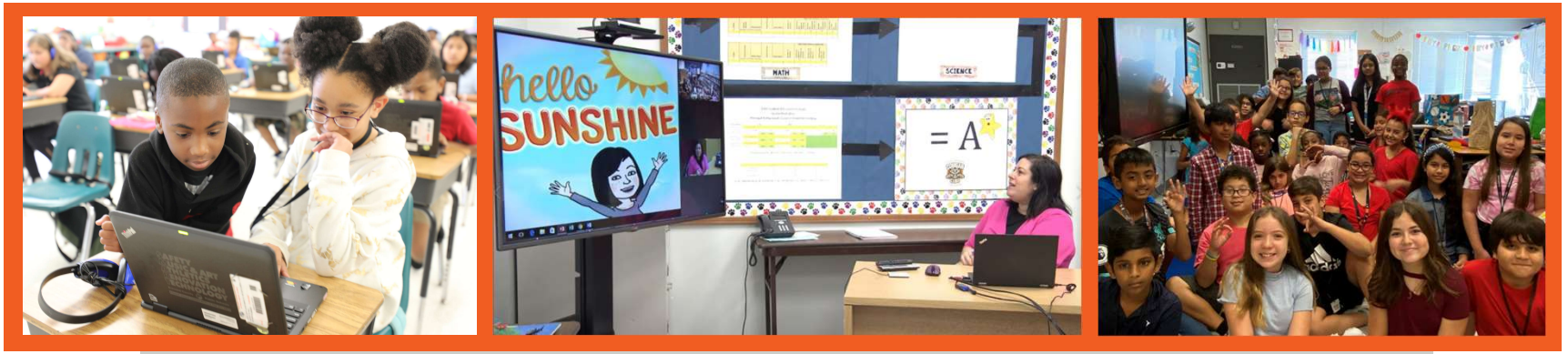

Facility Planning and Real Estate Department

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

FLORIDA EDUCATIONAL FACILITIES PLANNERS ASSOCIATION CONFERENCE

Presented By:

Chris O. Akagbosu, Director, Facility Planning & Real Estate Department
Yeni Aizpurua, F.I.S.H. Specialist Task Assigned
Sweta Soni, Real Property Analyst

July 12, 2023

Established 1915
BROWARD
County Public Schools

PART 1

3D BUILDING INFORMATION MODELING (BIM) REVIT

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES:

FROM 2D CAD TO 3D BIM REVIT/3D GIS

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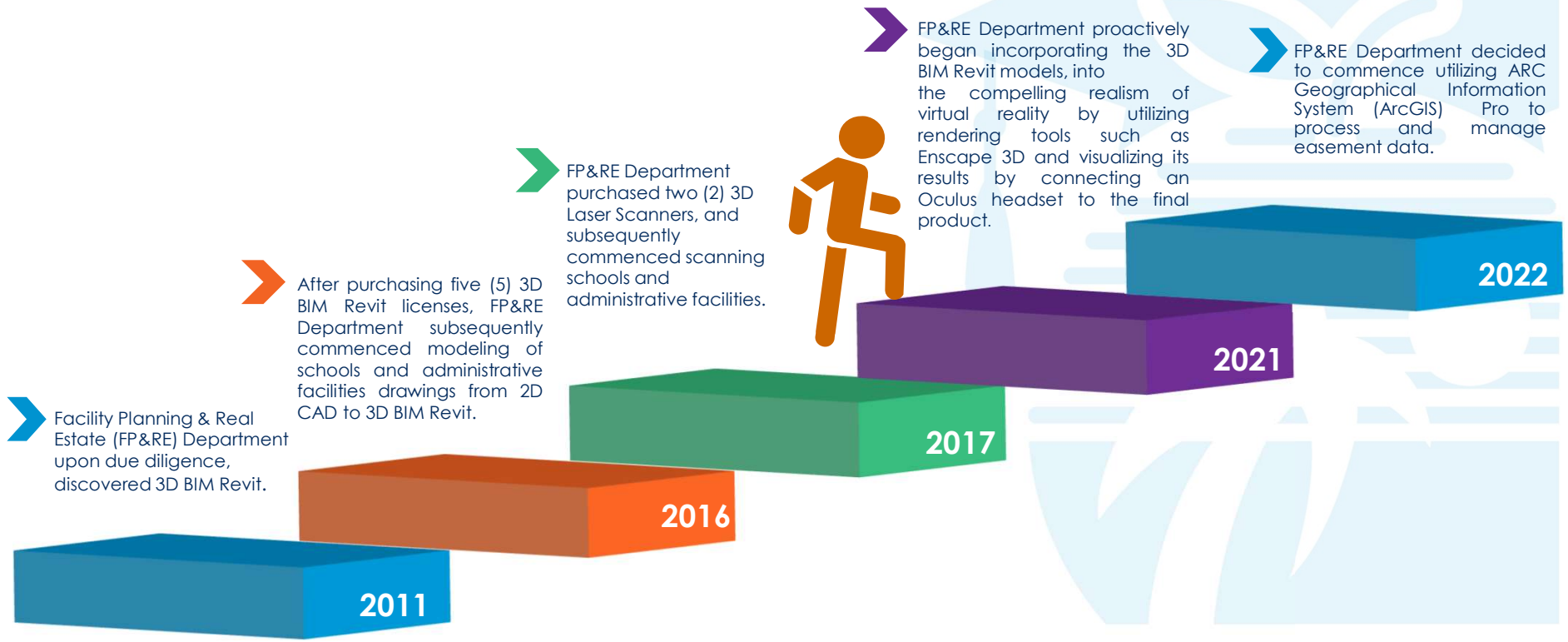
MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT / 3D GIS

BACKGROUND, HISTORY, AND GOAL

Timeline

Please buckle up because you are about to experience our incredible journey. Our adventure began in the 1990s, when Broward County Public Schools (BCPS) used drafting to develop BCPS sites and floor plans of schools and administrative facilities. The drawings were then gradually transformed into 2D computer aided drafting (CAD) format. Today, the world is witnessing yet another major shift from 2D to 3D BIM Revit.

