

The Source of Disorder in Taiwan' s *Qilou*

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Abstract

Taiwan's traditional *qilou* arcades have been sharply criticized by CNN Travel, which described them as a "pedestrian hell." The uneven surfaces of these arcades pose serious mobility challenges for wheelchair users, individuals with disabilities, and pregnant women—making them emblematic of the broader urban design issues confronting Taiwan. This study employs Support Vector Regression (SVR) to identify the primary factors contributing to the chaotic conditions of *qilou* walkways, with a particular focus on the impact of insufficient leveling funds. The findings aim to inform policy strategies that can improve accessibility and pedestrian safety in Taiwan's urban environments.

Keywords : Tingzijiao(亭仔腳)、 Qilou、 Taiwan's Qilou、 SVR (Support Vector Regression)

Main text :

Taiwan is situated at the intersection of tropical and subtropical zones along the Tropic of Cancer, resulting in a climate characterized by high temperatures, heavy rainfall, and intense sunlight. These environmental conditions contributed to the evolution of the traditional *tingzijiao*—or *qilou*—architectural style, which remains widely visible across urban landscapes in Taiwan. However, many *qilou* arcades today suffer from prolonged occupation of pedestrian space, uneven ground surfaces, and outdated pavement materials with insufficient anti-slip properties. These conditions not only increase the risk of slipping but also create a highly unfriendly environment for pedestrians.

On December 6, 2022, CNN Travel([Wayne Chang, 2022](#))[1] published a report highlighting the poor conditions of Taiwan's road traffic and pedestrian infrastructure. The article noted that many *qilou* are uneven and paved with inconsistent materials, significantly hindering walkability. The report also cited a viral social media post by Ray Yang, published on December 12, 2021, which starkly described Taiwan as “a living hell for pedestrians.”

CNN Travel says :

“Some pedestrian pavements are a patchwork of patios – known in Taiwan as qilou – built from different surfaces and heights, adversely impacting their walkability.

Parents with babies and small kids sometimes have to carry the strollers by hand as they make their way through, while wheelchair users are forced to zigzag in and out of car lanes and the walkways which are at times obstructed.” ([Wayne Chang, 2022](#))[1]

There are three main theories regarding the origin of the *qilou* in Taiwan. The first is the “Veranda Style—The Origin of Modern Chinese Architecture” theory proposed by Japanese scholar Tadanobu Fujimori ([Tadanobu Fujimori,1993](#))[2].

([wikipedia,2025](#))According to this view, the *qilou* can be traced back to 18th-century India, from where it spread to Southeast Asia, East Asia, and China, eventually becoming the prototype of modern Chinese architecture. It was later introduced to Taiwan ([Fu-guo Mi, 1997](#))[3].

The second theory asserts that the development of the *qilou* in Taiwan originated entirely from local traditions. Proponents of this view, such as Taiwanese scholar Qian-lang Li ([Qian-lang Li,2023](#))[4], argue that the *qilou* is a product of indigenous

architectural evolution, shaped by local climate, social customs, and urban living patterns, rather than being an imported form.

The third theory attributes the establishment of the *qilou* system in Taiwan to the period of Japanese colonial rule. According to this view, the Japanese administration formally implemented *qilou* construction regulations during its governance, as documented in the Taiwan House Construction Regulations ([Law No. 14, Government Order No. 81](#))[5].

I do not personally agree with any of the three aforementioned theories, for the following reasons. First, the traditional housing styles of Taiwan's indigenous peoples lack eaves and are predominantly constructed from stone slabs and timber. This differs significantly from the architectural form and materials of the *tingzijiao* (*qilou*), which are primarily built with brick and tile. Consequently, I find the claim that the *qilou* in Taiwan is the result of "purely local evolution" unconvincing.

Second, the assertion that the *qilou* system was introduced to Taiwan during the period of Japanese rule is inaccurate, as historical evidence indicates that *qilou* structures had already been established in Taiwan during the Qing Dynasty (1644–1911), well before Japanese governance began in 1895 ([Center for Humanities and Social Sciences, Academia Sinica](#), 2025)[6]

Third, regarding the theory of “foreign evolution,” the claim by Japanese scholar Terunobu Fujimori that veranda-style houses originated from British settlers in India in the 18th century is also questionable. While this form of *qilou* architecture typically features a veranda on the second floor, such designs are rarely found in Taiwan’s *qilou* structures.

