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FACULTY OF CIVIL ENGINEERING

FAKULTA STAVEBNÍ

INSTITUTE OF BUILDING STRUCTURES

ÚSTAV POZEMNÍHO STAVITELSTVÍ

MUNICIPAL CENTRE IN NIVNICE

MUNICIPAL CENTRE IN NIVNICE

DAYLIGHT FACTOR ASSESSMENT

MASTER'S THESIS

DIPLOMOVÁ PRÁCE

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1. Technical parameters

1.1. Identification data

Name of the building: Municipal centre
Type of building: Civic amenities facility
Purpose of building: Multifunctional building
Municipality: Nivnice
Cadastral area: 704679 NIVNICE
Parcel numbers: 65, 64, 63, 61 ,57
GPS: 48.98 °, 17.64 °
Median convergence: 1,99 °

1.2. Architectural and urban solution of the building

The subject of the documentation is fire safety solution of newly built municipal centre in town Nivnice, in cadastral area Nivnice [704679], on parcels 65, 64, 63, 61, 57, in the built-up area of town.

Designed building is permanent, detached construction with 2 above ground floors and a partial basement. It is located on flat land, without underground water. The shape of the building is rectangular with total area of 330,72 m². The building is divided into two separate functional units, post office and administrative area with ceremony hall. Entrances to both parts are from the northeast side, through the first floor.

The roof construction is flat and green with simple intensive type of vegetation. On the roof are placed photovoltaic panels. Façade surface has silicon thin-layered plaster, and it is insulated by mineral wool. Fillings of windows and doors are wooden-aluminium with triple glazing. External shadings from aluminium will be connected to the load-bearing peripheral walls by Propasiv system blocks.

1.3. Layout solution of the building

The building is divided into 2 functionally separate units, post office and administrative area with ceremony hall.

The main entrance to the post office is from the northeast side, through the first floor. The entrance leads through automatic doors to the customer area with delivery window and post office counter. The service office is designed for 2 employees. There is also small kitchen with electrical stove, toilet, washroom and cleaning/changing room. The storage area for delivering and storing of packages has car entrance from northeast side and it has area of 29,73 m². The total area of post office is 70,41 m².

The main entrance to the administrative part with ceremony hall is from the northeast side, through the first floor. The entrance leads through automatic doors to the hallway with waiting room. On the first floor there is submission office for the first contact with public, hygienic area, small storage and ceremony hall. Hygienic area contains 2 separate toilets for disabled people, women toilet with 4 WC cabins and separate washroom and men toilet with 2 cabins and 1 pisoar and separate washroom. In front of ceremony hall in small foyer with places to sit. 3

Ceremony hall has capacity of total cca 50 people, from which 40 can be seated. Total area is 72,96 m². Ceiling is 6,35m high, going through 2 floors. Ceremony hall is connected with small storage area for chairs that serves also as a passage for a person leading the ceremony, or if needed as a cloak room.

In the underground floor is located cleaning room below the arm of staircase, technical room with geothermal heat pump and water heater, HVAC room, storage for office furniture, depository and archive. All rooms are considered without a permanent work position.

In the second floor are 3 offices for administrative work and public relations, hygienic area, printing/storage room for office supplies, kitchen, meeting room, mayor's office with secretary office and vice mayor's office. The meeting room is designed for 15 people. In hygienic area is washroom for women and toilet with 2 WC cabins and separated washroom for men with toilet with 1 WC cabin and pisoar.

All floors are connected by vertical communication in a form of staircase with electrical elevator.

1.4. Structural solution of the building

The building is standing on strip foundation and foundation slab from plain concrete. Load-bearing system is designed as mixed from masonry locks.

Peripheral walls in 1.P are made of hollow core concrete blocks, BTB 50/30/25 (P+D), LxWxH 500x300x250mm, filled with reinforced concrete. They are insulated by XPS 300 L, thick 80 and 160 mm. Peripheral walls in 1.NP and 2.NP are bricked, made of ceramic blocks POROTHERM 30 PROFI, th. 300mm. Thermal insulation is made of mineral wool thick 200 mm, covered by silicon thin-layered plaster - ETICS system. Interior loadbearing wall are also made of ceramic blocks POROTHERM 30 PROFI, th. 300mm. Non-loadbearing partitions are made of ceramic block POROTHERM 11,5 PROFI thick 115 mm and POROTHERM 8 PROFI thick 80mm.

Ceiling structures are made of prefabricated prestressed ceiling panels (SPIROLL) placed on loadbearing walls and connected by concrete. Below spiroll panels on loadbearing walls are made reinforced concrete rings. The U-shaped staircase is designed as a left-hand turn from prefabricated reinforced concrete parts. There is a personal elevator in the mirror area, that is placed into prefabricated elevator shaft from reinforced concrete.

The roof structure is designed as a flat, green, simple intensive roof made of prestressed SPIROLL ceiling panels. The insulation is EPS with lowest thickness of 250 mm. Waterproofing is made of SBS asphalt felts.

Fillings of exterior windows and doors are wooden aluminium with triple glazing. Interior doors are mostly wooden placed in wooden frames, except for automatic doors that are made of safety glass and aluminium. Almost in all rooms is constructed dropped ceiling from plasterboard cassettes on load-bearing grid.

2. Aim of the assessment

The main aim of the assessment is to find out, whether the building satisfies the requirements in regulation ČSN EN 17037:2019, ČSN 730580-1, Amendment Z3:2019 and ČSN 730580-2, Change Z1:2019, Amendment 268/2009 Sb.

3. Background documents

- Situation drawings of surrounding areas
- Plan drawings
- Data from manufacturers
- Standards, norms, regulations

4. Used norms and regulations

- Normative requirements are based on the wording of ČSN EN 17037: 2019 – Daylighting of buildings,
- ČSN 734301:2004 – Residential buildings, as amended Z4:2019, ČSN 73 0580 -1: 2007- Daylighting of buildings
- Part 1: Basic requirements, as amended Z3:2019 and ČSN 73 0580 - 2:2007- Daylighting of buildings
- Part 2: Daylighting of residential buildings, as amended by Z1:2019

5. Magnitudes used for Daylight illumination

Daylight illumination in indoor spaces with permanent human occupancy is assessed to ensure visual comfort and good visibility of observed objects.

