Calculating the apocalypse : the unexpected career of the Swiss nuclear bunker

Calculating the Apocalypse: The Unexpected Career of the Swiss Nuclear Bunker

Silvia Berger Ziauddin

Imagine a nation with security cells in every home. Five decades ago, this vision materialized in Switzerland. At the height of Cold War saber rattling in the early 1960s, a federal construction law obliged the Swiss authorities to build 360,000 private nuclear shelters, the majority of them in the basements of family homes. [1] To this day, 12 billion U.S. dollars have been invested in constructing highly standardized nuclear shelters for the population. By 2006, the protection ratio reached 114 percent, meaning Switzerland currently has more protective spaces than inhabitants. [2] The survival infrastructure in the private sphere not only left massive scars in the country's soil, however; nuclear bunkers made in Switzerland have had a global impact. Since the 1970s, design codes and bunker technology from the alpine republic have represented a global benchmark from the United States to Saudi Arabia. And Swiss shelter know-how is still in demand. The ever-growing "survivalist" movement, for example, heavily relies on Swiss ventilation technology when equipping doomsday shelters. [3] How did a country that defined itself as neutral and never took center stage in the Cold War's recurrent international crises become a hub for bunker design and technology? How was the expertise in the alleged "periphery" accumulated? And how did it materialize into concrete and generate such international momentum?

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1 Bundesamt für Bevölkerungsschutz, ed., *Jubiläumsbuch 50 Jahre Schutz und Hilfe* (Bern: Bundesamt für Bevölkerungsschutz, 2013), 71.

2 Peter Amstutz, "Wie Murmeltiere ab in den Schutzraum," *CD Sicherheits-Management* 32, no. 3 (2008): 13–15, here 15.

3 Sophie Schimansky, "Bunker-Boom: Das Geschäft mit der Angst," *NZZ am Sonntag*, September 24, 2017.

The Emergence of Swiss Vertical Defense

There have been few peacetime eras in which the specter of war was so vividly present in so many people's minds as the 1950s and early 1960s. In Switzerland, four "hot" phases significantly exacerbated the feeling of being under threat and proved to be catalytic for the emergence of the Swiss system of civil defense: the Korean War of 1950 to 1953, the Suez and Hungarian crises of 1956, and the Berlin and Cuban crises of 1961 and 1962 respectively. [4] During the Korean crisis, military air-raid protection corps were established in support of the population, and the Federal Council required property owners to install air-raid shelters in new buildings to protect against shrapnel and debris. Referenda held after the dual crises of 1956 put civil defense and the right to civil protection on a constitutional basis and assigned responsibility for both to the civil authorities. The construction of the Berlin Wall and the Cuban Missile Crisis in turn forged the legislative anchors of civil defense. The Swiss parliament in 1962 voted in favor of the first phase of the new civil defense legislation, covering the

4 On the legal and institutional evolution of the Swiss system of civil defense outlined in this paragraph, see Yves Maik Meier and Martin Meier, "Zivilschutz: Ein Grundpfeiler der Schweizer Landesverteidigung im Diskurs," *Schweizerische Zeitschrift für Geschichte* 60, no. 2 (2010): 212–36.

organizational and service requirements for civil defense. In 1963, it passed the Federal Shelter Construction Law, which foresaw the installation of modern nuclear shelters for all new buildings in communes with over 1,000 inhabitants. In 1971, this provision was extended to all municipalities. Each inhabitant of Switzerland, including registered refugees and immigrant laborers, would receive a protective space to which the public sector contributed at least 70 percent of the cost. [5]

Switzerland's endeavor to roll out a blanket system of vertical defense is properly understood only if considered against the country's guiding principles. Particularly pertinent is a concept propagated since the early 1950s by the government and the military alike; namely, that a "total war" necessitates a "total national defense." [6] Consequently, not only military but also civil forms of defense were enormously expanded. Another motive for the defensive efforts was the belief that Switzerland was a "special case." This mindset, particular to national security officials, had been reinforced by the belief that the Swiss had survived the vicissitudes of the Second World War unscathed thanks to their own determination and strong deterrents—the latter symbolized by the Swiss militia army, which was based in a highly fortified alpine bastion, the so-called "redoubt." [7] The shared memory of being spared from an attack by Nazi Germany and mythologies flourishing around the redoubt fostered strong support for civil defense. In addition, values perceived as "Swiss" that strengthened the politico-cultural movement of "spiritual national defense" played a decisive role: love of freedom, independence, neutrality, military readiness, and the rejection of everything foreign. This "cultural fortification system" served to encourage a "hedgehog" mentality and legitimized both cultural and political isolationism. [8] Switzerland morphed into an inwardly highly-integrated defense community, which also left a strong legacy for civil protection. The fully self-sufficient "hedgehog" should be formed up again to dissuade potential attackers. [9] Bunkers not only fit perfectly into this picture of a fortified country whose citizens would never submit to subjugation. Advocates of the idea also embraced the redoubt myth by promoting private shelters as "citizen redoubts" that replicated the alpine military fortress. [10] Furthermore, the idea of a "survival island" for the middle-class family, that "primary cell of democratic society," resonated well with the notion that Switzerland was a chosen model republic, apt to survive as an isle of the blessed in a sea of destruction and death. [11]