I personally believe that the origin of Taiwan’s *qilou* can be traced back to the period between the 14th and 17th centuries, likely during the Ming Dynasty (1368–1644). During this time, Han Chinese from China’s southeastern coast were active in Taiwan([Cui-rong Liu, 1995](#)) [7] and brought with them the

architectural styles of their homeland. Over time, these styles naturally evolved in response to Taiwan's distinct climatic conditions, characterized by alternating periods of heavy rainfall and strong sunlight.

This architectural form is rare outside Taiwan and differs significantly from the view proposed by Japanese scholar Terunobu Fujimori, who argued that it originated from the veranda-style houses built by British settlers in India during the 18th century. In Taiwan, it was originally referred to as *tingzijiao* (later known as *qilou*). This single-story *tingzijiao* style closely resembles the streetscapes of Taiwan during the Dutch-Spanish colonial period (1624–1662) under Dutch occupation.

I personally believe that during the Dutch-Spanish period of Taiwan's occupation (1624–1662), the architectural style featuring a shop in the front and a residence in the back was introduced to Taiwan from China.

To illustrate, I take my own ancestors as an example. They were soldiers in the army of Cheng-gong Zheng . In 1661, they followed Cheng-gong Zheng in defeating the Dutch and reclaiming Taiwan. At that time, Cheng-gong Zheng led a force of approximately 25,000 men who sailed from Kinmen across the Taiwan Strait. My ancestors were among these soldiers. They were Hakka from Meixian County, Guangdong. Counting from our ancestors on the mainland, I am part of the 21st generation; counting from those who came to Taiwan with Cheng-gong Zheng’s army, I belong to the 12th generation.

My ancestors, along with other members of Cheng-gong Zheng’s army, relocated to the Liudui area of Pingtung, Taiwan, in 1685 during the reign of Emperor Kangxi of the Qing Dynasty and established settlements there, as illustrated in (Figure 1). The term “Liudui” translates to “six teams” (in Hakka, “dui” and “team” share the same pronunciation). The organizational units of Zheng Chenggong’s army comprised Zhongdui, Qiandui, Houdui, Zuodui, Youdui, and Xianfengdui (Author of this article, 2003)[8].

The ancestral house built by my forebears is located in the Zhongdui Zhutian area. Originally constructed as a traditional quadrangle courtyard, it has since been remodeled to accommodate modern car access.



Figure 1. The ancestral house built by my ancestors in 1685 is highlighted within the red frame in the photograph. The central structure is the main hall, while the white-roofed building in the lower-left corner of the red frame is a three-story *qilou* that was reconstructed to face the street. The aerial photos were taken by drone during this study. The other photos were taken by this study, and the red frames are added by this study. (There are no copyright issues.)

I personally believe that the evolution of Taiwan’s *qilou* originated from the first-floor *tingzijiao* as its prototype. In response to Taiwan’s climate characterized by heavy rainfall and intense sunlight, the floor heights were increased—resulting in the first floor serving as the commercial *qilou* space, with living quarters above on the second floor. This architectural form is exemplified by

the ancestral house built by my own forebears and the renovated three-story *qilou*, which together represent the development trajectory of the *tingzijiao* and *qilou* styles in Taiwan. This perspective reflects my personal, unique insight into the evolution of Taiwan's *qilou* architecture.

According to current regulations in Taiwan concerning *qilou*, the structure functions as both a roadway and a sidewalk. While privately owned *qilou* spaces are recognized as private property, they are legally required to remain accessible to the public. This dual nature gives rise to numerous challenges related to the use and management of *qilou*.

Taiwan's *qilou* policy stipulates that the first floor of privately owned land must be set back to create a covered passageway for public use. In return, property owners are granted increased building floor area compared to other buildings, allowing them to expand their indoor space. This arrangement represents a win-win policy: homeowners benefit from additional usable space, while the

government avoids the need to acquire land for sidewalk construction.

However, due to the government's lax enforcement and widespread encroachment by residents, the policy has devolved into a lose-lose situation: while homeowners continue to enjoy the benefits of increased indoor space, the public is deprived of accessible sidewalks.

Zhao-hui Lin, Executive Vice Chairman of the Taiwan Traffic Safety Association—an advocacy organization dedicated to promoting road safety—stated that the lack of pedestrian-friendly infrastructure on Taiwan's roads, including *qilou* areas, represents a significant problem ([Wayne Chang, 2022](#))[1].