According to Decree No. 268/2009 Coll., on technical requirements for buildings, occupied rooms must provide daylight illumination in compliance with standard values. The assessment of daylight in a room is determined by the daylight factor D[%].

According to the standard ČSN EN 17 037:2019, "Daylight in Buildings," a space is considered to have adequate daylight illumination if the target illuminance value is achieved on part of the reference plane inside the space for at least half of the time during daylight hours. Furthermore, in spaces with vertical light openings, the minimum target illuminance value on the reference plane must also be met.

The reference plane is located 850 mm above the floor, and the daylight factor is determined using a regular grid of control points.

Daylight Levels on Horizontal Planes in Interior and Exterior Spaces:

Illuminance (E) [lux]

The distribution of illuminance on the working plane is affected by factors such as sky conditions, time of day, and the orientation of windows relative to cardinal directions.

Daylight Factor (D) [%]

The daylight factor represents the ratio of internal horizontal illuminance to external (unshaded) horizontal illuminance, calculated specifically for the CIE overcast sky model (CIE: Commission Internationale de l'Éclairage – International Commission on Illumination).

This metric provides an overall assessment of daylight availability in a room under the most challenging conditions, such as an overcast sky and dark ground surfaces. The daylight factor indicates the quality of daylight in the room by expressing the relationship between internal and external illuminance as a percentage. A higher D value signifies greater daylight penetration into the space. Importantly, the daylight factor is independent of climatic conditions and the orientation of the space to cardinal directions.

$$DF = 100 \times E_{in} / E_{ext}$$

Where:

E_{in}inside illuminance at a fixed point

E_{ext}outside horizontal illuminance under an overcast (CIE sky) or uniform sky

The E_{in} illuminance can be considered as the sum of three different illuminances:

- the direct illuminance if the sky is visible from the considered point (E_D)

- the illuminance due to the reflections on the outside environment (EER)
- the illuminance due to the reflections on the inside surfaces (EIR)

The daylight factor can be expressed as the sum of three component:

$$DF = DC + ERC + IRC$$

Where:

DC.... direct component

ERC.... externally reflected component

IRC.... internally reflected component

Target Illuminance ET

Calculated based on the cumulative availability of diffuse (unobstructed external) illuminance H, obtained from standardized climate data. The relationship between the target illuminance ET, the target external diffuse horizontal illuminance HT , and the target daylight factor DT is defined by the following equation:

$$(ET \times 100)/HT = DT \%$$

Where:

HT... given external diffuse horizontal illuminance

DT ... target daylight factor (%)

ETrequired indoor illuminance

Target illuminance and minimum target illuminance values for vertical and slanted light openings according to the aforementioned standard:

Doporučená úroveň	Cílová osvětlenost E_T [lx]	Část prostoru pro hodnocení E_T	Minimální cílová osvětlenost E_{TM} [lx]	Část prostoru pro hodnocení	Podíl doby s denním světlem
Minimální	300	50 %	100	95 %	50 %
Střední	500	50 %	300	95 %	50 %
Velká	750	50 %	500	95 %	50 %

Illuminance values can be expressed using the daylight factor D [%] (according to Table A3 of the aforementioned standard):

For the Czech Republic:

- D for exceeding 100 lx: 0.7%
- D for exceeding 300 lx: 2.0%
- D for exceeding 500 lx: 3.4%
- D for exceeding 750 lx: 5.0%

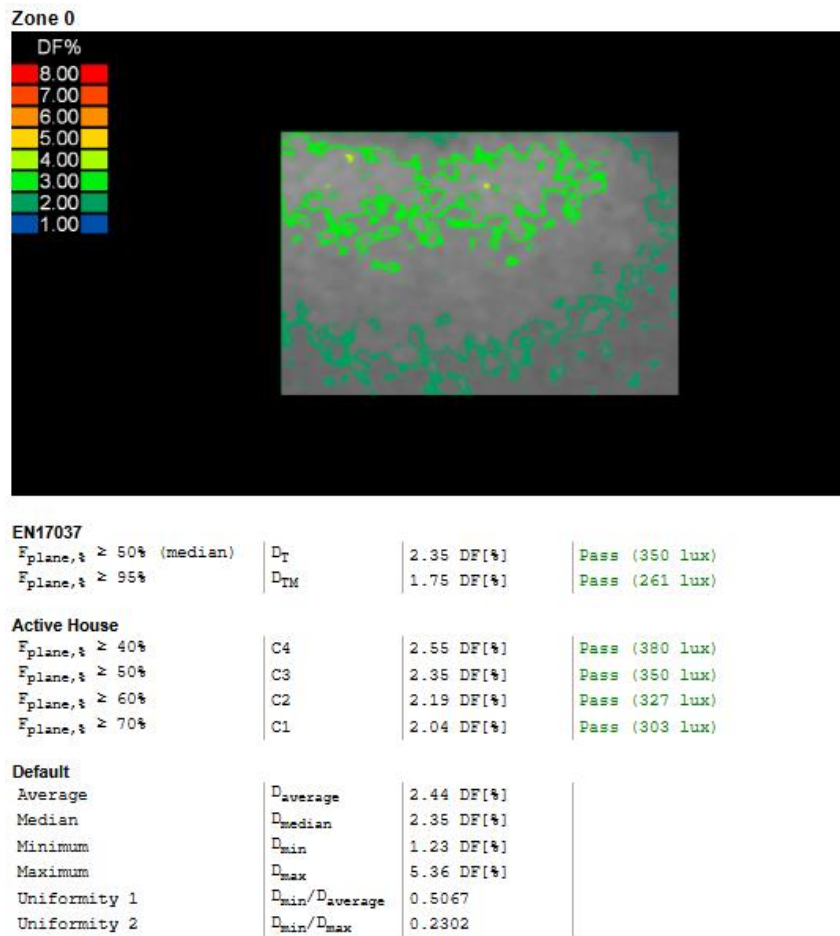
Required minimum illuminance values E [lx] for indoor workspaces are specified in the standard ČSN EN 12464-1, "Light and Lighting – Lighting of Workplaces – Indoor Workplaces."