5 Bundesamt für Zivilschutz, *Zivilschutz Konzeption 1971* (Bern: Bundesamt für Zivilschutz, 1978); "Bundesgesetz über die baulichen Massnahmen im Zivilschutz," *Zivilschutz* 10, no. 6 (1963): 127–29, here 128.

6 Bernhard Degen, "Die totale Verteidigungsgesellschaft," in *Krieg*, eds. Christoph Maeder, Ueli Mäder, and Sarah Schillinger (Zurich: Seismo, 2009), 89–105.

7 On the genealogy of the idea of a fortified "redoubt" in the Alps, see Rudolf Fuhrer and Marc Hamel, *Réduit I: Militärgeschichte zum Anfassen* (Zurich: Au, 2007).

8 Jakob Tanner, "Die Schweiz in den 1950er Jahren: Prozesse, Brüche, Widersprüche, Ungleichzeitigkeiten," in *achtung: die 50er Jahre! Annäherungen an eine widersprüchliche Zeit*, eds. Jean-Daniel Blanc and Christine Luchsinger (Zurich: Chronos, 1994), 19–50, here 44.

9 Degen, "Verteidigungsgesellschaft" (see note 6), 100.

10 "Reduit des Bürgers," *Protar* 18, no. 7/8 (1952): 91.

11 Werner Heierli, "Der Schutzraum als Überlebensinsel," *Schutz+Wehr* 34, no. 9/10 (1968): 120–22; "Praktischer Familienschutz," *Protar* 18, no. 7/8 (1952): 87; Thomas Maissen, "Auserwähltes Volk—Unter den Boden," in *Im Untergrund*, eds. Sylvia Ruettimann and Monika Hardmeier (Nuremburg: Verlag für moderne Kultur, 2007), 81–86, here 84.

Ever since the Swiss had started to build elaborated tunnels through the Alps in the second half of the nineteenth century in order to advance transport and trade, the vertical axis represented the inherently Swiss axis of colonization. [12] Thanks to this conquest of the underground, as well as the subsequent rereading both of the underworld and of mountain ranges as protective zones, there was little expectation that the public might baulk at the idea of retreating below ground. By choosing the alpine marmot as the mascot of Swiss civil defense, the authorities made the most of these associations of subterranean spaces. In Swiss civil defense propaganda, marmots warned of air raids by emitting a whistle, whereupon all animals were to retreat nimbly to their underground caves. [13]

12 Daniel Marek, "Die Landnahme im Untergrund," in *Im Untergrund*, eds. Ruettimann and Hardmeier (see note 11), 75–80.

13 Schweizerischer Bund für Zivilschutz, *Wir können uns schützen*, civil defense movie, 1963.

Accumulating Knowledge

"Nuclear war is doable" — this was the slogan the Swiss authorities propagated in the early 1960s. In the eyes of the Federal Council, modern shelters would considerably enhance the population's chances of survival, despite the devastating potential of nuclear weapons. The actual construction of nuclear shelters was still on shaky ground, however, in part because Swiss engineers and architects were reluctant to engage with the modern threat, but also because Switzerland, a nonmember of the North Atlantic Treaty Organization, had limited knowledge of the complex effects of nuclear weapons. [14] When thermonuclear scenarios started to proliferate in the mid-1950s, Swiss air defense officials realized how little use the air-raid shelters built thus far (approximately 65,000) would be in the event of a nuclear attack. The existing shelters had been geared to a conventional war: the walls were designed to withstand falling rubble, doors were made of wood, and the need for ventilation systems was not foreseen. [15] Any claims to real expertise in bunker design for the atomic age would have been far-fetched at this stage. At the start of the 1960s, with new shelter construction legislation in the pipeline, Switzerland had to launch itself on a frenzy of nuclear learning.