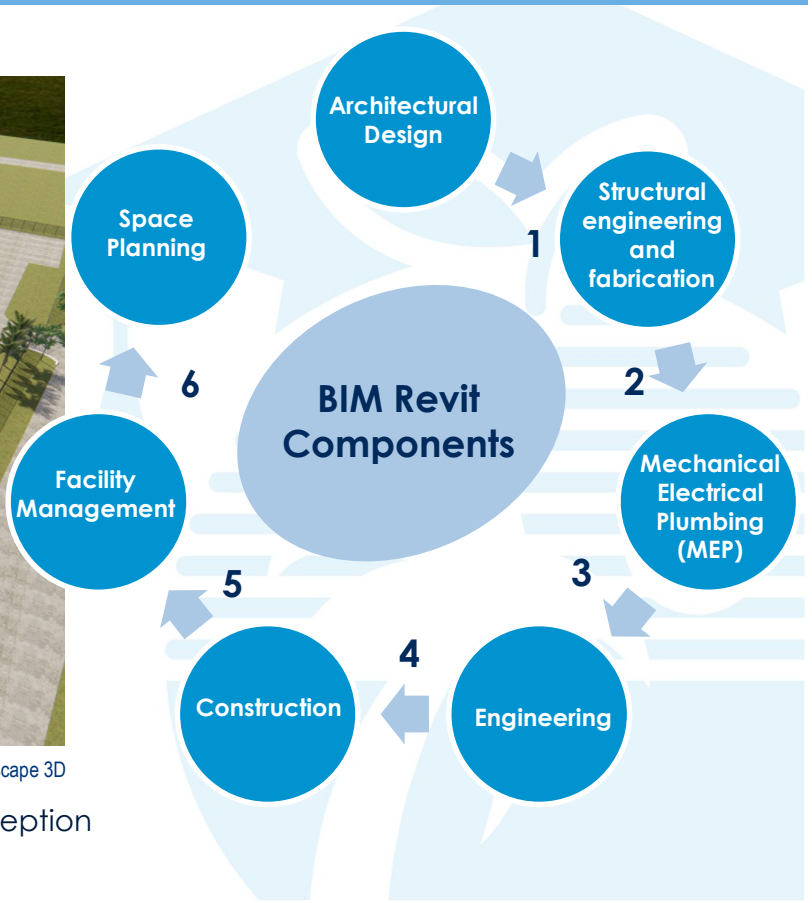


MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

WHAT IS BUILDING INFORMATION MODELING (BIM) REVIT

3D BIM Revit is an intelligent model-based design process that adds value across the entire lifecycle of building and infrastructure projects. [1] BIM helps architecture, engineering, and construction (AEC) service providers apply the same approach to building and infrastructure projects

Harbordale Elementary School Enscape 3D

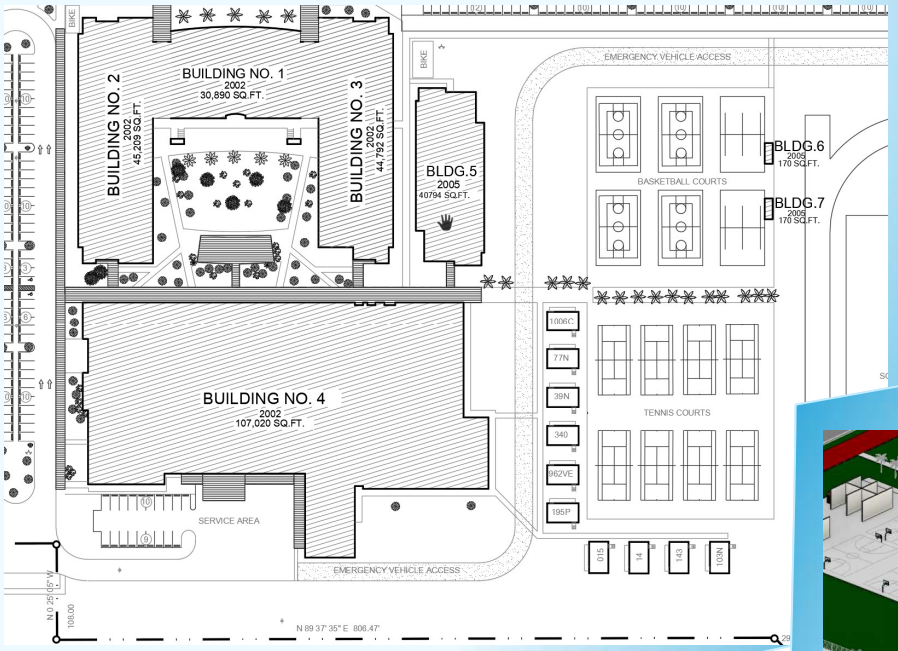


NOTE: In a nutshell, BIM Revit can be utilized to design a facility from inception and/or to model an existing facility

[1] Realizing the Benefits of BIM – A Autodesk White Paper

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

2D CAD AND 3D BIM REVIT SCHOOL SAMPLES



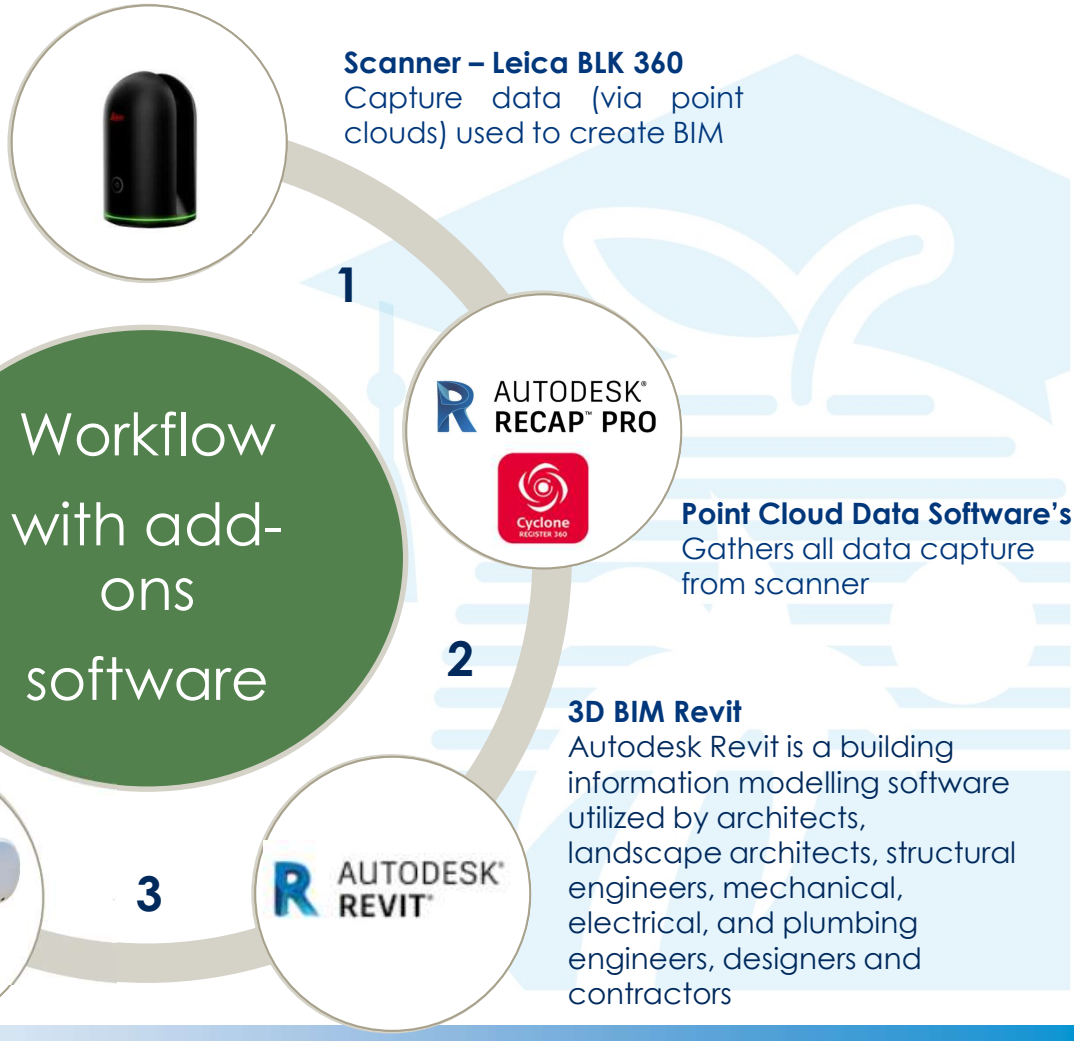
2D CAD VIEW – HIGH SCHOOL SAMPLE

3D BIM REVIT VIEW – HIGH SCHOL SAMPLE

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

3D BIM REVIT WORKFLOW

Esri GIS
A geographic information system (GIS) is a system that creates, manages, analyzes, and maps all types of data.



