A METHOD FOR PERFORMANCE BASED DESIGN EXPLORATION: GENERATING EXTERNAL SHADING UNITS FOR AN OFFICE BUILDING IN NICOSIA, CYPRUS

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ABSTRACT

A METHOD FOR PERFORMANCE BASED DESIGN EXPLORATION: GENERATING EXTERNAL SHADING UNITS FOR AN OFFICE BUILDING IN NICOSIA, CYPRUS

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Performance based design exploration has been practiced in architectural design for more than four decades. It has been within the scope of the expertise of technical and engineering professionals until now, and has become widely accessible to the architect within the last decade Latest advances in the computational and parametric tools and user interface enhancements in the simulation software has rendered possible the active involvement of the architect into the process. Every design process needs a custom design workflow according to the requirements of the project and the level of development necessary for each stage. The customization and parameterization of the design tools provide the base for both controlling and automating the design exploration process. Design process has become a process of reading, writing and manipulating databases and at the same time converting, translating and representing them.

The aim of this study is to build a custom workflow for the design exploration of external shading devices for an office building in hot climate. The initial shading units were designed without using any performance simulation. Afterwards, by parameters of rhythm, depth, angle and number of division, shading unit alternatives were generated. Through the workflow, the initial design and the alternatives generated by evolutionary algorithms based on daylight performance criteria are compared. As a result, improvements in terms of daylight factor and solar irradiation were achieved among an extensive number of geometric combinations which were made possible by a few number of parameters.

Keywords: grasshopper, genetic algorithms, parametric design, performance based design, building simulation.

ÖZ

PERFORMANS TABANLI TASARIM İÇİN BİR YÖNTEM: LEFKOŞA, KIBRIS'TA BİR OFİS BİNASI İÇİN DIŞ CEPHE GÖLGE ELEMANLARININ OLUŞTURULMASI

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Mimarlık alanında kırk yıldan uzun bir süredir performans tabanlı tasarım yapılmaktadır. Daha önce yalnızca mühendislik ve teknik uzmanlık alanlarına dahil olan performans tabanlı tasarım, son on yıldır mimarların erişimine de açılmıştır. Hesaplamalı ve parametrik araçlarla simülasyon yazılımlarının kullanıcı arayüzündeki son gelişmeler, mimarların sürece etkin olarak katılımını mümkün hale getirmiştir. Her tasarım süreci, projeye göre özelleşebilen ve o projenin aşamalarının gerektirdiği detay seviyesine uygun bir iş akışı gerektirir. Bu sürecin denetim ve otomasyonu için temel olan, tasarım araçlarının özelleştirilmesi ve parametrik hale getirilmesidir. Zira veritabanlarını idare etme, okuma, yazma ile ilgili olan tasarım süreci, aynı zamanda bu veritabanlarını değiştirme, tercüme etme ve sunma eylemleri haline gelmiştir.

Bu çalışmanın amacı, sıcak iklimdeki bir ofis binasının dış cephe gölge elemanları için özelleştirilmiş bir tasarım süreci oluşturmaktır. İlk tasarımdaki gölge elemanları, performans simülasyonu kullanmaksızın tasarlandı. Daha sonra ritm, derinlik, açı ve eleman adedi değişkenleri kullanılarak gölge elemanları alternatifleri oluşturuldu. İlk tasarım ile günışığı performansı kriterlerine dayanan ve evrimsel algoritmalarla elde edilen alternatifler karşılaştırıldı. Sonuç olarak, az sayıda parametreyle elde edilen çok sayıdaki geometrik kombinasyon arasından, günışığı faktörü ve güneş ışınımı bakımından en iyi alternatifler seçildi.

Anahtar Kelimeler: grasshopper, genetik algoritma, parametrik tasarım, performans temelli tasarım, bina simülasyonu.

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c/a	conjecture/analysis model
GA	Genetic Algorithms
WWR	Window to Wall Ratio
CIE	Commission International de l'Eclairage, International Commission on Illumination
VCP	The Visual Comfort Probability
UGR	Unified Glare Rating
DGI	Daylight Glare Index
DGP	Daylight Glare Probability
BRE	British Research Establishment
SPEA2	Strength Pareto Evolutionary Algorithm
DF	Daylight Factor
SI	Solar Irradiation
DGI_N	New Daylight Glare Index
LEED	Leadership in Energy and Environmental Design
CHPS	Collaborative for High Performance Schools
NSGA	Non-dominated Sorting Genetic Algorithm
VEGA	Vector-Evaluated Genetic Algorithm
PAES	Pareto Archived Evolution Strategy

CHAPTER 1

INTRODUCTION

This chapter presents the argument and objectives of the study and summarizes the way the study was conducted. It concludes with a disposition of the subject matter, covered in each subsequent chapter.

1.1. Argument

In this study, simulation tools integrated with parametric systems and genetic algorithms as design advisors are focused on The study aims to search and integrate the digital tools into the workflow of architectural design with immediate accessibility of the designer as the conductor of the design process. Recent advances both in software alternatives and graphical user interface eliminates or mitigates the necessity to write computer code giving way to designing custom design procedures and workflows much easier. It is essential for the designer to integrate performance measures for evaluation and generation of form, starting from conceptual to detailed design stages.

Contradictions or contrasting decisions are inherent in a design process thus, it is not practical or is even impossible to propose solutions by intuition. However, it might also be time consuming to run detailed simulations. The logic of architectural design is iterative and designing is sometimes a loose process, so alternatives or ideas should be evaluated without consuming too much time and effort. The need for designing suitable processes and tools for each specific design problem at any stage of the architectural design process should be within the expertise of and directly available to the architect. Ideally, tools for the design process should be easy to manipulate and give visual feedback to the designer apart from numerical data, to speed up the evaluation times. Rather than a trial and error method, it is desirable to evaluate a wide variety of design alternatives that can be generated in the control of the designer by computation.

Quite contrary to the existing interface design of the simulation tools which are hardly customizable, simplified and custom tailored interfaces for different design strategies are demanded by the designers, each tool having distinctive methods if possible. The designer should have the flexibility and knowhow of designing tools for building up custom procedures for performance driven generative systems and parametric design.

One of the main design problems for office buildings in hot climate is to achieve the optimum balance between natural lighting and heat gain through windows. To overcome this problem using external sun shades is an effective strategy. However, exploring possible form and geometric solutions is not within the reach of traditional design practices when we consider the complexity and conflicting character of the design criteria. We have to generate an effective number of alternatives to compare and evaluate with each other before we can confirm that we can further advance the design alternatives and run more detailed analysis and simulation tools. It is essential to maintain an equilibrium between computation time and simulation accuracy for each design case.

There are three main sources of heat gain in summer that have to be dealt with. These are direct solar radiation, high outside air temperatures and internal gains from occupancy, lighting and equipment. In hot climates energy used for cooling with active systems is the major operational cost therefore minimizing mechanical cooling and ventilation in the building during summer and eliminating heating in short winter season is the goal for designing an office in hot climate. Other criteria are natural lighting and ventilation. In this particular building on which this study elaborates, these are integrated to the design. In terms of natural lighting, while office buildings require certain lighting conditions, it is also significant to minimize heat gained by electrical lighting.

1.2. Objective

The objective of the thesis is the search for the design alternatives of the shading and envelope design of an office building with multiple design criteria using computational design procedures and methodologies and arrange the workflow for the performance based design with the use of parametric computational tools. The workflow is setup for the custom designed parametric model and procedure of the external shading components of an office building and the assessment of its performance in terms of daylight and solar irradiation. This analysis cannot be regarded as complete without a thermal performance assessment integrated into the process, nevertheless the workflow presented in the study can be widened to include other simulation tools for a comprehensive analysis of the building.

There were only single thermal zone analysis tools integrated to the parametric environment at the course of the writing of the thesis. It is only recently that tools making use of multiple zone analysis have emerged. However in the scope of the thesis the priority is on the methodology rather than a complete analysis. In order to keep the integrity of the architectural design and guide other disciplines through the whole process, it is necessary for the architect to develop custom methods and tools for enhancing the natural lighting performance.

It is important to explore the solutions in broad diversity extending the search area, therefore to make use of the possibilities of the digital design tools and procedures to the fuller extent, broadening the skills and expertise of the designer. One important aspect of the study is designing the procedure as manageable as possible labour and time wise, while making an abstraction as close as possible to the real phenomenon.

The conducted study will concentrate on the comparison of design alternatives supported by simulation and visualization tools rather than try to run the simulations as close as possible to the real world conditions. The simulation tools provide high levels of accuracy and detail. However high level of accuracy and complexity does not guarantee a design and living quality. In the conceptual phases sacrificing the level of accuracy for both encouraging creativity and maintaining multiplicity of design alternatives is preferred. How to maintain an equilibrium between two approaches is one of the topics discussed in the subsequent chapters.

1.3. Procedure

The thesis explores the external shading device alternatives for a General Headquarters bank office building in Nicosia in Cyprus. The application project is approved and construction phase is pending.

First of all, the building block and its envelope were modelled in Rhino3D simplified as possible in order to reduce the simulation periods. The building model is static and not parametric. Secondly, shading devices were modelled parametrically with Grasshopper. Thirdly, the system which generated the shading devices with parametric systems and genetic algorithms in Grasshopper connected to the Radiance simulation software with the components of Diva was designed.

Finally, results of the design exploration, their advantages and disadvantages were compared. Optimum strategies and configurations were determined for further clarifying the essential design decisions.

1.4. Disposition

The study covered in this research is composed of five chapters, introduction being the first.

Architectural design theories starting from 1960's are summarized in Chapter 2. Thereby, digital design theories and practices are summarized, current discussions and approaches up to now are introduced. The second chapter is a literature survey on the topics of architectural design theories from the end of WWII and the change in design approaches since then. This chapter also introduces the outcomes of the integration of performance criteria and survey into the realm of design and possibilities offered by computation in the process. Emergence of digital design theories and their application accompanying the studies on parametric algorithms including genetic algorithms and the like are introduced together with examples where appropriate.

In the third chapter, the description of the building, the software used are described in detail. The procedure of modelling is described according to the simulation requirements.

In the fourth chapter results of the simulation and the corresponding geometries influencing the design strategies are discussed. All of the design solutions are thereby illustrated by the solution graphics and compared accordingly.

In the last chapter a conclusion is made and further discussions based on the results in the preceding chapter are presented.

CHAPTER 2

LITERATURE SURVEY

The process of design research is defined as the knowledge and study of composition, structure, purpose, "value in the artificial" made by human beings and the way these activities have been directed in various application areas (Bayazit, 2004). Theories on design research have been developed since 1950's and early 1960's with the attraction of how profitably the recent technological advances of military technologies can be transferred to other design areas. With the advent of computing technologies and development of appropriate software, new processes expanded possibilities and alternatives of design research to a new level. There are several theories and approaches for the definition and process of design action some of which are presented and discussed in the proceeding pages which forms the basis of the discussions on digital design theory and applications.

Design process in architecture is a process through which various disciplines and domains of knowledge are combined. Apart from scientific and technical difficulties associated with the design and enhancement of thermal performance of buildings, interrelations of social, economic and cultural backgrounds further complicates the combination and renders the situation even more challenging for the designers involved. Although the climatic characteristics remain similar in random locations of the world, diversities in lived experience and spatial practices differ which in turn influence design preferences and related decisions. Impact of cultural differences is revealed in the patterns of use, activities and ways of adaptation (Aljawabra and Nikolopoulou, 2009). Impact of the existing urban fabric and spatial practices guides our evaluation and decision making processes. Nonetheless, regulations of authorities, client requirements and demands, whether coherent or not, either scientific or analytic, cannot be excluded from the process. "There is a relatively well-known repertoire of technical solutions, which provide efficient and comfortable buildings. Contrastingly, cultural influences appear in a surprising diversity. As a result, a proper technical solution may be not sufficient for the acceptance of the design" (Reis and Schmid, 2009).

Optimization of the design of building components is a time consuming and complex process. There are several methodologies either developed or being developed for a more simplified workflow, such as "Design of Experiments", a statistical method widely used to perform parametric studies to reduce the number of experiments required.

However, performing such a parametric study is rather complicated and time consuming because it requires a large number of simulation runs. Actually, there are a lot of parameters or factors to be considered such as building thermal insulation, building orientation, glazed surface area, window types, envelope air-tightness, building thermal inertia, efficiency of equipments and HVAC systems, renewable energy sources, etc. Moreover, there are interactions among some parameters, which are not easy to evaluate with a simple parametric study. For instance, increasing the thermal insulation of the building envelope to reduce the heating demand will increase the cooling demand in summer. (Chlela, Husaunndee, Inard and Riederer; 2009)

In the subsequent pages, the sections are organized as such: Firstly as a brief history, the passage from conventional to digital design theories are elaborated since 1960's till the advent of computers. Then digital design theories are addressed in more detail starting from 1990's. The third section is performance oriented design processes which are at the core of these discussions starting from the outset of these theories on design research. The last section will be on the optimization processes and genetic algorithms which are discussed together with some of the latest software available for generative design exploration coupled with a short description for each. The chapter is finalized with a brief discussion about the possible advances and strategies for the future of the generative systems in architectural design.

2.1. Design Theories: A History

Two major different approaches can be identified for architectural design process in the last 40 years according to Bayazit (2004). First approach designates the designer as the one who attempts to find a form that will support the desired function, which can be summarized as "form follows function". In the second approach, the designer is the one who begins with some forms which are adapted and modified to achieve the desired functional criteria. In fact neither of them are appropriate in formulating the architectural design process. Besides iteration, there are uncertainties and intuitive leaps inherent in architectural practice. Bayazit summarizes the design methods generated after WWII as two separate generations (2004). The first generation includes both approaches mentioned above, which can be summarized as simplistic and incapable of meeting the requirements of real world problems.

The second generation was influenced by Karl Popper which utilized argumentative method and IBIS- Issue Based Information System, characterized by user involvement in the design decisions and the identification of their objectives. Rittel and Kuntz (1970) briefly state that "it is not possible to separate 'understanding the problem' as a phase from 'information' or 'solution' since every formulation of the problem is also a statement about a potential solution" which is counter to the analysis/synthesis method influenced by Bacon and Descartes, suggesting that the analysis, synthesis and evaluation occur in sequence. In this process, analysis involves breaking down the problem into fragments and to solve each fragment separately and synthesis is defined as the response to the problem and evaluation as the final stage for reviewing the solutions against the objectives. In reality, this linearity is hardly achieved and designer has to go back and forth many times to identify problems or establish solutions (Trebilcock, 2009). Here conjecture/analysis model derived from Karl Popper's scientific method is proposed instead.

Analysis/synthesis paradigm is unworkable because it suggests that design should derive from an analysis of the requirements of the users rather than from the designer's preconceptions, whereas in reality, a complete account of the designer's activities during the design process would still not reveal where the solution came from (Trebilcock, 2009).

In reality, the design process will not reveal where the solution came from. The purpose of analysis is to test conjectures rather than optimize a synthesis by logical procedures. Darke (1979) observed in her socio-constructivist research that architects in practice tend to hold a relatively simple idea or concept very early in the design process, which she named 'primary generator'. The benefit of this 'primary generator' is that it reduces the number of potential solutions tested against the constraints and enables one or more tentative solutions to emerge. Trebilcock (2009) summarizes the process as:

> The Analysis/Synthesis paradigm proposes that design starts by dismantling problems into fragments, synthesizing and evaluating possible solutions, and arose at the time when designers attempted to make design more rational and systematic and its powerful attraction was that design would emerge by a rational process from the brief, so that a design would be therefore justifiable. In contrast, the Conjecture/Analysis paradigm proposes that design starts with ideas that can be quickly tested against constraints and that there is enormous value in making mistakes. The A/S model is mostly prescriptive and can be placed in the realm of design methodology, while the C/A model is mostly descriptive and can be placed in the realm of design theory.

Design is approached as an open ended process, exploration and experimentation are the tools used for possible solutions and every solution is a step of evaluation against other design alternatives. Schön's (1983) reflection in designing is a cognitive process we change our decisions compare them with previous designs and thinking while we are doing it. He defines design as a "reflective conversation with a unique and uncertain situation". Designers develop the skills to evaluate the complex technical and aesthetic qualities of design by looking at the representation of the object (Schon, 1991). One can boldly point here that the visual representations of the design are inseparable and important part of the process.

The theory of situated cognition originated by Dewey argues that knowing is inseparable from doing and cognition cannot be isolated from its context (Gallagher, 2009). Gero and Kannengiesser (2004) have modelled 'situated designing' as the recursive interaction between three different worlds: external, interpreted and expected. They formulate a 'situated function-behaviour-structure framework' (Gero & Kannengiesser, 2004). Here, 'situatedness' emphasizes that the agent's world view changes in the design process, which is dynamic and non-linear. They propose a model of designing that is not encoded apriori and allows adaptation to the changing world for developing computational design agents to aid human designers. This is a recursive process, an interaction of making and seeing. Based on Schön's design paradigm, Tschimmel (2010) builds up the "perception in action process" composed of five procedures which are intersecting each other. Perceptual reflection is prioritized as the basic skill and procedure for the creation of new realities. Dorst and Cross (2001) define the creative process as a combination of both developing ideas and the formulation of the problem, a non-linear process where it is hard to distinguish cause from effect. The originality of the design is the result of a framing and reframing process, where the personal approach and surprise takes precedence rather than a gradual changing of a phenotype and genotype to an optimum fitness function (Dorst & Cross, 2001).

The conceptual design phase is the key step for generating fruitful and innovative design alternatives; poor concepts cannot be compensated later in the detail design steps. Adapting and improving design is possible with promising concepts at the beginning. A creative event occurs at the time in which a problem and a solution pair is framed by the designer. In other words, it is a shift to a new part of solution space and finding an appropriate concept, defined with the term "bridging" (Cross, 1997). Quoting Rosenman and Gero, Cross suggests procedures by which creative design can occur: combination, mutation, analogy, first principles and emergence (1997: 433).

In co-evolution model, the designer formulates partially the structure of the problem space and transfers it to the solution space. Therefore solution and problem are developed simultaneously. "Co-evolution in design exploration supports the change over time of the design solution and the design requirements" (Maher, Poon, & Boulanger, 1996). In the other approach, the designer sets a partial structure in the solution space which he or she uses to structure the problem space. Hence first approach is defined as 'problem driven' and the latter, 'solution driven' design strategies. Besides these two strategies, 'information driven' as a variant of problem driven strategies and 'knowledge driven' as a variant of solution driven strategies are introduced (Kruger & Cross, 2006).

Problem driven strategy either starts with a highly defined problem which leads to less alternatives or defined on an abstract level leaving space for more alternatives. As in problem driven design in information driven design, one tries to define the problem as strictly as possible with more emphasis and time spent for data gathering. Solution driven strategy, on the other hand, surpasses the information gathering phase rather quickly and knowledge is gathered from memory. Generation and evaluation stages take more time in this approach. Knowledge based design depends heavily on prior knowledge with a relatively long analysis stage and a shorter synthesis stage (Kruger & Cross, 2006).

Dorst conducted a study on nine experienced industrial designers in relation to creativity in design and a problem/solution co-evolution model (Dorst & Cross, 2001). Contrary to the expectations, problem driven design resulted in many solutions with a high score on creativity with relatively good results. Solution driven design on the other hand resulted with high creativity but low overall quality. Knowledge driven design produced average results and information driven design with fewer solutions and lower creativity with a higher total score. Both problem and solution driven strategies used fewer iterations than the other two.

The theories and methodologies discussed up to now in fact are tightly integrated with the interaction of conventional and digital design theories.

2.1.1. Digital Design

Together with the advent of cybernetics, the scientific research methodologies were developed accordingly to aid the design process. The field of cybernetics with patterns of feedback loops and challenges in human-machine interaction is similar to design exploration according to Wiener (Kilian 2006). Starting with the 1960's, research areas on building performance (acoustics, climatic control etc.) developed and since the 1970's, computer scientists have become more interested in 'design science' and methods and thus become part of the performance evaluation, which can be described as a multi-criteria, multi-disciplinary practice. Kalay (1999: 396) argues that the quest for design tools should begin by "asking what architects do when they design" rather than "how they design" and proposes the performance based design approach as:

> (...) the performance of a proposed design solution can only be determined by an interpretive, judgmental evaluation, which considers the form (and other physical attributes) of the proposed solution, the functional objectives, goals it attempts to achieve, and the circumstances under which the two come together.

He also underlines that different forms can achieve similar functions and different functions can be maintained by similar forms although it has to be to admitted that performances will be varied according to context changes (Kalay, 1999).

First tools for digital performance analysis were developed in 1973 (Maver, 2000) and the first approach in the usage of computers was incorporating the computing power for speeding up the repetitive and time consuming practices, both in terms of drafting and calculating the complex geometric forms and systems. Another approach was the use of computers as a medium. This implied that the computer assisted the designer in the creative process, providing him/her with a new understanding of the design problem by presenting unexpected solutions as illustrated by the use of morphogenetic design (Menges, 2006).

The main question is whether digital design is a unique form or rather a conventional form of design accomplished with new media (Oxman, 2006). If we are to consider it as singular, then some of the concepts related to design methodology has to be reformulated both in theory and practice. In fact the significance of the digital design is not based on its new forms or complexity, rather it is its ability to propose meaningful alternatives to the logic of repetition in conventional design practices. The syndrome of repetition propagates the value of environmental stability, while the real world presents a different picture of dynamism, constant change, and minute incremental variations. The new design faces this syndrome of the normative, static, and typological and proposes alternatives of discreteness, diversity, differentiation and dynamic evolution.

Oxman (2006) sets forth the components such as presentation, generation, performance and evaluation as basic components that differentiate from conventional paper based design. Two streams of influence of digital design are mentioned by Oxman: one tries to establish digital design as methodologically a unique form of design and the other tries to define this unique content. He mentions the special issue of the journal Architectural Design *Folding in Architecture* as an important threshold which is followed by a sequence of special issues on digital design supporting the theoretical framework, though according to him, it is still not well formulated and conceptual foundations are bound up to ideological positions. (Oxman, 2006)

Interaction with the visual medium is still relevant for digital design where it is based on interaction and reflection of information with the designer. What is becoming characteristics of the digital design systems is the degree of control provided to the designer in the process. Oxman emphasizes the importance of user interface design together with the design computation literate designers as prominent aspects in the advance of integrated design systems. The designer becomes a tool builder, controls and moderates generative, performative processes and mechanisms and information becomes the new material for the designer. Representations of this knowledge and its formulation, interaction and implementation are depending on the designer's ability and skills to manipulate the generated data for the design goals.

The digital design model summarized by Oxman contains four basic components which are representation, generation, evaluation and performance. The relationship between these components are classified into two types: interactions and links. Interactions are categorized into two as external and internal. External ones are traditional interactions with shapes and forms, whereas internal ones are interactions with "digital form through the medium of certain digital environments, computational processes or mechanisms" (Oxman, 2006).

Oxman proposes five classes of digital design models:

i. Cad Models
ii. Digital Formation Models
iii. Generative Design Models
iv. Performance Models
v. Compound Models

Along with its traditional use, CAD Models are now bi-directional due to the new digital techniques. Seamless integration is now possible either by digitizing the physical model or physical models can be generated from a digital one. Apart from descriptive models the predictive models differentiate by the integration of analytical processes on geometrical models. Current digital models exhibit this predictive structure where there is a shared database between the representation and evaluation. Other than explicit relationship representation and evaluation, the rest of the design process remains typical of paper based design (Oxman, 2006).

Digital Formation Model is based on interaction with a digital technique enabling digital modification of certain formation processes with the representational structure in the CAD model. The designer has a high level of interaction and control in the geometrical or formal digital process. Three sub-classes are named. First one is topological design which is based on relational structure of objects rather than of geometry. The static coordinates of forms and shapes are replaced by computational dynamic constructs. Second is associative basing on parametric design techniques which make use of associative geometry. Relationships between objects are explicitly described and once the interdependencies are set, they can be manipulated to generate multiple variations. Parametric formations embody adaptability, continuity, proximity and connectivity, where the user can control type and level of interaction with the representational medium. The last sub-class is motion based models, which make use of animation and morphing techniques such as: key-frame animation, forward and inverse kinematics, dynamic force fields and particle emissions (Oxman, 2006). In this model designer does not interact directly with the medium.

Generative models look similar to the formation models except a subtle distinction: The designer interacts with the generative mechanism compared to the latter. Shape grammars and evolutionary models can be stated as distinct approaches to the generative design concept (Knight & Stiny, 2001): The first one can be described as "mathematical expressions for computational mechanisms that drive shape generation processes through transformational rules", and the latter is "form generation techniques based on evolutionary models of natural evolution that can be applied to generative process in design". Shape grammars are based on formal compositional rules as a general rule, though this could become more abstract and topological (Oxman, 2006). In evolutionary models, form emergence is the result of an evolutionary process which is derived from an internal genetic coding. A set of generative rules are defined and mapped onto a specific design problem defining their evolution. "Evolutionary systems based on morphogenesis produce properties related to differentiation and heterogeneity" and are emphasized as the most significant aspects of digital design (Oxman, 2006).

Performance based models generate forms as a result of design performance objectives and its simulation. Performance becomes the generative process, the variants of which are parametrically defined in relation to the design problem. Design performance may include any parameter; social, cultural, ecological or economical (Kolarevic & Malkawi, 2005). Multiple design criteria can be applied to form a complex simulation model which transforms the performance based formation model. Performance based generation models are described as "based on generative processes driven by performance and potentially integrated with formation processes". In this model data or performance simulations drive generation and/or formation processes in order to generate the form. The designer directly interacts with the performance criteria, generation procedure and digital representation.

Finally compound models are described by Oxman as the future of digital design media which are based on formation, generation, evaluation and performance. 'Digital design thinking' is defined as non-typological and non-deterministic and new forms and relationships between the designer, representation and information are explored. The conceptual terms used to characterize digital design and related subjects have their sources in Deleuzian philosophy. Geometric and formal complexity is not necessarily a defining characteristic of digital design, attributes such as hyper-connectivity, non-hierarchical, non-linear, diagram, design machines etc. influence the theory in digital design.

2.1.2. Performance Based Design

There is exceptionally a wide range of domains that the concept of performance covers in architecture taking into consideration social, financial, aesthetic and engineering parameters. Form and geometry in performative architecture synthesizes larger range of performance evaluations as compared to the traditional design. There is a complex network of relationships between various aspects of design, including changing needs, demands and environmental conditions. Performance assessment has been used as an evaluative tool rather than a generative one; this requires tools to integrate simulation tools into preferably flexible systems that will accept the intervention of the designer. As Huerta (2006) shows, early examples of 'performance driven form finding' can be seen in Antonio Gaudi's works, where structural design is based on equilibrium of tree forms, which has its origins back to the end of 17th century. Graphic methods and models were used in combination for a better understanding of geometry and stability. Gaudi used space hanging models in order to obtain equilibrated forms directly in three dimensional space (Huerta, 2006). Similarly, in the case of tensile membranes, finding the equilibrium shape is essential where Frei Otto used soap film experiments at the Institute of Lightweight Structures at the University of Stuttgart.

Performance is defined as a measure of desirability of the confluence of form and function within a given context (Kalay, 1999). To deal with the subjective definition of desirability, Kalay offers satisfaction functions which are mappings expressing a specific relationship between the behaviour of a system and the subjective measure of its desirability under specific circumstances. The graphs generally represent satisfaction of users or clients as a measure for performance evaluation. However, it is not possible to conduct a survey for each case, although it is possible to collect data from similar or typical scenarios that can be interpreted as the new case in performance evaluation. In case of multiple criteria, relationships between different needs and their priority or rules have to be integrated into the knowledge base.

Performance based design also called performative design is defined by Oxman as the synthesis of two characteristics of digital design which are geometry generation and performance evaluation by simulation. Performance becomes the determinant factor for form and geometry generation internally integrated into the process (Oxman, 2008). There is a shift from "form making" to "form finding", in which the building performance becomes the guiding factor. As a result of the process, direct manipulation of the geometric or material properties of the digital model becomes possible, placing parametric design systems at the core of the system. The prediction of the behaviour of the system is not based on the analysis alone but on information on its performance and interaction with its environment with the aid of simulation (Schewede, 2006). Schewede describes simulation as a digital bridge between the designer and digital representation in the performance based design process as seen in Figure 1.

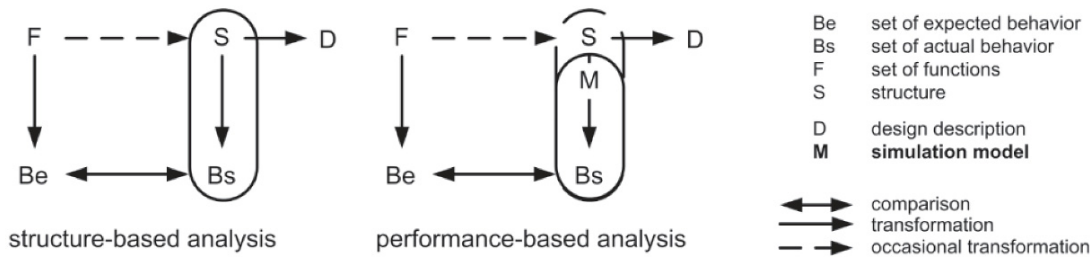

Figure 1 Left: analysis the structure-based, not augmented (Gero 1990) and right: in the performance-based, augmented design process (Schewede, 2006).

The use of performance models will make the computer a partner in the design process. Besides designing the components, the system can be modelled for a more complete understanding of the design problem. A topological model in architectural design maintains dependency relations of components while enabling transformations by reconfiguration of parameters of the digital model. Relationships between parts is defined in the model accommodating dependencies of each component to the rest of the parts and the model. The designer interacts with the parametric variables and controls and acts as the moderator; in fact it can be formulated as designing the design process, a meta-design. The answer to how and at what point should the designer interfere within the process yet remains incomplete. Another question is how performance based optimization techniques can be integrated into the process of modification in order to control the parametric model.

2.1.3. Design Optimization and Genetic Algorithms

Design exploration is based on an ill defined problem as opposed to search which starts with a well defined problem. Genetic algorithms provide an alternative to traditional design exploration techniques by simulating mechanisms found in genetics. In real design problems the number of parameters can be very large and the relationships among them can be very complicated. Problems with non-linear character cannot be handled with classical methods; for example gradient methods start from a single point in design space and search for a better solution, if the new point has a better value compared to the goal function it becomes the new point and the process is repeated (Renner & Ekárt, 2003). The problem with the gradient methods is that there is only a local optimum, computation is repeated for a number of starting points to improve the results obtained. To overcome the disadvantages of the gradient method, simulated annealing method is used, a stochastic search method is presented that operates by discomposing the current solution and obtaining a new one accepted if it is better than the old one. The main difference between classical search algorithms and Genetic algorithms is that the latter maintains a population of possible solutions rather than a single point in the design space.

Genetic algorithms transpose the notions of natural evolution to computers and imitate it by trying to find the fittest solutions for a population. In complex cases, where traditional methods may be insufficient, stochastic optimization techniques including genetic algorithms can provide solutions within a reasonable computation time. Genetic algorithms have a population of individuals and a collection of solutions, therefore perform a multidirectional search. Individuals are represented by chromosomes composed of genes. The individuals closer to the fitness value are kept and new ones are generated either by mutation, crossover and reproduction from the fit ones and each member of the population is assigned a fitness value (Renner & Ekárt, 2003).

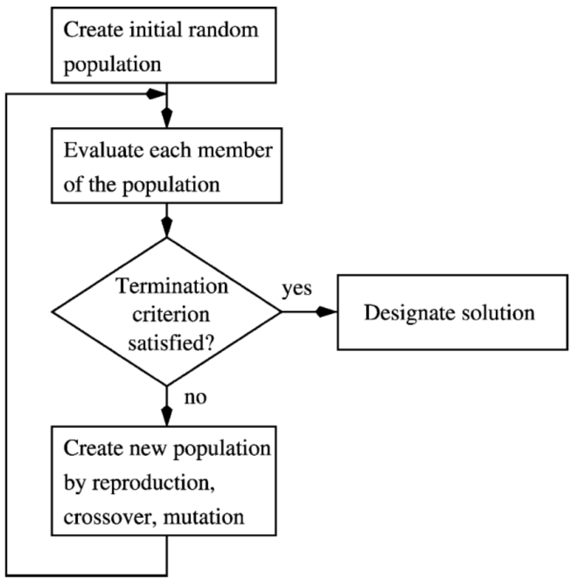

Figure 2 Genetic algorithm flowchart (Renner & Ekárt, 2003)

Genetic algorithms use separate search space and solution space, first one being the coded space consisting of genotypes or chromosomes, the latter being the actual solutions such as phenotypes. Genotypes might consist of several or single chromosomes and each genotype must be transformed into corresponding phenotype before its fitness is evaluated. A proper representation of the fitness value has to be designed when starting to solve a problem. Many representations are possible and each should work differently. The next step is the termination criterion, if not satisfied, new population is generated and evaluated using the fitness measure until the termination criterion is met and the best solution is returned. Each iteration is called a generation (Renner & Ekárt, 2003).

Individuals are selected which are called parents based on the previously computed fitness value while the resulting ones which are called offspring form a new population. The method to construct the new population differs every time. Some implementations extend the current population, others create a separate population and some do not use generations but continuous replacement.

Choosing the right representation technique when designing the GA for a given problem is the first and most substantial step. The results with different representations can vary significantly whereas one leads to satisfactory solutions and less computing time while another can result in poor results or excessive computation times. In some situations, it is desirable to explore a design space as broad as possible, conversely, it may be desirable to limit the space when needed depending on the design problem. As a general experience, integrating knowledge specific to the problem domain into the representation results in better solutions, but there is no exact method for designing the right representation, it is where it counts for the skill and knowledge of the designer. There is always a trade off when we are designing the representation, simple representation may result in irrelevant search regions, on the other hand a complex one may not result in reaching an equilibrium.

There are three genetic operators as mentioned before: reproduction, crossover and mutation. In reproduction part of the population is simply copied based on the selection of the fit solutions. By crossover new individuals are created as offspring of two parents, one or more crossover points are selected usually at random within the chromosome of each parent at the same place in each and interchanged between to create the offspring chromosomes. It is desirable to keep the fit individuals at later stages so it is common to decrease the crossover rate at later iterations or keep changing through the process. Mutation creates a new individual by changing values in the representation or adding and deleting parts of it. Different mutation operators can be used at different stages of the evolution (Renner & Ekárt, 2003).

Fitness function must indicate how well the solution performs in comparison to the requirements of the given design problem. Fitness assignment can be made in several ways: Either we incorporate the fitness function into the generic algorithm, or we may use a dedicated external analysis software. Sometimes there may not be a fitness function and the designer assigns a fitness value for each solution or we can assign fitness by comparing the individuals in the population, where fitness depends on the other solutions.

Selection schemes are used to form the new population according to the fitness assignment. Some of the most frequently used schemes are fitness-proportional selection, ranked selection and tournament selection. In fitness-proportional selection scheme, each individual has a chance to be selected proportionally to its fitness share. The problem with this method is that in most cases a good measure for fitness value cannot be defined so it may not contribute to the quality of the design. In ranked selection, individuals are arranged according to their fitness value and selected with a probability based on a linear function of their rank. In tournament selection, individuals of the pool are randomly chosen among which the most fit individuals are eventually selected.

2.2. Natural lighting, thermal comfort and energy performance

Utilization of daylight for office buildings is one of the major design concerns in terms of both visual and thermal comfort in hot climates. About 30% of energy consumption of office buildings is assumed to be obtained by artificial lighting (Linhart & Scartezzini, 2011). Detailed daylight distribution calculations comprise an important part of the process of assessing thermal and visual comfort of the building. This calculation is also important in order to assess the trade-off between necessary natural lighting and undesired solar heat gain.

The proper use of daylight provides an equilibrium between obtaining comfortable lighting levels and avoiding direct solar radiation. Controlled indirect daylight is preferable in climates where cooling dominated strategy is the guiding principle. Furthermore, the human eye adapts more easily to natural light than the artificial, as the artificial light produces a different spectrum of colours that contrasts with the natural light and reduces the richness of colours and contrast (Tavares, Kinsel, & Silva, 2006). Glare is another undesirable consequence of uncontrolled natural lighting. To avoid conflicting situations between the need for shading, overheating, glare and natural lighting, complex shading devices are developed (Schuster, 2006).

2.2.1. Performance parameters

There are multiple components affecting the desired visual and thermal performance. Besides window area and ratio to room area, room dimensions, floor plan configuration, size and position of shading and building orientation, physical properties such as coefficient factors of insulation performance, light transmittance and solar heat gain, glazing type, framing materials and thermal conductance are the factors to be assessed for optimizing inner comfort criteria specific to the type of activity. Window design and material selection have to be designed in combination with shading devices to increase the thermal and visual performance of the system.

> (...) in order to anticipate the realistic daylighting and visual comfort conditions inside buildings its essential to have a solid knowledge on the typical patterns of use of shading and electric lighting. These patterns of use are directly related with the occupants' preferences and motivations regarding their indoor visual and thermal environment (Santos, Carvalho, Rodrigues, & Santos, 2008).

It is clear that besides horizontal global radiation, meteorological data for direct, diffuse and vertical components are necessary for a more accurate analysis. It is indicated by analysis that for about half of the working hours in offices natural daylight alone can provide an average of 500lx illuminance with 2% daylight factor design. Therefore it is claimed that use of daylight is energy efficient in two ways: for reducing the need for artificial lighting and for dissipation of less heat for the same amount of lighting because of high luminous efficacy, thus, reducing cooling loads (Lam & Li, 1999).

Optimum energy performance can be achieved if daylighting benefits, due to the reduction in lighting energy demand and subsequent decrease in cooling load and demand, exceed the increase in energy demand due to increased solar gains (Tzempelikos & Athienitis, 2006).

In determining the cooling loads for windows, there is sufficient proof showing that they are maximized when solar transmittance is high and thermal transmittance is low. Especially in Mediterranean regions, in offices, increased thermal efficiency for windows constrains loss of ambient heat generated inside and results in higher cooling loads (Tsikaloudaki, Laskos, Theodosiou, & Bikas, 2012). The impact of geometrical and thermo-physical properties of windows has not been thoroughly analyzed, moreover there is an optimum window to wall ratio (WWR) interval where further increasing the ratio does not enhance the daylight availability. The graph shows the impact of WWR on several aspects of design criteria.

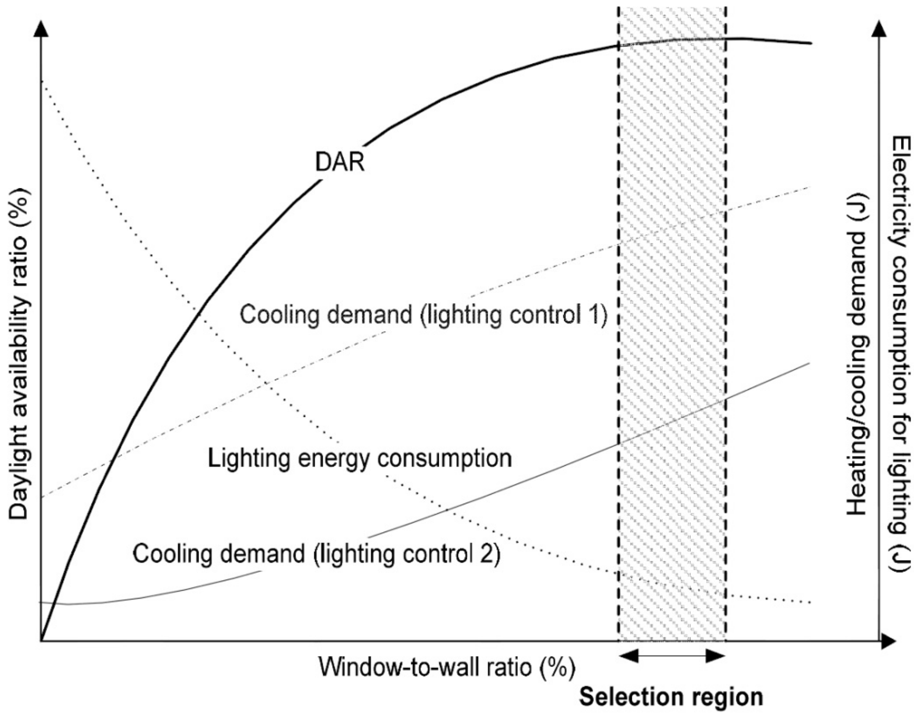

Figure 3 The impact of shade transmittance on performance indices (Tzempelikos & Athienitis, 2006).

Studies on the effect of the building envelope on daylight illuminance in office buildings show that facade direction, obstructions and transparency ratio are the basic parameters to be considered to obtain the required daylight illumination, whereas glass type and thickness of the wall do not affect the visual comfort significantly for the examined cases (Ünver, Öztürk, Adıgüzel, & Çelik, 2003). There is proof that geometry factors affect the energy consumption significantly especially in hot and cold climates. Window to wall ratio has the highest effect on energy consumption in deep rooms in hot climate zones and in shallow rooms in cold climate zones. Room width to height ratio has significant effect in rooms with small window areas in hot climates and in rooms with large window areas in cold climates whereas shallow rooms perform better in hot climates where less artificial lighting is required and deep rooms perform better in cold climates. As a brief conclusion it can be said that geometry factors have the highest effect in hot climate zones where energy savings vary from an average value of 2.74% to 5.75% and it can be effective from 9.95% to 14.09% in several cases (Susorova, Tabibzadeh, Rahman, Clack, & Elnimeiri, 2013).

A study was carried on lighting levels for office spaces where Daylight Coefficient method and Waldram Diagrams are used for calculation. The calculated daylight zone for 300lx illuminance on the work plane was 3.5 metres, beyond that value, for the side lit interiors, there appeared a need for supplementary permanent artificial lighting. The supplementary artificial lighting depth ranges from 4.5 meters at the north to 6.3 meters at the west. These values change to 3 metres for daylight zone, 4.25 meters for north and 6 meters for west orientation respectively for maintaining the 500 lx illumination level (Shahriar & Mohit, 2007).

As Tzempelikos & Athienitis (2007) point out, detailed optical and thermal properties of advanced glazing systems are not provided by manufacturers and there is no standard procedure for measuring, thus can only be estimated by experimental techniques, using detailed theoretical models or advanced software. The integration of shading devices is lacking in the assessment of optimal cooling and lighting design strategies and recent studies show that appropriate shading design and control could reduce the energy consumption significantly when linked with electrical lighting and HVAC systems (Tzempelikos & Athienitis, 2007).

A parametric study was carried out (Tsikaloudaki et al., 2012) on examining the window configuration, orientation and shading in relation to the cooling performance for office spaces in Athens, using Energy Plus software. The influence of window configuration and orientation was carried out and based on different alternatives with nine different thermal transmittance (U value) and solar transmittance (g value) range for glazing and framing fractions resulting in 27 test cases. Simulations for testing the window configuration and orientation were run and in the case of window with a low U value (1.37 W/m2 K), results for cooling energy index for southern windows, the energy increases with regard to frame fraction. For east and west orientation, however, the values were found to be even, regardless of the frame fraction. For the case of a U value higher than 2.00 W/m2 K, east and west values decreased, same trend was observed in south facade with 2.60 W/m2 K or higher values. Windows with a high g value on the other hand, different patterns were observed. For southern windows, energy is increased with the increase in window fraction especially the ones with low U value. East and west orientations behave in the opposite manner where cooling energy is dramatically reduced with regard to window fraction with high U value, and this trend increases as the U value decreases. Due to the occupancy status of office spaces the excessive heat gained at evening hours are dissipated through conduction during night time. Conventional openings at east and west contribute at a significant level to the cooling performance. In cases where external air is cooler than indoors at night time, advanced thermal protection leads to overheating in cooling dominated regions.

The influence of shading was tested as the second step with different shading ratios from 25% to 75%. As a result it can be said that as the shading is stronger while the influence of the window on the cooling loads decreases. Inclination and correlation between shading and window differs in each orientation. For southern windows, increasing shading leads to a decrease in cooling loads from 12% to 30% and in the case of eastern windows, the decrease is from 9% to 24%. Therefore it can be said that the effect of shading contributes more for reducing cooling loads on the south compared to the east and west. There is a curious point that given models with the same solar transmittance, cooling loads decrease as the thermal transmittance increases. As a consequence of the simulations it can be said that cooling loads is less significant when solar transmittance is low and in such cases thermal transmittance should not exceed 2.00 W/m2 K. When clear glazing is used, the range for thermal transmittance between 2.00 - 3.20 W/m2 K performs better, hence advanced thermal products with low transmittance result in higher cooling loads.

It is preferable to avoid side lighting in office spaces unless it is the only option; side lighting can be used to a depth of 2-2.5 times the head height of exterior windows. The shape of the room, rather than the size and the overall area, determines the utilization and mean of daylight factors. It is preferable to have various smaller daylight openings rather than a large opening for obtaining uniformity in lighting (Tavares et al., 2006). In a side lit room, the farther away from the window, the illumination falls more rapidly. As a solution for increasing the reception of daylight, a thin plan layout can be preferred or a glazed atrium can be proposed. Daylight levels adjacent to the atrium are affected by the height and width of the atrium, the amount of daylight available during the year, the reflectivity of interior surfaces, the size and the position of windows facing the atrium, the roofing design, the transmittance of glazing system and reflection strategies at the interior indoor wall (Brown & DeKay, 2001).

Scale models are used for calculating the illuminance values in atria besides measuring data in real cases. It is found that measuring the average roof illuminance levels, parametric effects of glazing and structure reflectance values is overly challenging. Computer modelling is considered easier for testing several parameters as well as input of geometry and photometric properties are more accurate with radiance integrated. Using overcast sky is also useful, independent of location and time for evaluating alternatives at the early stages of the design. Determining a point on the ground floor 4 meters away from the atrium window is another useful practice for evaluating the worst case scenario (Lash & Sharples, 2006). As a result of the study based on radiance simulations, simplified formulas are developed for preliminary calculation of daylight levels in several rectangular shaped atria with different proportions under CIE (International Commission on Illumination) overcast sky conditions (Calcagni & Paroncini, 2004). Increasing the reflectance of atrium surfaces is not considered to provide a significant improvement in daylight factor levels on the ground level when large windows are used facing the atrium, therefore reducing the reflecting surfaces and the use of atrium roof, cuts the DF by about 45% in the area adjacent to atrium.

For articulating daylight, several strategies can be developed at the component scale. Visual comfort is closely associated with energy saving objectives. These strategies are for avoiding the glare caused by direct sunlight and distributing light evenly throughout the space. Daylight reflecting surfaces such as light shelves are utilized for indirect illumination and ceiling reflectors for diffuse skylight.

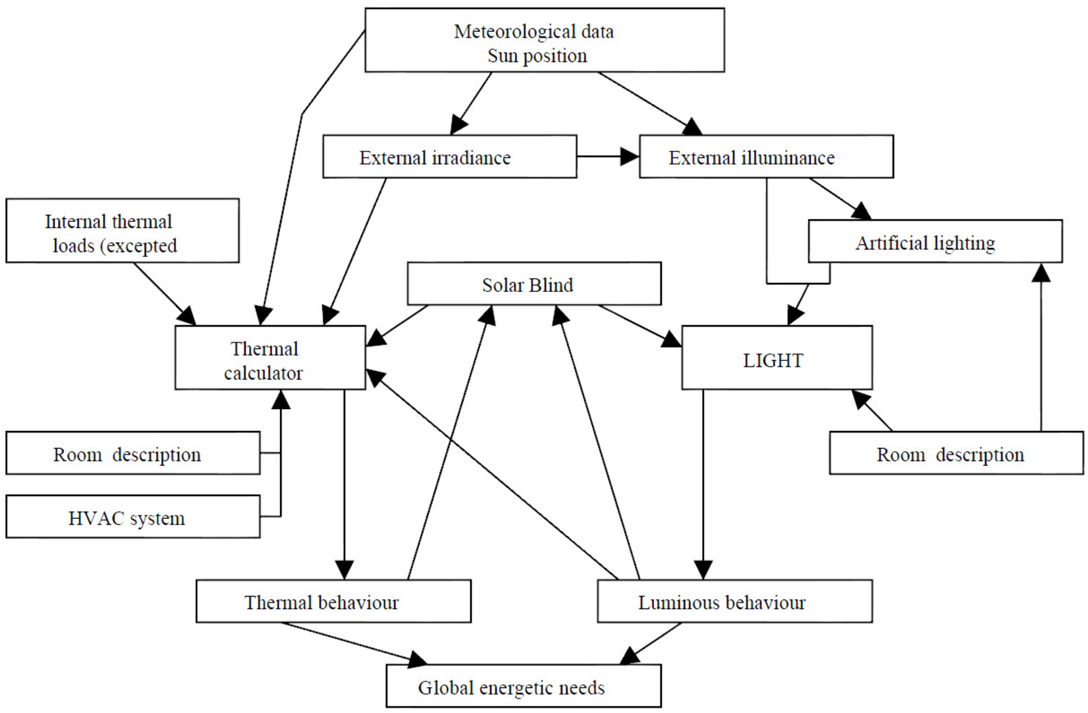

Figure 4 Diagram of interaction between thermal and luminous behaviors (Franzetti, Fraisse, & Achard, 2004).

There is a continuous interaction between thermal and luminous behaviour as seen in Figure 4. Besides, there are positive and negative consequences in the design of daylighting and energy related impacts as seen in Figure 5. In regions where cooling loads dominate the assessment of the impact of daylight, a new model is proposed by Santos addressing some of the problems with previous models. The proposed procedure "takes into consideration the prevailing average climatic conditions, the assurance of the lighting needs (daylighting levels, absence of glare, psychological benefits of daylight and contact with the exterior) in an energy efficient way and the attitudes and motivations of building users towards indoor visual comfort and control systems" (Santos et al., 2008). It is composed of four modules: exterior, transmission, interior and behavioural. Test cell is used for establishing daylight and transmission factors that are to be used as input data for daylighting-hours indicators model. Different types of buildings with different daylighting conditions, shading and control strategies were selected as case studies in Santos' research while on-site behavioural pattern observation and user evaluation were conducted through formal and informal post-occupancy surveys. Results from Santos' research show that although daylighting conditions are good for south facing rooms in summer time, roughly 80% of interior blinds were fully closed when there is poor solar protection. Moreover, electric lighting was on throughout the day. Closed blinds at the expense of daylight was due to excessive heat Generally, users forget to change the state of shading and lighting even the exterior daylight conditions change throughout the day.

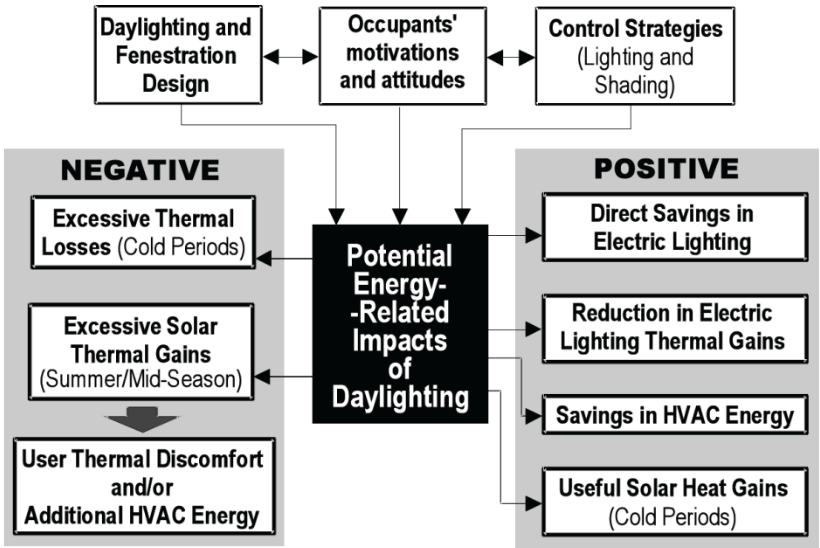

Figure 5 Schematic illustration of the major potential energy-related impacts of daylighting (Santos et al., 2008)

Another approach proposed is "integrated design" where there are several criteria to be met such as: maximization of daylight utilization, elimination of glare, reduction in peak thermal loads and cooling energy consumption and lighting energy consumption. Moreover time independent parameters are to be assessed, namely: annual energy demand (heating and cooling), peak thermal loads, daylight availability ratio and energy consumption for electric lighting. Window to wall ratio, window properties, shading device type and properties, shading device control are direct dynamic links that can be applied for integrated daylighting and thermal performance. Electric lighting control works as a secondary link which operates depending on the data read from daylighting module and transfers the internal gains to the thermal module (Tzempelikos & Athienitis, 2006).

2.2.2. Shading

Shading is an integral part of the fenestration and daylight design. Shading strategies are closely related with the building organization and massing. The building itself can be organized in order to shade its own parts or courtyards at different times of the day and year. Apart from self-shading, overhead shading facing south and vertical shading facing east and west are preferable. In hot climates where temperature rises quickly from early morning, overhead shading has to be very large to provide adequate shading, which comes out to be impractical. As a compensation, vertical shading devices can be utilized unless they are correctly oriented. Movable shading devices have also advantages in their adaptability to different times of the year compared to the fixed shadings. Planting is another effective way for complementing shading strategies (Brown & DeKay, 2001).

Shading strategies are related to natural lighting strategies where the components double function. The location of the shading can be outside, inside and in-between the glazing components. Exterior shading is more effective in hot climates; seasonally adjustable shading might also be preferable for winter season. Shading devices can be double functioneing, such as photovoltaic panels used as shading and energy generation unit at the same time.

Interior shading systems are cheaper and easier to operate but they cannot prevent overheating and are mostly forgotten closed when they are no longer needed. Operable outside systems have to be robust and most of them are expensive. Therefore designing fixed external shading in combination with internal curtains for diffusing the light is an effective strategy. Using fixed shading units is more effective in terms of east and west orientations where the panels can be oriented according to the most undesired sunlight direction, additionally the risk of overheating is limited to a few hours which is especially important for offices. As Matsuik advises, using inside curtains together with glazing with a total transmittance value lower than 10% is beneficial for decreasing the glare risk (Matusiak, 2006).

Large window areas especially applied on south facing facades result in high solar gains and glare problems. In such cases, automation and control of artificial lighting, motorized shading and HVAC systems reduce the energy demand for cooling and enhance the lighting in perimeter spaces by maximizing the use of daylight. In a test case in Montreal (Wang, Zmeureanu, & Rivard, 2005), the integrated analysis results ended up with cooling dominated strategy. Automatic control of lighting reduced the cooling energy load, and heating demand was slightly increased due to reduction in internal gains. Simulations were run for a south facing room with 30% facade glazing area with exterior roller shades during working hours. Passive shading control resulted in higher energy demand compared to automatic shading with a reduction in annual electric lighting 40% and 60% respectively for

20% shade transmittance. As regards lower transmittance values, poor daylighting conditions result in high internal gains due to continuous electric lighting whereas in warmer climates this value is assumed to be lower. As Tzempelikos and Athienitis show, cooling energy demand decreased by 50% and lighting energy increased by 38% provide a 12% reduction in total annual energy demand. Although the transmittance value of 20% satisfies the internal lighting levels, it does create glare problems. In fact any transmittance value higher than 5% cannot guarantee glare elimination. As a compensation, window area can be separated into two regions, lower part having lower transmittance compared to the upper part, thus, resulting in an average transmittance of 20% to avoid glare problems (Tzempelikos & Athienitis, 2007). In another study by Daum and Morel, simulations were run for identifying the important variables in a multi-objective optimization algorithm that are mostly effective for the control of the blinds, and research show that incorporating more than three variables for the control of the blinds does not further improve the performance than the use of two state variables which provide sufficient information for good blind controller. According to energy performance criteria (Daum & Morel, 2010), most effective components were respectively:

1. Indoor temperature, outdoor temperature
2. Vertical outdoor irradiance
3. Elevation of the sun, azimuth of the sun

Several daylighting systems are developed for enhancing the indoor illuminance for spaces with side-lighting (Sabry, 2006). Openings and elements of the building envelope have to be equipped with additional or integrated elements either outside, within or inside the building components. Side-lighting systems can be grouped according to their geometrical characteristics according to two types: integrated window elements, reflectors and light shelves. Integrated window elements can be adjacent or integrated to the glazing panel. They are made of tiny optical elements either in the form of miniature mirrored louvers, prismatic elements, prismatic films, laser cut panels positioned on a parallel plane behind or in between the glass panes and they work both as a reflector and a shading unit either fixed or operable. Light shelves can be placed either outside or inside the window units with the double function of daylight redirecting and shading at the same time. In order to decide on the appropriate daylighting system, there are numerous parameters to be considered. This procedure can be outlined in four main steps (Sabry, 2006).

First step is identifying the key elements of decision making process, main concern is the benefits to be achieved within the system appropriated for the purpose. Satisfying the basic objectives is critical such as redirecting natural light to under-lit zones, improving task illumination with daylighting, glare control and solar shading. Second step is the integration of what with the architectural design, while the interior is expected to complement the system to assure satisfactory performance. Interior organization, wall and ceiling materials and geometry, the layout of ducts, luminaries, furniture etc. are arranged so as not to interfere with the design goals. Third step is the evaluation of the performance of the proposed system. Daylighting and energy performance of the system are validated either through physical scale modelling or by simulation software. Last step is the maintenance and installation criteria. All systems collect dust and dirt which need to be removed periodically, moreover mechanical systems may fail after a certain use period ,therefore expected performance cannot be achieved without considering periodical surveys as seen in Figure 6.

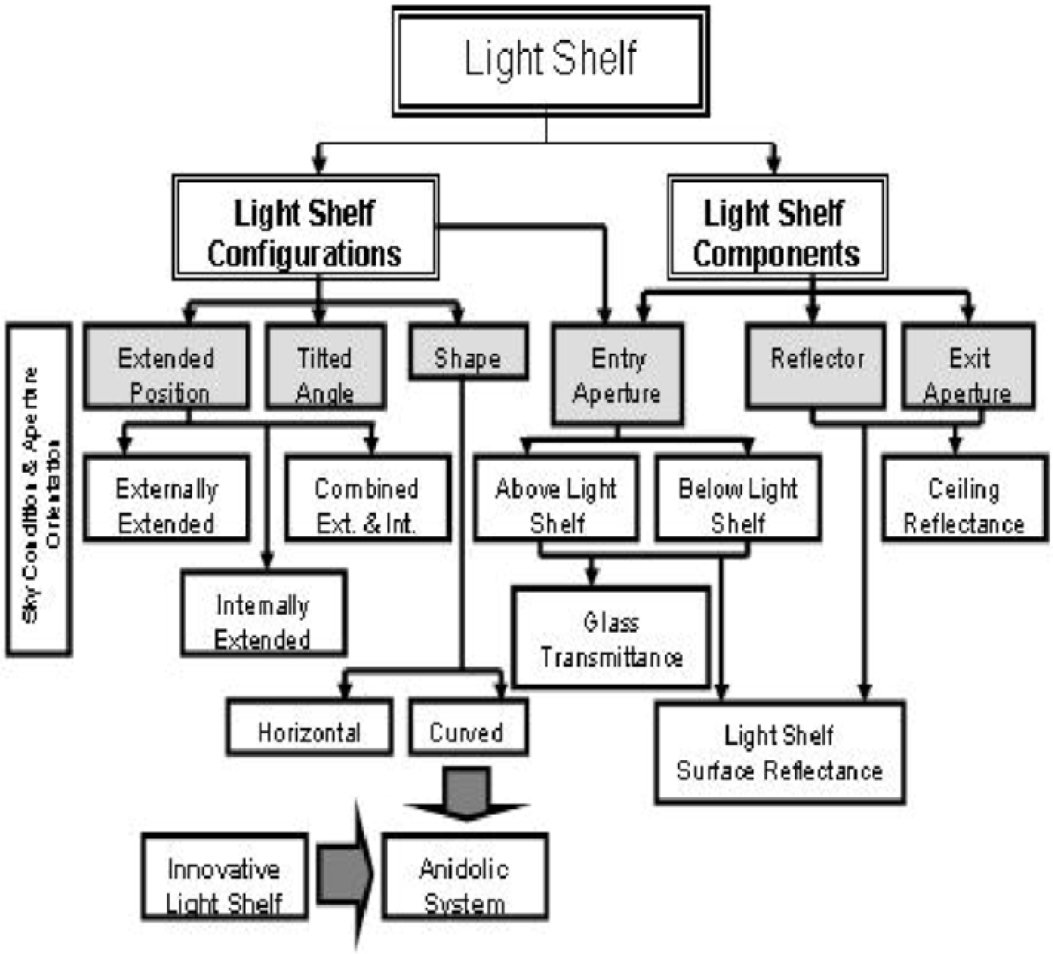

Figure 6 The integrated parameters of light shelf's configurations and components (Sabry, 2006).

