're considering developing an exemplary building and would like a sounding board or technical assistance, please reach out to us. If you've applied our guidelines, we hope you'll share your feedback. Continuous learning is both a guiding principle and a core method of HDC's Exemplary Buildings Program; your experiences will help us continually improve our model and refine the practices we champion.

Contact the Exemplary Buildings Program Task Force at:
206. 682.9541 (HDC office) or https://exemplarybuilding.housingconsortium.org/contact-us/

ACKNOWLEDGMENTS

EBP thanks the industry leaders who contributed their considerable expertise to the early integrative design charrette. **Mindy Black** of Bellwether Housing, **Scott Crosby** of Ankrom Moisan Architects, and **JJ Powell** of Walsh Construction Co. made invaluable contributions to the guidelines and to the case study. And finally, our gratitude to the funders below, whose support facilitates development and publication of EBP's Guidelines Series and the integration of its recommendations into our programming.

BULLITT FOUNDATION

Edwards Mother Earth Foundation

Seattle Office of Sustainability & Environment

Photo Credits— p.9 (L): Albert Lee. Remainder: Walsh Construction Co. and stock.

EXEMPLARY BUILDINGS PROGRAM TASK FORCE

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Ryan Meno
Rafn Company

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O'Brien360

Loren Tierney
HDC

Dan Whitmore
RDH Building Science, Inc.

EXHIBITS

The following pages include two briefs offering a more in-depth examination of topics presented earlier.

EXHIBIT 1. *Target-Value Design: Nine Foundational Practices for Delivering Surprising Client Value* by Hal Macomber of Lean Project Consulting and John Barbario of JB Consulting Services, LLC.

EXHIBIT 2. *CEDC: Cost Efficient Design and Construction of Affordable Housing* by the people who created CEDC, Walsh Construction Co.

LeanProject consulting

...activating the network of commitments

Target-Value Design: Nine Foundational Practices for Delivering Surprising Client Value

Hal Macomber[1] and John Barberio[2]

Throw-it-over-the-wall design performed by specialists and sub-specialists working in isolation from others interacting with the design results in projects that are unaffordable, unconstructable, off-target and late. Rework, repricing, change orders, and de-value engineering are all symptoms of a process that ignores the nature of design and the systems nature of the built environment.

Target-Value Design (TVD) turns the current design practice upside-down.

- Rather than estimate based on a detailed design, design based on a detailed estimate.
- Rather than evaluate the constructibility of a design, design for what is constructible.
- Rather than design alone and then come together for group reviews and decisions, work together to define the issues and produce decisions then design to those decisions.
- Rather than narrow choices to proceed with design, carry solution sets far into the design process.
- Rather than work alone in separate rooms, work in pairs or a larger group face-to-face.

TVD offers designers an opportunity to engage in the design conversation concurrently with those people who will procure services and execute the design.

A Little Background

What do we mean by design conversation? We hold design as principally a social activity. The notion that some one person sits alone and is inspired to design misses both the nature of design and the countless contributions from others. The point of design is to bring forth new value in line with the client's interests.

What is value? Value is an assessment made relative to a set of concerns that someone wants addressed. There is nothing *of value* independent of a person saying (assessing) it *is valued*. Client concerns – interests, not worries – must be

1 Hal is a Principal with Lean Project Consulting. Previously, he was the COO for the Neenan Company, an integrated design-build firm.

2 John is a business consultant to the design and construction industry, JB Consulting Services, LLC.

kept in the foreground of the design conversation. Doing so allows designers to engage in a conversation for exploring various ways to take care of the concerns of that client. Those concerns inevitably change over the life of the project. As design proceeds new concerns arise while others fade away. Locking down requirements early in the process cuts short the exploration and development of the clients' concerns. Consequently, design suffers as does the value delivered to the client.

What roles do clients play? Clients are key performers during design, not just customers. As performers they express their concerns, make value assessments, and eventually make choices. When clients fail to take those actions in a timely way it leads to immeasurable waste for the project team. The team cannot let their fear of the client get in their way of holding all performers, including the client, to act responsibly.

TVD Foundational Practices

Here we are introducing nine practices for creating the conditions for delivering the target-value from the design process.