Scanner – Leica BLK 360
Capture data (via point clouds) used to create BIM

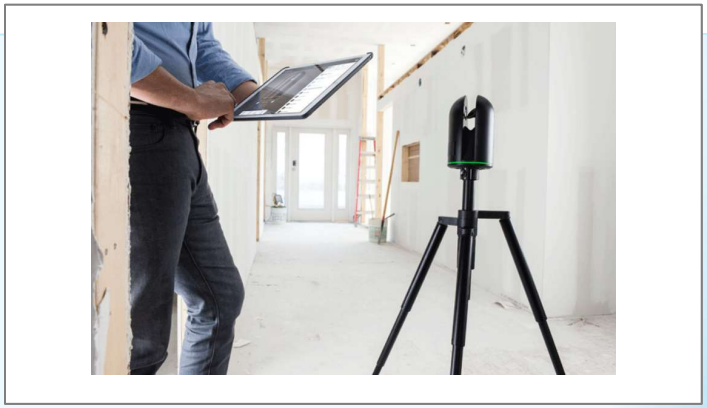
Point Cloud Data Software's
Gathers all data capture from scanner

3D BIM Revit
Autodesk Revit is a building information modelling software utilized by architects, landscape architects, structural engineers, mechanical, electrical, and plumbing engineers, designers and contractors

Virtual Reality
Virtual Reality (VR) is a computer-generated environment with scenes and objects that appear to be real, making the user feel that they are immersed in the scene

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

REALITY CAPTURE: HOW DOES IT WORK?



Capturing Data - Leica BLK 360

2D view with Recap after gathering point cloud data

REALITY CAPTURE

CURRENT BENEFITS

1. Provides accurate measurements and square footage data of the subject BCPS facilities and affiliated spaces (i.e., classrooms)

2. Availability of accurate FISH data, and assurance of 100% validation of a newly generated BCPS 5-year plant survey by the Florida Department of Education (upon the eventual the modeling of all 234 school/sites and 20 administrative facilities/sites)

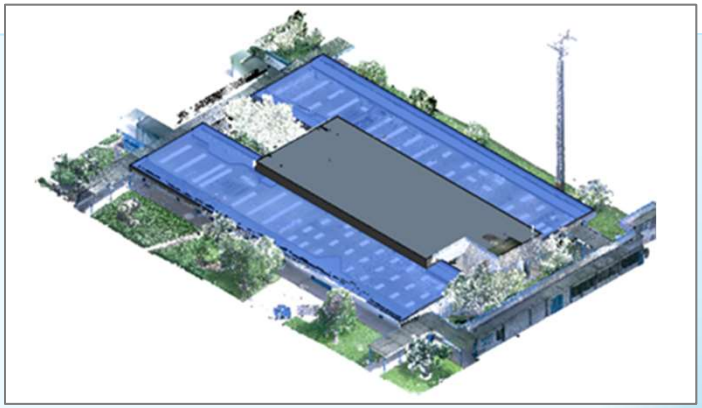
3. Provides for efficiency in space planning of administrative facilities

4. Create the fly-through presentation environment that the user can be immersed in through virtual reality, which gives the user a better perspective of the environment than still photos or videos

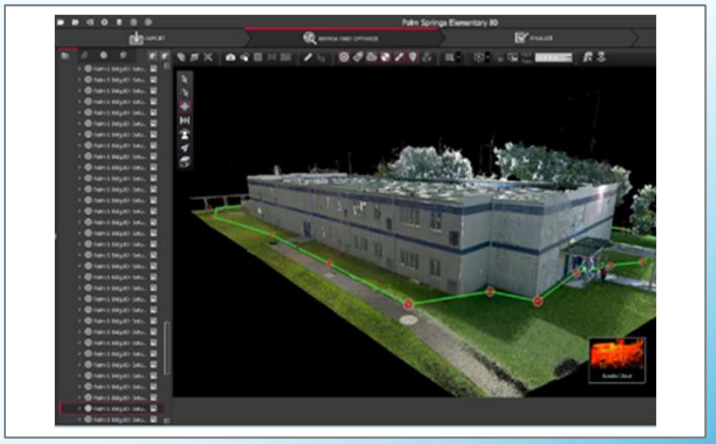
5. Receive complete documentation of existing as-built conditions/drawings of subject BCPS facilities (hard and electronic copies)

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

REALITY CAPTURE : HOW DOES IT WORK?



Exterior view with Recap



Exterior view with Cyclone – point cloud registration process

REALITY CAPTURE

CURRENT BENEFITS

6. The availability of 3D BIM Revit drawings creates opportunity for the BCPS Office of Facilities & Construction (OFC), pertinent departments, to add needed critical data (roofing, mechanical, electrical, plumbing, HVAC, etc.) of the subject facilities into 3D BIM Revit model

7. Creases opportunity for the added data to be imported from 3D BIM Revit into Maximo; which would subsequently allow the Physical Plant Operations (PPO) Department to utilize 3D BIM Revit to efficiently manage/maintain BCPS facilities

8. Creates opportunity for the OFC to require submittal of related construction bids in BIM Revit format during the procurement process

9. The availability of accurate 3D BIM Revit drawings for use by BCPS departments and Broward County/municipal police and fire departments

10. Allows for and would contribute to safety and the security of BCPS facilities; and by default, BCPS students

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

COMPLETED POINT CLOUD OF GULFSTREAM FACILITY IN RECAP AUTODESK VIDEO

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

COMPLETED 3D BIM OF GULFSTREAM FACILITY IN REVIT AND ENSCAPE 3D

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

RENDERING VIDEO/ENSCAPE 3D

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

POTENTIAL BENEFITS OF VIRTUAL REALITY TO BROWARD COUNTY PUBLIC SCHOOLS

1. Completes the modeling workflow of a facility and subsequently, allows for full visualization of the completed 3D BIM Revit model

2. A useful device in the design of a facility when utilizing 3D BIM Revit, during the construction phase of the facility, and in the remodeling of a facility

3. Enables the remote visualization (exterior and interior) of a 3D BIM Revit model of a BCPS facility, without being physically present at the facility site

4. Allows for the virtual replica of a model/space designed utilizing 3D BIM Revit, to be superimposed on the actual existing physical facility/space; thereby enabling experiencing of the desired finalized design of the area/space of the actual existing physical facility

5. Meetings can be held remotely, saving time and money, since 3D BIM Revit data in a virtual environment; enables faster and more robust decision-making, as well as better communication and coordination between stakeholders

