

Thule Prototype BIM Manual for Dormitories

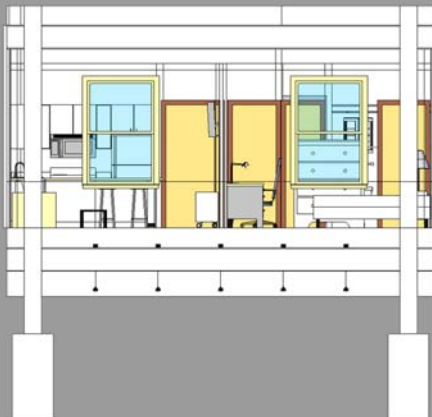
February 5, 2010



Unit A - Plan



Unit A - Partial Axon



Unit A - Section



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REFERENCES

Unaccompanied Housing Design Guide
<http://www.afcee.af.mil/shared/media/document/AFD-070919-082.pdf>



INTRODUCTION

Executive Summary

The intent of this Dynamic Prototype BIM (Building Information Model) Manual is to describe the process for utilizing the electronic design tool to improve efficiency and effectiveness in the implementation of the Unaccompanied Housing Design Guide. Thule Dynamic Prototype is a flexible design model that leverages the advantages of BIM to standardize components of a building type through a schematic 3D model. Design models can vary from performance criteria to prescriptive criteria depending on the number of variables. For Thule Prototype dormitories the prototype is utilizing a kit-of-parts approach. The kit-of-parts models are broken down into disciplines (Architecture, Structure, Mechanical, Electrical/Telecom, Plumbing/ Fire Suppression). Thule Dynamic Prototypes contains a model for each discipline. This manual coordinates with Chapter 3 – Facility Design of the Unaccompanied Housing Design Guide describing the use of the Dynamic Prototype in relation to the recommended development of design within the existing guide.

Goals

The goal is to provide vital information from the Unaccompanied Housing Design Guide as well as lessons learned from installation in a BIM platform that will allow A/Es to quickly and easily produce Dormitory Design at Thule.

Scope and Use

In accordance with the Unaccompanied Housing Design Guide, the kit-of-parts models created meet the minimum net living area (NLA) requirements along with the gross module area (GMA) as specified within the guide (*See Illustration 1-3 – Square Footage Comparison for specific page references & Illustration 4-5 – Unit Plans for each unit available within the kit-of-parts model*). Additional assumptions for the models were made to test the assembly of the kit-of-parts models into a building that meets the gross building area (GBA). Examples of these arrangements can be found on *Illustration 6-8 – Assembled Plan Examples*. The assumptions for Thule Dynamic Prototype are as follows:

1. Program Assumptions for Building 01
 - Unit A – Officer (04-10), Unit B – SNCO (E7-E9)/ Officer (01-03).
 - 72 Airman Dormitory is the bases for conceptual engineering and sizing requirements.
 - Units A and B meet the minimum net living area requirements
 - Commons Area is the most flexible and will require manipulation for site adaptation and installation-specific functional requirements
 - Mechanical, Electrical, Telecommunication, and other building utility spaces will need to be designed and integrated depending upon the location and specific installation requirements.
 - Structural Systems as well as the exterior wall types and materials were based on existing Thule Dorm 103. Future A/E will need to explore this issue based on site specific conditions.
 - Building envelope systems may be applied based on installation-specific requirements.
 - Unit configurations (A-E) have been approved by AF/A7CAH.
 - Other reconfigurations of the units must meet the requirements listed in the Unaccompanied Housing Design Guide.
2. Program Assumptions for Building 02
 - Unit C – SNCO (E7-E9)/ Officer (01-03), Unit E – SNCO Dorms 4 Airmen (E1-E4).
 - 48 Airman Dormitory is the bases for conceptual engineering and sizing requirements.
 - Units A and B meet the minimum net living area requirements



- Commons Area is the most flexible and will require manipulation for site adaptation and installation-specific functional requirements
- Mechanical, Electrical, Telecommunication, and other building utility spaces will need to be designed and integrated depending upon the location and specific installation requirements.
- Structural Systems as well as the exterior wall types and materials were based on existing Thule Dorm 103. Future A/E will need to explore this issue based on site specific conditions.
- Building envelope systems may be applied based on installation-specific requirements.
- Unit configurations (A-E) have been approved by AF/A7CAH.
- Other reconfigurations of the units must meet the requirements listed in the Unaccompanied Housing Design Guide.

3. Program Assumptions for Building 03

- Unit D NCO (E5-E6), Unit E – SNCO Dorms 4 Airmen (E1-E4).
- 48 Airman Dormitory is the bases for conceptual engineering and sizing requirements.
- Units A and B meet the minimum net living area requirements
- Commons Area is the most flexible and will require manipulation for site adaptation and installation-specific functional requirements
- Mechanical, Electrical, Telecommunication, and other building utility spaces will need to be designed and integrated depending upon the location and specific installation requirements.
- Structural Systems as well as the exterior wall types and materials were based on existing Thule Dorm 103. Future A/E will need to explore this issue based on site specific conditions.
- Building envelope systems may be applied based on installation-specific requirements.
- Unit configurations (A-E) have been approved by AF/A7CAH.
- Other reconfigurations of the units must meet the requirements listed in the Unaccompanied Housing Design Guide.

4. Kit of Parts

- a. Architectural
 - i. Kit-of-Parts include: Unit A, Unit B, Unit C, Unit D, Unit E, Common Space, Utility and Stairs.
 - ii. All units are intended to be assembled for interior, double-loaded corridor configurations (*Refer to Illustration 4-5 – Assembled Plan Examples*).
- b. Structural
 - i. Kit-of-Parts include: Unit A, Unit B, Unit C, Unit D, Unit E, Common Space, Support Space, and Stairs
- c. Mechanical
 - i. Kit-of-Parts include: Unit A, Unit B, Unit C, Unit D, Unit E, Common Space, Support Space, and Stairs.
- d. Electrical
 - i. Kit-of-Parts include: Unit A, Unit B Unit C, Unit D, Unit E, Common Space, Support Space, and Stairs.
- e. Plumbing
 - i. Kit-of-Parts include: Unit A, Unit B Unit C, Unit D, Unit E, Common Space, Support Space, and Stairs.
- f. Fire Protection
 - i. Kit-of-Parts include: Unit A, Unit B Unit C, Unit D, Unit E, Common Space, Support Space, and Stairs.



GUIDELINE INTEGRATION

Site Design

Tool Utilization Strategies

1. Sitting Requirements
 - Establish whether an interior or exterior circulation scheme will be employed.
 - Utilize the kit-of-parts to assemble the initial massing model.
 - Confirm Units are grouped before multiplying the units to take advantage of BIM.
 - Configure model to the appropriate site dimensions and established setback requirements listed in the Unaccompanied Housing Design Guide and other references.
 - After multiplying units into assembled massing model, “exclude” duplicated elements such as party-walls (*Refer to Illustration 5 for Duplication Example*).
2. Circulation
 - Ideas and concepts should be explored through other mediums quickly before narrowing the concepts to the selected proposition.
 - Establish site circulation to maximize building site efficiency.
 - Create outdoor spaces that are extensions of the building entrances allowing for small groups to stop and gather.
 - After all site circulation constraints and sitting requirements have been established the A/E should utilize the prototype tool to configure the initial massing model.
3. Establishing the Model
 - A/E is responsible for establishing a clear File Directory Structure (*Refer to Illustration 4 – File Directory Structure Example*).
 - See Attachment F to the contract for full extent of BIM related deliverables.