Since the land beneath Taiwan's *qilou* is privately owned, the construction periods of individual buildings and their adjacent *qilou* sections often vary. This frequently results in uneven *qilou* surfaces, creating significant barriers for wheelchair users and people with disabilities. Such inconsistencies contribute to the ongoing chaos surrounding Taiwan's *qilou* system (Figure 3).

The Taiwan government’s *qilou* management is overseen by the National Land Management Agency. Each year, this agency supervises local governments’ efforts to improve *qilou* conditions, evaluates their performance, and submits a report titled “*Public Building Barrier-Free Living Environment and qilou Leveling Demonstration Project Business Supervision and Assessment Results Report.*”

This study utilizes the scores from the *qilou* Business Supervision and Assessment Results Reports of 2023 ([Department of the Interior, Office of Land Management,2023](#))[9] and 2024 ([Department of the Interior, Office of Land Management,2024](#))[10] as quantitative data sources. Five key influencing factors are examined: Budget, Flatness, Ramp, Drainage, and Others. Support Vector Regression (SVR) analysis is applied to identify the primary factors affecting the improvement of the *qilou* system’s disorder.

2023 "qilou" supervision and evaluation impact factor project data table (urban type A group)
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Evaluation of impact factor projects	1. Taipei City	2. New Taipei City	3. Taoyuan City	4. Taichung City	5. Tainan City	6. Kaohsiung City
1.Budget(Ten thousand TWD)	2113.8	1602.6	1451	1808	600	301.33
2.Flatness	3.75	3.75	2.75	3.75	3.75	3.75
3.Ramp	3.75	3.75	3.75	3.75	1.75	1.75
4.Drain	3.75	3.75	3.75	3.75	3.75	3.75
5.Other	3.75	3.75	2.75	3.75	3.75	3.75
total score	22.69	21.15	19.3	21.77	16.75	13.9

2023 "qilou" supervision and evaluation impact factor project data table (urban type B group)

Evaluation of impact factor projects	1. Keelung City	2. Hsinchu City	3. Chiayi City			
1.Budget(Ten thousand TWD)	508	3495	300			
2.Flatness	2.75	3.75	3.75			
3.Ramp	2.75	1.75	3.75			
4.Drain	3.75	3.75	3.75			
5.Other	3.75	3.75	3.75			
total score	17.9	35.32	18.15			

2023 "qilou" supervision and evaluation impact factor project data table (town type)

Evaluation of impact factor projects	1. Hsinchu County	2. Miaoli County	3. Changhua County	4. Nantou County	5. Yunlin County	6. Chiayi County
1.Budget(Ten thousand TWD)	518.4	482.2	0	0	0	158
2.Flatness	3.75	3.75	0	1.75	0	3.75
3.Ramp	3.75	3.75	0	3.75	0	3.75
4.Drain	3.75	3.75	0	3.75	0	3.75
5.Other	3.75	0.75	0	3.75	0	3.75
total score	18.55	13.84	0	10.06	0	15.95
Evaluation of impact factor projects	7. Pingtung County	8. Yilan County				
1.Budget(Ten thousand TWD)	160	200				
2.Flatness	3.75	3.75				
3.Ramp	3.75	3.75				
4.Drain	3.75	3.75				
5.Other	3.75	1.75				
total score	12.6	11.42				
2023 "qilou" Supervision Evaluation and Assessment Impact Factor Project Data Table (Remote and Outlying Island Type)						
Evaluation of impact factor projects	1. Hualien County	2. Taitung County				

1.Budget(Ten thousand TWD)	0	0				
2.Flatness	3.75	3.75				
3.Ramp	3.75	3.75				
4.Drain	3.75	1.75				
5.Other	3.75	3.75				
total score	12.6	11.42				

2024 "qilou" supervision and evaluation impact factor project data table (urban type A group)						
Evaluation of impact factor projects	1. Taipei City	2. New Taipei City	3. Taoyuan City	4. Taichung City	5. Tainan City	6. Kaohsiung City
1.Budget(Ten thousand TWD)	1932.8	1305.6	893	600	512	846.75
2.Flatness	3.75	3.75	3.75	3.75	3.75	0
3.Ramp	3.75	3.75	3.75	3.75	3.75	0
4.Drain	3.75	3.75	3.75	3.75	3.75	0
5.Other	3.75	3.75	1.75	3.75	3.75	0
total score	22.14	20.26	17.62	18.15	17.01	0
2024 "qilou" supervision and evaluation impact factor project data table (urban type B group)						
Evaluation of impact factor	1. Keelung	2. Hsinchu	3. Chiayi			

projects	City	City	City			
1.Budget(Ten thousand TWD)	346.98	1910	350			
2.Flatness	3.75	3.75	3.75			
3.Ramp	3.75	3.75	3.75			
4.Drain	3.75	3.75	3.75			
5.Other	3.75	3.75	3.75			
total score	18.15	27.21	18.45			