Minimum illuminance values E [lx] according to the aforementioned standard:

- Offices (typing, meeting rooms): 500 lx

6. Assessment of daylight factor

Room 1.02 – Service area

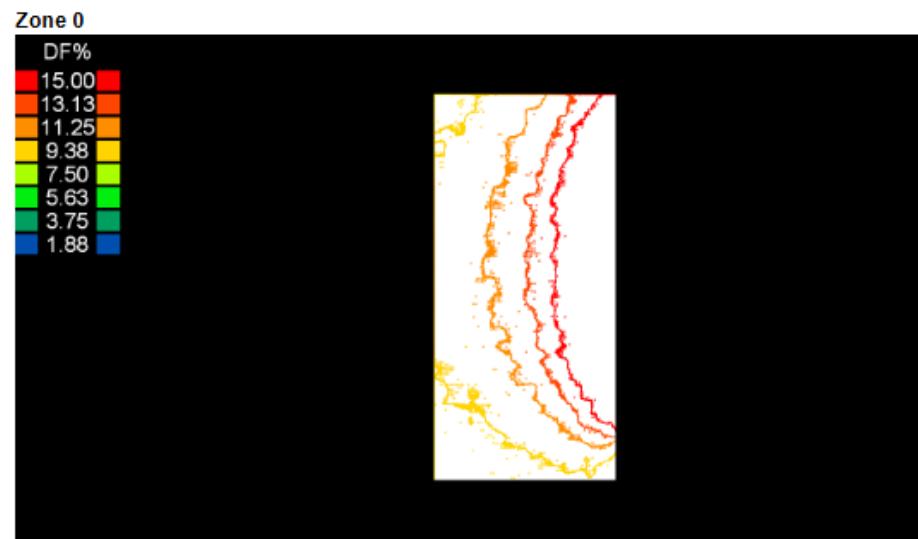


Assessment according to CSN 730580-2			
Value	Standard value	Calculated value	Assessment $D \geq D_{standard}$ $E \geq E_{standard}$
Min. target daylight factor, D_{tm} [%]	0,7%	1,75%	SATISFIED
Min. target illuminance, E_{tm} [lux] (95% area)	100 lx	261 lx	SATISFIED
Target daylight factor, D_t [%]	2,0%	2,35%	SATISFIED
Target illuminance, E_t [lux] (50% area)	300 lx	350 lx	SATISFIED
Uniformity(min/max)	0,2	0,23	SATISFIED

Level: Minimum

NOTE: Even though this is the office, and there should be illuminance min 500 lx, there is also light going through the customer window, which is not counted here.

Room 1.01 – Customer area



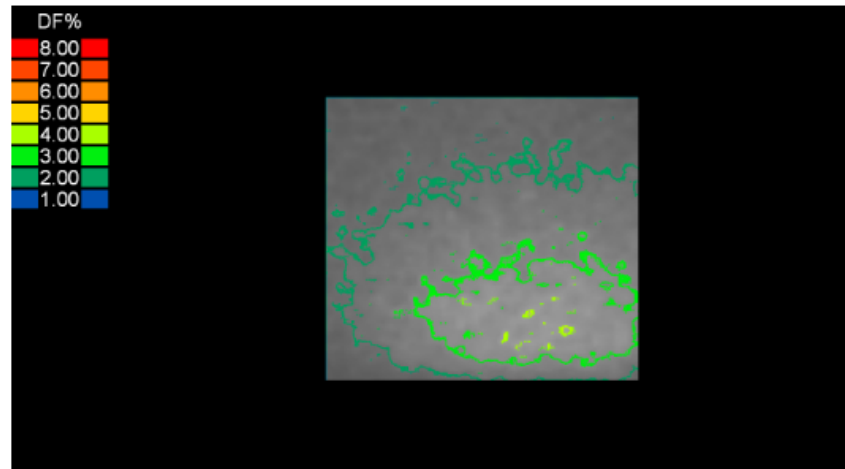
EN17037			
$F_{plane, \%} \geq 50\%$ (median)	D_T	11.46 DF[%]	Pass (1707 lux)
$F_{plane, \%} \geq 95\%$	D_{TM}	8.83 DF[%]	Pass (1316 lux)
Active House			
$F_{plane, \%} \geq 40\%$	C4	12.46 DF[%]	Pass (1856 lux)
$F_{plane, \%} \geq 50\%$	C3	11.46 DF[%]	Pass (1707 lux)
$F_{plane, \%} \geq 60\%$	C2	10.74 DF[%]	Pass (1601 lux)
$F_{plane, \%} \geq 70\%$	C1	10.24 DF[%]	Pass (1526 lux)
Default			
Average	$D_{average}$	12.79 DF[%]	
Median	D_{median}	11.46 DF[%]	
Minimum	D_{min}	7.72 DF[%]	
Maximum	D_{max}	25.92 DF[%]	
Uniformity 1	$D_{min}/D_{average}$	0.6035	
Uniformity 2	D_{min}/D_{max}	0.2978	

Assessment according to CSN 730580-2			
Value	Standard value	Calculated value	Assessment $D \geq D_{standard}$ $E \geq E_{standard}$
Min. target daylight factor, D_{tm} [%]	3,4%	8,83%	SATISFIED
Min. target illuminance, E_{tm} [lux] (95% area)	500 lx	1316 lx	SATISFIED
Target daylight factor, D_t [%]	5,0%	11,46 %	SATISFIED
Target illuminance, E_t [lux] (50% area)	750 lx	1707lx	SATISFIED
Uniformity(min/max)	0,2	0,3	SATISFIED

