Cadastre Development and Standardisation in Singapore

SOON Kean Huat

LIMITED LAND • UNLIMITED SPACE
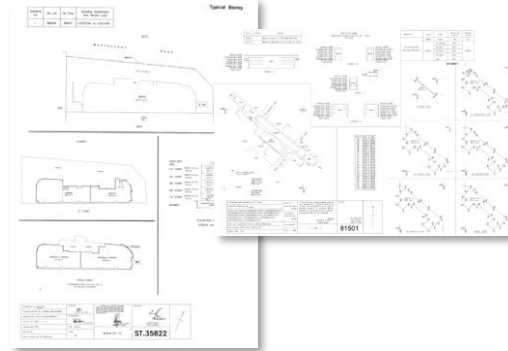
Innovations in Cadastre

Before 2004 → **2004** → **2018** → **Beyond 2024**

Paper Plan

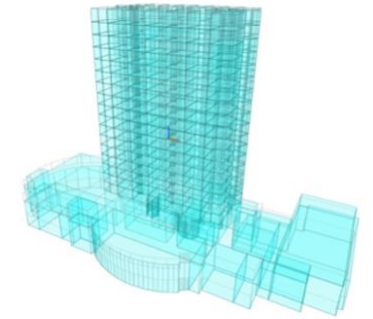- **Coordinated Cadastre with SVY21 (2004)**
- **Image Plan (2005)**

Digital Cadastre with SG LandXML

3D Cadastre in BIM (IFC-SG)

Cadastral Survey Management System (CSMS) (commissioned on 17 Sept 2018 – 5th anniversary)

Cadastral Survey Management System (CSMS)

Registered Surveyors' Portal

- Pre-validation
- Plan Generation
- Surveyor Workspace

SG LandXML

SLA Intranet for Inspection and Approval

- Cadastral Workflow
- Provenance GIS
- Inspection Officer Workspace
- Fully Digital
- Cadastral Validations

Benefits

SG LandXML

Registered Surveyors

SG LandXML Specification

Submit for approval

Cadastral Survey Management System

- Cadastral Rules Validations
- Highly Automated
- Data Integrity Checks
- Online Plan Generation
- Quick Response

