

# On the Current Situation and Improvement Measures of Library Light Environment

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**Abstract.** As the medium of communication between people and space, light plays an important role in the architectural environment, especially in the library, which has a high demand for light environment. Especially in the space with high requirements for light environment such as library, the treatment of light environment is more complicated than before. Taking Nanhu Library of Wuhan University of technology as an example, this paper investigates the current situation of the light environment in the reading area, collects necessary data, and makes reasonable suggestions and improvement on the existing problems on this basis, so as to improve the light environment ecology of the library and optimize the learning environment of College Students.

**Keywords:** Library; light environment; architectural lighting.

## 1. Introduction

At the same time, as an organic part of architectural environment, light design also plays a key role in improving the sensory experience of architectural users. Reasonable light environment design can meet the lighting demand of the building itself and reduce energy consumption at the same time. Rational use of natural light and artificial light is the ultimate goal of light environment design.

With the development of science and technology, people gradually pursue a good life experience. As one of the elements that people contact every day, light plays an important role in architectural design. Due to the particularity of the library reading area itself, the light environment design requirements of the functional area will be higher than most building related design standards. The light environment design of library reading area should start from the requirements of users themselves, make rational use of natural light and reduce the use of redundant artificial light sources.

## 2. Research and measurement -- Taking the reading area on the fifth floor of Nanhu Library of Wuhan University of Technology as an example

### 2.1 Introduction to the example

This experiment selects the reading area on the fifth floor of the library of Nanhu campus of Wuhan University of technology. Its plane shape is close to square, and the side length is about 96m. There is a atrium in the middle, with a size of about 63m × 35m, which can provide skylight for the internal reading area. The plane column grid is divided orthogonally, and the spacing is between 3.6m and 9.0m. The floor height is 4.8m, the sill height is 1.1m, the window height is about 3M and the width is 0.6m. It is linearly arranged in the north and south sides, and only some windows are opened in the East and west sides. At the same time, the central part of the East and west sides is the outdoor balcony.



Figure 1. Nanhu Library of Wuhan University of Technology.

## 2.2 Measuring preparation

The light environment investigation experiment involves measuring the relevant indicators of the light environment, and preparing to use the illuminance meter and laser rangefinder with an accuracy of 0.01lux ~ 20000lux for data acquisition according to the requirements for the height of the library desktop and the drawing of the library plan.

The measurement is carried out at 7:30 p.m. when the library is closed. At this time, the outdoor illuminance is 0Lux, and the measuring points are desktop with a height of 0.7m. The illuminance meter with an accuracy of 0.01LUX ~ 20000lux is used for measurement, and the average value is taken for multiple measurements.

## 2.3 Research process

Before the measurement, the laser rangefinder is used to draw the plan of the fifth floor of the library of Nanhu campus of Wuhan University of Technology.

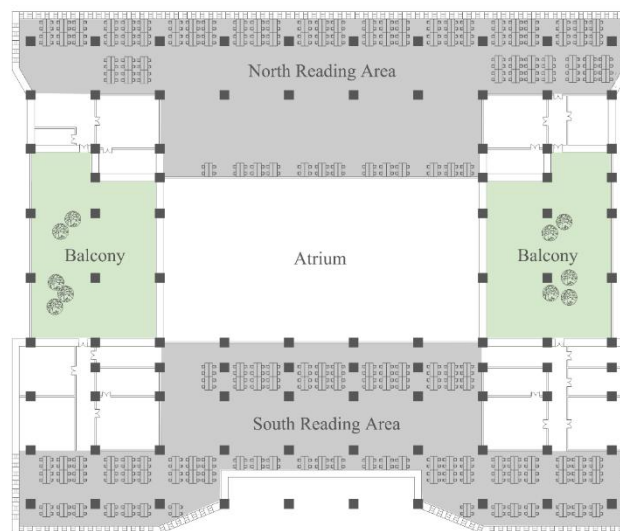


Figure 2. Fifth floor plan

In order to intuitively collect and record the data, the team selects the plane measurement points by using the orthogonal division method according to the placement of the plane tables and chairs, and the results are as follows.