The location of light shelf is determined as a function of the ceiling height and certainly above eye level, reducing glare and maintaining a vista to outside at the same time. Light shelf can be extended outside or inside or a combination of both. Besides being horizontal, it can be tilted according to the seasonal sun rays and obstructions around. In order to ideally achieve redirection of all rays inside, an anidolic reflector with a curved shape can be used. Anidolic zenithal systems concentrate all incoming light onto a vertical opening with a well defined angular spread. Three components are defined according to the aperture for light shelves: the entry aperture, the reflector and the exit aperture. The upper part and lower part of the light shelf can be treated separately in terms of glass transmittance and reflectivity, the upper part being more transparent and reflective to redirect natural light deep into the space towards the ceiling and walls. For a more effectively designed light shelf with a better performance, some basic design practices drawn from the results of simulations of some tested cases, are as follows: extending the shelf to both inside and outside the glazing, tilting the external part upwards further to enhance light penetration, utilizing curved geometry to make it even better. The reflectivity of walls contribute more to the enhancement of the illumination at the far end of the space (Sabry, 2006).

The anidolic concentrator is most effective when the office is facing south and the sun is in high altitude, however at low angles, there is risk of glare. Although light shelves may not be effective as the anidolic concentrator, it is less likely to cause glare problems (Capeluto & Ochoa, 2006). Effectiveness of light shelves decrease after 6 meters while with the anidolic concentrator 300lux minimum illumination can be achieved at even at 12 meters from the window. A second opening or atrium is preferable wherever the depth of room exceeds 6-7 meters.

Human response to natural light through operable shading devices demands a careful approach in terms of modelling. Wherein it comes to movable shading devices, there are several studies in terms of the influence of shading control patterns in office spaces which have to be modelled for assessing the energy demand for lighting, heating and cooling. These studies show that the occupants tend to control the shading devices with the motivation to adjust the work plane illuminance, glare and solar radiation during the occupied hours. Several calculation methods rely on assumptions either in one way or another. For example it is assumed that shading devices are used whenever solar irradiation on windows exceed $300W/m^2$ according to EN ISO13790, where it relies on a fixed schedule and it can be considered as a non-dynamic approach (da Silva, Leal, & Andersen, 2012). In simulation programs, these control patterns are already integrated, and they are activated whenever the control condition is verified. However, there are even more advanced stochastic models which integrate probabilistic criteria according to the dynamic of space occupation.

Sensitivity analysis are made in order to evaluate how consistent these different behavioural models are. For example, for the work plane minimum illuminance, recommendations vary from 200 to 600 lux for typical paperwork and from 100 to 300 lux for computer based tasks. The maximum levels also range from 1280 to 1800 lux. The ratio between minimum and maximum work plane illuminance should be higher than 0.7 and the ratio between the illuminance of work plane and immediate surrounding is accepted to range from 0.2 to 0.8.

As expected these variances and other similar assumptions will result in significantly different simulation results. Glare assessment alone has many divergent approaches and calculation methods.

As research show, glare from a window that causes discomfort is less dependent on the window size and its distance from the observer, rather than the sky portal seen from the window. The Visual Comfort Probability (VCP) predicts the percentage of population that will accept a given lighting condition as comfortable. Another calculation method was developed by International Commission on Illumination (CIE) to produce a consensus glare calculation called Unified Glare Rating (UGR) for artificial lighting. For daylighting, Daylight Glare Index (DGI) is commonly used, together with some limitations in such cases where the glare source is not uniform or fills the whole field of view. The calculated DGI value should be independent of the background luminance, but not in this case. Osterhaus (2005) indicates that glare perceived by the observers is less than predicted by the DGI system. Finally New Daylight Glare Index (DGI_N) introduced increased accuracy. Daylight Glare Probability (DGP) is another index which intends to express the percentage of people experiencing glare in a given condition based on vertical eye illuminance, glare source luminance, the solid angle and the position index. DGP is developed considering several daylight conditions and by analyzing responses from 70 subjects in two different locations and thus yielding more reliable results compared to previous methods and indices. The main difference of DGP from the other methods is the vertical eye illuminance taken into consideration as a measure of eye adaptation.

Several conditions were defined in literature as the driving force for controlling shading devices and electric lighting by the occupants. The behaviour patterns were derived from field monitoring in buildings. However these criteria are based on limited number of offices in restricted monitoring periods. A different approach is the probability of occurrence used to formulate the occupants' actions. Nevertheless, occupants operate the controls based on three criteria: quantity of daylight, glare and direct solar radiation. Solar radiation is the most cited parameter driving shading control and is expressed in different ways in different sources. As a result of the solar radiation, shading is activated while the lights will probably be switched on. There is no research on the counter case as there is little chance that the lights will be switched off with the shading activated. Twenty criteria relating to the manual operation of shading devices and eight criteria for the operation of electric lighting that will eventually affect the building simulation were identified and results were significantly obtained according to the choices made during thermal modelling stage.

As a result, the questions of how and to what extent these models influence the prediction of the energy consumption of the building are crucial. There are briefly two suggestions so as either to increase the robustness of the existing models or develop a method to choose the most appropriate model among the existing ones. A study was made for assessing the impact of eleven pre-existing behavioural models and control patterns for shading devices on the energy demand for heating, cooling and electric lighting. The cooling dominated and balanced scenario results showed that different models result in different best design alternative with significant differences as opposed to the heating dominated scenario as seen in Figure 7. Results indicate that the choice of behavioural models and their robustness is a priority in order to achieve reliable energy simulations (da Silva et al., 2012).

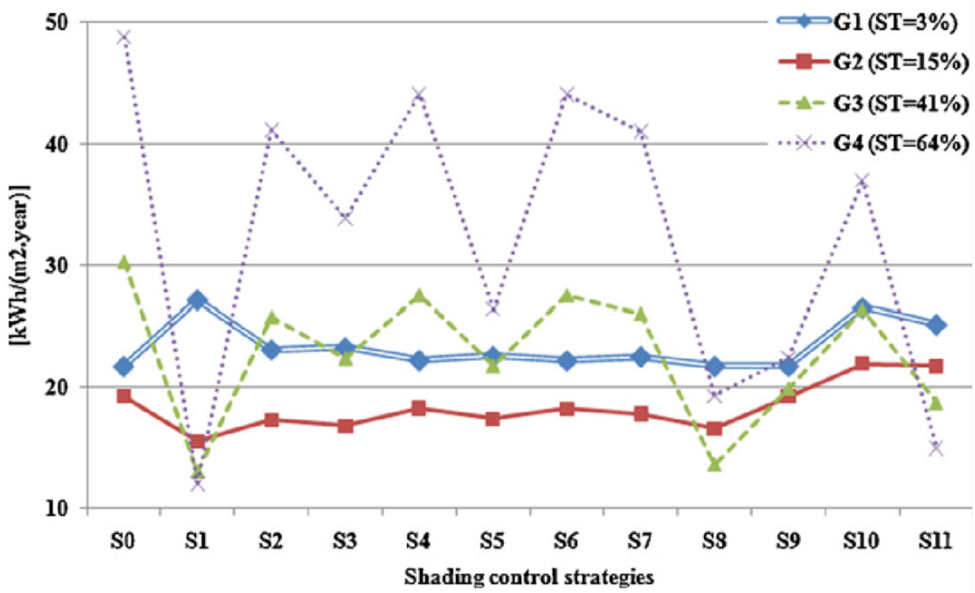

Figure 7 Overall energy consumption for the four glazing alternatives in each of the 12 control strategies (da Silva et al., 2012).

An alternative method is to assess the average value among the available strategies and choose the alternative that is closest to the representative value. However running simulations for each alternative is time consuming and may not be possible in real world conditions, therefore the most reliable strategy has to be decided with studies beforehand. As a result of the simulations da Silva (2012) carried out, S5 is considered as the most reliable model, and is capable of identifying design options that match the ranking for all control strategies in 83% of the cases. In S5, shading is active if DGI>20 and view direction is 20 degrees towards the window. This does not mean that strategy S5 is more realistic, rather that it represents better the average of whole group of strategies in terms of the results they produce. There is the need for more statistical studies regarding the post occupancy user behavioural models in office buildings for more reliable modelling (da Silva et al., 2012).

CHAPTER 3

MATERIALS AND METHOD

In this chapter, data of the site of the building of analysis, decisions and guiding criteria at the initial stages of the architectural design are introduced with the help of drawings and other visual material. Also in this chapter, modelling method and procedure are explained in detail for the purpose of thermal and lighting analysis. The softwares used for modelling, analysis, and form generation are studied in detail in the proceeding pages.

3.1. Case study: the building

The site is located in Nicosia at 35°10' N, 33°22' at 128m above sea level. The building is located at the north of the city center as shown in Figure 9. The building is on the Ataturk street with a football ground and green zone on the north side, residential buildings on the west and south and the municipal building on the east side with a large parking area. In contrast to the usual building orientation, as far as the building of this study is concerned, long facades of offices are facing east and west rather than south, thus having exposure to south thus, minimizing direct solar gain during daytime.

The weather file used for the simulations belongs to Larnaca 176090 (IWEC) obtained as a zip file from Energy Plus website (http://apps1.eere.energy.gov). Larnaca weather data is used as it was the only available weather data closest to Nicosia. The focus of the simulations were on lighting and solar irradiation so data from Larnaca was expected to yield similar results to the Nicosia case.

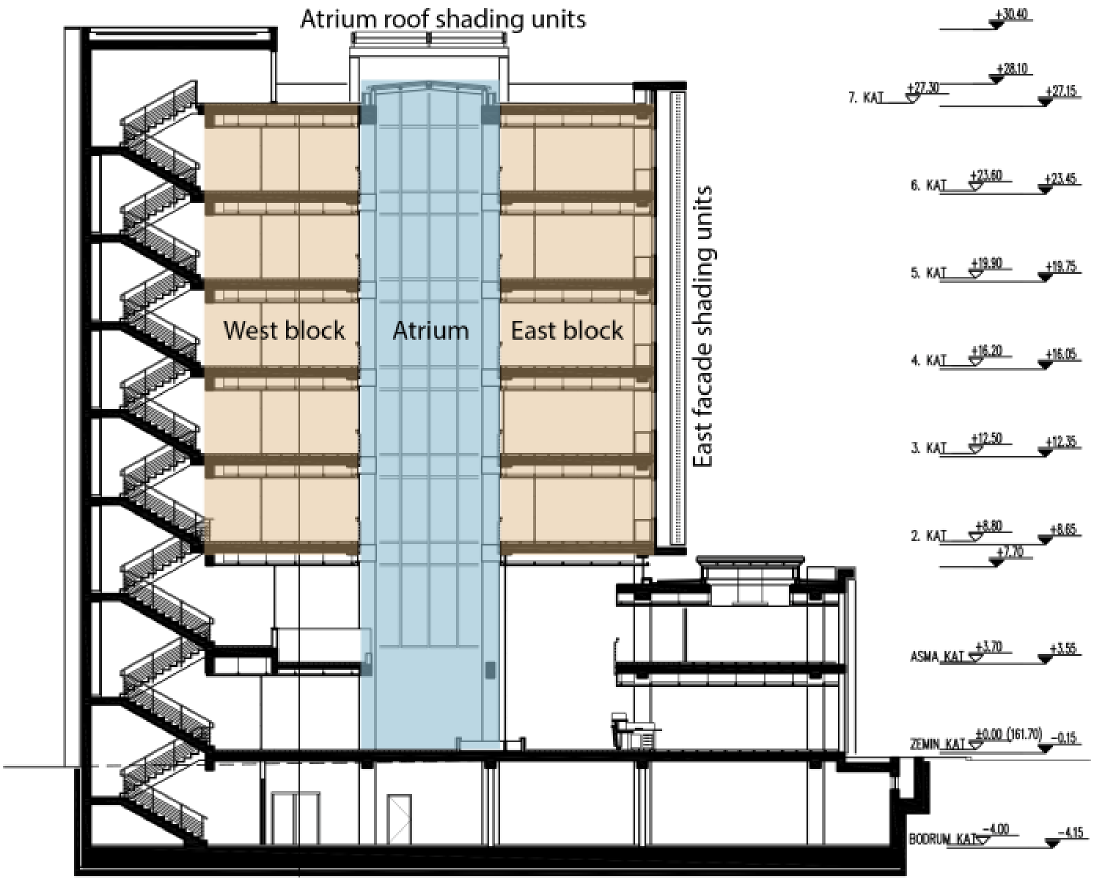

Figure 8 Transversal section.

Cyprus Vakıflar Bank consists of five office floors for the general headquarters employee, two floors for the banking head office, multi-purpose hall, cafeteria and a hall connecting these facilities within a total area of 6500 sqm including basement floor. The building is composed of two rectangular blocks forming a narrow zone in between so as to shade each other and receive diffuse natural light from north and reflected light through shading devices from the south facade of the atrium in the mornings and afternoons as well as from above at noon. The two office blocks are organized around a linear atrium lying on the north-south axis with an open corridor at the boundary of to the atrium on each side and office spaces facing east and west. Main goal of such a design was to utilize the site so as to maintain enough open parking space while the gain of solar radiation is controlled as much as possible. An atrium and exterior shading units are proposed to provide maximum daylight quality with minimum direct solar gain possible and to avoid single side lit interiors.

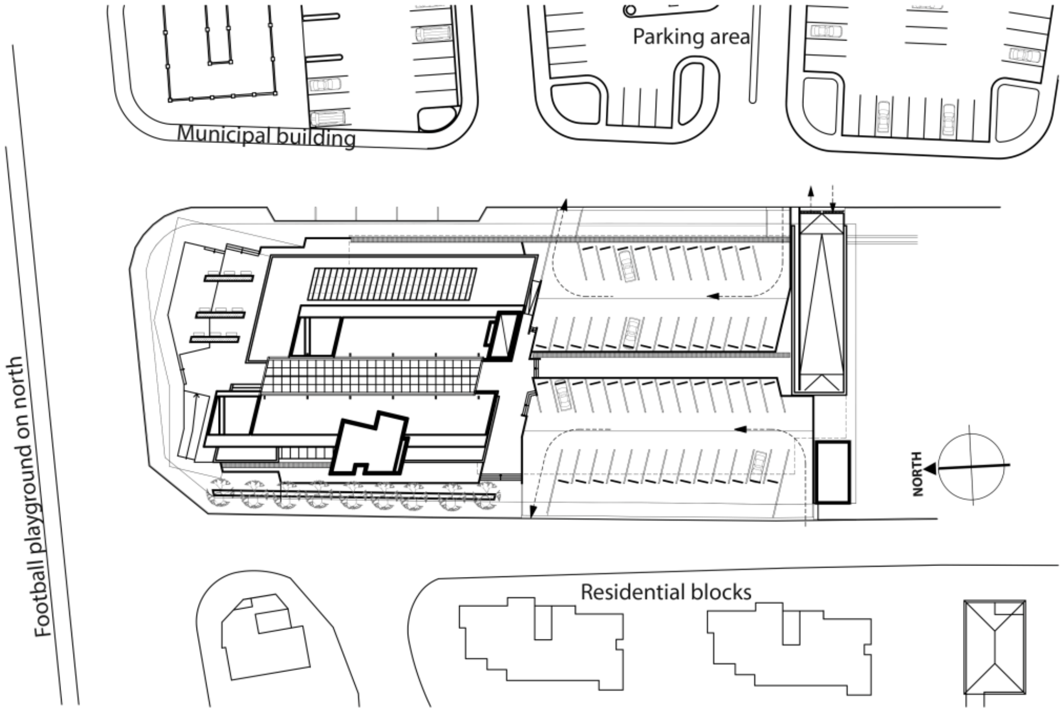

Figure 9 Site plan

The orientation of the building is restricted by the lot and open parking requirements which allocate a significant amount of the site. Apart from the building program which dictated specific functions for each floor, future adaptation and flexibility were also required. Conforming to these restrictions, keeping the building mass as compact as possible, providing the desired functions while keeping the living quality as predictable and cool as possible in terms of the thermal conditions and naturally lit working environment were all equally important.

As the exterior finishing is concerned, lower parts of the blocks are clad in light colored natural stone with mechanical fixing and external thermal insulation is proposed on concrete masonry blocks with flat roof. East and west facades of office blocks are initially designed with strip windows shaded externally by vertical shading units. Glazed central atrium is also shaded by photovoltaic panels on top, tilted to face south.

Interior office spaces are divided by a modular dry wall system for future flexibility and adaptation. Each block ends with a terrace on the fourth floor facing north. The two blocks are connected with a bridge at each level in the middle of the atrium space.

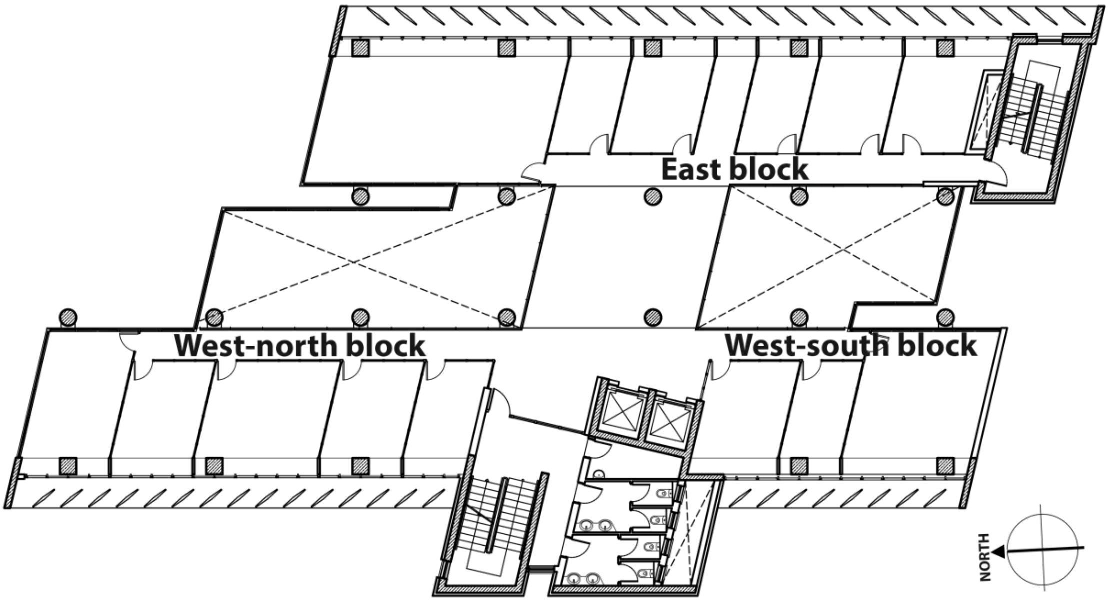

Figure 10 Typical office floor

3.2. Rhino3D, Grasshopper and Diva add-on software

Rhinoceros 3D application is a software that specializes in free form non-uniform rational B-spline (NURBS) modeling and other conventional CAD tools for a wide range of application areas including architecture which is developed by Mc. Neel and Associates. The flexibility of the software allows the users and developers to carry out custom procedures with the Visual Basic scripting language integrated into the software since its initial release in October 1998. With the introduction of Grasshopper visual programming language in September 2007 called "Explicit History" at that time as an add-on for Rhino 3D (version 4) software, the possibilities and customization have further become accessible to a wider population of users. The need for mastering a scripting language rendered to be indiscrete with the 'node based editor' as the main user interface for designing the algorithms. The data is either generated within these components or transferred to each other by representational wires which provide the connections of the outputs and inputs of the components visually as well. Generation of data is not limited to the built-in components in Grasshopper, but it is also possible to link to the Rhino geometry as well as to any file on the computer. Many developers introduced add-ons for Grasshopper's parametric module, making the possibilities much more intriguing for the users. The expansion of possibilities still continues to grow in rapid succession.

The integration of Grasshopper with simulation tools for building performance analysis is becoming widespread. One of the tools is the Geco add-on which enables a direct connection to Autodesk Ecotect Analysis software within the Grasshopper interface with various modules. The Plug-in allows to export complex geometries very quickly, evaluate the design in Ecotect and access the performance data and import the results as feedback to Grasshopper. The simulation tools are limited to lighting, shadow and radiation analysis only and it is not possible to fully integrate the thermal analysis into the Grasshopper workflow for now.

Autodesk Ecotect Analysis software uses Split Flux Method as outlined by BRE (British Research Establishment) for daylight calculations. This method has its limitations as it is essentially manual, however it is internationally recognized, quick to calculate and suitable for most type of conceptual design analysis. The main limitation of the BRE Daylight Factor method is a relatively simple formula employed for the effect of internal reflections. Being fully compliant with this method, Ecotect's ray-tracing cannot consider multiple reflections so the performance of indirect daylight solutions that rely on the reflection of light of multiple surfaces to illuminate a space are underestimated. On the other hand, Ecotect allows exporting the model to Radiance for more complex and physically accurate daylight calculation. Best practice is to export model to Radiance and import the raw radiances back to Ecotect.

As a result of the facts explained, Diva add-on was the best choice for simulations considering its tight integration with Radiance for daylight analysis. The plug-in was initially developed at the Graduate School of Design at Harvard University and is distributed by Solemma LLC. Diva-for-Rhino allows users to carry out a series of environmental performance evaluations of individual buildings and urban landscapes including radiation maps, photorealistic renderings, climate-based daylighting metrics, annual and individual time step glare analysis, LEED and CHPS daylighting compliance, and single thermal zone energy and load calculations using Energy Plus. The user interface includes daylight and thermal components to be used within Grasshopper both for exporting geometry and importing the results of the simulations.

Galapagos evolutionary solver was incorporated for the optimization of the shading devices which is the default component for the purpose when Grasshopper is installed. The solver has the limitation of single objective optimization algorithm, therefore it is essential to use a fitness function in order to get comprehensive results when dealing with multi-criteria problem solving. Alternatively Octopus add-on is based on Strength Pareto Evolutionary Algorithm (SPEA2) multi-objective evolutionary algorithm by Zitzler, Deb, Thiele at ETH Zürich for use within Grasshopper. Strength Pareto Evolutionary Algorithm is an extension of the Genetic Algorithm for multiple objective optimization problems. It is related to sibling Evolutionary Algorithms such as Non-dominated Sorting Genetic Algorithm (NSGA), Vector-Evaluated Genetic Algorithm (VEGA), and Pareto Archived Evolution Strategy (PAES). There are two versions of SPEA, the original SPEA algorithm and the extension SPEA2. Additional extensions include SPEA+ and iSPEA. Octopus is seen as an extension to Galapagos by introducing multiple fitness values to the optimization. The best trade-offs between those objectives are searched, producing a set of possible optimum solutions that ideally reach from one extreme trade-off to the other uniformly. When used with the Diva add-on in Rhino 3d, due to the instability and crashes it was not possible to use the Octopus solver for the study, so the optimization procedure was run with the Galapagos evolutionary solver. The evolutionary solver is better at refining a single solution when compared to the simulated annealing built in the Galapagos solver. The latter is suitable as an algorithm for finding many promising alternatives.

3.3. Modelling Procedure and Components of the Building

The building was modeled for lighting analysis primarily. Simplification of the components was necessary for the sake of computing optimization according to the analysis type, so structural columns and internal divisions within the office space were omitted from the model together with the glazing frames of the atrium and windows. This simplifications were necessary for especially decreasing calculation times in order to be able to include more alternatives to put to test. Geometry and materials of the office space were kept unchanged throughout the analysis. As a result, geometric definition of the shading devices between each of the performance analysis executed remained the only variables throughout the procedure.

An array of vertical shading devices with even spacing at full height of the facade was proposed in the initial design. As a reference case, the initial design was also simulated and the results were recorded and compared to the optimized alternatives generated by the performance analysis for the shading devices.

As mentioned before, two blocks of the office building in consideration are arranged in a linear fashion around a glazed atrium facing east and west with 34 meters and 44 meters length respectively and a fixed width of 6 meters interior office space. Upper two floors are recessed by 6.3 meters (which is also equal to the one axis of the structural grid) to create a two storey high open terrace on the north. Shading devices span the full height of the facade for the integrity of the design in this part of the building. In addition to the main office blocks, the building consists of the entrance and conference halls, a cafeteria and the bank's branch office on the ground floor within a height of two storeys.

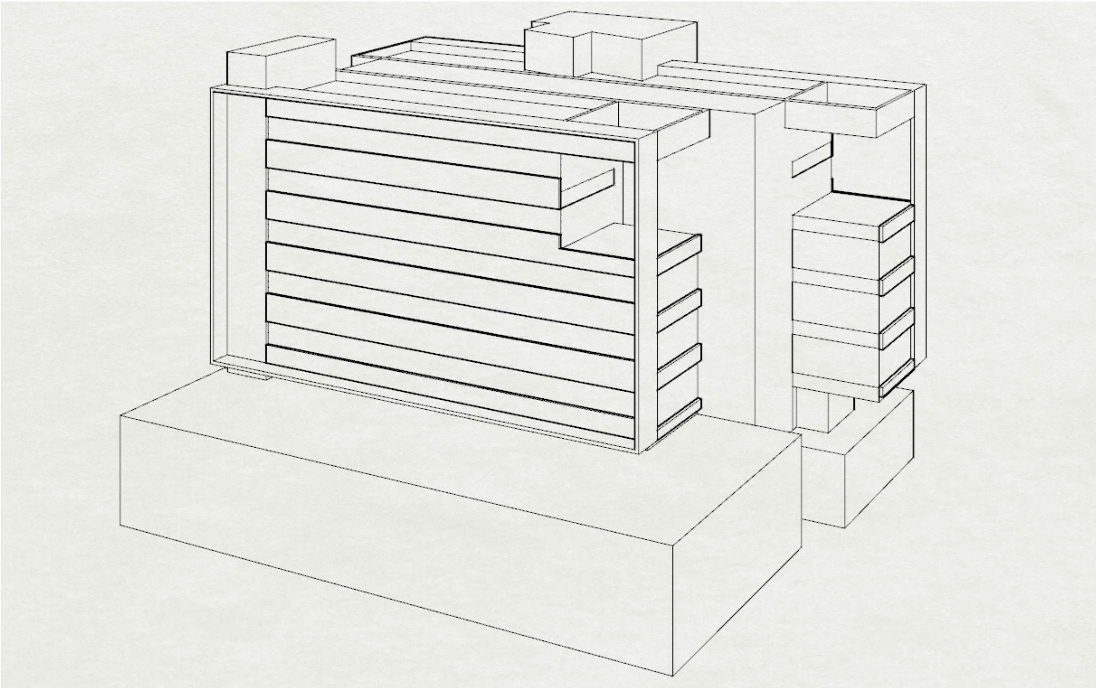

Figure 11 Lighting model perspective from north-east

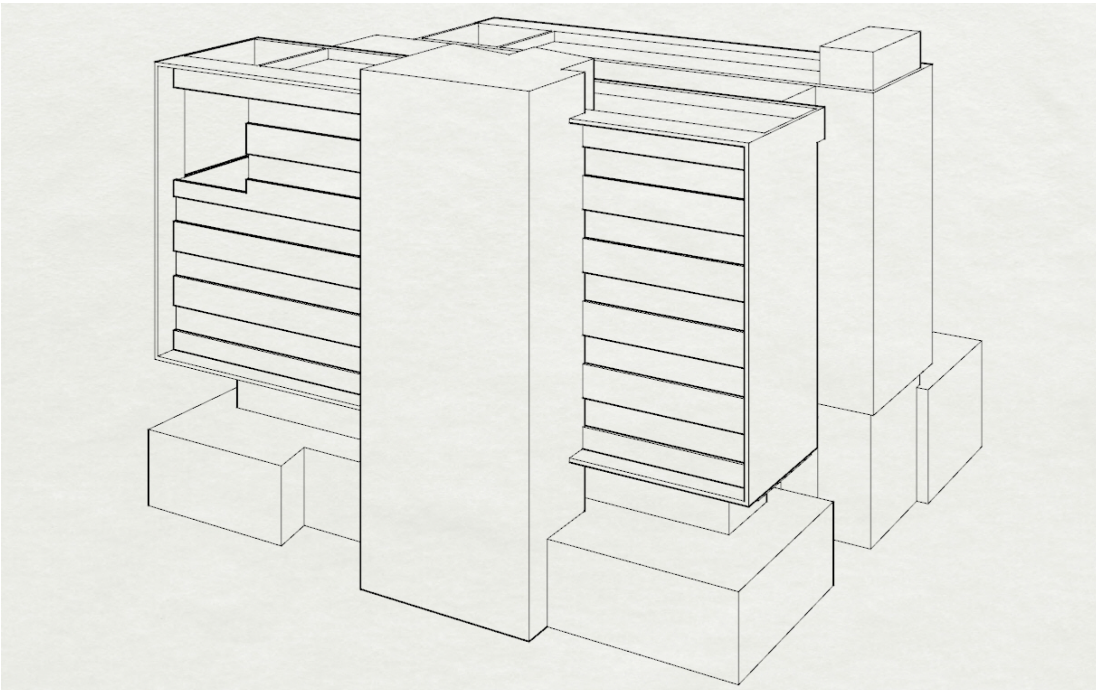

Figure 12 Lighting model perspective from south-west

External shading devices are necessary for the cooling dominated climates as it is essential to avoid direct sunlight reaching the windows. Besides achieving adequate lighting levels for the work plane, providing an even light distribution as much as possible within the office space for avoiding high contrast areas and minimizing the risk of glare is crucial. In order to achieve such an environment, several design strategies were utilized starting from the conceptual design phase of the building which can be grouped into three: firstly, thin plan layout for the office spaces was settled, secondly only the offices were divided into two blocks and connected with a glazed atrium and a bridge at each floor to avoid side lighting and last but not least the blocks were oriented so as to face east and west to minimize solar gains during daytime regarding the hot climate. Shading units were double functioning. In spite of reducing the solar radiation on the facade, they act as light reflecting surfaces to allow adequate daylight inside the office space.

As a preliminary step in the optimization process, the east and west shading devices were introduced to control the intensity of solar radiation on the glazed surfaces of the atrium. This approach is also supported by the solar panels on the roof glazing and south elevation of the atrium. So, separate optimization cycles for the roof and the south facade of the atrium were run for generating the shading units. As long as the design of the atrium is one of the primary decisions supporting the natural lighting of the office spaces, it was fundamental to design the atrium shading units in order to continue to the next step. The second step was the design exploration for the office facade shading units. In this phase, optimization cycles were run separately for the office floors on the east and west. The third phase was the comparison of the generated alternatives with the initial design by the simulation and visualization tools of the Diva add-on software. Each of the above mentioned steps are explained further in the upcoming sections.

3.4. System Setup and Simulation Workflow

It is important to model the faces with correct orientation for an accurate daylight simulation as the integrity of the simulation depends greatly on the light bouncing from these surfaces. The fixed geometry for the daylight simulation was modeled in Rhino3D software. The modeled geometry includes the surrounding buildings, the building mass of the lower floors and the office spaces. Ground level was modeled as a flat surface without any differentiation between paved areas and the road. The modeled geometry was linked to the Grasshopper interface with the built in geometry import components of the software. These components were linked to the modeled geometry with a dynamic link updating instantaneously in case of any future change. Shading devices were generated using the parametric tools inside Grasshopper and these parameters were used by the Galapagos GA to generate the design alternatives for the optimization process. The pool of generated design alternatives are transferred to the Radiance simulation by the Diva daylight component and the returned results are listed and recorded as the input for computing the fitness value for each member. The returned fitness value is then evaluated and used to generate the next population of members by the Galapagos GA solver. The representation showing the workflow cycle for each generation is shown in Figure 13.

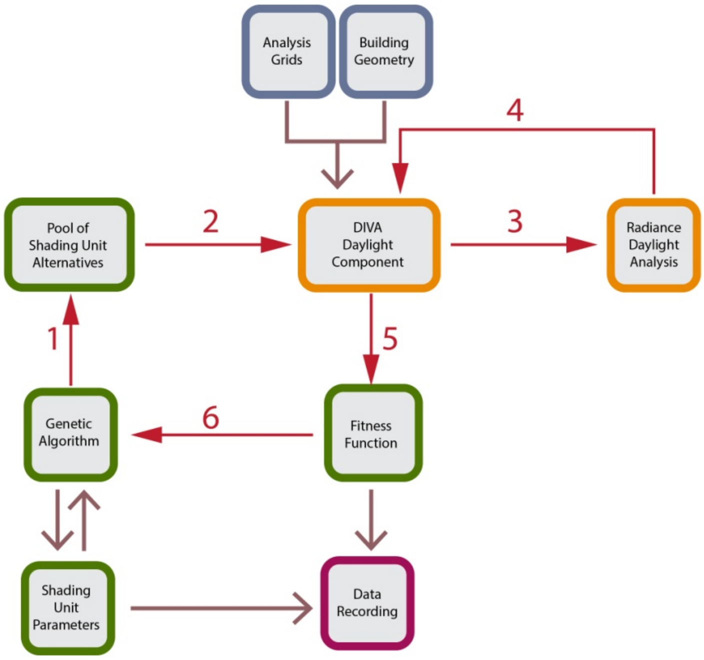

Figure 13 Simulation workflow for each generation showing GA solver cycle

The design of the Grasshopper setup can be summarized in six groups as seen in Figure 14.

1. Analysis mesh geometric definitions
2. Shading device geometric definitions
3. Building geometry import components
4. Simulation and genetic algorithm components
5. Control center for analysis and block selection
6. Data recording and reading group

These component groups are connected to other parts based on the relationship of the design procedure. Non changing building geometry was modeled in Rhino and imported to Grasshopper with these components, shading devices were generated within the Grasshopper interface. Analysis surfaces were modeled in Rhino and then subdivided by using Grasshopper components for the desired level of detail. Finally all the geometry was connected via the material component or directly to the simulation components for daylight factor (DF) and solar irradiation (SI) analysis. Genetic algorithm (Galapagos) components were created for each optimization run and linked with the design parameters and fitness function respectively. Data recorder group was used to keep track of the parameters and the fitness function for each member of the population computed for the Galapagos generations. Finally the control center components for the tasks defined were grouped together for easier operation.

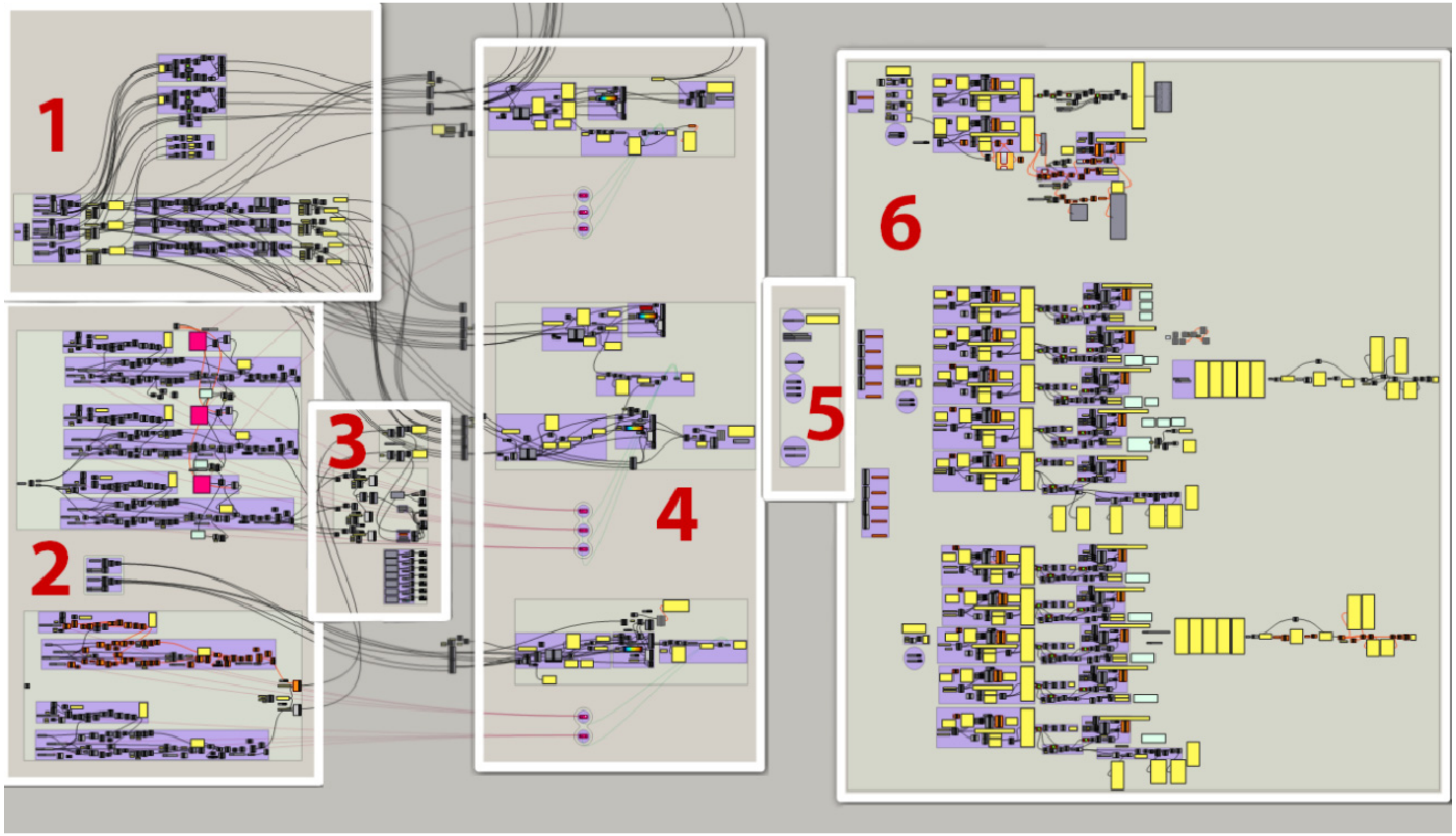

Figure 14 Grasshopper layout and organization used for the simulations.

3.4.1. The Interface

As mentioned before, for the daylight simulations Diva add-on for Rhino and Grasshopper was used. There are two components in Grasshopper in order to run the simulations and read the outputs. Material component was used for assigning Radiance materials to the geometry and daylight component was used for exporting the model geometry and running the simulation, after which the same component reads the Radiance data and provides an output back to the Grasshopper interface.

The Material Components has an input for the geometry to be referenced and an output is provided where together with the assigned material is ready to be passed to the Daylight Component which can be seen in Figure 15. There is a material button on the module to access the Radiance materials to be assigned to the geometry. New materials can be added to the list by modifying the file located in C:\DIVA\Daylight\material.rad. The Daylight Component has several inputs which are:

1. Project name
2. GM (geometry and material)
3. Nodes (Analysis)
4. Vectors (Analysis)
5. Run
6. Write Only

Project name can be used to give automatic names to a series of simulations when connected to any string and number slider components within Grasshopper. The output of material component is connected to the GM input for the geometry and materials required to run the simulation. Nodes input is for the analysis points to be measured while running the simulation, these nodes can be either the vertices or the centroids of any mesh surface. Centroids of the mesh surfaces were used in this case. Vectors input is for the analysis direction respectively for the Nodes. This can be a singular vector for a planar analysis mesh or can be separately assigned to each mesh orientation respectively. Run input is to be connected to a Boolean Toggle (True-False) component in Grasshopper for executing the simulation in Radiance. When Write Only Boolean Toggle is set to True and Run component is set to False, then all necessary simulation files are written to the Project Name folder and the simulation can be run by the batch file within the folder. This is useful if project files are uploaded to other computers to run multiple simulations at the same time.

The settings of daylight component menu button opens the dialog box containing the location, simulation parameters and outputs tabs. In the location tab the weather file for the simulations is selected either from the list or additional weather files can be located in the path C:\DIVA\WeatherData. Under the Simulation Parameters tab, types of analysis and options are set. The types of simulations are:

1. Solar Irradiation Nodes
2. Solar Irradiation Image
3. Daylight Factor
4. Illuminance
5. Climate Based
6. Visualization

Radiance parameters are also set in this tab. Outputs tab includes checkboxes and the types of possible outputs that are to be selected.

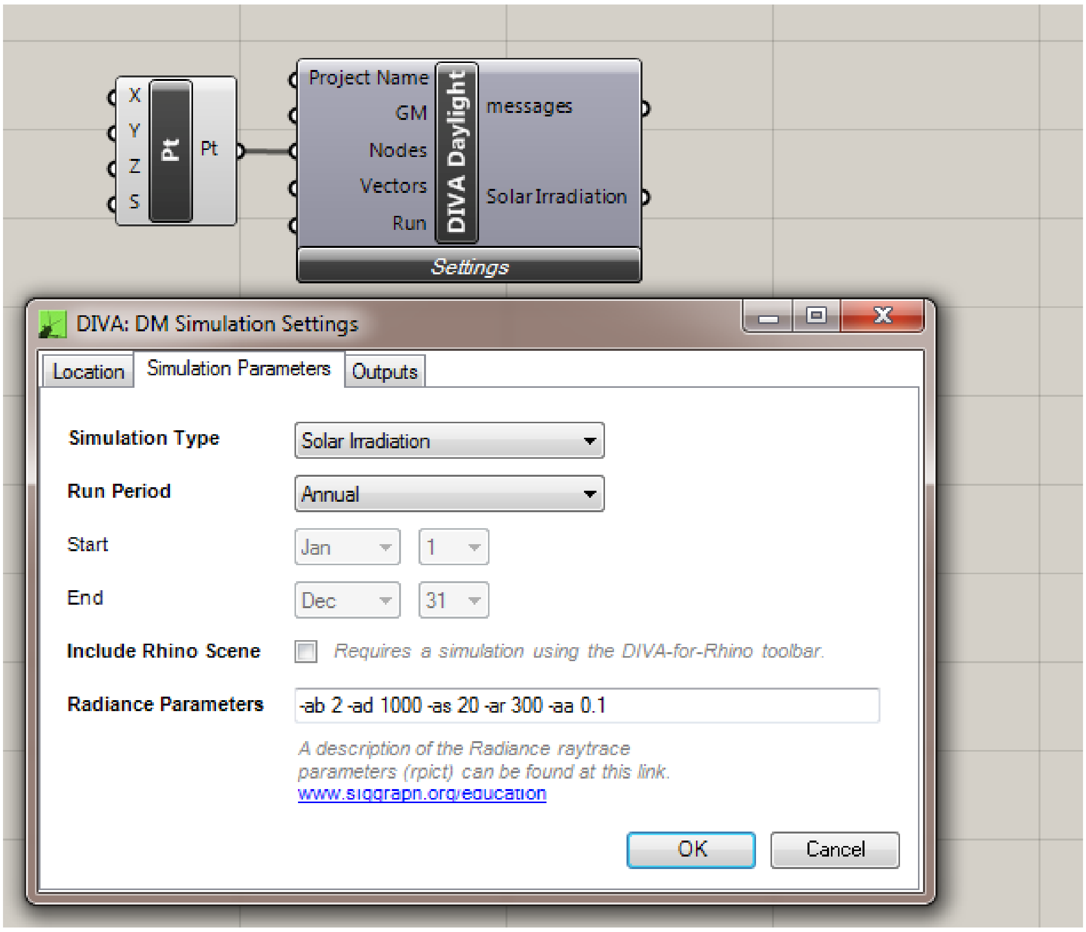

Figure 16 Diva daylight component.

The user interface of the Galapagos consists of three tabs; options, solvers and record which can be seen in appendices A, B and C. In the options tab for the evolutionary solver, the number of individuals at each generation and the initial population are set, together with maintain and inbreeding percentages. The solver tab is divided into four graphical areas. The top area shows the generations and the graphical representation of the fitness of the corresponding population. The red bar shows the mean of the population and the orange area represents the standard deviation. The bottom area is divided into three sections: The left part is the graphical representation of the members of the population, the middle area is the graphical representation of the parameters of each individual alternative, the vertical lines represent the sliders defined in Grasshopper, and the lines connecting them represent the gene combination of every single member of the population. The vertical lines from left to right correspond to the seed angle, shading depth, number of shading units and the division proximity sliders. The right area shows the fitness of each member from top to bottom for the selected generation. The record tab shows the text based record of the members and the generations in chronological order. Unfortunately, there is not a record function in the Galapagos yet, so the recording was done with other tools in the Grasshopper interface.

3.4.2. The Workflow

After the simulation was run from the Daylight Module and Radiance the results were returned to Grasshopper via the output connections. The output was connected to Grasshopper components and used to evaluate the fitness of the results and if desired as an input to other components. Within the Rhino interface, Diva provides more tools for analysis and visualization to the designers. Radiance is capable of calculating the bounced light contrary to Ecotect's built in lighting analysis engine, therefore it is important to model the light reflecting surfaces such as surrounding buildings, roofs and site components. Lower floors were expected to show different results compared to the upper floors as the light reflected from ground and the roof of the lower blocks have an impact, besides the upper floors differentiate from the lower ones by receiving more daylight from the atrium.

Analysis grids of 40cm by 40cm divisons were generated and used for atrium roof and south facade for the solar irradiation (SI) analysis. A similar sized grid was used for each floor area at the work plane height of 80cm above the floor level for daylight factor (DF) analysis and athird set of grid were used on the east and west facades for calculating the results of the solar irradiation (SI) runs. Ambient light bounces in Radiance are kept at 2 for shorter simulation times in the optimization process in order to test as much design alternatives as possible in a reasonable time. The shading unit alternatives were also generated with less mesh faces during the evolutionary solver calculations. After the optimization process with Galapagos, following simulations were run with a more detailed geometry for the selected shading design alternatives used to generate the analysis grid results and visualizations. See Figure 17 for the level of detail adjustments used for the simulations.

For the design of the atrium shading units, Galapagos evolutionary solver was run with a fitness definition to minimize the solar irradiation and the variance between the analysis nodes. For the shading devices on the east and west facades, the optimizations waere run with a fitness function for minimizing the standard deviation for a target daylight factor of 2% as well as minimizing the annual solar irradiation. The fitness function is composed of two parts, the mean of the calculated SI on analysis nodes is multiplied with a 1/100 weight factor in order to get values similar with the DF values and then summed up with the daylight factor to get obtain the fitness value. After evaluating the results of each block, the third optimization cycle was run for all of the floors for optimizing the tilt angle of the shading units for minimizing the DF to a target value of 2% as the fitness function.

The four variables used for the generation of the shading units.:Random angle seed, Shading unit depth, Number of divisions, Division function

The initial design of the shading units have a fixed angle all along the facade height. One of the concerns for the design was exploring the possibilities of orientation of the shading units changing along the height of the facade. The design concept aims to achieve a dynamic form aesthetically for the shading units hand in hand with the optimization of the daylight quality inside the office space. Four set of variables were designed for the shading devices as illustrated in Figure 17, 18 and 19. Tilt angle of the shading units is the variable defined in xy-plane, ranging between 45 degrees clockwise and counter-clockwise from the facade plane along the nodes of the shading units, this is done by a random number generator component. Depth of the shading devices ranged from 0.1 meters to 1.1 meters. The number of the shading units along each facade was the third parameter. Lastly the division function variable was used for adjusting the distance between each unit from equidistant to ascending defined by a function curve.

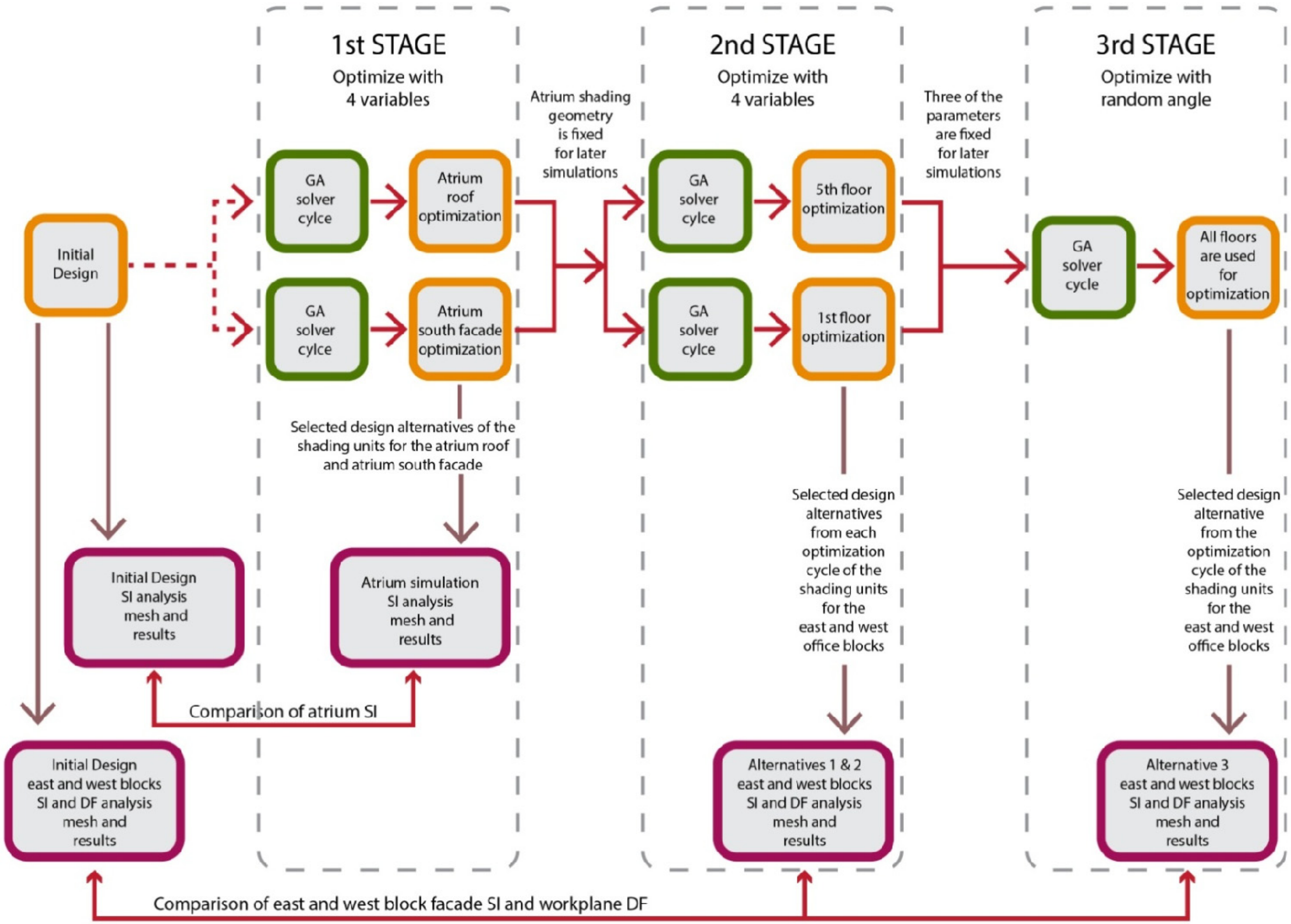

Figure 17 Workflow stages, for the GA solver cycle see Figure 13

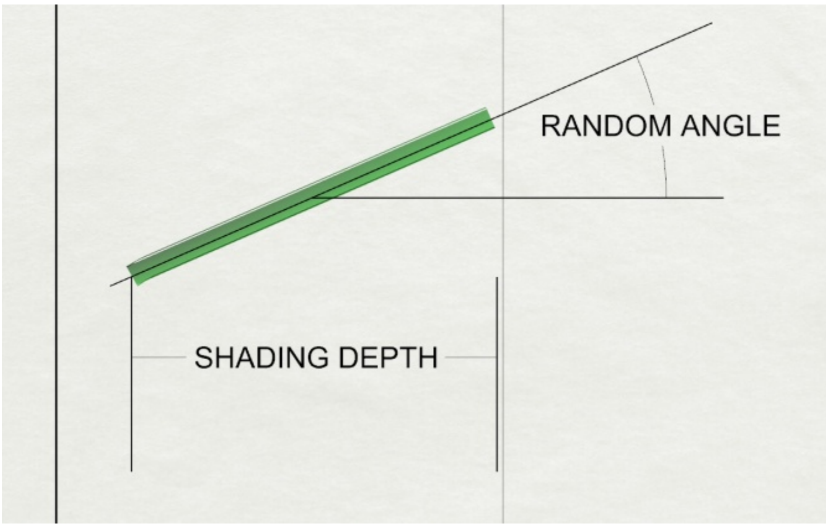

Figure 18 Shading Depth, Random Angle Variables on plan

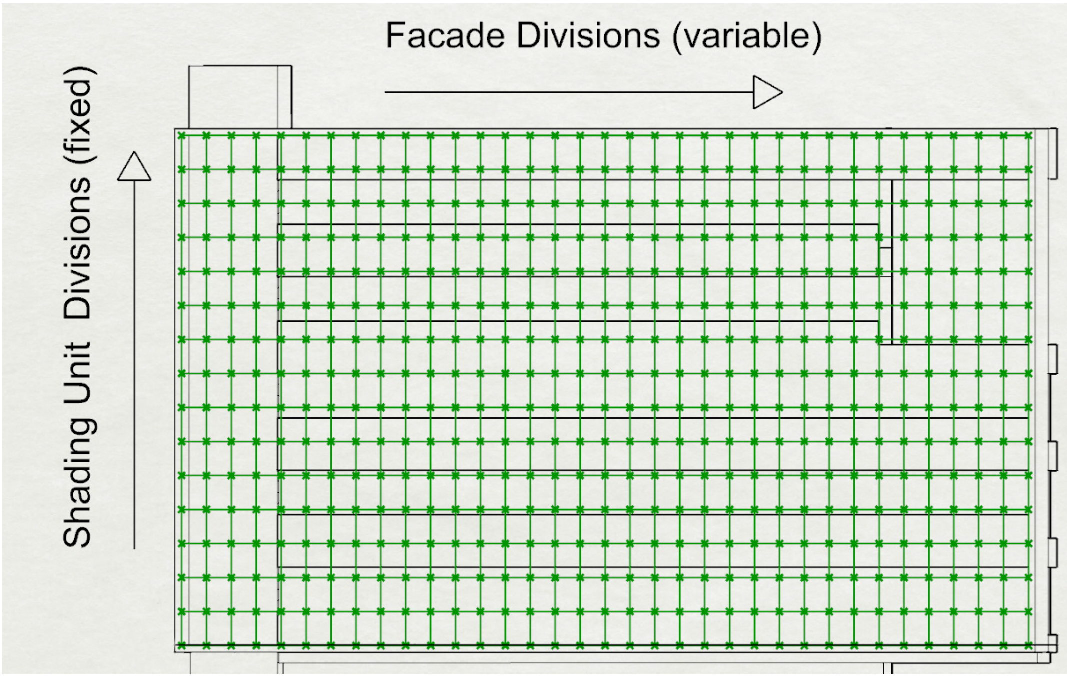

Figure 19 Fixed vertical divisions of each shading unit and variable number of units along the length of the facade.

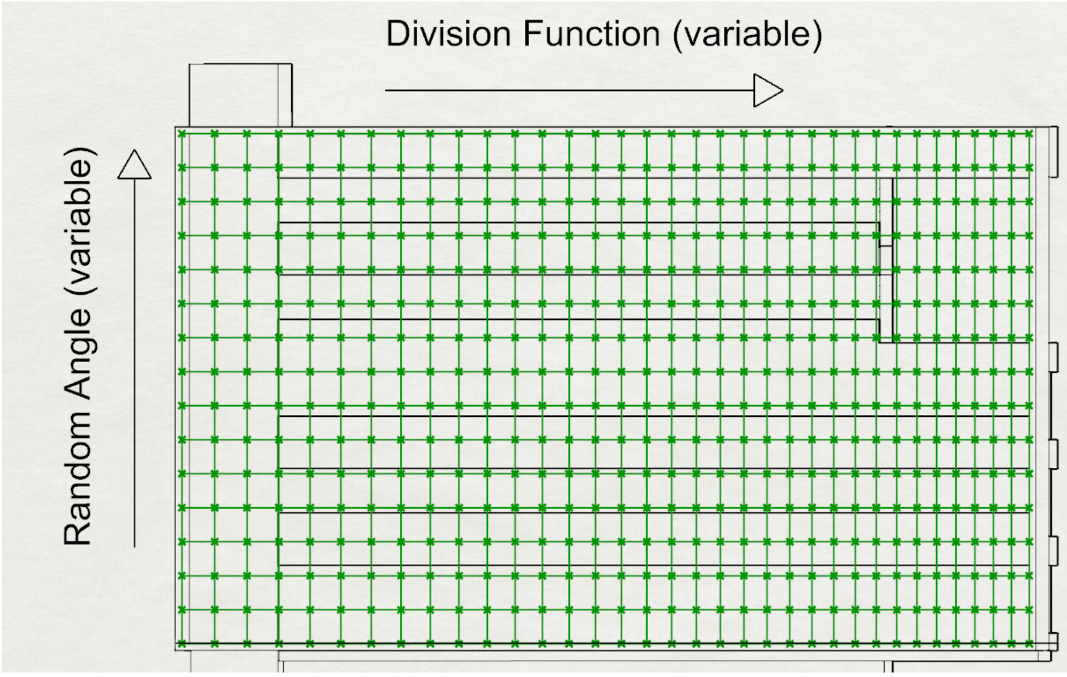

Figure 20 Variable angle at nodes along height and variable proximity of shading units along the length of the facade.

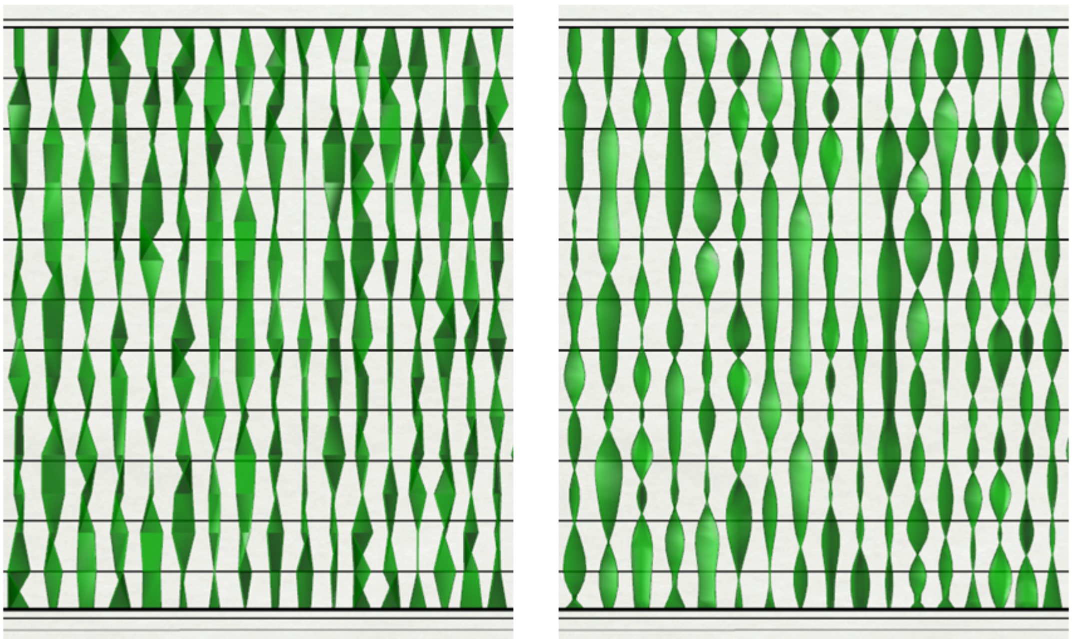

Figure 21 Left: Shading units with fewer faces were generated during the evolutionary solver simulations. Right: Shading units are modeled accurately prior to analysis mesh calculations.

These four parameters were defined for the shading devices on each facade, namely the east, west-south and west-north. The west facade is divided into two parts by the circulation core protruding from the west office block so the analysis grids both in work plane and facade was divided as south and north groups. A similar system with the exception of orientation, from vertical to horizontal, was applied for generating the atrium shading units in order to minimize the SI on the roof and south facade of the atrium.

The workflow is composed of three stages. First stage is the design of the atrium shading units primary to get coherent results from the next step of the optimization. After completing the assessment of the atrium shading units and choosing one of the design alternatives, Galapagos solver was used to optimize the first and the fifth floors of each block. The first floor receives the minimum light from the atrium and the fifth floor gets the maximum of it, so after completing the optimization runs, the results were compared in order to decide the number of units, the depth and the proximity of each unit in order to continue the last step of the design phase. In the last stage, only the tilt angle of the shading units were optimized in order to achieve the target DF and minimize variance on the analysis grid at each work plane. The last step is to list the results of each step and make an evaluation of the alternative design selections, comparing them with each other and the initial design alternative as well.