Cadastral Database

Cadastral Plans

CP89729
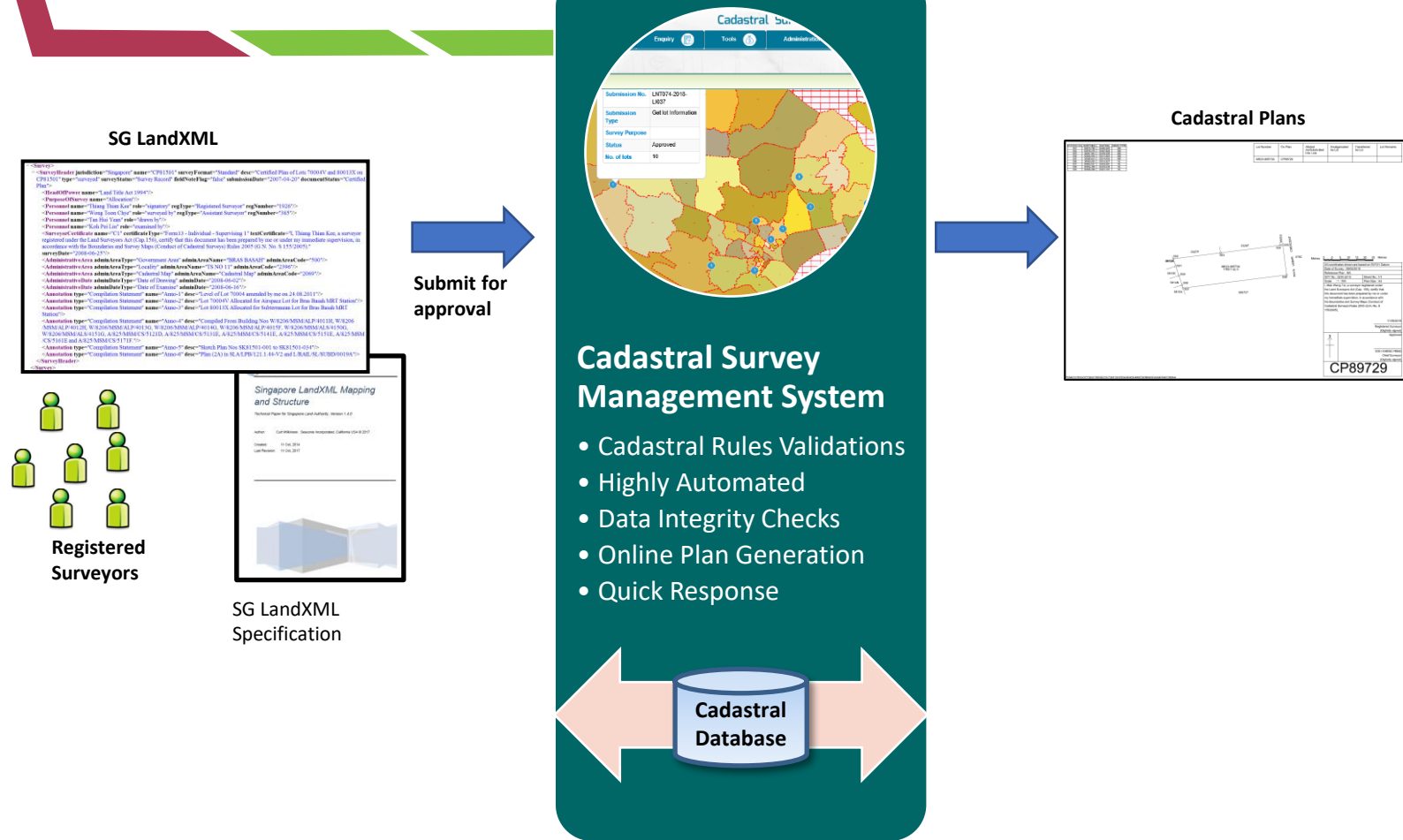
- Faster issuance of Titles
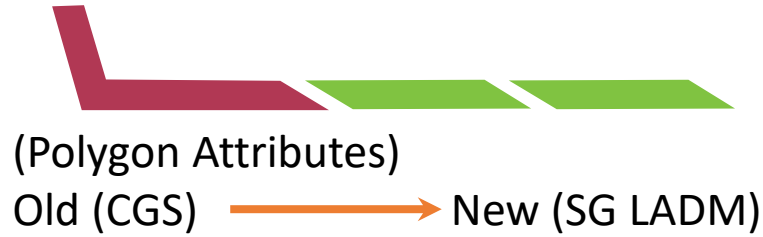- Improves the quality of plan data
- Automates digital plan examination process
- Reduces submission errors due to missing or incorrect information
- Reduces duplication of data
- Saves time because data does not need to be re-entered
- Enhances the accuracy of the Cadastral database
- Provides a standard data exchange format for sharing and collaboration
- Single source of truth from SG LandXML

Managing Provenance of Cadastral Lots through VersionedObject (Temporal)

*All lots are linked with Parent-Child Relationship, which can be obtained from LIMS as the only source.

Allocated Tier

Once a child lot is created in the Allocated Tier, the existing lot in the Allocated Tier will be moved to the Development Tier.

The Development Tier has 5 Layers: Development Approved Lots, Development non-Approved Lots, RT Lots, Caveat Lots and Dummy Lots. These layers are exclusive, meaning that a lot exists in one layer will not appear in other layers in the Development Tier

Development Tier

Any lots in the Development Tier, once approved, will be moved to the Approved Tier

Lots in the Development Tier that do not become approved lots will move to the History Tier, e.g. Dummy Lots

Approved Tier

Any lots in the Approved Tier that their associated CP Plan is no longer current, will be moved to the History Tier

History Tier

Allocation-of-Lot-Numbers Lots

Allocated Tier only has one layer in which each parcel lot is associated with the most current lot number. A new cadastral lot will be created in this layer when a new lot number is allocated during the allocation of lot number stage.

Development Approved Lots

The Development Approved Lots layer contains Approved lots that are being taken certain action (e.g. subdivision)

Lots are linked with Parent-Child Relationship

Development non-Approved Lots

Lots are linked with Parent-Child Relationship and Order IDs

The Development non-Approved Lots layer contains lots that are neither Approved lots, RT lots, Caveat lots nor Dummy lots, i.e. the "normal" lots before approval. In other words, most lots will come to this layer, if the lot is not made live, does not have RT or CP Plan number, or is not a dummy lot.