Level: High

Room 1.17 – Submission office

Zone 0



EN17037

$E_{plane, \%} \geq 50\%$ (median)	D_T	2.20 DF[%]	Pass (328 lux)
$E_{plane, \%} \geq 95\%$	D_{TM}	1.61 DF[%]	Pass (241 lux)

Active House

$E_{plane, \%} \geq 40\%$	C4	2.40 DF[%]	Pass (358 lux)
$E_{plane, \%} \geq 50\%$	C3	2.20 DF[%]	Pass (328 lux)
$E_{plane, \%} \geq 60\%$	C2	2.02 DF[%]	Pass (301 lux)
$E_{plane, \%} \geq 70\%$	C1	1.89 DF[%]	Fail (282 lux)

Default

Average	$D_{average}$	2.36 DF[%]
Median	D_{median}	2.20 DF[%]
Minimum	D_{min}	1.35 DF[%]
Maximum	D_{max}	5.62 DF[%]
Uniformity 1	$D_{min}/D_{average}$	0.5705
Uniformity 2	D_{min}/D_{max}	0.2397

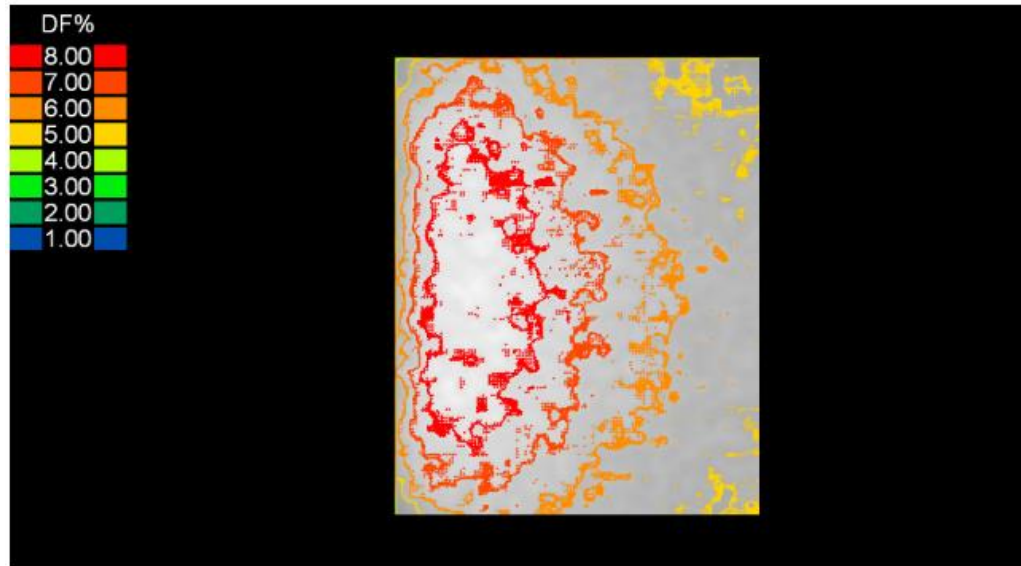
Assessment according to CSN 730580-2			
Value	Standard value	Calculated value	Assessment $D \geq D_{standard}$ $E \geq E_{standard}$
Min. target daylight factor, D_{tm} [%]	0,7%	1,61%	SATISFIED
Min. target illuminance, E_{tm} [lux] (95% area)	100 lx	241 lx	SATISFIED
Target daylight factor, D_t [%]	2,0%	2,20%	SATISFIED
Target illuminance, E_t [lux] (50% area)	300 lx	328 lx	SATISFIED
Uniformity(min/max)	0,2	0,24	SATISFIED

Level: Minimum

NOTE: Even though this is the office, and there should be illuminance min 500 lx, it is not used for paperwork, just for first contact with public, there is also light going through the customer window, which is not counted here.

Room 1.15 – Ceremony hall

Zone 0



EN17037

$F_{plane, \%} \geq 50\%$ (median)	D_T	6.34 DF[%]	Pass (944 lux)
$F_{plane, \%} \geq 95\%$	D_{TM}	5.10 DF[%]	Pass (760 lux)

Active House

$F_{plane, \%} \geq 40\%$	C4	6.75 DF[%]	Pass (1005 lux)
$F_{plane, \%} \geq 50\%$	C3	6.34 DF[%]	Pass (944 lux)
$F_{plane, \%} \geq 60\%$	C2	6.02 DF[%]	Pass (896 lux)
$F_{plane, \%} \geq 70\%$	C1	5.72 DF[%]	Pass (853 lux)

Default

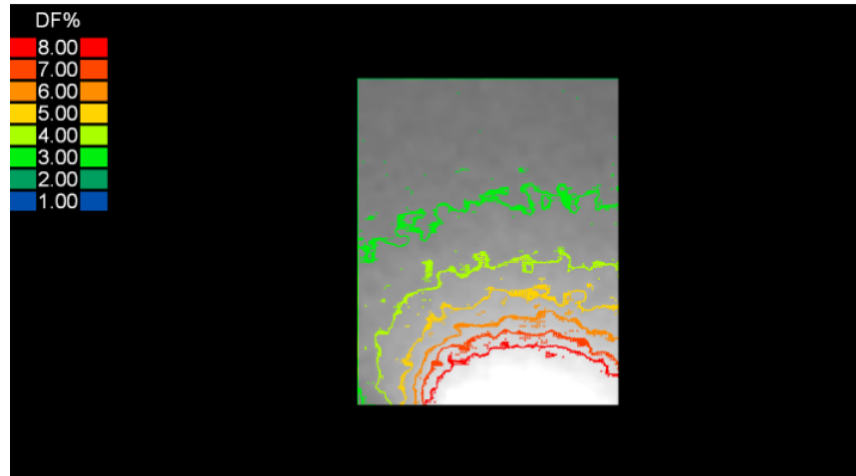
Average	$D_{average}$	6.58 DF[%]
Median	D_{median}	6.34 DF[%]
Minimum	D_{min}	3.82 DF[%]
Maximum	D_{max}	12.39 DF[%]
Uniformity 1	$D_{min}/D_{average}$	0.5812
Uniformity 2	D_{min}/D_{max}	0.3085

