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Change Request #:	67
Assigned OGC Document #:	10-050
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Document Name/Version:	*City Geography Markup Language (CityGML) Encoding Standard / 1.0.0
OGC Project Document:	*08-007r1

If this is a revision of a previous submission and you have a Change Request Number, then check here: Enter the CR number here:

Enter the Revsion Number that you are revising here:

Title:	*Surface property specification
Source:	*Special Interest Group 3D (SIG 3D)
Work item code:	
Category: 9	* B (Addition of feature)

## Reason for \* change:

The current Appearance implementation heavily favors visualization data (colors), even though the specification states "Appearances are not limited to visual data but represent arbitrary categories called themes such as infrared radiation, noise pollution, or earthquake-induced structural stress". All these different categories or surface properties require differing data representations, which are not possible to convey in a straightforward and well-defined manner in CityGML 1.0 and cannot be made explicit unless a specific ADE is defined. In particular, there is no obvious way to specify "non-color" materials.

The current specification only provides the theme identifier for surface property description with the argument that "mixing of themes or their usage is not defined within CityGML and left to the application". Consequently, applications and users need to guess or

know from the theme identifier what kind of data to expect for a specific surface property before being able to use it. An additional formal and textual description would enable any application or service - to present the user with a more informed summary of a CityGML file's contents, - to check surface property data for consistency (conformance to formal description), - to provide generic processing services (e.g., color-coding of scalar data through a look up table), - to analyze surface property data using standard analysis functionality (e.g., min/max/average), or - to visualize arbitrary surface properties through color coding or other visualization techniques. A sample formal description is the "field" descriptor used in the OGC Web Coverage Service (WCS) or the definition of "bands" found in many image format specifications. This change request does not attempt to define semantics of surface

This change request does not attempt to define semantics of surface properties nor affects the definition of ADEs to add semantically rich surface properties. It aims at enabling interoperable exchange of not only color but arbitrary surface property data and its use in generic analysis and visualization systems.

A sample use case is the noise immission simulation presented in the CityGML specification. The NoiseADE enables the storage of simulation input within CityGML. With the envisioned changes, the simulation results could also be stored directly - and without the help of an ADE - in CityGML as surface property consisting of scalar double values using "dBA" as unit of measurement. A generic visualization system then could generate a noise map similar to the one shown in Fig. 64 (p. 205 of OGC doc. 08-007rl) with an interactive color mapping and apply advanced visualization and analysis techniques such as thresholding or peak detection directly to the untransformed original data. Similarly, other analyses that result in surface properties, such as solar potential analysis, could provide their detailed results in an interoperable and accessible form as CityGML for further use or visualization.

## Summary of \* change:

1. Add an optional data descriptor to the class app:Appearance with the following or similar content: - the number of bands (for supporting vector-valued quantities; required), - the data type (boolean, integer, double; applies to all bands; required), - an explicit NULL value (per band or as vector; optional), - the range (e.g. min/max value; applies to all bands; optional), - the unit of measurements (applies to all bands; optional), - a textual description (optional), and - a name and textual description per band (e.g., "R", "G", and "B"; optional). For CityGML 1.1, the data descriptor has to be made optional in order to not break backwards compatibility with CityGML 1.0. However, in the next major revision of CityGML the data descriptor should be made mandatory. This could already be indicated in the revised version 1.1 of the specification document. 2. Add a new class app:Material derived from app:\_SurfaceData, containing a target relation identical to app:X3DMaterial (Fig. 13) and a choice of a doubleOrNullList, integerOrNullList, or

	booleanOrNullList to represent a value.
	3. Add a new optional element app:borderValue to class app:_Texture as choice of a doubleOrNullList, integerOrNullList, or booleanOrNullList to complement the element app:borderColor. No other changes to the texture classes are necessary as the actual data is contained in the image. The descriptor should be sharable across different Appearance objects.
	The outlined changes restrict surface properties to consisting of uniform scalar or vector quantities of simple types. Complex surface properties (e.g., consisting of date values, strings, or complex custom types) are not part of this change request as those cannot be supported in a straightforward manner for textures. The authors are not aware of any image formats or other standardized means for transporting such complex data in a "gridded" form. Aggregations of multiple scalar or vector quantities (coverage terminology: fields) need to be separated into multiple individual surface properties.
	In addition, the authors would like to initiate a discussion about the definition of an external codelist (gml:dictionary) of well-known surface properties, such as "RGB color", "RGBA color", "thermal infrared", "normal perturbation", "illumination", or "albedo", and its possible use as additional semiformal surface property descriptor. Such a descriptor could further guide the use of surface property data.
	This extension can be realized without breaking backwards compatibility.
Consequences if not approved: 9	Multiple solutions could emerge for handling the requirements, which leads to a lack of interoperability. Generic processing and use of appearances for visualizations is impeded.
Clauses affected:	* 9, 9.2, 9.3, 9.4, A.2
Additional Documents affected: 9	
Supporting Documentation:	
Comments: 9	
Status: 🥹	Assigned
Disposition: 9	Reffered