1. **Engage deeply with the client to establish the target-value.** Both designers and clients share the responsibility for revealing and refining concerns, for making new assessments of what is value, and for selecting how that value is produced. Continue engaging with the client throughout the design process continue to uncover client concerns.
2. **Lead the design effort for learning and innovation.** Expect the team will learn and produce something surprising. Establish routines to reveal what is learned and innovated real-time. Also expect surprise will upset the current plan and require more re-planning.
3. **Design to a detailed estimate.** Use a mechanism for evaluating design against the budget and the target values of the client. Review how well you are achieving the targets in the midst of design. When budget matters, stick to the budget.
4. **Collaboratively plan and re-plan the project.** Use planning to refine practices of coordinating action. This will avoid delay, rework, and out-of-sequence design.
5. **Concurrently design the product and the process in design sets.** Develop details in small batches (lot size of one) in tandem with the *customers* (engineer, builders, owner, users, architect) of the design detail. Adopt a practice of accepting (approving) completed work as you design.

6. **Design and detail in the sequence of the customer who will use it.** This maintains attention to what is valued by the customer. Rather than doing what you can do at this time, do what others need you to do next. This leads to a reduction in negative iterations.
7. **Work in small and diverse groups.** Learning and innovation arises socially. The group dynamics of small groups – 8 people or less – is more conducive to learning and innovating: trust and care for one another establish faster; and communication and coordination are easier.
8. **Work in a Big Room.** Co-locating design team members is usually the best option. Design is messy. Impromptu sessions among design team members are a necessary part of the process. So are regular short co-design sessions among various specialists working in pairs.
9. **Conduct Retrospectives throughout the process.** Make a habit of finishing each design cycle with a conversation for reflection and learning. Err on the side of having more retrospectives not less. Use plus|deltas at the end of meetings. Use more formal retrospectives that include the client at the end of integration events. Instruct all team members to ask for a retrospective at any time even if they just have a hunch that it might uncover an opportunity for improvement.

How to Proceed

Be careful not to pick and choose from the above nine practices. We call them foundational practices indicating that taken together they establish a base for adopting other lean design practices. Both *Responsibility-based Project Delivery*™ and *Knowledge-based Design* build on TVD.

Also, be careful not to think "We already do this." While we have taken care to describe what we see as different, we recognize that it might sound like something very familiar. Consider how what we are describing here is different from what you are doing.

Take an experimental approach to adoption – PDCA (plan-do-confirm-adjust) – based on the scientific method. While the nine foundational practices work, exactly how they work for your organization and specific projects might vary. Use your team leaders to bring about TVD practices on a project-by-project basis by considering both what is being designed and who will be doing the work. Stay close to these early experiments standing ready to offer whatever help the project team needs to succeed both on their project and with these new practices.

EID GUIDELINES EXHIBIT 2

CEDC

Cost Efficient Design and Construction of Affordable Housing

In order to introduce a leaner and more standardized approach to multifamily design and construction, WALSH has developed Cost-Efficient Design and Construction guidelines for owners and design teams. CEDC aims to minimize design complexity, reduce the number of conflicts between building systems and drive towards more standardization to carry from one project to the next.

WHY CEDC?

- **Higher density at a lower cost per unit**
- Reduced footprint and building envelope area leads to:
  - **Better energy performance**
  - **Lower initial and replacement costs** for items like siding, exterior paint, windows and weatherproofing.
  - Lower excavation, shoring and concrete foundation cost.
- Right-sizing unit wall dimensions reduces construction waste (ie drywall and framing)
- **Project team coordination is simplified at all stages,** reducing staffing/consultant costs and saving time.
- Resources can be shifted to focus on enhancing the long-term performance of building envelope, heating, venting and plumbing systems.