14 Ernst Basler, epilogue to *Schild aus Stein und Eisen*, ed. René Bondt (Stäfa, Switzerland: Th. Gut and Co., 1978), 229–34, here 230.

15 Fritz Sager, "Die Bedeutung der Zivilschutzkonzeption 1971," *Schweizer Baublatt*, April 1972, 4–14, here 4.

In 1962, a Working Group for Structural Planning for Civil Defense was set up at the Federal Office for Civil Protection (FOCP), a ten-member advisory board comprising physicists, engineers, architects, chemists, and civil defense officials. [16] Yet how was this group of self-confessed "beginners" supposed to acquire data on the effects of nuclear weapons, including the latest and most powerful one, the hydrogen bomb? On this steep nuclear learning curve, Samuel Glasstone's book *The Effects of Nuclear Weapons* proved to be a vital first step. The U.S. Atomic

16 Swiss Federal Archives (SFA), 4390C, 1977/164, vol. 48, Ordinance regarding the working group on structural civil defense, December 28, 1962.

Energy Commission had published the book in 1957, subsequent to a policy shift in the mid-1950s: the U.S. government had revoked the "top secret" classification of knowledge pertaining to the effects of nuclear weapons, thus signaling its intent to facilitate other countries' defense strategies by allowing them monitored access to the relevant data. [17] Glasstone's work can be regarded as a simplified condensate of a varied spectrum of local actor-worlds, comprising human and nonhuman actants such as test sites in Nevada, atomic bombs, measuring tools and practices, animals, buildings, scientists, and inscriptions devices. By means of statistics, illustrations, and graphs, *The Effects of Nuclear Weapons* delivered from the American desert to Switzerland data on phenomena such as pressure waves, thermal radiation, and radioactive fallout and their effects on human beings, materials, and structures.

Knowledge transfer, however, depended on more than just textbooks crossing the Atlantic. From 1963 until circa 1970, increasing numbers of people boarded airplanes, made contacts in the United States, visited research labs, acquired reports and data, took notes on test sites, returned to Switzerland, dispatched letters to the United States, received answers, and welcomed American atomic physicists, engineers, and civil defense officials in Switzerland. The starting point for this process of knowledge accumulation was a symposium organized by the Working Group on Structural Civil Defense at the Federal Institute of Technology (ETH) Zurich in 1963. Glasstone may have provided data on nuclear weapons, but his book contained no concrete guidelines on effective dimensions for shelter structures. Time was running short, for in 1962 the Federal Council had announced forthcoming legislation on structural civil defense. To facilitate the development of the requisite building codes, the Swiss decided to pool all the data they had acquired on nuclear weapons effects and to invite all known structural defense specialists to Switzerland. Appointing German ballistics expert Hubert Schardin to act as conference director proved to be a decisive move—he had an excellent network of European and American contacts. [18] The efforts paid off. In the summer of 1963, more or less all of the Western world's combined know-how on the effects of nuclear weapons and passive defense systems rolled into Zurich, including Harold Brode, a physicist and weapons impact specialist on the RAND Corporation payroll; Nate Newmark, the central figure in refining understanding of structural response to atomic blast effects, from the University of Illinois; and world-renowned civil engineer John Biggs of the Massachusetts Institute of Technology (MIT). [19]

17 Samuel Glasstone, *The Effects of Nuclear Weapons*, prepared by the United States Department of Defense, published by the United States Atomic Energy Commission (Washington, D.C.: U.S. Government Printing Office, 1957).

18 Hubert Schardin was director both of the German-French Research Institute of Saint-Louis and the Ernst-Mach-Institute (EMI) in Freiburg, eminent institutions for protective structures and shock-wave research in Europe at that time.

19 Bundesamt für Zivilschutz, *Symposium über wissenschaftliche Grundlagen des Schutzbaues an der Eidgenössischen Technischen Hochschule Zürich*, July 25—30, 1963, Symposium report (Bern: Bundesamt für Zivilschutz, 1963).