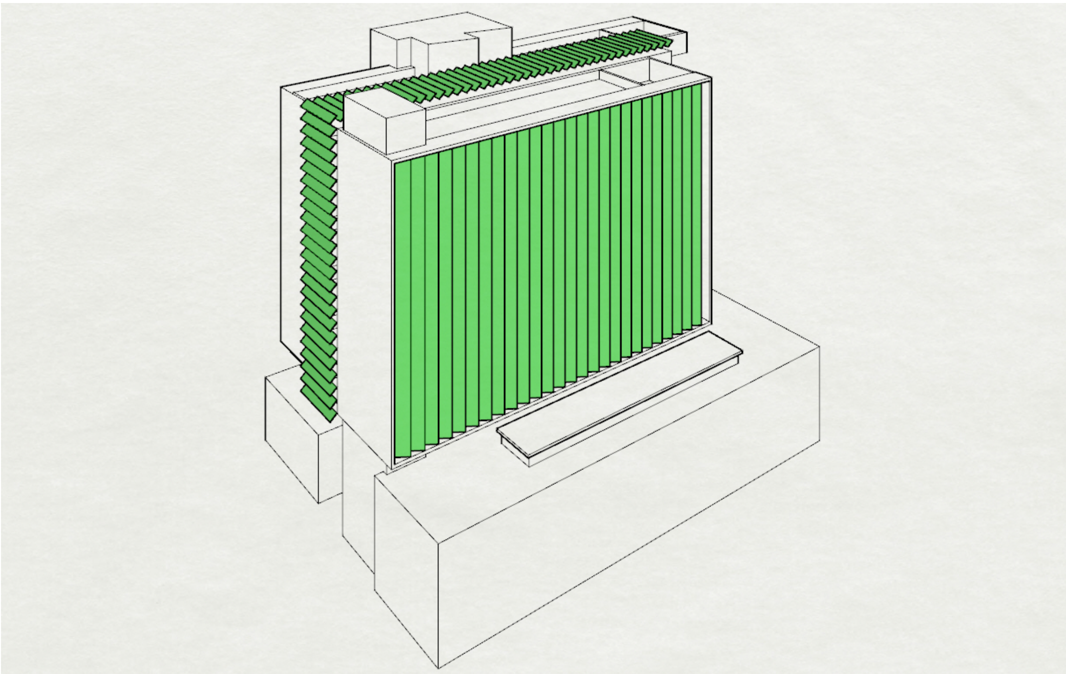

Figure 22 Perspective from south-east showing initial shading unit design of atrium and east facade.

CHAPTER 4

RESULTS AND DISCUSSIONS

This chapter presents the results of the analysis, the comparison of the design phases with the initial design concept. Further enhancements and discussions are carried out in the last section.

4.1. Initial Design Analysis and Results

The initial design of the shading units were simulated as a reference for the comparison of the results with the generated alternatives. As mentioned before, the initial design is composed of identical shading units at a fixed distance along the east, west, south facades and the atrium roof.

In the initial design there are 41 shading units on the atrium roof measuring 0.77 by 5.4 meters tilted 45 degrees , spaced 0.9 meters apart from each other. The bounding depth of the members is 0.7 meters. Identically sized 23 units with 0.9 meters gaps in between are proposed vertically on the atrium south facade. On the east and west facades, the shading units have 1.2 meters and 0.75 meters bounding depth and a rotation angle of 50 degrees from the normal of the facade with 1.2 meters gaps in between. The bounding depth of the members is 0.77 meters. There are 26 units on east facade and two groups consisting of 15 and 8 units in the west facade. For the ceiling, default radiance material with 80% reflectance value was selected for the shading units, as well as for all the the alternatives. The results of the analysis meshes are shown in the Appendix D. The values of the initial design analysis are presented in comparison with the alternatives in tables in the following chapters.

4.2. Atrium Analysis and Results

Two separate optimization calculations were run for the atrium, one for the roof and one for the south facade shading devices. The results showed fairly distinct SI values for roof and the south facade. The roof is directly exposed to sun and the south facade is in a relatively recessed and protected zone, shaded by the building mass.

The fitness function was defined to minimize the SI and the variance of the values on the analysis mesh. The analysis was made with the parameters; random seed angle, shading depth, number of facade divisions and the division proximity function. The ranges for the number of divisions for the roof is between 18 and 40, and between 18 and 30 for the south facade. The values for the four variables across generations for each member and their fitness function is presented in the tables in Appendix A, together with the optimization graph of the evolutionary solver in Galapagos showing the tested 800 design alternatives and the results. The initial population starts with 75 members and the following generations with 25 members each.

The alternative for the atrium roof was selected from generation 27 member number 10 with results of closest fitness value to the mean of the populations of the last 15 generations. As can be seen on the graphs in Appendix A, showing Galapagos generations, starting from around the 15th generation the population fitness settles to an average value across the generations. For this reason, it is possible to select another member from the population with a similar fitness value. The selection was made by visually comparing the alternatives with similar fitness value in the Rhino 3d viewport and selecting one among them. Another designer might have selected another alternative in terms of the design components or the aesthetic criteria. The selection of the design alternative for the south atrium facade was then made not by picking the fittest members with minimum SI values from the candidate populations, but the criteria set by reading the fitness value of the member for the atrium roof, Generation 5 Member 23 one of the closest fitness values for the roof. Although it is preferable to minimize the SI value, here the selection was set by another criteria. The fitness values of the selected design alternatives for the atrium roof and south facade was set close. This was in order to minimize the risk of higher contrast in lighting levels between the roof and south facade. Selected members and parameters are listed in the tables 1 and 2. The simulations for the shading units for east and west facade were run with the mentioned shading units for the atrium as shown in Figure 22. The table showing the average SI values for the selected design alternative and the analysis mesh can be seen in Appendix D.

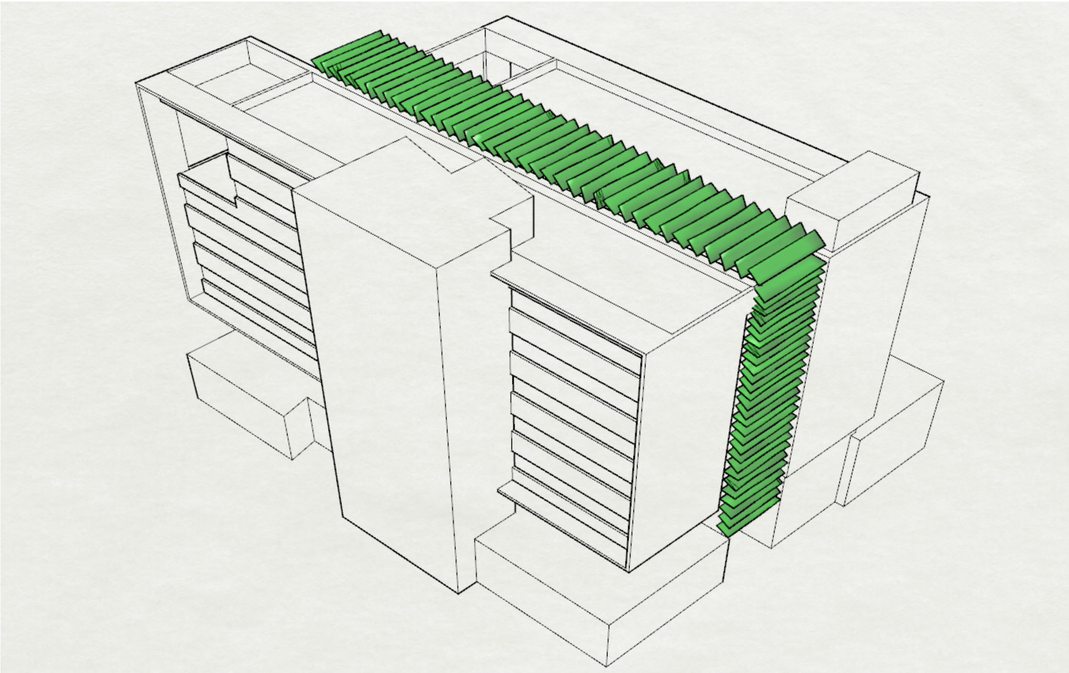

Figure 23 Perspective showing the selected alternatives for shading units of the atrium.

Table 1 Atrium roof values for the selected design alternative

ATRIUM ROOF	*Random Angle Seed*	*Shading Depth*	*Number of Divisions*	*Division Function*	*Fitness Function*
Average of last 15 Generations	226	1.1 meters	39	1.415914	503.809
Generation 27 Member 10	158	1.1 meters	40	1,415843	504,245

Table 2 Atrium south facade values for the selected design alternative

ATRIUM SOUTH FACADE	*Random Angle Seed*	*Shading Depth*	*Number of Divisions*	*Division Function*	*Fitness Function*
Average of last 15 Generations	536	1 meters	28	1.418833	361.811
Generation 5 Member 23	479	0.9 meters	26	1,418671	499,978

4.3. East and West Facade DF and SI Analysis and Results

The simulations for the design alternatives for the east and west facades were run with the same atrium shading units picked in the previous section. The optimization for the facades were done in two steps, the second of which is explained in the next topic. First step for generating the design alternatives is based on the performance values for DF on the work planes, for the first and fifth floors together with the SI on the facade segment of the corresponding floor. The four parameters of the atrium also apply to the east and west shading units. Number of facade divisions for the east, west-north and west-south facades are between 18-36, 12-22 and 8-13 respectively. The fitness function was defined by minimizing the variance to a target DF value of 2% and the sum of the average annual SI multiplied by 1/100 to convert the values to a similar weight in relation to the values obtained from the DF analysis. The units of the two fitness variables were not same so it was better to introduce a factor in order to pull the value of the fitness variables for the design purposes to a similar magnitude in the fitness function. The evolutionary solver was run to minimize the fitness value for the generated design alternatives.

The analysis was done for the first and fifth floors separately for each block. As mentioned before the west block is divided into two as west-north and west-south by the main circulation core. The lowest and uppermost floors were selected on the premise that these had the peak attributes in terms of the level of natural light falling on the work plane. It was expected that comparing the results between the two would demonstrate the indication for the need of a different design approach. The difference between the two would determine the strategy to be employed for the rest of the process.

The evolutionary solver started with an initial population of 75 individuals with chromosomes composed of 4 genes as variables and then continued to with the design alternatives with 25 members at each generation. The solver was run for the first and fifth floor respectively on three blocks resulting in six simulation groups. For every member of the population, two simulations were run to assess the fitness value: one for DF on work plane and the other for SI on the facade. Each simulation lasted about 30 - 45 seconds on a 4th generation icore7 3.4 Ghz four-core CPU, resulting in 60 - 90 seconds for each member of the population. Total duration was around 14 hours for each simulation run for 25 generations and a total number of 700 members across generations. Four simulations were run simultaneously on each core of the CPU and a total time around 28 hours was spent for the calculations at this stage. The results of the simulations can be seen in Appendix B.

In simulations run for the first floor of the east block, the variance of the fitness of the members of the populations decrease beginning with the fifth generation and the fittest members begin to have closer gene values across the generations starting from then. With the exception of the division function parameter, after the tenth generation, the division function values tended to get closer for each of the members of the population and the fitness value for the fittest member improved throughout the generations in the simulations run for the first floor. Same improvement pattern was observed at different points on the fifth floor graph with a slightly different fitness curve character. See Appendix B, tables B5 and B10 for the fitness values.

In west-north block, the graph shows a horizontal graphic starting from the 6th generation for the first floor and from 15th generation for fifth floor. For the first floor, the division function parameter is distinctive in the 6th generation and for the fifth floor the values for the division function gets more close in the 9th generation. Only after the shading depth and number of divisions parameter values between the members gets closer in the 15th generation and the curve tended to be more horizontal. The West-North block is characterized by receiving large amount of radiation from the north facade and the atrium compared to other blocks, so the fitness function is dominated by this large glazing area. See Appendix B, tables B15 and B20 for the fitness values.

In west-south block, the 11th generation for the first floor is the point where the values for the genes get closer across the members. Though after this generation a combination of wider range of values for the parameters are tested by the solver where the shading depth and number of divisions affect the fitness function significantly. For the fifth floor on the contrary, it is not possible to say that the division function parameter effect the fitness function in the way that it is used to be on other blocks. This is possibly due to the fact that west-south has the smallest facade length and number of shading units that can be placed on the block is very limited compared to the longer facades on other blocks. See Appendix B, tables B25 and B30 for the fitness values.

For deciding the best values for the parameters of the shading device the average values of the last 13 generations were taken into account. The average of the mean values for the parameters of each generation were taken and calculated for each floor, except the random angle seed parameter. Random angle seed component created a combination of values for the orientation of each shading unit. In order to explore the possibilities of other possible angle combinations on the shading units, the third step was run for optimizing the angles only and keeping the other three parameters fixed for the shading units. The selected values for the parameters for each block is presented in tables 3, 4 and 5.

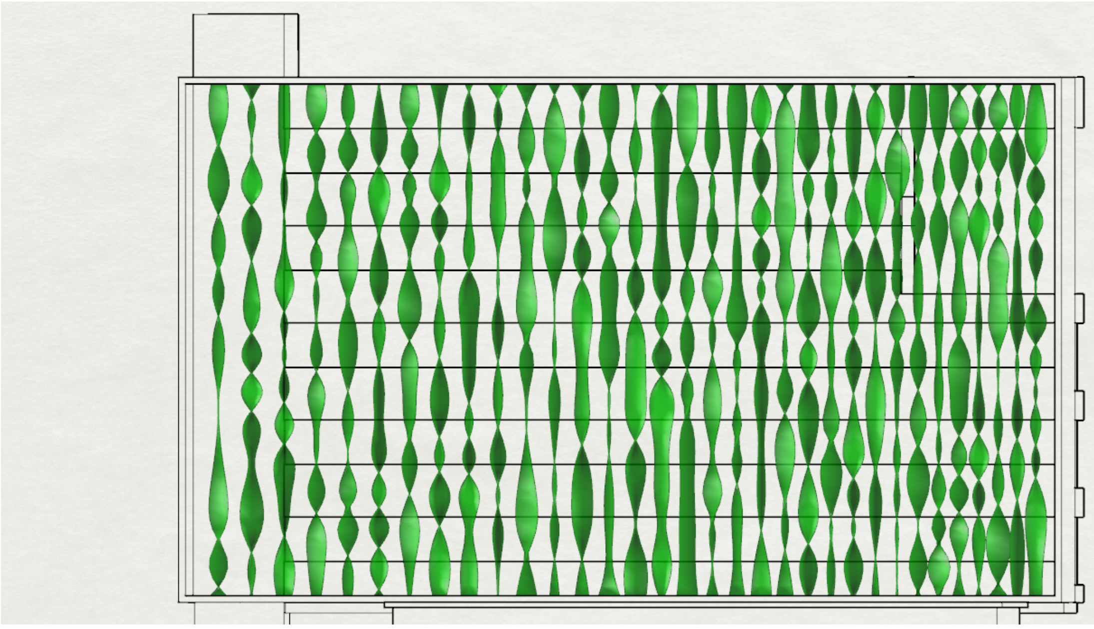

Figure 24 East facade elevation showing selected alternative 1.

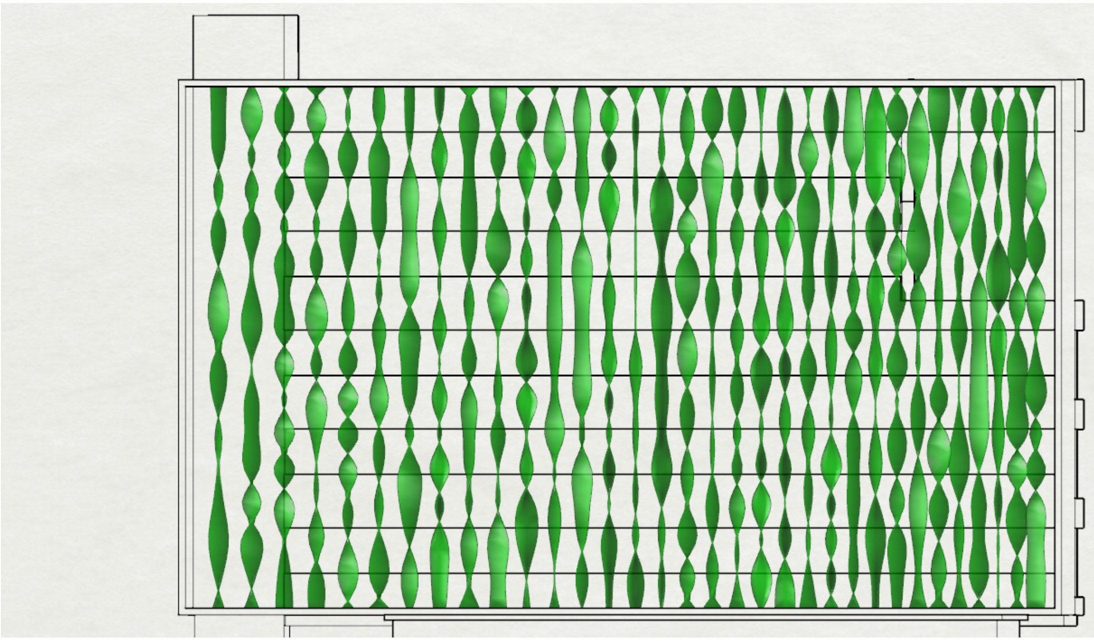

Figure 25 East facade elevation showing selected alternative 2.

For a more comprehensive comparison the random angle seed parameters of the fittest members from each simulation run were used. From floor 1 simulations random angle seed variable for the alternative 1 was selected for each block. Same selection is made for the floor 5 simulations for the alternative 2. The random angle seed numbers for floor 1 are 760, 863 and 330 respectively for each block. The values for the floor 5 are 498, 734 and 543. The selected alternatives for the east facade are shown in figures 23 and 24.

Table 3 East facade values

EAST FACADE	*Shading Depth*	*Number of Divisions*	*Division Function*	*Fitness Function*
Floor 1 Average of last 13 Generations	1.1 meters	34	1.418712	7.605657
Floor 5 Average of last 13 Generations	1.1 meters	34	1.416219	6.024408
AVERAGE	1.1 meters	34	1.417466	6.815033

Table 4 West-north facade values

WEST-NORTH FACADE	*Shading Depth*	*Number of Divisions*	*Division Function*	*Fitness Function*
Floor 1 Average of last 13 Generations	1.1 meters	21.5	1.416612	9.508841
Floor 5 Average of last 13 Generations	1 meters	21	1.419244	6.742137
AVERAGE	1 meters	21	1.417928	8.125489

Table 5 West-south facade values

WEST-SOUTH FACADE	*Shading Depth*	*Number of Divisions*	*Division Function*	*Fitness Function*
Floor 1 Average of last 13 Generations	1.06 meters	12.4	1.416739	2.339036
Floor 5 Average of last 13 Generations	1.03 meters	11	1.415962	2.233185
AVERAGE	1 meters	12	1.416351	2.286111

4.4. East and West Facade DF Analysis and Results

In this stage the simulations were run for minimizing the mean of the variance of the DF to the target value of 2% for analysis meshes on all floors in a single simulation run for each block. The parameters for the shading depth, number of divisions and division function are fixed and the random angle of the shading divisions is the only variable for design explorations. The analysis were run for 28 generations on each block. The range for each gene was set between -45 and 45 degrees from the normal vector of the facade. The East block random angle seed consists of 528 genes in each chromosome for the members of the population corresponding to the 33 shading units and divisions along the height of the facade. The West-North facade has 320 parameters for 20 units and the West-South facade has 176 parameters for 11 shading units. This stage consumed the most extensive amount of computing time from 150,2300 and 300 seconds for each member tested for west-south, west-north and east blocks respectively. Three simulations were run simultaneously and it consumed around 48 hours to complete the simulations for the east facade. The results of the simulations can be seen in tables in Appendix C.

From the results of the evolutionary solver, we can clearly see the fitness of all floors tend to give better results as the generations pass by. While we can say that the fitness values of each floor does not necessarily evolve to the fittest members in every case but stay close to the best performing member. The values for the DF and SI calculations are presented in the next section together with the comparisons to the initial design and alternatives 1 and 2.

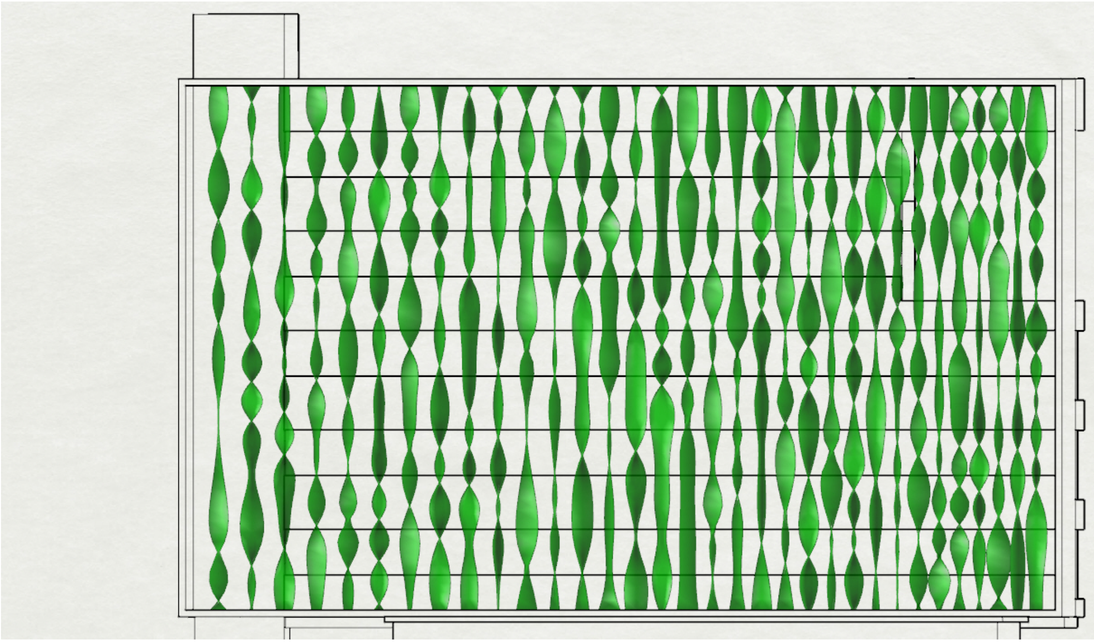

Figure 26 East facade elevation showing selected alternative 3

4.5. Comparison of the Alternatives

The evaluation of the alternatives was done under three sections. First section is for the atrium SI analysis comparison for the initial design and one alternative, the second part is for the facade SI analysis and the third is for the work plane DF comparisons for the initial design and three alternatives.

After the Galapagos runs in the second analysis stage, the most fit design alternatives generated for floor 1 and floor 5 are named as alternative 1 and alternative 2 respectively. The third alternative was generated in the previous section with random angle seed variable only.

4.5.1. Atrium Solar Irradiation Analysis

The alternatives selected for the atrium roof and south facade were compared with the initial design in terms of solar irradiation values. The distribution of the SI on the analysis mesh can be seen at Appendix D figures D10 and D11. It is clearly seen that in terms of average values, there is a significant amount of reduction in the radiation received in the selected design alternatives compared to the initial design in figures D1 and D2. In the atrium roof design, this was due to the increase in shading depth and angle variations of the shading units. Lower bound of the SI value was decreased a significant amount and the upper bound is similar, though these values remain in very limited cases on the analysis mesh. Although the fitness values are similar to the roof, the south facade values are 25% lower. This is due to the fitness function taking the variance of the SI on the analysis mesh and the fact that the south facade is covered by the building mass to a great extent.

Table 6 Atrium roof analysis results

ATRIUM ROOF	*Annual Solar Irradiation Bounds (SI) kWh/m²*	*Annual Solar Irradiation Average (SI) kWh/m²*
Initial Design	356 To 973	579.706667
Alternative Design	127 To 993	349.598333

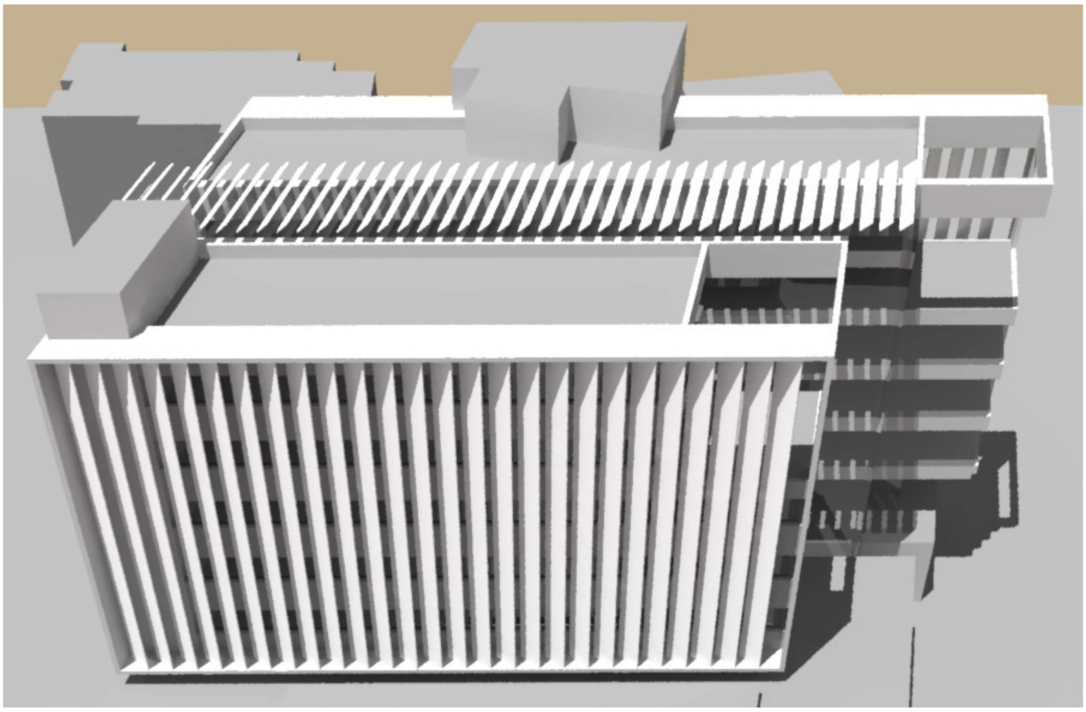

Figure 27 Initial design shading units on June 21, 11:00

Table 7 Atrium South Facade Analysis Results

ATRIUM SOUTH FACADE	*Annual Solar Irradiation Bounds (SI) kWh/m²*	*Annual Solar Irradiation Average (SI) kWh/m²*
Initial Design	125 To 733	369.177778
Alternative Design	117 To 654	264.115556

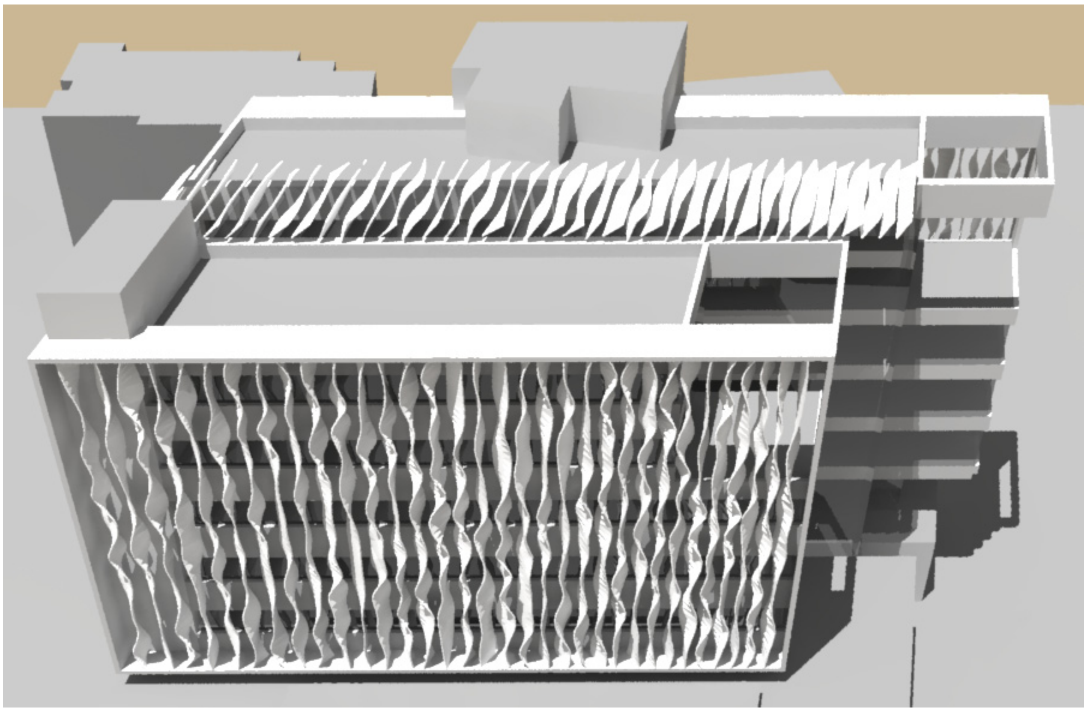

Figure 28 Atrium alternative with east facade alternative 3 on June 21, 11:00

4.5.2. Facade Solar Irradiation Analysis

The annual solar irradiation values increased by 70-100% on the facades when compared with the initial design. On the other hand, when we compare the solar irradiation values with the atrium values in the previous section, average values are close in magnitude. The results show that the initial shading design is an over-design for the office facades and the atrium glazing. The lack of the integration of simulation tools with the initial design, decisions made solely by intuition and relying on experience produced a design with excessive shading that became disadvantageous in terms of interior lighting. When all of the alternatives are compared with the initial design, the distribution of the SI values on the analysis meshes yielded a nice random distribution as seen in Appendix D, figures D12, D13, D19, D20, D26 and D27.

Table 8 East facade SI values

EAST FACADE	*Annual Solar Irradiation Bounds (SI) kWh/m²*	*Annual Solar Irradiation Average (SI) kWh/m²*
Initial Design	28 To 574	171.352333
Alternative 1	36 To 724	347.942167
Alternative 2	23 To 762	351.6655
Alternative 3	24 To 704	339.197

Table 9 West-north facade SI values

WEST-NORTH FACADE	*Annual Solar Irradiation Bounds (SI) kWh/m²*	*Annual Solar Irradiation Average (SI) kWh/m²*
Initial Design	29 To 572	179.585897
Alternative 1	14 To 630	305.844615
Alternative 2	23 To 609	306.635128
Alternative 3	15 To 624	310.183077

Table 10 West-south facade SI values

WEST-SOUTH FACADE	*Annual Solar Irradiation Bounds (SI) kWh/m²*	*Annual Solar Irradiation Average (SI) kWh/m²*
Initial Design	26 To 393	164.628125
Alternative 1	41 To 624	327.984896
Alternative 2	41 To 636	319.735938
Alternative 3	29 To 633	327.458333

4.5.3. Work Plane Daylight Factor Analysis

East Block: The daylight factor distribution for the east block is under the influence of the shading units to a great extent. A relatively small area on the north facade on the first three floors of the block receives uncontrolled daylight and the analysis points that are within the 1 meter range on the north glazing area are over 10% DF so it is necessary to suggest alternative shading systems for the north facade. See the Appendix D, figures D5, D6 and D7. The effect of the shading units can be observed in the north side of the fourth and fifth floors when we observe the DF distribution in figures D8 and D9. Same condition can be observed in all of the shading design alternatives.

For the initial design, if we disregard the values at this specific area in the north, the calculated value decreases by 15% from an average of 3.43 to 2.9 DF value. The ratio of the areas that are below 2% DF to the total area is between 30-45% among the floors. The DF values fall below 2% beginning from 2 meters from the windows.

Table 11 Initial design DF values for east block

EAST BLOCK WORK PLANE INITIAL DESIGN	*Daylight Factor Bounds (DF) %*	*Daylight Factor Average (DF) %*
Floor 1	0.362 To 23.617	3.197
Floor 2	0.519 To 24.571	3.364
Floor 3	0.568 To 25.294	3.579
Floor 4	0.643 To 17.259	3.597
Floor 5	0.791 To 18.432	3.423
AVERAGE		3.43

Figure 29 Initial design east facade on June 21, 11:00

In Alternative 1, which is one of the fittest members in the optimization run for the first floor the difference between the initial design is most noticeable in the 1st and 2nd floors and the values tend to be much closer when we look at the average value for the 5th floor. As expected, more improvement can be noticed in the lower floors.

In the middle of the plan, the values in the first three floors of the analysis points, we can see that the DF values increased from values between 1-1.5% to 2%, whereas nearer to the east facade, an increase of the area of points around 5% in the DF values and after 3 meters from the windows, a decrease below 2% in the DF values can be observed. To speed up the process, ambient bounces in the Radiance parameters were kept at 2. If more bounces were made, these values would have been higher.

Table 12 Design alternative 1 DF values for east block

EAST BLOCK WORK PLANE ALTERNATIVE 1	*Daylight Factor Bounds (DF) %*	*Daylight Factor Average (DF) %*
Floor 1	0.566 To 23.537	3.47
Floor 2	0.637 To 24.182	3.652
Floor 3	0.664 To 24.927	3.763
Floor 4	0.712 To 15.219	3.682
Floor 5	0.921 To 17.16	3.431
AVERAGE		3.6

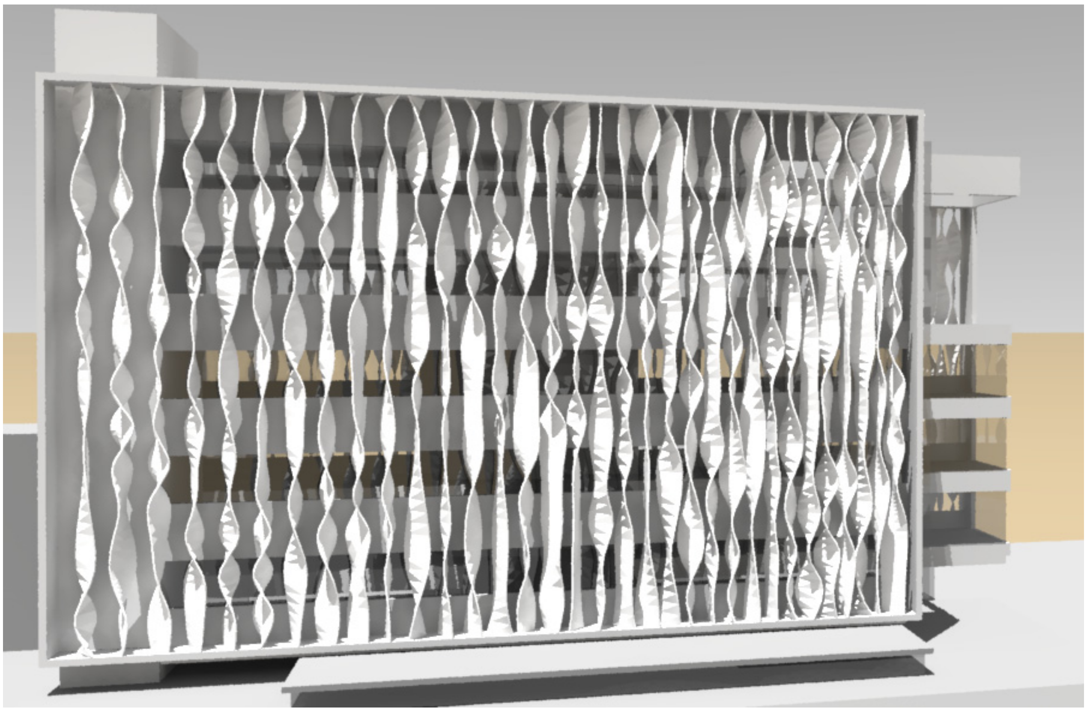

Figure 30 Alternative 1 east facade on June 21, 11:00

Alternative 2 optimized for the 5th floor yielded a very close average value for all floors like the first alternative. The difference with the initial design is maximum in the 5th floor and gets closer to the values obtained for the 1st floor. The values are very close to the ones from the first alternative in the lower floors.

Table 13 Design alternative 2 DF values for east block

EAST BLOCK WORK PLANE ALTERNATIVE 2	*Daylight Factor Bounds (DF) %*	*Daylight Factor Average (DF) %*
Floor 1	0.548 To 23.353	3.445
Floor 2	0.667 To 24.364	3.604
Floor 3	0.68 To 24.74	3.755
Floor 4	0.75 To 15.046	3.707
Floor 5	0.907 To 17.096	3.565
AVERAGE		3.62

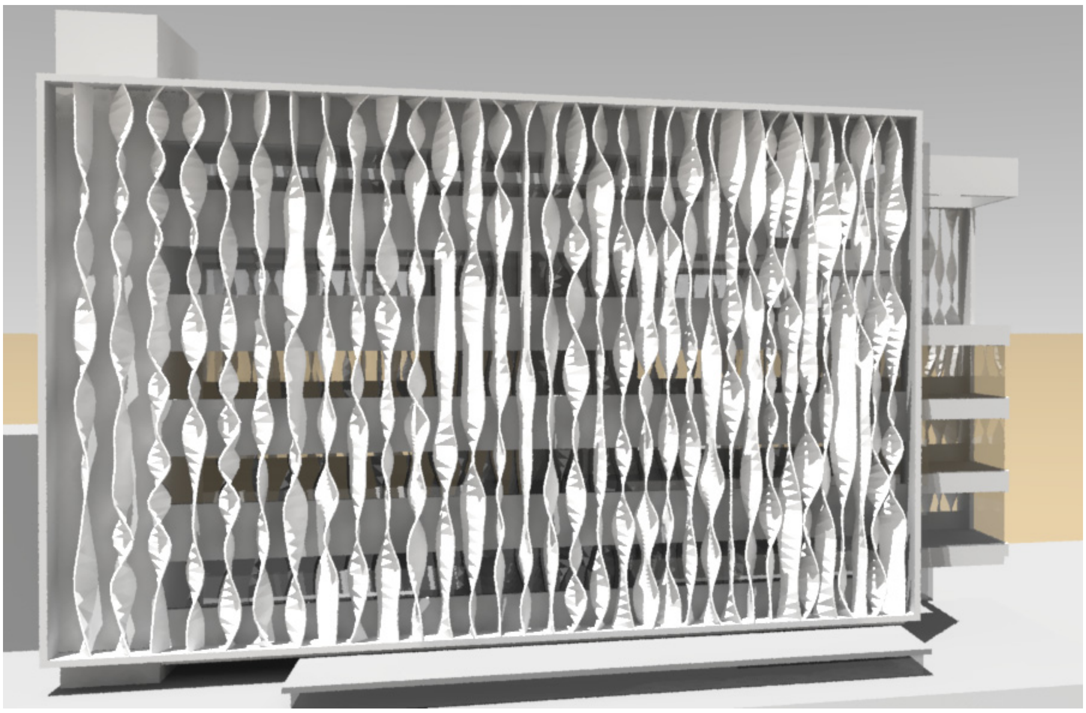

Figure 31 Alternative 2 east facade on June 21, 11:00

The 3rd alternative was optimized for the average of all floors, as a result the average DF value of all floors is lower than the 1st and 2nd alternatives. When we compare the values at each floor, either a very close or lower DF value. The light entering through the atrium shading units is better distributed although the amount of light is less than the initial design.

Table 14 Design alternative 3 DF values for east block

EAST BLOCK WORK PLANE ALTERNATIVE 3	*Daylight Factor Bounds (DF) %*	*Daylight Factor Average (DF) %*
Floor 1	0.434 To 23.522	3.336
Floor 2	0.596 To 24.202	3.628
Floor 3	0.68 To 24.679	3.761
Floor 4	0.703 To 14.826	3.487
Floor 5	1.058 To 17.406	3.534
AVERAGE		3.55

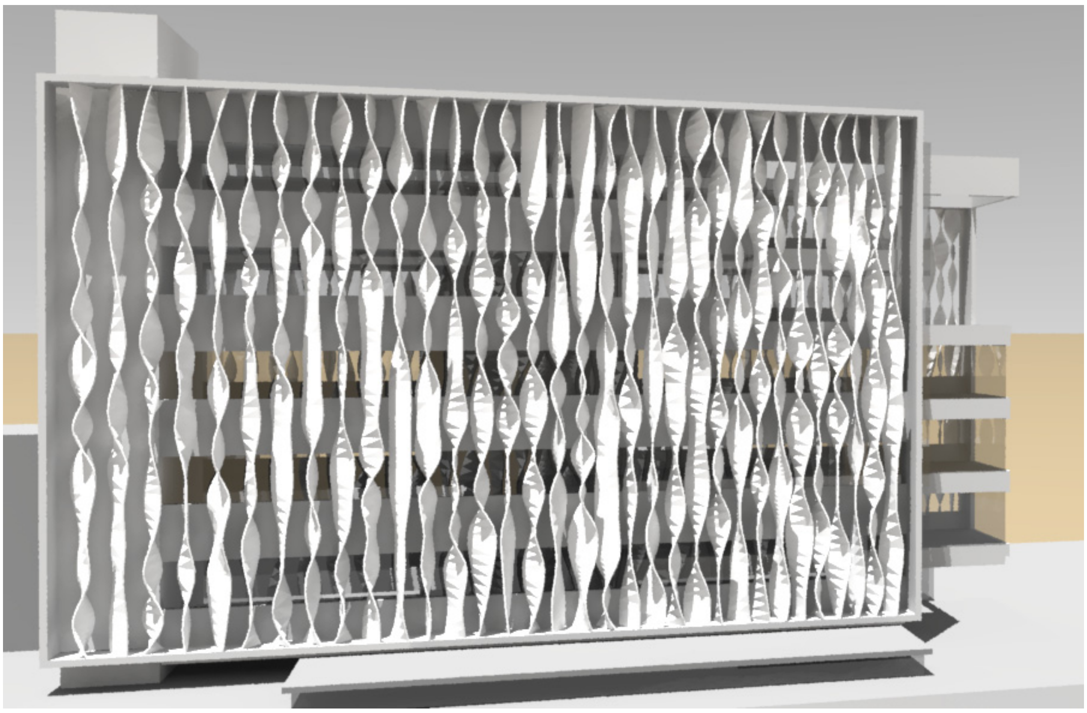

Figure 32 Alternative 3 east facade on June 21, 11:00

West-north block: As a consequence of the massing configuration of the building the light distribution in this block is characterized by the excessive facade area facing to north and east. The area that is over the 10% DF value in this block is around 25% of the office area up to the third floor, as seen in Appendix D, figures D5-D8. We can say that this is an over lit block and additional shading units should be considered to control the light entering from north and east. Nevertheless, this problem is almost eliminated on the 4th and 5th floors, as the block is recessed from north and shaded by the structural beams. The DF value at the 5th floor decreases a significant amount when compared to the 4th floor, this case shows how effective the shading provided by the structural beams at the roof level (where they continue to the full length of the block) is. As a result for a comprehensive optimization of the design alternatives it is necessary to introduce additional components to the simulation.

When we look at the initial design for the minimum values at at each floor, under-lit areas are very small compared to the whole area but a significant drop in the DF values in the middle of the block can still be noticed, especially closer to the circulation core. Dealing with the over-lit areas needs additional design strategies to be integrated to the current optimization calculations. When we eliminate the areas with DF higher than 10% the average of all floors decrease from 7.7 to 5 and the values for floors are range from 4.4% to 5.4% DF.

Table 15 Initial design DF values for west-north block

WEST-NORTH BLOCK WORK PLANE INITIAL DESIGN	*Daylight Factor Bounds (DF) %*	*Daylight Factor Average (DF) %*
Floor 1	1.593 To 36.917	7.966
Floor 2	1.706 To 36.603	8.278
Floor 3	2.214To 37.787	8.63
Floor 4	2.377 To 27.355	8.051
Floor 5	1.390 To 21.88	5.528
AVERAGE		7.7

The selected design for the 1st alternative generated by the evolutionary solver performs similar to the initial design with slightly higher DF with about 2% increase. When we eliminate the areas over 10% DF, the increase is around 5% at the lower floors.

Table 16 Design alternative 1 DF values for west-north block

WEST-NORTH BLOCK WORK PLANE ALTERNATIVE 1	*Daylight Factor Bounds (DF) %*	*Daylight Factor Average (DF) %*
Floor 1	1.28 To 36.897	8.047
Floor 2	1.478 To 37.354	8.485
Floor 3	1.837 To 37.974	8.772
Floor 4	2.134 To 26.435	7.927
Floor 5	1.12 To 21.341	5.709
AVERAGE		7.79

The 2nd alternative yielded higher average values at the lower floors and lower value at the 5th floor.

Table 17 Design alternative 2 DF values for west-north block

WEST-NORTH BLOCK WORK PLANE ALTERNATIVE 2	*Daylight Factor Bounds (DF) %*	*Daylight Factor Average (DF) %*
Floor 1	1.545 To 36.257	8.278
Floor 2	1.442 To 36.857	8.385
Floor 3	2.16 To 37.68	8.787
Floor 4	1.818 To 26.66	8.026
Floor 5	1.224 To 21.209	5.553
AVERAGE		7.8

As regards the 3rd alternative for the west-north block, higher DF values were obtained when compared to the 1st and 2nd alternatives. The evolutionary solver tries to minimize the variance of the DF values and due to the significant amount of over lit areas in this block, the average values tend to be higher compared to the initial design and former alternatives.

Table 18 Design alternative 3 DF values for west-north block

WEST-NORTH BLOCK WORK PLANE ALTERNATIVE 3	*Daylight Factor Bounds (DF) %*	*Daylight Factor Average (DF) %*
Floor 1	1.504 To 36.95	8.31
Floor 2	1.345 To 36.973	8.437
Floor 3	2.204 To 37.766	8.908
Floor 4	2.178 To 27.033	7.987
Floor 5	1.45 To 21.032	5.78
AVERAGE		7.88

West-south block: This is the only block with the same office area across the floors and with the lowest DF values. As this floor does not have a facade facing north and the only way to receive daylight is through the atrium and the west facade, none of the design alternatives have values higher than 10% DF. The initial design is characterized by the dominance of the under lit areas, ranging from 55% to 75% of the office area is below 2% DF. It hardly gets over the 5%DF in areas which are very close to the west facade and the atrium.

Table 19 Initial design DF values for west-south block

WEST-SOUTH BLOCK WORK PLANE INITIAL DESIGN	*Daylight Factor Bounds (DF) %*	*Daylight Factor Average (DF) %*
Floor 1	0.031 To 7.732	1.435
Floor 2	0.032 To 7.546	1.546
Floor 3	0.042 To 7.854	1.741
Floor 4	0.046 To 8.307	2.33
Floor 5	0.037 To 6.35	2.067
AVERAGE		1.824

Figure 33 Initial design west facade on June 21, 13:00

Starting with the first alternative the average DF for each floors was increased by 25% to 40% and about 30% for all floors. The increase in values is higher in the lower floors, this is because these floors receive the least amount of reflected light from the atrium. The ratio of the area under 2% DF to the total area ranges from 43% to 66%.

Table 20 Design alternative 1 DF values for west-south block

WEST-SOUTH BLOCK WORK PLANE ALTERNATIVE 1	*Daylight Factor Bounds (DF) %*	*Daylight Factor Average (DF) %*
Floor 1	0.113 To 9.505	1.986
Floor 2	0.143 To 8.869	2.22
Floor 3	0.134 To 8.62	2.196
Floor 4	0.141 To 9.051	2.857
Floor 5	0.087 To 8.796	2.501
AVERAGE		2.352

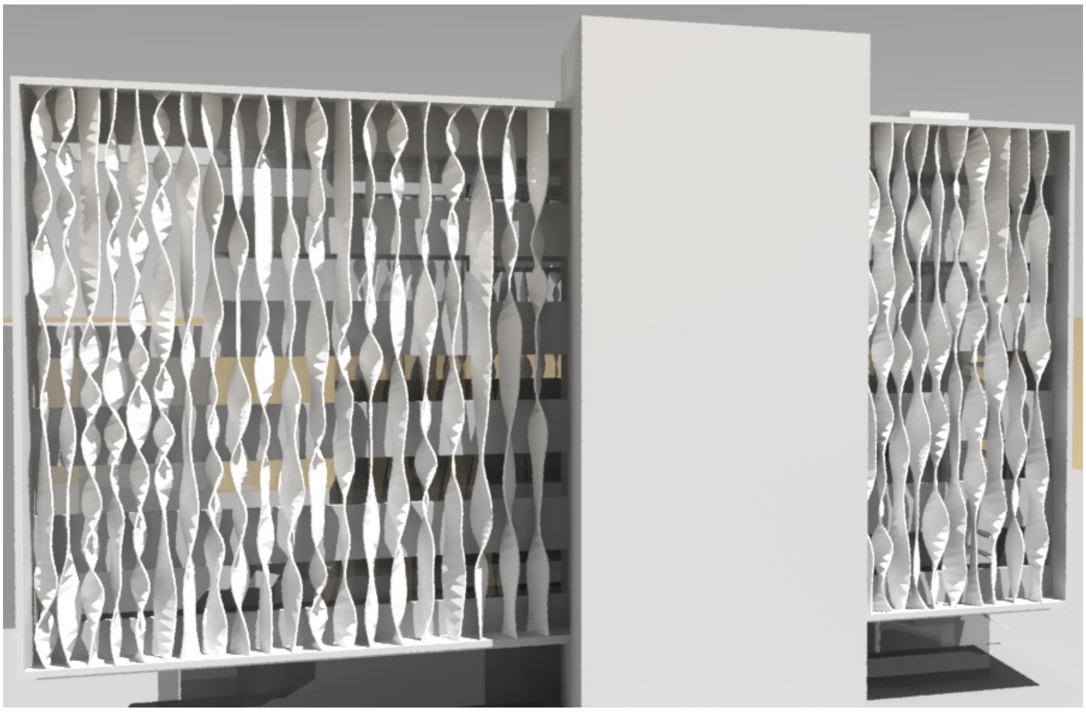

Figure 34 Alternative 1 west facade on June 21, 13:00

The 2nd alternative yielded a similar average value for all floors each with slight differences. The average at the 5th floor decreased due to minimized variance compared to the 1st alternative. Similar ratios apply for the under lit areas with 2% DF in this alternative from 44% to 67%. An improvement can be seen compared to the areas under 1% DF.

Table 21 Design alternative 2 DF values for west-south block

WEST-SOUTH BLOCK WORK PLANE ALTERNATIVE 2	*Daylight Factor Bounds (DF) %*	*Daylight Factor Average (DF) %*
Floor 1	0.091 To 8.116	2.003
Floor 2	0.08 To 8.89	2.093
Floor 3	0.145 To 8.603	2.359
Floor 4	0.15 To 9.501	2.752
Floor 5	0.079 To 8.751	2.436
AVERAGE		2.328

Figure 35 Alternative 2 west facade on June 21, 13:00

The 3rd alternative shows a similar average value for all floors slightly lower than the 1st and 2nd alternatives. When we look at the values for the amount of analysis points that are under 1% DF we can say that the 2nd and 3rd alternatives perform better by 15-20% than the 1st one. When compared with the initial design the areas under 1% DF decreased by 25-55% and the better the values for the third alternative.

Table 22 Design alternative 3 DF values for west-south block.

WEST-SOUTH BLOCK WORK PLANE ALTERNATIVE 3	*Daylight Factor Bounds (DF) %*	*Daylight Factor Average (DF) %*
Floor 1	0.105 To 8.978	2.073
Floor 2	0.088 To 8.535	2.199
Floor 3	0.123 To 9.408	2.25
Floor 4	0.103 To 10.953	2.73
Floor 5	0.081 To 7.689	2.371
AVERAGE		2.325

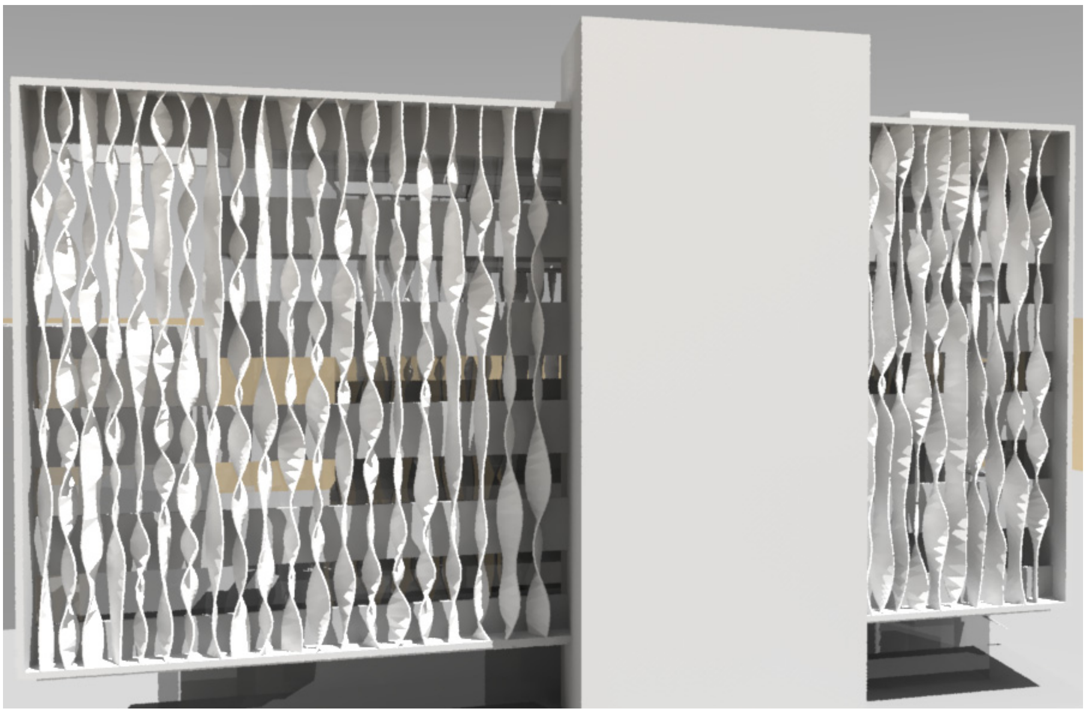

Figure 36 Alternative 3 west facade on June 21, 13:00

As a result of the three optimization approaches to the initial design problem, better performing design alternatives is generated by performance based computing. Based on the results and data generated it is possible to elaborate the future steps of the design process. The process presented in this study can be considered as the conceptual phase of the design. The columns, office partitions, glazing frames and basic office furniture were not modeled at this stage. Neither the light control alternatives for the glazing on the north integrated into the design process nor the other possible shading alternatives for the atrium are explored yet. The significance of the study was the generation of a case responsive shading system with variations rather than an excessive repetition of shading units. Besides the better performance in computed data, it is significant that the variations of the shading system break up the monotonous office space and promoted the quality of the indoor space. Moreover for each design optimization, an amount of totaling around 8000 alternatives were tested, which was impossible to b e carried out in a conventional design workflow.

CHAPTER 5

CONCLUSION

The recent advances within the last five years in computational design provided more tools accessible to the designers. In time of the studies carried out in this thesis, more tools became available for Rhino and Grasshopper and yet, it was not possible to implement Diva into the parametric process until a few months ago. There is a rapid expansion in the possibilities for design exploration, both with the add-on software components for the integration of class leading freeware simulation tools like Radiance and Energy Plus and the introduction of more evolutionary algorithm components into parametric medium. Besides testing an extensive amount of alternatives and parameters, the communication and integration of the software platforms broaden the possibilities of interpreting the data visually which is of great importance especially in the field of architecture. The dominance of visual media in the education and practice of architecture is indispensible and necessary for rapid design evaluation and presentation, moreover it facilitates the participation of the designer and client into the performance based design practice. With the opportunities provided by the new workflow, the designer has become capable of supervising and controlling a performance based design process. Nonetheless, designers still need to exercise in simulation software and search in potentials of interpreting data.

The custom tailored workflow for a specific design case developed for this thesis is meant to be a contribution to the enlarging possibilities of design exploration. Rather than a search for a generally applicable design method, this study emphasizes the significance of problem solving for a specific generation, simulation, and optimization workflow. As stated before, the design process is a framing and reframing act based on the iterations through which the designer and the designed object is in a continuous interaction transforming each other in a dialogical relationship. In this kind of workflow the inputs, processing and the outputs are custom designed for each different case. In addition to these, it is also important to limit the number of parameters in order to achieve a manageable optimization process. If the evaluation process becomes too complex, advantages of the system may not be as many as expected at the end. Therefore it is important to divide the design components and process into segments and stages in accordance with the design priorities. Topological, geometric or hierarchical complexity of relationships should be designed so as to enhance the design quality for the complexity of the digital model does not necessarily lead to better solutions for the design problem. The balance between the design goals and the level of abstraction is of paramount importance for the workflow. The complexity of the model is closely related with the computing power of the software and hardware used for the design workflow, so it is not possible to make any generalization on the topic as both software and hardware changes are very rapid and the possibilities change every year.

The use of case specific visual scripting with the help of Grasshopper is one of the significant advances for the designers. The visual interface makes possible to see the whole structure of workflow at a glance, in contrast to a text based editor where it is possible to get the whole picture by following the line by line interface and we have to construct the picture of the relationships in our minds to grasp the whole system. However, with the graphical interface, the picture is formed while the designer is scripting and at every stage we have a snapshot of either a partial area or the whole structure of relationships. This kind of workflow is extremely easy to adopt for the visually trained designer. In a way the map of the designer's way of thinking is formed while scripting, basically a mind map. Another characteristic of this way of designing is open to experimentation, the process is not a predetermined workflow. The designer sees the decisions and connections s/he has made and their outcome almost instantly interacts with the interface and results simultaneously.

It can be considered that the selection of the simulation software, the algorithm to be used, the fitness function, number of individuals at each generation, the relationship of components and parameters are now part of the creative process. The designer has more or less an idea of what the solution for the design problem could possibly look like even at the early stages of the methodology of the optimization. The solutions explored show that the benefit of the evolutionary algorithms are distinctive when a large number of alternatives are tested, therefore a wide choice of possible solutions becomes available to the designer in a very short period of time.

The design of the shading units presented in this thesis were just a case for applying the evolutionary algorithms with a custom designed workflow. Similar principles with a different workflow can be applied to another design problem. What is important in this study is to manage a custom tailored design methodology which can be applied as an aid to a variety of design decisions for any building component or the whole of the building at any stage of the process. Rather than finding a perfect solution, the aim of the design optimization is to end up with a variety of promising design options. It is not possible to include all the parameters when designing the computational model as the designer can have other ideas or judgments that cannot be translated to a parameter easily. As a result of the process, a wide variety of alternatives are ensured to be at hand for evaluation and each can be studied at different stages with additional criteria which were not present during the initial optimization process.

The support of simulation tools is an essential component in the design process and their key role is to assist the actions and reasoning of the designer with scientific tools besides enhancing the creativity by discovering a pool of good solutions to the problem. In this process, the intuition of the designer keeps to be an important part of problem solving, what is new here is to generate extensive number of alternatives in a very limited time opening up new possibilities on how the designer constructs and handles the process. The adaptation and customization of the process is desirable and support the designer where intuition, experience and previous knowledge become insufficient in solving a design problem.

The use of evolutionary algorithms and parametric tools started to open new opportunities on how the designer works and thinks. Although hand sketching still plays a part in the process, adaptation to digital sketching is seamlessly integrated with the help of tools introduced in the recent years. Grasshopper interface seamlessly becomes the tool for mapping the way the designer thinks and acts when solving a specific problem. Together with the possibilities of data exchange to a variety of simulation software directly from Grasshopper, the workflow becomes seamless. In addition to Diva, Geco, Karamba, Kangaroo and Ladybug newly introduced Honeybee, Gerilla and many more tools are in development for the Grasshopper interface either as a built-in component or as a connection to external simulation software. Together with the use of rapid prototyping the building of physical models are also integrated to the process for the evaluation of design alternatives for further testing and research.