Assessment according to CSN 730580-2			
Value	Standard value	Calculated value	Assessment $D \geq D_{standard}$ $E \geq E_{standard}$
Min. target daylight factor, D_{tm} [%]	3,4%	5,10%	SATISFIED
Min. target illuminance, E_{tm} [lux] (95% area)	500 lx	760 lx	SATISFIED
Target daylight factor, D_t [%]	5,0%	6,34%	SATISFIED
Target illuminance, E_t [lux] (50% area)	750 lx	944lx	SATISFIED
Uniformity(min/max)	0,2	0,31	SATISFIED

Level: High

Room 2.01 – Mayor's office

Zone 0



EN17037

F _{plane, %} ≥ 50% (median)	D _T	3.37 DF[%]	Pass (502 lux)
F _{plane, %} ≥ 95%	D _{TM}	2.33 DF[%]	Pass (348 lux)

Active House

F _{plane, %} ≥ 40%	C4	3.83 DF[%]	Pass (571 lux)
F _{plane, %} ≥ 50%	C3	3.37 DF[%]	Pass (502 lux)
F _{plane, %} ≥ 60%	C2	2.98 DF[%]	Pass (444 lux)
F _{plane, %} ≥ 70%	C1	2.72 DF[%]	Pass (406 lux)

Default

Average	D _{average}	4.40 DF[%]
Median	D _{median}	3.37 DF[%]
Minimum	D _{min}	2.09 DF[%]
Maximum	D _{max}	17.57 DF[%]
Uniformity 1	D _{min} /D _{average}	0.4742
Uniformity 2	D _{min} /D _{max}	0.1189

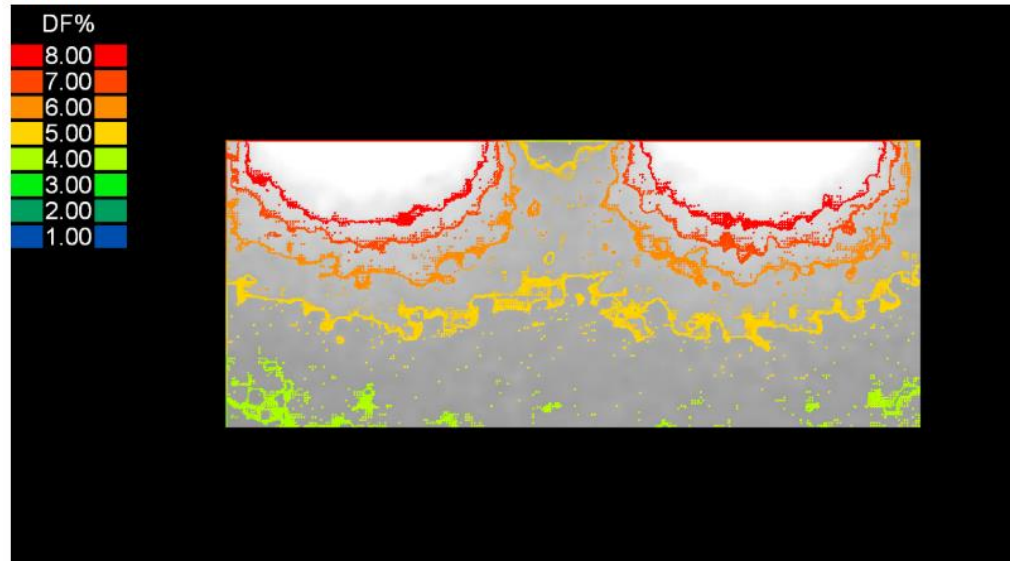
Assessment according to CSN 730580-2			
Value	Standard value	Calculated value	Assessment D ≥ Dstandard E ≥ Estandard
Min. target daylight factor, D _{tm} [%]	2,0 %	2,33 %	SATISFIED
Min. target illuminance, E _{tm} [lux] (95% area)	300 lx	348 lx	SATISFIED
Target daylight factor, D _t [%]	3,4%	3,37 %	SATISFIED
Target illuminance, E _t [lux] (50% area)	500 lx	502 x	SATISFIED
Uniformity(min/max)	0,2	0,11	NOT SATISFIED

Level: Minimum/medium

NOTE: Uniformity is overcome, by placing working desk near the window and placing light colour furniture to the back of the room, making the room area smaller, or placing furniture with more reflective surfaces. D_t 3,37% can be rounded to 3,4%.

Room 2.02 – Meeting room

Zone 0



EN17037

$F_{plane, \%} \geq 50\%$ (median)	D_T	5.32 DF[%]	Pass (793 lux)
$F_{plane, \%} \geq 95\%$	D_{TM}	4.14 DF[%]	Pass (617 lux)

Active House

$F_{plane, \%} \geq 40\%$	C4	5.69 DF[%]	Pass (848 lux)
$F_{plane, \%} \geq 50\%$	C3	5.32 DF[%]	Pass (793 lux)
$F_{plane, \%} \geq 60\%$	C2	4.95 DF[%]	Pass (737 lux)
$F_{plane, \%} \geq 70\%$	C1	4.65 DF[%]	Pass (693 lux)