Despite the phalanx of experts, the outcome of the conference was ultimately modest. Owing to the number of factors to be considered—from dynamic and static pressure to impulse and reflection, from supersonic and subseismic waves to Rayleigh waves, from fusion and fission bombs to primary and secondary radiation—not one of the participants was able to provide a complete assessment of shelter criteria. Yet the symposium was beneficial in the medium term. It put the issue in the public eye, established the bunker as a legitimate study object of Swiss civil engineering, and, most important, laid the groundwork for further contacts with the United States. [20]

Additional stimuli for such exchanges came from the Research Institute for Military Construction (FMB), a strong institutional hub founded at the Federal Institute of Technology in 1964. The director of the new institute, Lieutenant-Colonel Ernst Basler—a civil engineer who had graduated from ETH Zurich and completed his postgraduate studies at MIT—arranged stays at American research laboratories for his team, organized observations at experimental test stations, and invited American scientists and officials to FMB. [21] Close friendships even developed; for example, with Neal FitzSimons, who, as director of the Engineering Development Division, Office of Civil Defense, U.S. Department of Defense, led special projects studying ways to protect the president and key federal officials from military attack. [22]

Local Calculations

The foreign data that piled up in Switzerland ultimately served to define building codes apt for immediate use. Basler was essential for the speedy production of this new entity of knowledge. He and his team at FMB defined most of the critical issues, created stable institutional settings, and led the epistemic groundwork for new conceptual frames and methodological repertoires. Given the time pressure and the limited number of expert staff, time-consuming and labor-intensive test-site experiments did not take center stage. The adopted solution instead was to synthesize all available data and draw up theoretical models with the aid of mathematical and quantitative methods and techniques, such as stochastics, statistical correlation, and cost-benefit analysis. Since the Second World War this repertoire had been applied to the thriving field of operations research. [23] Basler and other Swiss engineers, such as Werner Heierli, ranked among its greatest advocates. In their opinion, there was no better way to address a highly complex engineering system like the nuclear shelter, or indeed any intricate system that required decisions be reached on the basis of incomplete and imprecise information.

20 See Ernst Basler, *Erinnerungen* (Zollikerberg, Switzerland: Ernst Basler+Partner, 2010), 210.

21 SFA, FMB 5484, 1978/44, vol. 8, Foreign Contacts.

22 See "Neil FitzSimons, 71," *Washington Post*, April 1, 2000.

23 See Dominique Pestre and Amy Dahan, "Transferring Formal and Mathematical Tools from War Management to Political, Technological and Social Intervention (1940–1960)," in *Technological Concepts and Mathematical Tools in the Evolution of Modern Engineering Systems*, eds. Mario Lucertini, Ana Millian Gasca, and Fernando Nicolo (Basel: Birkhäuser, 2004), 79–192; Maurice W. Kirby, *Operational Research in War and Peace: The British Experience from the 1930s to 1970* (London: Imperial College Press, 2003).

Their approach was fueled by the dual premise formulated at the outset: protective measures should safeguard against all types of weapons effects, and they should be economically viable. Shelters were accordingly required to offer not total protection but the *optimal* protection possible proportional to the cost expenditure. This aspiration to provide a uniform level of protection (i.e., against all weapons effects) yet to simultaneously tolerate the reality that protection would never be total had already been formulated by Glasstone. [24] However, had the Swiss been less eager to adopt the knowledge register and mathematical tools of optimization, Glasstone's ideas would not have left the drawing board. Likewise, had Switzerland not had the political will and finances, plus a cultural tradition apt to foster a bunker mentality, the concerted research on protective structures and the utter sense of vocation that drove the small group of people entrusted with shelter issues would never have transpired. As it was, the scientists, engineers, and civil defense officials involved were all persuaded of the absolute necessity of a defense in the vertical plane; all had an unwavering faith in the feasibility of planning and designing civil defense against even the most complex threats; and all had strong ties with the military and accordingly saw eye to eye on matters concerning the physical and ideological defense of their land.

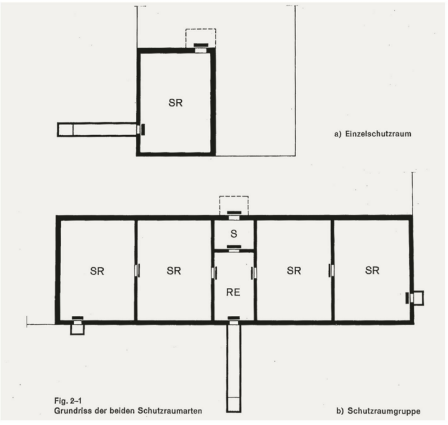
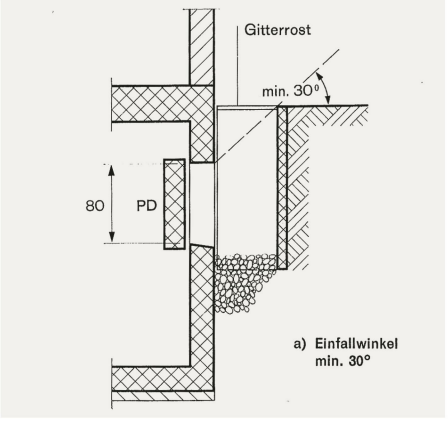


fig. 1 Floor plan of a single shelter (SR) and a shelter group with four shelter cells, an airlock system (S), and cleaning room (RE).