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APPENDIX A

STAGE 1 PARAMETERS ACROSS GENERATIONS

Table A 1 Atrium Roof Random Angle Seed

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28	Gen_29	Gen_30
0	773	370	533	325	356	402	347	375	300	186	173	174	172	173	510	169	169	165	175	174	165	168	176	174	169	170	170	167	165	177
970	195	401	306	388	320	349	311	398	201	168	177	185	172	173	174	170	172	169	181	164	172	171	164	174	170	165	169	166	168	170
867	852	167	452	416	542	320	160	297	353	376	168	173	175	173	173	171	164	177	169	167	167	168	171	171	174	161	175	162	165	168
699	375	279	415	447	672	670	337	405	356	178	186	177	173	172	178	164	169	169	176	168	168	176	172	165	173	169	164	167	165	164
763	266	162	366	321	476	562	315	331	191	175	176	255	178	166	172	175	163	167	176	178	169	176	166	167	172	161	171	156	170	172
51	550	624	742	542	662	402	400	376	378	195	376	180	174	172	169	177	179	174	175	175	176	167	166	175	170	173	169	176	172	211
638	879	331	416	388	347	372	606	372	297	297	176	180	177	162	172	175	178	178	177	174	166	164	176	169	173	169	174	170	168	162
537	823	681	552	214	400	396	353	204	248	176	181	166	174	174	172	170	178	167	218	163	163	175	168	168	170	170	163	165	165	172
309	742	380	624	533	416	400	375	161	376	261	178	168	170	168	180	179	169	168	171	169	169	169	171	174	169	159	161	167	167	161
114	307	575	702	329	312	386	384	337	191	169	270	175	171	172	172	169	171	177	168	172	171	171	166	170	173	169	158	173	171	168
728	424	660	385	410	375	382	400	312	300	185	180	171	165	169	170	176	167	184	167	175	168	165	169	174	166	169	170	165	166	168
550	539	159	542	542	447	303	382	297	161	255	166	180	171	171	170	179	174	169	163	173	168	169	176	169	171	163	163	165	169	165
864	452	406	468	327	337	331	378	199	168	260	181	175	154	180	172	171	177	171	178	173	169	173	169	244	159	164	164	162	165	161
686	579	693	161	625	364	342	362	177	233	179	190	170	177	173	171	178	164	168	169	167	175	171	175	171	174	163	169	175	171	173
937	167	534	401	401	410	662	372	209	312	332	175	185	176	172	173	170	167	169	176	176	178	167	174	169	170	170	161	169	169	167
361	534	278	330	363	665	376	297	378	195	187	194	177	173	173	167	171	169	164	164	166	176	169	165	166	169	176	162	163	169	166
849	624	370	218	203	571	392	394	554	261	185	179	169	185	168	169	183	173	176	174	167	165	171	166	175	159	170	169	165	163	174
628	308	266	624	385	329	347	161	353	297	191	175	178	174	590	173	172	169	170	158	175	179	165	172	176	175	170	162	169	167	199
308	152	743	533	352	388	565	371	357	173	163	345	191	184	173	172	167	170	178	173	172	165	176	161	166	172	161	174	163	167	168
51	695	554	337	662	357	407	630	342	391	339	185	192	184	172	174	170	168	131	177	169	168	165	171	172	169	172	162	166	188	169
229	383	452	279	330	363	364	407	401	405	331	180	166	168	174	172	170	171	179	168	178	173	165	169	174	171	170	167	169	169	165
383	518	416	659	296	347	589	389	344	332	197	177	310	177	170	180	174	167	179	169	173	177	173	166	173	175	171	169	212	176	166
660	444	277	370	675	387	595	209	403	181	170	331	187	172	174	175	172	182	175	166	167	162	287	166	173	169	170	165	172	164	170
935	699	878	279	337	158	329	401	353	331	405	402	176	192	172	179	172	169	158	171	164	164	172	168	171	175	169	163	164	163	165
358	794	799	533	457	303	351	398	337	315	402	180	199	173	176	173	173	170	169	166	170	161	166	176	171	170	173	223	173	167	165
833																														
195																														
429																														
690																														
993																														
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241																														
640																														
273																														
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876																														
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129																														
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828																														
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871																														
539																														

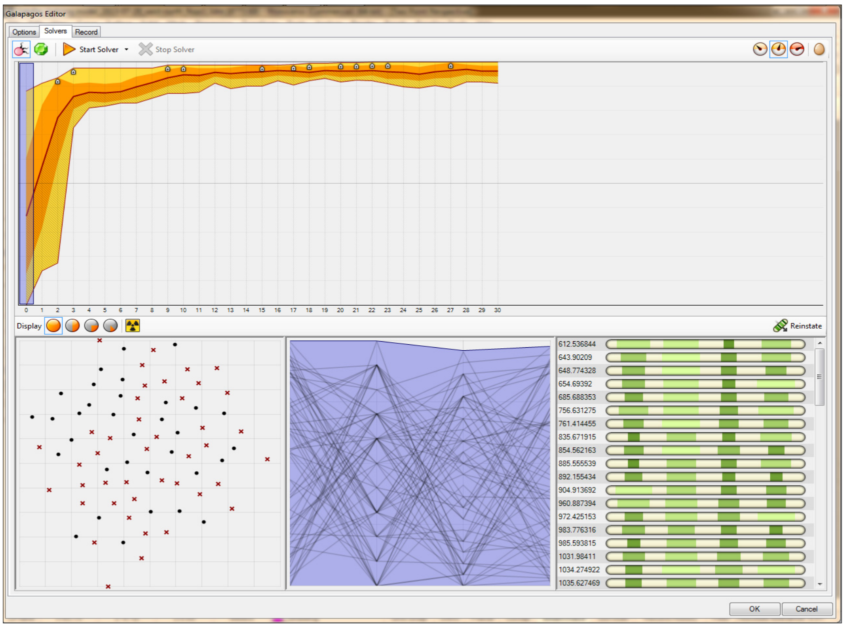

Table A 2 Atrium Roof Shading Depth

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28	Gen_29	Gen_30
-0,1	-0,7	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1
-0,9	-0,7	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0
-0,4	-0,5	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,0	-1,1	-1,0	-1,0	-1,1	-1,1	-1,1	-1,1
-1,0	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-0,9	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1
-0,8	-0,8	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1
-0,6	-0,4	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,5	-0,3	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1
-1,0	-0,9	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,0
-0,4	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,4	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,2	-0,5	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,0	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,0	-1,1	-1,1
-0,4	-0,7	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-0,9	-1,1
-0,6	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0
-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0
-0,8	-1,0	-1,1	-1,0	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,0	-1,1
-0,5	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,0	-1,0	-1,1	-1,1	-1,1	-1,1
-0,3	-1,0	-1,0	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1
-0,6	-1,0	-0,8	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,0	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1
-1,0	-0,6	-0,8	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,0	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,0	-1,1	-1,1	-1,1
-0,5	-0,9	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,5	-0,2	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,0	-1,1	-1,0	-1,1
-0,2	-0,6	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,0	-1,1	-1,1	-1,1	-1,1
-0,4	-0,9	-0,7	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1
-0,4	-0,7	-0,3	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,0	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,0	-1,1	-1,0	-1,0	-1,0	-1,1	-1,1	-1,1	-1,1
-0,3	-0,8	-0,9	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1
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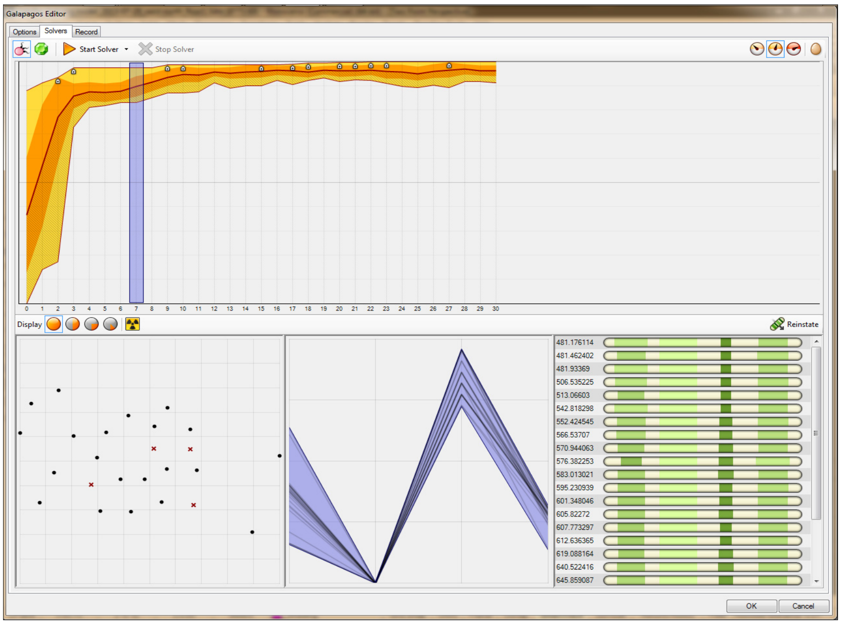

Table A 3 Atrium Roof Number of Divisions

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28	Gen_29	Gen_30
18	32	31	32	34	34	35	33	37	37	39	39	39	39	40	39	39	39	39	40	38	39	40	39	40	40	39	38	40	40	40
23	29	35	34	36	34	33	39	35	39	39	37	38	39	39	39	40	40	40	40	38	40	40	40	39	40	40	38	40	40	39
37	29	33	34	35	36	34	39	38	35	39	39	39	39	39	40	40	38	40	39	40	40	39	40	39	40	40	40	40	40	40
35	35	34	35	35	34	34	36	36	36	39	39	39	39	40	39	39	38	39	40	40	40	39	40	40	39	40	40	38	39	40
31	18	39	35	34	35	35	37	37	39	39	39	39	39	40	40	40	39	39	38	40	40	40	40	40	40	39	40	40	38	40
18	28	39	37	36	36	36	38	39	36	39	39	39	39	40	39	39	40	38	39	40	37	40	40	38	40	39	40	40	40	40
37	29	35	35	35	34	37	36	36	37	37	38	38	39	39	39	40	40	40	40	40	39	40	39	35	38	40	38	39	40	40
37	30	34	36	36	36	35	35	39	38	39	38	39	39	39	39	39	40	39	40	39	40	40	40	40	40	40	40	40	40	40
29	37	35	39	31	36	39	37	39	39	39	39	40	39	39	40	40	39	39	40	40	40	39	40	40	40	40	40	40	40	40
19	31	36	35	34	34	39	35	40	39	39	38	39	39	39	38	39	40	39	40	40	39	40	38	40	40	40	40	40	39	40
29	35	35	35	35	37	36	38	38	38	39	39	39	39	38	40	40	39	40	39	40	40	38	40	40	40	40	39	39	40	40
28	35	39	36	35	36	34	39	37	39	39	39	38	39	39	39	40	40	39	40	39	38	40	40	39	39	40	40	40	40	38
35	35	35	36	34	34	37	37	39	39	38	39	39	39	39	39	39	40	40	40	38	40	39	40	40	40	40	40	40	40	40
20	31	35	39	36	34	34	35	39	38	39	39	39	39	39	40	40	39	39	38	40	40	40	39	39	39	40	40	40	39	40
35	39	36	39	39	35	36	36	39	39	39	39	39	40	40	40	40	38	39	40	39	40	40	40	39	40	40	40	39	39	40
31	36	34	34	35	34	37	37	37	39	39	39	40	39	40	40	39	38	39	39	39	39	40	39	40	40	39	40	40	39	38
38	35	32	33	35	35	35	35	34	38	39	39	39	37	38	39	39	40	40	40	39	38	38	40	39	40	39	39	40	39	37
26	33	18	38	39	36	34	39	35	38	40	39	39	40	39	40	39	39	39	40	40	39	39	40	39	39	40	40	40	39	40
33	18	32	31	34	35	35	34	36	39	39	36	39	38	39	40	39	39	40	38	40	39	39	40	38	39	40	39	40	40	40
32	23	32	34	36	34	35	34	35	36	36	39	39	38	39	40	39	39	38	40	40	40	40	39	39	36	38	40	40	38	38
33	21	36	34	34	39	34	36	35	36	36	39	40	39	39	39	38	40	39	39	40	39	39	40	40	39	40	40	39	40	39
25	36	21	34	34	34	35	35	36	39	39	39	36	39	39	39	40	39	40	39	39	40	40	38	40	39	39	40	38	38	39
25	19	34	31	34	34	34	39	36	39	39	36	39	39	40	39	40	40	40	39	38	37	40	38	39	36	36	39	40	40	39
20	35	29	34	34	39	36	36	36	37	36	36	39	39	39	40	37	39	39	39	38	38	40	39	39	38	40	40	40	40	39
29	32	31	33	35	34	34	35	39	39	36	39	38	39	39	38	40	39	39	39	39	39	38	39	40	39	40	38	38	38	40
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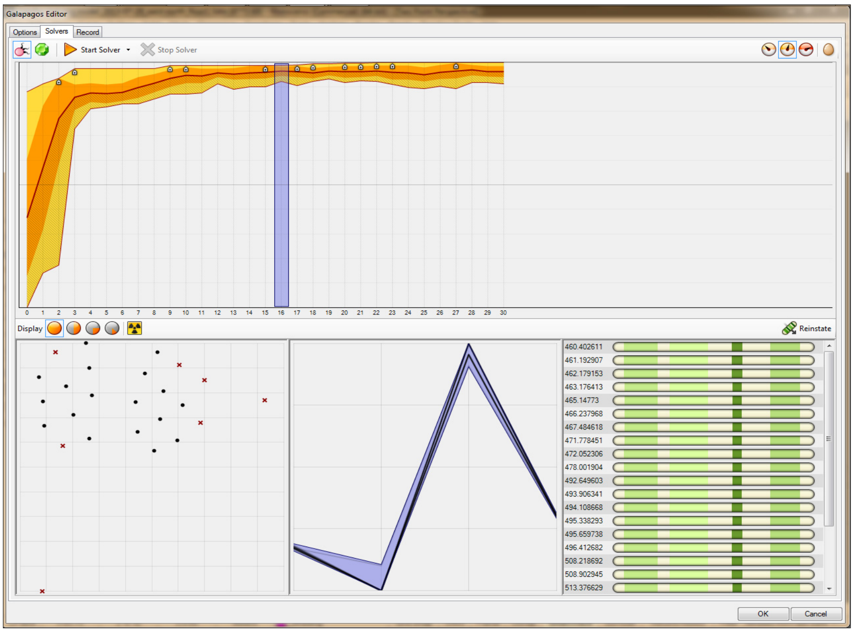

Table A 4 Atrium Roof Division Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28	Gen_29	Gen_30
1,414	1,416	1,418	1,415	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,415	1,418	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,416	1,419	1,415	1,415	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,414
1,417	1,416	1,415	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,417	1,416	1,416	1,415	1,415	1,415	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,415	1,415	1,416	1,416	1,415	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,417	1,416	1,416	1,416	1,416	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,414	1,416
1,414	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,416	1,416	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,417	1,418	1,415	1,416	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,416	1,419	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,416	1,419	1,416	1,415	1,415	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,419	1,417	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,419	1,414	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,416	1,416	1,414	1,416	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,418	1,415	1,415	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,420	1,417	1,418	1,415	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,415	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,415	1,415	1,416	1,415	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,415
1,419	1,414	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,420	1,415	1,415	1,415	1,415	1,416	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,415	1,418	1,418	1,416	1,415	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,419	1,418	1,418	1,418	1,416	1,415	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,414	1,419	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,418	1,416	1,416	1,415	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
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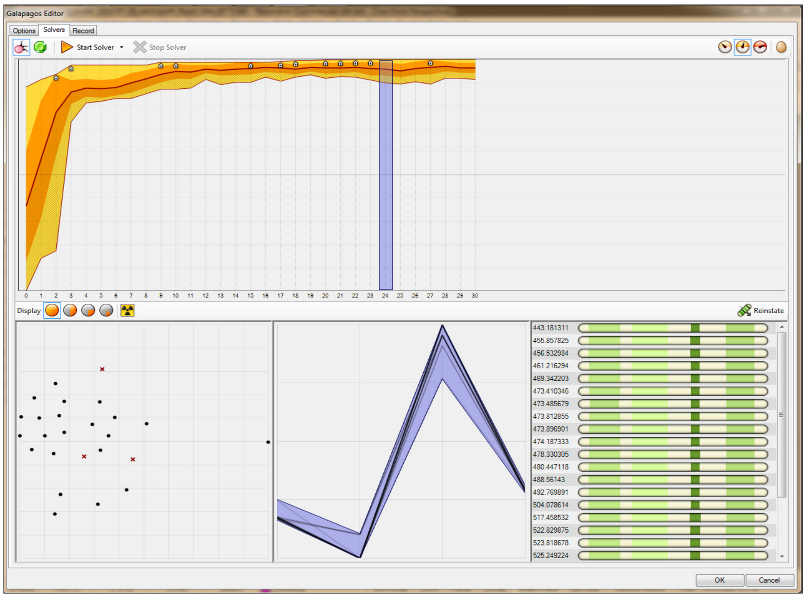

Table A 5 Atrium Roof Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28	Gen_29	Gen_30
#####	#####	906,7	730,2	638,9	645,9	617,7	739,7	597,9	603,9	488,6	479,8	526,1	497,4	464,0	544,5	462,2	458,4	500,8	464,3	531,5	500,2	469,8	558,1	473,4	523,5	493,4	524,4	504,8	476,6	491,9
#####	#####	607,1	706,6	573,8	635,7	675,5	481,5	654,8	492,7	490,0	595,7	524,1	495,3	479,0	526,9	478,0	472,9	451,4	481,5	544,3	472,3	491,4	559,1	525,2	480,6	485,8	493,7	491,2	472,2	570,5
#####	#####	803,6	643,4	661,7	586,4	635,1	542,8	533,7	635,9	509,1	488,6	481,4	483,4	476,6	465,5	492,6	545,7	491,6	549,5	505,7	505,5	488,1	570,8	523,8	545,4	540,2	462,1	466,3	474,9	479,1
#####	656,8	727,1	596,2	629,9	647,3	682,0	645,9	550,5	590,0	514,5	487,4	527,9	480,2	473,7	698,8	508,2	493,0	543,4	462,5	469,9	469,9	485,3	471,8	566,2	473,9	531,4	483,9	561,5	500,4	483,0
685,7	#####	565,3	608,3	687,9	629,0	679,6	552,4	554,7	513,5	484,1	487,1	473,3	599,0	494,8	560,2	466,2	498,6	507,7	499,6	496,3	446,6	460,8	490,2	504,1	472,7	556,7	486,1	473,3	524,2	471,0
#####	#####	598,9	569,3	585,0	598,3	577,5	612,6	521,5	628,5	643,3	514,7	486,6	527,3	475,0	465,0	528,3	494,7	529,6	482,6	465,0	530,8	505,3	574,9	517,5	479,1	474,3	442,7	460,0	472,3	472,4
#####	#####	611,9	663,2	598,8	701,9	563,9	576,4	607,3	552,8	553,5	502,1	529,9	530,9	476,2	586,7	465,1	508,1	504,8	516,2	473,0	520,1	487,1	487,2	587,2	518,2	443,7	608,6	495,4	477,7	466,2
#####	999,3	654,2	592,0	559,6	662,7	574,9	640,5	493,9	524,5	487,0	538,8	522,7	526,4	525,7	494,4	495,7	510,7	508,7	538,0	498,7	468,4	462,3	471,4	469,3	479,3	550,5	468,6	478,0	480,0	550,6
654,7	568,8	612,5	615,9	772,4	630,7	578,5	601,3	483,4	510,2	522,4	510,4	469,7	498,9	488,0	460,8	495,3	458,9	487,6	489,6	447,3	451,9	466,6	487,9	474,2	449,5	499,2	471,4	503,4	502,4	473,5
#####	896,4	586,3	621,6	651,3	618,2	543,4	651,4	511,4	513,0	462,5	573,9	485,2	526,1	494,8	540,3	461,2	490,8	528,1	470,3	471,7	522,7	568,7	546,4	480,4	460,9	443,7	504,2	460,9	524,6	472,6
#####	#####	618,0	632,1	625,0	597,2	597,0	607,8	499,5	581,2	497,7	484,3	526,1	497,4	492,7	478,2	467,5	507,2	523,8	506,9	542,2	541,3	535,1	445,3	473,8	569,2	455,4	494,7	573,2	484,1	469,6
#####	985,4	535,9	586,5	625,1	594,0	630,4	513,1	552,4	483,0	475,5	523,0	531,5	526,1	604,6	496,0	493,9	472,2	548,1	468,1	476,7	519,7	445,1	460,5	456,5	602,3	468,8	467,4	475,3	620,1	533,5
#####	630,9	622,2	668,2	685,1	701,5	560,6	595,2	498,0	492,1	586,4	495,2	484,0	497,3	568,1	497,7	523,5	491,3	491,2	514,5	604,3	527,1	476,3	443,2	473,5	505,0	486,6	487,3	464,7	478,4	540,4
#####	837,7	635,9	481,2	589,2	674,4	659,3	583,0	526,5	526,3	534,9	565,7	496,9	530,6	564,6	492,1	513,4	508,5	486,9	494,2	505,6	465,5	490,0	562,1	522,8	525,8	468,8	449,1	463,3	524,7	539,1
#####	601,7	557,6	566,5	566,2	620,5	605,4	605,8	523,9	463,6	490,8	485,7	498,0	464,8	473,9	467,5	552,7	560,8	544,1	467,5	486,2	501,6	505,0	474,2	455,9	480,6	479,2	472,6	539,5	546,1	503,5
885,6	573,8	795,8	668,5	652,1	687,1	584,1	566,5	597,1	565,0	567,0	513,3	493,2	479,3	465,5	506,1	524,4	493,1	508,3	506,1	520,9	486,9	529,2	500,0	488,6	519,6	560,3	466,3	467,0	455,2	542,0
#####	736,1	879,6	827,4	603,3	662,1	654,0	645,9	686,4	549,2	497,1	536,7	467,4	559,3	530,2	460,4	535,4	465,5	461,7	471,8	506,5	535,4	546,8	493,8	478,3	513,5	494,6	538,2	474,2	499,8	566,4
#####	757,1	#####	636,9	497,4	591,1	702,0	481,9	642,2	611,4	484,5	563,7	512,3	473,4	543,2	463,8	496,4	546,0	496,7	507,1	466,5	534,6	500,2	558,0	559,2	479,4	480,0	466,0	532,5	506,6	466,7
#####	#####	987,3	771,6	644,3	597,6	592,3	656,6	630,0	477,4	498,3	619,5	512,8	558,7	563,8	474,1	508,9	494,9	585,1	522,5	553,7	499,9	487,6	474,2	542,5	575,3	472,8	596,5	467,5	504,3	475,0
756,6	#####	750,7	701,9	617,4	707,5	648,8	682,2	641,1	592,7	578,2	496,7	531,0	642,8	494,9	473,1	494,1	487,1	552,3	493,0	446,7	469,7	482,5	523,4	577,5	541,7	533,4	466,0	487,1	556,6	493,3
#####	#####	581,9	737,3	663,9	525,4	677,1	619,1	592,5	624,2	597,3	486,9	499,3	488,2	526,3	580,1	526,7	490,6	536,4	487,4	506,0	475,9	499,2	454,9	473,9	524,0	548,7	579,1	455,4	522,1	500,3
#####	#####	#####	655,4	633,7	696,3	615,3	660,1	604,2	484,9	489,7	531,2	616,6	530,6	496,3	485,1	471,8	596,2	496,2	456,3	478,5	491,3	462,9	542,4	461,2	560,4	598,2	443,0	538,6	493,7	520,2
#####	#####	#####	902,7	651,8	659,8	684,8	506,5	606,0	495,6	493,9	597,2	567,9	495,4	472,3	481,9	472,1	476,4	468,1	521,0	561,3	549,7	517,5	545,3	558,7	542,0	580,9	573,1	471,1	481,3	494,1
#####	#####	#####	637,4	710,7	542,5	588,9	570,9	610,7	557,9	626,0	664,0	486,5	533,5	586,1	495,4	568,1	464,0	536,1	523,1	543,1	618,6	553,0	487,4	600,1	594,9	523,0	469,2	483,5	466,8	499,2
#####	#####	940,4	692,8	648,0	643,9	682,5	652,9	561,3	490,8	578,0	484,4	517,7	482,5	486,5	525,3	463,2	577,8	457,7	522,2	494,3	479,4	544,1	487,7	492,8	572,9	461,0	575,1	515,5	560,3	474,0
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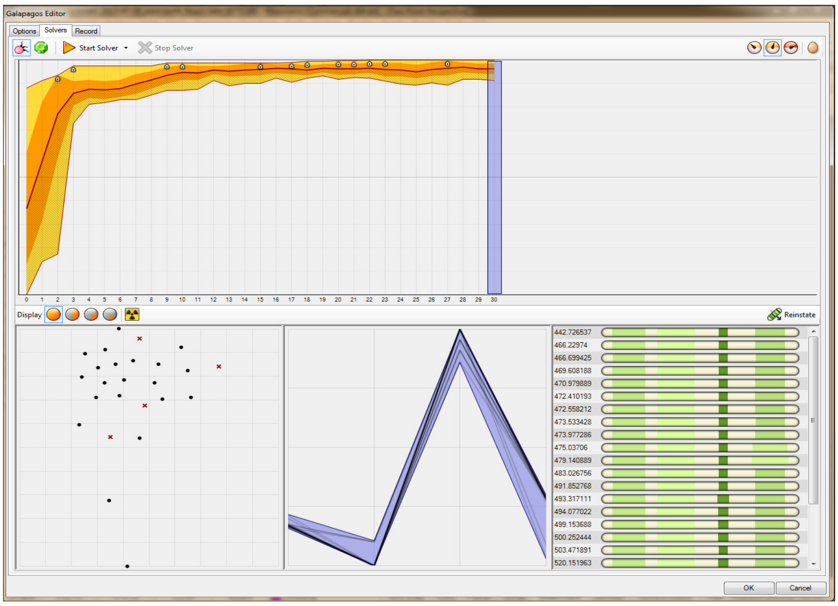

Table A 6 Atrium South Facade Random Angle Seed

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28	Gen_29	Gen_30
0	584	614	476	471	445	482	461	514	562	538	552	551	555	558	548	549	543	553	551	546	549	548	544	558	545	541	549	550	543	542
553	943	590	444	497	546	465	456	481	527	554	552	546	551	546	548	562	556	553	549	554	547	552	548	549	548	548	551	547	526	533
268	661	361	472	540	491	492	472	530	530	563	539	551	551	551	554	558	547	557	555	557	552	553	548	554	550	551	515	515	538	537
658	439	391	451	126	436	472	465	467	549	488	546	551	544	549	552	555	556	551	548	558	552	546	557	551	556	551	550	548	549	527
901	722	554	594	459	471	461	502	482	563	543	547	538	547	552	550	554	546	553	554	550	556	546	556	554	554	531	551	550	549	517
488	424	882	578	481	497	479	498	461	439	563	537	543	561	551	567	548	548	555	553	553	553	549	552	548	557	550	543	550	515	535
202	472	424	410	466	471	451	509	506	485	536	562	542	553	543	541	550	554	555	554	552	553	552	548	557	553	551	541	543	531	532
527	389	265	533	555	486	522	484	481	514	555	539	545	542	552	561	555	557	554	546	549	549	553	548	552	553	527	543	549	526	577
154	424	651	250	562	466	562	449	554	559	537	544	551	545	550	552	547	558	550	558	553	551	552	559	552	546	557	550	541	550	531
317	882	451	491	427	479	466	478	562	530	556	551	538	553	552	556	552	551	550	555	553	552	548	552	549	551	551	555	543	531	526
990	886	578	466	573	264	517	482	559	558	555	551	552	543	565	552	557	548	548	553	553	552	552	550	555	551	546	544	549	547	535
880	658	250	424	540	481	405	465	562	484	562	549	552	552	551	551	552	563	552	555	553	551	553	557	485	554	548	557	515	527	528
707	451	407	562	524	523	449	478	530	536	551	561	554	551	552	547	547	550	555	553	555	551	552	550	551	553	548	559	547	531	535
290	651	569	540	521	530	488	562	465	537	558	538	555	552	553	551	553	547	551	552	554	554	548	549	552	555	551	556	527	537	521
895	424	569	128	491	405	562	481	565	467	549	513	561	586	539	551	552	561	557	555	546	546	552	552	554	548	553	548	538	535	506
661	400	473	474	405	459	470	562	530	549	558	561	547	551	612	568	551	550	544	550	551	552	552	558	556	550	553	546	547	535	534
279	327	412	456	481	476	478	460	522	461	544	630	538	549	545	551	550	548	555	556	547	550	550	552	550	546	550	550	545	529	524
703	436	361	546	546	466	465	451	484	554	484	547	552	552	542	552	558	549	556	551	555	554	552	554	551	556	551	551	544	516	543
941	6	841	576	473	465	459	530	474	477	539	551	537	546	551	550	560	554	549	553	557	551	552	544	546	556	539	551	535	554	544
351	626	546	501	474	472	480	476	516	468	479	563	552	550	546	559	554	548	556	546	548	547	551	553	554	551	553	555	549	548	528
196	250	472	250	456	554	515	522	560	481	484	558	551	542	574	551	547	552	553	555	552	553	546	550	552	554	555	551	555	519	519
747	772	839	570	475	543	465	486	461	489	489	538	546	539	545	544	557	552	544	554	552	548	552	557	554	550	550	553	550	549	546
157	568	355	511	554	479	481	562	540	484	543	546	558	539	547	550	548	555	554	550	554	552	548	552	554	555	552	551	553	551	541
313	311	472	262	410	410	465	461	486	506	484	555	535	542	554	547	547	557	558	554	553	557	553	552	547	554	556	551	543	551	527
887	361	451	361	463	515	486	465	458	506	481	552	545	554	551	552	563	559	548	550	553	557	549	548	551	505	551	549	535	531	529
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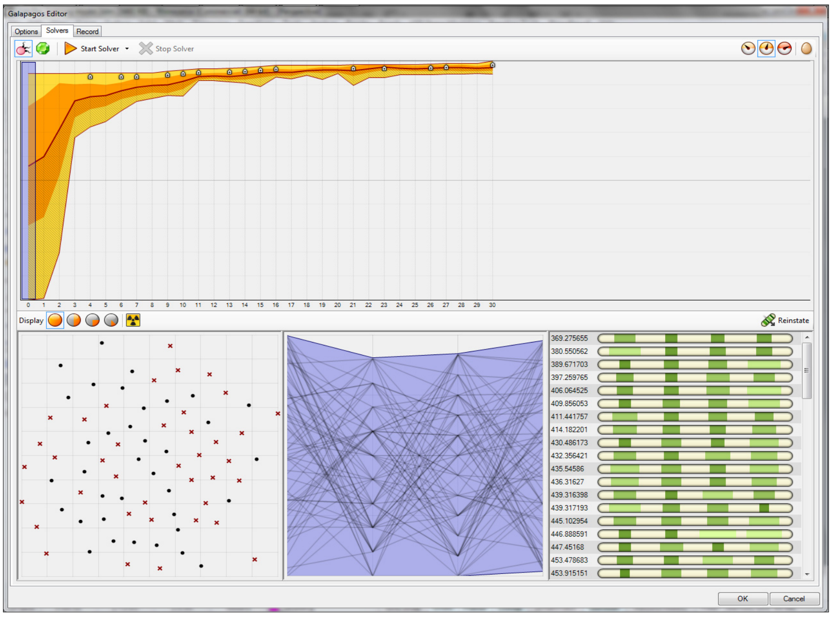

Table A 7 Atrium South Facade Shading Depth

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28	Gen_29	Gen_30
0,1	0,4	0,6	0,8	0,8	0,9	0,9	0,9	0,9	0,9	1,0	1,0	1,0	1,0	1,1	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1
0,6	0,6	0,9	1,0	0,8	0,9	0,9	0,9	0,9	0,9	1,0	1,1	1,0	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,0	1,0	1,1	1,1	1,1	1,1	1,1
0,7	0,6	0,7	0,9	0,9	0,9	0,9	0,9	0,9	1,0	1,0	1,0	1,1	1,0	1,0	1,0	1,1	1,1	1,1	1,1	1,1	0,9	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1
0,6	0,7	0,6	0,8	1,0	1,0	0,9	1,0	0,9	1,0	0,9	1,0	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,0	1,1	1,1
0,7	0,3	0,4	0,8	0,9	0,9	0,9	0,9	0,9	1,0	1,0	1,0	1,0	1,1	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,0	1,1	1,1
0,4	0,9	0,2	0,9	0,8	0,7	0,9	0,9	0,8	0,9	1,0	1,0	1,1	1,0	1,1	1,1	1,0	1,0	1,1	1,0	1,1	1,1	1,1	1,1	0,9	1,0	1,1	1,1	1,1	1,1	1,1
0,3	0,4	0,8	0,7	0,9	0,9	0,9	0,9	0,9	0,9	1,0	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,0	1,1	1,1
1,0	0,2	0,5	0,8	0,8	0,9	0,9	0,9	0,9	0,9	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,0	1,1	1,1	1,1	1,1	1,0	1,0
0,4	1,0	0,8	1,0	1,0	0,9	1,0	0,8	1,0	0,9	1,0	1,0	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,1	0,9	1,1
0,4	0,2	0,8	0,9	0,9	0,8	0,8	0,9	0,9	1,1	1,0	1,0	1,1	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1
0,4	0,7	0,9	0,8	0,8	0,8	0,9	0,9	1,0	1,0	0,9	1,0	1,0	1,0	1,1	1,0	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1
1,0	0,6	1,0	0,8	1,0	0,9	1,0	1,1	1,0	0,9	1,0	0,9	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	0,9	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1
0,6	0,9	0,7	0,9	0,8	0,8	0,9	0,8	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1
0,7	0,9	0,8	0,9	0,9	0,9	0,9	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1
0,6	0,8	1,0	1,0	0,9	1,0	1,0	0,9	1,0	0,9	1,0	1,1	1,0	1,1	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,0	1,1
0,2	0,7	0,9	0,8	1,0	0,9	0,9	1,0	1,0	1,0	1,1	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1
0,7	0,7	0,5	0,8	0,8	0,8	0,8	0,9	1,0	0,9	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	0,9	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,1
0,5	0,5	0,7	0,8	0,5	0,9	0,9	0,9	0,9	1,1	0,9	1,0	0,9	1,0	1,0	1,1	1,1	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,0	1,0	1,1	1,1	1,1	1,1	1,1
0,9	0,1	0,6	0,6	0,8	0,9	0,9	0,9	0,9	0,9	1,0	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1
0,1	0,2	0,8	0,9	0,8	0,8	0,7	0,9	0,9	0,9	0,9	1,0	1,0	1,0	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,0	1,0	1,1	0,9	1,1	1,1	1,0	1,1
0,8	0,7	0,9	1,0	0,9	0,8	0,8	1,0	1,0	0,9	0,9	1,0	1,1	1,0	0,9	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,0	1,1	1,1
0,6	0,1	0,7	0,8	0,9	0,7	0,9	0,9	0,9	0,9	0,9	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,0	1,1	1,0	1,1	1,0	1,0
0,8	0,2	0,2	0,8	0,8	0,9	0,9	1,0	0,9	0,9	1,0	1,0	1,0	1,0	1,0	0,9	1,1	1,1	1,1	1,0	1,1	0,6	1,0	1,1	1,1	1,1	1,0	1,0	1,1	1,0	1,1
0,4	0,5	0,1	0,5	0,7	0,7	0,9	0,9	0,9	0,9	0,9	1,0	1,0	1,0	1,0	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1
0,8	0,7	1,0	0,7	0,8	0,8	0,9	1,1	0,9	0,9	0,9	1,0	1,0	1,0	1,1	1,0	1,1	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0
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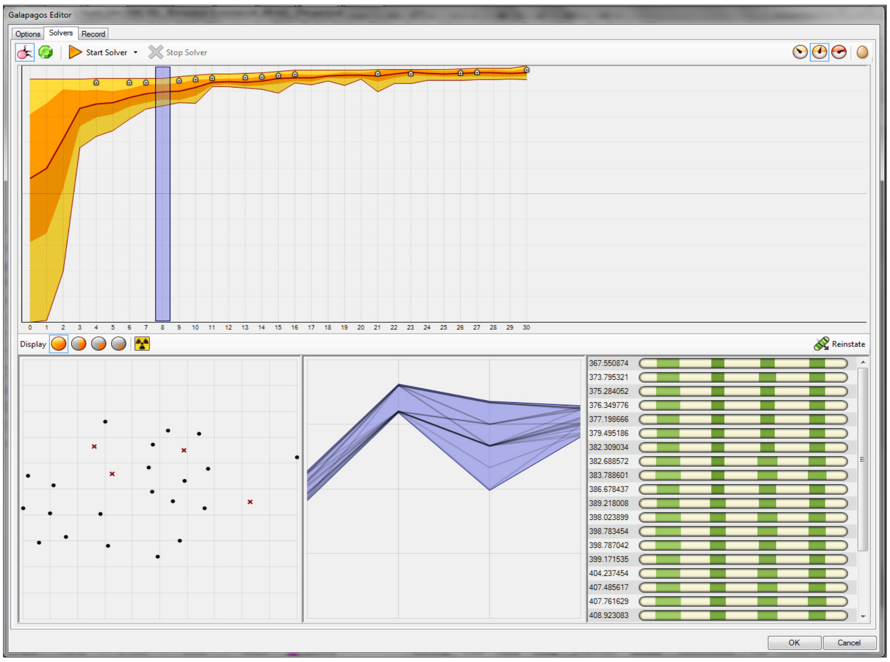

Table A 8 Atrium South Facade Number of Divisions

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28	Gen_29	Gen_30
18	28	23	25	25	26	26	26	26	28	27	28	28	28	27	29	29	29	29	29	28	28	30	30	30	29	30	30	30	30	30
23	28	24	27	25	27	24	26	26	26	29	28	29	28	29	29	27	28	28	28	29	30	30	30	30	30	30	30	30	29	30
20	22	23	26	24	26	26	26	27	27	28	28	26	27	29	29	29	27	28	27	29	27	29	30	30	30	30	30	30	30	30
24	23	20	25	26	27	26	26	26	28	26	28	28	28	28	29	28	29	29	29	28	30	28	30	30	30	30	30	30	29	30
26	25	26	23	26	26	26	26	27	28	28	28	26	27	28	28	27	28	28	29	28	28	27	30	30	30	30	29	30	30	30
29	27	25	24	25	25	26	26	26	26	28	27	28	28	28	28	29	29	28	28	30	30	29	30	29	29	30	29	30	30	30
28	25	26	22	26	26	26	26	26	26	27	28	28	28	28	30	29	27	28	28	29	30	30	30	29	30	30	30	30	30	30
21	25	22	26	23	26	26	26	26	26	28	28	28	28	29	28	28	25	28	28	29	28	30	30	30	30	30	30	30	30	30
28	26	23	28	28	25	28	26	28	27	28	28	28	29	27	28	29	28	29	29	30	28	30	30	30	30	30	30	30	30	30
26	25	26	26	26	26	25	26	27	28	27	28	27	28	30	27	29	28	29	29	30	30	30	29	30	30	30	30	30	30	30
18	19	24	26	23	26	26	26	27	28	28	29	28	28	28	29	27	28	28	29	29	28	30	30	30	30	30	30	30	30	29
18	24	27	26	27	24	26	26	27	26	28	28	28	27	29	29	28	28	28	29	28	29	30	29	30	30	30	30	30	30	30
20	26	22	24	26	26	26	26	28	27	28	28	28	29	29	29	30	29	29	29	28	30	30	30	30	30	29	29	30	30	30
20	23	23	26	26	26	26	27	26	28	28	28	28	29	27	29	29	29	29	29	28	29	30	30	29	30	30	30	30	30	29
29	26	28	26	27	26	27	26	28	26	28	27	28	28	30	30	30	28	28	28	30	28	29	29	30	30	29	30	30	30	30
23	22	26	26	27	26	24	28	28	28	28	28	28	28	28	27	28	28	29	30	30	30	30	30	30	30	30	29	30	30	29
27	20	22	26	25	24	24	24	26	24	28	28	28	28	28	28	28	29	29	28	29	28	27	30	30	30	30	30	30	30	30
20	26	23	23	23	26	26	26	26	28	25	28	28	28	27	28	27	29	28	29	29	28	30	30	29	30	30	30	29	30	30
26	19	19	23	24	26	25	26	26	26	28	28	27	28	26	26	27	27	28	28	28	29	30	30	30	29	30	30	30	30	29
18	26	22	27	25	25	25	26	26	25	25	28	28	28	27	27	27	29	28	29	27	28	30	28	29	30	29	30	29	30	30
25	23	26	27	26	24	24	28	28	24	26	28	28	27	28	27	27	28	28	30	28	30	28	29	30	30	30	29	30	30	30
21	19	19	22	26	22	26	26	25	26	26	28	28	26	28	28	27	29	29	28	29	28	29	30	30	29	30	30	30	30	30
19	21	23	25	23	26	26	27	26	26	27	28	28	29	29	26	28	28	28	28	28	28	28	30	29	29	30	30	30	30	29
19	22	25	22	22	23	26	26	26	26	24	28	28	26	27	29	29	28	29	28	29	29	29	30	30	30	30	30	30	30	30
26	20	26	22	25	25	26	25	24	26	24	27	28	27	27	27	28	27	28	28	30	29	27	30	30	30	30	30	30	29	30
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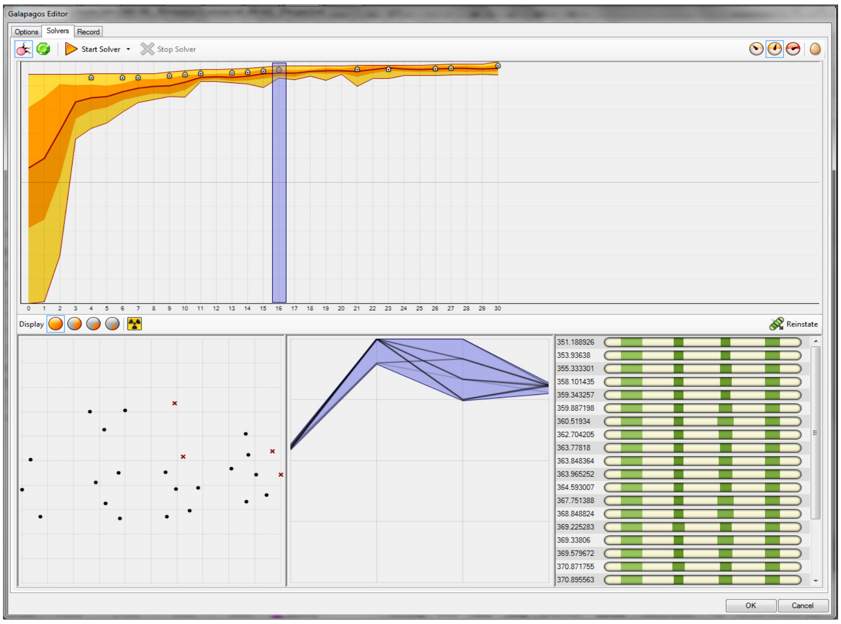

Table A 9 Atrium South Facade Division Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28	Gen_29	Gen_30
1,416	1,419	1,415	1,418	1,418	1,418	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,420	1,417	1,418	1,419	1,418	1,419	1,418	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,420	1,416	1,420	1,418	1,418	1,418	1,418	1,419	1,419	1,419	1,419	1,419	1,417	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,417	1,415	1,418	1,418	1,418	1,419	1,419	1,418	1,419	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,418	1,417	1,418	1,418	1,419	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,419	1,417	1,418	1,418	1,418	1,418	1,419	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,420	1,419	1,419	1,419	1,419
1,416	1,418	1,418	1,415	1,418	1,418	1,419	1,419	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,420	1,419	1,419	1,419	1,419
1,417	1,420	1,419	1,419	1,418	1,419	1,419	1,418	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,415	1,418	1,419	1,419	1,419	1,419	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,419	1,418	1,418	1,418	1,418	1,419	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,420	1,418	1,418	1,418	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,415
1,415	1,415	1,419	1,419	1,419	1,418	1,418	1,418	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,419	1,418	1,415	1,418	1,419	1,419	1,418	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,418
1,415	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,416	1,418	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,418	1,419	1,417	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,416	1,415	1,418	1,418	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,420	1,419	1,419	1,419	1,419	1,419
1,416	1,417	1,417	1,418	1,418	1,418	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,418	1,415	1,420	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,420	1,419	1,419	1,419
1,415	1,417	1,417	1,416	1,418	1,418	1,419	1,419	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,416	1,415	1,419	1,419	1,418	1,418	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,420	1,420	1,418	1,419	1,418	1,418	1,418	1,419	1,419	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,417	1,417	1,418	1,418	1,418	1,418	1,418	1,418	1,418	1,419	1,418	1,419	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,419	1,417	1,419	1,418	1,418	1,419	1,419	1,419	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,419	1,417	1,420	1,419	1,415	1,415	1,418	1,418	1,418	1,419	1,418	1,419	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,420	1,419	1,419	1,419
1,415	1,419	1,418	1,420	1,418	1,418	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,420	1,419	1,419	1,419	1,419
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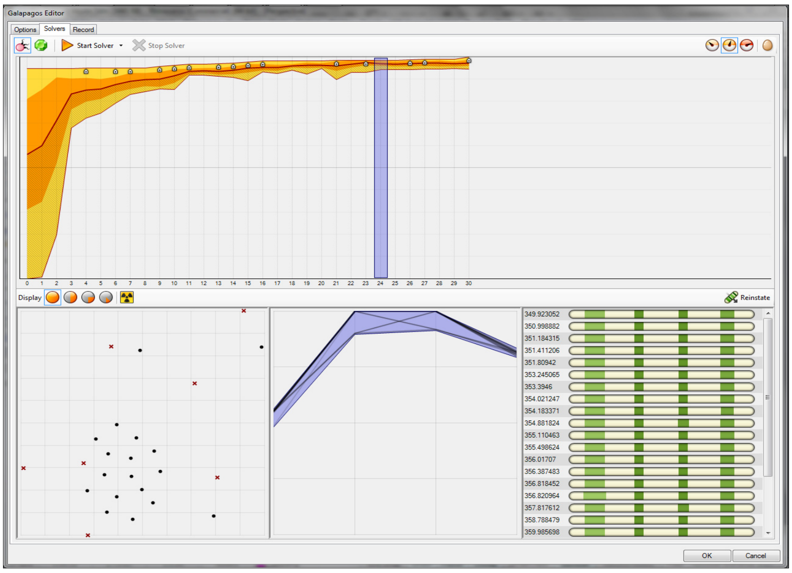

Table A 10 Atrium South Facade Fitness Function

Gen 0	Gen 1	Gen 2	Gen 3	Gen 4	Gen 5	Gen 6	Gen 7	Gen 8	Gen 9	Gen 10	Gen 11	Gen 12	Gen 13	Gen 14	Gen 15	Gen 16	Gen 17	Gen 18	Gen 19	Gen 20	Gen 21	Gen 22	Gen 23	Gen 24	Gen 25	Gen 26	Gen 27	Gen 28	Gen 29	Gen 30
862,7	369,3	532,8	388,4	509,3	443,7	428,5	408,4	375,1	423,3	403,2	415,8	378,5	376,6	383,1	369,1	379,1	370,9	387,1	377,1	371,0	358,1	358,6	366,2	352,9	354,2	352,2	353,6	350,5	349,5	358,2
861,4	571,2	500,7	434,9	439,5	410,2	404,9	411,3	407,5	382,9	377,8	373,6	376,4	377,6	367,8	372,3	369,2	364,0	362,6	358,5	364,6	360,0	353,8	354,8	351,4	358,8	348,3	350,3	358,5	359,1	353,0
529,1	468,5	422,6	386,2	433,5	398,7	417,6	410,6	398,0	415,6	371,9	359,3	371,7	377,7	372,5	358,6	360,5	365,4	366,9	361,3	360,0	358,6	362,8	353,0	364,0	365,7	353,2	353,0	359,5	362,0	357,4
526,6	523,0	496,9	414,6	425,1	402,8	405,7	415,9	399,2	382,6	383,3	382,4	368,5	384,0	372,6	373,8	358,1	376,3	364,4	368,3	358,6	395,5	377,4	353,3	355,5	360,1	353,2	346,8	347,5	348,4	352,6
503,1	467,0	560,6	433,4	390,6	384,6	415,0	384,0	408,9	375,1	410,2	377,3	377,7	378,6	374,6	368,1	377,3	360,0	359,5	358,2	362,8	350,7	364,7	353,4	351,8	355,3	354,7	370,5	365,6	354,6	362,0
455,8	663,0	585,0	455,6	401,4	410,6	410,9	409,5	398,8	383,6	382,6	384,5	382,3	376,4	373,0	382,6	372,8	364,6	367,6	360,5	369,1	364,3	368,2	354,6	356,0	368,0	354,5	358,9	369,9	350,7	354,0
563,6	399,5	741,1	417,5	426,4	463,2	402,1	407,8	431,5	407,0	383,6	382,3	370,6	375,8	365,1	372,3	370,9	370,7	363,6	382,1	357,7	357,8	355,6	350,6	386,0	371,6	360,9	364,1	359,0	348,6	349,4
629,8	604,2	430,8	483,3	406,7	410,3	405,8	412,1	404,2	408,9	390,9	366,9	377,5	381,6	382,7	362,6	363,8	371,8	363,2	365,3	353,9	356,1	350,9	353,2	357,8	370,9	356,0	350,6	371,0	354,1	352,4
439,3	747,1	573,6	429,8	454,6	408,9	402,0	409,4	398,8	410,9	377,6	383,1	377,6	376,8	368,4	361,4	362,7	381,4	364,9	364,1	355,7	362,1	370,7	352,7	363,0	356,1	361,7	358,4	351,2	368,9	372,3
557,0	393,9	454,1	382,3	368,5	414,5	368,3	430,3	377,2	405,9	375,8	378,1	364,5	370,6	376,5	360,8	364,6	362,3	363,9	356,7	357,1	378,1	350,6	355,8	363,4	355,2	354,1	359,3	350,3	386,3	352,7
588,2	751,0	425,5	402,4	404,2	424,3	437,2	412,9	389,2	363,5	384,9	377,5	363,6	381,0	363,1	369,8	355,3	363,6	363,7	357,2	358,0	350,1	353,0	355,3	351,0	353,4	351,9	353,4	360,3	353,4	356,9
677,2	536,9	417,6	427,1	449,9	430,9	406,6	402,9	386,7	375,2	392,9	371,3	372,1	384,0	365,2	368,0	368,8	377,6	362,1	362,1	362,9	360,2	351,4	360,8	353,4	353,7	366,4	354,1	351,0	359,3	341,4
446,9	492,0	385,7	435,7	386,5	414,2	396,2	369,9	373,8	409,6	368,1	391,2	373,4	365,5	357,4	359,4	359,9	367,8	360,5	356,6	368,3	387,8	358,2	358,3	356,8	356,6	365,4	353,6	347,3	361,3	351,5
559,5	405,3	483,6	414,3	435,9	436,5	409,0	433,0	375,3	388,8	377,8	376,0	380,3	357,8	355,6	377,4	359,3	364,2	357,9	362,6	362,3	353,2	351,2	360,5	353,2	357,9	357,9	361,2	358,5	366,1	347,4
509,6	432,6	456,3	408,7	401,2	406,6	411,0	374,1	383,8	376,7	376,7	370,1	378,0	368,1	387,5	372,1	374,6	377,1	373,0	355,3	366,6	372,5	352,3	351,0	354,9	352,4	354,0	354,6	374,1	354,1	353,1
447,5	431,7	378,9	389,4	398,0	397,6	373,8	398,4	379,5	407,0	375,0	363,5	374,3	362,9	373,2	353,9	351,2	373,7	364,9	363,7	353,6	364,6	354,9	354,6	356,8	352,6	362,9	365,7	347,1	361,6	354,0
757,6	475,5	397,8	432,1	393,2	399,9	425,6	367,6	376,3	373,8	361,3	375,1	384,2	364,3	365,8	362,0	363,8	370,1	358,7	359,4	354,5	350,4	352,0	352,3	355,1	362,0	371,1	359,7	359,9	349,3	371,1
435,5	518,1	561,3	431,1	425,6	443,3	450,1	423,4	382,7	426,3	378,1	378,2	370,8	375,5	377,5	363,7	369,6	358,4	357,7	363,2	364,1	369,6	406,3	364,5	358,8	354,1	372,0	359,2	353,1	358,0	358,5
599,2	520,3	498,7	451,5	561,0	408,2	402,3	405,8	410,1	365,6	418,5	383,9	390,0	372,9	380,7	360,3	367,8	368,9	364,6	357,6	369,7	365,9	350,5	356,8	371,4	369,2	352,5	354,9	359,4	357,9	359,4
389,7	858,9	566,7	508,5	437,0	402,6	409,7	405,1	411,0	405,4	382,5	378,4	381,4	377,2	390,2	397,7	376,2	371,8	360,4	367,8	375,4	358,0	350,8	355,7	354,0	359,9	357,3	353,4	349,2	356,3	359,4
862,1	735,7	463,8	394,5	439,1	444,9	464,6	408,4	411,3	411,7	408,9	383,1	373,2	382,5	382,9	372,5	371,5	371,9	364,6	357,9	368,4	369,2	352,8	381,6	372,2	353,0	390,4	352,0	355,5	366,9	351,6
439,3	493,9	415,3	388,8	411,6	444,4	434,7	370,2	382,3	416,7	409,8	375,3	362,9	383,9	402,8	366,9	375,9	359,6	367,8	351,8	359,8	357,1	363,6	377,7	351,2	355,3	352,9	357,1	365,1	357,2	358,2
537,3	858,9	535,0	474,8	405,0	500,0	399,6	407,4	416,1	405,0	405,3	370,3	377,1	393,2	377,4	377,3	369,3	354,7	359,9	367,4	367,2	363,3	355,0	353,5	356,4	376,3	358,7	370,9	360,3	365,2	365,0
503,5	774,8	759,9	424,2	451,5	401,1	400,1	373,3	411,1	409,0	389,6	378,0	375,1	376,8	376,9	415,3	364,0	363,0	366,7	381,7	366,3	467,3	377,6	350,8	361,8	357,4	362,5	366,7	358,7	366,8	353,4
663,8	581,8	834,4	575,9	485,1	473,8	400,3	409,7	407,8	403,6	426,0	375,7	372,7	387,7	384,8	363,8	378,1	363,9	358,3	364,9	362,9	357,8	363,3	349,9	360,0	356,2	354,5	356,1	360,3	365,1	362,1
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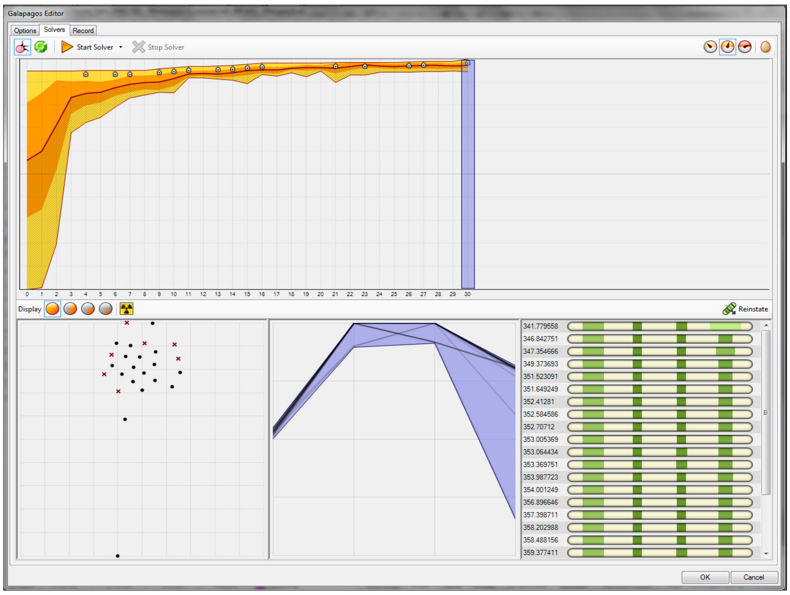

APPENDIX B

STAGE 2 PARAMETERS ACROSS GENERATIONS

Table B 1 East Facade Floor1 Random Angle Seed

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24
0	355	203	705	739	761	746	775	763	751	767	758	760	754	746	754	752	750	750	750	752	773	763	771	753
278	142	397	776	747	691	743	791	761	754	774	755	767	758	757	764	748	750	750	761	753	752	763	755	759
687	722	879	647	752	738	834	831	755	782	759	767	758	756	754	763	764	754	753	759	763	763	772	757	755
560	216	739	732	759	787	756	756	758	755	758	754	763	768	751	751	755	753	750	750	752	754	758	775	764
143	374	707	663	761	757	765	747	772	779	755	758	755	764	755	753	763	754	751	746	760	756	755	760	757
230	461	752	752	834	839	839	751	751	764	779	773	754	755	751	757	735	747	756	755	756	755	754	760	755
461	549	685	777	772	764	743	751	767	759	758	751	764	755	776	763	753	751	757	757	756	754	757	747	755
124	420	356	341	695	748	766	743	746	761	801	779	762	754	759	772	748	749	749	750	774	756	768	753	760
938	479	687	752	647	772	764	743	743	768	751	754	760	754	779	751	747	750	749	755	751	747	748	757	769
174	879	310	852	743	656	756	748	751	751	751	778	776	758	751	755	750	750	755	747	747	762	759	755	752
870	289	846	740	812	712	767	752	755	755	780	760	756	761	774	748	752	758	751	750	755	752	759	750	759
322	687	879	647	752	744	695	710	750	782	768	774	755	766	754	754	754	750	750	748	774	764	752	761	760
893	487	605	879	772	656	769	755	764	780	766	770	769	789	756	749	751	754	779	750	766	762	751	759	760
450	187	856	869	751	735	710	782	751	773	767	760	795	754	757	748	749	756	759	752	772	765	769	758	755
335	259	691	739	744	695	787	714	764	831	746	754	754	754	763	751	751	758	750	779	747	747	747	769	769
462	375	705	625	843	746	749	775	754	764	780	778	766	758	763	749	750	895	779	763	747	748	764	755	747
337	537	315	622	522	747	714	743	744	756	755	753	759	753	757	750	761	762	750	749	762	752	755	758	754
93	637	479	739	627	769	695	764	743	751	746	758	778	767	767	757	754	749	748	750	755	766	765	764	761
547	166	647	777	769	765	766	718	784	751	759	767	210	758	759	756	755	749	749	749	760	751	773	755	752
350	357	577	775	860	831	747	744	756	758	774	752	753	761	762	761	759	748	760	753	509	749	758	761	765
518	361	637	856	736	751	831	746	744	746	782	801	751	760	748	768	754	748	753	748	779	753	776	763	757
75	398	411	749	684	823	749	736	755	759	759	754	772	779	770	773	750	750	735	752	775	762	749	765	769
901	752	827	834	648	834	759	775	741	744	754	774	754	763	756	759	749	751	750	751	750	776	750	757	766
191	976	375	356	749	648	823	767	782	746	758	766	754	758	753	757	750	759	749	756	764	774	774	759	755
567	819	188	465	610	651	796	717	748	751	756	754	799	751	756	748	751	750	779	774	748	773	759	765	765
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459																								
326																								
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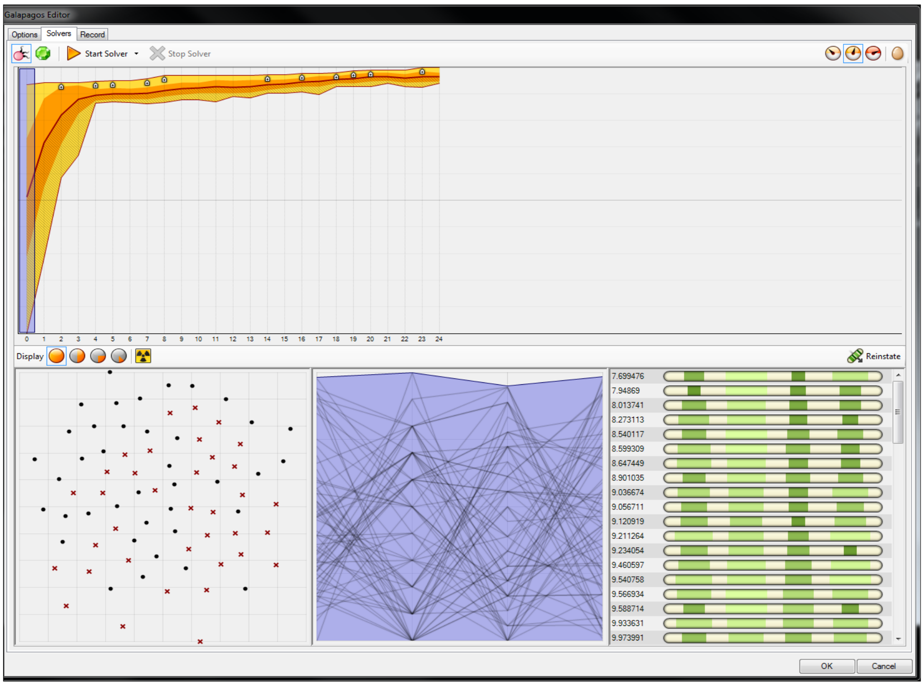