Default

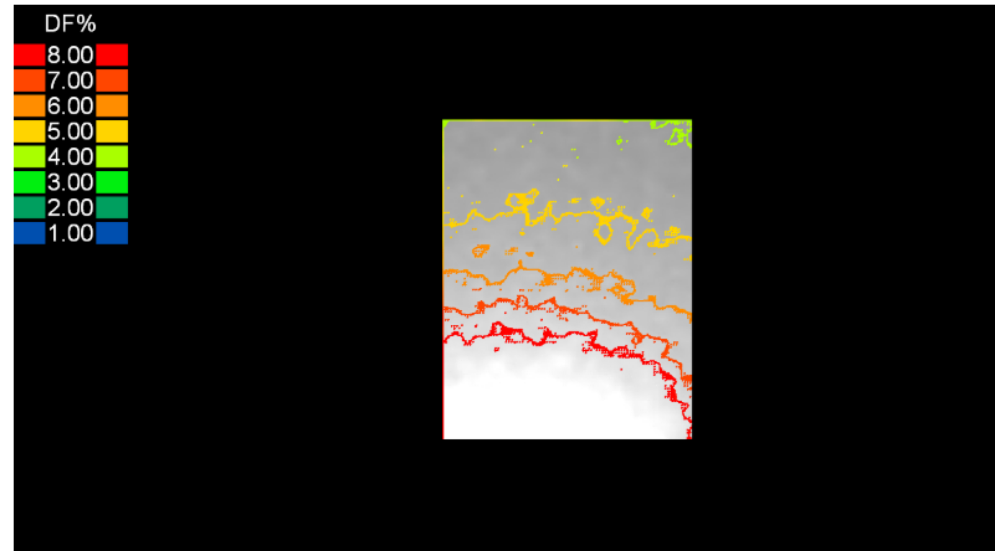
Average	$D_{average}$	6.13 DF[%]
Median	D_{median}	5.32 DF[%]
Minimum	D_{min}	3.58 DF[%]
Maximum	D_{max}	16.84 DF[%]
Uniformity 1	$D_{min}/D_{average}$	0.5845
Uniformity 2	D_{min}/D_{max}	0.2127

Assessment according to CSN 730580-2			
Value	Standard value	Calculated value	Assessment $D \geq D_{standard}$ $E \geq E_{standard}$
Min. target daylight factor, D_{tm} [%]	3,4%	4,14%	SATISFIED
Min. target illuminance, E_{tm} [lux] (95% area)	500 lx	617 lx	SATISFIED
Target daylight factor, D_t [%]	5,0%	5,32%	SATISFIED
Target illuminance, E_t [lux] (50% area)	750 lx	793lx	SATISFIED
Uniformity(min/max)	0,2	0,21	SATISFIED

Level: High

Room 2.03 – Secretary

Zone 0



EN17037

$F_{plane, \%} \geq 50\%$ (median)	D_T	5.95 DF[%]	Pass (886 lux)
$F_{plane, \%} \geq 95\%$	D_{TM}	4.23 DF[%]	Pass (631 lux)

Active House

$F_{plane, \%} \geq 40\%$	C4	6.70 DF[%]	Pass (999 lux)
$F_{plane, \%} \geq 50\%$	C3	5.95 DF[%]	Pass (886 lux)
$F_{plane, \%} \geq 60\%$	C2	5.39 DF[%]	Pass (804 lux)
$F_{plane, \%} \geq 70\%$	C1	4.93 DF[%]	Pass (734 lux)

Default

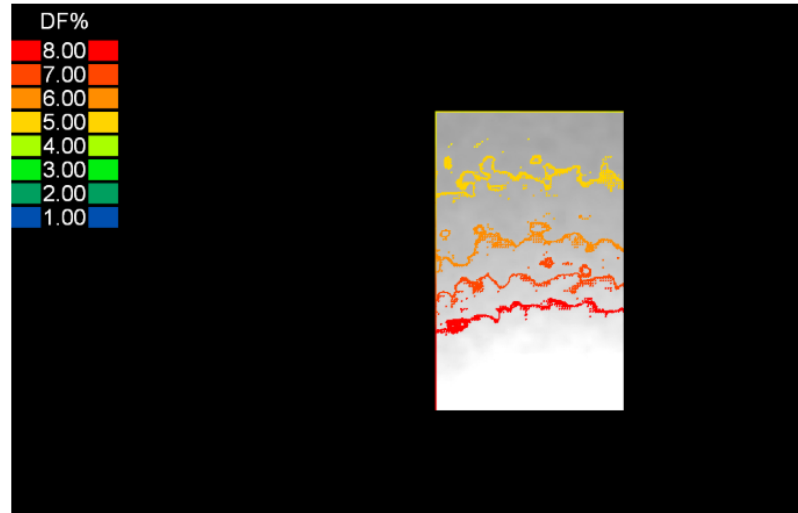
Average	$D_{average}$	7.00 DF[%]	
Median	D_{median}	5.95 DF[%]	
Minimum	D_{min}	3.72 DF[%]	
Maximum	D_{max}	17.33 DF[%]	
Uniformity 1	$D_{min}/D_{average}$	0.5315	
Uniformity 2	D_{min}/D_{max}	0.2148	

Assessment according to CSN 730580-2			
Value	Standard value	Calculated value	Assessment $D \geq D_{standard}$ $E \geq E_{standard}$
Min. target daylight factor, D_{tm} [%]	3,4%	4,23%	SATISFIED
Min. target illuminance, E_{tm} [lux] (95% area)	500 lx	631 lx	SATISFIED
Target daylight factor, D_t [%]	5,0%	5,95%	SATISFIED
Target illuminance, E_t [lux] (50% area)	750 lx	886lx	SATISFIED
Uniformity(min/max)	0,2	0,21	SATISFIED

Level: High

Room 2.12 – Office

Zone 0



EN17037

$F_{plane, \%} \geq 50\%$ (median)	D_T	6.46 DF[%]	Pass (962 lux)
$F_{plane, \%} \geq 95\%$	D_{TM}	4.54 DF[%]	Pass (676 lux)

Active House

$F_{plane, \%} \geq 40\%$	C4	7.33 DF[%]	Pass (1093 lux)
$F_{plane, \%} \geq 50\%$	C3	6.46 DF[%]	Pass (962 lux)
$F_{plane, \%} \geq 60\%$	C2	5.80 DF[%]	Pass (865 lux)
$F_{plane, \%} \geq 70\%$	C1	5.31 DF[%]	Pass (792 lux)