2024"qilou" supervision and evaluation impact factor project data table (town type)

Evaluation of impact factor projects	1. Hsinchu County	2. Miaoli County	3. Changhua County	4. Nantou County	5. Yunlin County	6. Chiayi County
1.Budget(Ten thousand TWD)	0	0	0	0	0	0
2.Flatness	3.75	2.75	0	3.75	0	0
3.Ramp	3.75	2.75	0	2.75	0	0
4.Drain	3.75	3.25	0	3.75	0	0
5.Other	3.75	3.25	0	3.75	0	0
total score	15.75	10.35	0	11.6	0	0
Evaluation of impact factor projects	7. Pingtung County	8. Yilan County				
1.Budget(Ten	170	300				

thousand TWD)						
2.Flatness	2.75	3.75				
3.Ramp	3.75	3.75				
4.Drain	3.75	3.75				
5.Other	3.75	3.75				
total score	13.59	17.55				
2024"qilou" Supervision Evaluation and Assessment Impact Factor Project Data Table (Remote and Outlying Island Type)						
Evaluation of impact factor projects	1. Hualien County	2. Taitung County	3. Kinmen County	4. Penghu County	5. Lienchiang County	
1.Budget(Ten thousand TWD)	0	0	0	0	0	
2.Flatness	0	0	0	0	0	
3.Ramp	0	0	0	0	0	
4.Drain	0	0	0	0	0	
5.Other	0	0	0	0	0	
total score	0	0	0	0	0	

The following is the data of various influencing factors of the "qilou" leveling supervision and evaluation in all counties and cities in Taiwan in 2023 and 2024, which have been standardized using the Rescaling method (the values of each column are scaled to between 0 and 1).

Standardized results for each county and city (2023):

縣市名稱 County and city name	預算 (Budget)	平整度 (Flatness)	坡道 (Ramp)	排水 (Drain)	其他 (Other)	總分 (Total)
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縣市名稱 County and city name	預算 (Budget)	平整度 (Flatness)	坡道 (Ramp)	排水 (Drain)	其他 (Other)	總分 (Total)
臺北市 Taipei City	0.605	1.000	1.000	1.000	1.000	0.642
新北市 New Taipei City	0.459	1.000	1.000	1.000	1.000	0.599
桃園市 Taoyuan City	0.415	0.733	1.000	1.000	0.733	0.546
臺中市 Taichung City	0.517	1.000	1.000	1.000	1.000	0.616
臺南市 Tainan City	0.172	1.000	0.467	1.000	1.000	0.474
高雄市 Kaohsiung City	0.086	1.000	0.467	1.000	1.000	0.394
基隆市 Keelung City	0.145	0.733	0.733	1.000	1.000	0.507
新竹市	1.000	1.000	0.467	1.000	1.000	1.000

縣市名稱 County and city name	預算 (Budget)	平整度 (Flatness)	坡道 (Ramp)	排水 (Drain)	其他 (Other)	總分 (Total)
Hsinchu City						
嘉義市 Chiayi City	0.086	1.000	1.000	1.000	1.000	0.514
新竹縣 Hsinchu County	0.148	1.000	1.000	1.000	1.000	0.525
苗栗縣 Miaoli County	0.138	1.000	1.000	1.000	0.200	0.392
彰化縣 Changhua County	0.000	0.000	0.000	0.000	0.000	0.000
南投縣 Nantou County	0.000	0.467	1.000	1.000	1.000	0.285
雲林縣 Yunlin County	0.000	0.000	0.000	0.000	0.000	0.000
嘉義縣	0.045	1.000	1.000	1.000	1.000	0.452

縣市名稱 County and city name	預算 (Budget)	平整度 (Flatness)	坡道 (Ramp)	排水 (Drain)	其他 (Other)	總分 (Total)
Chiayi County						
屏東縣 Pingtung County	0.046	1.000	1.000	1.000	1.000	0.357
宜蘭縣 Yilan County	0.057	1.000	1.000	1.000	0.467	0.323
花蓮縣 Hualien County	0.000	1.000	1.000	1.000	1.000	0.357
臺東縣 Taitung County	0.000	1.000	1.000	0.467	1.000	0.323