Table B 2 East Facade Floor1 Shading Depth

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24
-0,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-1,1	-1,0	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-1,1	-0,9	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,9	-0,5	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1
-0,4	-0,8	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,5	-0,9	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1
-0,9	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0
-0,9	-0,6	-1,0	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,3	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,4	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1
-1,0	-0,9	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1
-0,5	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0
-0,6	-0,9	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1
-0,8	-0,9	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0
-1,0	-0,8	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,0	-1,0	-1,1	-1,0	-1,1	-1,1	-1,1
-0,5	-1,0	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,3	-1,0	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,8	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,6	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-1,0	-0,9	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,9	-1,0	-0,6	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0
-0,6	-0,3	-0,7	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,3	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1
-1,0	-0,6	-1,0	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,0
-0,3	-0,6	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
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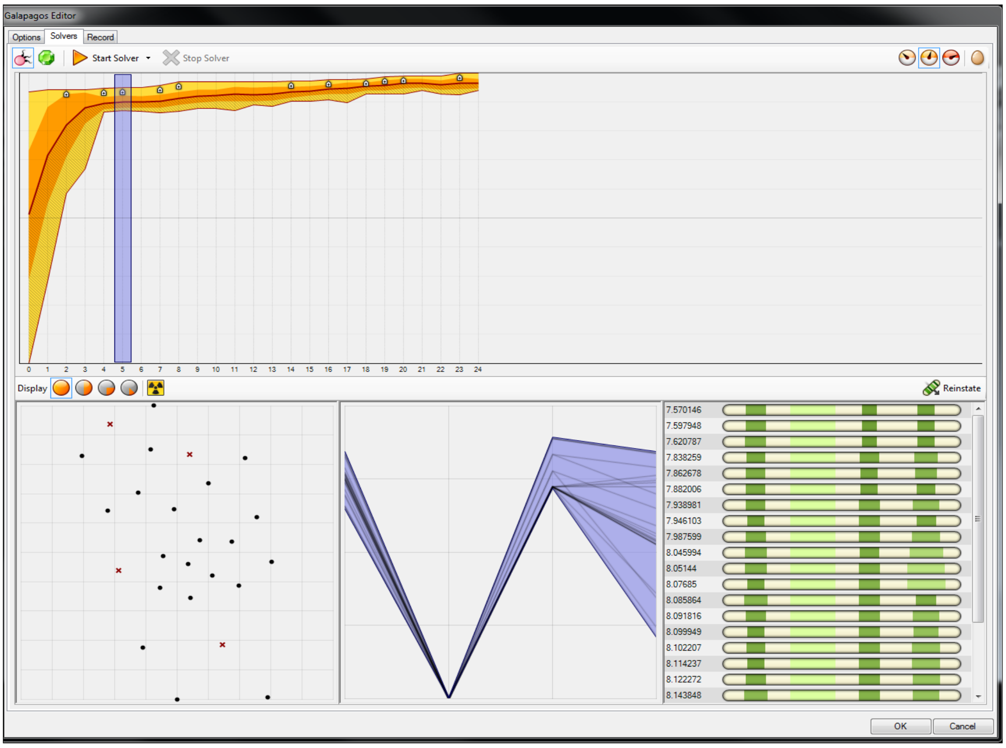

Table B 3 East Facade Floor1 Number of Divisions

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24
18	23	19	32	32	31	31	31	32	33	33	32	33	34	34	35	34	35	33	35	33	34	35	35	35
28	27	31	33	31	32	31	31	32	33	33	33	33	33	33	33	34	36	35	35	35	35	35	35	35
34	28	33	30	34	31	31	34	33	33	32	32	33	33	33	33	33	36	35	34	36	36	35	36	36
27	19	31	31	33	32	33	31	31	32	32	33	33	33	34	35	33	34	35	35	35	35	35	35	35
24	27	32	30	31	33	31	31	34	33	32	33	33	33	34	34	33	35	35	36	35	35	35	35	34
25	30	31	31	31	31	31	33	31	32	33	33	34	33	34	34	33	34	35	35	36	36	35	36	36
29	22	29	31	31	33	31	33	33	32	32	32	32	33	33	33	34	34	34	35	35	36	35	36	35
30	32	21	23	30	31	31	31	31	32	33	33	33	34	33	33	33	34	35	35	35	35	35	35	34
20	23	33	34	33	31	34	31	32	33	33	35	33	35	34	34	34	35	34	35	34	35	34	35	35
22	33	21	32	32	31	31	31	33	31	33	32	33	26	34	33	34	35	35	35	35	35	35	35	35
23	26	32	31	32	34	32	33	31	33	33	33	33	34	33	34	34	35	36	35	35	35	35	35	35
30	34	33	30	34	31	31	31	31	34	33	33	32	33	36	34	35	34	35	34	35	35	35	35	35
21	22	31	33	31	31	31	31	32	33	33	33	33	33	33	34	35	33	35	35	35	35	36	35	35
34	26	31	32	31	34	31	32	33	33	33	33	33	34	34	34	35	35	35	35	34	35	35	35	36
27	34	34	31	31	31	33	30	31	33	33	33	35	35	33	35	35	33	35	35	36	36	36	35	35
28	31	28	31	31	31	31	32	34	33	33	32	33	33	33	35	35	35	35	35	36	35	35	36	35
22	31	24	27	24	31	31	31	32	31	31	32	33	33	33	34	35	33	34	34	35	36	35	35	36
19	29	25	31	31	31	32	31	31	32	33	32	32	33	34	33	34	35	35	35	35	35	35	34	35
19	19	30	31	31	31	31	31	31	33	32	33	32	33	34	32	33	35	36	35	35	35	34	35	35
32	20	25	33	31	31	31	31	32	32	33	33	33	33	33	33	33	34	33	34	35	35	35	35	35
18	32	30	31	31	31	31	31	31	32	33	36	32	33	34	34	35	31	34	36	34	36	35	35	36
28	24	31	31	30	31	32	31	31	32	32	32	32	33	33	33	33	34	34	35	35	35	36	35	35
34	31	31	31	31	31	31	32	33	31	33	33	33	33	33	33	34	36	36	35	35	35	35	33	35
24	20	31	21	31	31	31	32	33	33	32	33	34	35	33	34	34	33	35	36	35	35	35	35	36
34	30	27	31	30	31	31	31	33	33	32	33	32	34	32	33	35	34	35	35	35	35	35	35	35
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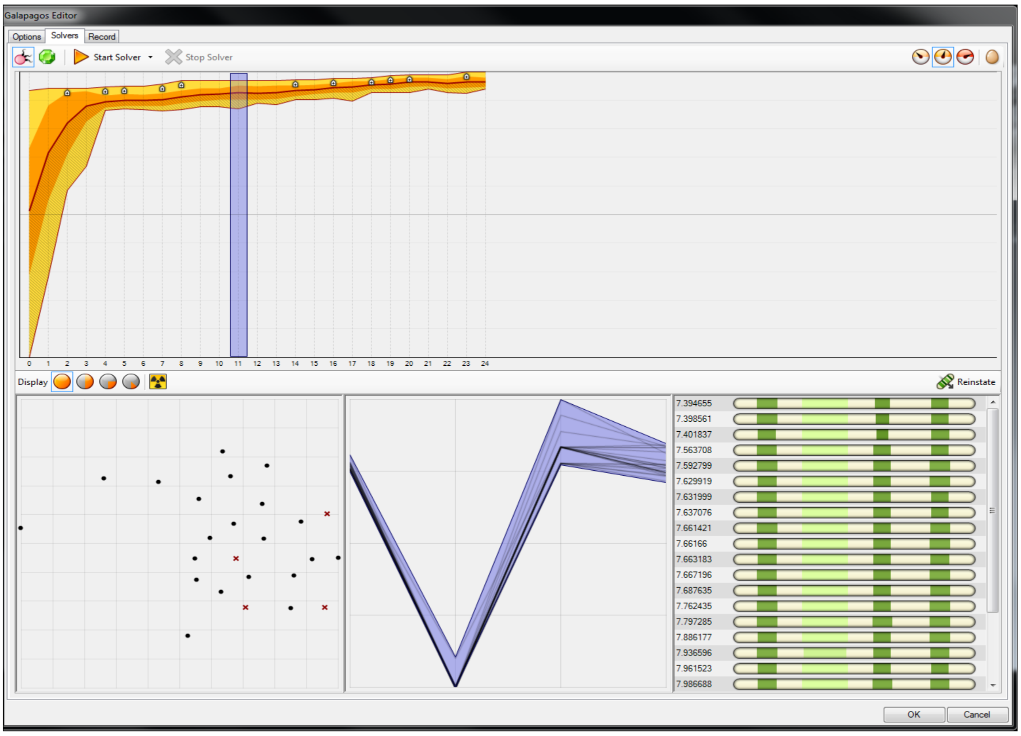

Table B 4 East Facade Floor1 Division Function

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24
1,414	1,417	1,416	1,417	1,416	1,416	1,417	1,416	1,418	1,419	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,418	1,414	1,416	1,419	1,417	1,416	1,417	1,415	1,418	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,415	1,414	1,418	1,417	1,419	1,417	1,419	1,419	1,418	1,418	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,416	1,420	1,417	1,417	1,419	1,418	1,418	1,417	1,419	1,418	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,420	1,419	1,417	1,417	1,418	1,418	1,419	1,417	1,419	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,415	1,420	1,418	1,417	1,416	1,417	1,418	1,418	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,420	1,419	1,419	1,419
1,420	1,416	1,417	1,418	1,417	1,419	1,417	1,419	1,419	1,418	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,414	1,416	1,416	1,417	1,417	1,417	1,418	1,417	1,417	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,416	1,418	1,417	1,419	1,416	1,417	1,419	1,417	1,416	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,419	1,417	1,415	1,417	1,416	1,419	1,417	1,417	1,419	1,417	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,416	1,415	1,417	1,417	1,418	1,419	1,418	1,418	1,417	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,417	1,418	1,415	1,417	1,419	1,417	1,415	1,415	1,417	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,415	1,415	1,418	1,416	1,417	1,418	1,418	1,417	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,416	1,418	1,417	1,418	1,417	1,419	1,417	1,418	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,415	1,416	1,419	1,417	1,417	1,416	1,418	1,419	1,419	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,420	1,419	1,419	1,419	1,419
1,417	1,415	1,415	1,417	1,415	1,417	1,417	1,416	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,418	1,418	1,417	1,418	1,417	1,417	1,418	1,417	1,419	1,418	1,418	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,417	1,417	1,419	1,417	1,417	1,418	1,416	1,418	1,417	1,418	1,419	1,418	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,415	1,416	1,417	1,418	1,418	1,417	1,418	1,419	1,415	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,419	1,415	1,418	1,418	1,418	1,419	1,417	1,417	1,418	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,417	1,419	1,417	1,418	1,417	1,417	1,418	1,418	1,417	1,416	1,418	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,417	1,417	1,416	1,418	1,416	1,415	1,417	1,417	1,417	1,418	1,418	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,415	1,417	1,417	1,415	1,418	1,418	1,417	1,418	1,419	1,417	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,415	1,420	1,417	1,415	1,417	1,418	1,415	1,418	1,419	1,419	1,418	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,417	1,417	1,415	1,416	1,417	1,417	1,416	1,417	1,419	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
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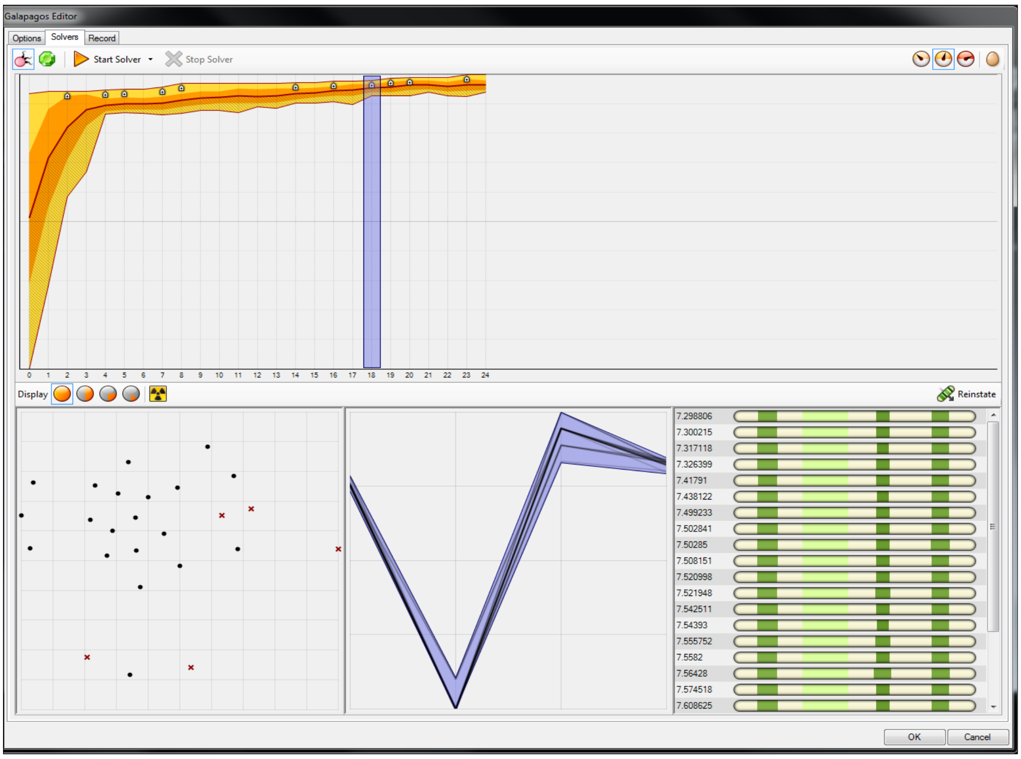

Table B 5 East Facade Floor1 Fitness Function

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24
16,362	9,783	10,953	8,148	8,126	8,175	7,927	8,064	7,987	7,802	7,829	8,312	7,617	7,471	7,477	7,433	7,627	7,525	7,818	7,579	7,787	7,593	7,473	7,607	7,495
8,599	9,399	8,530	7,898	8,142	8,046	8,060	8,310	7,980	7,615	7,585	7,667	7,889	8,042	7,727	8,001	8,014	7,378	7,503	7,541	7,562	7,488	7,555	7,348	7,463
7,699	9,586	7,672	8,444	7,598	8,181	8,094	7,500	7,715	7,768	7,970	7,987	8,128	7,866	7,624	7,828	7,959	7,347	7,499	7,731	7,369	7,366	7,509	7,334	7,296
9,974	13,760	8,352	8,132	7,902	7,838	7,991	8,376	8,378	7,886	8,233	7,593	7,852	7,861	7,634	7,626	7,651	7,705	7,575	7,600	7,770	7,323	7,765	7,446	7,593
13,619	10,399	8,128	8,489	8,212	7,863	7,990	8,061	7,748	7,639	7,847	8,073	7,670	7,863	7,518	7,694	7,806	7,348	7,543	7,225	7,281	7,584	7,312	7,207	7,550
12,736	9,040	8,095	8,125	8,024	8,114	8,036	7,872	8,312	8,122	7,719	7,637	7,526	7,678	7,646	7,559	7,732	7,471	7,558	7,340	7,492	7,228	7,636	7,101	7,150
9,234	9,789	8,434	8,141	8,254	7,882	8,208	7,918	7,832	7,914	8,177	8,005	8,126	8,047	8,019	7,844	7,627	7,692	7,522	7,469	7,651	7,223	7,413	7,301	7,738
9,211	10,795	10,711	10,169	8,311	8,234	8,125	8,217	7,995	7,972	7,844	7,688	7,932	7,453	7,847	7,802	7,858	7,691	7,780	7,487	7,371	7,663	7,582	7,517	7,464
14,893	9,724	7,852	7,657	7,703	8,102	7,691	8,121	7,859	7,963	7,966	7,399	7,652	7,401	7,501	7,723	7,512	7,536	7,615	7,259	7,703	7,374	7,717	7,361	7,532
13,919	7,648	10,717	7,981	8,028	8,317	8,358	8,147	7,949	8,170	7,919	8,078	7,997	9,333	7,658	7,654	7,610	7,492	7,300	7,421	7,381	7,880	7,504	7,302	7,457
10,141	10,019	8,003	8,120	7,853	7,621	8,050	7,757	7,918	7,603	7,920	7,564	7,915	7,628	7,741	7,689	7,667	7,724	7,544	7,780	7,350	7,374	7,508	7,538	7,444
11,805	7,693	7,711	8,400	7,961	7,988	8,075	8,064	8,124	7,573	7,770	7,663	7,859	7,653	7,354	7,434	7,326	7,728	7,503	7,712	7,371	7,561	7,356	7,441	7,618
12,841	10,848	8,297	7,668	8,132	8,086	8,338	7,891	8,116	7,837	7,750	7,962	7,813	7,928	7,979	7,574	7,590	7,579	7,299	7,803	7,351	7,632	7,567	7,530	7,215
9,121	9,888	8,469	7,974	8,228	7,570	8,109	7,852	7,888	7,649	7,787	7,632	7,673	7,819	7,612	7,696	7,564	7,635	7,521	7,407	7,686	7,369	7,494	7,779	7,567
9,461	9,069	7,636	8,514	8,074	8,051	7,711	8,399	8,327	7,634	7,675	7,937	7,423	7,659	7,883	7,640	7,539	8,058	7,790	7,691	7,268	7,628	7,392	7,515	7,577
12,017	8,417	9,121	8,209	8,186	8,122	8,137	7,934	7,395	7,867	7,744	8,004	7,645	8,125	7,827	7,523	7,536	7,452	7,418	7,441	7,251	7,518	7,525	7,238	7,332
14,527	8,430	9,858	8,916	9,520	8,092	8,270	8,104	7,867	8,373	8,001	8,024	7,759	7,808	7,831	7,644	7,453	8,036	7,701	7,673	7,579	7,293	7,293	7,763	7,275
12,182	8,548	9,243	8,279	8,130	8,192	7,792	8,303	8,177	8,071	7,700	8,314	7,944	7,946	7,631	7,736	7,516	7,515	7,508	7,423	7,306	7,388	7,416	7,713	7,543
13,247	11,005	8,392	8,129	8,232	7,939	8,105	8,073	7,968	7,939	7,947	7,886	8,086	8,170	7,719	8,083	7,610	7,535	7,438	7,500	7,204	7,554	7,578	7,294	7,470
8,273	11,311	9,204	7,831	8,118	7,946	7,993	8,058	8,023	8,230	7,595	7,762	7,872	7,872	7,929	7,851	7,880	7,736	7,564	7,784	7,423	7,438	7,817	7,334	7,381
11,813	8,233	11,140	8,421	8,024	8,237	7,996	8,159	8,021	7,880	7,736	7,402	8,063	7,553	7,730	7,729	7,421	8,132	7,645	7,414	7,460	7,392	7,611	7,448	7,663
11,542	14,370	10,248	8,081	8,359	8,077	8,015	8,128	7,938	7,945	7,982	7,797	7,898	7,718	7,894	7,687	7,854	7,668	7,556	7,426	7,430	7,526	7,372	7,372	7,562
13,206	8,096	8,297	8,014	8,081	8,100	8,238	7,929	7,743	7,961	7,672	7,630	7,672	7,890	7,925	7,968	7,686	7,525	7,317	7,490	7,522	7,614	7,783	7,799	7,358
9,934	13,036	8,403	10,330	8,034	8,391	8,025	7,911	7,756	7,695	8,302	7,662	7,446	7,705	7,873	7,663	7,666	7,660	7,609	7,513	7,580	7,275	7,316	7,815	7,561
13,175	11,169	9,319	8,158	8,323	8,144	8,179	7,960	7,909	8,104	8,010	7,661	8,219	7,734	8,168	7,758	7,642	7,672	7,637	7,377	7,502	7,350	7,359	7,414	7,364
15,297																								
12,840																								
13,018																								
12,271																								
9,589																								
11,548																								
10,163																								
14,065																								
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13,407																								
11,635																								
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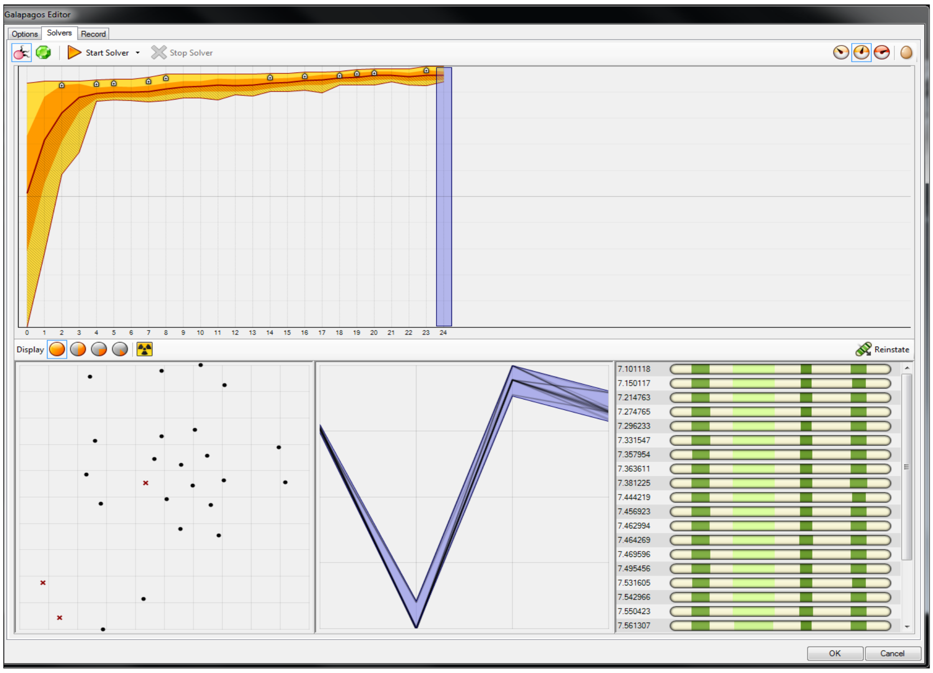

Table B 6 East Facade Floor5 Random Angle Seed

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
0	811	730	436	489	434	448	438	474	442	507	525	516	415	495	505	522	522	505	522	499	498	495	500	496	505	500
970	702	424	501	400	491	422	427	431	528	439	506	493	504	513	528	519	518	520	511	520	526	516	514	509	507	500
52	125	443	482	393	429	433	434	431	503	516	516	516	500	521	519	507	518	521	515	521	494	509	513	514	505	515
112	323	439	359	429	416	431	436	432	486	523	527	521	526	502	494	516	506	520	518	501	510	513	497	506	497	512
312	315	426	445	411	431	439	427	432	452	525	516	519	514	496	517	518	521	522	519	494	493	510	507	512	505	508
368	800	638	319	443	510	438	431	431	474	257	523	500	521	500	516	506	519	507	516	518	509	509	510	511	511	511
833	536	340	490	416	469	462	460	445	492	511	487	527	511	508	517	524	499	497	521	512	513	509	506	506	506	510
730	802	473	438	410	415	434	443	511	438	443	520	493	518	506	528	519	507	519	490	547	497	510	512	510	497	500
443	638	412	473	451	411	438	479	439	436	427	511	500	523	527	517	528	518	490	505	519	512	520	510	498	498	505
439	614	319	428	482	441	497	469	503	522	516	517	499	498	522	514	505	514	525	502	520	520	516	498	505	497	505
321	247	741	433	441	438	433	431	432	434	503	513	523	494	506	514	495	518	522	499	513	495	511	505	497	508	511
242	598	482	482	436	489	441	431	473	474	527	527	542	493	525	529	529	527	490	528	494	509	517	509	512	497	512
469	403	594	436	448	438	476	541	538	516	508	500	510	497	525	520	516	522	525	513	515	517	511	514	496	510	503
756	439	356	518	428	520	451	434	521	481	494	516	502	516	519	507	509	495	524	520	496	490	503	510	507	511	503
249	543	323	638	386	429	599	527	441	445	442	490	527	490	532	525	523	524	522	521	490	514	512	509	500	511	510
385	482	411	451	436	489	442	473	445	505	527	499	505	497	516	517	521	503	521	510	509	526	513	510	513	512	501
819	526	406	381	394	433	424	450	432	443	512	509	516	519	490	526	533	525	519	525	520	525	512	510	511	503	508
580	565	482	426	381	451	415	439	436	431	433	440	520	500	504	505	507	521	518	521	522	509	518	512	496	513	505
25	729	332	333	599	487	527	433	436	431	451	516	502	517	514	518	529	516	521	501	490	511	494	479	506	511	500
751	648	454	393	512	510	449	431	438	431	440	395	519	501	516	501	528	524	515	522	528	505	496	514	508	505	501
848	368	443	411	431	400	487	448	436	431	477	427	490	528	516	519	518	509	519	524	522	512	514	511	514	509	497
500	710	540	414	489	468	431	436	439	514	518	517	516	518	520	514	505	502	529	520	514	541	509	509	517	499	507
361	497	621	386	492	429	413	433	471	527	535	464	521	502	505	507	525	518	521	523	521	510	498	520	497	512	510
533	848	403	323	414	428	431	441	431	528	514	621	517	516	496	506	494	514	513	521	508	520	496	496	510	497	503
800	412	339	354	416	446	428	436	442	435	490	520	506	475	518	502	504	524	505	517	514	527	497	498	508	497	503
125																										
636																										
175																										
571																										
346																										
518																										
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543																										
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772																										
755																										
810																										
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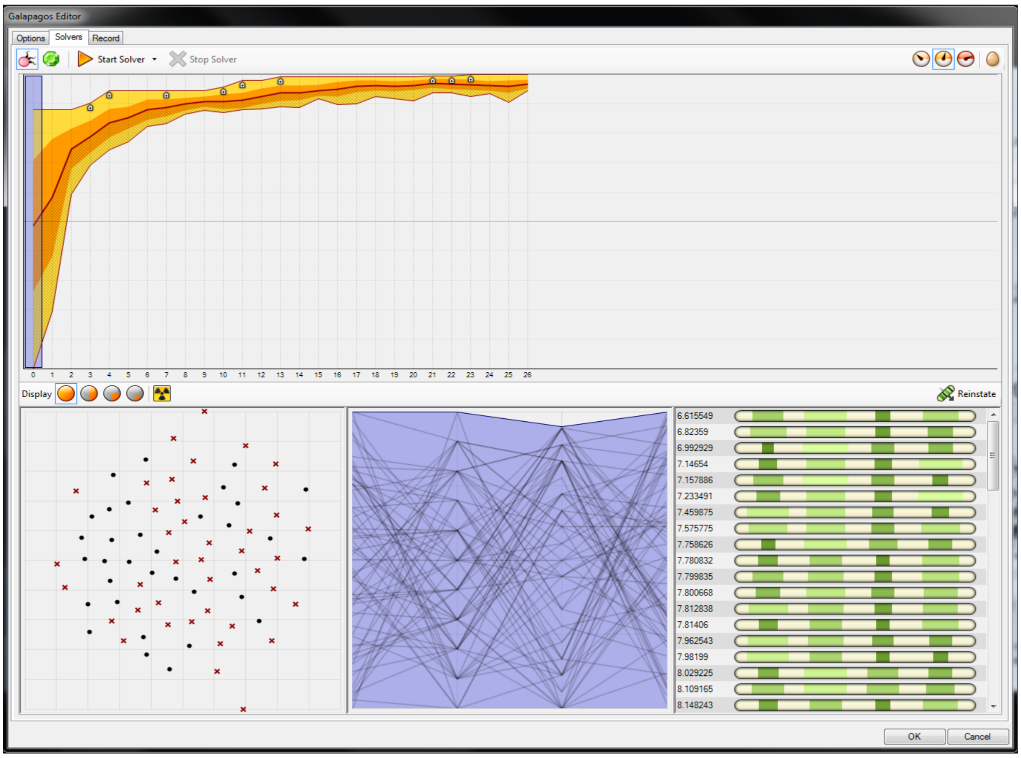

Table B 7 East Facade Floor5 Shading Depth

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
-0,1	-0,5	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,6	-0,6	-1,0	-1,0	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,9	-1,0	-0,7	-0,9	-0,9	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-0,9	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,7	-0,8	-1,0	-1,0	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,6	-0,8	-0,9	-0,9	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1
-0,7	-0,4	-0,8	-0,8	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-1,0	-0,3	-0,9	-0,8	-1,0	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1
-1,0	-1,1	-1,0	-0,9	-0,9	-0,9	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-1,0	-0,8	-0,8	-1,0	-0,9	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,0	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,3	-0,9	-0,8	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,8	-0,9	-1,1	-0,9	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-1,0	-0,6	-0,9	-0,9	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-1,1	-0,8	-0,9	-1,0	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,8	-0,9	-0,8	-1,1	-0,9	-1,0	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,2	-0,8	-0,8	-0,8	-0,9	-1,0	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1
-0,3	-0,6	-0,9	-0,9	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1
-0,8	-0,3	-0,8	-0,8	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1
-0,5	-0,4	-0,6	-0,9	-0,8	-0,9	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,0	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,4	-0,4	-0,8	-0,9	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,4	-0,7	-0,8	-0,9	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1
-0,3	-0,7	-0,8	-0,9	-0,9	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,0	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1
-0,6	-0,8	-0,4	-0,9	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1
-0,6	-0,9	-0,8	-0,9	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1
-0,5	-0,2	-0,8	-0,8	-0,9	-0,9	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1	-1,1	-1,0	-1,1	-1,1
-0,4	-0,8	-0,9	-0,9	-0,9	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,1	-1,0	-1,1
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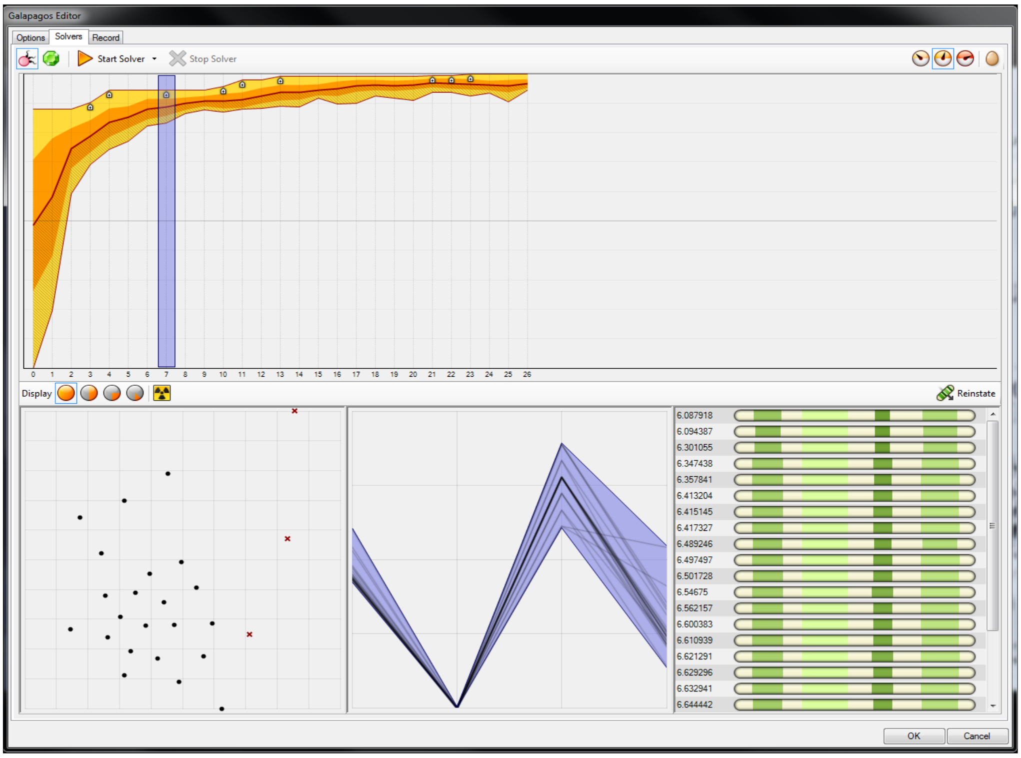

Table B 8 East Facade Floor5 Number of Divisions

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
18	30	29	32	29	31	32	32	32	32	33	33	34	33	34	33	36	36	36	36	36	36	35	36	36	36	36
31	35	32	30	32	30	29	33	32	33	32	33	33	34	33	35	36	35	36	36	36	36	36	36	36	36	36
18	31	34	28	31	31	32	32	32	34	33	32	36	35	36	34	36	36	36	36	34	36	36	36	36	36	35
35	32	32	30	32	30	31	32	31	32	33	35	34	34	34	34	36	36	35	36	36	36	36	36	36	36	36
35	29	32	33	31	32	32	30	30	32	33	34	33	33	34	34	36	36	36	36	36	36	36	36	36	35	36
31	20	35	28	32	30	32	32	32	32	32	34	34	36	35	35	36	35	36	36	36	36	36	36	36	35	35
21	33	30	33	31	28	30	29	32	33	33	34	36	34	34	35	36	36	36	36	36	36	36	36	36	36	36
26	28	30	32	32	32	32	32	33	32	32	33	34	35	36	36	36	36	36	36	36	36	36	36	36	36	36
34	33	33	30	34	30	32	33	32	32	32	34	33	36	36	36	36	36	36	36	36	36	36	36	35	35	35
27	30	31	32	29	32	33	32	33	33	33	33	33	34	36	36	33	36	36	36	36	35	36	36	36	35	35
29	31	30	32	32	32	31	31	32	32	33	33	34	34	35	36	36	36	36	36	36	36	36	36	36	36	36
23	26	31	31	32	30	32	32	32	34	35	36	36	33	36	36	36	36	36	36	36	36	36	36	36	36	36
30	32	28	32	32	32	32	34	34	33	34	34	34	35	36	36	36	36	35	36	36	36	36	36	35	36	35
31	32	32	31	33	32	29	32	33	34	34	34	33	33	34	36	36	36	36	36	36	36	36	36	36	36	36
24	28	33	35	33	32	34	34	34	32	32	34	35	36	36	36	36	35	36	36	36	36	36	36	36	36	35
28	33	32	33	31	29	32	32	32	33	34	33	34	35	36	36	36	36	35	36	36	36	36	36	36	35	36
18	31	32	32	30	29	30	29	31	32	33	33	34	34	34	36	36	36	36	36	35	36	36	35	36	36	36
26	19	33	34	32	34	34	32	32	33	32	32	33	33	34	34	35	35	36	36	35	36	35	36	35	36	36
21	26	29	29	34	29	34	32	32	32	33	33	33	34	35	36	36	36	36	36	36	36	36	35	36	36	35
24	35	33	31	30	34	29	31	32	32	32	32	33	34	34	34	34	36	36	35	36	36	36	36	36	35	36
26	31	32	32	32	31	30	32	32	31	34	32	35	36	35	34	36	36	34	36	35	36	36	36	36	36	36
33	21	30	32	28	30	31	31	32	33	33	33	33	36	36	36	32	33	36	35	36	36	36	36	36	36	36
18	19	28	32	31	31	31	30	32	33	32	33	33	34	34	34	35	36	36	36	36	35	36	36	36	36	36
33	29	33	32	32	32	32	32	32	34	33	32	33	34	33	36	34	35	36	36	36	36	36	36	35	35	36
20	33	29	30	32	32	32	32	32	32	34	33	33	34	34	36	33	36	35	35	36	36	35	35	36	36	35
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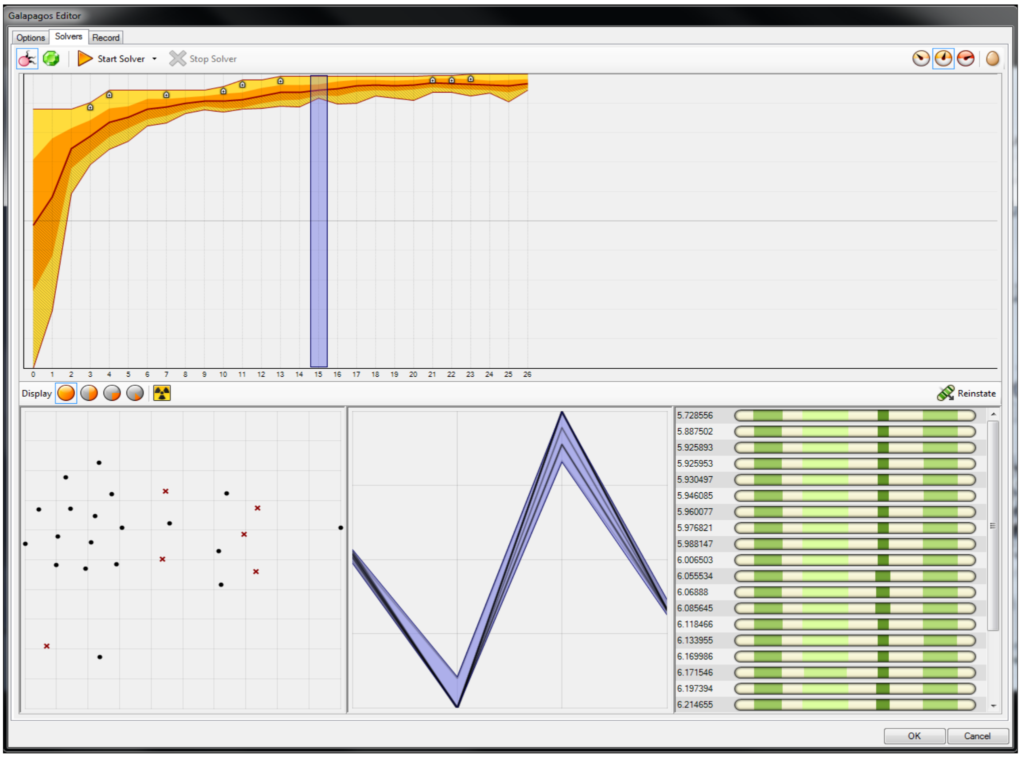

Table B 9 East Facade Floor5 Division Function

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
1,414	1,415	1,418	1,416	1,418	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,416	1,417	1,415	1,418	1,415	1,418	1,418	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,417	1,419	1,416	1,418	1,418	1,415	1,415	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,419	1,415	1,416	1,416	1,415	1,418	1,416	1,415	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,417	1,416	1,415	1,416	1,414	1,415	1,415	1,415	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,418	1,419	1,416	1,419	1,416	1,417	1,416	1,416	1,415	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,420	1,416	1,416	1,416	1,415	1,418	1,416	1,417	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,418	1,419	1,419	1,415	1,415	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,416	1,416	1,416	1,418	1,416	1,414	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,416	1,416	1,419	1,415	1,418	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,420	1,418	1,418	1,415	1,416	1,416	1,415	1,415	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,416	1,416	1,418	1,418	1,416	1,417	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,419	1,415	1,419	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,416	1,416	1,415	1,417	1,415	1,416	1,418	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,419	1,419	1,414	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,419	1,417	1,415	1,416	1,416	1,418	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,420	1,416	1,415	1,415	1,417	1,417	1,415	1,417	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,417	1,419	1,416	1,416	1,415	1,415	1,415	1,416	1,415	1,416	1,415	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,420	1,418	1,416	1,416	1,416	1,418	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,418	1,416	1,415	1,418	1,417	1,416	1,416	1,415	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,418	1,419	1,415	1,415	1,415	1,416	1,418	1,416	1,416	1,415	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,417	1,416	1,416	1,416	1,416
1,415	1,417	1,416	1,415	1,418	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,417	1,417	1,416	1,415	1,417	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,417	1,418	1,415	1,415	1,415	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
1,419	1,415	1,416	1,416	1,415	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
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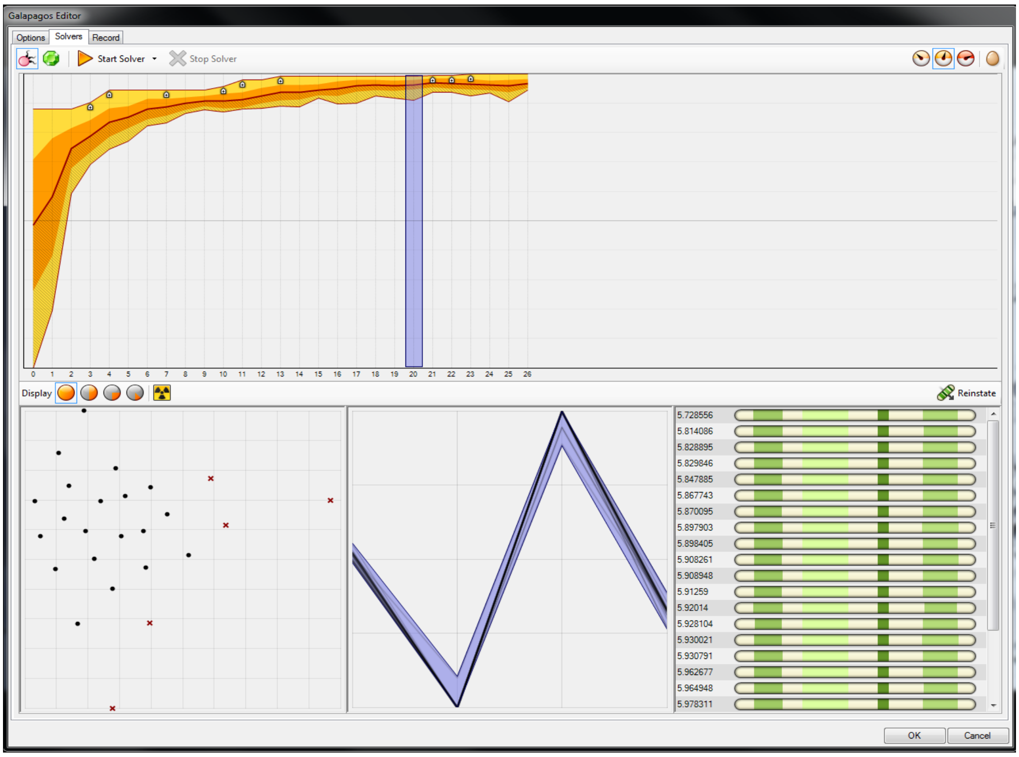

Table B 10 East Facade Floor5 Fitness Function

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
13,616	10,079	6,986	6,442	7,573	6,777	6,530	6,600	6,726	6,295	6,370	6,343	6,420	6,433	6,272	6,317	6,352	5,927	5,760	5,950	5,909	5,697	6,130	5,931	6,043	5,815	6,000
9,181	8,761	6,909	7,197	6,844	6,829	7,133	6,358	6,410	6,410	6,672	6,548	6,308	6,220	6,578	6,069	5,944	6,093	5,944	5,857	5,908	5,906	6,131	5,966	5,772	6,020	5,993
10,019	7,005	8,191	8,103	7,540	6,723	6,616	6,562	6,403	6,249	6,622	6,616	6,084	6,063	5,920	6,259	5,986	6,667	5,931	5,904	6,206	5,964	5,751	6,031	6,005	5,842	6,087
7,982	7,964	7,097	7,407	6,576	7,256	6,630	6,417	6,581	6,517	6,559	6,016	6,280	6,169	6,354	6,265	6,141	6,079	6,046	5,912	5,829	5,909	5,969	6,029	6,021	6,086	5,788
8,693	8,411	7,227	7,116	6,661	6,369	6,736	6,858	6,761	6,523	6,340	6,447	6,348	6,432	6,342	6,390	5,944	5,866	5,895	6,013	6,028	5,863	5,931	5,953	6,180	5,893	5,881
8,633	12,003	7,522	8,665	7,021	6,689	6,601	6,415	6,427	6,729	6,585	6,515	6,206	5,903	6,146	6,197	6,045	6,095	6,352	6,094	5,848	5,778	5,696	5,925	5,927	6,042	6,099
8,827	11,120	7,726	7,634	7,098	7,813	6,875	6,921	6,379	6,348	6,290	6,246	5,842	6,217	6,158	6,215	5,799	5,914	6,049	5,932	5,868	5,894	5,772	6,005	6,108	6,427	5,857
8,029	7,267	7,343	7,366	7,283	7,480	6,607	6,629	6,393	6,635	6,584	6,238	6,070	6,064	6,092	5,888	5,960	5,942	6,002	5,803	5,928	6,047	5,817	5,817	5,921	6,032	5,878
6,616	7,884	7,867	7,299	6,968	6,832	7,040	6,489	6,681	6,492	6,592	6,232	6,324	6,216	6,206	6,170	6,344	6,131	5,865	5,742	5,930	5,789	5,924	5,940	5,860	5,882	6,003
11,771	7,658	8,001	6,754	7,039	6,616	6,536	6,778	6,452	6,360	6,591	6,515	6,407	5,938	5,892	5,988	6,284	5,934	5,939	6,048	5,870	6,003	6,050	5,652	5,762	6,169	5,946
8,454	7,645	6,748	7,465	6,583	6,536	6,785	6,621	6,414	6,572	6,306	6,544	6,410	6,320	6,282	5,946	6,007	5,830	5,935	5,898	5,965	6,015	5,914	5,884	5,923	5,848	5,933
8,531	10,150	7,544	7,558	6,538	7,028	6,682	6,347	6,654	6,419	6,000	5,813	6,060	6,341	5,958	6,007	5,950	5,830	5,882	5,839	5,978	5,773	6,118	5,813	5,821	6,090	5,851
7,158	7,870	7,873	6,809	6,912	6,650	6,637	6,301	6,095	6,448	6,241	6,273	6,214	6,122	6,271	5,930	6,103	5,937	6,048	6,029	6,376	6,158	5,913	5,916	6,172	5,918	6,014
8,224	7,430	7,893	6,622	7,075	6,788	6,858	7,014	6,389	6,363	6,303	6,366	6,400	6,523	6,293	5,977	5,819	5,951	5,776	5,925	5,931	5,891	5,919	5,892	5,977	5,949	5,866
12,716	8,732	7,785	7,539	7,172	6,873	6,159	6,088	6,246	6,337	6,686	6,164	5,931	5,729	6,010	5,926	6,253	5,904	5,930	6,001	5,920	6,009	5,832	5,738	5,965	6,201	5,967
11,691	8,927	7,410	7,139	6,635	7,148	6,272	6,644	6,431	6,301	6,099	6,508	6,145	6,175	6,097	6,134	5,852	5,954	5,993	5,962	5,830	5,934	5,994	6,247	5,898	5,989	5,817
10,587	11,379	7,976	7,920	7,143	7,170	6,980	6,981	6,613	6,578	6,301	6,174	6,371	6,255	6,143	6,282	5,803	5,936	5,921	6,007	6,078	5,908	6,146	6,073	5,941	5,946	5,718
10,603	12,062	8,901	7,033	7,884	6,965	6,732	6,689	6,520	6,238	6,585	6,601	6,214	6,835	6,554	6,086	6,128	6,070	5,843	6,308	6,133	5,796	6,047	5,830	6,029	5,929	5,796
11,867	11,239	8,330	7,952	6,094	7,157	6,097	6,497	6,526	6,400	6,243	6,569	6,514	6,382	6,152	6,172	6,056	6,074	5,912	5,875	5,814	5,921	5,992	6,233	6,048	5,988	6,111
11,458	8,028	7,786	7,581	6,756	6,587	7,072	6,547	6,647	6,400	6,551	6,616	6,401	6,142	6,389	6,056	6,654	6,136	5,902	6,065	5,913	5,826	5,971	6,034	5,862	6,276	5,815
11,901	8,636	7,906	7,411	7,302	6,947	6,879	6,502	6,471	6,565	6,340	6,629	5,949	5,910	6,181	6,298	5,943	5,757	6,229	6,175	6,407	5,773	5,958	6,253	5,986	5,742	6,007
8,914	9,977	10,788	7,495	7,703	6,910	6,521	6,633	6,655	6,350	6,289	6,471	6,473	5,874	5,809	5,926	6,465	6,445	6,257	5,998	5,898	6,043	5,760	6,108	6,149	5,854	5,988
11,240	9,935	8,530	7,320	6,678	6,721	6,557	6,937	6,615	6,161	6,596	6,293	6,415	6,287	6,191	6,256	6,103	5,871	6,221	6,260	5,963	6,003	5,716	5,916	6,122	5,860	5,936
9,527	12,396	7,636	7,934	7,415	7,158	6,409	6,611	6,380	6,231	6,699	6,464	6,598	6,354	6,495	6,118	6,293	6,188	6,002	5,925	5,898	6,249	5,980	5,942	6,388	6,157	5,956
12,009	7,835	7,904	7,820	7,333	6,450	6,329	6,413	6,295	6,486	6,043	6,296	6,605	6,104	6,071	5,960	6,325	5,807	5,972	6,308	6,018	5,811	6,181	5,812	5,912	6,422	6,093
7,460																										
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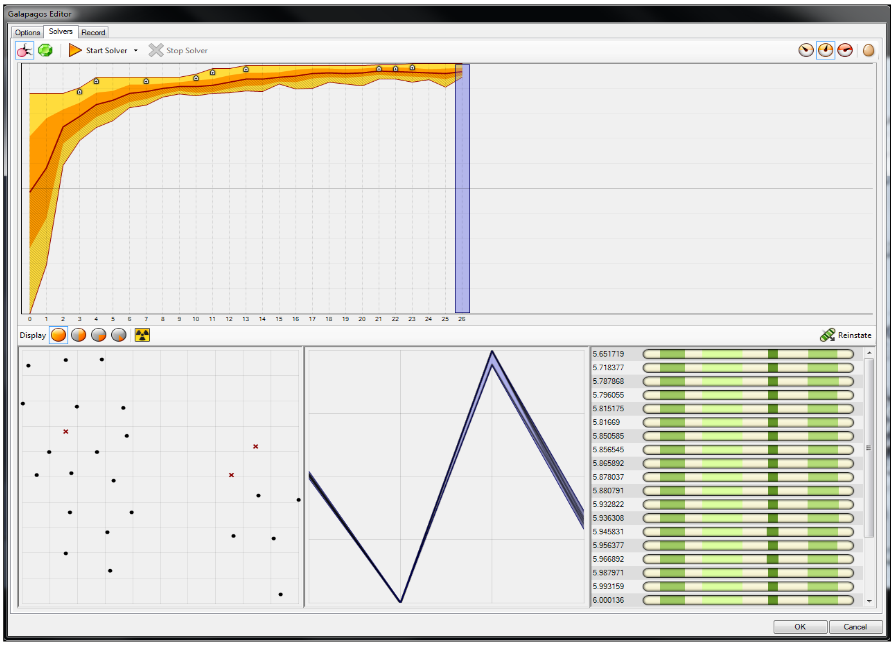

Table B 11 West-north Facade Floor1 Random Angle Seed

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
0	322	724	936	880	876	875	827	880	873	873	870	879	871	868	878	869	867	866	865	864	864	865	860	858	866	868
539	240	206	894	927	880	872	873	875	875	874	877	869	875	873	869	752	864	865	871	859	860	848	857	862	867	866
554	466	319	936	880	873	878	869	873	873	874	873	872	877	863	867	871	872	868	861	862	861	866	868	872	866	863
57	982	881	368	878	873	816	878	866	867	870	876	873	876	867	871	877	868	865	864	859	863	859	866	866	867	867
880	200	936	880	886	876	879	873	874	872	869	874	872	871	871	878	877	876	864	868	863	860	868	857	862	855	862
567	657	578	881	880	874	883	874	875	866	872	868	872	868	879	881	869	872	868	870	866	775	860	865	857	857	862
794	847	962	924	874	876	869	828	873	875	872	868	873	867	877	869	870	868	863	866	861	863	862	861	860	853	856
749	647	425	628	880	880	876	875	870	875	880	872	869	868	869	877	863	863	865	861	865	867	862	867	859	867	864
255	882	454	454	873	881	872	873	874	875	873	870	876	872	869	869	864	866	867	864	863	861	860	860	866	855	862
139	361	462	908	880	878	874	873	866	873	873	874	873	879	874	872	866	867	868	865	861	860	861	860	865	872	868
986	113	313	880	880	872	880	878	857	873	877	874	872	871	877	913	872	871	870	865	864	860	840	861	857	868	865
911	980	567	454	873	876	874	874	874	874	881	872	874	869	871	868	865	863	864	865	865	876	852	862	867	859	872
977	319	916	936	878	880	875	881	876	872	871	870	873	872	870	863	869	867	863	863	863	863	865	873	857	861	863
130	449	880	903	876	876	873	874	874	878	867	873	869	876	874	874	874	870	865	864	868	862	866	864	869	865	860
614	567	982	881	872	883	883	869	873	800	866	872	877	866	879	872	870	866	878	865	861	863	866	860	866	857	858
278	578	915	880	880	880	872	856	872	870	868	871	869	870	872	868	872	863	866	864	860	863	863	858	864	862	859
364	389	951	620	880	902	875	874	880	870	875	872	873	872	867	868	869	871	864	862	861	864	865	861	861	865	863
704	282	982	873	873	872	876	877	873	875	872	866	868	877	876	873	869	874	864	868	869	866	866	865	857	863	866
503	146	375	341	898	880	877	863	876	875	872	869	873	871	871	881	868	867	842	866	864	864	863	860	857	860	868
660	360	548	880	693	880	871	880	873	872	872	871	872	872	870	849	867	869	870	882	863	862	864	856	860	857	863
213	507	817	817	880	880	873	883	875	874	873	866	869	871	871	871	878	869	867	864	868	859	866	864	860	867	870
310	982	352	742	874	875	873	876	876	875	873	875	871	870	875	868	852	857	868	865	874	863	860	866	865	867	866
589	817	620	880	913	880	873	875	876	874	868	872	871	873	873	873	864	883	870	869	863	866	864	862	863	867	860
591	660	880	724	880	874	878	880	873	860	861	871	871	879	874	877	867	876	888	868	864	861	862	862	857	862	863
221	213	593	968	933	880	877	876	873	872	872	869	877	890	867	871	876	873	876	867	867	863	860	860	861	857	866
877																										
619																										
407																										
540																										
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315																										
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775																										
654																										
705																										
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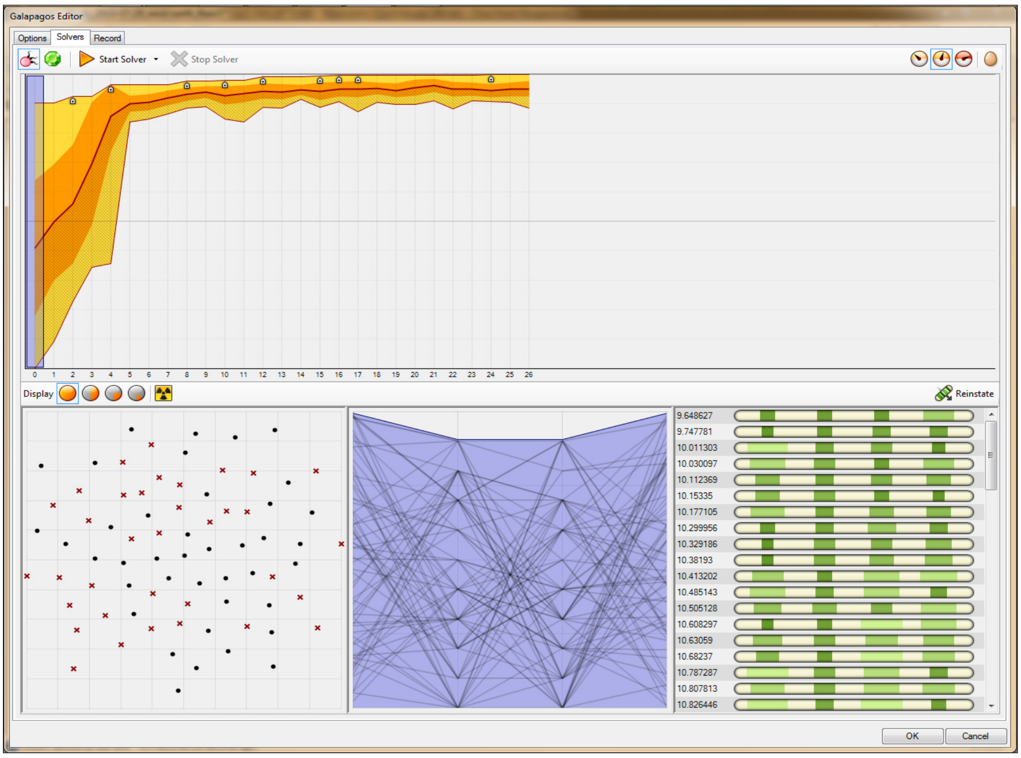

Table B 12 West-north Facade Floor1 Shading Depth

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
0,1	0,7	0,4	0,8	1,0	1,0	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,0	1,1	1,1	1,1
0,7	0,9	0,6	0,9	0,7	1,0	1,0	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1
0,5	0,5	0,6	0,7	1,0	1,1	1,0	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1
0,9	0,4	1,0	0,6	0,9	1,0	1,0	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1
1,0	0,5	0,9	1,0	0,9	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1
0,8	0,9	0,5	1,1	1,0	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,0	1,0	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1
0,3	0,1	0,5	0,9	1,0	1,0	1,1	1,0	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,0	1,0	1,1	1,0	1,1	1,1	1,0	1,1	1,1
0,5	0,6	0,8	0,5	0,9	1,1	1,1	1,1	1,1	1,1	1,0	1,0	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1
0,4	1,0	0,8	0,8	1,0	1,0	0,9	1,0	1,1	1,1	1,1	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,0	1,1	1,1
0,6	0,8	0,7	0,8	1,1	1,0	1,0	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,0	1,1	1,0
0,8	0,5	0,6	1,0	1,0	1,0	1,0	1,1	1,1	1,0	0,9	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1
0,4	0,8	0,7	0,8	1,0	0,9	1,1	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	0,9	1,1	1,1	1,1	1,1	1,1
1,0	0,6	0,8	0,8	1,0	1,0	1,0	1,1	0,9	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	0,9	1,1	1,1	1,1	0,7	1,1	1,1	1,1	1,1
0,9	0,8	1,1	0,9	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,0	1,0	1,0	1,1	1,1	1,1	0,4	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1
0,1	0,8	0,4	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,0	1,1	1,0	1,1
0,4	0,5	0,8	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	0,9	1,0	1,0	0,5	1,1	1,0	1,1	1,0	1,1	1,1	1,0	1,1
0,3	0,4	0,8	0,5	1,0	0,8	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1
0,7	1,0	0,3	1,0	1,1	1,0	0,9	1,0	1,1	1,1	1,1	0,9	1,0	1,1	1,1	1,0	1,1	0,9	1,1	1,1	1,0	1,1	1,0	1,0	1,1	1,0	1,1
0,6	0,1	0,4	0,4	0,4	1,0	1,0	1,0	1,1	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,0
0,4	0,2	0,6	0,9	0,4	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,0
0,5	0,7	0,5	0,4	1,0	0,9	0,9	1,1	1,1	1,1	0,9	1,0	1,1	1,1	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1
0,8	0,4	0,3	0,4	1,0	1,0	1,1	1,0	1,1	1,1	1,0	0,9	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0
0,2	0,5	0,5	1,0	0,9	1,0	1,0	1,1	1,0	1,0	1,1	1,0	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1
0,2	0,4	1,0	0,4	1,0	1,0	1,0	0,9	1,0	1,1	1,0	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,0	1,1	1,1	1,1	1,1	1,1
0,1	0,8	0,5	0,4	0,8	1,0	1,0	1,0	1,1	1,1	1,1	1,0	1,1	1,0	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,0	1,0	1,1	1,1
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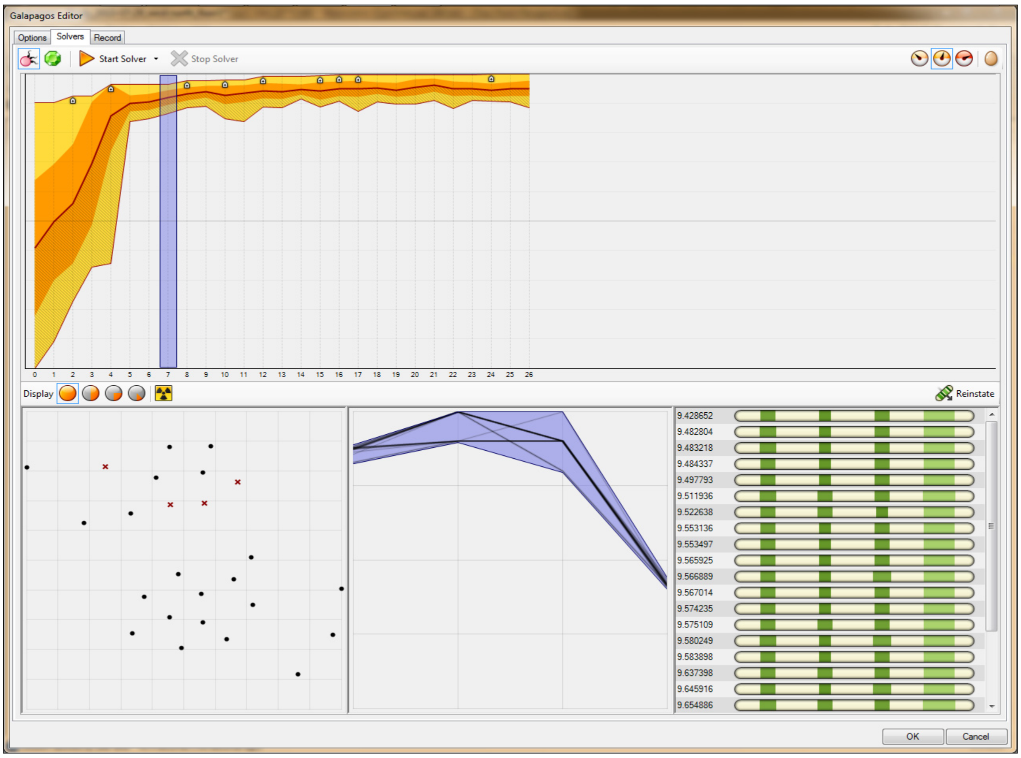