Default

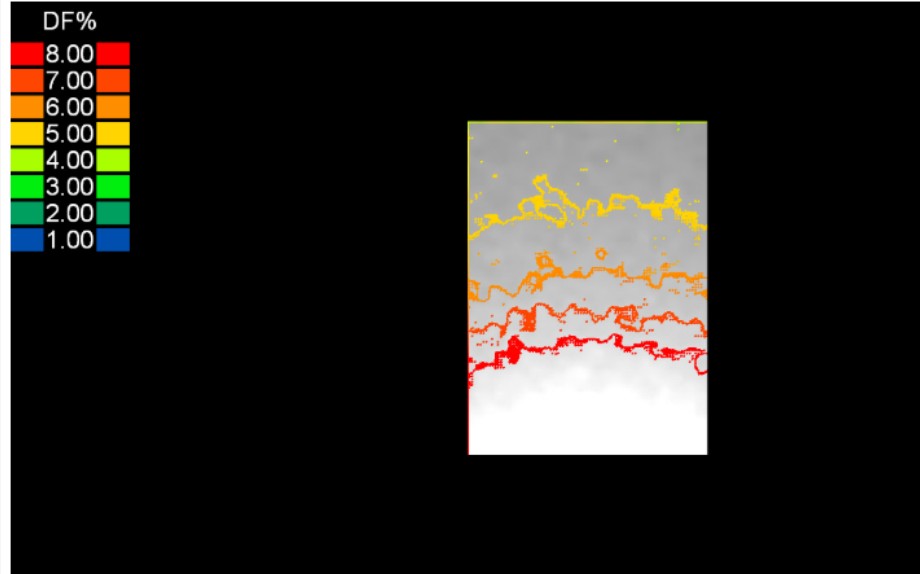
Average	$D_{average}$	7.54 DF[%]	
Median	D_{median}	6.46 DF[%]	
Minimum	D_{min}	4.22 DF[%]	
Maximum	D_{max}	17.60 DF[%]	
Uniformity 1	$D_{min}/D_{average}$	0.5602	
Uniformity 2	D_{min}/D_{max}	0.2401	

Assessment according to CSN 730580-2			
Value	Standard value	Calculated value	Assessment $D \geq D_{standard}$ $E \geq E_{standard}$
Min. target daylight factor, D_{tm} [%]	3,4%	4,54%	SATISFIED
Min. target illuminance, E_{tm} [lux] (95% area)	500 lx	676 lx	SATISFIED
Target daylight factor, D_t [%]	5,0%	6,46%	SATISFIED
Target illuminance, E_t [lux] (50% area)	750 lx	962 lx	SATISFIED
Uniformity(min/max)	0,2	0,24	SATISFIED

Level: High

Room 2.13 – Office

Zone 0



EN17037

$F_{plane, \%} \geq 50\%$ (median)	D_T	6.22 DF[%]	Pass (927 lux)
$F_{plane, \%} \geq 95\%$	D_{TM}	4.39 DF[%]	Pass (653 lux)

Active House

$F_{plane, \%} \geq 40\%$	C4	7.13 DF[%]	Pass (1063 lux)
$F_{plane, \%} \geq 50\%$	C3	6.22 DF[%]	Pass (927 lux)
$F_{plane, \%} \geq 60\%$	C2	5.61 DF[%]	Pass (836 lux)
$F_{plane, \%} \geq 70\%$	C1	5.14 DF[%]	Pass (766 lux)

Default

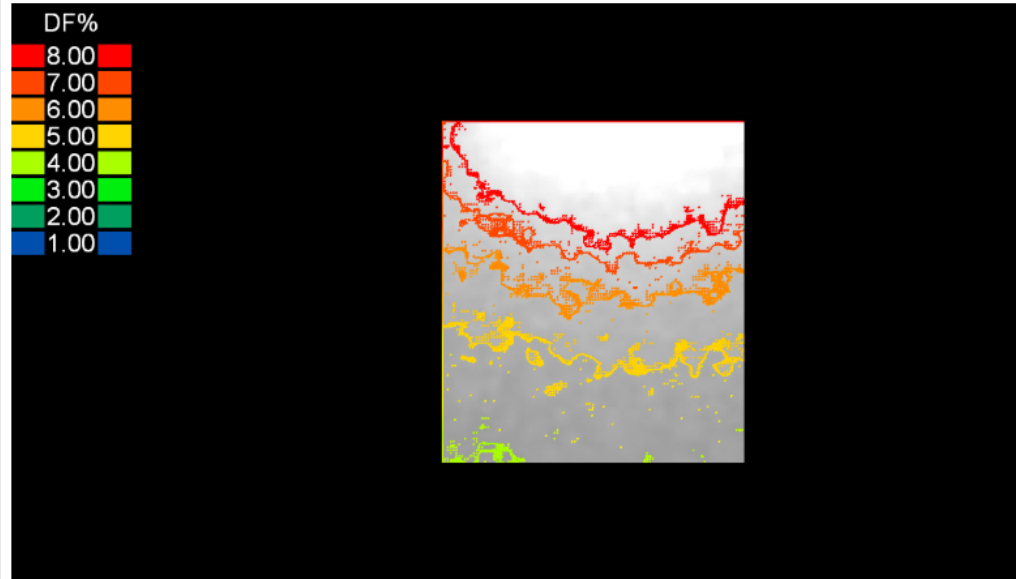
Average	$D_{average}$	7.29 DF[%]
Median	D_{median}	6.22 DF[%]
Minimum	D_{min}	3.98 DF[%]
Maximum	D_{max}	17.57 DF[%]
Uniformity 1	$D_{min}/D_{average}$	0.5466
Uniformity 2	D_{min}/D_{max}	0.2267