6. Provides realistic and accurate scenarios of a 3D BIM Revit model, allows for easy modifications to the model, and enables visualization of the model during meeting, presentation, and design discussions with stakeholders and customers regarding the model

7. Creates opportunities for the OFC and the Physical Plant Operations Department to visualize 3D BIM Revit models of BCPS facilities, which would enable efficiency to aspects of related OFC and PPO Department projects; thereby saving the OFC and PPO Department time and money regarding travel time and visit to the BCPS facility

8. Provides for efficiency and further enhancement in space planning of administrative facilities, including allowing the customer to view scenarios of the envisioned designed space(s)

9. Further, walk-thru in virtual reality enables the space planning customer to visualize and experience the office/cubicle space, and the proposed design/layout of subject space(s), including related components such as the furniture layout in the subject space

BUILDING INFORMATION MODELING (BIM) IMPLEMENTATION, CONVERSION, AND UTILIZATION OF 3D LASER SCANNERS WHERE WE ARE

PROJECT GOAL AND STATUS

❑ Project Goal

To model all 234 schools/sites and 20 administrative facilities/sites from 2D CAD drawings into 3D BIM Revit format

❑ As of June 20, 2023, the FP&RE Department has accomplished the following:

- *Scanned: 6 Schools and 1 Administrative Facility = 7 Facilities*
- *Modeled: 34 Elementary, 9 Middle, 16 High Schools, 3 Center = 62 School Facilities*
- *Modeled: 4 Administrative Facilities*

NOTE: Two (2) approaches for modeling of facilities are as follows:

1. Modeling from CAD or As-built drawings into BIM Revit software
2. Scanning the facility and completion in BIM Revit
3. Presenting a realistic 3D view in Enscape if needed for virtual reality visualization purposes.

PART 2

3D BUILDING INFORMATION MODELING (BIM) REVIT/3D GEOGRAPHIC INFORMATION SYSTEM(GIS)INTEGRATION

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES:

FROM 2D CAD TO 3D BIM REVIT/3D GIS

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MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES

FROM 2D CAD TO 3D BIM REVIT/3D GIS

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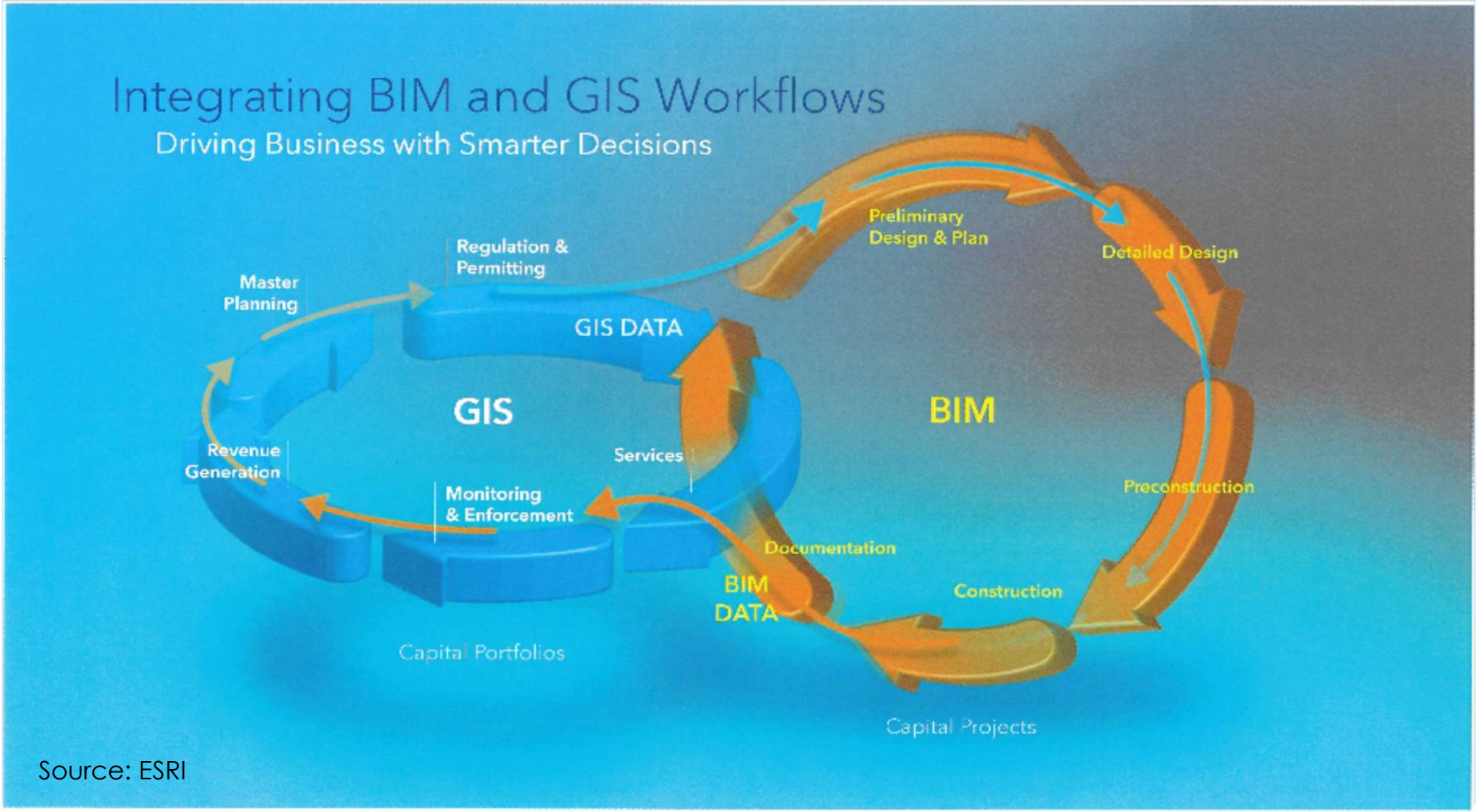
WHAT IS 3D GIS

- "3D Geographic Information Systems are systems for structuring and managing 3D spatial data and are capable of handling 3D geometry structures and performing onto them basic spatial analysis functionalities of a GIS"

NOTE: 3D GIS is a component of ArcGIS Pro; So, where appropriate, 3D GIS will be used interchangeably with ArcGIS

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

3D BIM REVIT/ARCGIS PRO PROJECT



Source: ESRI

3D BIM REVIT AND 3D GIS INTEGRATION – WHAT DOES IT MEAN

- **The components of 3D BIM Revit and 3D GIS include, but are not limited to the following:**
  - 3D BIM Revit and 3D GIS are both intelligent software's with graphic and data query capabilities
  - In BIM Revit, you can design a physical structure at an object level, i.e., sketching a door, window, wall, building, etc.
  - GIS operates at rural, city, regional, and country scales, i.e., depicting and managing outdoor objects in landscapes, and related data such as roads, bridges, airports, rail networks, relative to their surrounding settings
  - With the integration of 3D BIM Revit and 3D GIS, one is presented with the opportunity of managing and maximizing the capabilities of the merged models, in a context that allows for the following:
    - A larger and smarter landscape; whereby, the building(s) becomes connected to a parcel of land, utilities, and roads, etc.
    - Expanded query capabilities of the relative interior and exterior data, etc.
    - Provides the in scenario whereby, relative data can be accessed in one source, by multiple work silos, for their various related uses; and the work silos could continue to access and reuse pertinent data throughout the structure's lifecycle