24 Samuel Glasstone, *Die Wirkung der Kernwaffen* (Cologne: Heymanns, 1960), 491.

The first outcome of the Swiss efforts to synthesize the available data was a handbook of weapons effects for the design of protective structures, published in 1964. [25] The compendium described the relative effects of the broadest possible range of weapons and calibers on buildings and people and came complete with graphs and diagrams for easier comparison. Subsequent studies centering on the optimal scope of protection were published in smaller reports and articles. As the value of protective constructions could not be assessed without an "objective" rating scale, Basler coined a new concept, *Wirkungsgrad*, roughly translatable as "efficiency ratio." In an article published in the trade journal *Schweizerische Bauzeitung* in 1965, Basler presented the efficiency ratio in terms of probability calculations; namely, as the relation of the increase of the population's chances of



25 Arbeitsgruppe für den baulichen Zivilschutz, *Handbuch der Waffenwirkungen für die Bemessung von Schutzbauten* (Bern: Bundesamt für Bevölkerungsschutz, 1964).

fig. 2 Specification for the layout of the emergency exit.

survival with a specific protective measure to the likelihood of losses of life were that measure not taken. [26] The FMB then drew on specifically developed computer programs to assess the protective yield of different installations in typical Swiss settlements and was thus able to quantify the damage the Swiss population would suffer in a future war. [27] Finally, it turned its attention to the cost-benefit analysis, the purpose of which was to define the optimal scope of protection. The number crunching boiled down to a concrete question: How many lives could be saved per Swiss franc invested in shelter construction? The conclusion ultimately drawn from these optimization studies was that the investment of CHF 1,000 per person and the construction of shelters able to withstand a force of fifteen pounds per square inch (psi) would effectively reduce the number of losses in Switzerland to one-tenth, whatever the weapons used. This corresponded to an efficiency ratio of 90 percent. [28]

These calculations paved the way for state endorsement of the shelter construction program. FOCP accepted the experts' opinion without a word, and shortly afterward the findings provided the basis for the *Technical Directives for the Construction*

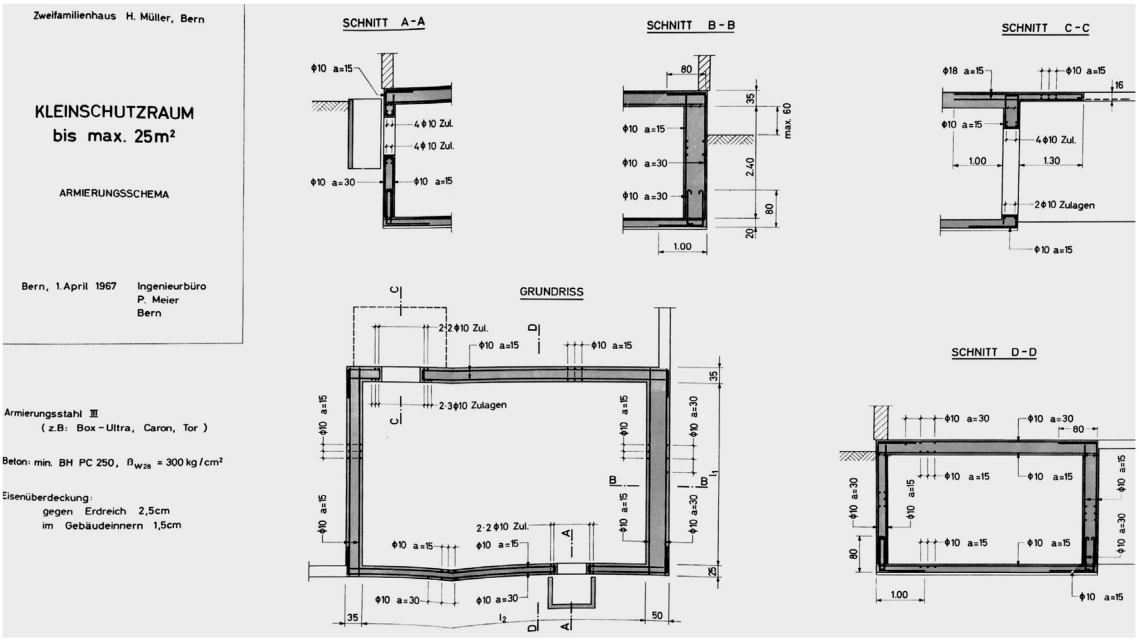


fig. 3 Schematic plan for the concrete reinforcement of a single shelter envelope in a family home.