Table B 13 West-north Facade Floor1 Number of Divisions

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
12	14	17	20	21	21	21	21	20	22	22	21	21	21	22	22	21	21	22	22	21	21	22	22	22	22	22
19	12	14	20	19	21	21	20	21	21	22	21	21	22	21	22	22	22	22	21	22	22	22	22	22	22	21
15	18	15	17	21	21	21	20	20	21	20	21	21	22	21	22	22	21	22	22	21	22	22	22	22	22	22
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21	16	19	21	20	21	21	21	21	21	20	20	21	20	20	22	21	22	22	20	22	22	22	22	22	22	21
14	17	17	21	20	21	21	21	21	22	21	21	21	21	22	22	21	22	22	22	22	22	22	22	22	21	22
16	12	20	19	21	21	21	21	21	20	22	22	22	22	22	22	21	22	22	21	22	22	21	22	21	22	22
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13	21	19	19	20	22	21	22	22	22	21	21	22	20	22	22	21	22	22	22	22	21	22	22	22	22	22
16	12	14	17	21	21	21	21	22	21	22	22	22	22	22	21	22	22	22	22	21	22	21	22	22	22	21
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12	18	14	19	21	21	21	21	21	22	21	21	22	22	22	22	21	22	22	22	22	21	22	21	21	22	22
13	15	17	20	21	21	21	21	21	21	21	22	22	22	21	22	22	22	22	22	22	21	22	22	22	22	22
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17	17	17	21	20	20	20	21	20	21	21	22	21	21	22	21	22	22	22	22	22	21	21	22	21	22	22
16	13	20	16	22	18	21	21	21	21	21	21	20	21	22	20	22	21	22	22	22	22	21	22	21	21	21
15	15	17	21	21	21	21	21	21	22	20	20	21	21	21	20	22	22	22	21	21	22	22	21	22	22	21
16	20	12	12	17	21	21	21	21	22	21	21	22	21	21	20	21	22	22	22	22	22	21	21	22	20	21
17	13	18	21	16	20	21	21	22	21	22	20	21	21	20	22	22	21	21	22	22	22	22	21	21	22	21
15	14	17	16	21	21	20	21	21	21	20	22	21	21	22	21	22	21	21	21	21	21	22	21	20	21	20
21	20	13	17	22	21	20	21	21	21	20	21	22	22	21	22	21	21	22	21	22	22	22	21	22	22	22
19	16	13	21	18	21	21	21	21	21	21	22	21	22	21	20	21	22	22	22	22	21	21	20	22	22	22
13	17	21	17	21	21	21	21	21	21	22	21	20	22	20	21	20	21	22	21	22	21	22	21	22	22	21
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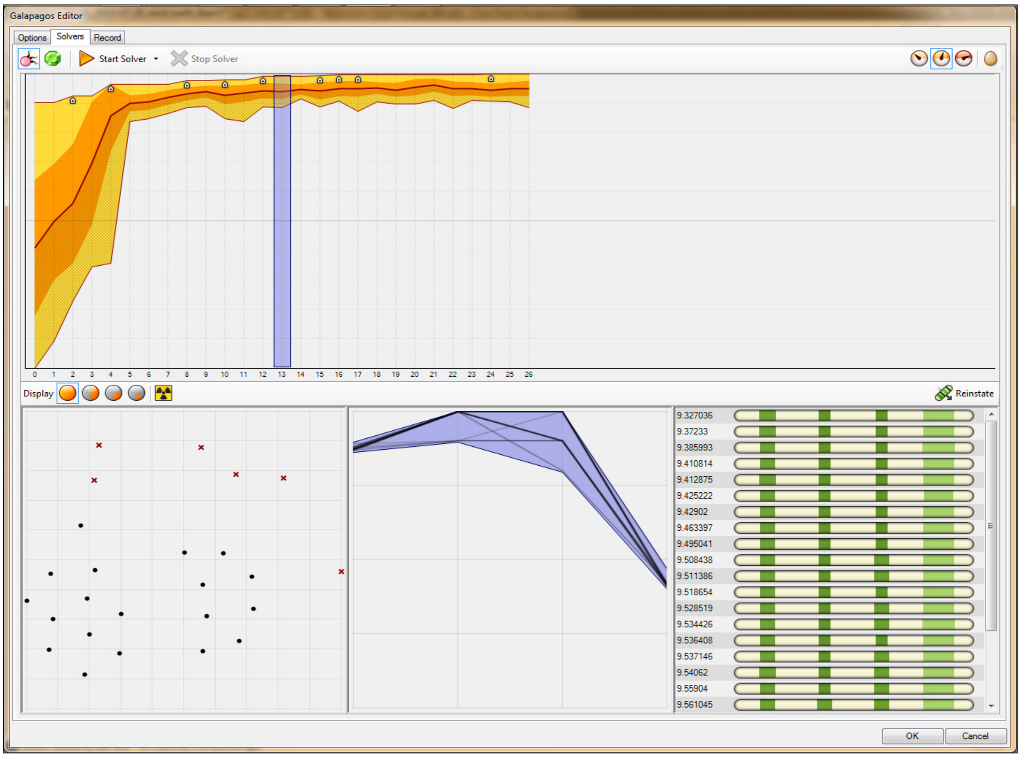

Table B 14 West-north Facade Floor1 Division Function

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
1,414	1,419	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,416	1,418	1,419	1,416	1,417	1,416	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,418	1,419	1,418	1,418	1,415	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,417	1,417	1,417	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,417	1,419	1,416	1,417	1,416	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,417	1,419	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,416	1,419	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,415	1,418	1,419	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,416	1,417	1,419	1,419	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,417	1,419	1,415	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,419	1,417	1,416	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,420	1,417	1,419	1,419	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,416	1,418	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,420	1,419	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,416	1,419	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,415	1,419	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,416	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,418	1,417	1,417	1,416	1,417	1,416	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,416	1,416	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,419	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,417	1,417	1,419	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,419	1,414	1,419	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,417	1,417	1,418	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,415	1,420	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,418	1,419	1,419	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,416	1,417	1,417	1,417	1,417	1,417	1,417	1,417
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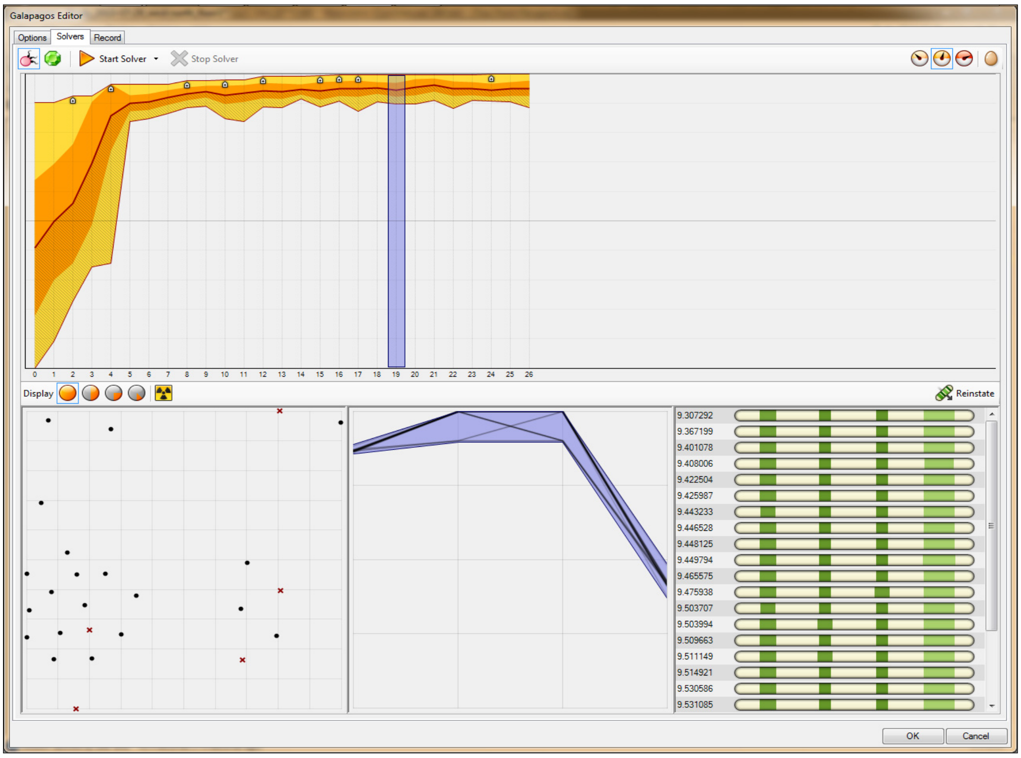

Table B 15 West-north Facade Floor1 Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26
12,897	11,117	11,605	10,220	9,627	9,689	9,688	9,655	9,634	9,384	9,375	9,538	9,599	9,511	9,489	9,488	9,483	9,521	9,407	9,531	9,566	9,516	9,632	9,510	9,400	9,486	9,538
10,505	10,950	11,359	9,904	10,500	9,658	9,611	9,567	9,704	9,553	9,500	9,527	9,444	9,495	9,465	9,413	9,514	9,440	9,495	9,670	9,506	9,426	9,448	9,403	9,442	9,398	9,521
11,502	11,196	11,255	10,697	9,677	9,476	9,738	9,580	9,495	9,460	9,750	9,484	9,528	9,411	9,393	9,440	9,543	9,521	9,536	9,426	9,525	9,393	9,460	9,554	9,433	9,582	9,315
10,983	11,428	9,779	11,350	9,872	9,612	9,684	9,726	9,522	9,525	9,621	9,520	9,563	9,559	9,525	9,470	9,560	9,515	9,499	9,447	9,476	9,315	9,631	9,479	9,526	9,444	9,406
9,649	11,414	10,066	9,612	9,928	9,635	9,746	9,484	9,576	9,483	9,601	9,629	9,449	9,646	9,610	9,489	9,577	9,417	9,380	9,694	9,336	9,406	9,480	9,490	9,442	9,458	9,519
10,899	10,336	11,279	9,597	9,728	9,636	9,649	9,553	9,571	9,444	9,498	9,588	9,608	9,712	9,519	9,493	9,461	9,533	9,533	9,443	9,379	9,602	9,401	9,536	9,501	9,540	9,459
12,051	12,878	10,982	10,044	9,669	9,661	9,480	9,785	9,482	9,786	9,448	9,541	9,366	9,413	9,475	9,351	9,634	9,503	9,447	9,645	9,418	9,405	9,515	9,397	9,599	9,432	9,434
11,890	11,514	11,015	11,295	9,828	9,560	9,543	9,566	9,646	9,574	9,733	9,528	9,327	9,709	9,356	9,566	9,316	9,340	9,546	9,401	9,534	9,430	9,464	9,438	9,560	9,545	9,408
12,006	9,666	10,276	10,298	9,692	9,632	9,836	9,523	9,458	9,511	9,480	9,627	9,459	9,622	9,529	9,392	9,473	9,441	9,422	9,504	9,328	9,497	9,446	9,437	9,564	9,436	9,429
11,134	11,234	11,126	10,560	9,533	9,746	9,659	9,575	9,481	9,442	9,504	9,487	9,399	9,536	9,502	9,546	9,480	9,390	9,533	9,531	9,515	9,409	9,500	9,437	9,632	9,392	9,713
11,192	11,266	11,545	9,773	9,649	9,623	9,637	9,574	9,564	9,696	9,844	9,534	9,611	9,463	9,476	9,436	9,465	9,471	9,394	9,515	9,428	9,473	9,505	9,520	9,522	9,534	9,527
12,098	10,416	11,097	10,259	9,612	9,835	9,556	9,664	9,622	9,534	9,602	9,508	9,446	9,372	9,447	9,526	9,621	9,307	9,448	9,510	9,672	9,878	9,342	9,535	9,529	9,505	9,430
10,608	11,245	10,545	10,207	9,698	9,671	9,684	9,584	9,864	9,545	9,500	9,421	9,530	9,429	9,521	9,321	9,336	9,452	9,642	9,367	9,311	9,435	10,233	9,397	9,498	9,375	9,350
10,011	10,215	9,575	10,215	9,680	9,715	9,491	9,646	9,539	9,577	9,432	9,519	9,603	9,594	9,477	9,451	9,660	11,149	9,508	9,423	9,812	9,441	9,458	9,439	9,431	9,629	9,572
12,539	10,889	11,431	9,742	9,642	9,544	9,580	9,483	9,383	9,463	9,561	9,435	9,537	9,541	9,494	9,447	9,402	9,550	9,451	9,584	9,488	9,408	9,418	9,482	9,486	9,639	9,543
11,624	11,280	10,521	9,612	9,593	9,664	9,731	9,483	9,558	9,527	9,577	9,391	9,463	9,508	9,451	9,900	9,544	9,455	10,794	9,466	9,481	9,388	9,475	9,361	9,549	9,559	9,533
12,043	12,004	10,206	11,433	9,574	10,448	9,685	9,637	9,569	9,453	9,569	9,477	9,548	9,529	9,451	9,703	9,346	9,546	9,415	9,448	9,398	9,366	9,720	9,402	9,480	9,612	9,427
10,936	10,342	11,961	9,593	9,429	9,624	9,843	9,694	9,503	9,510	9,574	9,924	9,709	9,580	9,528	9,684	9,393	9,757	9,397	9,610	9,601	9,436	9,570	9,740	9,461	9,381	9,559
11,164	12,571	12,077	12,105	11,615	9,617	9,660	9,512	9,547	9,621	9,545	9,484	9,540	9,537	9,549	9,703	9,549	9,412	9,458	9,408	9,427	9,376	9,419	9,531	9,536	9,707	9,715
11,565	12,547	10,879	9,835	11,736	9,735	9,626	9,553	9,393	9,523	9,432	9,604	9,639	9,608	9,607	9,525	9,446	9,520	9,479	9,504	9,348	9,423	9,435	9,499	9,530	9,504	9,452
11,518	11,149	11,237	11,662	9,633	9,811	9,912	9,498	9,577	9,524	9,904	9,556	9,489	9,534	9,544	9,529	9,463	9,627	9,517	9,476	9,600	9,583	9,465	9,613	9,615	9,522	9,578
10,030	11,351	12,263	11,610	9,528	9,689	9,553	9,689	9,583	9,581	9,704	9,881	9,468	9,425	9,561	9,647	9,484	9,617	9,518	9,621	9,500	9,372	9,448	9,508	9,515	9,443	9,571
12,209	11,351	11,773	9,642	10,166	9,622	9,581	9,567	9,710	9,624	9,611	9,506	9,490	9,386	9,487	9,661	9,526	9,384	9,441	9,511	9,342	9,546	9,529	9,628	9,298	9,453	9,455
12,540	11,545	9,665	11,573	9,639	9,699	9,715	9,814	9,536	9,518	9,549	9,505	9,731	9,519	9,642	9,593	9,611	9,533	9,522	9,592	9,527	9,621	9,426	9,530	9,521	9,423	9,422
12,725	11,043	11,287	11,522	10,135	9,886	9,666	9,679	9,543	9,521	9,608	9,731	9,413	9,561	9,476	9,543	9,521	9,521	9,523	9,450	9,514	9,410	9,549	9,581	9,632	9,532	9,479
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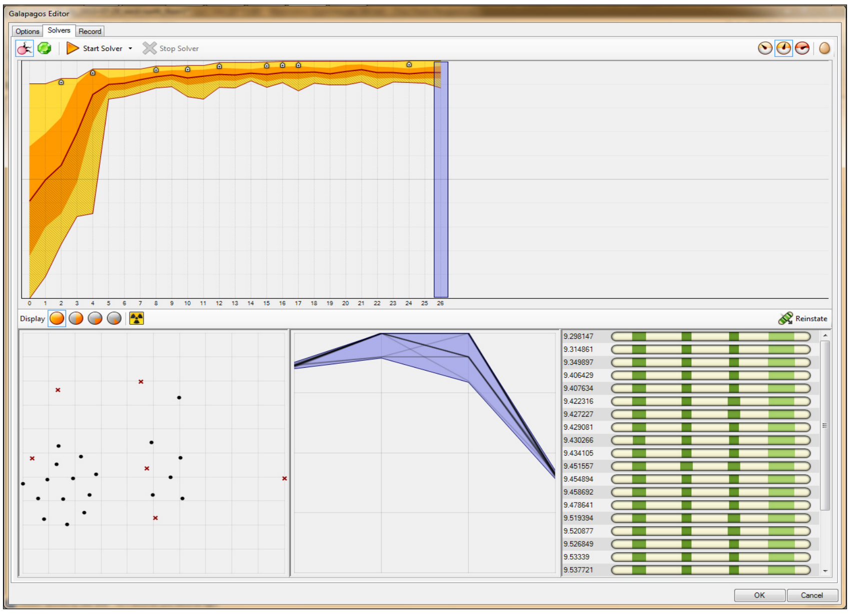

Table B 16 West-north Facade Floor5 Random Angle Seed

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
0	664	621	420	394	693	592	705	723	695	714	718	704	711	717	720	722	712	725	719	718	717	733	718	713	732	716
862	204	531	639	716	566	687	605	721	724	714	714	715	709	711	743	713	714	696	717	739	717	733	710	721	711	709
223	424	701	327	693	724	746	723	736	720	715	718	721	704	716	710	721	708	718	718	736	717	716	733	708	715	712
843	406	327	759	637	693	612	741	717	714	719	717	718	720	715	713	717	706	746	715	741	712	733	735	717	720	718
122	660	430	698	639	628	696	715	719	723	713	712	696	722	707	710	714	718	719	722	720	728	718	780	712	719	718
965	68	727	777	698	724	594	723	721	725	724	714	710	709	716	716	713	729	717	746	715	717	726	717	735	730	720
931	701	679	643	453	704	694	718	604	715	709	719	717	714	718	711	712	712	707	724	716	716	717	729	715	709	709
800	290	747	592	502	580	701	739	623	702	721	713	724	714	704	713	712	716	716	718	714	728	718	715	712	730	711
729	689	690	731	777	698	717	701	716	740	713	714	714	714	714	734	707	735	720	739	723	719	714	715	715	712	710
426	668	292	663	646	727	699	705	708	718	718	714	718	722	713	712	711	719	746	717	715	716	717	717	729	723	715
68	838	538	534	571	628	724	721	722	720	721	726	718	719	716	716	729	719	718	723	717	715	716	715	711	712	728
472	689	724	727	534	723	723	716	600	724	720	710	724	715	714	721	714	717	717	718	727	713	716	723	707	710	712
591	777	535	454	703	594	723	719	714	713	712	720	722	716	710	718	715	715	727	716	716	716	722	715	708	714	709
352	724	661	637	723	754	718	710	717	721	728	710	719	714	719	706	780	713	739	736	717	726	714	710	724	711	716
157	484	303	430	777	686	724	717	705	721	714	726	714	714	714	714	715	754	718	746	707	708	820	713	713	720	715
319	592	387	589	667	586	732	709	713	709	725	719	704	721	721	714	715	714	726	717	714	720	728	732	720	718	722
689	392	555	701	693	656	669	648	725	720	717	698	714	716	713	718	731	717	734	714	716	716	715	717	734	711	718
367	223	406	686	461	686	628	722	717	713	723	724	710	728	719	713	720	720	722	716	719	741	717	716	729	713	752
857	345	664	696	643	699	716	717	718	641	721	714	721	722	712	715	719	745	721	715	723	715	731	718	710	718	710
395	303	574	698	477	693	552	690	635	710	691	722	723	710	713	716	718	722	713	716	715	820	716	729	717	715	731
323	352	777	292	693	502	724	594	693	721	702	702	719	707	708	717	717	687	722	711	717	720	728	734	708	735	720
233	443	684	693	646	683	646	718	723	717	713	724	712	725	749	718	710	716	716	727	718	707	729	716	732	712	714
676	718	483	662	686	462	679	736	720	725	724	721	717	718	710	714	717	717	708	723	724	730	731	714	732	714	723
885	672	672	661	663	724	704	679	705	600	706	718	714	714	719	726	714	719	715	717	717	739	713	718	720	720	714
610	434	420	693	744	462	687	560	722	622	716	714	712	713	719	715	708	713	711	719	732	717	715	715	717	689	716
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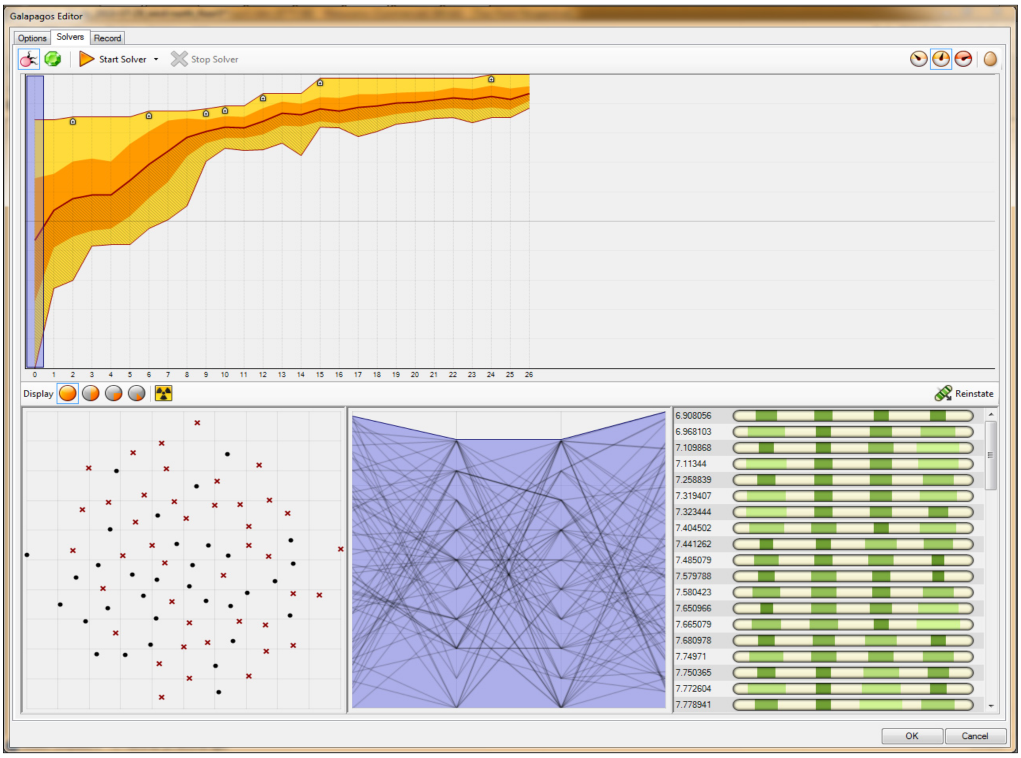

Table B 17 West-north Facade Floor5 Shading Depth

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
0,1	0,6	0,8	0,5	0,8	0,7	0,7	0,9	0,8	0,7	1,0	0,8	0,9	1,0	1,0	1,0	0,9	0,9	1,0	1,0	1,1	0,9	1,1	0,9	1,1	1,0	1,1
0,8	0,8	0,7	0,8	0,8	0,7	0,7	0,6	0,9	0,9	0,9	0,9	0,9	0,9	1,0	0,9	1,0	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1
0,5	0,3	0,6	0,8	0,6	0,9	0,8	0,9	0,9	0,9	0,9	0,9	0,9	0,9	1,0	0,9	1,1	0,9	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1
0,7	0,6	0,8	0,6	0,7	0,7	0,6	0,8	0,9	0,9	0,9	0,8	0,9	0,9	1,0	1,0	1,0	1,0	1,1	1,1	1,1	1,1	1,0	1,1	1,0	1,0	1,1
0,8	0,9	0,6	0,8	0,7	0,7	0,9	0,7	0,9	0,9	0,8	0,9	1,0	1,1	0,8	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,0	1,0	1,1	1,1	1,1
0,7	1,0	0,9	0,6	0,7	0,9	0,6	0,9	0,9	0,9	0,9	1,0	0,9	1,0	1,0	1,0	1,1	1,0	1,1	1,1	1,0	1,0	1,0	1,0	1,1	1,0	1,1
1,0	0,6	0,9	0,7	0,5	0,7	0,7	0,8	0,6	0,9	1,0	1,0	1,0	0,9	1,0	0,9	0,9	0,6	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1
0,9	0,7	0,9	0,7	0,6	0,7	0,9	0,8	0,9	0,9	0,8	0,9	1,0	0,9	1,0	1,0	1,0	1,0	1,1	1,0	1,1	1,1	1,0	0,9	1,1	1,1	1,1
0,3	0,7	0,7	0,9	0,9	0,6	0,9	0,9	0,9	0,9	0,9	0,8	0,9	1,0	0,9	1,0	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1
0,3	0,9	0,7	0,7	0,7	0,6	0,7	0,9	0,9	0,9	0,9	0,9	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,0	1,1	1,0
0,8	0,9	0,8	0,6	0,6	0,6	0,9	0,9	0,8	0,9	0,8	0,9	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,0	1,1	1,0	1,1	1,1	1,1	1,1	1,1
0,1	0,6	0,9	0,9	0,7	0,8	0,8	0,9	0,9	0,8	0,9	1,0	0,9	0,9	1,0	0,9	1,1	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,0	1,1	1,1
0,6	0,6	0,7	0,7	0,7	0,6	0,8	0,9	0,9	0,9	0,9	1,0	1,0	1,0	1,0	0,9	1,0	1,1	0,9	1,1	1,0	1,1	1,0	1,1	1,1	1,1	1,1
0,7	0,9	0,7	0,7	0,8	0,8	0,9	0,8	0,8	1,0	0,9	0,9	1,0	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,0	1,0	1,1	1,1	1,0	1,0	1,1
0,1	0,7	0,7	0,6	0,6	0,9	0,9	0,9	0,9	0,9	1,0	1,0	0,9	1,0	1,0	0,9	1,1	1,1	1,1	1,1	1,1	0,9	1,0	1,1	1,1	1,1	1,1
1,0	0,9	0,7	0,7	0,7	0,6	0,9	0,9	0,9	0,9	0,9	1,0	0,9	1,0	0,9	1,1	1,0	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1
0,6	0,8	0,7	0,5	0,6	0,7	0,6	0,7	0,9	0,8	0,9	0,8	0,7	1,0	1,0	1,0	1,0	1,1	1,0	1,1	1,0	1,0	1,1	1,0	1,1	1,1	1,1
0,4	0,4	0,6	0,7	0,7	0,7	0,7	0,9	0,9	0,9	0,9	0,9	1,0	0,9	0,9	1,1	1,0	1,1	1,0	1,1	1,0	1,1	0,9	1,1	1,0	1,0	1,0
0,3	0,4	0,6	0,6	0,8	0,7	0,9	0,9	0,9	0,9	0,9	0,9	0,8	0,9	1,0	1,1	1,0	1,1	1,0	1,0	1,0	1,1	1,1	1,0	1,1	1,0	1,1
0,4	0,7	0,8	0,8	0,5	0,6	0,5	0,7	0,6	0,9	0,9	0,9	1,0	1,0	1,0	1,0	1,0	1,0	0,9	1,1	1,1	1,0	1,0	1,0	1,1	1,1	0,9
0,7	0,7	0,6	0,7	0,5	0,6	0,9	0,6	0,7	0,8	0,9	0,9	0,9	0,9	1,0	1,0	0,9	1,0	1,0	0,9	1,1	1,0	1,1	1,1	1,1	1,0	1,1
0,6	0,7	0,6	0,6	0,7	0,6	0,6	0,9	0,9	0,8	0,9	0,9	0,9	1,0	0,8	1,0	1,0	1,0	1,1	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1
0,9	0,4	0,5	0,8	0,7	0,8	0,6	0,9	0,9	0,9	0,9	0,9	0,9	1,0	1,0	1,1	1,0	1,0	0,9	1,1	1,0	1,1	1,0	1,1	1,0	1,1	1,1
1,0	0,4	0,3	0,6	0,7	0,9	0,7	0,6	0,9	0,9	0,9	1,0	1,0	1,0	0,9	0,9	1,0	1,0	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,0
0,9	0,8	0,3	0,6	0,6	0,5	0,7	0,5	0,9	0,9	0,8	0,9	1,0	1,0	1,0	1,0	1,0	0,9	1,0	1,0	1,1	1,1	1,1	1,1	0,9	1,1	1,1
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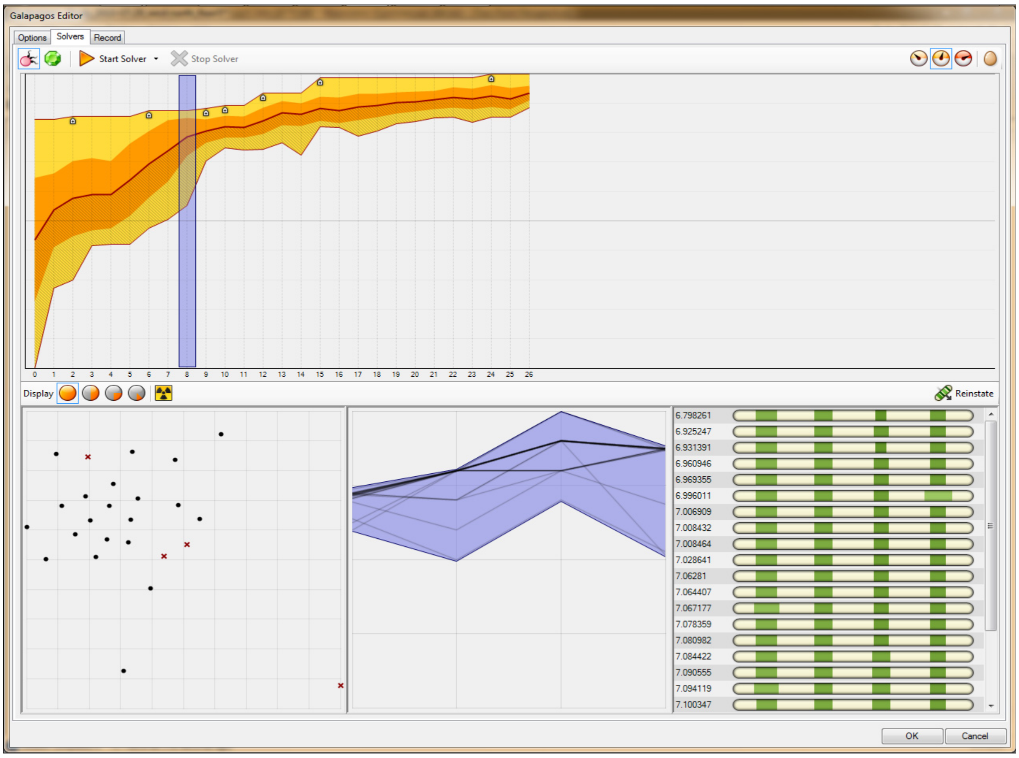

Table B 18 West-north Facade Floor5 Number of Divisions

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
12	17	15	19	14	20	19	21	21	20	21	21	21	21	21	21	22	22	22	22	22	22	21	22	21	21	22
16	12	15	15	19	19	19	19	21	21	21	21	21	21	21	22	20	22	21	22	21	22	21	22	21	22	22
21	20	17	15	17	21	20	22	20	21	21	21	21	21	20	22	21	22	22	20	21	20	22	22	22	21	22
20	20	14	18	14	20	19	20	21	21	21	20	20	20	21	21	21	22	21	21	21	21	21	21	22	22	22
14	18	19	20	15	19	20	20	21	22	21	21	21	21	20	21	20	22	19	22	21	21	22	21	22	22	21
19	14	21	21	20	20	19	21	21	20	21	20	21	21	21	22	21	21	21	21	20	22	22	22	21	22	22
16	15	15	16	19	20	19	21	18	21	21	21	21	20	21	21	22	21	21	21	20	22	20	21	22	22	21
19	15	14	15	19	19	21	20	20	21	21	21	21	22	21	20	21	21	21	22	21	21	21	22	22	21	22
14	20	20	21	21	20	21	20	21	21	21	21	21	22	22	22	21	22	21	20	21	22	22	22	22	22	21
20	15	15	20	20	18	20	21	21	21	21	20	21	21	21	21	21	21	21	22	21	22	22	22	21	21	22
14	15	15	19	19	19	21	21	21	21	21	21	21	21	21	21	21	20	21	21	21	22	22	22	22	22	22
18	15	21	20	20	20	21	21	21	22	21	21	21	21	21	22	22	21	22	22	20	22	22	22	22	22	22
18	17	18	19	20	19	20	20	21	21	21	21	21	21	22	22	22	21	21	21	22	22	22	22	22	22	22
18	17	17	14	20	20	21	21	20	21	21	21	22	21	21	21	22	22	21	21	22	21	22	21	22	22	22
16	20	19	19	20	21	19	21	21	21	21	21	22	21	21	21	21	22	22	21	22	22	22	22	22	21	22
12	15	19	20	20	19	20	20	21	21	22	21	21	21	21	21	20	21	21	21	21	22	21	21	22	22	21
15	15	20	18	16	19	18	18	21	20	20	21	21	21	21	21	21	21	21	21	22	22	22	19	22	22	22
17	21	21	20	19	19	20	21	20	21	21	20	21	21	22	21	21	21	21	21	20	21	22	22	21	22	22
14	16	16	14	14	20	20	20	21	20	20	21	20	21	21	21	20	21	21	21	21	20	21	22	22	20	22
18	19	15	20	19	16	19	19	19	21	21	20	21	21	21	21	21	21	21	20	22	22	22	21	22	21	20
21	15	18	19	17	19	22	18	20	21	22	21	20	21	21	21	21	21	21	21	22	22	21	21	22	21	22
12	19	15	17	14	15	15	20	22	21	21	21	21	21	21	21	20	20	21	21	22	22	21	21	21	22	21
15	12	20	14	20	14	19	20	21	20	20	20	20	21	20	22	21	21	22	21	20	21	21	22	21	22	22
18	20	20	15	19	21	19	19	20	21	21	21	22	21	21	22	22	20	20	22	21	21	22	20	21	22	21
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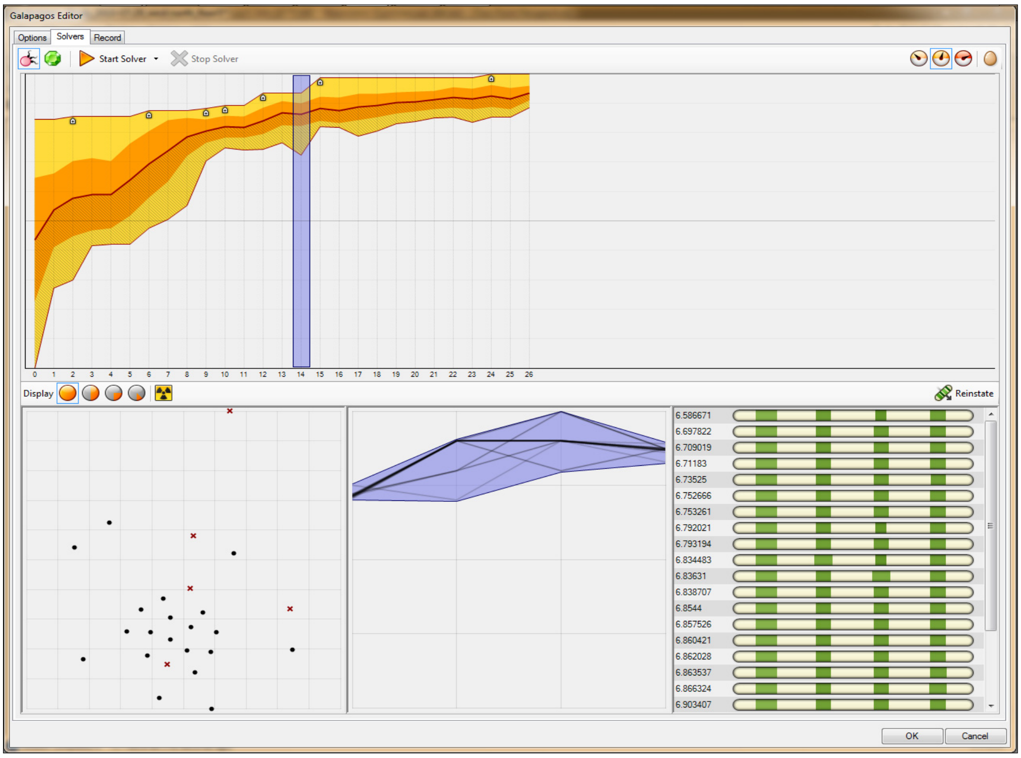

Table B 19 West-north Facade Floor5 Division Function

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
1,414	1,417	1,417	1,419	1,417	1,418	1,419	1,419	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,419	1,418	1,417	1,417	1,419	1,419	1,417	1,417	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,415	1,416	1,417	1,417	1,416	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,420	1,415	1,417	1,417	1,417	1,418	1,417	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,416	1,419	1,416	1,419	1,417	1,417	1,419	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,415	1,419	1,419	1,415	1,418	1,419	1,417	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,417	1,417	1,417	1,417	1,419	1,418	1,418	1,419	1,417	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,417	1,417	1,417	1,417	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,417	1,420	1,417	1,419	1,419	1,417	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,420	1,417	1,418	1,417	1,417	1,416	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,416	1,417	1,417	1,417	1,417	1,417	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,419	1,415	1,419	1,419	1,417	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,415	1,416	1,416	1,419	1,419	1,417	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,417	1,417	1,417	1,417	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,419	1,417	1,420	1,416	1,415	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,416	1,416	1,419	1,418	1,417	1,417	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,417	1,417	1,418	1,417	1,417	1,417	1,417	1,417	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,419	1,415	1,415	1,417	1,419	1,417	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,416	1,417	1,417	1,416	1,417	1,418	1,419	1,419	1,417	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,419	1,419	1,417	1,418	1,418	1,417	1,418	1,418	1,417	1,419	1,419	1,420	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,416	1,417	1,416	1,420	1,417	1,418	1,419	1,417	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,415	1,416	1,416	1,417	1,417	1,417	1,417	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,417	1,418	1,417	1,417	1,417	1,417	1,417	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,415	1,418	1,418	1,417	1,417	1,419	1,417	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
1,420	1,417	1,416	1,417	1,417	1,419	1,417	1,418	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419	1,419
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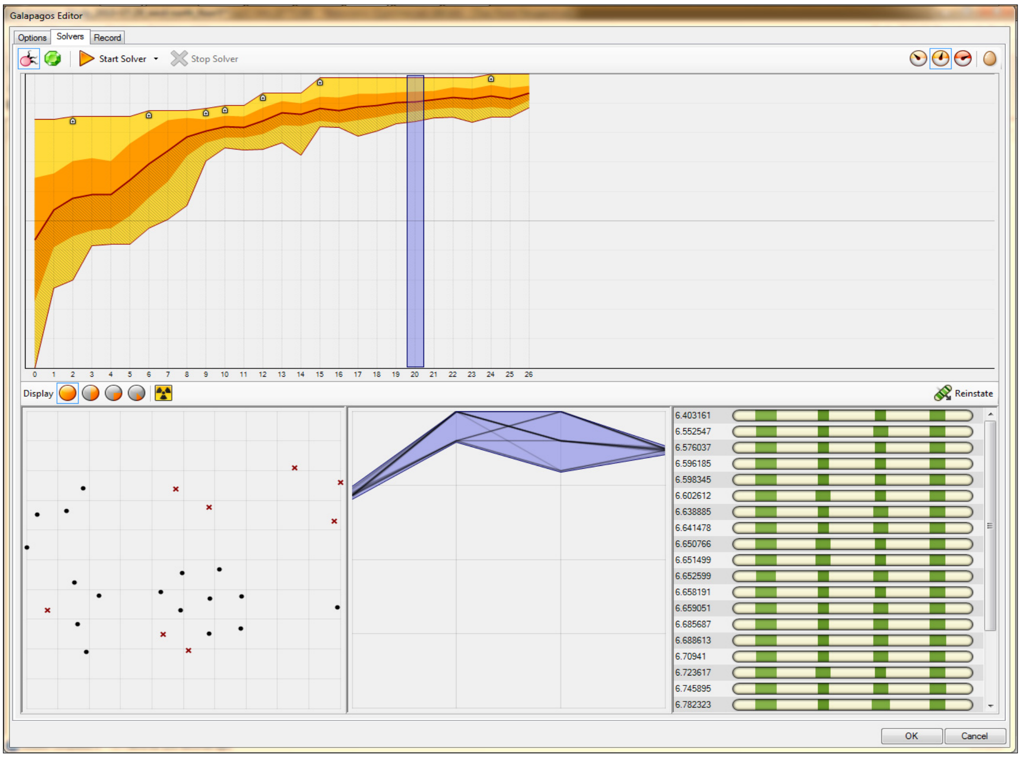

Table B 20 West-north Facade Floor5 Fitness Function

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
9,905	8,250	7,997	8,276	8,011	7,562	7,696	7,016	7,341	7,459	6,758	7,280	7,025	6,789	6,712	6,821	6,897	7,007	6,733	6,707	6,596	6,845	6,772	6,939	6,609	6,742	6,520
7,681	8,454	8,231	7,930	7,468	7,700	7,681	7,933	6,961	6,889	6,957	6,959	7,030	6,956	6,793	6,920	6,933	6,437	6,890	6,538	6,804	6,639	6,685	6,665	6,589	6,531	6,474
8,078	8,938	8,256	7,922	8,304	6,908	7,289	6,911	7,100	7,030	7,037	7,065	6,929	7,015	6,836	6,955	6,521	6,965	6,746	6,963	6,709	6,848	6,518	6,691	6,561	6,736	6,628
7,580	7,886	8,053	8,150	8,246	7,553	7,892	7,354	7,008	6,955	7,066	7,354	7,141	7,221	6,903	6,821	6,762	6,752	6,628	6,765	6,653	6,668	6,802	6,735	6,671	6,794	6,593
7,970	7,395	7,874	7,378	8,199	7,666	7,208	7,587	7,029	6,927	7,338	7,048	6,942	6,603	7,562	6,719	6,983	6,691	7,052	6,731	6,746	6,620	6,763	6,683	6,626	6,551	6,736
7,651	7,784	6,937	7,710	7,576	7,073	7,958	7,070	6,969	7,213	6,915	6,975	7,000	6,752	6,735	6,646	6,656	6,880	6,665	6,644	7,006	6,658	6,770	6,689	6,772	6,880	6,580
7,441	8,445	7,748	7,961	8,334	7,594	7,688	7,284	8,016	7,049	6,746	6,855	6,792	7,078	6,862	7,035	7,005	7,810	6,955	6,593	6,782	6,621	6,797	6,725	6,584	6,554	6,550
7,259	8,056	7,779	8,210	8,112	7,763	7,168	7,434	7,094	7,066	7,144	7,080	6,755	6,756	6,753	6,937	6,859	6,742	6,574	6,739	6,641	6,548	6,878	6,858	6,629	6,849	6,545
9,322	7,686	7,537	6,998	7,065	7,880	7,023	7,322	7,007	7,002	7,088	7,204	6,980	6,635	6,834	6,462	7,001	6,767	6,678	6,882	6,639	6,541	6,499	6,596	6,624	6,636	6,676
8,923	7,929	8,208	7,530	7,573	8,068	7,503	6,994	7,078	7,042	7,057	7,106	6,892	6,768	6,839	6,863	6,817	6,689	6,664	6,648	6,689	6,587	6,554	6,488	6,870	6,685	6,770
8,093	7,789	7,894	7,979	7,896	7,941	6,887	6,924	7,213	7,096	7,116	7,171	6,833	6,846	6,698	6,686	6,894	6,825	6,741	6,904	6,659	6,808	6,542	6,615	6,547	6,619	6,461
9,760	8,339	6,877	7,052	7,618	7,336	7,309	7,044	7,067	7,036	7,009	6,830	6,916	7,041	6,753	6,885	6,536	6,776	6,635	6,611	6,838	6,614	6,563	6,590	6,831	6,673	6,642
7,899	8,160	7,815	7,735	7,582	7,943	7,336	7,147	6,925	7,069	7,030	6,891	6,816	6,734	6,792	6,929	6,756	6,735	6,933	6,675	6,651	6,579	6,672	6,573	6,606	6,440	6,521
7,750	7,512	8,003	8,241	7,363	7,437	7,048	7,184	7,364	6,777	6,905	7,049	6,698	6,827	6,860	6,749	6,701	6,729	6,765	6,709	6,651	6,890	6,443	6,645	6,595	6,698	6,583
9,839	7,669	7,771	7,880	7,824	6,923	7,241	6,998	7,008	6,931	6,743	6,936	6,758	6,748	6,709	6,969	6,756	6,574	6,591	6,670	6,658	6,925	6,668	6,635	6,579	6,725	6,604
7,952	7,708	7,609	7,520	7,533	8,075	7,074	7,057	7,064	6,962	7,040	6,881	7,018	6,770	6,948	6,703	7,015	6,609	6,746	6,705	6,789	6,621	6,553	6,630	6,602	6,628	6,631
8,345	7,918	7,534	8,434	8,409	7,667	8,080	7,781	7,081	7,412	7,094	7,158	7,454	6,742	6,866	6,826	6,893	6,623	6,592	6,625	6,603	6,621	6,555	7,048	6,357	6,525	6,605
8,759	8,376	7,796	7,521	7,719	7,661	7,518	6,980	7,091	6,990	7,072	7,026	6,836	6,935	6,932	6,701	6,876	6,723	6,775	6,638	6,930	6,684	6,907	6,638	6,881	6,714	6,569
9,306	8,829	8,337	8,571	7,930	7,514	7,140	7,074	6,996	7,229	7,091	6,909	7,269	6,947	6,854	6,743	6,945	6,726	6,677	6,851	6,892	6,826	6,716	6,736	6,608	6,944	6,657
8,718	7,784	7,957	7,345	8,337	8,411	8,216	7,722	7,945	7,023	7,088	7,077	6,892	6,762	6,858	6,726	6,862	6,815	7,078	6,782	6,576	6,657	6,631	6,856	6,383	6,769	7,153
7,405	8,211	8,070	7,740	8,565	8,103	6,798	8,116	7,560	7,127	6,954	7,042	7,165	7,194	6,914	6,712	6,946	6,675	6,826	7,028	6,598	6,704	6,536	6,467	6,633	6,878	6,609
8,790	7,657	8,321	8,289	8,316	8,420	8,465	7,175	6,931	7,237	7,083	6,895	7,046	6,796	7,338	6,845	6,833	6,880	6,647	6,636	6,724	6,669	6,726	6,696	6,588	6,659	6,574
7,825	9,207	8,180	7,910	7,509	8,106	8,024	7,105	7,063	7,089	7,071	7,082	7,146	6,851	6,915	6,403	6,733	6,769	6,931	6,718	6,895	6,806	6,799	6,556	6,773	6,489	6,577
7,110	8,483	8,901	8,391	7,633	6,887	7,795	8,080	7,121	7,087	6,882	6,849	6,587	6,747	7,056	7,000	6,633	6,943	6,828	6,655	6,686	6,717	6,593	6,837	6,721	6,626	6,748
7,485	7,891	8,847	8,300	8,006	8,260	7,687	8,257	7,084	7,173	7,254	6,959	6,848	6,866	6,864	6,873	6,805	7,114	6,797	6,939	6,553	6,673	6,600	6,632	6,887	6,687	6,606
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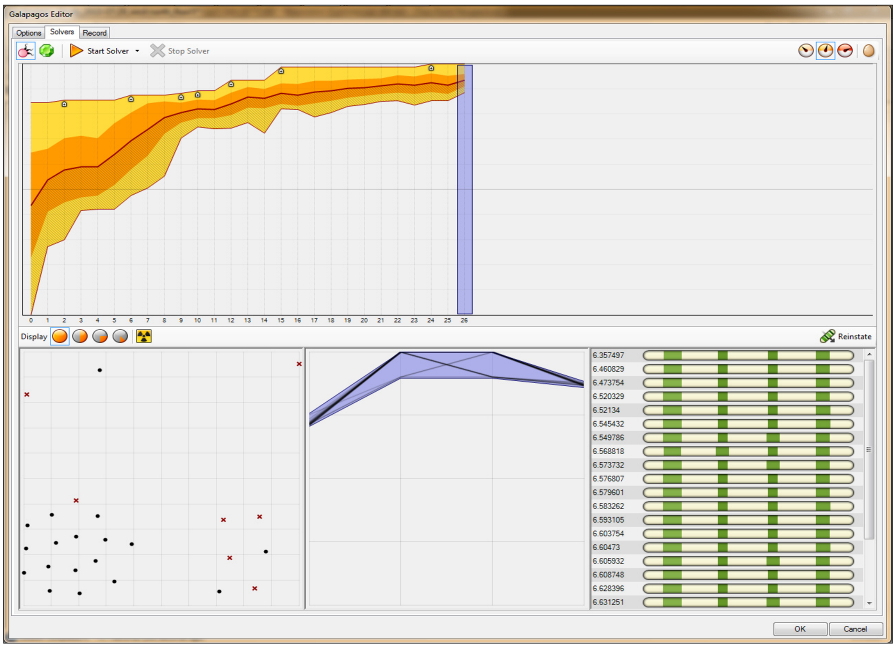

Table B 21 West-south Facade Floor1 Random Angle Seed

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
0	360	399	380	440	343	612	589	563	336	338	393	336	338	339	333	329	335	334	334	333	330	329	331	329	330	319
7	265	434	465	343	498	395	341	339	419	339	337	337	336	334	333	328	333	198	331	126	334	331	338	330	326	330
109	491	360	380	343	340	393	383	557	400	598	337	340	337	341	337	335	336	328	331	335	330	316	329	330	327	334
90	187	381	344	380	379	348	573	399	336	396	336	345	333	331	336	334	335	329	135	328	339	330	329	256	329	328
320	323	810	382	386	610	596	342	370	385	336	333	338	338	332	327	332	335	331	333	331	332	332	331	330	329	330
808	900	564	256	344	416	416	338	589	351	337	337	337	336	289	336	337	332	209	331	327	328	338	327	332	334	343
409	699	739	423	519	379	620	399	351	373	378	332	337	333	336	332	326	335	120	327	331	331	328	326	327	334	327
784	282	515	393	644	374	486	378	340	339	491	379	336	335	336	334	333	330	333	244	333	316	333	326	333	330	331
821	303	409	564	344	553	557	348	338	582	340	338	332	336	333	332	336	334	334	335	333	333	331	331	330	333	293
900	360	832	511	519	393	567	385	598	343	392	337	336	338	336	335	412	338	120	332	287	327	333	329	325	329	326
970	564	653	436	401	343	343	356	340	364	339	338	334	333	334	332	333	330	330	225	326	328	329	329	327	335	328
449	409	564	672	567	627	557	412	342	381	343	338	337	337	333	332	336	329	332	335	334	329	327	331	329	336	326
382	468	371	315	209	557	383	344	377	337	338	337	335	334	333	335	330	67	337	191	331	328	327	335	339	332	330
624	374	504	601	627	631	412	595	406	395	336	338	335	331	336	332	336	330	334	339	333	338	331	328	415	305	328
922	589	409	343	419	344	343	335	414	595	385	333	328	337	337	336	336	333	335	328	329	126	327	330	329	326	326
89	708	672	373	553	350	343	589	351	337	336	340	336	334	338	334	335	328	125	333	332	331	328	327	326	293	321
110	608	532	479	421	402	351	381	381	337	385	456	337	338	333	333	0	333	344	180	331	331	371	332	322	330	338
923	320	256	564	436	440	384	612	335	370	337	336	340	345	338	331	303	332	345	141	334	325	334	328	331	325	327
286	407	387	344	379	455	598	389	395	359	376	338	338	333	345	333	335	334	334	369	330	334	318	329	330	328	321
930	388	412	379	386	384	426	556	394	403	381	334	336	340	335	338	334	389	334	324	330	333	339	332	329	326	329
165	355	468	256	344	401	340	557	344	406	340	336	336	337	332	334	332	326	389	331	334	331	338	316	339	322	329
257	428	293	419	553	372	348	565	595	577	396	376	337	337	333	341	332	334	333	162	341	319	328	325	333	328	322
986	205	320	427	588	595	376	404	582	442	413	340	339	336	340	332	338	332	332	117	337	333	332	328	331	321	329
808	670	355	509	380	436	455	596	341	598	364	336	337	337	338	333	332	328	335	329	324	327	333	338	332	335	326
707	109	319	393	399	403	343	596	351	396	408	372	337	339	335	336	332	349	378	330	331	326	326	330	343	327	334
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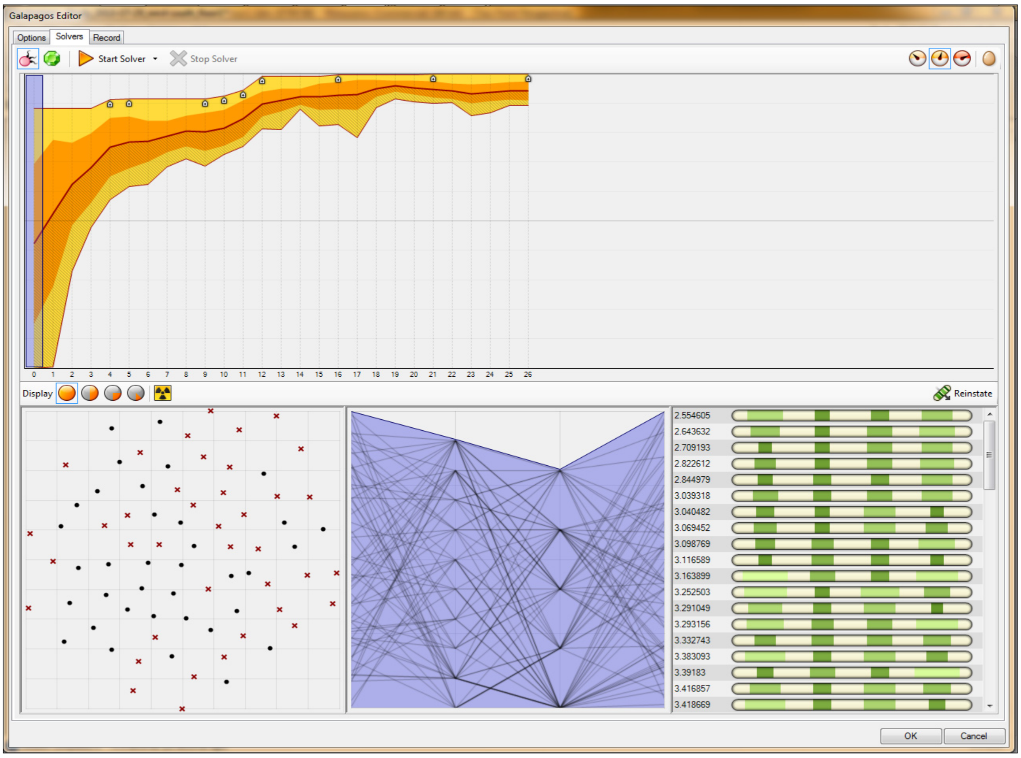

Table B 22 West-south Facade Floor1 Shading Depth

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
0,1	0,8	0,8	0,8	0,9	0,9	0,9	0,9	0,7	1,1	1,0	0,7	0,9	1,1	1,0	0,9	1,1	1,1	1,0	1,1	1,0	1,1	1,1	0,9	1,0	1,0	1,1
0,7	0,5	0,8	0,9	1,0	0,9	0,9	0,9	0,9	0,9	1,0	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1
0,2	0,9	0,8	0,8	1,1	1,1	0,9	0,9	0,9	0,9	0,8	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,0
0,2	0,4	0,8	1,0	0,8	0,8	1,0	0,8	0,9	1,1	0,9	1,1	1,1	1,1	1,1	1,0	1,0	1,0	1,1	1,1	1,1	1,0	1,0	1,1	1,1	1,0	1,1
0,2	0,6	0,9	0,8	0,8	0,9	0,8	1,0	0,9	0,9	1,1	1,0	0,9	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,0	1,0	1,1	0,9	1,1
0,3	0,9	0,9	0,8	1,1	0,9	0,9	0,9	1,0	1,0	1,1	1,1	1,1	1,0	1,1	0,9	1,1	0,9	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,0	1,0
0,8	0,4	0,5	0,8	0,9	0,8	0,9	0,9	0,9	0,9	0,9	1,1	1,1	1,0	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,0	1,0	1,1	1,0	1,0	1,1
0,6	1,0	0,6	0,8	0,9	1,0	0,8	0,9	0,9	1,0	0,8	0,9	1,0	1,1	1,0	1,0	1,0	1,1	1,1	1,1	1,1	1,0	1,0	1,0	1,1	1,0	1,0
0,1	1,0	0,8	0,8	1,0	0,9	0,8	0,9	0,9	0,8	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	0,9	1,0	1,1	1,1
0,9	0,9	0,9	0,9	0,8	0,9	0,8	0,9	0,8	0,9	0,9	1,0	1,0	1,1	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1
0,1	0,9	0,5	0,8	0,9	1,0	0,9	0,9	0,9	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,0	1,1	1,0	1,1
0,5	0,8	0,9	0,9	0,8	0,9	0,9	1,0	0,9	1,0	0,9	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1
0,1	0,8	0,8	0,6	0,9	0,8	0,9	0,9	1,0	0,9	1,0	0,9	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1
0,6	0,8	0,9	0,6	0,9	0,9	0,9	0,8	0,9	0,9	1,1	1,1	1,0	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1
0,5	0,9	0,9	1,0	0,8	0,9	0,3	1,1	1,0	1,0	0,9	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,0	1,1	1,0
1,0	0,9	0,5	0,8	0,9	1,0	1,0	0,9	0,9	0,8	0,9	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1
1,0	0,3	0,8	0,9	0,8	0,8	0,9	0,9	0,9	1,1	0,8	0,8	1,1	1,1	1,1	1,0	1,1	1,1	0,9	1,1	1,0	1,0	1,1	1,0	1,1	1,1	1,0
1,0	0,1	0,5	0,9	0,8	0,8	0,8	0,9	1,1	0,9	0,8	0,9	1,1	0,9	1,1	1,1	0,9	0,9	1,1	1,1	1,1	1,1	1,0	1,0	1,0	1,1	1,0
0,1	0,6	0,8	1,1	0,8	0,8	0,9	0,9	0,9	0,8	0,9	0,8	1,0	1,1	1,0	1,1	1,0	1,1	1,0	1,1	1,1	1,1	1,0	1,1	1,0	1,0	1,0
0,8	0,1	0,8	0,8	0,8	0,8	0,8	0,8	0,9	0,9	0,9	1,0	1,0	1,0	1,1	1,0	0,9	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,0	1,1	1,0
0,9	0,7	0,8	0,5	1,1	0,9	1,0	0,9	0,9	0,9	1,1	0,8	1,1	1,0	1,1	1,1	1,0	0,9	1,1	1,1	1,0	1,1	1,1	1,0	1,0	1,1	1,1
0,4	0,9	0,1	0,8	0,9	0,8	0,9	0,8	0,8	0,8	0,8	0,8	1,0	0,9	1,0	0,9	1,0	1,1	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,0	1,1
0,8	0,2	0,8	0,8	0,6	0,9	0,9	0,9	0,8	0,8	0,9	0,9	1,1	1,0	1,1	1,0	0,9	1,1	1,1	1,1	1,1	1,0	1,1	1,0	1,1	1,1	1,0
0,7	0,3	1,0	0,6	0,8	0,8	0,8	0,8	1,1	0,8	0,9	0,9	1,0	1,0	1,0	1,0	1,1	1,1	1,0	1,1	1,1	1,0	1,1	1,1	1,0	1,1	1,1
0,8	0,2	0,6	0,8	0,8	0,8	0,9	0,8	0,8	0,9	0,9	0,9	1,0	1,1	1,1	0,8	1,1	0,9	1,1	1,0	1,1	1,0	1,1	1,1	0,9	1,0	1,0
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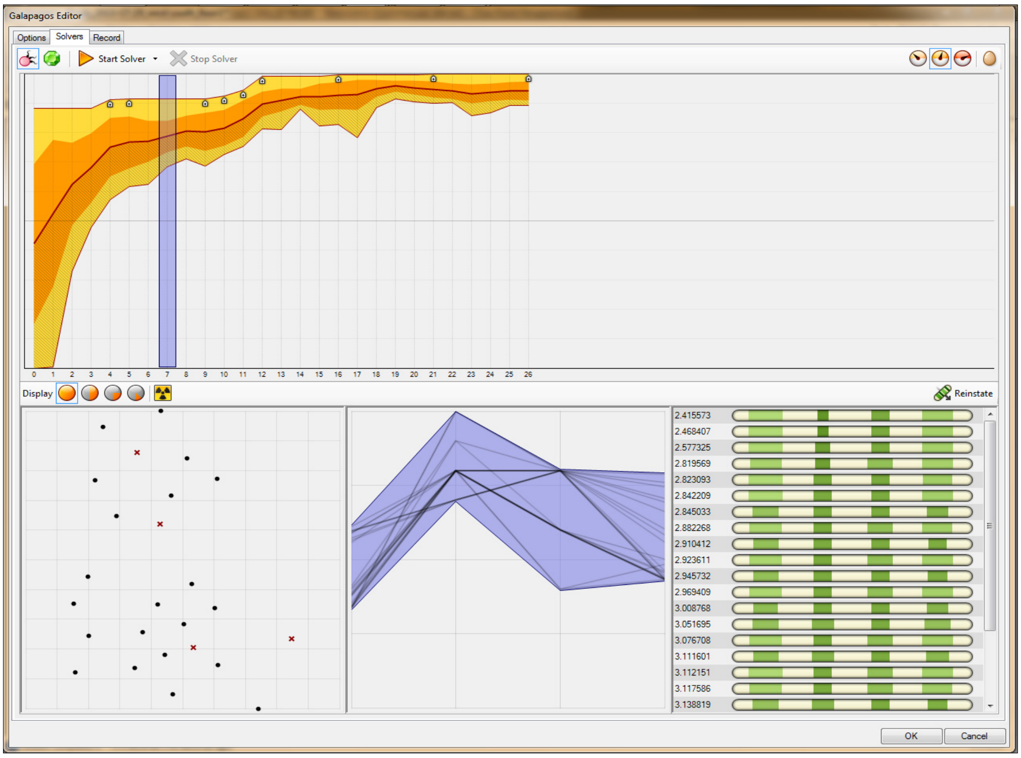