The measuring points can be numbered as follows.

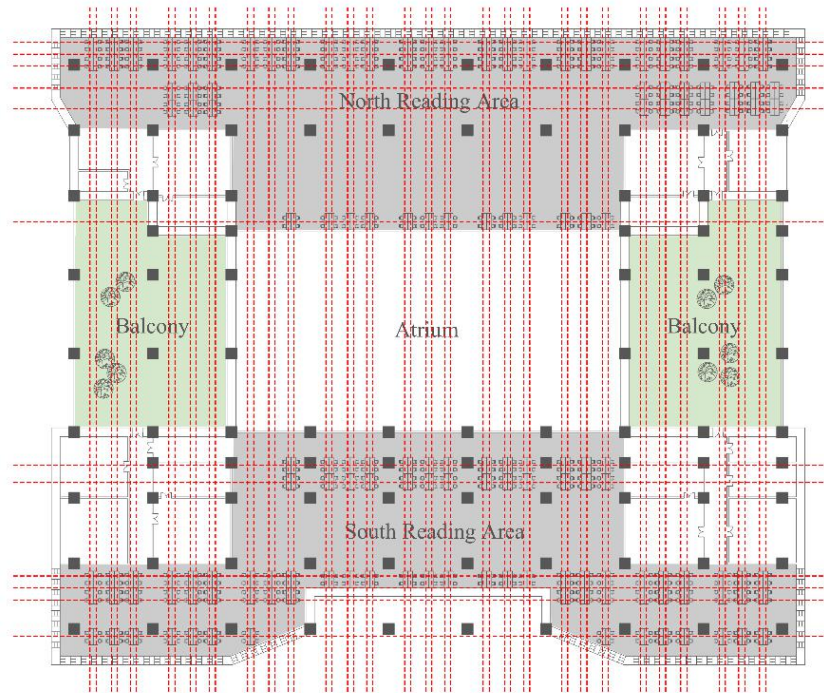


Figure 3. Orthogonal division of measuring points.

### 3. Results and analysis

#### 3.1 Measurement result

The data according to the above steps are shown in the following table.

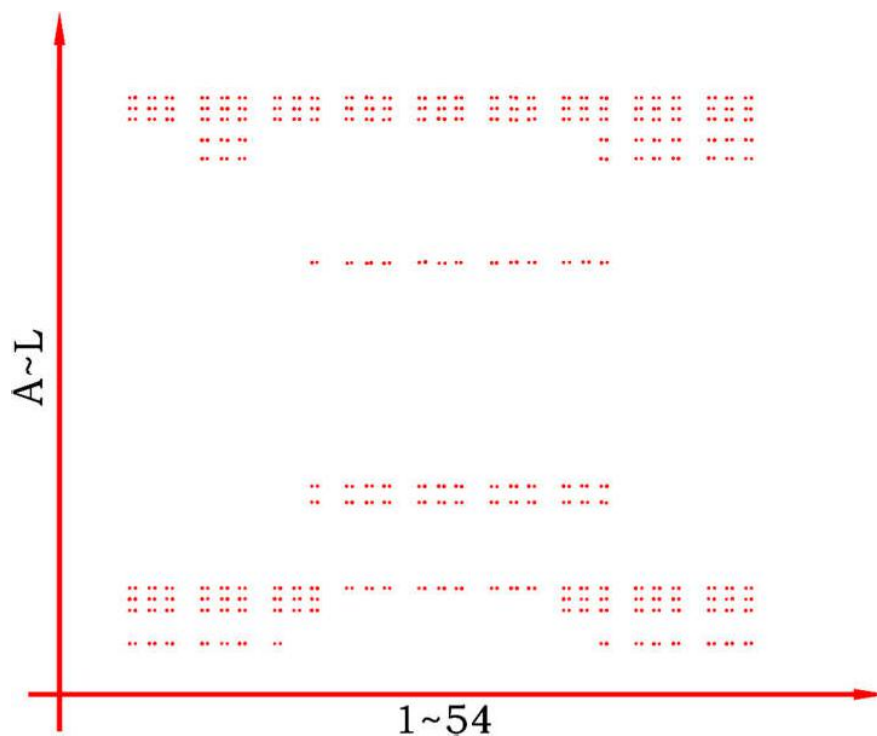


Figure 4 numbered measuring points

Table 1. Illuminance measurement results(lux).