Additional Requirements and Integration Concepts

1. Parking & Site Considerations
 - All disciplines need to have their own model that is linked to the master model.
 - All work shall be in 3D with associated parametric information and linked to the master model.
 - Establish finish floor and floor-to-floor elevations early in the process.
 - Coordinate utilities between all disciplines early in the process.
2. Site Amenities
 - Small structures shall reside within discipline models.
 - In the example of site furniture and site lighting establish the furniture in the landscape architect’s model and the site lighting in the electrical engineer’s.
 - Coordinate site amenities early and allocate the work to the responsible disciplines.
3. Landscape Architecture
 - Like Civil, the work developed within the discipline of landscape architecture is very specific to the installation and should be developed in 3D with associated data to inform and develop the coordination between other disciplines.

Building Design

Tool Utilization Strategies

1. Structural
 - Prototypes offer one system based on existing Thule Dorm 103 structural steel
 - Other systems shall be explored after initial massing is determined.
 - A/E will need to run new load calculations and resize members and spacing depending upon final building configuration.



2. Heating, Ventilation and Air Conditioning (HVAC)

- Prototypes provide a starting point for the A/E with systems designed in accordance with Air Force design criteria and Thule installation criteria.
- Systems and equipment in the model such as diffusers, ductwork, piping, Ventilation Units, Floor Mounted Radiant Heating Units etc. are all place holders. Actual sizes and selections to be determined by A/E.
- Alternative HVAC systems may be proposed on a life cycle cost analysis basis. The systems utilized must enable the building to meet the energy optimization requirements of EPAct 2005 as well as LEED.
- A/E will need to run new load calculations for the actual building layout in order to properly select equipment, size ductwork, select diffusers/grilles, and size piping. The configuration of mechanical chases can be adjusted based on the number of dorm modules and height of the building.
- Overall building systems such as outside air pretreatment, exhaust air collection, energy recovery and method of heating water production to be determined by A/E.
- All HVAC equipment such as air devices, boilers and ventilation units are linked to schedules. Any changes made to equipment data within the model will automatically update the associated schedules.
- All equipment, ductwork, piping, diffusers, dampers, etc. have been created as families within the model.
- Locations of hydronic valves to be determined by A/E.

3. Plumbing

- The plumbing model consists of plumbing fixtures, domestic CW piping, domestic HW piping, and sanitary waste/vent piping.
- The plumbing models are drawn as the ground floor units to show the underslab sanitary piping.
- The piping within the units has been sized in accordance with Uniform Plumbing Code (UPC) but will need verification by A/E.
- Sizes for plumbing risers to be determined by A/E based on the actual building height and number of dorm modules.
- Overall building plumbing systems such as the method of producing domestic hot water to be determined by A/E.
- Location(s) of water heaters either in centralized location or multiple locations to be determined by A/E.
- All piping and plumbing fixtures have been created as families within the model and are intended as place holders for routing purposes. Actual sizes to be determined by A/E.

4. Building Configuration

- Building Circulation – In developing the site circulation the building circulation will become apparent. In deciding the building circulation the A/E should be aware that the units presented are intended for one distinct building circulation concept.
- There are three building types with two unit types in each building. Every building type will be a double loaded corridor with commons and utilities in the core of the building and units on both sides.
- In developing the model it is required to use the provided kit-of-parts as a starting point. Each unit is a group and should remain a group to leverage the efficiency of BIM. As the A/E assembles the building there will be a need to change a group to create a corner unit or the roof. However, it is encouraged that the A/E creates new groups for these units so when one unit is changed within the group all the rest are updated. By the time the A/E begins Construction Documents and is solely developing details there may come a logical point to not utilize groups any longer in this manner, but it is the recommendation of this manual that this



particular building type could benefit greatly by the use of groups. (Refer to *Illustration 11 for Group Manipulation Example*).

5. Interior/Exterior Relationships

- Building Circulation – Develop a clear path of travel, consider egress distances and associated site considerations to design not only the location of the hardscapes but the surrounding landscape and the creation of outdoor gathering areas.
- Civil and Landscape Models – 3D models that work with the specified BIM platform shall be developed concurrently with the other disciplines and maintained as a linked and integral part of the project development.

6. Noise Considerations

- Wall types – Develop clear requirements as per the Unaccompanied Housing Design Guide and manipulate existing wall types as needed.

7. Architecture

- Building Envelope – Designs shall amplify the local architectural character through the development of the building envelope.
- Glazing Systems – The prototypes have windows as current place holders within the wall types. The ultimate size and quantities depend upon installation requirements and building envelope design.
- Coordinate chases within units after mechanical system is selected as there may be the opportunity to eliminate chases (specifically those associated with base board heaters in the corner of each bedroom).

8. Interior Design

- Comprehensive Interior Design – The furniture provided within the model only dictates the scale and placement of furniture for the units. A/E's should develop a comprehensive interior design package per installation requirements.
- Finishes and Materials – The prototype units have the Air Force's preference modeled and the guidelines list some options. The A/E may explore other options as long as they meet or exceed the materials' characteristics listed.
- Bathrooms and Kitchens – The prototype units provide cabinets and millwork for dimensional purposes only. The A/E can alter the style, countertops, and back splashes to fit the appropriate aesthetics of that particular installation.

9. Electrical

- Electrical prototypes include lighting, receptacles, telephone, cable, light switches, fire/smoke detection, and personnel alerting systems located within the units. This equipment has been created within the BIM model as families with linked specifications.
- Models also have the distribution equipment created however this will need to be reconsidered as the design is assembled and the A/E establishes the full extent of the buildings power requirements.
- Exterior lighting and other associated work with the buildings exterior or landscape will be developed by A/E.
- Actual building electrical loads and service to be determined by A/E.
- Panel boards and spare circuit breakers are included in grouping of the unit, but are floating on the outside of the unit areas. Coordination of panel boards are required by client before installation of units electrical components. Spare circuit breakers shall be installed in panel boards for future add-on to units.

10. Fire Protection

- Sprinkler heads are laid out in accordance with NFPA 13, *Installation of Sprinkler Systems*.



- There is flexibility within the model to relocate heads depending upon modifications in the floor plan to meet base needs.
- Any relocation of sprinkler heads must still be in accordance with NFPA 13.
- Fire alarm equipment has been laid out within the model in accordance with NFPA 72, *National Fire Alarm Code*.
- Piping and sprinkler heads have been created as families within the model with linked specifications.

Specifications

Tool Utilization Strategies

1. ESspecs for Revit 4.1 with MASTERSPEC 2004
 - ESspecs links specifications sections with objects in the Prototypes through the use of assembly codes listed within each objects property elements.
 - After all of the specification sections have been properly bound to the objects within Revit notes on drawings will be coordinated, listing the same language tied to the specification language. Text will be consist and concise.
 - Specifications for the prototypes have been developed based upon the Unaccompanied Housing Design Guide and the developed Prototypes
 - Other specifications specific to the development of the full design at local installations will need to be developed. Some of these include:
 - Civil associated specifications
 - Landscape associated specifications
 - Foundation systems
 - Building envelope
 - Roof structure
2. Linking ESspecs for Prototypes
 - A Microsoft SQL database will be provided on the website for download. This database will contain all information related to the prototype project manual. This also holds the bindings to each Revit file.
 - E-Specs for Revit should be installed per installation instructions given by InterSpec (<http://www.e-specs.com/>).
 - E-Specs for Revit plug-in should also be installed per installation instructions given by InterSpec (<http://www.e-specs.com/>).
 - Special interaction will be required to ensure that the database file downloaded is set as the main database file during installation.
 - A uniformClassifications.txt file will be provided which contains information on bindings from and to Revit and E-Specs. This must be placed in the following directory: C:\Program Files\Revit Architecture 2009\Program
 - Once files have been downloaded all questions and problems related to integration and setup of E-Specs should be directed to InterSpec @ 888-50-SPECS.

LEED Checklist

Tool Utilization Strategies

1. LEED 2009 Checklist
 - Consolidates all points from Federal Mandates and creates an initial starting point for the A/E to utilize.