Lots are linked with Parent-Child Relationship

RT Lots

Lots are linked with Parent-Child Relationship and Order IDs

The RT Lots layer contains lots that have RT Plan Numbers. Once a RT Plan is approved, the respective lots will be moved to this layer

Lots are linked with Parent-Child Relationship

Caveat Lots

Lots are linked with Parent-Child Relationship and Order IDs

The Caveat Lots layer contains live lots. Once a lot is made live, the lot will be moved to this layer

Lots are linked with Parent-Child Relationship

Dummy Lots

Lots are linked with Parent-Child Relationship and Order IDs

The Dummy Lots layer contains lots that have lot numbers but do not even exist

Submitted Lots

The Submitted Lots layer contains lots that are submitted by RSs to CSMS. Once the RS submitted his job, the respective lots will be populated here. The layer is mainly used for field survey checks.

Approved Lots

The Approved Lots layer contains all lots that are approved, i.e. have CP Plan Numbers. Once a CP is approved, the respective lots will be moved to this layer

History Lots

Lots are linked with Parent-Child Relationship and Order IDs

The History Lots layer contains old lots that are no longer used/valid or no longer under certain action. These include RT lots, non-Approved lots or Caveat lots that have new CP number, Approved lots that are dead, dummy lots and unused lots. These lots should be retrievable for later investigation.

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Data Mapping from Legacy to SG LADM

(Polygon Attributes)

Old (CGS) → New (SG LADM)

CGS Field	SG LADM (class attribute)
OBJECTID	
OBJECT_ID	
LOT_KEY	SG_Lot lotNumber
SUB_TYPE	SG_Lot approvalState
TABULATE	
MKTS	SG_Lot surveyDistrict or LA_SpatialUnit suID
MKTS_NUMBER	
LOT_NUMBER	
CHECK_DIGIT	
BLOCK	
CP_NUMBER	SG_Lot cpNumber
SVYQTY	see discussion of quality in Versioning
PO_AREA	SG_Lot poArea or LA_SpatialUnit area
AREA_TYPE	SG_Lot isScaled
LOT_TITLE	SG_Lot title
SVY21	SG_Lot originalDatum
LAST_UPD_BY	VersionedObject or SG_Point lastUpdatedBy
LAST_UPD_DT	VersionedObject or SG_Point lastUpdatedDate
REMARKS	SG_Lot remarks
SHAPE	
GLOBALID	LA_SpatialUnit extAddressID or SG_Lot globalID

LA_SpatialUnit

«featureType»
SG_Lot

+ lotNumber: CharacterString
+ type: SG_LotType
+ class: SG_LotClass
+ surveyDistrict: Oid
+ approvalState: SG_ApprovalState
+ cpNumber: CharacterString
+ title: CharacterString
+ originalDatum: SG_DatumType
+ remarks: CharacterString
+ areaDescription: CharacterString
+ globalID: long
+ balance: boolean = false

::LA_SpatialUnit
+ extAddressID: ExtAddress [0..*]
+ area: LA_AreaValue [0..*]
+ dimension: LA_DimensionType [0..1]
+ label: CharacterString [0..1]
+ referencePoint: GM_Point [0..1]
+ suID: Oid
+ surfaceRelation: LA_SurfaceRelationType [0..1]
+ volume: LA_VolumeValue [0..*]

::VersionedObject
+ beginLifespanVersion: DateTime
+ endLifespanVersion: DateTime [0..1]
+ quality: DQ_Element [0..*]
+ source: CI_ResponsibleParty [0..*]

(Point Attributes)

Old (CGS) → New (SG LADM)