Seeking Better Building Blocks for Affordable Housing

Unit plans are the basic building blocks of multi-unit residential building design. *Efficient unit plans are the starting point for creating efficient building plans. A well laid out unit plan properly accommodates all the basic functional areas for living, cooking, dining, sleeping and bathing, and does so using a minimum of square footage and building volume. Ideally, spaces should have a loose fit to accommodate multiple activities and a variety of furniture layouts. There should be ample space within the unit for storage and the area dedicated to circulation should be minimized.*

GUIDING PRINCIPLE
SIMPLICITY & EFFICIENCY

- Minimize # of different unit plans.
- Standardize kitchen and bathrooms.
- Stack walls and unit plans.
- Minimize areas of circulation
- Simple unit layouts. Minimize # of walls, doors, and closets. Avoid built-ins.
- Design units and window openings on a 2' module to align with material dimensions
- Ceiling height of 8', 8'6" or 9' using standard drywall sheet sizes.
- Reduced overall apartment width to reduce building footprint and exterior envelope.
- Consider prefabrication of wall or floor panels
- Concentrate MEP and storage areas along corridor spine.
- Standardized enclosure and MEP systems that can be replicated from project to project.
- Avoid unnecessary exterior modulation or upper level stepping whenever possible.
- Orient buildings in a manner which respects topography and southwest solar exposure.
- Reduced window size such that glazing % is between 20-25%.
- Reduce structural spans and use of steel which is an expensive material. Simplify or avoid cantilevers, canopies, etc.
- Avoid individual unit amenities like laundry or balconies. Provide shared common amenities instead.

WHAT ARE CEDC MODEL UNIT PLANS?

- Unit plans are the basic building blocks of multi-unit residential building design
- Immense variation in unit design, size and layout creates inefficiencies in our housing delivery system
- We are attempting to define simpler, more inherently efficient, yet equally functional apartment designs to be used for affordable housing
- Our idea is not to make all buildings look and feel the same, but rather to create more standardization of the parts and pieces that make up the building, recognizing that every building itself must be highly individual and well-adapted to its unique site and program, and the overarching goals of the client

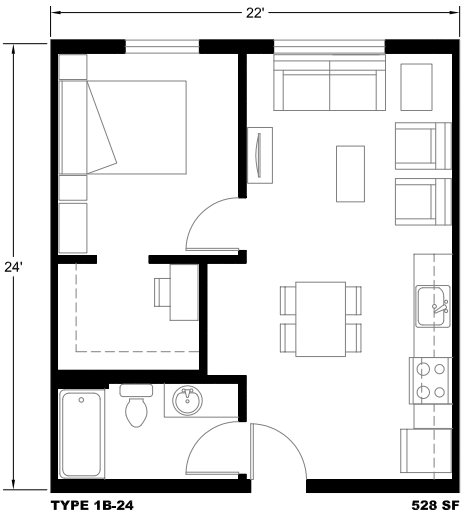
WHY MODEL UNIT PLANS?

- Drive efficiency into the heart of affordable housing building designs…re-structuring what we do at the DNA level
- Optimize the layout of systems and components: structure, enclosure, MEP, finishes, kitchens and bathrooms
- Maintain the essential functionality and livability of apartment designs, while significantly lowering costs

EXAMPLE OF TYPICAL UNIT PLAN VS OPTIMIZED UNIT PLAN:

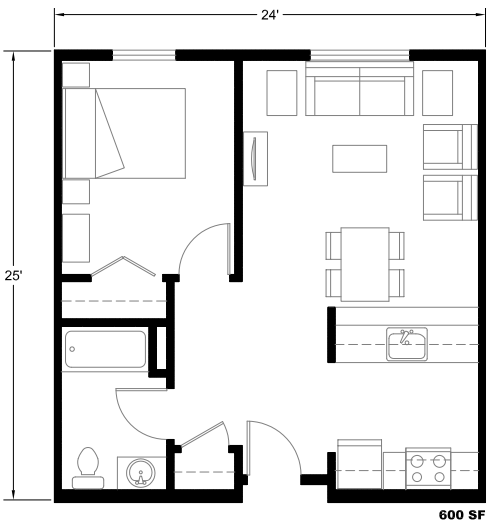
CRITERIA	TYPICAL PLAN	OPTIMIZED PLAN
OVERALL UNIT DIMENSIONS	24' wide x 25' deep (600 SF)	**22' wide x 24' deep (528 SF)**
LIVING ROOM DIMENSIONS	12' wide	**11' wide**
SEATING CAPACITY AT LIVING ROOM	5	**5**
BEDROOM DIMENSIONS	11' wide	**10' wide**
AREA DEDICATED TO CIRCULATION WITHIN UNIT	102 SF	**71 SF**
FURNISHABLE WALL LENGTH	71'-3"	**70'-8"**
STORAGE AREA	22 SF	**45 SF**
BUILDING ENVELOPE AREA	246 SF	**200 SF**
CORRIDOR AREA	72 SF	**66 SF**
SURFACE AREA OF WALLS WITHIN UNIT	1,728 SF	**1,360 SF**
NUMBER OF CORNERS	32	**24**
NUMBER OF DOORS	5	**3**