Software Requirements

Additional Requirements

1. Autodesk Revit 2009 or higher (latest Service Pack)



- Revit was utilized in developing the Prototypes and shall be utilized in developing all discipline models.
2. E-Specs for Revit (latest release) with MASTERSPEC 2004
- E-Specs for Revit 4.1 was utilized in developing the Prototypes specifications and shall be utilized in developing the specifications throughout the completion of design.
 - MASTERSPEC 2004 licenses must be purchased as E-Specs uses MASTERSPEC 2004 format.
 - E-Specs and Masterspec are separate entities and each require the purchase of software/Licenses which can be coordinated through InterSpec.
 - Software licensing agreements will supersede all information in this document and must be followed.



Illustration 1 – Square Footage Comparison

Unaccompanied Housing for Thule Dorms - Building 1

Unit A - Officer (04-10)				Unit B - SNCO/ET-ER Officer (01-03)				Unaccompanied Housing Design Guide (04 - 10)				Unaccompanied Housing Design Guide (E7-E9 and O1-O3)				Notes
Living Areas	sq. ft.	sq. meters	sq. ft.	sq. meters	sq. ft.	sq. meters	sq. ft.	sq. feet	sq. meters	sq. feet	sq. meters	sq. feet	sq. meters	sq. feet	sq. meters	
1 Bedroom 1	129	12.01	129	12.00	0	0.00	0									min. bedroom width 10'-0" (p. 15, 43) - required
2 Bedroom 2	0	0.00	0	0.00	0	0.00	0									
3 Bedroom 3	0	0.00	0	0.00	0	0.00	0									
4 Bedroom 4	0	0.00	0	0.00	0	0.00	0									
5 Bathroom 1	43	3.95	35	3.25	35	3.25	35									1 toilet, 1 tub/shower, and 1 lavatory/vanity (p. 15, 43)
6 Bathroom 2	0	0.00	0	0.00	0	0.00	0									
7 Bathroom 3	0	0.00	0	0.00	0	0.00	0									
8 Bathroom 4	0	0.00	0	0.00	0	0.00	0									
9 Closet 1	20	1.86	20	1.86	20	1.86	20									1 per person (p. 43)
10 Closet 2	6	0.53	8	0.75	20	1.86	20									1 per person (p. 43)
11 Closet 3	0	0.00	0	0.00	0	0.00	0									
12 Closet 4	0	0.00	0	0.00	0	0.00	0									
13 Laundry	10	0.93	0	0.00	0	0.00	0									
14 HVAC	0	0.00	0	0.00	0	0.00	0									
15 Kitchen/Dining	79	7.30	78	7.20	0	0.00	0									
16 Living	133	12.40	133	12.36	0	0.00	0									
17 Living	0	0.00	0	0.00	0	0.00	0									
18 NET TOTAL	420	38.88	403	37.42												
Common Support Areas (NLA)																
19 Multi-Purpose	589	54.70	589	54.70												
20 Lobby	399	37.10	399	37.10												
21 Supply Storage	64	5.91	64	5.91												
22 Office	0	0.00	0	0.00												
23 Vending	0	0.00	0	0.00												
24 Laundry	82	7.64	82	7.64												
25 Vestibule	77	7.14	77	7.14												
26 Housekeeping	38	3.51	38	3.51												
27 Kitchen	182	17.04	182	17.04												
28 ADA Toilet	42	3.87	42	3.87												
29 Bulk Storage	525	48.76	525	48.76												
30 Utility	459	42.64	459	42.64												
31 NET TOTAL	2466	229.11	2466	229.11												
32 Stairs	623	57.89	623	57.89												
33 Circulation	3688	342.65	3688	342.65												
34 BLDG CIRC	4311	400.64	4311	400.64												
35 GMA	563	52.26	531	49.32												
36 GBA *	710	66.00	710	66.00												

* Calculations are based on demonstration Assembled Plan Examples at Illustration 7.



Illustration 2 – Square Footage Comparison

Unaccompanied Housing for Thule Dorms - Building 2

	Unit C - SNCO/E7-E9/ Officer (01-03)				Unit E - Dorms 4-Airmen (E1-E4)				Unaccompanied Housing Design Guide (E7-E9 and O1-O3)		Unaccompanied Housing Design Guide (E1-E4)		Notes
	sq. ft.	sq. meters	sq. ft.	sq. meters	sq. ft.	sq. meters	sq. ft.	sq. meters	sq. feet	sq. meters	sq. feet	sq. meters	
1 Bedroom 1	129	11.98	128	11.93			129-183	12-17			129-183	12-17	min. bedroom width 10'-0" (p. 15, 31, 43) - required
2 Bedroom 2	0	0.00	128	11.93			129-183	12-17			129-183	12-17	min. bedroom width 10'-0" (p. 15, 31, 43) - required
3 Bedroom 3	0	0.00	129	11.98			129-183	12-17			129-183	12-17	min. bedroom width 10'-0" (p. 15, 31, 43) - required
4 Bedroom 4	0	0.00	129	11.98			129-183	12-17			129-183	12-17	min. bedroom width 10'-0" (p. 15, 31, 43) - required
5 Bathroom 1	35	3.25	35	3.25			35	3.25			35	3.25	1 toilet, 1 tub/shower, and 1 lavatory/ vanity (p. 15, 43)
6 Bathroom 2	0	0.00	35	3.25			35	3.25			35	3.25	1 toilet, 1 tub/shower, and 1 lavatory/ vanity (p. 15, 43)
7 Bathroom 3	0	0.00	35	3.25			35	3.25			35	3.25	1 toilet, 1 tub/shower, and 1 lavatory/ vanity (p. 15, 43)
8 Bathroom 4	0	0.00	35	3.25			35	3.25			35	3.25	1 toilet, 1 tub/shower, and 1 lavatory/ vanity (p. 15, 43)
9 Closet 1	20	1.86	20	1.86			20	1.86			20	1.86	1 per person (p. 43)
10 Closet 2	0	0.00	20	1.86			20	1.86			20	1.86	1 per person (p. 43)
11 Closet 3	0	0.00	20	1.86			20	1.86			20	1.86	1 per person (p. 43)
12 Closet 4	0	0.00	20	1.86			20	1.86			20	1.86	1 per person (p. 43)
13 Laundry	0	0.00	0	0.00			10-21	.93 - 1.95			10-21	.93 - 1.95	.93 per appliance footprint/ 1.95 per appliance - circulation inclusive (43)
14 HVAC	0	0.00	0	0.00			Varies per Unit	Varies per Unit			Varies per Unit	Varies per Unit	required dining (p. 43)
15 Kitchen/Dining	61	5.69	62	4.79			129-460	12 - 42.8			129-182	12-16	separate living/ bedroom for SNCO/ Officers (p. 15, 43) - required
16 Living	0	0.00	129	11.98			214-656	19.9-51.72			875-1155	81.37-107.30	min. room width 11'0" (p. 15) recommended
17 Living	0	0.00	0	0.00									refer to page 15 for NLA calculation requirements
18 NET TOTAL	245	22.78	915	85.03									
Common Support Areas (NLA)													
19 Multi-Purpose	0	0.00	0	0.00			269	25.00			269	25.00	1 Space per Dormitory Required (p. 32)
20 Lobby	399	37.10	399	37.10			100	9.30			100	9.30	part of Multi-Purpose Space
21 Supply Storage	64	5.91	64	5.91									min. net required (p. 32)
22 Office	0	0.00	0	0.00									recommended (p. 32)
23 Vending	0	0.00	0	0.00			25	2.32			25	2.32	1 vending area per dormitory. Recommended (p. 32)
24 Laundry	82	7.64	82	7.64			10-21	.93-1.95			10-21	.93-1.95	laundry per Module Recommended, min 1 washer/ 8 persons 1 dryer/ 6 persons (p. 43)
25 Vestibule	77	7.14	77	7.14									
26 Housekeeping	38	3.51	38	3.51									
27 Kitchen	192	17.84	192	17.84									
28 ADA Toilet	42	3.87	42	3.87			100	9.30			100	9.30	Minimum 1 per dormitory (p. 32)
29 Bulk Storage	48	4.46	48	4.46			60	5.67			60	5.67	2M ³ (70.6 CF) per storage cubical. Recommended 1 cubic/ area per 4 persons (p. 32)
30 Utility	459	42.64	459	42.64			As Required	As Required			As Required	As Required	8% of building gross is recommendation
31 NET TOTAL	1400	130.11	1400	130.11			564	52.42			564	52.42	refer to page 15 for NLA calculation requirements
32 Stairs	896	82.31	896	82.31									1/2 off area based on Memorandum from the dep. Of Air Force giving permission to do so
33 Circulation	3932	365.29	3932	365.29									
34 BLDG CIRC	4918	447.60	4918	447.60									
35 GMA	323	30.00	305	28.32									varies based on model configuration (p. 17)
36 GBA *	397	36.88	397	36.88									5 additional M ² per person can be added based on sub-artic conditions (p. 18)