Assessment according to CSN 730580-2			
Value	Standard value	Calculated value	Assessment $D \geq D_{standard}$ $E \geq E_{standard}$
Min. target daylight factor, D_{tm} [%]	3,4%	4,39%	SATISFIED
Min. target illuminance, E_{tm} [lux] (95% area)	500 lx	653 lx	SATISFIED
Target daylight factor, D_t [%]	5,0%	6,22%	SATISFIED
Target illuminance, E_t [lux] (50% area)	750 lx	927 lx	SATISFIED
Uniformity(min/max)	0,2	0,22	SATISFIED

Level: High

Room 2.15 – Vice mayor's office

Zone 0



EN17037

F _{plane, %} ≥ 50% (median)	D _T	5.88 DF [%]	Pass (876 lux)
F _{plane, %} ≥ 95%	D _{TM}	4.29 DF [%]	Pass (639 lux)

Active House

F _{plane, %} ≥ 40%	C4	6.59 DF [%]	Pass (983 lux)
F _{plane, %} ≥ 50%	C3	5.88 DF [%]	Pass (876 lux)
F _{plane, %} ≥ 60%	C2	5.36 DF [%]	Pass (798 lux)
F _{plane, %} ≥ 70%	C1	4.92 DF [%]	Pass (733 lux)

Default

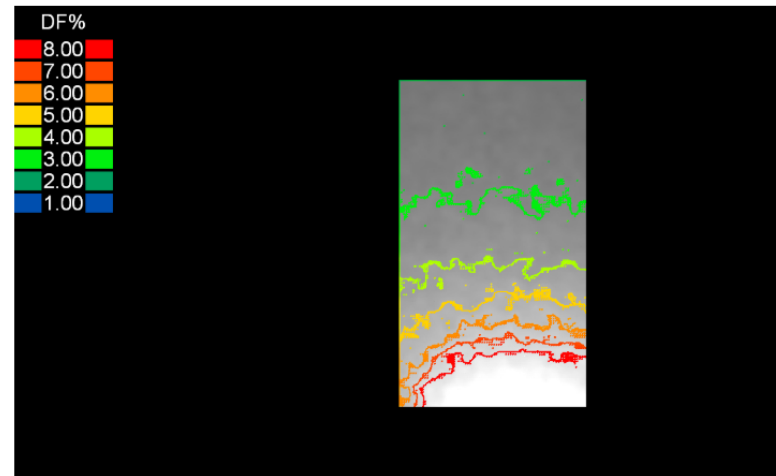
Average	D _{average}	6.89 DF [%]
Median	D _{median}	5.88 DF [%]
Minimum	D _{min}	3.83 DF [%]
Maximum	D _{max}	17.38 DF [%]
Uniformity 1	D _{min} /D _{average}	0.5551
Uniformity 2	D _{min} /D _{max}	0.2201

Assessment according to CSN 730580-2			
Value	Standard value	Calculated value	Assessment D ≥ D _{standard} E ≥ E _{standard}
Min. target daylight factor, D _{tm} [%]	3,4%	4,29%	SATISFIED
Min. target illuminance, E _{tm} [lux] (95% area)	500 lx	639 lx	SATISFIED
Target daylight factor, D _t [%]	5,0%	5,88%	SATISFIED
Target illuminance, E _t [lux] (50% area)	750 lx	876 lx	SATISFIED
Uniformity(min/max)	0,2	0,22	SATISFIED

Level: High

Room 2.16 – Office

Zone 0



EN17037

$F_{plane, \%} \geq 50\%$ (median)	D_T	3.56 DF[%]	Pass (530 lux)
$F_{plane, \%} \geq 95\%$	D_{TM}	2.38 DF[%]	Pass (355 lux)

Active House

$F_{plane, \%} \geq 40\%$	C4	4.17 DF[%]	Pass (621 lux)
$F_{plane, \%} \geq 50\%$	C3	3.56 DF[%]	Pass (530 lux)
$F_{plane, \%} \geq 60\%$	C2	3.11 DF[%]	Pass (464 lux)
$F_{plane, \%} \geq 70\%$	C1	2.83 DF[%]	Pass (421 lux)

Default

Average	$D_{average}$	4.69 DF[%]
Median	D_{median}	3.56 DF[%]
Minimum	D_{min}	2.10 DF[%]
Maximum	D_{max}	17.14 DF[%]
Uniformity 1	$D_{min}/D_{average}$	0.4476
Uniformity 2	D_{min}/D_{max}	0.1225

Assessment according to CSN 730580-2			
Value	Standard value	Calculated value	Assessment $D \geq D_{standard}$ $E \geq E_{standard}$
Min. target daylight factor, D_{tm} [%]	2,0%	2,38%	SATISFIED
Min. target illuminance, E_{tm} [lux] (95% area)	300 lx	355 lx	SATISFIED
Target daylight factor, D_t [%]	3,4%	3,56%	SATISFIED
Target illuminance, E_t [lux] (50% area)	500 lx	530 lx	SATISFIED
Uniformity(min/max)	0,2	0,12	NOT SATISFIED

Level: Medium

NOTE: Uniformity is overcome, by placing working desk near the window and placing light colour furniture to the back of the room, making the room area smaller, or placing furniture with more reflective surfaces

7. Shadowing

The designed object is located in the vicinity of other objects. Before new building of Municipality centre is built, old family houses have to be demolished. Neighbouring objects are single/double - storey family houses, but around designed object are roads, parking space and free grass areas, therefore there is no shadowing from or to neighbouring buildings. The closest building is in 14m distance, with height appx. 7,5m.



8. Conclusion

All calculations and simulation were made in Velux daylight visualizer 3. Assessed rooms were mostly offices with permanent working places, ceremony hall and customer area in the Post office. All offices met the criteria from the standard to have illuminance more than 500 lux. Other rooms, that have not been assessed should comply with minimum standards given by the ČSN EN 17037:2019, ČSN 730580-1, Amendment Z3:2019 and ČSN 730580-2.