CGS Field	SG LADM (class attribute)
OBJECTID	
POINT_KEY	SG_Point pID
SUB_TYPE	SG_Point approvalState
XCOORD	SG_Point location x or x
YCOORD	SG_Point location y or y
PT_FLAG	SG_Point MethodType
PT_TYP	LA_Point monumentation
CV_NO	
CV_PAGE	
FIELD_BOOK	
FIELD_BOOK_PAGE	
STATION_NO	SG_Point stationNumber
CM_NO	
OBJECT_ID	
LAST_UPD_BY	VersionedObject or SG_Point lastUpdatedBy
LAST_UPD_DT	VersionedObject or SG_Point lastUpdatedDate
REMARKS	SG_Point remarks
SHAPE	
GLOBALID	LA_Point extAddressID

LA_Point

«featureType»
SG_Point

+ approvalState: SG_ApprovalState
+ pointMethod: SG_PointSurveyMethodType
+ stationNumber: char
+ monumentation: SG_MonumentType
+ extAddressID: ExtAddress

::LA_Point
+ interpolationRole: LA_InterpolationType
+ monumentation: LA_MonumentationType [0..1]
+ originalLocation: GM_Point
+ pID: Oid
+ pointType: LA_PointType = control
+ /productionMethod: LI_Lineage [0..1]
+ transAndResult: LA_Transformation [0..*]