POTENTIAL BENEFITS OF 3D BIM REVIT/3D GIS TO BROWARD COUNTY PUBLIC SCHOOLS

- Seamless transition of data between 3D BIM Revit and 3D GIS, which allows for the reduction or complete elimination of data redundancy
- Seamless transfer of data between different stages of design and construction processes, which results in reduced project costs and cost savings
- Ease of data reuse for all the parties involved in planning, design, construction, and maintenance of buildings
- Further eliminates the need to recreate pertinent data for use in other areas (i.e., Maximo) of facilities and maintenance
- Would provide highly detailed geospatial context to 3D BIM Revit as a process
- Would make it easier to manage data due to the cloud storage option
- Would as necessary, enable the reuse and repurposing of data

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

BCPS AND CITY OF MIRAMAR COLLABORATION PROJECT AND PROCESS IMPLEMENTATION

- **In 2020**, BCPS via the Facility Planning & Real Estate (FP&RE) Department, and the City of Miramar (City), initiated a collaborative project (Note, the City is a National Winner for the All-America Smart Cities)

- **Project's Purpose:** To enhance the then Department's modeling of 17 BCPS facilities located in the City, which entailed the site plan and floor plan drawings, from 2D CAD into 3D BIM Revit, and integrating the models with 3D GIS. Process implemented were as follows:

  1. Utilized 3D Laser Scanning (Leica Scanner) to capture the as-builts conditions of the pilot school facility (Dolphin Bay Elementary), in the form of point cloud, and subsequently created the 3D BIM Revit model of the school facility

  2. Laser scanning captured building interiors and exteriors, i.e., all rooms such as classrooms, cafeteria, PE building, offices, bathrooms, storage, etc.

  3. Thereafter, the Department provided the completed 3D BIM Revit of the school facility to the City

  4. Thereafter, the City's GIS Team in coordination with FP&RE Department, utilized drone to capture the aerial view of the school building's roof and related features

BCPS AND CITY OF MIRAMAR COLLABORATION PROJECT AND PROCESS IMPLEMENTATION

5. The Team established GPS coordinates for the 3D BIM Revit of the school facility placing it on the real-world coordinates system, tying the elevations with reference to sea level elevation as a benchmark; thereby aligning the orientation with respect to the true North, and later transferred the model into the GIS System

6. Upon completion of the scanning and the field work, the Team spent numerous hours transferring the resultant data into computer, and thereafter, created the 3D BIM Revit/3D GIS model of the school facility

7. Several months later, the Department transmitted completed 3D BIM Revit models of the remaining 16 schools to the City for integration with 3D GIS

8. Currently, the City has successfully integrated/completed 9 models of the remaining school facilities, and transmitted the models to the Department

9. The completed 3D BIM Revit/3D GIS model of the pilot school facility is displayed on the screen

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

THE PILOT PROJECT

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

BCPS PLANNED USE OF THE INTERGRATED MODEL AND/OR STANDALONE ARCGIS

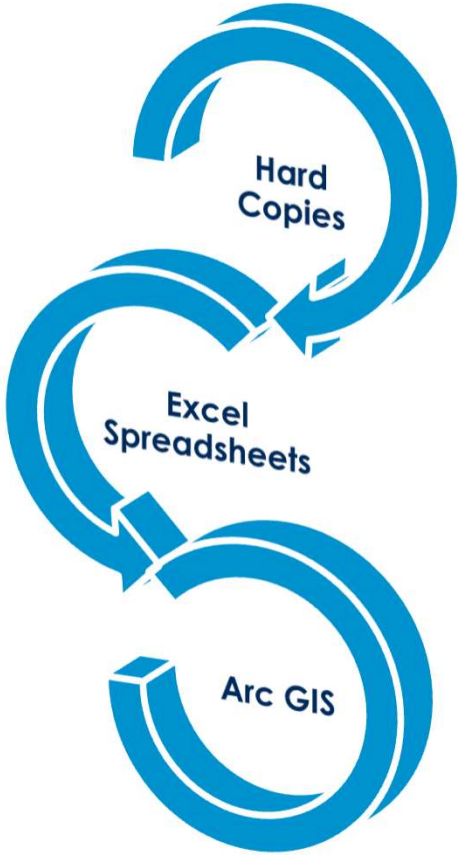
- Plot the location of all pertinent BCPS facilities on the model
- Integrate data for all BCPS facilities (i.e., site name, location, site number, acreage, etc.) into the model
- Plot and depict in the model, easements and their locations on BCPS campuses, or if applicable, administrative facilities
- Integrate into the model for each specific BCPS facility, pertinent data such as agreements, easements, correspondence, etc., which allows for related data of the facility to be accessed from one source
- Utilize as a resource in the BCPS development review process, to ascertain the availability or lack thereof, of sidewalk connectivity from proposed residential development(s) to an impacted school campus or campuses

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

EXAMPLE - USE OF 3D GIS TO MANAGE EASEMENT DATA

Currently, the FP&RE Department utilizes Excel Spreadsheets to track and manage data related to easements

In 2022, the Department acquired advanced ArcGIS Pro, and commenced utilizing it to review, process, and manage easement requests; and ongoingly, is working to integrate current easement data into ArcGIS Pro



MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES:

FROM 2D CAD TO 3D BIM REVIT/3D GIS

STEPS IMPLEMENTED TO GRAPHICALLY DEPICT EASEMENT DATA ON SCHOOL SITES

LOCATING AND DIGITIZING THE PHYSICAL COPIES

- Commenced inputting into Excel spreadsheet, recently School Board approved easement agreements
- Searched the Department's hard files for approved existing easement agreements, records, and data
- Scanned or took photographs of the physical files using a scanner or digital camera
- Saved the scanned or photographed files in a common image format, such as JPEG or PNG
- Searched for easements data in the Broward County Property Appraisers website and other public records

TRANSFER TO EXCEL FORMAT

- Transferred the available data into excel format for better organization of easements data
- Approach enhanced the process, making it easier in locating comprehensive data on easements

IMPORTING to 3D GIS

- The Excel data along with the easement drawings were imported into ArcGIS

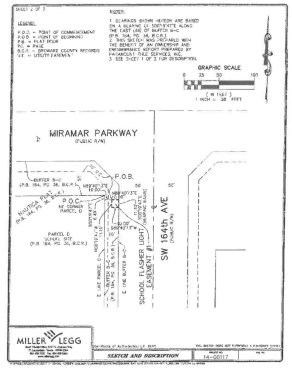
MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

SUMMARY - ONGOING WORK PROCESS FROM 3D BIM REVIT TO ARCGIS PRO

Import	Add	Create
Import BIM Revit 3D Drawings into GIS without Geo Referencing	Add easements and information related to easements into a separate table	Create files/ drawings with a title block/ title sheet/template for the BCPS