	A	B	C	D	E	F	G	H	I	J	K	L
1	207	321	329	288	/	/	/	/	/	100	282	341
2	214	378	364	301	/	/	/	/	/	112	331	399
3	167	413	394	339	/	/	/	/	/	123	333	409
4	184	421	368	339	/	/	/	/	/	120	336	395
5	198	392	354	314	/	/	/	/	/	113	365	404
6	196	382	356	316	/	/	/	/	/	109	313	389
7	197	400	352	310	/	/	/	393	428	95	255	324
8	166	408	349	310	/	/	/	401	422	102	301	376
9	204	414	367	267	/	/	/	401	434	133	359	432
10	214	396	338	255	/	/	/	430	456	128	343	416
11	201	397	347	203	/	/	/	417	426	111	343	397
12	198	388	352	249	/	/	/	420	454	112	331	389
13	161	403	346	306	/	/	/	/	/	84	189	233
14	126	412	352	284	/	/	/	/	/	90	250	284
15	/	410	376	321	/	/	/	/	/	115	303	337
16	/	433	396	340	/	/	/	/	/	105	295	323
17	/	447	382	368	273	322	280	/	/	71	163	205
18	/	421	368	347	268	298	291	/	/	79	190	238
19	/	/	/	252	266	307	291	/	/	108	303	327
20	/	/	/	250	267	306	310	/	/	110	314	326
21	/	/	/	243	282	307	298	/	/	119	336	352
22	/	/	/	240	275	307	304	/	/	113	339	351
23	/	/	/	247	265	328	305	/	/	124	324	330
24	/	/	/	252	261	331	324	/	/	123	324	345
25	/	/	/	250	272	334	311	/	/	122	312	343
26	/	/	/	228	284	337	358	/	/	115	338	351
27	/	/	/	246	277	333	321	/	/	131	341	346
28	/	/	/	241	270	332	297	/	/	130	323	346
29	/	/	/	247	278	320	307	/	/	131	333	317
30	/	/	/	244	265	316	300	/	/	125	292	282
31	/	/	/	250	266	326	301	/	/	121	300	289
32	/	/	/	227	279	330	336	/	/	118	320	313
33	/	/	/	236	282	342	308	/	/	127	318	326
34	/	/	/	213	275	323	322	/	/	120	315	333
35	/	/	/	132	281	318	309	/	/	118	322	351
36	/	/	/	167	268	325	298	/	/	126	324	347
37	/	395	360	302	278	338	309	/	/	129	337	349
38	/	416	381	293	279	334	310	/	/	117	376	364
39	/	420	378	306	288	369	314	/	/	129	335	350
40	/	419	390	297	278	330	311	/	/	116	325	339
41	130	405	352	194	279	346	250	470	482	98	258	303
42	160	402	345	214	264	354	185	431	451	88	225	297

43	186	365	367	303	/	/	/	367	436	94	253	319
44	190	409	394	318	/	/	/	357	406	102	315	385
45	188	408	389	324	/	/	/	422	470	144	366	428
46	170	411	380	322	/	/	/	405	452	123	341	411
47	182	396	341	283	/	/	/	382	326	129	355	400
48	195	331	291	245	/	/	/	395	385	121	349	330
49	198	404	351	314	/	/	/	399	433	145	381	423
50	195	434	385	321	/	/	/	407	442	132	372	429
51	189	424	396	337	/	/	/	392	410	134	341	383
52	175	414	379	321	/	/	/	420	423	125	337	380
53	189	390	368	298	/	/	/	381	394	92	269	337
54	204	285	323	267	/	/	/	300	300	70	185	249

### 3.2 Analysis

According to the provisions of 5.3.1 in the standard for lighting design of buildings (GB 50034-2013), the standard value of illumination in general reading rooms and open reading rooms at 0.75m horizontal plane is 300lux. According to the above data: less than 250lux, 250 ~ 300lux and more than 300lux, the following figure can be obtained.