::VersionedObject
+ beginLifespanVersion: DateTime
+ endLifespanVersion: DateTime [0..1]
+ quality: DQ_Element [0..*]
+ source: CI_ResponsibleParty [0..*]
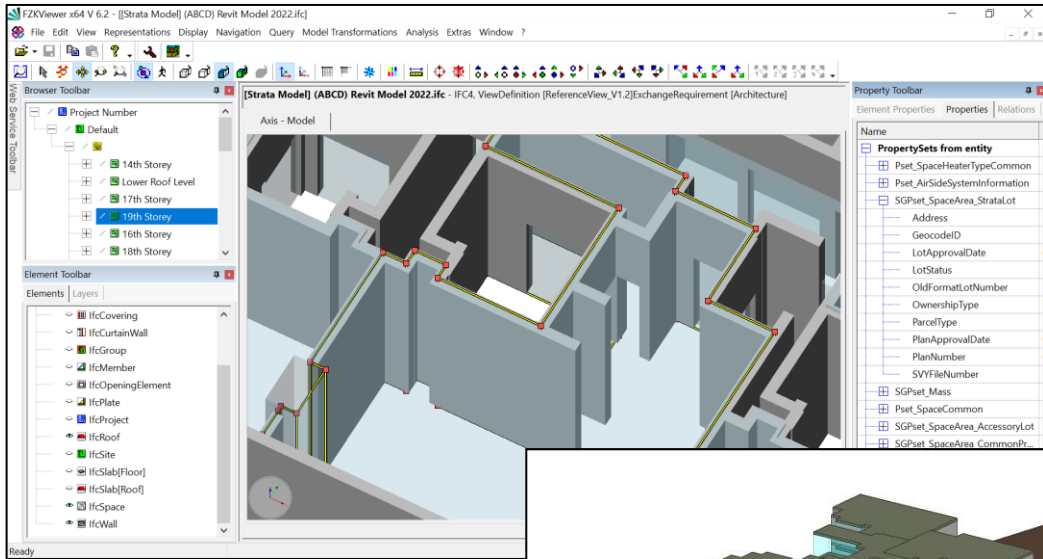
Object-based Data Modeling (Spatial)