* Calculations are based on demonstration Assembled Plan Examples at Illustration 8.



Illustration 3 – Square Footage Comparison

Unaccompanied Housing for Thule Doms - Building 3

Unit D - NCO/ES-E6				Unit E - Doms-4-Airmen (E1-E4)				Unaccompanied Housing Design Guide (E1-E6)				Unaccompanied Housing Design Guide (E1-E4)				Notes	
	sq. ft.	sq. meters	sq. ft.	sq. meters	sq. ft.	sq. meters	sq. ft.	sq. meters	sq. ft.	sq. meters	sq. ft.	sq. meters	sq. ft.	sq. meters	sq. ft.	sq. meters	
1 Bedroom 1	129	11.98	128	11.93	129-183	12-17	129-183	12-17	129-183	12-17	129-183	12-17	129-183	12-17	129-183	12-17	min. bedroom width 10'-0" (p. 15, 31, 43) - required
2 Bedroom 2	129	11.98	128	11.93	129-183	12-17	129-183	12-17	129-183	12-17	129-183	12-17	129-183	12-17	129-183	12-17	min. bedroom width 10'-0" (p. 15, 31, 43) - required
3 Bedroom 3	0	0.00	129	11.98	129-183	12-17	129-183	12-17	129-183	12-17	129-183	12-17	129-183	12-17	129-183	12-17	min. bedroom width 10'-0" (p. 15, 31, 43) - required
4 Bedroom 4	0	0.00	129	11.98	129-183	12-17	129-183	12-17	129-183	12-17	129-183	12-17	129-183	12-17	129-183	12-17	min. bedroom width 10'-0" (p. 15, 31, 43) - required
5 Bathroom 1	35	3.25	35	3.25	35	3.25	35	3.25	35	3.25	35	3.25	35	3.25	35	3.25	1 toilet, 1 tub/shower, and 1 lavatory/ vanity (p. 15, 43)
6 Bathroom 2	35	3.25	35	3.25	35	3.25	35	3.25	35	3.25	35	3.25	35	3.25	35	3.25	1 toilet, 1 tub/shower, and 1 lavatory/ vanity (p. 15, 43)
7 Bathroom 3	0	0.00	35	3.25	35	3.25	35	3.25	35	3.25	35	3.25	35	3.25	35	3.25	1 toilet, 1 tub/shower, and 1 lavatory/ vanity (p. 15, 43)
8 Bathroom 4	0	0.00	35	3.25	35	3.25	35	3.25	35	3.25	35	3.25	35	3.25	35	3.25	1 toilet, 1 tub/shower, and 1 lavatory/ vanity (p. 15, 43)
9 Closet 1	20	1.86	20	1.86	20	1.86	20	1.86	20	1.86	20	1.86	20	1.86	20	1.86	1 per person (p. 43)
10 Closet 2	20	1.86	20	1.86	20	1.86	20	1.86	20	1.86	20	1.86	20	1.86	20	1.86	1 per person (p. 43)
11 Closet 3	0	0.00	20	1.86	20	1.86	20	1.86	20	1.86	20	1.86	20	1.86	20	1.86	1 per person (p. 43)
12 Closet 4	0	0.00	20	1.86	20	1.86	20	1.86	20	1.86	20	1.86	20	1.86	20	1.86	1 per person (p. 43)
13 Laundry	0	0.00	0	0.00	10-21	93 - 1.95	10-21	93 - 1.95	10-21	93 - 1.95	10-21	93 - 1.95	10-21	93 - 1.95	10-21	93 - 1.95	83 per appliance footprint/ 1.95 per appliance - circulation inclusive (43)
14 HVAC	0	0.00	0	0.00													
15 Kitchen/Dining	150	13.98	52	4.79	Varies per Unit	Varies per Unit	Varies per Unit	Varies per Unit	Varies per Unit	Varies per Unit	Varies per Unit	Varies per Unit	Varies per Unit	Varies per Unit	Varies per Unit	Varies per Unit	required dining (p. 43)
16 Living	119	11.06	129	11.98	129-330	12 - 30.7	129-182	12-16	129-330	12 - 30.7	129-182	12-16	129-330	12 - 30.7	129-182	12-16	separate living/ bedroom for SNCO/ Officers (p. 15, 43) - required
17 Living	119	11.06	0	0.00	129-330	12 - 30.7	129-182	12-16	129-330	12 - 30.7	129-182	12-16	129-330	12 - 30.7	129-182	12-16	min. room width 11'-0" (p. 15) recommended
18 NET TOTAL	786	70.28	915	85.03	386-770	32.36-71.62	876-1165	81.37-107.30	386-770	32.36-71.62	876-1165	81.37-107.30	386-770	32.36-71.62	876-1165	81.37-107.30	refer to page 15 for NLA calculation requirements
Common Support Areas (NLA)																	
19 Multi-Purpose	1340	124.46	1340	124.46	269	25.00	269	25.00	269	25.00	269	25.00	269	25.00	269	25.00	1 Space per Dormitory Required (p. 32)
20 Lobby	399	37.10	399	37.10	100	9.30	100	9.30	100	9.30	100	9.30	100	9.30	100	9.30	part of Multi-Purpose Space
21 Supply Storage	64	5.91	64	5.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	min. net required (p. 32)
22 Office	0	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	recommended (p. 32)
23 Vending	0	0.00	0	0.00	25	2.32	25	2.32	25	2.32	25	2.32	25	2.32	25	2.32	1 vending area per dormitory. Recommended (p. 32)
24 Laundry	247	22.92	247	22.92	10-21	93-1.95	10-21	93-1.95	10-21	93-1.95	10-21	93-1.95	10-21	93-1.95	10-21	93-1.95	laundry per Module Recommended. min 1 washer/ 8 persons (p. 43)
25 Vestibule	77	7.14	77	7.14													
26 Housekeeping	113	10.53	113	10.53													
27 Kitchen	384	35.68	384	35.68													
28 Bathroom	42	3.87	42	3.87													
29 Bulk Storage	444	41.22	444	41.22	100	9.30	100	9.30	100	9.30	100	9.30	100	9.30	100	9.30	Minimum 1 per dormitory (p. 32)
30 Utility	944	87.66	944	87.66	60	5.57	60	5.57	60	5.57	60	5.57	60	5.57	60	5.57	2M ³ (70.6 CF) per storage cubical. Recommended 1 cubic area per 4 persons (p. 32)
31 NET TOTAL	4063	376.49	4063	376.49	As Required	As Required	As Required	As Required	As Required	As Required	As Required	As Required	As Required	As Required	As Required	As Required	8% of building gross is recommendation
32 Stairs	886	82.31	886	82.31	864	82.42	864	82.42	864	82.42	864	82.42	864	82.42	864	82.42	refer to page 15 for NLA calculation requirements
33 Circulation	2644	245.59	2644	245.59													1/2 off area based on Memorandum from the dep. Of Air Force giving permission to do so
34 BLDG CIRC	3629	337.90	3629	337.90													
35 GMA	481	41.91	305	28.32													varies based on model configuration (p. 17)
36 GBA *	468	42.63	458	42.63													5 additional M ² per person can be added based on sub-artic conditions (p. 18)

* Calculations are based on demonstration Assembled Plan Examples at Illustration 9.



