Improving the Accessibility of the Swiss Cadastral Web Map Service – a Visualization Redesign

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Abstract:

The representation model of Switzerland's official cadastral Web Map Service (WMS) was defined in 2010 (see Figure 1 top row). The implementation of the new geodata model of the cadastral data (swisstopo 2025) provided an opportunity to revise its visualization as WMS. The representation approach from 2010 was derived from traditional hand-drawn cadastral plans and relied on outlines and linear. The presented redesign aimed to establish a purpose-oriented visualization that aligns with current technical and legal requirements. The primary objective was to develop a modern representation model for official cadastral data that ensured clarity and usability. At the same time, the redesign had to respect established conventions to maintain recognizability and user acceptance, while explicitly avoiding geometric generalization of the underlying data. The resulting representation model is not a single solution but comprises multiple variants tailored to different use cases and requirements. These include (see Figure 1 bottom row): (i) a black-and-white variant optimized for overlay with thematic maps, (ii) a grayscale variant optimized for users with color vision deficiencies, (iii) a dark mode variant addressing emerging user interface preferences, and (iv) a color variant that provides the highest information density while maintaining readability under conditions of impaired color perception (cf. Jenny & Kelso, 2007). The design process was backed up by recurrent discussions with expert users, and the final draft is currently under review by experts from different domains using the WMS as part of an official consultation process.

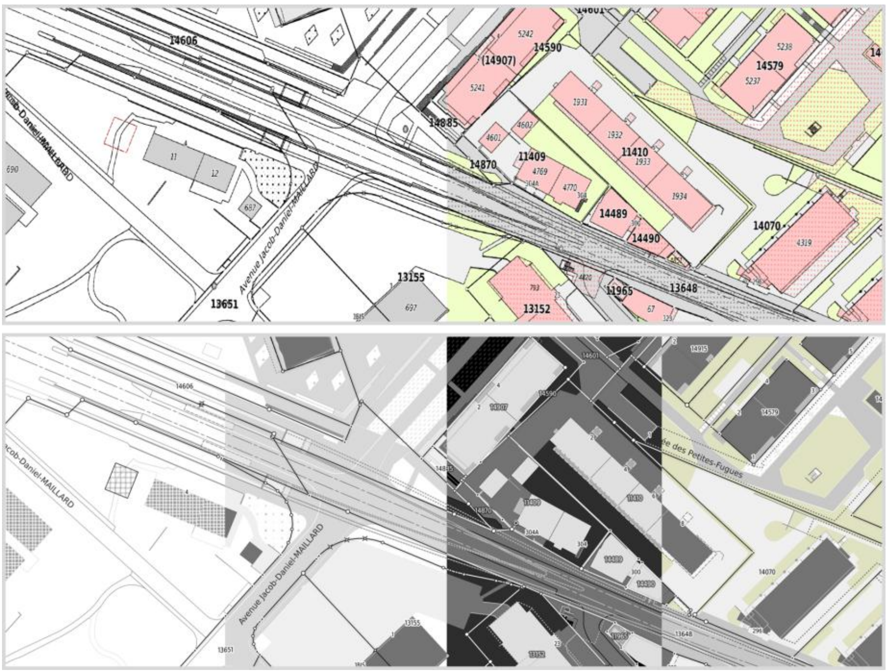

Figure 1: top row: Former representation of Switzerland's official cadastral WMS (situation plan, black & white (left), colored (right), source: Infrastructure cantonale de données géographiques (ICDG), 03.03.2026), bottom row: redesigned cadastral WMS (from left to right: black & white, grayscale, dark mode (grayscale), colored).

A key focus of the redesigned representation model was the optimization of readability and accessibility. In cadastral maps, it is essential that point, line, and polygon features can be clearly distinguished even when superimposed. This requires sufficient contrast between background elements (particularly planar features) and foreground elements such as

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lines and points. The cadastral WMS comprises more than 100 object classes at map scale 1:1'000. To guide the map reader through the complex image arising from the multitude of overlapping layers, we defined a semantically informed visual hierarchy with three main groups of object classes (Fig. 2): objects of the natural and agricultural land cover, objects of the built environment, and objects of the intangible cadastral infrastructure, i.e. borders and planned buildings. The first group of objects form the background of the cadastral map. They are at the base of the visual hierarchy. They are represented using point-pattern fillings in light grey values. The "intangible" object classes are at the top of the visual hierarchy. They are represented in black. In between, the objects are layered mostly according to their actual spatial superimposition and symbolized in decreasing lightness from background to foreground.

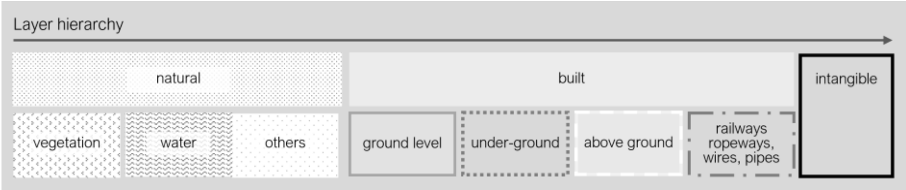

Figure 2: Semantically guided visual hierarchy and signature design of the redesigned representation model for the Swiss cadastral WMS.

From an accessibility and application-oriented perspective, it is necessary that map symbols remain interpretable without relying solely on differences in hue, which is relevant for users with color vision deficiencies. Contrasts between symbols were achieved through variation in visual variables, including lightness (grayscale), pattern, and text. Ideally, multiple variables were varied simultaneously rather than relying exclusively on tonal differences. Planar objects are now represented using fills, not outlines. The natural land cover is symbolized using point-pattern fills, while solid fills are used to represent objects of the built environment. Line type is used to differentiate objects underground (dotted lines) and objects above ground (dashed lines) from the objects at ground level. In line with the established conventions, different types of dot dashed lines are reserved for railways, ropeways, pipes and wires. We reduced the number of different line types to maximize the contrasts between the signatures. For planar features, the number of distinguishable grayscale levels was limited to approximately five to seven (Brewer & Pickle, 2002; Campbell et al., 2024), with intervals based on perceptual rather than linear differences (Stevens, 1957). These principles applied similarly to color scales, where variations in color and lightness had to ensure sufficient perceptual separation between classes. The newly developed dark mode WMS is not a linear inversion of the grayscale variant, but its gray levels are adjusted to the use of a dark background and to maintain the same, semantically guided visual hierarchy. To maintain the legibility of the WMS across the scales from 1:178 to 1:8'929, we implemented object class-specific signature generalization. Selective down-scaling, omission, but also amplification of signatures of smaller objects that are equally part of the national maps which follow at smaller scales, ensure a visually fluid transition between the cadastral and national WMSs. Minimized signatures for cadastral object classes at intermediate map scales, on the other hand, facilitate the localization of and the drilling-down to plot numbers and border points from small map scales.

The feedback we have received so far from experts in various fields has been positive, and we are now awaiting the results of the consultation process.

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