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

3D GIS IMPLEMENTATION - WHERE WE ARE



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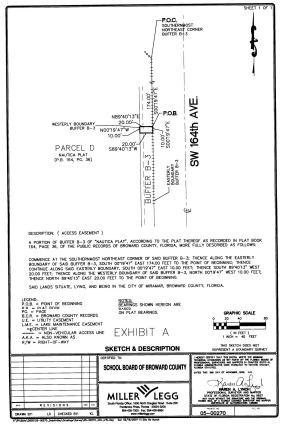

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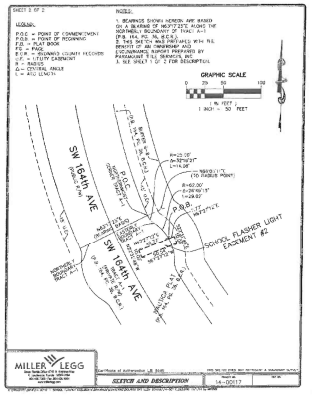
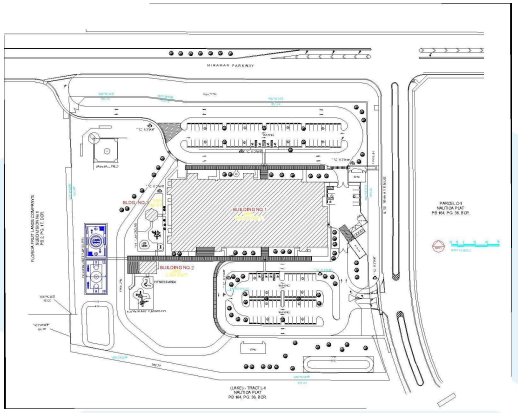
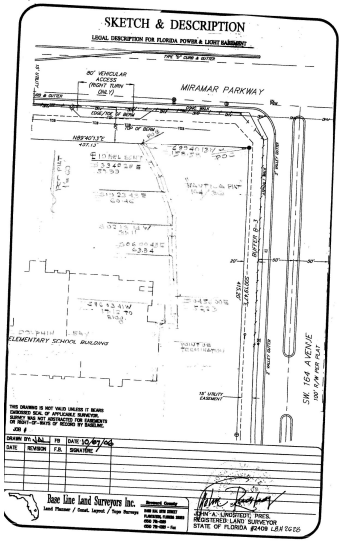
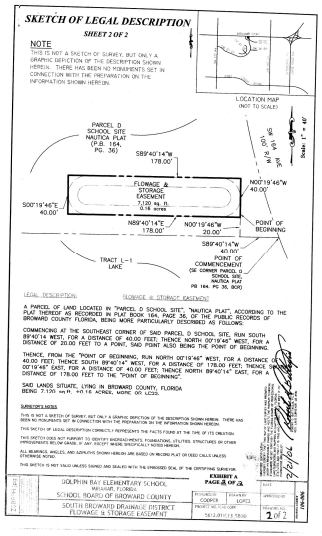


3 of 3

EASEMENT #2
Dolphin Bay ES (3751)







l Board of Broward County, Florida
Easement Matrix

GRANTEE	LOCATION	SITE NO.	PURPOSE	EASEMENT TYPE	EASEMENT SIZE (APPROXIMATE)	DATE SIGNED BY BOARD	DATE RECORDED	BOOK	PAGE	INSTRUMENT #
Nautica Community Association, Inc.	Dolphin Bay Elementary	375.1	Perpetual Utility Easement #1			5/26/2015	9/21/2015			113240006
Nautica Community Association, Inc.	Dolphin Bay Elementary	375.1	Perpetual Utility Easement #2			5/26/2015	9/21/2015			113240005
South Broward Drainage District	Dolphin Bay Elementary	375.1	Flowage/Storage Easement			10/17/2006	11/22/2006	43155	1501	106817749
FP&L	Dolphin Bay Elementary	375.1	Easement			12/12/2006	1/8/2007	43403	1912	106732613
Nautica Community Association, Inc.	Dolphin Bay Elementary	375.1	Driveway/Walkway Easement			1/17/2007	5/18/2007	44062	1029	107078418
South Broward Drainage District	Dolphin Bay Elementary	375.1	Flowage/Storage Easement			3/18/1991	4/23/1991	18324	409	91154545

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

3D GIS IMPLEMENTATION - WHERE WE ARE

5,547 ft | 80.3670222°W 25.9759858°N | 0 ft

DBbuffer | DBbuffer_Intersect

Field: Add Calculate | Selection: Select By Attributes Zoom To Switch Clear Delete Copy

	OBJECTID *	Shape *	Easement	Facility	Grantor	Grantee	Purpose	Daterecorded	bookpage	Instrumentnumber
1	1	Polygon	Utility	Dolphin Bay Elementary	SBBC	FP&L	Florida Power and Electr...	01/09/2007	43403/1912	106732613
2	2	Polygon	Drainage	Dolphin Bay Elementary	SBBC	South Broward drainag...	Flowage_Storage Easem...	11/22/2006	18324/409	91154545
3	3	Polygon	Walkway Easement	Dolphin Bay Elementary	SBBC	NAutica Community As...	Walkway	5/18/2007	44062/1029	1070784418
4	4	Polygon	Perpetual Utility 1	Dolphin Bay Elementary	SBBC	NAutica Community As...	School Flasher Light	9/21/2015	<Null>	113240006
5	5	Polygon	Perpetual Utility 2	Dolphin BAy Elementary	SBBC	Nautica Community As...	School Flasher Light	9/21/2015	<Null>	113240005

Click to add new row.

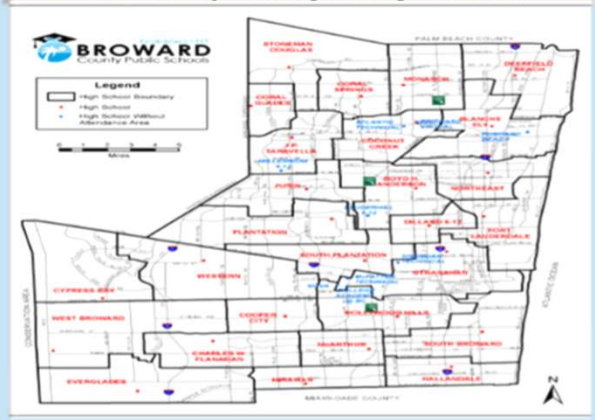
DEMONSTRATION OF EASEMENT(S) ON SCHOOL SITES USING 3D GIS

DEMONSTRATION OF EASEMENT(S) ON SCHOOL SITES USING 3D GIS

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

OTHER PLANNED USE OF ARCGIS PRO

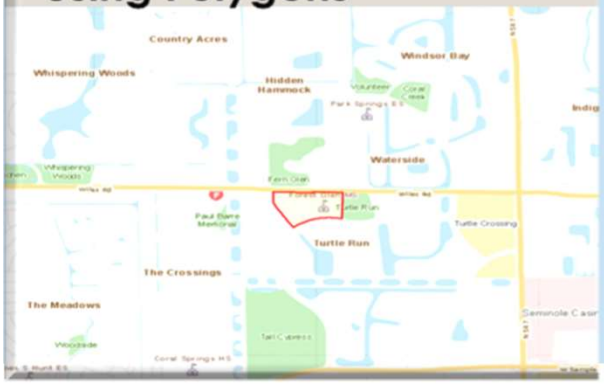
Query for City limits/ Parcels/ Property Lines