Illustration 4 – Unit A and B

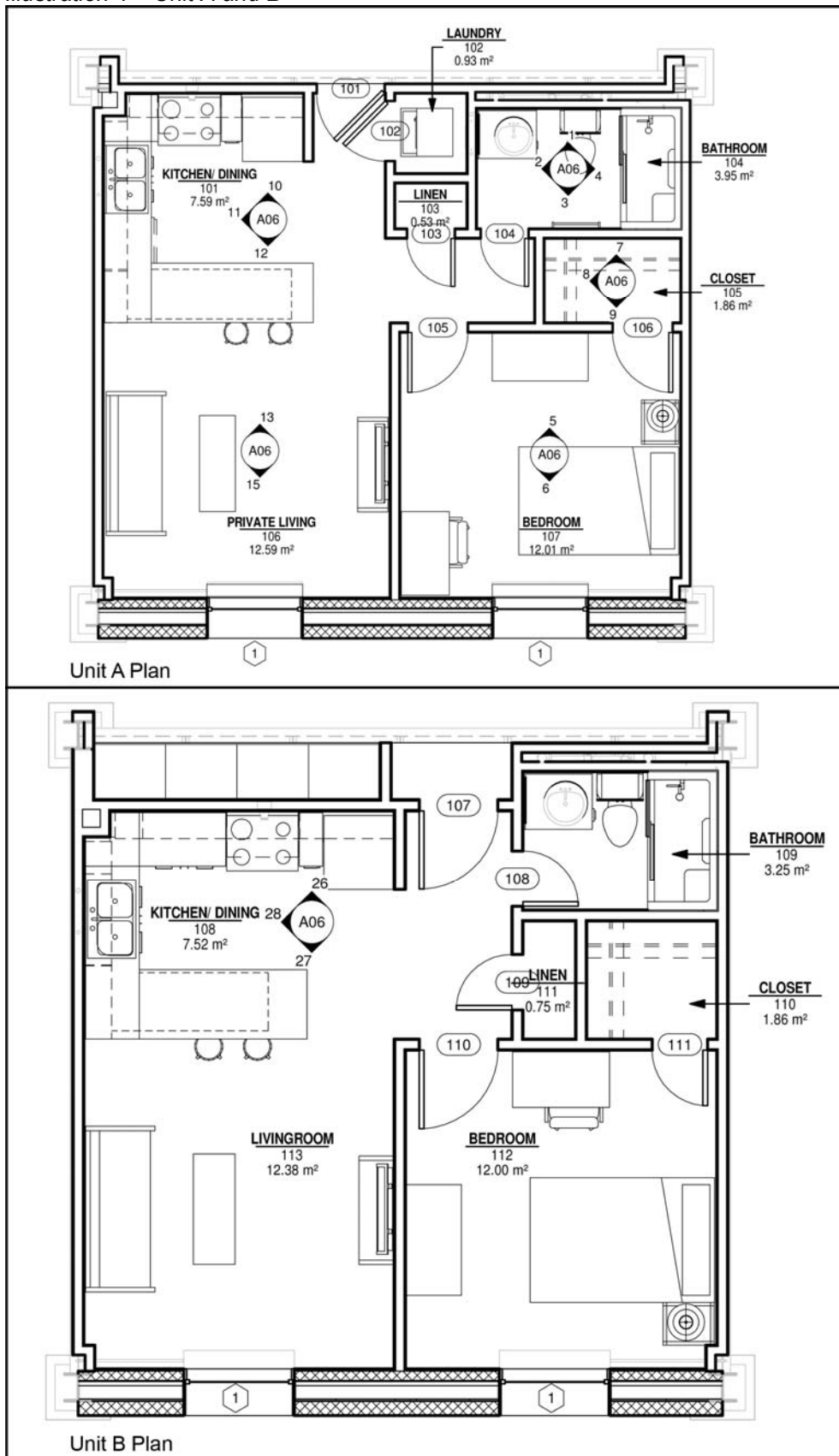
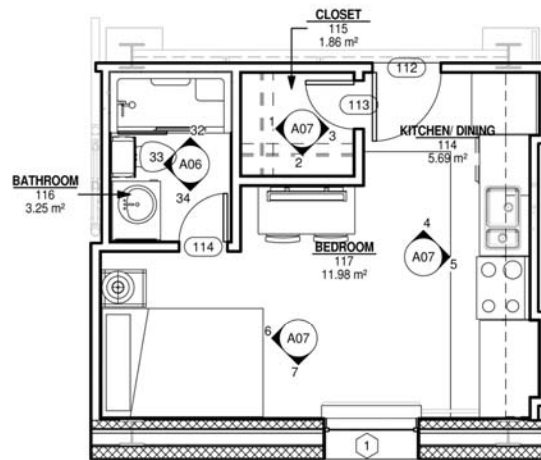
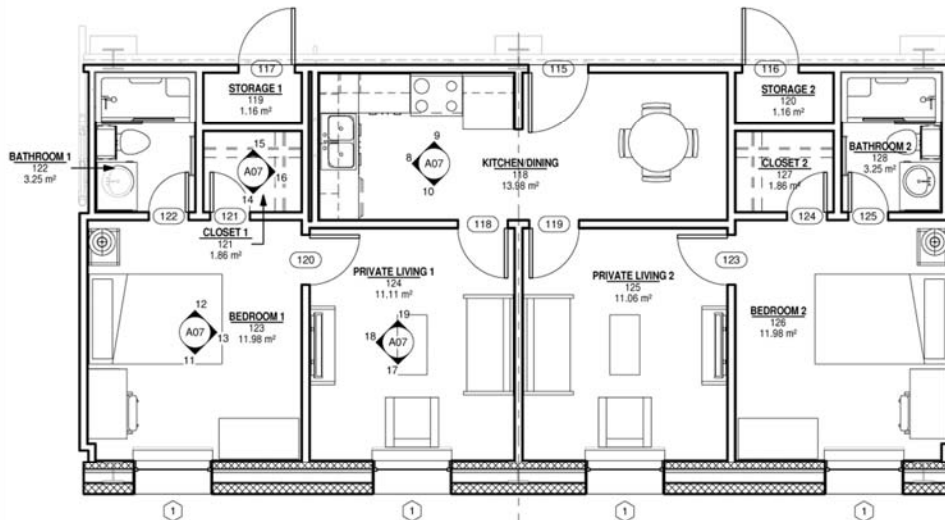