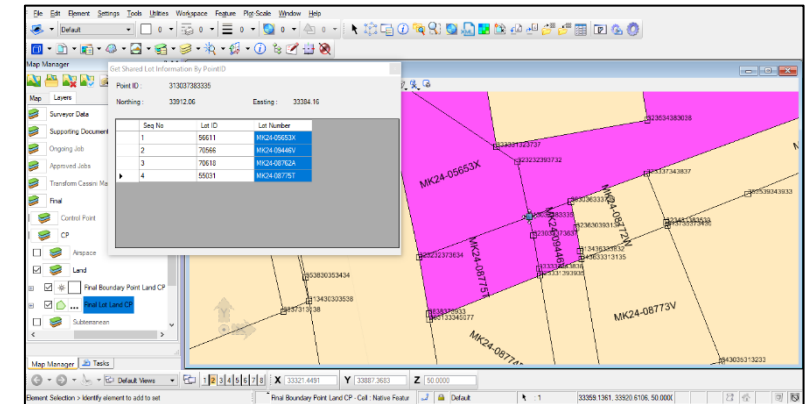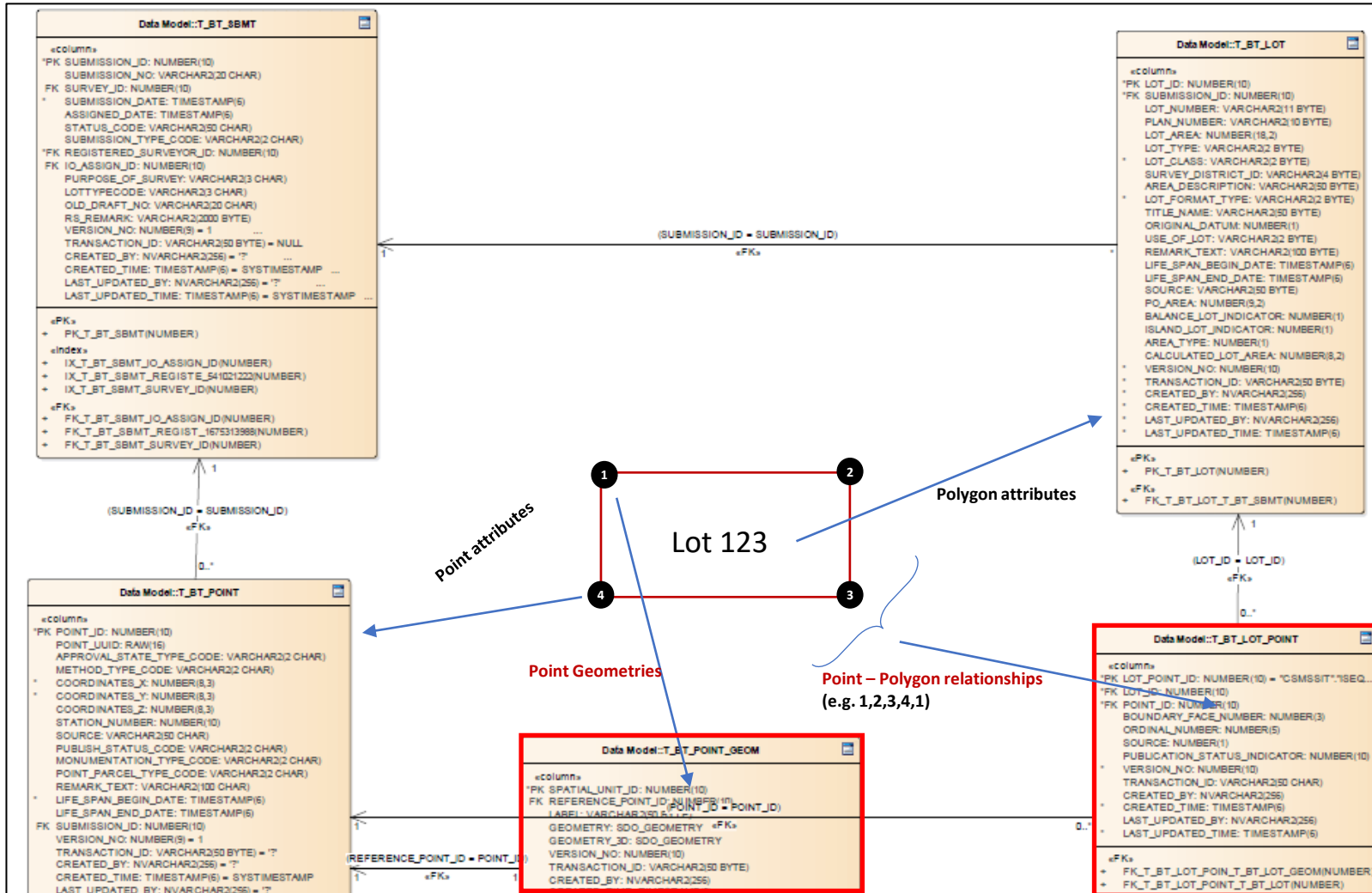
Only point geometries are stored. Queries can be made across different geometry types (point and polygon)
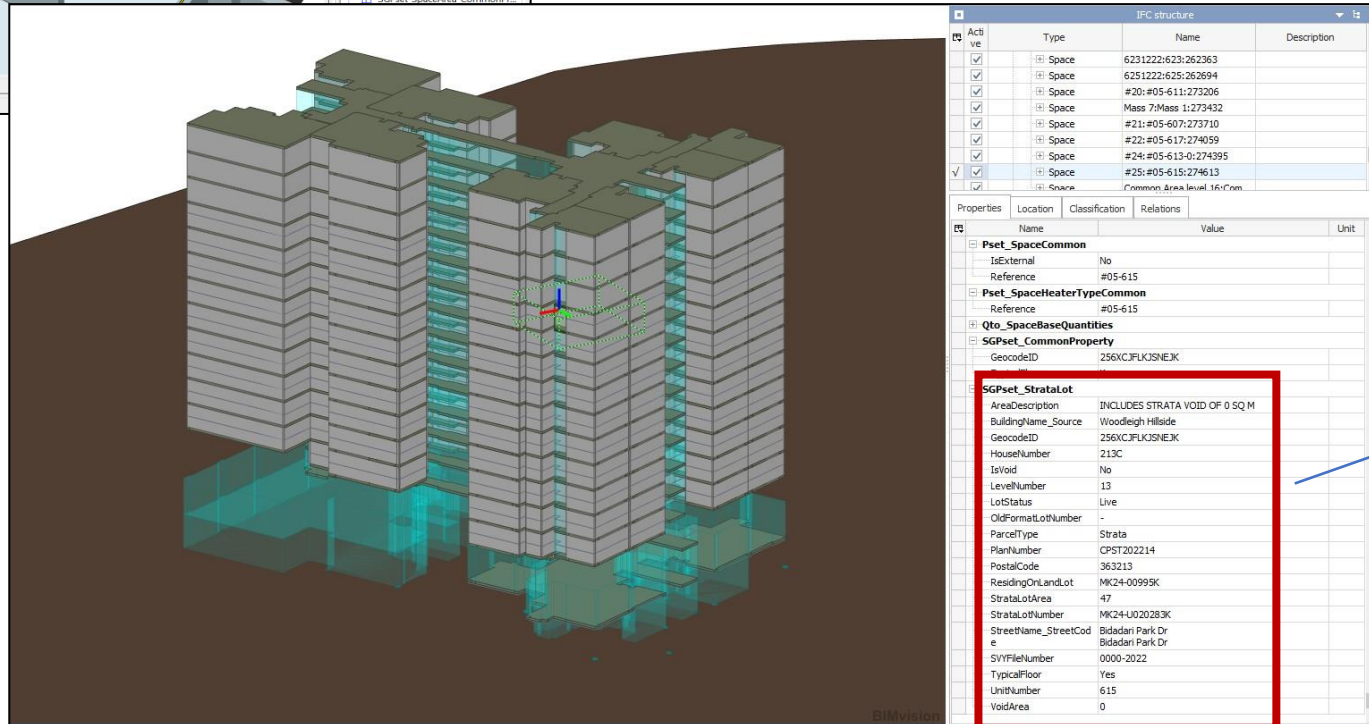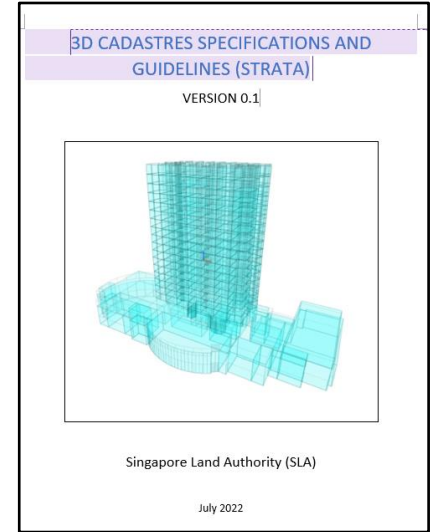
Road Map to 3D Cadastre