of Private Air-Raid Shelters (TWP 66), published in 1966. Comprising detailed design and construction regulations for shelters able to withstand 15 psi, the manual thus embodied those gradual processes of adaptation and transformation by which the traces produced at nuclear test sites abroad were translated to the Swiss political-cultural arena, in keeping with its technological, material, and methodological agendas. The urgency of pushing through legislation, along with the broad political consensus on vertical defense, explains why the recommendations were endorsed immediately and disseminated as technical guidelines. The

26 Ernst Basler and Ulrich Kämpfer, "Über den Wert von Schutzmassnahmen gegen nukleare Waffen," *Schweizerische Bauzeitung* 83, no. 28 (1965): 500–505.

27 See Theo Ginsburg, *Grundlagen für Verlusterwartungsrechnungen*, FMB 65-13 (Zürich: Forschungsinstitut für Militärische Bautechnik, 1965); Serge Prêtre, *Untersuchungen zur Ermittlung einer optimalen Schutzraum-Konzeption*, FMB 66-2 (Zürich: Forschungsinstitut für Militärische Bautechnik, 1966).

28 Basler and Kämpfer, "Über den Wert von Schutzmassnahmen" (see note 26), 505.

seamless officialization of the technical knowledge can also be ascribed to the experts' rhetoric, which consisted of unambiguous, categorical, and quantifiable statements.

The TWP 66 was circulated with an initial print run of 46,000 copies. [29] The manual included planning principles for single shelters in private homes, consisting of a reinforced shelter envelope in the basement, as well as for shelter groups with multiple shelter cells. The latter were suited for larger apartment buildings and would provide protective space for up to two hundred people. fig. 1 Architects could find data on the space required per person, the height of the ceiling, the strength of the walls of the shelter envelope, the clear dimension of the standardized blast door, the layout of the entrance and emergency exit, effective ventilation systems, and the layout of the airlock system and cleaning room that were mandatory for shelters with protective space for over fifty people. fig. 2 To facilitate the dimensioning and detailing of the shelter for the engineer, a schematic plan for the concrete reinforcement of a standardized shelter in a private home was also included in the manual. [30]/fig. 3

fig. 4 Entrance to the nuclear shelter in my parent's family home, built according to TWP 66.

The TWP 66 spurred shelter construction in Switzerland, in a climate rendered favorable by the simultaneous general building boom. [31] From 1963 to the early 1970s, the number of nuclear shelters doubled from 50,000 to 100,000, which assured almost 50 percent of the population access to a modern, ventilated bunker. fig. 4 Shelter groups beneath apartment and office buildings, churches, or schools completed the system of single nuclear shelters in family homes, as floor plans for shelters with two separate shelter cells, an airlock system and a cleaning room in the basement of an apartment block illustrate. fig. 5 To create protective spaces for inhabitants of old buildings in historic city centers, nuclear shelters were also occasionally incorporated into new parking garages.

Economic crisis triggered by the oil shock and the introduction of austerity measures slowed the increase of bunker construction in Switzerland in the mid-1970s. Yet by the early 1980s the construction sector was booming again, and the nationwide shelter deficit was soon reduced. [32] Thus, within two decades the country was peppered with highly standardized defensive "capsules," [33] transforming Switzerland into an archipelago of insular underground entities.

29 Schweizerisches Bundesamt für Zivilschutz, *10 Jahr Bundesamt für Zivilschutz, 1963–1972* (Bern: Bundesamt für Zivilschutz, 1973), 3.

30 Schweizerisches Bundesamt für Zivilschutz, *TWP 1966: Technische Weisungen für den privaten Schutzraumbau* (Bern: Eidgenössische Drucksachen- und Materialzentrale, 1966), appendix.

31 From 1950 to 1973, the effective investment in building in Switzerland increased by 250 percent. During this period, Switzerland counted among the countries with the highest investment in building and home construction worldwide.

32 Martin Meier, "Von der Konzeption 71 zum Zivilschutz 95: Der Schweizer Zivilschutz zwischen Schein und Sein" (Master's thesis, University of Fribourg, 2007), 95, 99.

33 I adopt the term *capsule* from the philosopher Lieven de Cauter, *The Capsular Civilization: On the City in an Age of Fear* (Rotterdam: Nai, 2004), 81. In de Cauter's understanding, capsules are architectural membranes that absorb velocity and change; the active protection against hostile environments is transferred to the capsule, which renders the passenger immobile and passive.