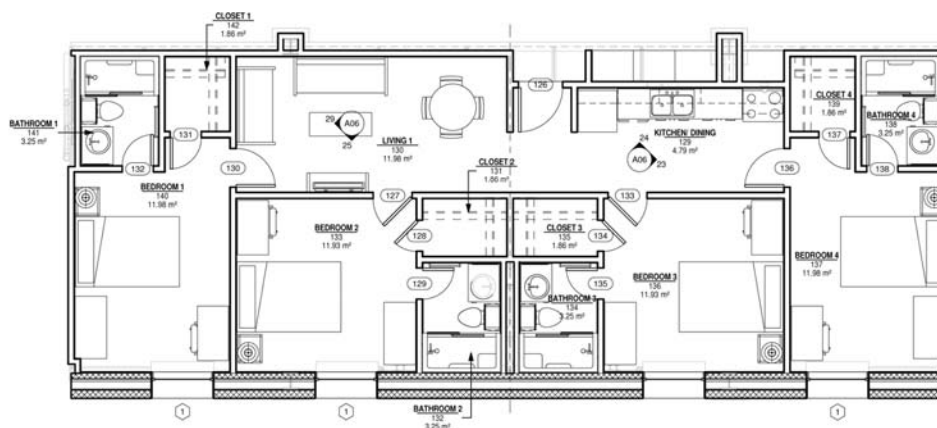
Illustration 5 – Unit C, D, and E



Unit C Plan



Unit D Plan



Unit E Plan



Illustration 6 – Unit A and B

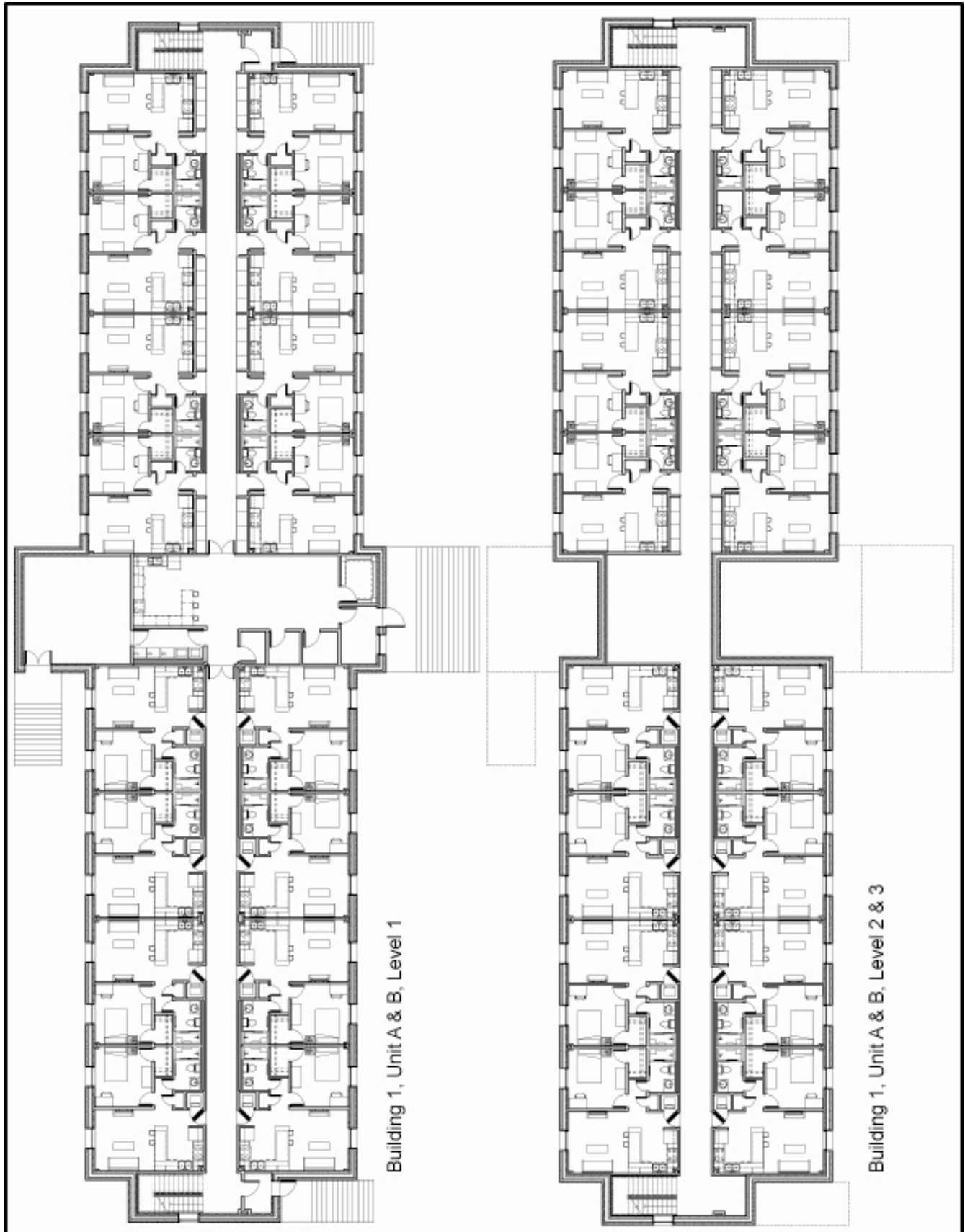