Table B 23 West-south Facade Floor1 Number of Divisions

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
8	10	10	10	11	11	12	12	12	12	11	11	11	12	12	12	13	13	13	13	12	13	13	13	13	13	13
12	10	10	12	11	11	11	12	12	11	11	12	11	12	12	13	12	12	13	13	13	13	12	12	13	13	13
8	8	10	10	11	12	11	11	12	11	12	12	12	13	12	13	13	12	13	13	12	13	13	13	12	13	13
8	10	10	11	10	10	11	12	11	12	11	12	12	12	12	13	13	13	13	13	13	13	13	13	13	13	13
10	11	10	10	10	12	12	12	11	11	12	12	12	12	12	12	12	12	13	13	13	12	13	13	12	12	13
10	12	12	9	10	11	10	12	12	11	12	12	12	13	12	13	11	13	13	13	13	12	13	13	13	13	13
10	11	10	10	12	9	12	10	11	11	11	12	12	12	12	11	12	13	13	13	13	13	13	13	13	13	12
8	9	10	10	12	11	11	11	12	12	12	11	12	12	13	13	13	13	13	13	13	13	13	13	13	13	13
9	11	10	12	12	13	12	10	12	12	12	12	13	13	11	13	13	13	13	13	13	13	13	12	13	13	13
12	10	12	12	12	11	12	11	12	12	11	12	12	12	13	13	12	13	12	13	13	13	12	13	13	12	13
9	12	11	10	11	11	11	11	11	11	12	12	12	12	12	11	13	13	13	13	12	13	13	13	13	13	13
11	10	12	12	12	12	12	11	11	11	12	12	12	12	12	13	13	13	13	13	13	13	13	13	13	13	13
9	10	10	11	12	12	11	11	11	12	12	12	12	12	12	13	12	13	13	13	13	12	13	13	13	13	13
8	10	10	11	12	12	11	12	11	11	12	11	12	12	13	13	13	13	12	13	11	13	13	13	13	13	13
8	10	9	12	10	12	12	12	11	12	11	12	13	12	12	13	13	13	13	13	13	13	13	12	13	13	13
9	9	11	10	12	11	12	12	11	12	11	12	13	13	13	13	13	13	13	13	13	13	12	12	13	13	13
8	8	10	9	10	10	11	11	11	12	12	12	11	12	12	13	13	11	12	13	13	13	12	13	13	13	13
11	9	8	12	10	11	10	12	12	10	12	11	12	12	11	12	11	11	13	13	12	13	13	13	13	13	13
9	9	10	11	10	11	12	11	10	10	10	12	12	12	12	12	13	13	13	12	12	12	13	13	12	13	13
12	8	8	10	10	10	10	11	11	10	11	12	12	12	12	12	12	12	13	13	13	13	12	12	12	13	13
10	11	10	9	12	11	12	12	12	11	12	12	12	12	13	12	13	12	12	13	13	12	13	13	13	12	13
10	8	9	10	12	10	11	12	12	12	11	12	12	12	12	12	11	13	13	12	13	13	12	12	13	13	13
9	8	9	8	11	12	11	11	12	12	11	12	12	12	12	13	12	13	12	12	13	12	12	12	12	13	13
9	11	11	10	9	10	10	12	12	12	11	11	12	11	12	11	13	12	12	13	13	13	13	13	12	13	12
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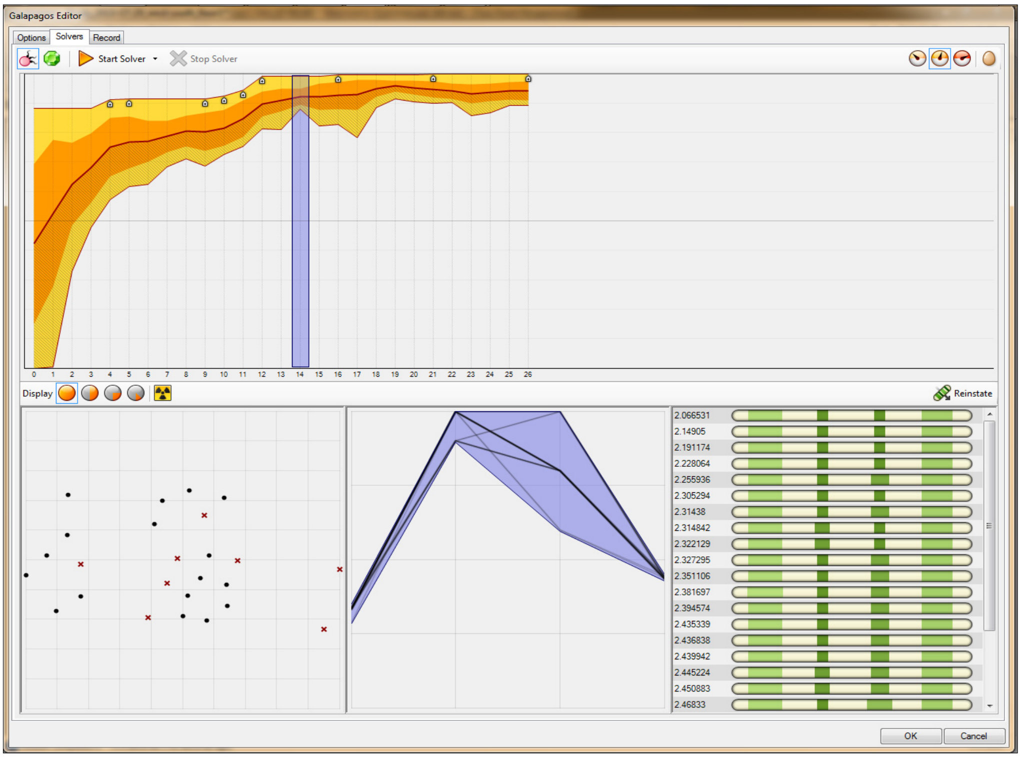

Table B 24 West-south Facade Floor1 Division Function

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
1,414	1,420	1,418	1,418	1,417	1,417	1,418	1,419	1,419	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,415	1,415	1,419	1,417	1,417	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,414	1,416	1,420	1,419	1,417	1,417	1,417	1,417	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,416	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,417	1,418	1,420	1,417	1,418	1,418	1,417	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,415	1,415	1,420	1,418	1,418	1,419	1,417	1,417	1,417	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,416	1,417	1,417	1,417	1,417	1,417
1,416	1,419	1,417	1,416	1,417	1,417	1,417	1,417	1,419	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,420	1,418	1,418	1,419	1,418	1,418	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,418	1,417	1,417	1,417	1,417
1,415	1,416	1,418	1,420	1,419	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,418	1,417	1,417	1,417	1,417	1,417	1,417
1,415	1,417	1,420	1,417	1,417	1,419	1,419	1,417	1,417	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,417	1,420	1,419	1,419	1,417	1,417	1,417	1,417	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,419	1,417	1,418	1,420	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,418	1,418	1,419	1,419	1,417	1,418	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,418	1,419	1,420	1,416	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,417	1,420	1,420	1,417	1,419	1,419	1,417	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,415	1,420	1,420	1,417	1,419	1,417	1,417	1,417	1,417	1,419	1,419	1,417	1,417	1,417	1,417	1,417	1,416	1,417	1,417	1,417	1,417	1,417	1,414	1,417	1,417	1,417	1,417
1,417	1,419	1,418	1,420	1,419	1,417	1,417	1,419	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,415	1,415	1,420	1,420	1,419	1,419	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,417	1,419	1,415	1,419	1,420	1,417	1,420	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,419	1,418	1,418	1,417	1,418	1,417	1,419	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,420	1,416	1,418	1,419	1,418	1,418	1,419	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,418	1,415	1,418	1,416	1,417	1,418	1,417	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,416	1,418	1,419	1,420	1,419	1,418	1,417	1,419	1,418	1,417	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,417	1,414	1,416	1,418	1,418	1,419	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,414	1,415	1,417	1,418	1,418	1,420	1,417	1,417	1,417	1,419	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
1,417	1,415	1,415	1,419	1,420	1,420	1,417	1,418	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417	1,417
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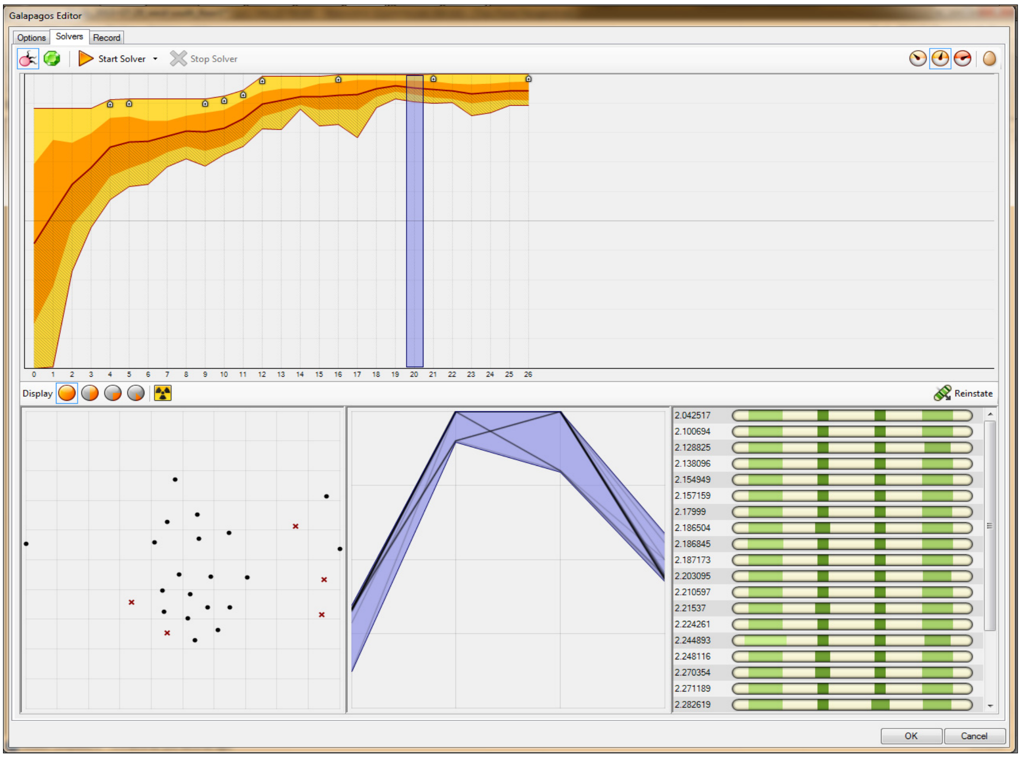

Table B 25 West-south Facade Floor1 Fitness Function

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
6,518	3,689	3,741	3,758	3,116	3,143	2,970	2,910	3,340	2,525	2,800	3,565	3,007	2,459	2,494	2,634	2,324	2,231	2,337	2,139	2,433	2,027	2,308	2,482	2,474	2,241	2,275
3,164	4,588	3,727	2,935	2,803	3,002	3,108	2,823	2,789	2,977	2,708	2,640	2,869	2,489	2,437	2,140	2,351	2,310	2,120	2,151	2,245	2,251	2,325	2,373	2,239	2,324	2,074
6,167	3,822	3,688	3,737	2,716	2,416	2,932	3,148	2,864	3,045	3,091	2,700	2,462	2,295	2,475	2,304	2,162	2,428	2,213	2,180	2,452	2,088	2,449	2,256	2,330	2,303	2,296
6,178	5,092	3,540	2,768	3,724	3,616	2,822	3,052	3,035	2,408	3,175	2,419	2,364	2,259	2,314	2,321	2,326	2,363	2,294	2,262	2,157	2,350	2,237	2,305	2,302	2,514	2,263
5,963	4,001	3,438	3,575	3,633	2,819	3,159	2,577	3,206	3,064	2,368	2,470	2,864	2,451	2,327	2,503	2,402	2,573	2,067	2,155	2,155	2,327	2,216	2,245	2,329	2,915	2,026
5,542	2,813	2,816	3,830	3,084	3,188	3,386	2,842	2,666	2,770	2,507	2,523	2,562	2,275	2,382	2,459	2,745	2,503	2,279	2,136	2,187	2,405	2,217	2,234	2,167	2,300	2,343
3,626	4,929	4,782	3,637	2,824	3,820	2,970	3,448	2,985	3,087	2,954	2,364	2,543	2,445	2,484	2,579	2,496	2,298	2,161	2,259	2,138	2,234	2,464	2,288	2,377	2,316	2,456
4,758	3,194	4,425	3,752	2,776	2,879	3,366	2,969	2,810	2,491	3,097	3,101	2,503	2,453	2,322	2,349	2,228	2,168	2,069	2,165	2,129	2,402	2,208	2,403	2,151	2,232	2,183
6,465	2,859	3,644	3,027	2,418	2,606	3,160	3,361	2,831	3,096	2,656	2,621	2,067	2,347	2,566	2,187	2,222	2,272	2,324	2,240	2,180	2,132	2,133	2,726	2,245	2,171	2,193
2,845	3,390	2,818	2,806	3,108	2,817	3,118	2,924	3,066	2,843	3,062	2,656	2,516	2,419	2,315	2,390	2,496	2,218	2,483	2,141	2,187	2,181	2,299	2,433	2,376	2,478	2,380
6,466	2,702	4,510	3,641	2,985	2,787	3,129	3,112	2,939	2,876	2,536	2,419	2,397	2,285	2,435	2,545	2,043	2,155	2,142	2,189	2,444	2,153	2,291	2,496	2,194	2,367	2,236
4,466	3,646	2,861	2,940	3,154	2,818	2,808	2,820	2,868	2,693	2,820	2,594	2,451	2,533	2,445	2,113	[illegible]	2,329	2,179	2,216	2,203	2,334	[illegible]	2,135	2,437	2,161	2,190
6,446	3,738	3,566	4,035	2,759	3,072	3,113	3,203	2,787	2,910	2,560	2,892	2,432	2,435	[illegible]	2,391	2,365	2,185	2,223	2,201	2,187	2,474	2,217	[illegible]	[illegible]	2,113	2,134
4,820	3,805	3,451	4,040	2,848	2,781	3,172	3,112	3,047	3,112	2,458	2,549	2,544	2,299	2,305	2,187	2,305	2,194	2,310	2,143	2,636	2,184	2,227	2,176	2,338	2,033	2,162
[illegible]	3,375	3,594	2,560	3,676	2,808	5,231	2,468	2,771	2,478	3,088	[illegible]	2,223	2,536	2,535	2,333	[illegible]	2,056	[illegible]	2,413	2,337	[illegible]	2,225	2,345	2,481	[illegible]	2,441
3,253	3,721	4,466	3,740	2,828	2,833	2,523	2,946	3,066	3,191	3,012	2,448	2,244	2,228	2,191	[illegible]	2,398	2,229	2,167	2,139	[illegible]	2,145	2,407	2,418	2,350	2,171	2,421
3,620	5,830	3,837	3,787	3,655	3,691	2,878	2,882	2,870	2,481	3,018	3,131	2,737	2,324	2,351	[illegible]	[illegible]	2,673	2,839	[illegible]	2,215	[illegible]	2,457	2,315	2,069	2,123	2,398
2,709	6,497	[illegible]	2,843	3,622	3,261	3,714	3,009	2,458	3,324	3,252	2,964	2,360	2,727	2,468	2,353	3,071	2,996	2,229	2,208	[illegible]	2,406	2,324	2,459	[illegible]	2,326	2,451
6,483	4,528	3,713	2,871	3,561	3,303	2,815	3,077	3,326	3,603	3,155	3,130	2,550	[illegible]	2,473	2,354	2,354	2,229	2,314	2,320	2,331	2,328	2,440	2,312	2,485	2,463	2,509
3,117	6,550	4,335	3,641	3,597	3,668	3,645	3,498	3,072	3,435	2,895	2,507	2,543	2,518	2,395	2,637	2,797	2,467	[illegible]	2,234	2,211	[illegible]	2,443	2,370	2,672	2,325	2,469
3,383	3,546	3,660	4,834	2,503	3,012	2,634	2,845	2,807	3,108	2,492	3,127	2,315	2,647	2,149	2,360	2,209	3,027	2,491	2,147	2,348	2,356	2,216	2,465	[illegible]	[illegible]	2,324
5,159	3,887	6,495	3,652	2,931	3,685	3,031	3,139	3,061	3,181	3,424	3,121	2,646	2,945	2,451	2,824	2,709	[illegible]	2,129	2,452	[illegible]	[illegible]	2,474	2,560	2,166	2,485	2,064
3,952	6,194	3,938	4,327	3,991	2,799	3,045	3,118	2,996	3,021	3,040	2,768	2,386	2,511	2,440	2,215	2,759	2,157	2,334	2,383	2,226	2,478	2,405	2,665	2,345	2,428	2,487
4,135	5,297	2,750	4,377	3,950	3,608	3,560	3,143	2,465	3,122	3,143	3,033	2,667	2,881	2,604	2,821	2,200	2,433	2,541	2,231	[illegible]	2,380	2,089	2,216	2,457	2,231	2,399
3,333	6,199	3,944	3,703	3,726	3,750	2,873	3,177	3,305	3,137	3,038	2,904	2,663	2,524	[illegible]	2,908	2,167	2,892	2,354	[illegible]	2,101	2,400	2,344	2,169	2,625	2,422	2,528
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6,183																										
4,694																										
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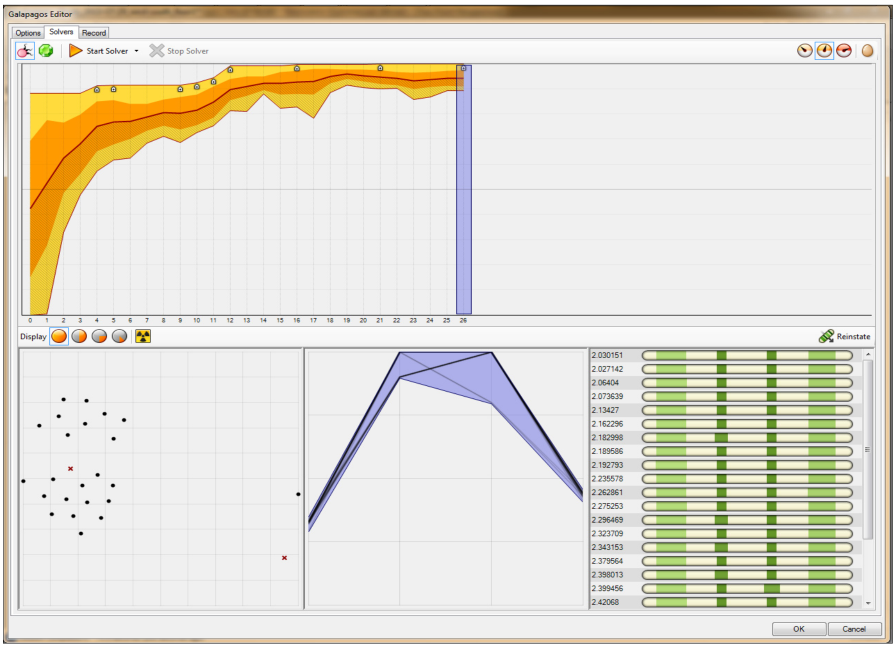

Table B 26 West-south Facade Floor5 Random Angle Seed

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
0	493	980	495	472	255	349	497	506	451	475	512	519	522	554	553	550	551	554	554	551	543	551	577	546	546	551
383	571	401	480	522	350	476	480	464	435	445	442	548	554	552	554	552	550	552	555	551	551	549	550	546	548	550
960	513	505	401	491	481	482	366	366	525	443	556	556	554	553	554	554	555	550	554	552	719	549	553	546	551	544
283	712	513	420	565	442	367	514	475	490	424	533	554	543	552	551	552	551	553	488	551	552	585	550	551	550	551
805	721	384	491	809	477	501	459	470	509	442	532	542	501	554	552	551	544	551	551	534	550	550	551	551	551	551
774	505	505	672	479	479	333	477	558	470	490	539	442	556	554	554	553	554	473	552	548	549	719	551	551	551	554
257	381	608	605	870	476	476	517	492	539	369	331	535	537	553	551	555	551	551	553	552	549	550	546	551	550	551
591	318	497	532	354	417	481	474	490	381	442	515	554	530	551	552	551	554	552	551	552	552	546	572	550	546	553
440	884	505	479	233	482	535	536	536	514	556	550	515	554	550	558	548	550	552	551	559	556	553	544	554	550	543
784	530	202	477	282	372	470	468	538	542	551	551	514	554	554	554	551	552	550	552	552	557	552	551	551	552	552
932	844	421	479	346	528	372	354	527	453	430	468	554	553	554	552	553	550	553	553	553	548	551	554	547	551	547
672	505	677	479	473	479	561	493	497	444	449	556	551	550	550	552	555	555	548	551	547	552	550	552	552	551	554
34	127	429	497	488	492	462	419	458	442	521	526	554	552	553	550	552	553	551	551	551	551	557	551	550	552	551
160	434	365	865	479	499	493	478	546	449	532	491	512	598	551	551	555	554	552	553	551	552	551	551	551	552	553
491	505	479	550	479	346	350	509	480	444	503	445	515	554	552	554	554	555	551	548	549	551	551	584	554	551	543
57	677	495	774	535	333	448	558	525	531	537	550	532	529	545	553	554	550	555	488	552	552	551	551	551	554	551
884	344	480	550	591	668	456	452	490	443	428	446	420	512	552	551	555	551	554	552	553	551	551	551	551	551	548
715	346	290	473	488	472	668	536	419	490	550	382	557	514	556	554	553	555	551	552	550	553	547	546	555	551	550
626	290	473	402	483	546	509	473	506	556	493	512	431	509	550	555	552	556	551	550	560	553	553	552	580	551	551
518	657	458	891	481	686	405	466	443	377	453	427	448	557	552	552	550	552	550	549	547	549	551	550	551	574	552
709	513	844	495	482	472	536	367	476	419	539	442	550	550	554	556	557	552	552	552	551	552	552	553	572	544	550
794	857	672	488	485	498	451	480	408	462	452	512	532	543	520	550	557	552	554	550	550	551	584	549	576	574	551
686	311	587	531	737	486	678	474	444	437	486	539	546	521	556	553	550	552	557	544	550	551	550	551	550	550	550
496	803	550	587	400	535	477	476	421	366	444	452	442	554	554	552	552	555	555	552	551	546	551	551	551	551	547
318	580	341	233	493	599	454	481	434	472	503	413	500	521	553	551	552	552	552	553	552	547	549	551	551	551	551
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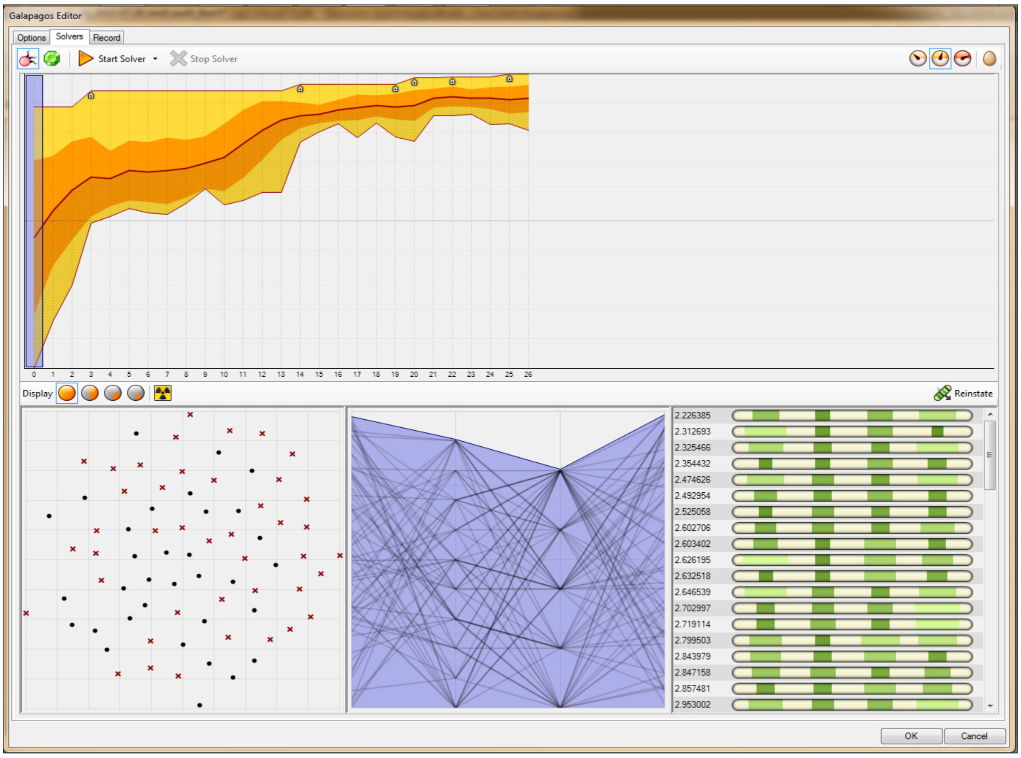

Table B 27 West-south Facade Floor5 Number of Divisions

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26
8	12	12	12	9	9	10	11	11	11	10	11	11	11	11	11	11	11	11	10	11	11	12	12	12	12	12
9	10	12	12	11	10	11	11	11	10	11	11	11	11	11	11	11	11	11	11	12	12	12	12	11	11	12
12	12	10	12	11	11	11	10	10	11	11	11	11	11	10	11	10	11	11	12	12	12	11	13	11	11	11
9	9	11	10	12	10	10	11	9	10	10	10	11	10	10	11	12	11	12	11	11	12	12	12	12	12	12
10	10	10	12	12	9	9	11	10	11	11	10	10	10	11	11	11	11	11	11	11	11	11	12	12	12	11
12	12	12	12	11	11	9	11	11	10	9	11	12	11	11	11	11	11	11	12	11	11	12	12	12	11	12
12	11	10	12	12	11	9	11	10	10	10	11	10	10	11	11	11	12	11	10	11	11	12	11	11	12	12
11	9	12	9	10	10	10	9	11	10	11	11	11	11	11	11	11	12	11	11	11	10	11	12	12	12	12
10	10	11	12	9	11	9	10	8	11	11	10	11	11	11	11	11	11	11	12	12	11	13	12	12	11	12
8	10	10	10	10	10	9	11	10	9	11	11	11	11	12	11	11	10	11	11	11	11	12	12	12	13	12
11	12	12	12	10	11	10	10	10	11	10	11	11	11	11	11	11	11	12	11	12	11	12	12	12	12	11
8	12	12	11	11	12	11	11	10	11	11	11	11	11	11	11	12	11	11	12	11	13	11	11	13	12	12
9	10	10	12	12	11	11	11	11	11	11	11	11	11	11	11	12	10	12	11	12	12	11	13	12	12	12
12	8	10	12	11	11	11	10	10	11	11	11	11	10	11	11	11	12	11	11	12	11	12	12	11	12	12
12	11	12	11	12	11	10	11	11	11	11	11	11	10	11	12	11	12	11	11	11	11	12	12	11	12	12
11	12	12	12	9	10	10	11	11	11	10	11	11	11	10	11	11	11	11	11	10	12	12	12	12	12	12
10	11	9	11	12	12	10	10	11	11	11	10	11	11	10	11	11	11	11	11	11	12	12	12	12	12	11
12	12	9	11	11	9	12	9	11	11	11	11	11	11	11	11	11	11	12	11	10	12	11	11	12	12	11
10	8	11	10	12	11	11	11	11	11	11	10	10	10	11	11	11	11	11	11	11	11	10	11	11	12	12
10	10	8	12	11	12	11	9	11	11	11	10	11	11	11	11	11	10	11	11	11	11	11	12	12	12	12
8	11	12	12	10	10	9	10	10	11	11	11	11	11	11	11	12	11	10	11	13	11	12	11	12	11	10
9	12	9	11	11	9	10	10	10	11	10	12	10	10	11	11	11	12	11	11	11	12	12	12	12	10	11
12	8	12	10	12	11	12	9	11	11	11	11	11	11	11	11	11	11	11	11	11	10	11	12	12	12	11
10	10	11	12	12	9	11	9	10	10	11	10	10	11	11	10	11	11	12	11	11	12	13	12	12	12	12
12	10	8	10	11	12	11	10	11	10	10	10	11	11	11	11	11	11	11	11	11	11	11	12	12	12	11
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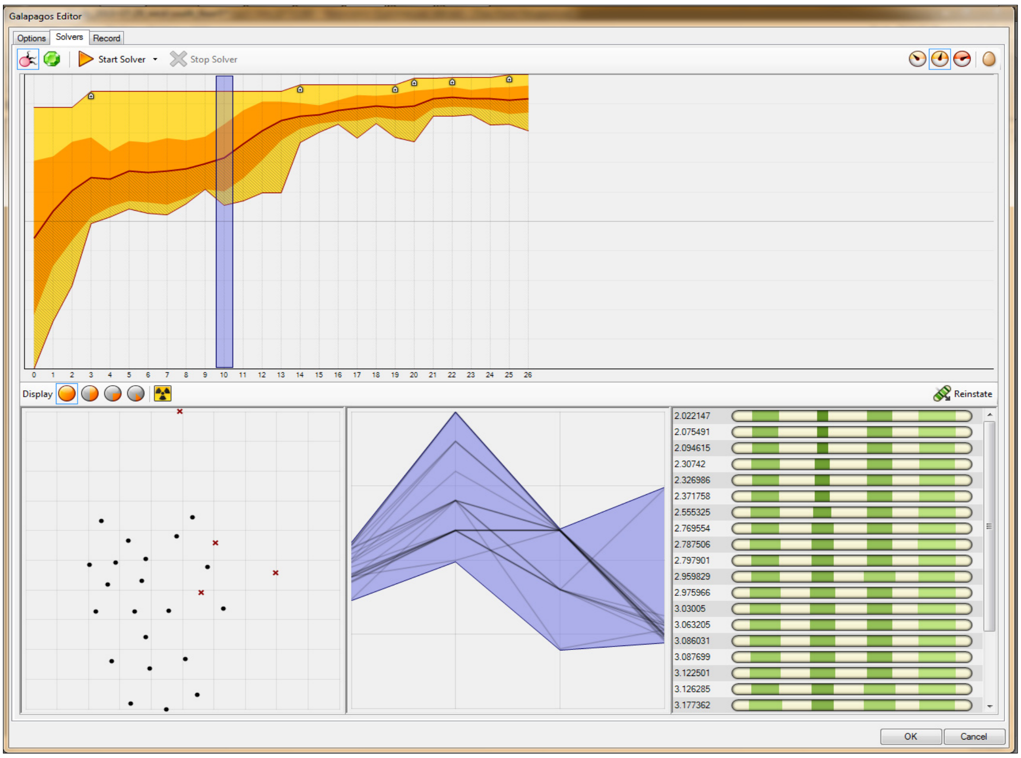

Table B 28 West-south Facade Floor5 Shading Depth

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
0,1	0,5	0,7	0,5	0,8	0,8	0,8	0,7	0,6	0,7	0,7	1,0	1,0	1,0	1,1	1,1	1,0	1,0	1,0	1,0	1,1	1,1	1,1	0,9	1,0	1,0	1,1
1,0	0,8	0,5	0,5	0,8	0,8	0,6	0,7	0,7	0,7	0,7	0,7	1,0	1,1	1,0	1,0	1,0	1,0	1,0	1,0	1,1	1,0	1,0	0,9	1,0	1,0	1,0
0,7	0,6	0,8	0,5	0,7	0,6	0,7	0,8	0,8	1,0	0,8	1,1	1,1	1,1	1,0	1,0	1,1	1,0	0,9	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1
0,3	0,4	0,5	0,7	0,5	0,8	0,8	0,6	0,6	0,8	0,7	0,8	1,1	1,0	1,1	1,0	1,0	1,0	1,0	1,1	1,0	1,0	1,0	1,0	1,1	1,0	1,0
0,9	0,6	0,8	0,7	0,5	0,8	0,8	0,7	0,7	0,7	0,7	0,9	1,0	0,7	1,1	1,0	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1	1,1
0,2	0,8	0,8	0,6	1,0	0,7	0,8	0,7	1,0	0,7	0,8	0,8	0,7	1,0	1,0	1,0	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,0	1,0	1,0	1,0
0,8	0,7	0,5	0,5	0,5	0,7	0,8	1,0	0,7	0,8	0,8	0,7	0,9	0,9	1,0	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,0	1,0	0,9	1,1	1,1
0,2	0,4	0,7	0,8	0,9	0,8	0,7	0,8	0,7	0,8	0,7	1,0	1,1	0,9	1,0	1,1	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,0	1,0	1,0	1,1
0,6	0,5	0,6	0,7	0,9	0,8	0,9	0,9	0,9	0,8	1,1	1,1	1,0	1,1	1,0	1,1	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,0	1,1
0,5	0,6	0,9	0,8	0,9	0,8	0,8	0,7	0,8	0,9	1,0	1,1	1,0	1,0	1,1	0,9	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1
1,0	0,6	0,7	0,7	0,8	1,0	0,8	0,8	0,9	0,7	0,7	0,8	1,1	1,0	1,1	1,0	1,0	1,0	0,9	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,1
0,4	0,7	0,6	1,0	0,7	0,7	1,1	0,8	0,7	0,7	0,7	1,1	1,1	1,0	0,9	1,0	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	0,9	1,1
0,5	1,0	0,7	0,5	0,7	0,7	0,7	0,7	0,7	0,7	0,8	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,0	1,1	1,1
0,6	0,6	1,0	0,5	0,8	1,0	0,8	0,7	0,9	0,7	1,0	0,7	0,9	1,0	1,1	1,0	1,1	1,0	1,0	1,1	0,9	1,1	1,1	1,0	1,1	1,1	1,1
0,5	0,7	0,7	1,1	0,7	0,8	0,8	1,1	0,7	0,7	1,0	0,7	1,0	1,1	1,0	1,0	1,0	1,1	1,0	1,1	1,1	1,1	1,0	0,9	1,1	1,1	1,1
0,2	0,4	0,5	0,5	0,8	0,7	0,8	1,1	1,0	1,0	0,8	1,1	1,0	1,0	1,0	1,0	1,0	1,1	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1
0,6	0,1	0,5	1,0	0,5	0,6	0,8	0,6	0,6	0,7	0,7	0,6	0,7	0,9	1,0	1,0	1,1	1,0	1,0	1,1	0,9	1,1	1,0	1,1	1,1	1,1	1,0
0,8	0,7	0,4	0,7	0,6	0,9	0,7	0,9	0,7	0,7	1,1	0,7	1,1	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,1	1,1	1,0
1,0	0,3	0,7	1,0	0,5	0,4	1,0	0,6	0,8	1,0	0,9	1,0	0,7	0,7	1,0	1,0	1,0	1,0	1,1	1,0	1,1	1,1	1,1	1,1	1,0	1,0	1,1
0,1	0,5	0,6	0,6	0,6	0,5	0,7	0,8	0,7	0,6	0,7	0,7	0,7	1,0	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,1	1,1	1,0	1,0	0,9	1,1
0,4	0,5	0,5	0,5	0,8	0,8	0,9	0,8	0,8	0,7	0,8	0,7	1,0	1,0	1,0	1,0	1,1	1,1	1,0	1,1	1,1	1,1	1,0	1,1	0,9	1,1	1,0
0,4	0,3	0,4	0,6	0,6	0,8	0,6	0,7	0,7	0,7	0,7	1,0	0,8	1,0	1,0	1,0	1,0	1,0	1,1	0,9	0,8	1,1	0,9	1,0	0,9	1,0	1,1
0,5	0,7	0,5	0,5	0,5	0,6	0,5	0,7	0,7	0,7	0,6	1,0	1,0	1,0	1,0	1,0	1,0	1,1	1,0	1,0	0,9	1,0	1,1	1,0	0,9	0,9	1,0
0,6	0,8	1,0	0,5	0,5	0,9	0,7	0,8	0,8	0,8	0,6	0,7	0,7	1,0	0,9	1,0	1,0	1,1	1,1	0,9	1,1	1,1	1,1	1,1	1,1	1,1	1,1
0,9	0,5	0,3	0,9	0,7	0,5	0,6	0,7	0,7	0,7	0,8	0,7	0,7	1,0	0,9	1,0	1,1	1,0	1,1	1,0	1,0	1,1	1,1	1,0	1,0	1,1	0,9
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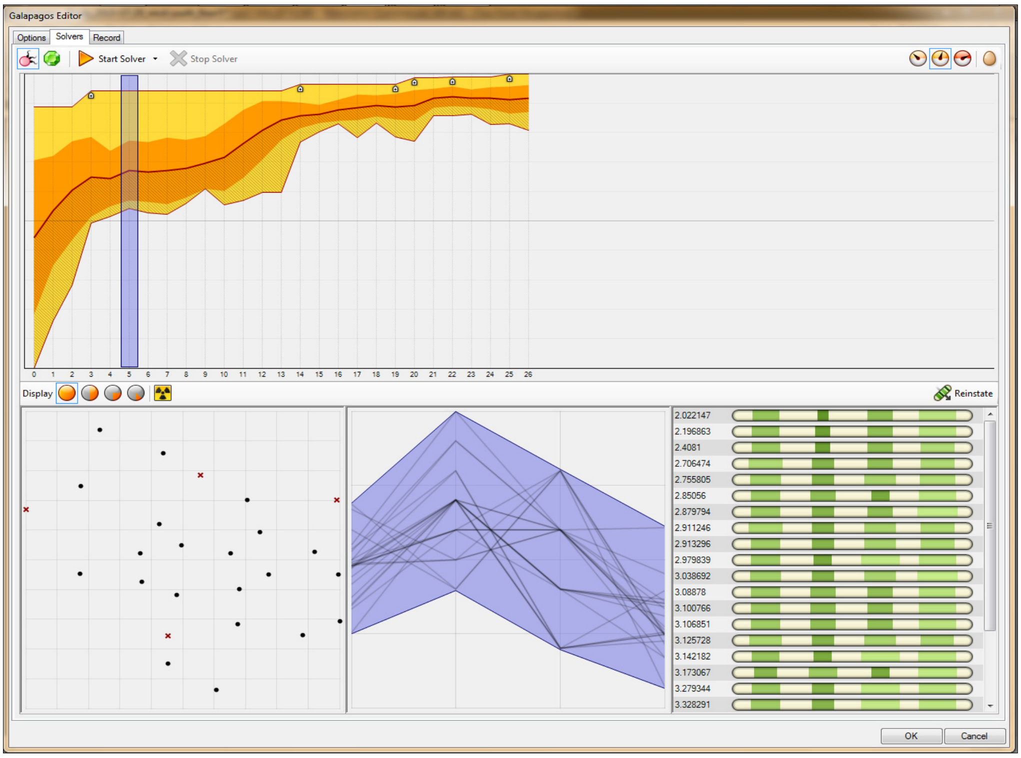

Table B 29 West-south Facade Floor5 Division Function

Gen _0	Gen _1	Gen _2	Gen _3	Gen _4	Gen _5	Gen _6	Gen _7	Gen _8	Gen _9	Gen _10	Gen _11	Gen _12	Gen _13	Gen _14	Gen _15	Gen _16	Gen _17	Gen _18	Gen _19	Gen _20	Gen _21	Gen _22	Gen _23	Gen _24	Gen _25	Gen _26
1,414	1,418	1,416	1,418	1,416	1,417	1,416	1,415	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,417	1,417	1,418	1,418	1,418
1,415	1,415	1,418	1,417	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,417	1,417	1,416	1,416	1,416	1,416	1,417
1,420	1,415	1,415	1,418	1,417	1,418	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,418	1,416	1,418	1,417
1,418	1,416	1,414	1,416	1,415	1,415	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,418	1,417	1,418
1,417	1,419	1,416	1,417	1,418	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,417	1,418	1,417
1,415	1,417	1,417	1,415	1,417	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,417	1,417	1,418
1,415	1,419	1,419	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,418	1,418
1,417	1,418	1,418	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,417	1,416	1,418	1,418
1,417	1,418	1,416	1,416	1,417	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,418	1,418	1,418	1,416	1,418
1,418	1,420	1,417	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,417	1,418	1,418	1,418
1,419	1,418	1,416	1,417	1,416	1,416	1,416	1,416	1,416	1,416	1,419	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,417	1,418	1,418	1,418	1,416
1,418	1,416	1,415	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,418	1,416	1,418	1,416	1,416	1,418	1,416	1,418
1,417	1,416	1,416	1,418	1,416	1,416	1,416	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,417	1,416	1,418	1,416	1,418	1,418
1,415	1,419	1,416	1,415	1,415	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,417	1,416	1,418	1,418
1,418	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,415	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,418	1,416	1,418	1,417	1,417	1,418
1,419	1,416	1,418	1,418	1,416	1,416	1,418	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,417	1,417	1,418	1,418
1,418	1,418	1,419	1,415	1,414	1,415	1,415	1,417	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,418	1,416	1,417	1,418	1,418	1,416
1,416	1,417	1,416	1,416	1,415	1,416	1,416	1,416	1,418	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,418	1,417	1,416
1,419	1,415	1,416	1,416	1,417	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,418	1,418
1,420	1,417	1,419	1,417	1,417	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,417	1,418
1,415	1,414	1,418	1,418	1,415	1,416	1,416	1,418	1,416	1,418	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,418	1,416	1,417	1,416	1,418	1,416	1,416
1,420	1,416	1,416	1,416	1,416	1,416	1,417	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,417	1,416	1,418
1,416	1,415	1,415	1,418	1,415	1,417	1,416	1,416	1,415	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,417
1,419	1,414	1,415	1,414	1,418	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,418	1,418	1,417	1,416	1,417
1,415	1,419	1,418	1,417	1,416	1,415	1,417	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,417	1,417	1,416
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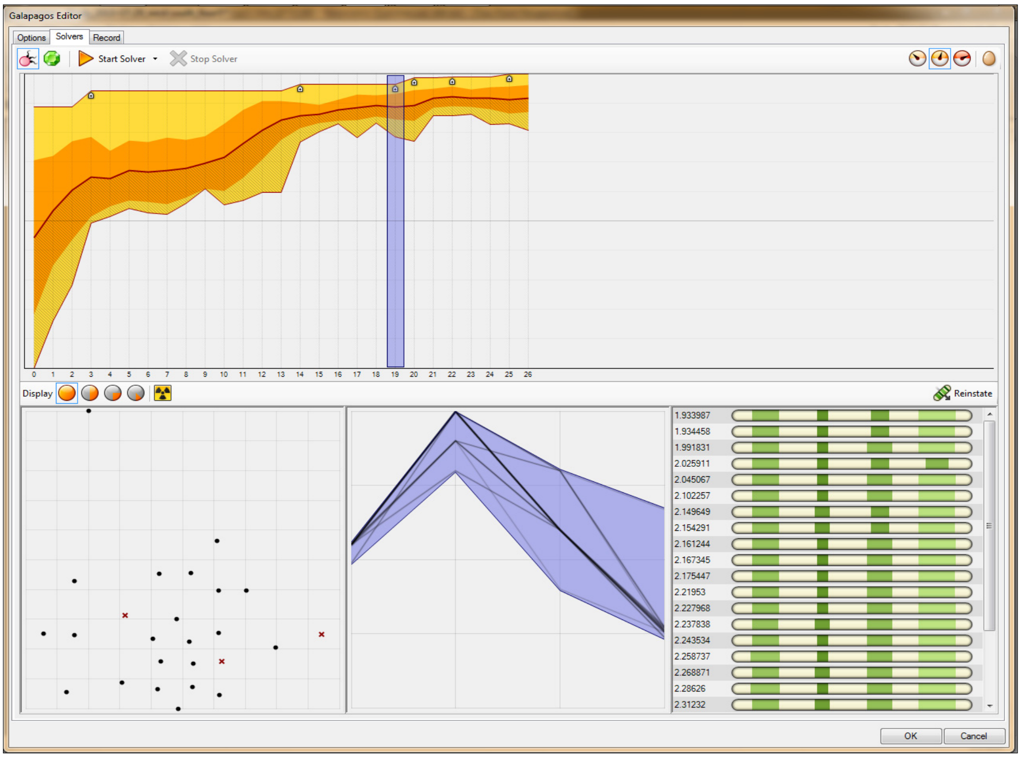

Table B 30 West-south Facade Floor5 Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26
5,540	3,539	2,787	3,605	3,250	3,358	3,043	3,020	3,451	2,986	3,266	2,407	2,413	2,436	2,226	2,327	2,344	2,348	2,402	2,607	2,266	1,963	2,118	2,319	2,135	2,190	2,140
2,800	3,112	3,551	3,542	2,906	2,911	3,424	3,042	2,961	3,259	3,086	3,050	2,360	2,112	2,257	2,392	2,346	2,311	2,391	2,238	2,033	2,179	2,179	2,168	2,332	2,376	2,019
2,961	3,137	2,975	3,567	3,162	3,492	3,157	3,096	3,063	2,181	2,788	2,186	2,069	2,196	2,665	2,357	2,418	2,230	2,432	2,154	1,944	2,044	2,285	2,000	2,142	2,269	2,175
4,844	4,507	3,692	3,201	3,512	3,039	3,143	3,403	3,775	3,029	3,302	3,009	2,212	2,419	2,318	2,315	2,107	2,321	2,159	2,286	2,352	2,106	2,036	2,032	1,998	2,052	2,211
2,857	3,757	3,002	2,823	3,646	3,328	3,308	3,146	3,367	3,032	3,030	2,857	2,518	3,321	2,176	2,288	2,329	2,291	2,220	2,228	2,214	2,119	2,061	2,141	2,070	2,162	2,322
4,818	2,483	2,576	3,148	2,579	3,107	3,367	3,020	2,232	3,238	3,258	2,828	2,795	2,331	2,402	2,388	2,313	2,405	2,160	1,934	2,173	2,221	1,942	2,131	2,156	2,340	2,263
2,475	3,148	4,009	3,696	3,547	3,089	3,356	2,333	3,320	3,009	3,177	3,082	2,852	2,767	2,450	2,319	2,272	2,149	2,339	2,678	2,109	2,104	2,018	2,296	2,603	1,801	2,148
4,917	4,585	2,814	3,460	2,801	2,756	3,381	3,421	3,096	2,981	3,063	2,348	2,233	2,478	2,341	2,110	2,303	2,190	2,114	2,175	2,213	2,282	2,204	2,170	1,979	2,186	2,035
3,674	4,024	3,407	2,811	3,134	2,880	3,151	2,795	3,316	2,732	2,075	2,331	2,416	2,240	2,235	2,247	2,373	2,067	2,126	2,150	2,016	2,157	1,844	2,045	2,055	2,329	1,913
4,483	3,693	2,859	3,003	2,889	3,126	3,298	3,062	3,117	3,129	2,327	2,263	2,231	2,374	1,934	2,543	2,325	2,472	2,015	2,220	2,156	2,120	2,007	1,972	2,176	1,818	2,027
2,354	3,130	2,883	2,904	2,987	2,197	3,106	3,101	2,661	3,029	3,370	2,753	2,098	2,431	2,142	2,370	2,441	2,305	2,420	2,333	2,153	2,181	2,030	2,017	1,923	2,119	2,122
4,707	2,793	3,086	2,437	3,039	2,851	2,172	2,833	3,347	3,215	2,976	2,128	2,220	2,237	2,458	2,364	2,106	2,267	2,145	2,026	2,144	1,889	2,025	2,242	1,900	2,440	2,010
4,198	2,665	3,405	3,520	2,987	3,101	3,061	3,184	3,028	3,035	2,770	2,333	2,397	2,304	2,463	2,250	2,172	2,665	2,170	2,167	2,071	2,060	2,165	1,943	1,914	2,000	2,065
3,108	4,122	2,588	3,588	2,892	2,408	2,807	3,360	2,716	2,983	2,372	3,133	2,706	2,627	2,207	2,317	2,106	2,204	2,216	2,362	2,364	2,100	2,084	2,169	2,250	2,019	2,151
3,602	3,060	2,856	2,022	2,859	2,706	2,950	2,157	2,986	3,206	2,307	3,086	2,439	2,280	2,414	2,158	2,438	1,947	2,343	2,161	2,178	2,338	2,138	2,306	2,149	2,124	1,899
4,950	3,934	3,589	3,653	3,360	3,386	3,124	2,156	2,298	2,323	3,126	2,108	2,432	2,337	2,550	2,415	2,399	2,005	2,209	2,259	2,400	2,119	2,009	2,074	2,100	1,914	2,060
3,738	5,364	4,204	2,192	3,334	3,173	3,004	3,591	3,370	2,955	3,123	3,565	2,943	2,671	2,402	2,335	2,104	2,333	2,377	1,992	2,664	2,132	2,070	2,081	2,071	2,139	2,351
2,603	2,733	4,465	3,091	3,489	2,980	2,810	3,161	3,215	3,099	2,095	3,079	2,162	2,203	2,355	2,400	2,436	2,246	2,051	2,102	2,585	2,098	2,111	2,164	2,036	2,055	2,325
2,603	4,945	3,103	2,453	3,613	4,125	2,257	3,431	2,810	2,333	2,555	2,681	3,352	3,310	2,297	2,278	2,429	2,348	2,229	2,312	2,096	2,307	2,520	2,131	2,355	2,239	2,051
5,389	3,999	4,175	3,315	3,449	3,466	3,117	3,318	2,967	3,457	3,088	3,306	3,182	2,298	2,313	2,311	2,282	2,617	2,237	2,244	2,138	2,282	2,291	2,038	2,128	2,425	1,928
4,649	3,706	3,476	3,570	3,119	2,913	3,126	3,170	3,052	3,230	2,798	3,041	2,314	2,308	2,412	2,336	2,032	2,133	2,616	2,045	1,850	2,064	2,144	2,373	2,442	2,132	2,516
4,505	4,372	4,482	3,508	3,337	3,279	3,570	3,308	3,324	3,041	3,255	2,181	3,145	2,413	2,307	2,285	2,305	2,045	2,195	2,493	2,759	2,026	2,338	2,167	2,206	2,673	2,247
3,467	3,923	3,590	4,009	3,480	3,470	3,575	3,628	3,231	3,081	3,471	2,337	2,345	2,297	2,333	2,445	2,304	2,101	2,162	2,269	2,481	2,583	2,159	2,165	2,172	2,204	2,273
3,783	2,947	2,285	3,563	3,486	3,142	3,015	3,346	3,154	3,065	3,463	3,290	3,309	2,419	2,587	2,634	2,212	2,076	1,956	2,429	2,270	1,877	1,944	2,097	2,053	2,072	1,864
2,325	3,943	4,943	2,863	3,030	3,514	3,479	3,362	3,038	3,227	2,960	3,411	3,094	2,331	2,693	2,339	2,223	2,408	2,194	2,418	2,319	2,169	2,245	2,161	2,173	2,113	2,594
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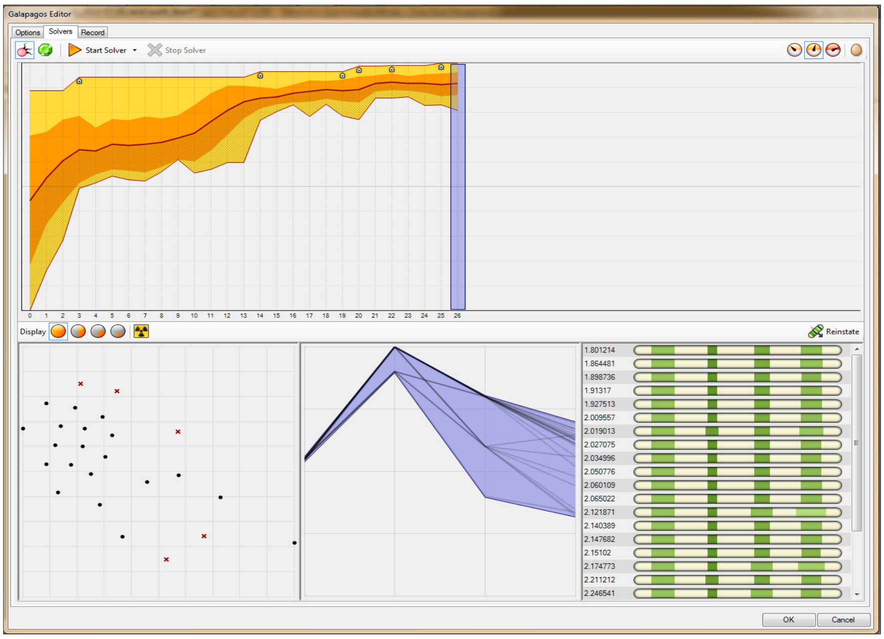

APPENDIX C

STAGE 3 PARAMETERS ACROSS GENERATIONS

Table C 1 East Block Floor1Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27
4,057	4,009	3,943	4,030	4,004	4,057	4,023	3,976	3,964	4,004	3,967	3,925	3,922	3,897	3,925	3,934	3,921	3,894	3,896	3,881	3,897	3,883	3,877	3,889	3,890	3,882	3,884	3,887
3,917	4,043	3,996	3,986	4,047	4,026	3,888	3,968	3,985	3,929	3,926	3,929	3,906	3,913	3,907	3,917	3,908	3,919	3,901	3,880	3,906	3,908	3,885	3,881	3,880	3,880	3,869	3,867
3,972	3,976	3,984	4,026	4,025	4,004	4,006	4,009	3,986	3,999	3,934	3,918	3,918	3,916	3,904	3,918	3,915	3,917	3,918	3,883	3,901	3,877	3,875	3,880	3,878	3,886	3,887	3,893
3,947	3,986	4,019	4,014	4,034	3,992	4,023	3,976	3,976	3,989	3,914	3,921	3,942	3,910	3,920	3,909	3,907	3,919	3,881	3,877	3,891	3,882	3,879	3,890	3,869	3,886	3,888	3,875
3,943	4,004	4,035	3,973	4,036	4,032	3,963	4,024	3,991	3,980	3,932	3,905	3,921	3,930	3,915	3,915	3,915	3,917	3,914	3,874	3,884	3,873	3,893	3,883	3,887	3,890	3,880	3,894
3,961	4,036	3,949	4,004	4,003	4,002	4,032	4,016	3,995	3,879	3,935	3,926	3,916	3,918	3,910	3,903	3,893	3,902	3,887	3,894	3,879	3,887	3,876	3,885	3,889	3,884	3,878	3,884
3,973	3,973	3,983	4,027	4,038	4,020	4,024	3,999	3,954	3,993	4,005	3,933	3,920	3,913	3,905	3,909	3,924	3,924	3,908	3,887	3,886	3,884	3,879	3,889	3,887	3,887	3,881	3,886
3,989	3,995	4,018	4,034	4,007	4,017	4,037	4,009	3,999	3,982	4,001	3,919	3,906	3,913	3,916	3,918	3,901	3,878	3,898	3,881	3,881	3,886	3,894	3,893	3,887	3,892	3,875	3,882
3,922	3,876	3,983	4,003	3,987	3,932	4,024	3,991	3,875	3,959	3,928	3,911	3,930	3,907	3,881	3,909	3,901	3,891	3,851	3,892	3,882	3,889	3,885	3,887	3,875	3,886	3,898	3,885
3,981	3,947	4,046	4,003	4,032	4,043	4,047	4,015	3,985	3,949	3,978	3,924	3,909	3,920	3,930	3,910	3,893	3,908	3,892	3,887	3,875	3,877	3,886	3,888	3,891	3,880	3,891	3,880
3,956	3,955	4,012	3,996	4,018	4,021	3,982	3,970	3,996	3,912	3,933	3,918	3,867	3,904	3,912	3,861	3,903	3,905	3,883	3,879	3,872	3,886	3,878	3,892	3,883	3,880	3,852	3,883
3,954	3,907	3,999	3,992	3,981	3,989	3,991	4,012	3,940	3,901	3,917	3,936	3,913	3,890	3,904	3,913	3,894	3,896	3,911	3,876	3,884	3,888	3,888	3,882	3,890	3,869	3,888	3,887
3,976	3,976	3,999	4,032	3,995	3,910	4,025	3,913	3,969	3,933	3,934	3,931	3,933	3,907	3,877	3,943	3,907	3,883	3,880	3,918	3,882	3,878	3,886	3,887	3,882	3,882	3,884	3,881
3,947	3,951	4,023	4,008	3,926	4,020	4,001	3,963	3,972	3,985	4,004	3,931	3,910	3,896	3,930	3,925	3,898	3,909	3,909	3,857	3,886	3,888	3,872	3,865	3,891	3,882	3,879	3,872
3,898	4,003	3,966	3,993	3,999	3,993	4,017	3,990	3,999	3,980	3,939	3,928	3,927	3,911	3,906	3,899	3,913	3,886	3,901	3,882	3,889	3,880	3,890	3,874	3,887	3,874	3,890	3,883
3,940	4,004	3,980	4,018	4,038	4,049	3,975	4,020	3,973	3,968	3,991	3,914	3,903	3,929	3,934	3,945	3,912	3,920	3,887	3,893	3,890	3,875	3,880	3,873	3,886	3,890	3,886	3,850
4,011	4,005	3,949	4,031	4,019	4,021	4,004	4,025	3,976	3,983	3,998	4,004	3,913	3,901	3,913	3,923	3,907	3,926	3,907	3,891	3,894	3,882	3,884	3,887	3,884	3,889	3,890	3,898
3,948	3,924	3,976	4,022	4,011	4,047	4,018	4,048	3,962	3,993	3,884	3,997	3,931	3,910	3,913	3,903	3,911	3,899	3,867	3,914	3,914	3,880	3,880	3,886	3,886	3,882	3,886	3,890
3,899	4,005	4,042	4,026	4,017	4,034	4,057	3,969	4,012	4,014	3,928	3,915	3,924	3,970	3,915	3,899	3,916	3,909	3,893	3,915	3,904	3,880	3,881	3,882	3,880	3,893	3,883	3,880
3,992	4,012	4,030	4,025	4,007	4,044	3,997	4,003	3,930	3,995	3,984	3,934	3,925	3,911	3,916	3,917	3,911	3,916	3,884	3,918	3,888	3,894	3,874	3,881	3,875	3,883	3,889	3,892
3,979	3,947	3,964	4,020	3,978	4,006	4,008	4,012	3,965	3,994	3,921	3,871	4,010	3,926	3,905	3,907	3,907	3,883	3,913	3,884	3,897	3,875	3,880	3,878	3,886	3,884	3,889	3,881
3,867	4,021	4,015	4,029	4,047	4,017	4,033	4,005	3,986	4,005	3,991	3,998	3,924	3,911	3,919	3,904	3,921	3,928	3,902	3,918	3,899	3,882	3,885	3,873	3,893	3,886	3,882	3,880
3,946	3,981	4,023	4,025	4,057	4,042	3,983	4,012	3,982	3,969	3,974	3,922	3,927	3,916	3,912	3,932	3,906	3,931	3,929	3,903	3,889	3,903	3,880	3,890	3,875	3,882	3,896	3,878
3,935	3,895	4,033	4,014	3,999	4,020	4,038	4,022	4,017	3,953	3,985	3,906	3,912	3,933	3,925	3,906	3,928	3,918	3,919	3,881	3,909	3,886	3,887	3,892	3,891	3,888	3,882	3,886
3,869	3,963	3,984	4,040	4,015	4,055	4,036	4,034	3,968	3,992	3,952	4,006	3,977	3,935	3,917	3,911	3,907	3,903	3,910	3,913	3,879	3,884	3,879	3,881	3,885	3,884	3,875	3,887
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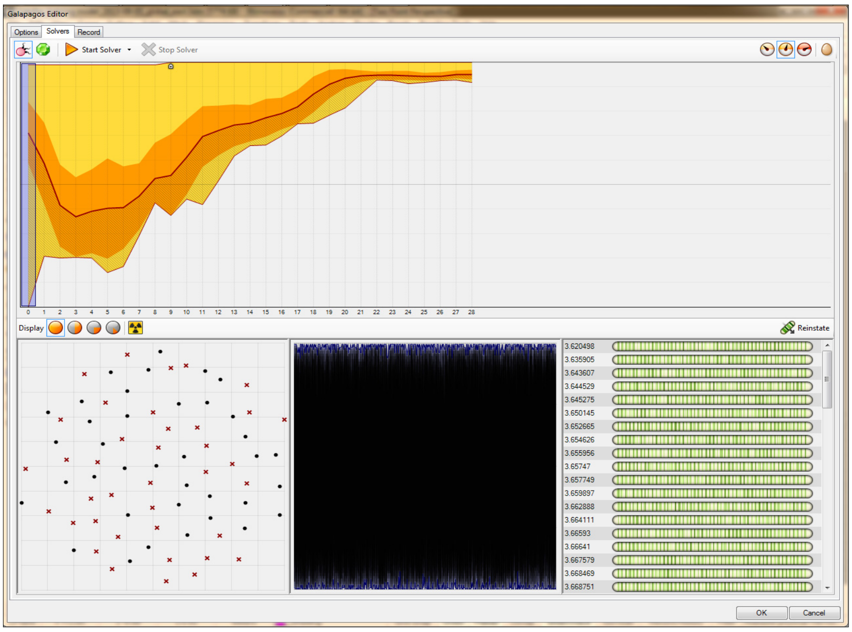