Going Global

Since the 1970s, Swiss bunker know-how and building codes have made a splash internationally. Sure enough, the longstanding humanitarian tradition and the fact that Switzerland with its concept of armed neutrality had not been involved in an international

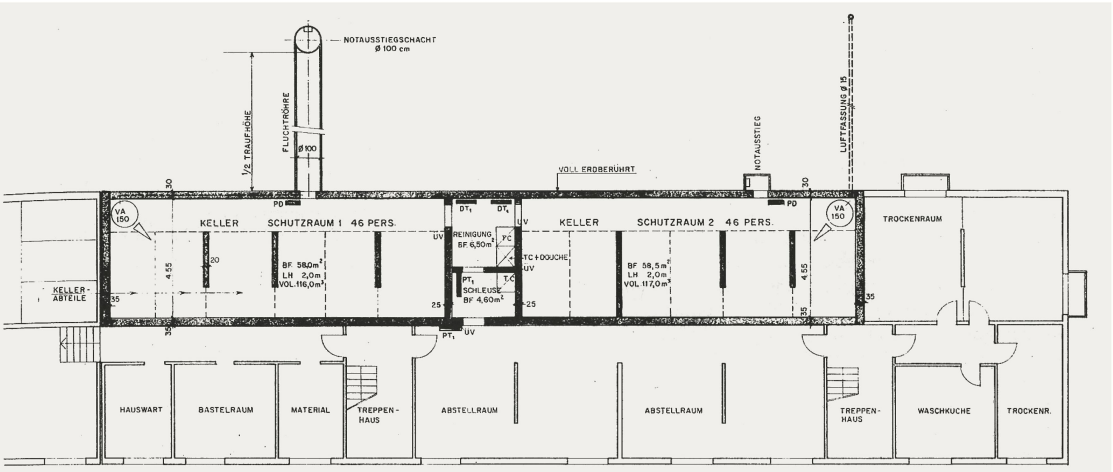


Abb. 3. Beispiel einer Schutzraumanordnung nach TWP im Untergeschoss eines Wohnblockes.

fig. 5 Shelter layout according to TWP 66 in the basement of an apartment building, drawn by the engineering office Heierli AG, a Swiss company specialized in constructing protection against nuclear weapons.

conflict since becoming a federal state helped to confer upon the country's bunker zeal an exemplary aura of trustworthiness. The Swiss themselves repeatedly characterized their civil defense shelters as "peaceful insurance" and a deterrent against outside interference and nuclear blackmail. The bunker expertise was not only closely linked to Switzerland's self-conception as an independent, purely defensive and peaceful country; it also symbolized the "Swiss" virtues that the engineers had accredited to themselves: efficiency, pragmatism, and economic thinking.

As for the information flow, FOCP made sure to distribute copies of TWP 66 to all foreign civil defense officials, asking for feedback and making public the most laudatory comments in professional journals. **34** From the beginning, they allowed translations and reprints (TWP 66 was translated into twelve languages) and offered to show the underground infrastructure to foreign visitors. Buttressed by various presentations and bunker tours, the country's defensive capsules started to rival the Swiss Alps as a magnet for American scientists. Among the most renowned participants in such "bunker tourism" were the atomic physicist and Nobel Prize winner Eugene P. Wigner and the legendary "father of the hydrogen bomb," Edward Teller. **35**

The new engineering prowess fostered by the circulation of the technical guidelines and the shelter tours also became a considerable source of income. When the domestic building boom came to a halt due to the recession following the oil shock, efforts to open up new markets came to the fore. During the 1970s and 1980s, Swiss companies rapidly gained a reputation as bunker construction specialists. For such international ventures, international

34 See "Die Schweiz hat die besten Weisungen für den Privaten Schutzraumbau," *Zivilschutz: Die deutsche wissenschaftlich-technische Fachzeitschrift für die zivile Verteidigung* 11 (1967): 374; "Swiss Civil Defense 'Best in World,'" *Zivilschutz* 15, no. 7/8 (1968): 194.