Illustration 7 – Unit C and E

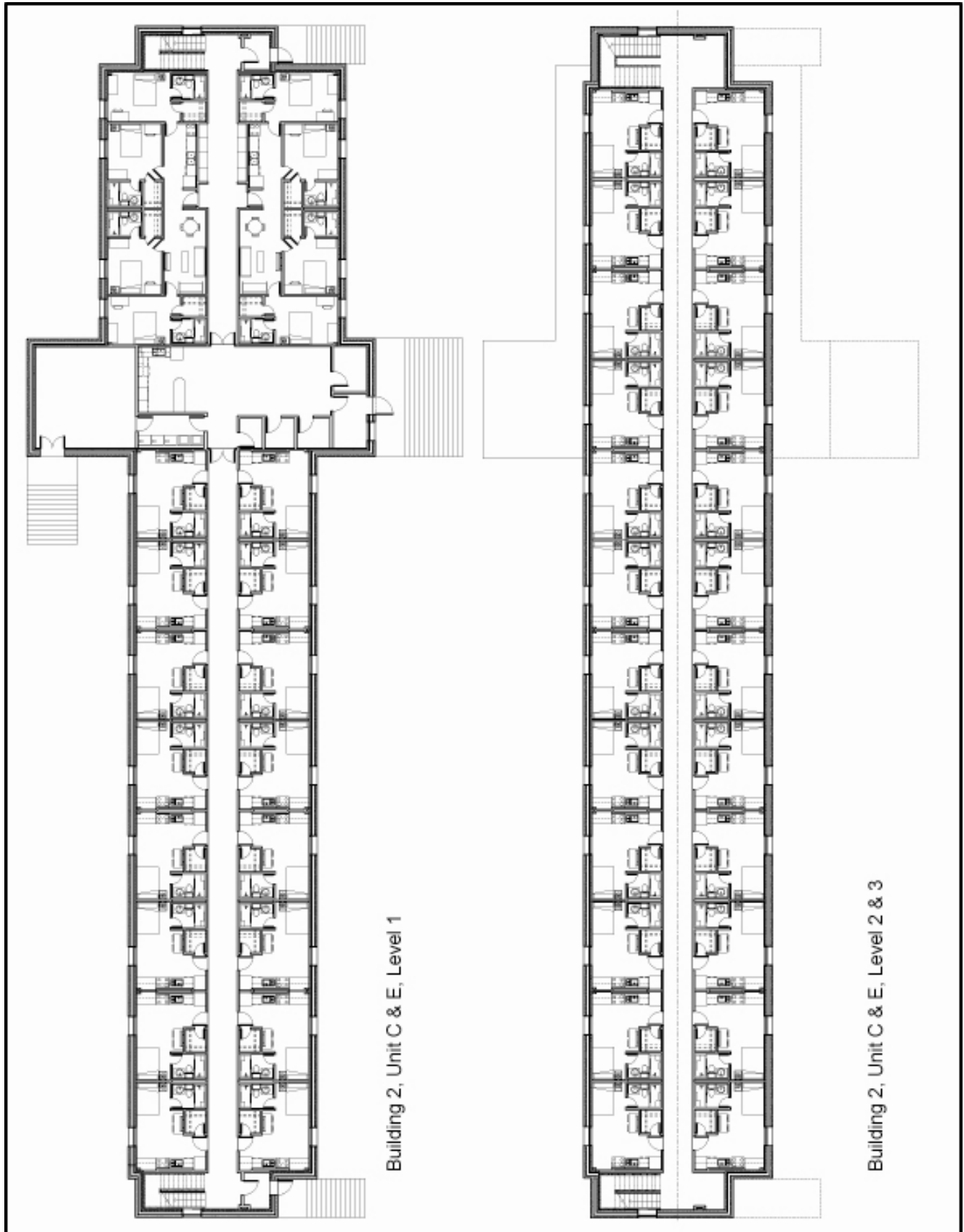




Illustration 8 – Unit D and E

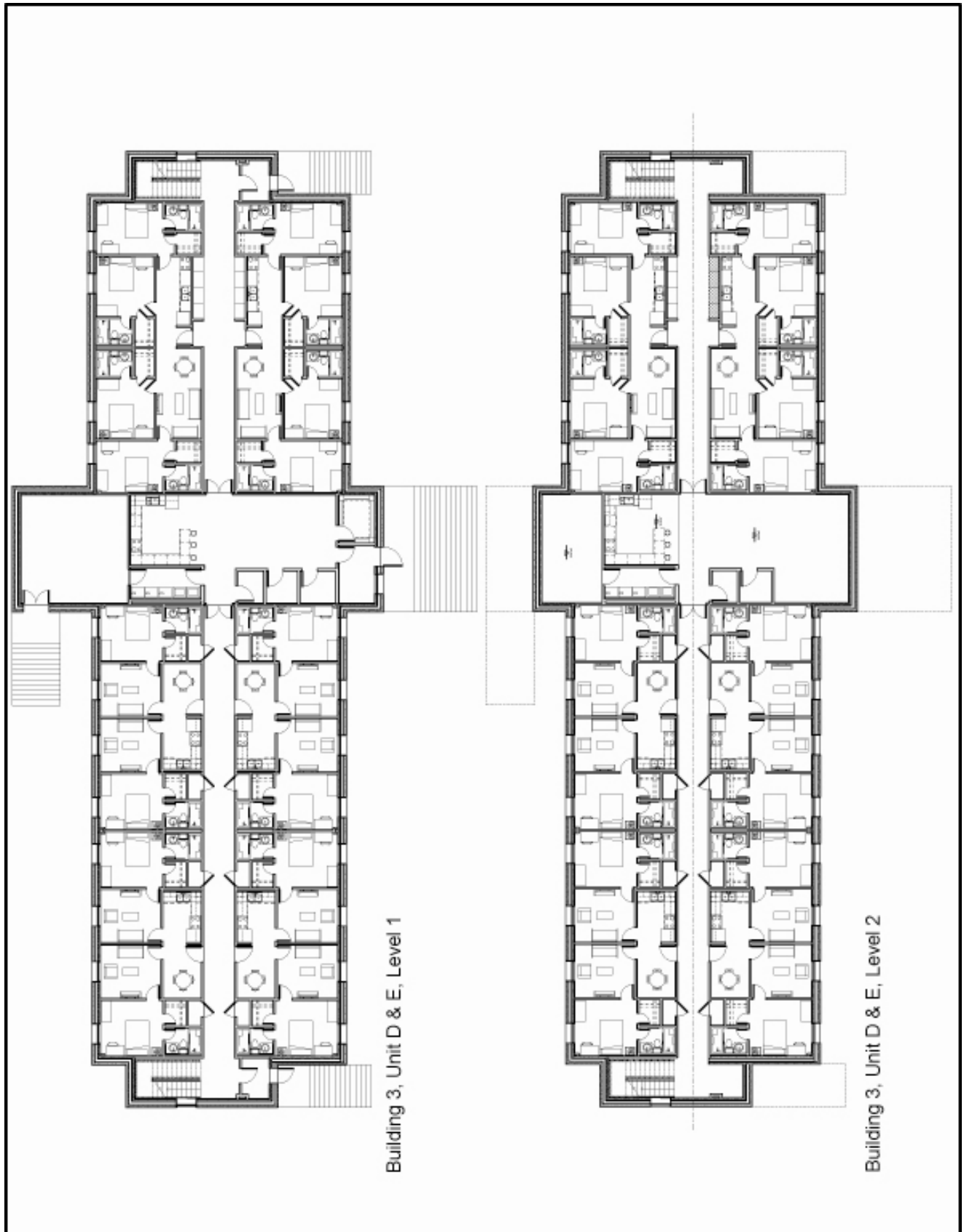
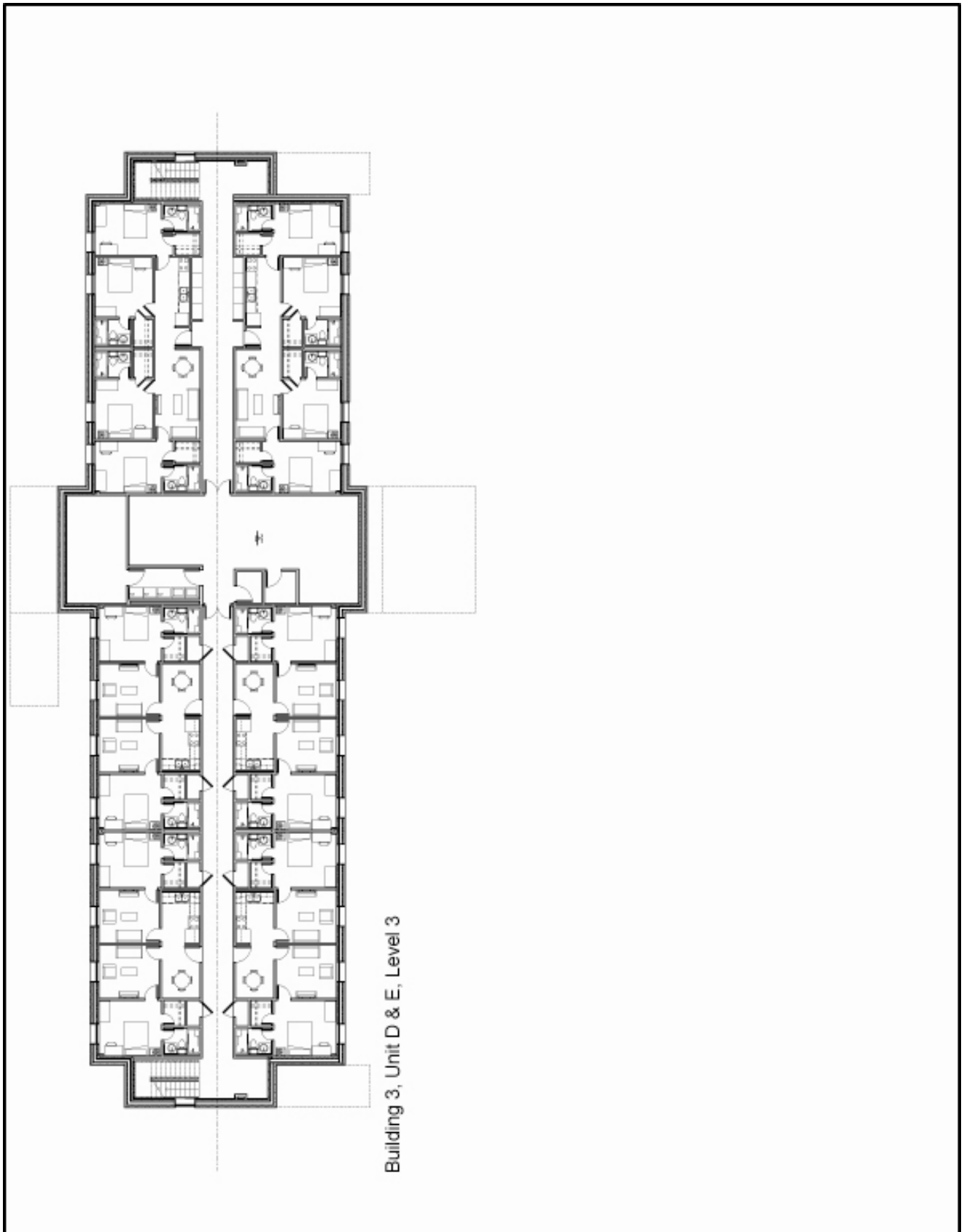