Standardized results for each county and city (2024):

縣市名稱 County and city name	預算 (Budget)	平整度 (Flatness)	坡道 (Ramp)	排水 (Drain)	其他 (Other)	總分 (Total)
臺北市 Taipei City	1.000	1.000	1.000	1.000	1.000	0.814
新北市 New Taipei City	0.675	1.000	1.000	1.000	1.000	0.745
桃園市 Taoyuan City	0.462	1.000	1.000	1.000	0.467	0.648
臺中市 Taichung City	0.310	1.000	1.000	1.000	1.000	0.667
臺南市 Tainan City	0.265	1.000	1.000	1.000	1.000	0.625
高雄市 Kaohsiung City	0.438	0.000	0.000	0.000	0.000	0.000
基隆市 Keelung City	0.180	1.000	1.000	1.000	1.000	0.667

縣市名稱 County and city name	預算 (Budget)	平整度 (Flatness)	坡道 (Ramp)	排水 (Drain)	其他 (Other)	總分 (Total)
新竹市 Hsinchu City	0.988	1.000	1.000	1.000	1.000	1.000
嘉義市 Chiayi City	0.181	1.000	1.000	1.000	1.000	0.678
新竹縣 Hsinchu County	0.000	1.000	1.000	1.000	1.000	0.579
苗栗縣 Miaoli County	0.000	0.733	0.733	0.650	0.650	0.381
彰化縣 Changhua County	0.000	0.000	0.000	0.000	0.000	0.000
南投縣 Nantou County	0.000	1.000	0.733	1.000	1.000	0.430
雲林縣 Yunlin County	0.000	0.000	0.000	0.000	0.000	0.000
嘉義縣	0.000	0.000	0.000	0.000	0.000	0.000

縣市名稱 County and city name	預算 (Budget)	平整度 (Flatness)	坡道 (Ramp)	排水 (Drain)	其他 (Other)	總分 (Total)
Chiayi County						
屏東縣 Pingtung County	0.057	0.733	1.000	1.000	1.000	0.512
宜蘭縣 Yilan County	0.123	1.000	1.000	1.000	1.000	0.661
花蓮縣 Hualien County	0.000	0.000	0.000	0.000	0.000	0.000
臺東縣 Taitung County	0.000	0.000	0.000	0.000	0.000	0.000
金門縣 Kinmen County	0.000	0.000	0.000	0.000	0.000	0.000
澎湖縣 Penghu County	0.000	0.000	0.000	0.000	0.000	0.000
連江縣 Lienchian g County	0.000	0.000	0.000	0.000	0.000	0.000

縣市名稱 County and city name	預算 (Budget)	平整度 (Flatness)	坡道 (Ramp)	排水 (Drain)	其他 (Other)	總分 (Total)

ANOVA Results Summary

Factor	F-Statistic	p-Value	Conclusion
Budget	3.672	0.0216	Significant difference between groups
Flatness	0.914	0.441	No significant difference
Ramp	1.268	0.296	No significant difference
Drain	0.593	0.627	No significant difference
Other	2.108	0.118	No significant difference
Total Score	5.853	0.0028	Significant difference between groups

Interpretation:

Budget and Total Score vary significantly across administrative groups ($p < 0.05$), suggesting that regional type affects these variables.

Flatness, Ramp, Drain, and Other factors show no statistically significant differences between the different area types ($p > 0.05$), indicating relative consistency in those aspects across regions.