CEDC MODEL UNIT PLAN EXAMPLE

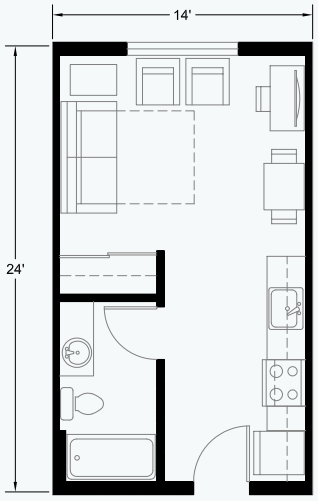


One Bedroom Unit Plan

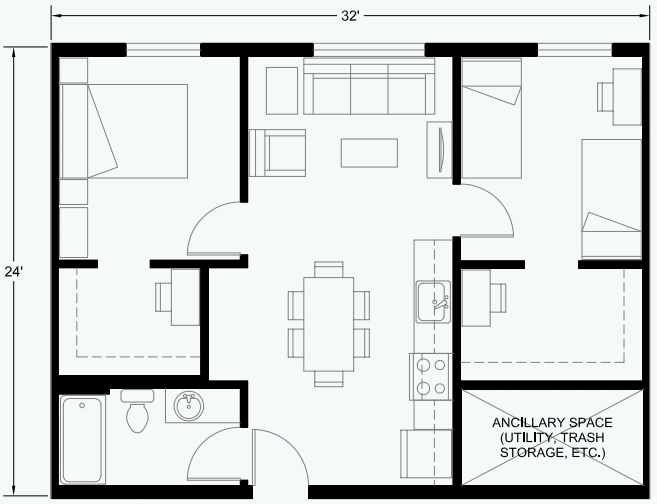
TYPICAL UNIT PLAN EXAMPLE



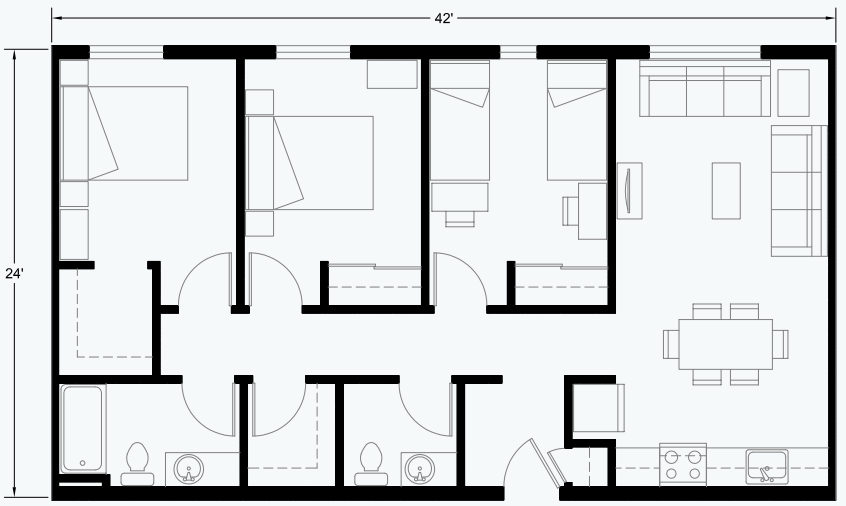
One Bedroom Unit Plan



Studio Unit Plan



Two Bedroom Unit Plan



Three Bedroom Unit Plan

WHY WALSH?

Operating in the Northwest for over 50 years, WALSH is passionate about exploring high value design solutions for affordable, multifamily construction. We understand that the resources to build and operate affordable multifamily housing are scarce and we partner with owners in their goals to maximize the quantity and long -term quality of the homes we build. And of course, we have FUN doing this work!

For more information, please contact:

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