Illustration 9 – Unit D and E



Building 3, Unit D & E, Level 3



Illustration 10 – File Directory Structure

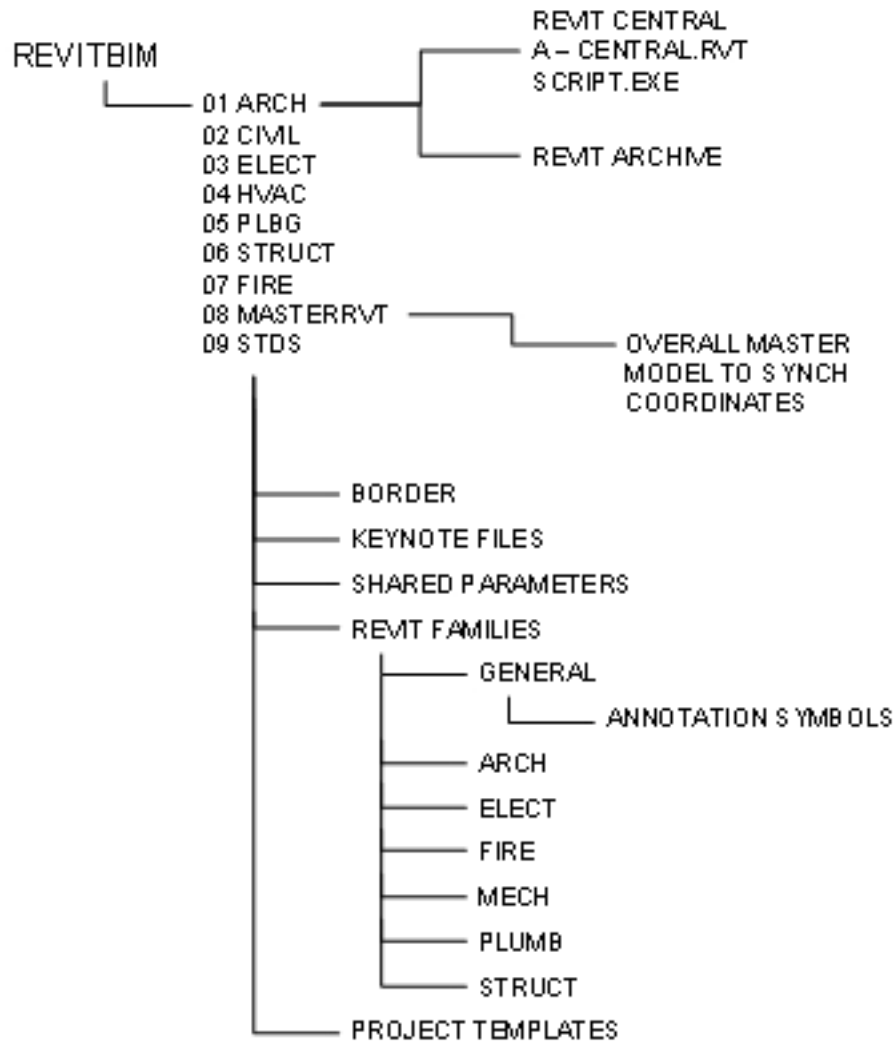




Illustration 11 – Duplication/ Manipulation Example

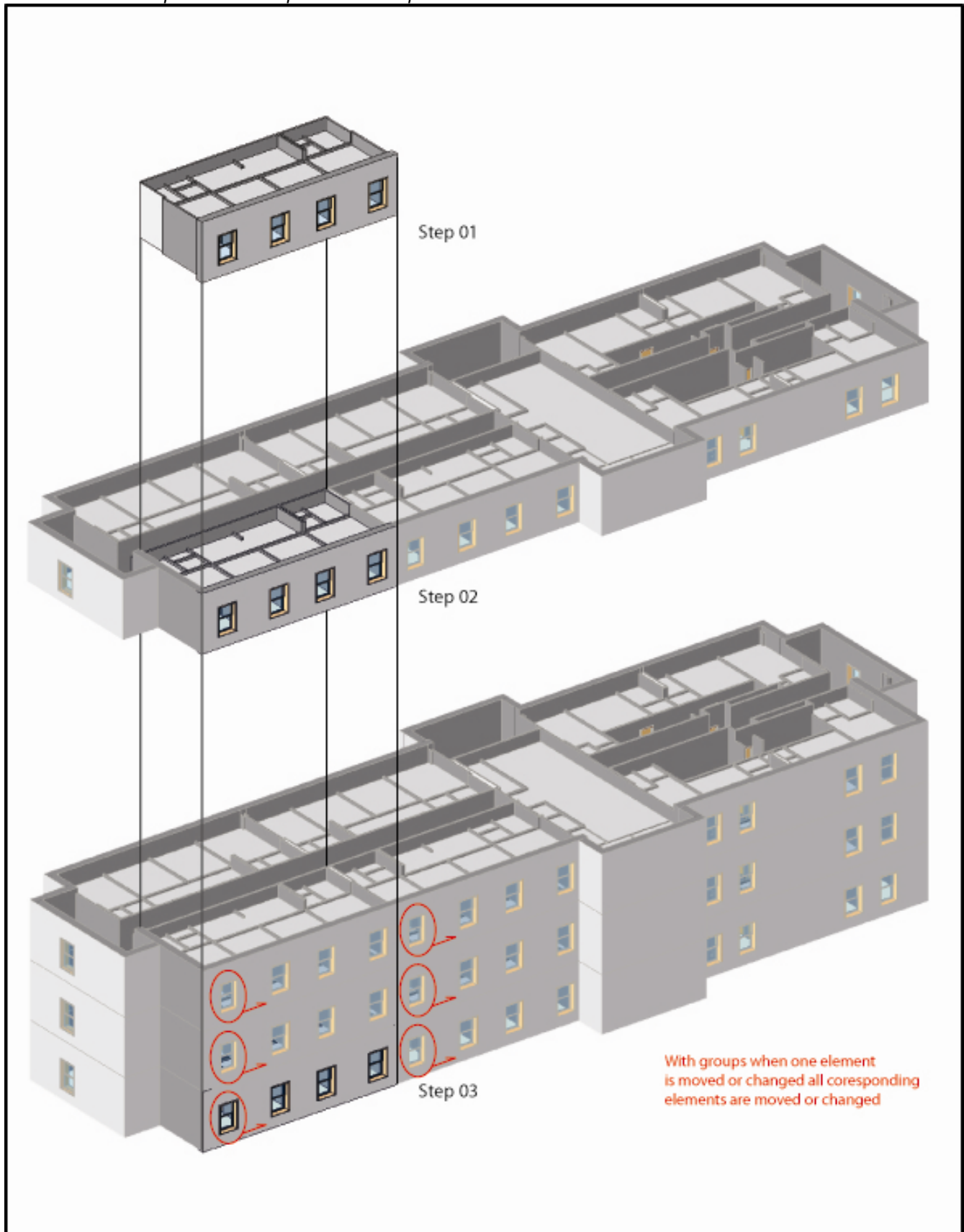




Illustration 12 – Perspective Examples