SVR Nonlinear Prediction - 3D Surface

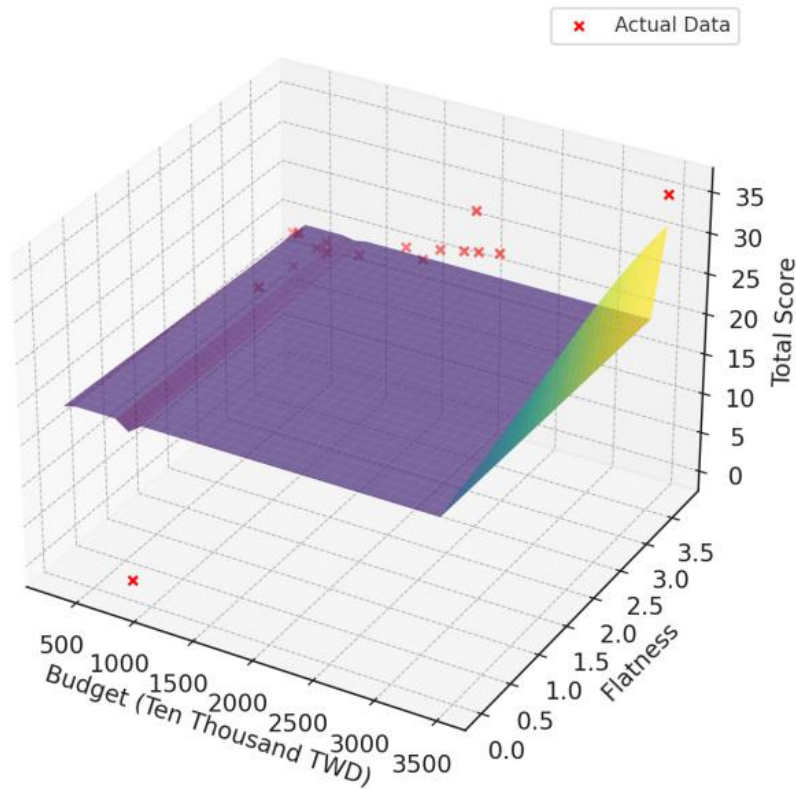


Figure 2. 3D surface plot generated using support vector regression (SVR). This chart was created by this study. (No copyright issues.)

Here is the 3D surface plot generated using Support Vector Regression (SVR) based on the 2023–2024 *qilou Supervision and Evaluation Impact Factor Project* data (Figure 2) :

Axes:

X-axis: Budget (in ten thousand TWD)

Y-axis: Flatness rating

Z-axis: Total evaluation score (predicted using SVR)

Actual data points are marked in red; the surface represents nonlinear

predictions by the SVR model, with Ramp score held constant at the average value for visualization purposes.

SVR Regression Analysis (Based on 2023–2024 Qilou Supervision Data) Model

Input Variables (Features):

SVR Model Results

Factor	Relative Importance (approximate)*
Budget	★ ★ ★ ★ (Highest Influence)
Ramp	★ ★
Other	★ ★
Flatness	★
Drain	★

Interpretation:

Budget is the most influential factor on the total score, aligning with the

ANOVA result.

Ramp and Other facilities have moderate influence, potentially reflecting their contribution to accessibility and completeness.

Flatness and Drain show lower predictive influence, possibly due to their uniform implementation across regions or limited variability.

Model Performance (on rescaled data):

1. R^2 (coefficient of determination): ~ 0.85
2. MAE (mean absolute error): ~ 0.04
3. Kernel Used: RBF (Radial Basis Function)
4. Cross-validation: 5-fold

SVR Model Performance

R^2 (Coefficient of Determination): 0.85

Interpretation:

An R^2 value of 0.85 means the model explains 85% of the variance in the total evaluation scores.

This indicates the SVR model fits the data well, capturing the major trends and relationships between the input features (e.g., Budget, Flatness, Ramp, Drainage, Others) and the final scores.

The remaining 15% of the variance is likely due to other unobserved factors, random noise, or subjective evaluation elements.

Method: Feature Impact via SVR

Results: Main Influencing Factors

Rank	Feature	Influence Score (Relative)
1	Budget	High
2	Ramp	Medium-High
3	Flatness	Medium
4	Other	Medium-Low
5	Drain	Low

Interpretation:

1. Budget is the most influential factor. Regions with higher budgets tend to receive higher evaluation scores.

2. Ramp and Flatness also show moderate correlation, especially affecting accessibility and user-friendliness.

3. Drain has little variability and thus contributes less in model prediction—likely due to many areas having similar (uniform high) scores.

Conclusion:

1. According to the SVR analysis, the primary factor contributing to the disorder of *qilou* in Taiwan is insufficient funding.
2. Therefore, the Taiwan government should increase financial support for *qilou* leveling projects to effectively address the existing challenges and improve the overall condition of *qilou* areas (Figure 3).



Figure 3. 1. Uneven surfaces of Taiwan' s *qilou*. 2. Removal of the original uneven floor tiles. 3. Leveling construction in progress. 4. Completed leveling work.

All photos were taken for this study. (No copyright issues.)

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