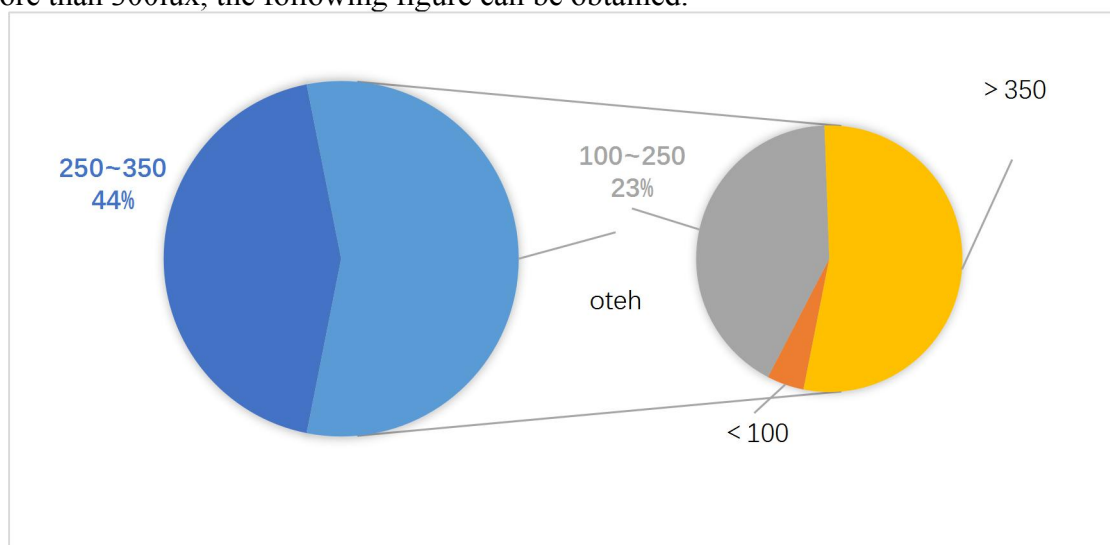


Figure 5. Pie chart of illumination

It is not difficult to see that more than half of the measuring points do not meet the illuminance design standards. In other words, in the reading area on the fifth floor, more than half of the desktop is not suitable for reading and learning. There are also a few areas with illumination less than 100lux.

## 4. Conclusion

For the above light environment, the following improvements can be made.

Replace old lamps and lanterns when necessary: strengthen the care and monitoring of lamps and lanterns in the library, and replace them at the first time when the lamps and lanterns are aging, so as to solve the problem of insufficient lighting caused by the damage of lamps and lanterns themselves.

Optimization of lighting quantity: according to relevant national regulations, the illuminance of library reading space should be more than 300lx, and it should be supplemented in areas that do not

meet the illuminance. Specifically, it can be divided into increasing the lighting power or quantity, changing the layout of lamps and lanterns and increasing local lighting. The former is to increase the lighting quantity or change the lamp model on the existing basis to make the changed lamps meet the lighting demand. The latter is to add wall lamps or desk lamps in areas with insufficient lighting to supplement the illuminance and mix lighting with the original lighting system.

Lighting quality optimization: starting from the light color and color rendering, distinguish the cold and warm tone of lights in different reading areas. The cold and clear atmosphere can be created in the learning and reading area, so as to improve students' concentration and learning efficiency. For the leisure reading area, the warm tone of lights can be used to create a warm and comfortable atmosphere to improve readers' reading comfort.

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