35 Ernst Basler, oral history interview, August 16, 2013. On Wigner's and Teller's acclaim for Swiss shelter design and policy, see Eugene P. Wigner and Walter Murphey, "Armed Neutrality," *Bulletin of the American Scientist* 31, no. 6 (1975): 2; Edward Teller, "Is Civil Defense the Way to Prevent War?" in *Civil Defense: A Symposium Presented at the Berkeley Meeting of the American Association for the Advancement of Science, December 1965*, ed. Henry Eyring (Washington, D.C.: American Association for the Advancement of Science, 1966), 134.

civil defense fairs acted as door openers. The largest of these events took place in Riyadh in 1986 and was organized by the Swiss Office for Trade Promotion. After a welcoming address by the director of FOCP and presentations ranging from shelter design to training for civil defense operations, thirty-six Swiss companies were allowed to advertise their "cost-effective" planning and design services and "efficient" products to Saudi Prince Nayif, his generals, and various ambassadors of Arab and African countries. [36] The sales brochure was adorned with images of Saudis sitting in a standard shelter and the slogan "Switzerland: Your Partner in Civil Defence." [37/fig. 6]

This slogan echoed all over the world, most markedly in the early 1980s, when a resurgent arms race pushed the so-called "Second Cold War." In 1981, the country's expertise attracted the attention of reporters from the *New York Times*, which ran a story entitled "Swiss, Determined to Survive, Dig Nuclear Shelters and Show Others How." [38] According to the *Times*, the Swiss Office for Civil Protection had had to cope with more than one thousand inquiries from foreign authorities and private firms since the beginning of 1981. As media reports in recent years have documented, Switzerland's reputation as a "superpower underground" also caught the attention of potentates in the 1980s. When reporters from the *Al-Jazeera* network investigated Muammar Gadhafi's Al-Baida Palace in eastern Libya in 2011, for example, they found a bunker system equipped with Swiss shelter doors and ventilation technology from the Swiss firm Zellweger Luwa AG. [39] The same company also supplied parts of the nuclear command bunker beneath Saddam Hussein's presidential palace in Baghdad. [40] To this day, Swiss bunker design and technology still dominates the market. Swiss ventilation and filtration systems are a commercial success worldwide, as are the Swiss-made explosion protection valves and blast doors by Andair AG. [41] With survivalism edging deeper into mainstream culture and demands for doomsday shelters and technology rising, [42] the future for Swiss bunker products and expertise looks bright.

36 "Saudisch-schweizerisches Zivilschutzsymposium," *Neue Zürcher Zeitung*, October 21, 1986.

37 Saudi-Swiss Symposium on Civil Defense Safety and Security, Riyadh Kingdom of Saudi-Arabia, October 19–22, 1986, Symposium Proceedings, annex.

38 Susan Heller Anderson, "Swiss, Determined to Survive, Dig Nuclear Shelters and Show Others How," *New York Times*, March 20, 1981.

fig. 6 Sales brochure, *Switzerland: Your Partner in Civil Defence*, 1986.

39 Jacky Rowland, "A Glimpse into Gaddafi's Palace," Al Jazeera, video, 2:34, February 27, 2011, http://www.aljazeera.com/video/africa/2011/02/20112276522858202.html (accessed June 28, 2016).

40 Gret Heer, "Unglückliche Hand," *Handelszeitung*, March 24, 2011; Ruedi Suter, "Saddam Husseins verschwiegene Schweizer Bunkerbauer," *Neue Zürcher Zeitung*, February 23, 2003.

41 The California-based company Atlas Survival Shelter, for example, relies on Swiss-made air filtration systems and blast valves. See http://www.atlassurvivalshelters.com/features/ (accessed October 19, 2017).

42 Evan Osnos, "Doomsday Prep for the Super Rich," The *New Yorker*, January 30, 2017.

Swiss air filters installed in American doomsday bunkers mark the latest step in a remarkable history that started in an era when nuclear war was anticipated, talked about, and calculated in perpetual loops. In the 1960s, Swiss engineers, thanks to the pooling of know-how and transatlantic transfers of knowledge, started to familiarize themselves with the language and technomaterial routines of weaponry-effects and protective-structures specialists. Local compilation of data, the introduction of an epistemic register of optimization, and sophisticated cost-benefit analysis subsequently transformed Switzerland into a center of calculation. Driven by a strong sense of vocation, sustained by an immense faith in their planning and design capacities, and backed by a state solidly committed to implementing their recommendations, the shelter experts were free to rationalize and standardize the prospect of a nuclear war through the application of building codes. In technical guidelines, future risks and complex threats were transformed into manageable, classifiable, quantifiable entities. Incorporating the concept of the "optimized" bunker, the building codes perpetuated the belief that security and survival are feasible even in the case of nuclear apocalypse—and prompted an unprecedent use of resources both financial and concrete material.

Poured in concrete, the results of the Cold War calculations are still present. Not only historians but politicians and the larger Swiss public will have to tackle the often unsettling affective and material qualities of these architectural capsules that permeate the domestic sphere and have quite literally brought home the theater of war.