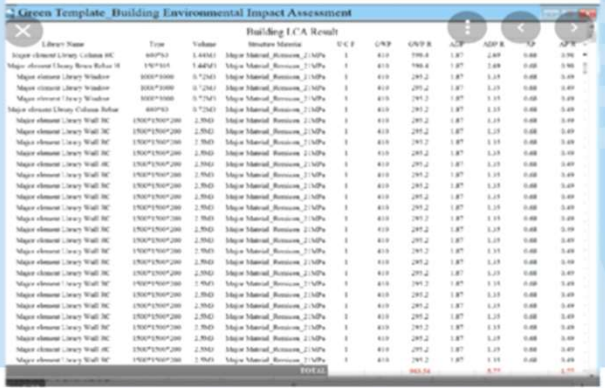
Mapping/Plot different easements using layers

Import 3D Base Map from the Broward County Data

Show SBBC Property Lines using Polygons



Asset Management

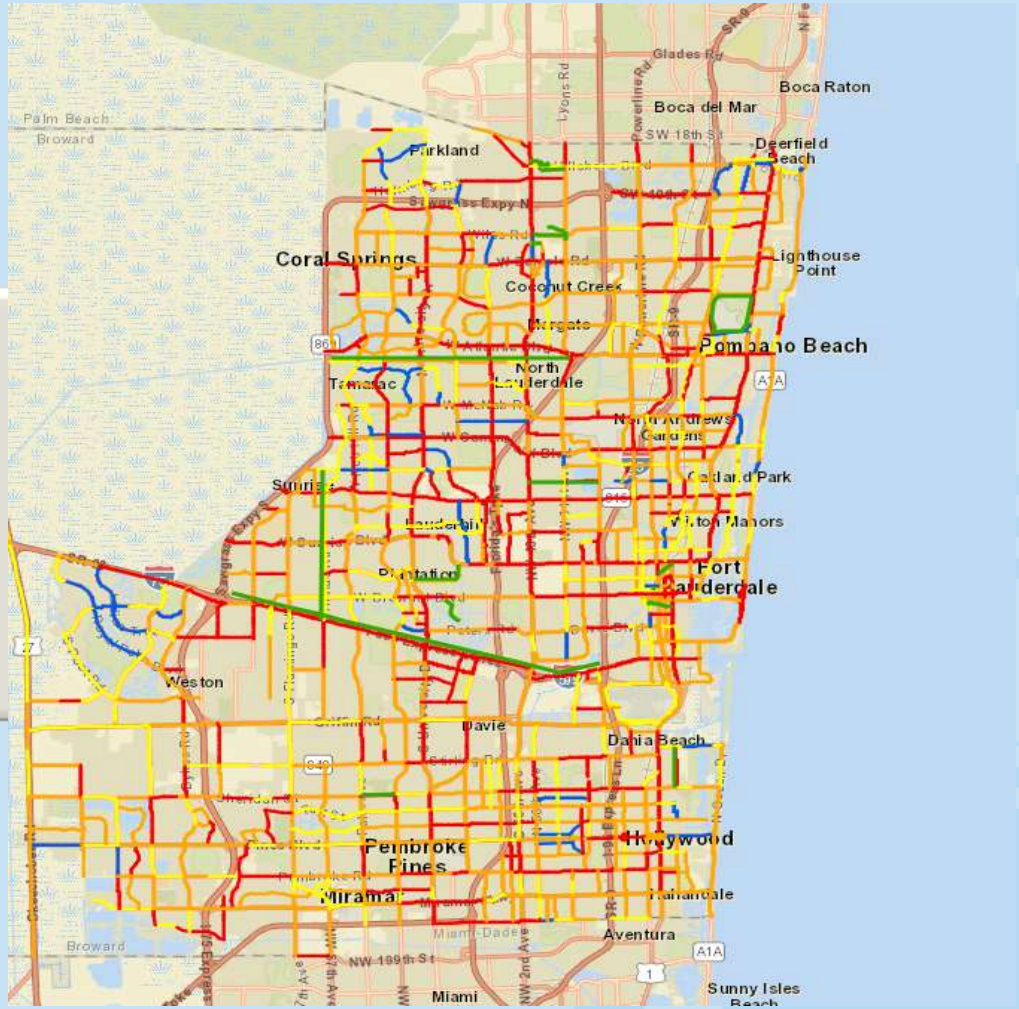


Spotlight Specific SBBC Sites

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

OTHER PLANNED USE OF ARC GIS PRO

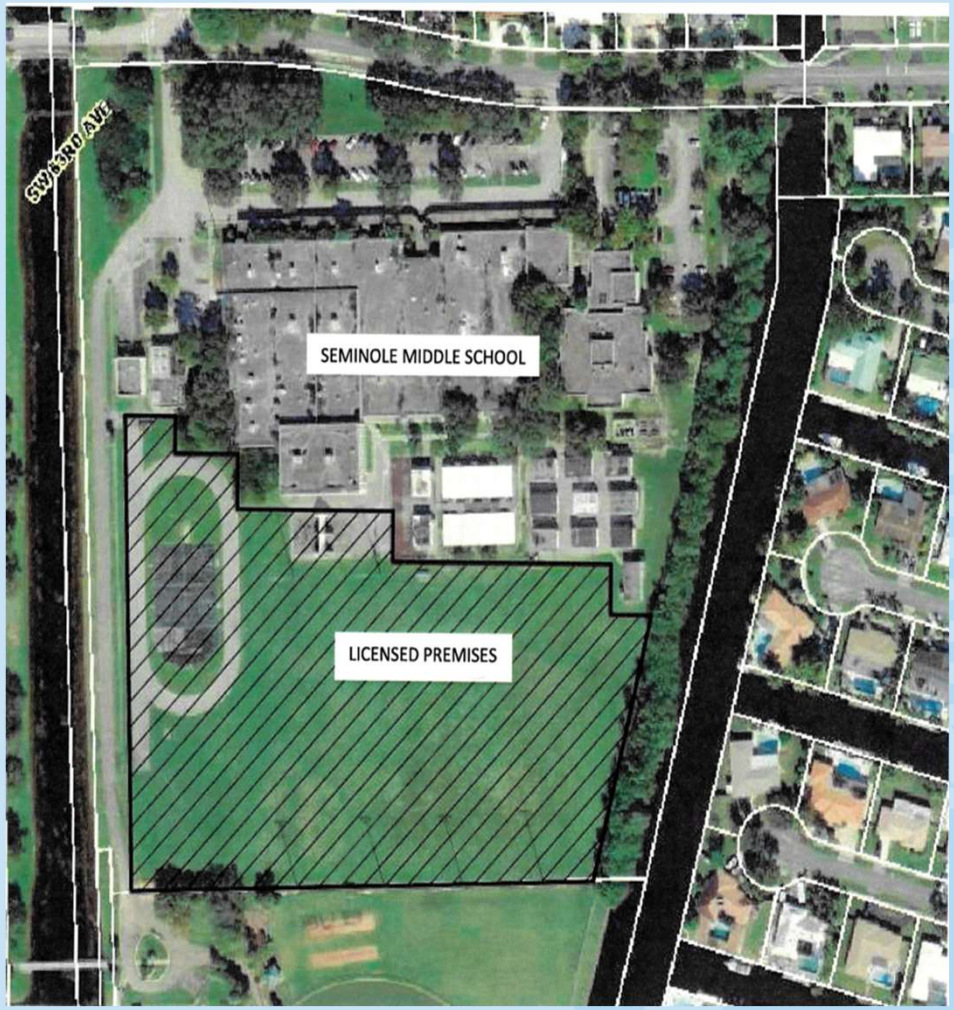
Resource For Growth Management:
During the review of proposed development applications (land uses, rezoning, plats and site plans) to determine the availability of sidewalks and lack thereof.



MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

OTHER PLANNED USE OF ARCGIS PRO

Graphical depiction of exhibits in Real Estate interlocal agreements with municipalities, local government lease of recreational areas on school grounds



MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

TIMELINE

March 31, 2023 - Completed organizing all available easement data

Late 2022 – Selected FP&RE Department staff received basic training on ArcGIS Pro
Spring 2023 – Selected FP&RE Department staff received advanced training on ArcGIS Pro

Currently- ArcGIS Pro is being utilized in the FP&RE Department for selected Real Estate Department functions.
Summer 2024- Plan to utilize as components in graphically depict features in related exhibits (i.e. recreational areas)

Late Fall 2023 - The FP&RE Department is planning to use ArcGIS Pro for Growth Management review of development applications to detect available or missing mission sidewalk to school campus.

PART 3

OTHER POTENTIAL BENEFITS/BIG PICTURE

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES:

FROM 2D CAD TO 3D BIM REVIT/3D GIS

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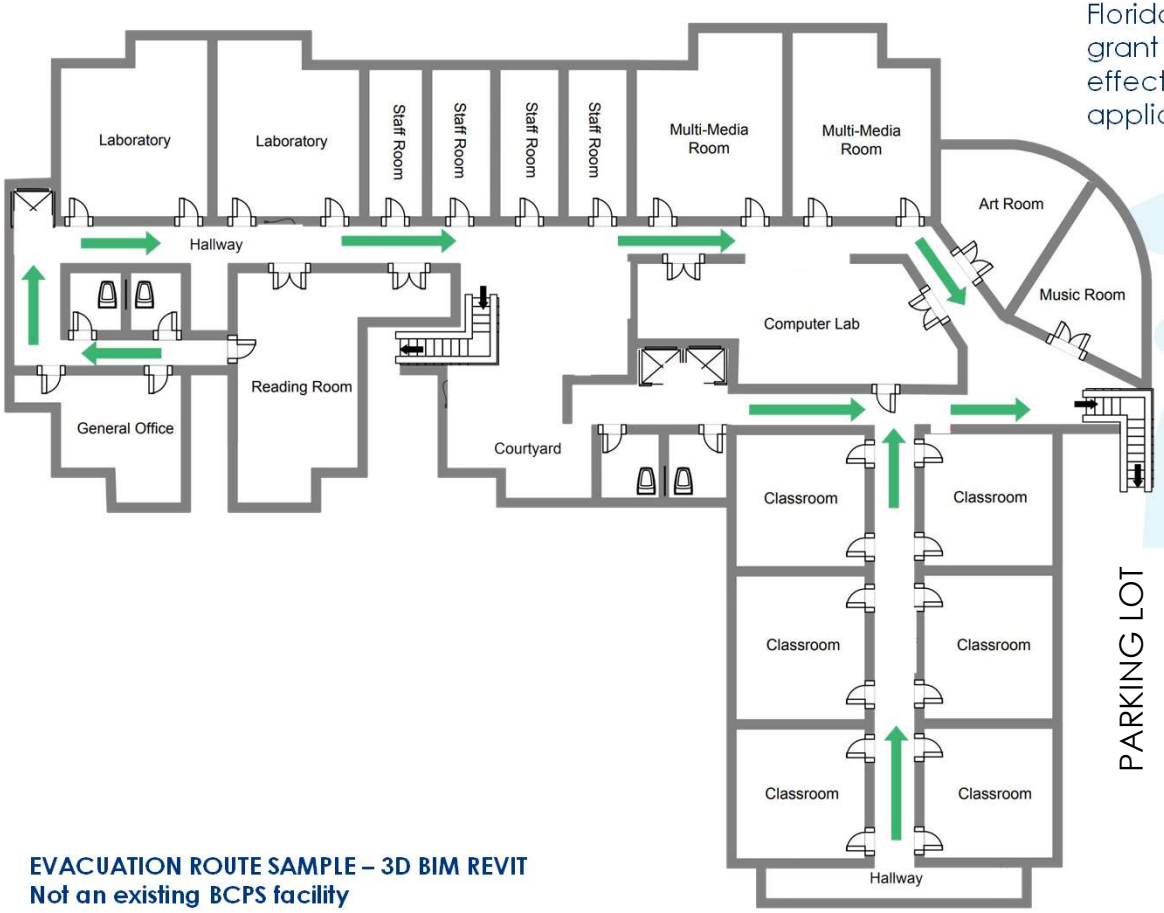
OTHER POTENTIAL BENEFITS/BIG PICTURE

- Could allow BCPS to process and submit FISH data which is affiliated with pertinent school's 3D BIM Revit model, to the Florida Department of Education (FDOE)
- As applicable (***including for plant survey purposes***), may enhance the ability of the FDOE to remotely access, view, and walk-thru a BCPS school or administrative facility, without physically visiting and be present at the facility
- Could allow for compliance with the recently passed provisions of HB 301 (Emergency Response Mapping Data for Public School Buildings)
- Other yet to be identified related benefits

MODELING OF BROWARD COUNTY PUBLIC SCHOOLS FACILITIES: FROM 2D CAD TO 3D BIM REVIT/3D GIS

EMERGENCY RESPONSE MAPPING DATA - INTERIOR



EVACUATION ROUTE SAMPLE – 3D BIM REVIT
Not an existing BCPS facility

With the recent approval of **HB 301**, school districts in Florida now have access to Department of Education grant funds for school mapping. While the legislation's effective date is July 1, 2023, the Grant will be open for applicants for a prolonged period.

REQUIREMENTS FOR THE EMERGENCY MAPPING DATA

- Requires the data to be provided in an electronic or digital format.
- Is compatible with software platforms in use by the specific school for which the data are provided.
- Is provided in printable format and if requested be in a digital file format.
- Oriented true north.
- Overlaid on current aerial imagery.
- Contains site-specific labeling that matches the structure of school buildings; room labels, hallway names, external doors, stairwells, location of hazards, AED, key boxes, etc.
- Site-specific labeling that matches school grounds; parking areas, athletic fields, surrounding roads, etc.
- Be overlaid with gridded x/y coordinates.

QUESTIONS?