Focus Group Discussions → **Pilots/Prototyping** (Now) → **CSMS Development and Testing**

Registered Surveyors	*Brainstorming Ideas from Industry, Contribute Samples, Design, Test*
SLA	*Brainstorming Ideas from Regulatory, Contribute Samples, Design, Develop, Test*
Software Vendors	*Show and Tell, Prototype, Design, Develop, Test*
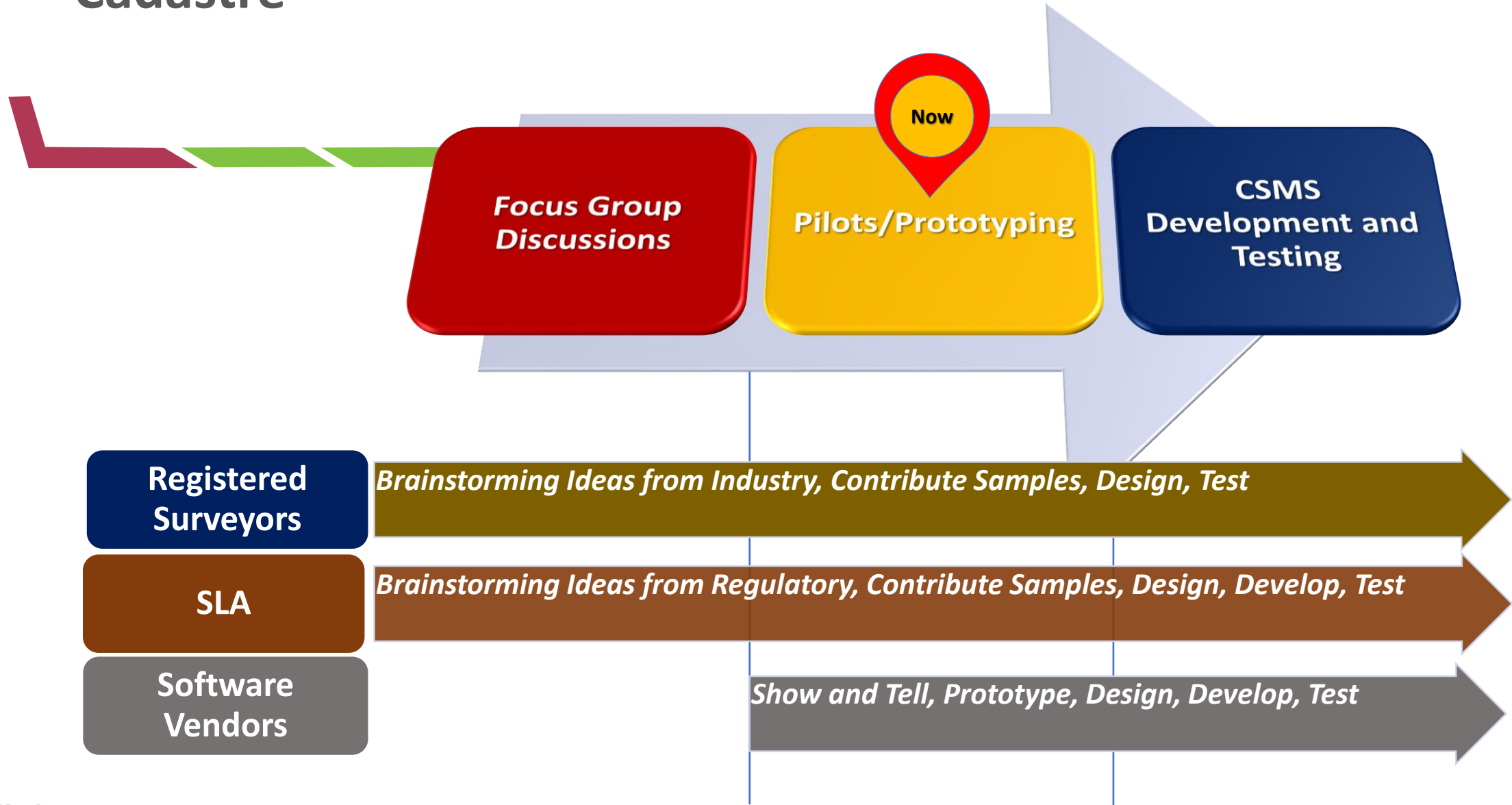
3D Strata Modeling in IFC-SG

Visualisation of 3D Strata Boundaries in Building Information Model (BIM)

3D Cadastre Specification and Guideline (Ongoing)

IFC - SG

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