Table C 2 East Block Floor2 Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27
4,028	4,110	4,077	4,033	4,102	4,083	4,007	4,064	4,063	4,054	4,067	4,057	4,077	4,086	4,076	4,093	4,091	4,071	4,055	4,017	4,055	4,041	4,019	4,008	4,019	4,019	4,031	4,031
4,000	3,978	4,009	4,131	4,090	4,120	4,048	4,097	4,062	4,083	4,054	4,075	4,090	4,071	4,081	4,063	4,057	4,078	4,081	3,994	4,000	4,010	4,019	4,003	4,020	4,013	4,020	4,023
4,022	4,015	4,068	4,110	4,101	4,067	4,083	4,080	4,093	4,114	4,082	4,068	4,072	4,097	4,091	4,088	4,062	4,073	4,020	4,002	4,006	4,026	4,011	4,019	4,014	4,007	4,025	4,004
4,059	4,069	4,072	4,034	4,098	4,091	4,068	4,109	4,071	4,091	4,052	4,065	4,072	4,071	4,059	4,088	4,079	4,079	4,098	4,027	4,010	4,009	4,029	4,018	4,011	4,011	4,008	4,013
4,025	4,047	4,075	4,054	4,014	4,017	4,108	4,098	4,067	3,980	4,051	4,068	4,085	4,084	4,085	4,066	4,066	4,054	4,055	4,028	4,010	4,015	4,025	4,024	4,011	4,013	4,023	4,025
4,010	4,067	4,055	4,076	4,092	4,078	4,096	4,103	4,091	4,111	4,074	4,061	4,086	4,060	4,113	4,076	4,065	4,080	4,099	4,027	4,020	4,025	4,028	4,010	4,023	4,021	4,019	4,026
4,037	4,040	4,108	4,100	4,104	4,108	4,111	4,082	4,085	4,070	4,093	4,070	4,081	4,064	4,075	4,064	4,085	4,076	4,030	4,024	4,024	4,005	4,014	4,014	4,012	4,024	4,023	4,016
4,031	3,953	4,010	4,049	4,026	3,948	4,079	4,069	4,002	4,100	4,064	4,056	4,045	4,086	4,030	4,043	4,076	4,048	4,026	4,019	4,015	4,018	4,021	4,020	4,005	4,011	4,019	4,010
4,042	4,036	4,157	4,074	4,087	4,136	4,123	4,062	4,053	4,088	4,093	4,088	4,064	4,053	4,068	4,076	4,053	4,088	4,021	4,021	4,014	4,021	4,013	4,017	4,019	4,011	4,025	4,015
4,063	4,041	4,076	4,091	4,122	4,043	4,049	4,054	4,067	4,061	4,055	4,100	4,007	4,089	4,083	4,002	4,062	4,058	4,038	4,009	4,001	4,020	4,011	4,022	4,031	4,014	4,013	4,021
4,005	4,040	4,111	4,067	4,054	4,047	4,064	4,084	4,077	4,041	4,060	4,052	4,092	3,990	4,079	4,049	4,023	4,089	4,051	4,017	4,024	4,015	4,025	4,022	4,018	4,024	4,018	4,012
3,929	4,027	4,119	4,088	4,046	4,027	4,111	4,029	4,083	4,039	4,087	4,083	4,079	4,083	4,048	4,089	4,093	4,018	4,015	4,072	4,014	4,028	4,026	4,010	4,016	4,022	4,019	4,022
4,043	4,026	4,083	4,031	4,044	4,101	4,091	4,058	4,095	4,074	4,083	4,080	4,054	4,058	4,059	4,084	4,055	4,074	4,041	4,006	4,019	4,013	4,016	4,002	4,012	4,010	4,012	4,009
3,918	4,043	4,030	4,005	4,090	4,042	4,083	4,066	4,049	4,095	4,105	4,088	4,083	4,061	4,051	4,052	4,063	4,017	4,018	4,028	4,020	4,025	4,025	4,019	4,024	4,023	4,020	4,023
3,973	4,044	4,131	4,094	4,075	4,141	4,095	4,066	4,110	4,087	4,085	4,087	4,071	4,052	4,065	4,092	4,040	4,088	4,088	4,010	4,010	4,010	4,017	4,011	4,015	4,019	4,017	4,010
3,994	4,087	4,101	4,071	4,097	4,070	4,076	4,103	4,084	4,074	4,062	4,119	4,050	4,070	4,081	4,083	4,063	4,053	4,077	4,026	4,029	4,022	4,022	4,010	4,004	4,024	4,009	4,010
3,983	3,969	4,003	4,072	4,069	4,126	4,096	4,093	4,065	4,038	4,025	4,067	4,085	4,084	4,077	4,056	4,070	4,071	4,004	4,057	4,075	4,021	4,000	4,017	4,028	4,026	4,011	4,021
4,038	4,065	4,131	4,079	4,092	4,112	4,128	4,087	4,088	4,067	4,065	4,078	4,060	4,054	4,064	4,078	4,071	4,065	4,034	4,081	4,050	4,012	4,025	4,004	4,018	4,009	4,018	4,014
4,090	4,095	4,062	4,121	4,067	4,079	4,034	4,083	4,043	4,100	4,104	4,112	4,070	4,078	4,090	4,092	4,078	4,080	4,004	4,086	4,029	4,018	4,012	4,022	4,008	4,026	4,024	4,009
3,976	4,070	4,020	4,120	4,051	4,048	4,098	4,086	4,109	4,051	4,058	4,019	4,068	4,067	4,076	4,074	4,081	4,013	4,062	4,019	4,028	4,007	4,013	4,015	4,016	4,019	4,015	4,017
4,031	4,085	4,079	4,079	4,114	4,109	4,097	4,067	4,094	4,106	4,089	4,059	4,097	4,068	4,082	4,075	4,082	4,074	4,067	4,063	4,023	4,041	4,024	4,017	4,020	4,024	4,019	4,016
4,075	4,008	4,109	4,073	4,109	4,143	4,070	4,088	4,067	4,115	4,086	4,047	4,080	4,067	4,079	4,069	4,076	4,061	4,091	4,046	4,018	4,090	4,018	4,023	4,020	4,021	4,007	4,019
4,081	4,025	4,025	4,107	4,064	4,054	4,082	4,073	4,108	4,109	4,061	4,033	4,073	4,058	4,081	4,054	4,062	4,077	4,089	4,023	4,061	4,018	4,030	4,019	4,019	4,015	4,020	4,019
4,004	4,102	4,058	4,086	4,099	4,100	4,137	4,089	4,066	4,091	4,121	4,067	4,080	4,058	4,080	4,060	4,081	4,067	4,058	4,038	4,025	4,035	4,023	4,016	4,028	4,015	4,015	4,027
4,027	4,059	4,079	3,999	4,115	4,099	4,072	4,052	4,096	4,109	4,109	4,105	4,061	4,069	4,084	4,068	4,081	4,084	4,010	4,027	4,018	4,020	4,021	4,027	4,013	4,020	4,024	4,005
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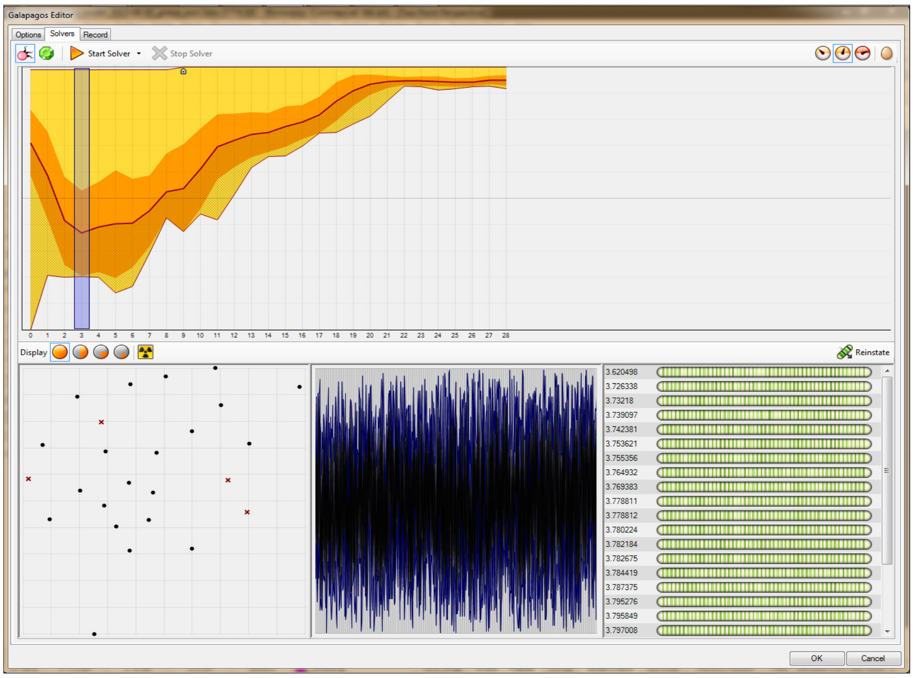

Table C 3 East Block Floor3 Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27
4,166	4,101	4,160	4,226	4,208	4,183	4,212	4,199	4,227	4,221	4,164	4,156	4,187	4,138	4,173	4,169	4,162	4,143	4,135	4,088	4,110	4,104	4,103	4,093	4,089	4,092	4,086	4,106
4,138	4,139	4,229	4,229	4,233	4,207	4,218	4,201	4,188	4,226	4,121	4,148	4,181	4,185	4,140	4,163	4,137	4,166	4,093	4,091	4,098	4,084	4,098	4,110	4,096	4,099	4,108	4,107
4,144	4,204	4,242	4,213	4,217	4,223	4,219	4,221	4,215	4,198	4,156	4,123	4,176	4,147	4,168	4,140	4,136	4,154	4,162	4,090	4,082	4,088	4,082	4,096	4,108	4,087	4,101	4,096
4,101	4,057	4,169	4,208	4,218	4,199	4,237	4,175	4,233	4,087	4,156	4,158	4,165	4,158	4,161	4,093	4,165	4,160	4,162	4,113	4,100	4,107	4,087	4,091	4,103	4,095	4,108	4,093
4,137	4,154	4,177	4,226	4,248	4,231	4,217	4,223	4,183	4,219	4,201	4,151	4,190	4,170	4,177	4,155	4,151	4,151	4,177	4,079	4,079	4,097	4,113	4,097	4,094	4,096	4,104	4,104
4,152	4,193	4,232	4,249	4,254	4,177	4,237	4,207	4,224	4,234	4,204	4,168	4,153	4,181	4,161	4,176	4,129	4,159	4,105	4,097	4,099	4,093	4,087	4,087	4,115	4,092	4,105	4,096
4,035	4,115	4,205	4,173	4,202	4,169	4,216	4,218	4,075	4,199	4,149	4,121	4,144	4,135	4,103	4,157	4,126	4,109	4,133	4,088	4,087	4,094	4,099	4,098	4,114	4,089	4,098	4,097
4,163	4,173	4,264	4,130	4,240	4,269	4,248	4,216	4,194	4,187	4,205	4,156	4,140	4,156	4,168	4,121	4,176	4,130	4,109	4,103	4,101	4,100	4,100	4,108	4,106	4,103	4,091	4,098
4,095	4,160	4,184	4,259	4,198	4,200	4,204	4,216	4,217	4,155	4,153	4,140	4,079	4,154	4,101	4,114	4,152	4,153	4,113	4,108	4,112	4,091	4,108	4,104	4,095	4,102	4,107	4,098
4,144	4,123	4,240	4,148	4,193	4,204	4,204	4,217	4,185	4,160	4,150	4,152	4,168	4,106	4,176	4,161	4,111	4,132	4,168	4,095	4,084	4,101	4,084	4,090	4,102	4,115	4,093	4,096
4,130	4,148	4,221	4,218	4,210	4,146	4,256	4,174	4,218	4,165	4,134	4,163	4,175	4,183	4,151	4,176	4,124	4,091	4,088	4,166	4,093	4,105	4,086	4,097	4,081	4,101	4,104	4,090
4,128	4,156	4,192	4,200	4,162	4,224	4,220	4,211	4,199	4,187	4,213	4,162	4,096	4,099	4,156	4,157	4,137	4,139	4,106	4,106	4,109	4,105	4,108	4,091	4,099	4,095	4,088	4,115
4,098	4,171	4,198	4,143	4,181	4,196	4,217	4,200	4,216	4,216	4,172	4,140	4,121	4,143	4,137	4,153	4,151	4,104	4,116	4,092	4,078	4,110	4,096	4,088	4,093	4,101	4,090	4,093
4,194	4,149	4,182	4,226	4,226	4,261	4,197	4,216	4,219	4,223	4,232	4,158	4,133	4,131	4,175	4,143	4,136	4,177	4,117	4,090	4,105	4,085	4,091	4,099	4,093	4,101	4,092	4,106
4,142	4,246	4,212	4,260	4,234	4,210	4,215	4,231	4,215	4,208	4,219	4,205	4,169	4,194	4,174	4,173	4,158	4,119	4,145	4,112	4,112	4,104	4,088	4,100	4,101	4,094	4,090	4,087
4,147	4,139	4,192	4,197	4,246	4,231	4,164	4,248	4,203	4,215	4,085	4,230	4,155	4,170	4,164	4,160	4,152	4,158	4,081	4,175	4,158	4,099	4,078	4,103	4,086	4,095	4,098	4,108
4,189	4,180	4,250	4,211	4,249	4,230	4,232	4,222	4,215	4,222	4,140	4,173	4,164	4,199	4,168	4,166	4,167	4,141	4,102	4,154	4,145	4,087	4,096	4,094	4,105	4,089	4,094	4,094
4,125	4,176	4,241	4,268	4,206	4,233	4,199	4,232	4,182	4,231	4,236	4,140	4,180	4,141	4,162	4,184	4,180	4,173	4,099	4,162	4,081	4,093	4,108	4,103	4,095	4,089	4,104	4,101
4,068	4,140	4,175	4,237	4,191	4,230	4,214	4,207	4,213	4,211	4,162	4,067	4,225	4,151	4,176	4,172	4,158	4,151	4,165	4,092	4,104	4,099	4,097	4,082	4,088	4,102	4,098	4,096
4,117	4,215	4,229	4,225	4,245	4,239	4,225	4,228	4,202	4,225	4,214	4,243	4,183	4,171	4,144	4,174	4,169	4,169	4,108	4,151	4,096	4,116	4,098	4,105	4,079	4,100	4,101	4,092
4,142	4,214	4,221	4,221	4,258	4,268	4,217	4,228	4,221	4,209	4,193	4,129	4,144	4,187	4,162	4,181	4,178	4,172	4,148	4,133	4,097	4,111	4,103	4,103	4,107	4,103	4,100	4,104
4,155	4,197	4,216	4,238	4,229	4,219	4,242	4,208	4,204	4,203	4,236	4,148	4,126	4,173	4,182	4,141	4,167	4,120	4,159	4,105	4,163	4,097	4,111	4,088	4,115	4,098	4,104	4,097
4,166	4,108	4,150	4,222	4,232	4,233	4,259	4,222	4,221	4,243	4,177	4,228	4,222	4,177	4,157	4,179	4,111	4,127	4,153	4,151	4,096	4,087	4,099	4,103	4,094	4,087	4,106	4,102
4,085	4,138	4,222	4,204	4,250	4,222	4,206	4,236	4,223	4,208	4,177	4,193	4,169	4,164	4,165	4,154	4,124	4,159	4,095	4,090	4,090	4,083	4,095	4,116	4,093	4,097	4,097	4,112
4,170	4,230	4,226	4,234	4,216	4,182	4,217	4,223	4,158	4,178	4,167	4,160	4,155	4,194	4,139	4,149	4,152	4,165	4,086	4,162	4,120	4,093	4,111	4,086	4,103	4,095	4,098	4,095
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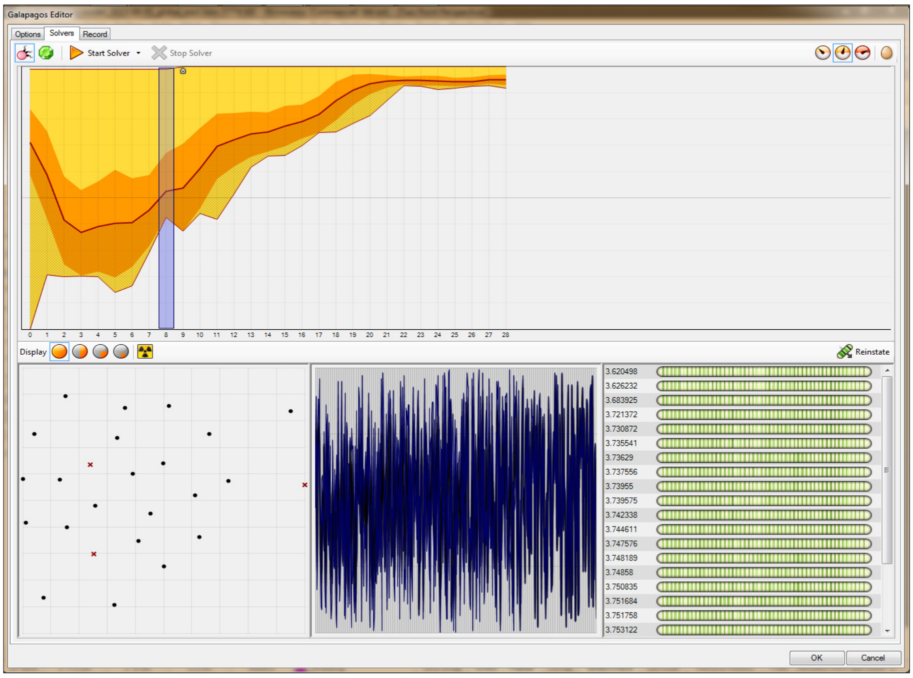

Table C 4 East Block Floor4 Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27
3,167	3,241	3,301	3,324	3,286	3,184	3,278	3,227	3,200	3,272	3,099	3,147	3,136	3,141	3,070	3,153	3,107	3,086	3,060	3,069	3,059	3,059	3,073	3,062	3,077	3,071	3,068	3,068
3,091	3,270	3,320	3,173	3,327	3,286	3,188	3,276	3,239	3,163	3,122	3,105	3,137	3,056	3,104	3,104	3,085	3,054	3,080	3,068	3,074	3,047	3,063	3,070	3,088	3,071	3,065	3,076
3,156	3,238	3,256	3,170	3,233	3,249	3,237	3,300	3,232	3,059	3,174	3,128	3,102	3,081	3,138	3,041	3,116	3,080	3,098	3,073	3,048	3,076	3,074	3,078	3,063	3,053	3,066	3,073
3,134	3,215	3,275	3,265	3,277	3,271	3,232	3,250	3,209	3,189	3,247	3,170	3,130	3,097	3,146	3,064	3,048	3,062	3,066	3,076	3,077	3,055	3,063	3,057	3,076	3,079	3,068	3,056
3,185	3,289	3,236	3,315	3,338	3,283	3,290	3,244	3,217	3,173	3,196	3,106	3,080	3,126	3,121	3,117	3,079	3,043	3,064	3,064	3,072	3,062	3,064	3,080	3,070	3,071	3,068	3,062
3,119	3,218	3,229	3,241	3,225	3,091	3,287	3,202	3,089	3,159	3,139	3,100	3,116	3,106	3,094	3,065	3,114	3,091	3,074	3,061	3,083	3,081	3,057	3,068	3,072	3,057	3,060	3,065
3,168	3,230	3,331	3,285	3,288	3,353	3,338	3,227	3,154	3,205	3,144	3,114	3,039	3,071	3,078	3,104	3,078	3,116	3,072	3,083	3,068	3,068	3,059	3,057	3,083	3,067	3,065	3,071
3,273	3,209	3,303	3,288	3,290	3,258	3,165	3,203	3,208	3,136	3,132	3,141	3,110	3,096	3,060	3,101	3,063	3,116	3,065	3,067	3,067	3,065	3,067	3,063	3,065	3,073	3,073	3,069
3,234	3,105	3,256	3,303	3,282	3,218	3,187	3,246	3,181	3,126	3,149	3,162	3,144	3,054	3,074	3,098	3,077	3,136	3,099	3,068	3,075	3,069	3,064	3,069	3,050	3,086	3,073	3,081
3,184	3,113	3,318	3,259	3,198	3,094	3,320	3,140	3,161	3,155	3,104	3,160	3,131	3,147	3,076	3,075	3,106	3,059	3,085	3,097	3,048	3,057	3,086	3,087	3,072	3,074	3,058	3,064
3,042	3,286	3,345	3,292	3,143	3,267	3,277	3,266	3,198	3,201	3,200	3,130	3,066	3,118	3,079	3,081	3,056	3,120	3,069	3,081	3,073	3,062	3,070	3,078	3,082	3,088	3,074	3,061
3,261	3,126	3,264	3,277	3,256	3,138	3,268	3,192	3,219	3,228	3,133	3,107	3,109	3,180	3,077	3,075	3,109	3,068	3,059	3,090	3,071	3,054	3,056	3,071	3,062	3,074	3,079	3,068
3,190	3,164	3,298	3,327	3,261	3,336	3,236	3,198	3,219	3,207	3,169	3,095	3,097	3,107	3,096	3,067	3,124	3,083	3,116	3,076	3,075	3,071	3,077	3,088	3,064	3,078	3,074	3,065
3,073	3,400	3,322	3,293	3,291	3,254	3,225	3,289	3,221	3,207	3,211	3,250	3,139	3,144	3,112	3,135	3,124	3,089	3,054	3,070	3,057	3,070	3,079	3,067	3,063	3,074	3,047	3,072
3,252	3,272	3,165	3,329	3,202	3,268	3,295	3,259	3,268	3,198	3,079	3,182	3,150	3,082	3,137	3,048	3,076	3,097	3,066	3,092	3,037	3,078	3,084	3,076	3,078	3,068	3,068	3,063
3,193	3,285	3,330	3,347	3,309	3,315	3,322	3,212	3,232	3,245	3,141	3,155	3,091	3,153	3,134	3,135	3,080	3,104	3,075	3,049	3,051	3,057	3,069	3,066	3,076	3,061	3,050	3,079
3,161	3,319	3,338	3,334	3,314	3,293	3,240	3,229	3,059	3,230	3,195	3,089	3,142	3,101	3,136	3,155	3,113	3,064	3,063	3,127	3,061	3,073	3,070	3,071	3,073	3,077	3,067	3,081
3,225	3,204	3,249	3,327	3,275	3,266	3,271	3,304	3,233	3,272	3,127	3,070	3,211	3,148	3,135	3,120	3,085	3,071	3,057	3,081	3,074	3,061	3,051	3,051	3,068	3,062	3,073	3,067
3,254	3,198	3,250	3,275	3,295	3,328	3,293	3,200	3,146	3,250	3,214	3,231	3,153	3,136	3,103	3,140	3,063	3,073	3,067	3,115	3,059	3,072	3,060	3,073	3,073	3,075	3,075	3,060
3,247	3,243	3,316	3,274	3,315	3,337	3,238	3,232	3,208	3,257	3,248	3,127	3,125	3,114	3,081	3,071	3,150	3,066	3,075	3,077	3,073	3,071	3,054	3,062	3,050	3,060	3,072	3,046
3,121	3,351	3,174	3,290	3,231	3,325	3,269	3,240	3,228	3,224	3,228	3,117	3,107	3,126	3,125	3,056	3,078	3,109	3,062	3,076	3,026	3,091	3,091	3,072	3,049	3,081	3,067	3,079
3,268	3,277	3,278	3,317	3,275	3,295	3,327	3,240	3,218	3,248	3,190	3,208	3,172	3,149	3,119	3,117	3,100	3,129	3,092	3,076	3,073	3,073	3,084	3,062	3,074	3,066	3,069	3,070
3,280	3,164	3,288	3,226	3,281	3,280	3,167	3,227	3,185	3,230	3,125	3,178	3,113	3,095	3,081	3,081	3,066	3,049	3,084	3,052	3,065	3,056	3,074	3,075	3,066	3,072	3,058	3,059
3,100	3,320	3,242	3,312	3,274	3,137	3,207	3,193	3,135	3,181	3,112	3,130	3,080	3,113	3,096	3,078	3,090	3,100	3,095	3,074	3,062	3,063	3,074	3,066	3,063	3,069	3,065	3,059
3,281	3,261	3,347	3,291	3,289	3,231	3,236	3,210	3,233	3,131	3,102	3,134	3,130	3,083	3,082	3,096	3,092	3,114	3,075	3,066	3,072	3,080	3,057	3,044	3,070	3,065	3,078	3,067
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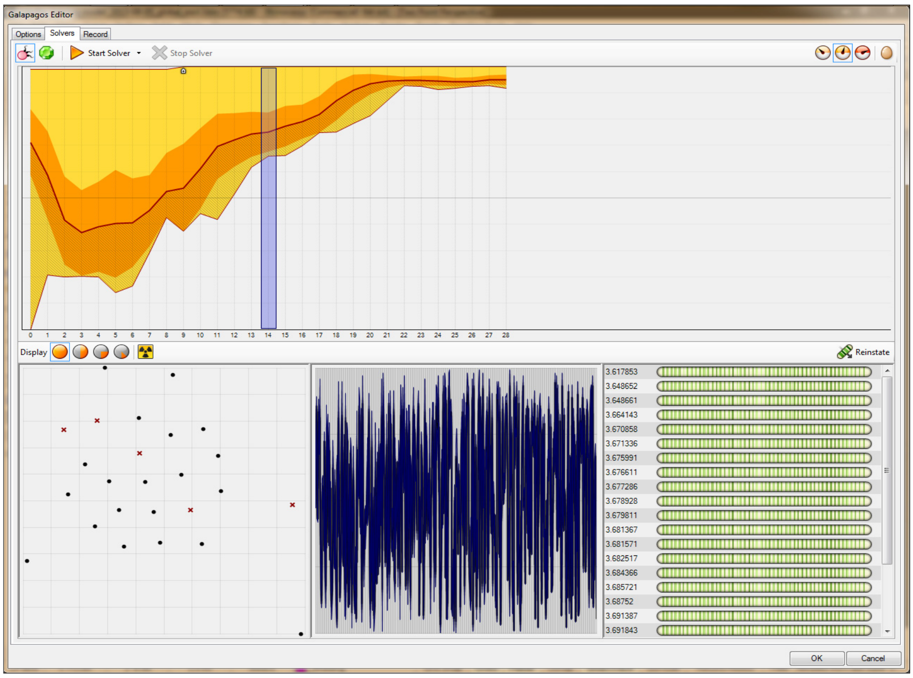

Table C 5 East Block Floor5 Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27
3,169	3,311	3,328	3,239	3,315	3,324	3,258	3,303	3,277	3,239	3,167	3,142	3,187	3,181	3,175	3,097	3,156	3,142	3,139	3,094	3,083	3,101	3,072	3,096	3,098	3,107	3,094	3,085
3,072	3,093	3,258	3,224	3,215	3,215	3,270	3,286	3,248	3,085	3,182	3,209	3,150	3,145	3,174	3,133	3,169	3,101	3,113	3,089	3,097	3,078	3,101	3,090	3,086	3,093	3,094	3,085
3,158	3,309	3,286	3,299	3,294	3,308	3,271	3,266	3,241	3,247	3,264	3,180	3,174	3,179	3,222	3,163	3,128	3,157	3,146	3,098	3,079	3,103	3,088	3,092	3,083	3,104	3,091	3,081
3,065	3,211	3,341	3,360	3,378	3,287	3,333	3,282	3,264	3,245	3,251	3,198	3,151	3,193	3,165	3,183	3,127	3,085	3,077	3,092	3,102	3,082	3,093	3,090	3,098	3,113	3,096	3,084
3,180	3,051	3,230	3,302	3,230	3,190	3,305	3,269	3,090	3,262	3,193	3,168	3,179	3,182	3,136	3,104	3,144	3,108	3,104	3,092	3,102	3,097	3,108	3,096	3,094	3,103	3,099	3,084
3,178	3,215	3,338	3,332	3,316	3,335	3,353	3,293	3,268	3,226	3,224	3,162	3,151	3,115	3,143	3,152	3,132	3,070	3,075	3,104	3,093	3,093	3,100	3,090	3,100	3,108	3,100	3,095
3,240	3,310	3,276	3,366	3,340	3,269	3,226	3,235	3,250	3,194	3,194	3,182	3,105	3,154	3,165	3,126	3,126	3,142	3,097	3,100	3,088	3,094	3,091	3,093	3,095	3,096	3,093	3,091
3,211	3,179	3,282	3,337	3,290	3,210	3,269	3,254	3,223	3,183	3,204	3,173	3,145	3,106	3,151	3,168	3,085	3,111	3,125	3,091	3,097	3,092	3,098	3,102	3,087	3,098	3,091	3,103
3,249	3,263	3,340	3,297	3,248	3,165	3,311	3,215	3,250	3,203	3,184	3,193	3,172	3,174	3,092	3,143	3,090	3,090	3,093	3,102	3,081	3,111	3,092	3,102	3,093	3,087	3,082	3,089
3,184	3,254	3,290	3,245	3,209	3,270	3,264	3,246	3,247	3,259	3,264	3,196	3,153	3,095	3,131	3,149	3,080	3,136	3,077	3,097	3,090	3,085	3,089	3,101	3,084	3,094	3,088	3,089
3,154	3,062	3,264	3,277	3,281	3,205	3,257	3,237	3,258	3,286	3,201	3,183	3,187	3,174	3,184	3,169	3,177	3,092	3,103	3,108	3,094	3,095	3,103	3,089	3,089	3,097	3,104	3,093
3,194	3,210	3,319	3,311	3,292	3,353	3,289	3,275	3,233	3,239	3,238	3,147	3,163	3,159	3,138	3,158	3,152	3,158	3,066	3,100	3,107	3,087	3,091	3,095	3,092	3,092	3,098	3,072
3,168	3,383	3,250	3,351	3,344	3,298	3,293	3,309	3,263	3,268	3,269	3,238	3,161	3,199	3,176	3,189	3,177	3,071	3,156	3,103	3,089	3,078	3,080	3,094	3,082	3,103	3,096	3,085
3,198	3,152	3,206	3,302	3,268	3,329	3,279	3,316	3,270	3,255	3,091	3,238	3,190	3,139	3,175	3,117	3,176	3,162	3,097	3,087	3,134	3,093	3,093	3,093	3,103	3,087	3,087	3,078
3,254	3,159	3,313	3,274	3,372	3,301	3,361	3,244	3,240	3,271	3,179	3,210	3,174	3,214	3,178	3,168	3,143	3,168	3,096	3,125	3,101	3,091	3,106	3,085	3,087	3,093	3,104	3,096
3,187	3,278	3,394	3,330	3,321	3,278	3,286	3,276	3,206	3,280	3,242	3,171	3,177	3,190	3,203	3,204	3,176	3,112	3,097	3,114	3,099	3,108	3,095	3,098	3,093	3,099	3,107	3,097
3,117	3,088	3,268	3,359	3,241	3,328	3,242	3,270	3,245	3,268	3,189	3,103	3,215	3,185	3,194	3,174	3,162	3,079	3,131	3,102	3,091	3,105	3,100	3,104	3,102	3,098	3,104	3,093
3,161	3,223	3,265	3,293	3,332	3,367	3,306	3,264	3,260	3,297	3,263	3,268	3,211	3,184	3,166	3,167	3,163	3,134	3,096	3,104	3,096	3,089	3,095	3,096	3,095	3,100	3,105	3,084
3,205	3,218	3,336	3,318	3,329	3,354	3,288	3,291	3,281	3,258	3,261	3,179	3,162	3,176	3,146	3,151	3,166	3,140	3,081	3,057	3,076	3,091	3,091	3,104	3,095	3,092	3,082	3,090
3,174	3,137	3,183	3,330	3,214	3,297	3,296	3,273	3,272	3,255	3,261	3,173	3,186	3,177	3,160	3,164	3,141	3,163	3,147	3,102	3,115	3,089	3,089	3,089	3,100	3,079	3,097	3,093
3,278	3,263	3,334	3,321	3,388	3,289	3,357	3,303	3,249	3,262	3,246	3,246	3,232	3,171	3,155	3,172	3,104	3,146	3,156	3,108	3,100	3,096	3,091	3,090	3,092	3,098	3,106	3,079
3,185	3,348	3,295	3,229	3,312	3,296	3,266	3,264	3,249	3,250	3,187	3,204	3,175	3,142	3,142	3,158	3,092	3,081	3,085	3,083	3,094	3,093	3,089	3,092	3,096	3,084	3,079	3,104
3,173	3,336	3,226	3,302	3,277	3,195	3,282	3,233	3,160	3,215	3,173	3,162	3,182	3,178	3,073	3,146	3,144	3,117	3,101	3,123	3,119	3,099	3,089	3,081	3,095	3,100	3,092	3,099
3,145	3,216	3,330	3,261	3,330	3,218	3,255	3,292	3,250	3,194	3,181	3,193	3,162	3,165	3,146	3,170	3,169	3,081	3,100	3,091	3,090	3,097	3,081	3,092	3,095	3,106	3,098	3,093
3,152	3,300	3,354	3,310	3,254	3,301	3,251	3,240	3,254	3,160	3,186	3,170	3,225	3,178	3,184	3,148	3,141	3,099	3,089	3,084	3,086	3,076	3,110	3,104	3,085	3,090	3,096	3,086
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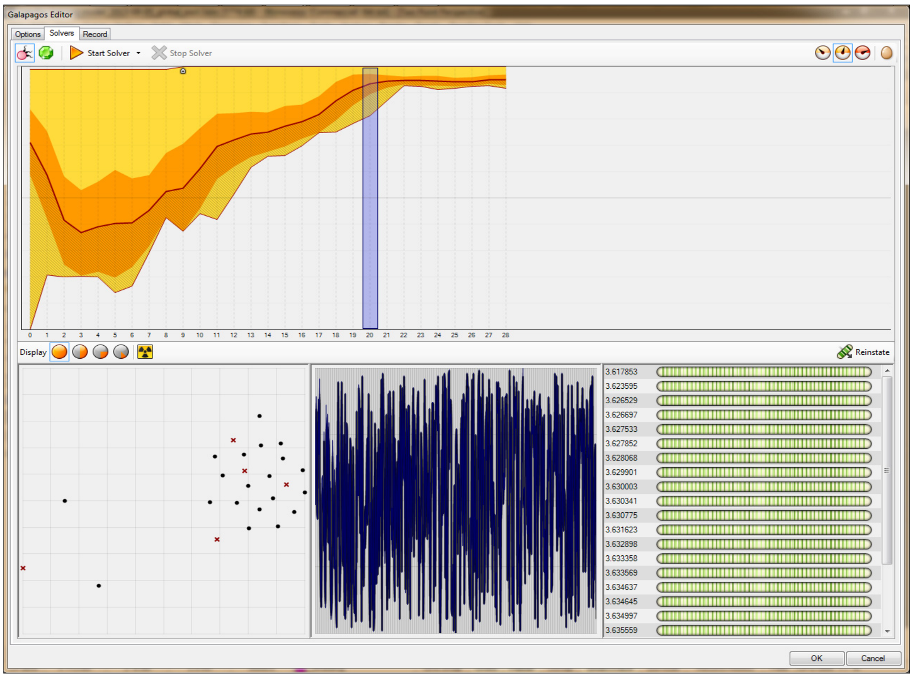

Table C 6 East Block Floor All Floors Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27
3,717	3,754	3,762	3,770	3,783	3,766	3,756	3,754	3,746	3,758	3,693	3,685	3,702	3,689	3,684	3,689	3,688	3,667	3,657	3,630	3,641	3,638	3,629	3,629	3,634	3,634	3,632	3,635
3,644	3,705	3,762	3,749	3,782	3,771	3,722	3,766	3,744	3,697	3,681	3,693	3,693	3,674	3,681	3,676	3,671	3,664	3,654	3,624	3,635	3,625	3,633	3,631	3,634	3,631	3,631	3,632
3,690	3,748	3,767	3,764	3,774	3,770	3,763	3,775	3,753	3,723	3,722	3,683	3,688	3,684	3,705	3,670	3,671	3,676	3,669	3,629	3,623	3,634	3,626	3,633	3,629	3,627	3,634	3,629
3,661	3,707	3,775	3,776	3,801	3,768	3,779	3,758	3,750	3,720	3,724	3,702	3,692	3,686	3,690	3,667	3,665	3,661	3,657	3,637	3,636	3,627	3,630	3,629	3,632	3,637	3,634	3,624
3,694	3,709	3,750	3,774	3,773	3,751	3,777	3,772	3,710	3,723	3,714	3,680	3,691	3,698	3,687	3,671	3,671	3,654	3,663	3,627	3,630	3,628	3,641	3,636	3,631	3,635	3,635	3,634
3,684	3,746	3,760	3,781	3,778	3,737	3,801	3,764	3,733	3,722	3,715	3,683	3,684	3,676	3,684	3,675	3,667	3,660	3,648	3,636	3,635	3,636	3,630	3,628	3,640	3,632	3,632	3,633
3,691	3,734	3,781	3,790	3,794	3,784	3,783	3,752	3,703	3,732	3,717	3,684	3,658	3,667	3,665	3,672	3,668	3,673	3,648	3,636	3,630	3,629	3,628	3,630	3,638	3,633	3,632	3,632
3,733	3,702	3,775	3,768	3,771	3,740	3,759	3,750	3,725	3,718	3,721	3,689	3,669	3,671	3,665	3,670	3,660	3,657	3,644	3,632	3,632	3,632	3,636	3,637	3,630	3,636	3,630	3,632
3,708	3,688	3,784	3,787	3,761	3,730	3,770	3,746	3,715	3,706	3,701	3,699	3,678	3,668	3,643	3,668	3,655	3,671	3,636	3,638	3,633	3,636	3,633	3,636	3,626	3,634	3,637	3,634
3,711	3,696	3,794	3,749	3,751	3,731	3,777	3,734	3,729	3,717	3,710	3,706	3,674	3,671	3,679	3,659	3,650	3,658	3,652	3,637	3,619	3,628	3,631	3,638	3,636	3,635	3,629	3,630
3,657	3,698	3,791	3,770	3,741	3,737	3,767	3,746	3,749	3,721	3,706	3,689	3,677	3,674	3,681	3,667	3,657	3,659	3,639	3,650	3,631	3,633	3,632	3,636	3,631	3,638	3,630	3,628
3,693	3,685	3,779	3,773	3,748	3,746	3,776	3,744	3,735	3,719	3,718	3,687	3,672	3,682	3,665	3,679	3,677	3,656	3,631	3,649	3,637	3,633	3,633	3,630	3,632	3,630	3,634	3,633
3,695	3,744	3,766	3,777	3,765	3,768	3,773	3,736	3,753	3,740	3,725	3,697	3,673	3,683	3,669	3,687	3,683	3,643	3,662	3,639	3,629	3,630	3,631	3,632	3,627	3,635	3,631	3,627
3,666	3,739	3,753	3,767	3,760	3,781	3,757	3,770	3,746	3,753	3,729	3,733	3,691	3,674	3,689	3,674	3,679	3,671	3,639	3,626	3,640	3,632	3,632	3,629	3,634	3,633	3,625	3,630
3,704	3,745	3,757	3,790	3,776	3,782	3,797	3,758	3,766	3,749	3,700	3,722	3,698	3,691	3,692	3,676	3,666	3,671	3,659	3,644	3,630	3,632	3,637	3,629	3,634	3,629	3,634	3,628
3,692	3,759	3,799	3,793	3,802	3,789	3,765	3,772	3,740	3,756	3,704	3,718	3,675	3,702	3,703	3,705	3,677	3,669	3,644	3,651	3,645	3,632	3,629	3,630	3,629	3,634	3,630	3,629
3,692	3,712	3,762	3,802	3,778	3,800	3,763	3,768	3,712	3,748	3,709	3,687	3,704	3,694	3,698	3,695	3,684	3,656	3,641	3,666	3,653	3,633	3,630	3,635	3,638	3,636	3,633	3,637
3,699	3,718	3,772	3,798	3,783	3,805	3,784	3,787	3,745	3,772	3,715	3,711	3,719	3,687	3,688	3,690	3,682	3,668	3,630	3,668	3,643	3,627	3,632	3,628	3,632	3,628	3,637	3,631
3,703	3,731	3,773	3,795	3,780	3,805	3,777	3,750	3,739	3,767	3,734	3,701	3,707	3,702	3,686	3,691	3,676	3,670	3,642	3,653	3,634	3,632	3,628	3,633	3,629	3,638	3,632	3,627
3,701	3,735	3,755	3,795	3,766	3,793	3,771	3,764	3,744	3,757	3,753	3,700	3,697	3,688	3,675	3,680	3,691	3,666	3,655	3,653	3,640	3,635	3,626	3,630	3,624	3,628	3,635	3,628
3,710	3,772	3,755	3,786	3,794	3,799	3,790	3,770	3,751	3,759	3,736	3,685	3,718	3,696	3,686	3,678	3,670	3,677	3,669	3,653	3,629	3,643	3,638	3,632	3,631	3,638	3,636	3,632
3,710	3,770	3,783	3,777	3,795	3,794	3,788	3,761	3,745	3,764	3,738	3,721	3,695	3,688	3,688	3,678	3,671	3,664	3,666	3,646	3,650	3,647	3,637	3,628	3,639	3,631	3,628	3,634
3,729	3,723	3,742	3,776	3,782	3,761	3,755	3,754	3,731	3,753	3,702	3,705	3,703	3,685	3,661	3,678	3,658	3,660	3,671	3,651	3,646	3,633	3,635	3,634	3,630	3,631	3,634	3,631
3,654	3,734	3,777	3,775	3,791	3,739	3,769	3,766	3,738	3,725	3,715	3,698	3,680	3,687	3,682	3,674	3,678	3,665	3,654	3,635	3,635	3,633	3,632	3,636	3,634	3,635	3,631	3,635
3,700	3,762	3,798	3,775	3,778	3,773	3,763	3,752	3,742	3,714	3,703	3,715	3,709	3,692	3,681	3,674	3,675	3,673	3,634	3,650	3,635	3,631	3,636	3,628	3,631	3,631	3,634	3,628
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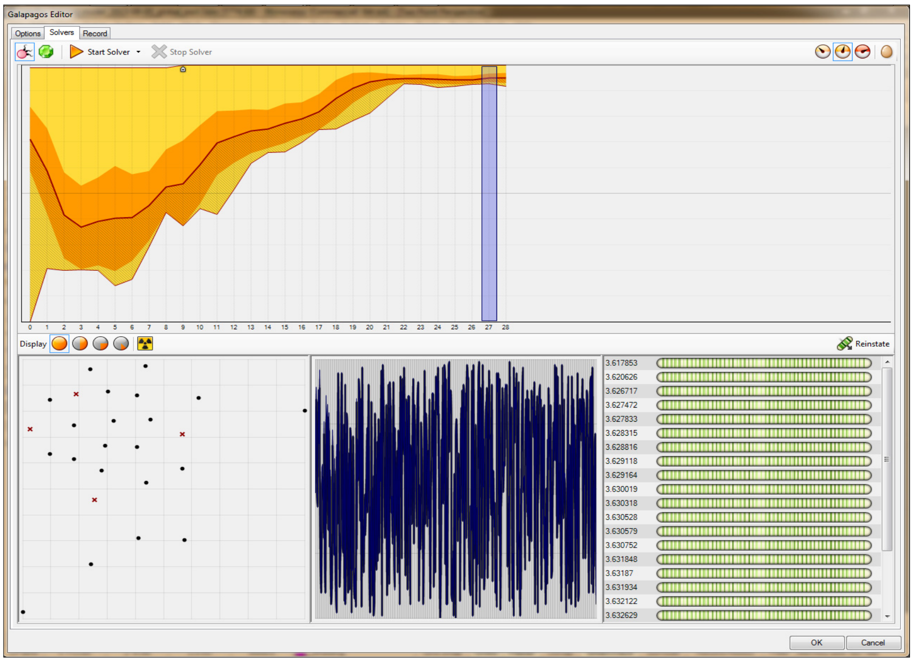

Table C 7 West-north Block Floor1 Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28
9,092	8,925	8,996	8,933	9,039	8,951	8,990	8,984	8,846	8,956	8,913	8,872	8,850	8,844	8,835	8,848	8,845	8,841	8,842	8,839	8,840	8,835	8,836	8,833	8,848	8,837	8,837	8,850	8,848
8,835	9,003	9,019	9,035	8,959	8,929	8,995	8,958	8,940	8,938	8,842	8,905	8,844	8,851	8,826	8,887	8,826	8,836	8,863	8,831	8,835	8,843	8,844	8,839	8,838	8,844	8,836	8,828	8,830
8,923	8,886	8,886	8,999	8,993	8,987	8,960	8,908	8,901	8,830	8,873	8,893	8,850	8,844	8,863	8,839	8,833	8,841	8,852	8,846	8,836	8,832	8,852	8,854	8,833	8,825	8,853	8,836	8,849
8,946	8,937	8,995	8,944	8,948	9,020	8,983	8,963	8,930	8,888	8,937	8,835	8,848	8,854	8,876	8,847	8,846	8,862	8,836	8,841	8,839	8,832	8,844	8,831	8,855	8,845	8,839	8,844	8,831
8,857	8,921	8,858	8,969	9,043	8,993	8,945	8,936	8,926	8,952	8,877	8,904	8,925	8,854	8,853	8,841	8,831	8,828	8,831	8,826	8,845	8,831	8,843	8,828	8,840	8,849	8,832	8,830	8,831
8,978	8,870	9,001	8,934	8,899	9,019	8,984	8,931	8,924	8,824	8,877	8,863	8,909	8,832	8,843	8,856	8,844	8,843	8,852	8,836	8,850	8,840	8,829	8,842	8,845	8,841	8,841	8,839	8,824
8,962	8,951	9,009	9,000	9,034	8,924	8,961	8,916	8,924	8,986	8,887	8,859	8,847	8,858	8,848	8,856	8,844	8,841	8,837	8,834	8,841	8,853	8,852	8,833	8,832	8,846	8,839	8,847	8,853
8,853	8,882	9,044	8,910	9,028	8,974	8,891	8,969	8,950	8,906	8,924	8,903	8,849	8,846	8,853	8,838	8,838	8,875	8,827	8,841	8,824	8,834	8,845	8,804	8,843	8,837	8,842	8,837	8,835
8,928	8,899	8,927	8,926	8,924	8,978	8,913	8,940	8,824	8,905	8,855	8,897	8,855	8,840	8,843	8,847	8,845	8,838	8,831	8,849	8,821	8,840	8,838	8,856	8,836	8,858	8,836	8,812	8,848
8,923	8,995	9,009	9,007	8,915	8,967	8,935	8,946	8,957	8,863	8,943	8,844	8,854	8,857	8,828	8,846	8,824	8,840	8,846	8,840	8,838	8,824	8,835	8,853	8,832	8,834	8,851	8,855	8,836
8,855	8,958	8,965	8,942	8,950	8,970	8,961	8,952	8,898	8,891	8,833	8,884	8,850	8,826	8,864	8,832	8,843	8,839	8,828	8,864	8,820	8,834	8,854	8,839	8,836	8,840	8,835	8,829	8,849
8,809	8,897	8,963	8,924	8,984	8,970	8,853	8,968	8,923	8,928	8,837	8,886	8,843	8,840	8,843	8,825	8,867	8,832	8,836	8,825	8,849	8,844	8,830	8,844	8,835	8,810	8,853	8,838	8,827
8,929	8,999	8,996	8,992	8,970	8,959	8,976	8,952	8,970	8,927	8,891	8,855	8,845	8,866	8,855	8,823	8,833	8,850	8,849	8,832	8,840	8,832	8,841	8,829	8,832	8,831	8,832	8,857	8,849
8,997	8,982	9,014	8,929	8,984	8,931	8,942	8,933	8,893	8,839	8,893	8,851	8,841	8,860	8,842	8,829	8,832	8,833	8,847	8,830	8,847	8,832	8,839	8,854	8,825	8,862	8,842	8,833	8,845
8,890	8,904	8,895	9,027	8,931	8,911	8,932	8,936	8,967	8,886	8,854	8,857	8,867	8,836	8,849	8,836	8,838	8,849	8,842	8,848	8,837	8,839	8,831	8,836	8,827	8,821	8,835	8,822	8,839
8,739	9,113	8,986	9,044	8,977	8,951	8,911	8,848	8,901	8,849	8,904	8,852	8,847	8,887	8,845	8,850	8,843	8,843	8,837	8,838	8,828	8,859	8,833	8,833	8,821	8,838	8,831	8,841	8,855
8,757	8,960	9,000	9,002	8,993	8,940	8,964	8,943	8,945	8,954	8,864	8,887	8,859	8,841	8,851	8,845	8,826	8,844	8,859	8,821	8,837	8,842	8,849	8,829	8,833	8,850	8,843	8,834	8,842
8,878	8,862	8,932	8,959	8,903	9,017	8,962	8,895	8,964	8,960	8,941	8,841	8,890	8,830	8,840	8,855	8,836	8,847	8,837	8,832	8,823	8,843	8,844	8,834	8,836	8,838	8,847	8,842	8,834
8,903	8,946	9,009	8,979	9,006	9,002	8,971	8,973	8,906	8,978	8,938	8,940	8,828	8,881	8,820	8,853	8,821	8,830	8,844	8,828	8,865	8,838	8,840	8,850	8,851	8,842	8,840	8,846	8,831
8,795	9,015	8,984	9,016	9,007	8,959	8,961	8,886	8,945	8,962	8,838	8,892	8,901	8,928	8,885	8,840	8,864	8,821	8,835	8,843	8,843	8,847	8,844	8,836	8,830	8,844	8,831	8,836	8,836
8,902	8,857	8,961	8,978	8,929	8,999	8,970	8,900	8,933	8,955	8,847	8,920	8,912	8,844	8,834	8,838	8,842	8,843	8,842	8,839	8,838	8,866	8,829	8,834	8,829	8,828	8,827	8,831	8,831
8,924	8,994	9,046	8,876	8,929	9,017	8,981	8,967	8,940	8,890	8,959	8,858	8,921	8,899	8,844	8,884	8,848	8,845	8,854	8,838	8,857	8,826	8,839	8,853	8,858	8,830	8,822	8,852	8,834
8,867	8,939	9,033	9,022	8,979	8,960	8,941	8,955	8,965	8,964	8,931	8,828	8,892	8,848	8,844	8,850	8,848	8,834	8,837	8,843	8,828	8,838	8,844	8,837	8,836	8,837	8,836	8,832	8,843
8,844	8,943	8,970	8,997	8,966	8,957	8,989	8,964	8,831	8,893	8,892	8,852	8,916	8,837	8,839	8,848	8,838	8,858	8,844	8,827	8,834	8,844	8,843	8,855	8,836	8,840	8,828	8,851	8,855
8,848	8,978	8,988	8,971	8,973	8,994	8,976	8,955	8,966	8,924	8,944	8,911	8,871	8,921	8,909	8,848	8,848	8,822	8,835	8,831	8,836	8,836	8,857	8,864	8,825	8,847	8,846	8,850	8,848
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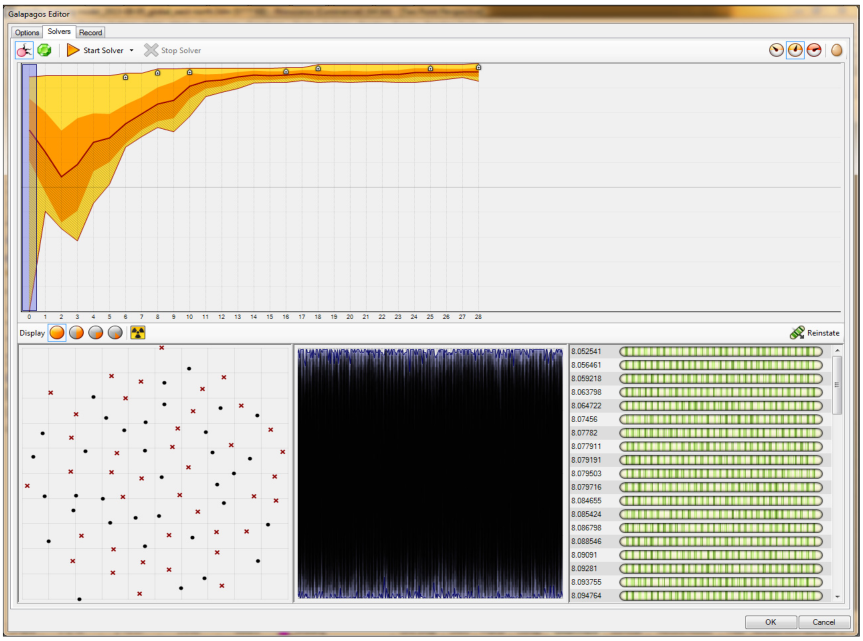

Table C 8 West-north Block Floor2 Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28
8,848	9,245	9,190	9,200	9,178	9,138	9,171	9,201	9,178	9,085	9,090	9,087	9,073	9,057	9,095	9,089	9,091	9,088	9,077	9,099	9,103	9,096	9,082	9,087	9,079	9,107	9,086	9,093	9,105
8,826	9,190	9,214	9,246	9,255	9,169	9,212	9,168	9,117	9,167	9,168	9,119	9,105	9,087	9,081	9,070	9,077	9,082	9,084	9,086	9,110	9,072	9,106	9,091	9,080	9,090	9,098	9,092	9,082
9,337	9,250	9,252	9,114	9,214	9,177	9,181	9,151	9,083	9,107	9,100	9,094	9,108	9,081	9,084	9,094	9,081	9,076	9,068	9,081	9,088	9,097	9,106	9,099	9,108	9,095	9,113	9,094	9,097
9,126	9,122	9,231	9,283	9,153	9,107	9,182	9,183	9,121	9,115	9,097	9,107	9,068	9,072	9,090	9,099	9,071	9,080	9,078	9,092	9,086	9,084	9,088	9,099	9,087	9,104	9,110	9,092	9,099
9,164	9,149	9,093	9,105	9,210	9,191	9,170	9,120	9,106	9,099	9,078	9,063	9,076	9,078	9,080	9,083	9,078	9,052	9,097	9,087	9,091	9,075	9,095	9,095	9,103	9,107	9,106	9,079	9,098
9,139	9,238	9,253	9,185	9,160	9,218	9,170	9,127	9,141	9,085	9,122	9,083	9,071	9,069	9,071	9,079	9,067	9,058	9,100	9,079	9,093	9,066	9,067	9,105	9,102	9,089	9,092	9,080	9,107
9,200	9,231	9,090	9,192	9,212	9,220	9,118	9,103	9,126	9,159	9,090	9,063	9,114	9,077	9,065	9,072	9,083	9,098	9,097	9,101	9,099	9,096	9,093	9,084	9,097	9,084	9,096	9,087	9,098
9,022	9,087	9,168	9,143	9,123	9,190	9,153	9,132	9,089	9,072	9,093	9,094	9,075	9,079	9,063	9,076	9,099	9,085	9,083	9,066	9,097	9,090	9,096	9,083	9,092	9,083	9,101	9,105	9,076
9,119	9,150	9,254	9,204	9,191	9,124	9,162	9,101	9,117	9,160	9,087	9,087	9,059	9,074	9,097	9,083	9,093	9,071	9,054	9,100	9,086	9,087	9,102	9,106	9,095	9,082	9,102	9,094	9,109
9,166	9,169	9,287	9,166	9,239	9,167	9,148	9,132	9,140	9,142	9,056	9,094	9,084	9,077	9,076	9,100	9,069	9,077	9,075	9,078	9,082	9,112	9,087	9,078	9,080	9,091	9,104	9,093	9,097
9,142	9,064	9,180	9,132	9,112	9,152	9,104	9,149	9,087	9,105	9,086	9,091	9,059	9,075	9,055	9,073	9,078	9,068	9,088	9,082	9,067	9,117	9,084	9,110	9,108	9,081	9,103	9,088	9,107
9,129	9,219	9,249	9,195	9,140	9,163	9,130	9,138	9,132	9,084	9,090	9,074	9,079	9,066	9,085	9,078	9,083	9,076	9,068	9,087	9,100	9,078	9,104	9,081	9,078	9,082	9,105	9,105	9,092
9,149	9,198	9,144	9,190	9,124	9,195	9,127	9,138	9,097	9,092	9,087	9,082	9,087	9,084	9,087	9,073	9,075	9,076	9,077	9,085	9,104	9,093	9,072	9,098	9,093	9,094	9,088	9,080	9,081
9,080	9,133	9,116	9,103	9,157	9,166	9,079	9,132	9,134	9,122	9,079	9,102	9,082	9,072	9,077	9,069	9,091	9,079	9,068	9,087	9,097	9,087	9,091	9,097	9,065	9,086	9,098	9,089	9,090
9,141	9,123	9,134	9,146	9,177	9,180	9,180	9,153	9,138	9,072	9,100	9,077	9,085	9,079	9,086	9,081	9,076	9,076	9,094	9,080	9,103	9,092	9,067	9,068	9,101	9,082	9,092	9,089	9,092
9,082	9,195	9,174	9,132	9,196	9,158	9,150	9,145	9,077	9,098	9,086	9,072	9,071	9,080	9,072	9,084	9,059	9,097	9,064	9,087	9,096	9,093	9,103	9,091	9,098	9,092	9,101	9,096	9,083
9,088	9,131	9,149	9,218	9,106	9,129	9,119	9,093	9,129	9,107	9,079	9,089	9,073	9,077	9,075	9,089	9,074	9,083	9,079	9,083	9,092	9,089	9,076	9,090	9,106	9,084	9,100	9,092	9,097
9,096	9,344	9,235	9,261	9,193	9,172	9,111	9,092	9,109	9,092	9,105	9,080	9,089	9,070	9,094	9,075	9,085	9,068	9,105	9,085	9,099	9,097	9,095	9,112	9,090	9,107	9,089	9,075	9,100
9,168	9,221	9,251	9,267	9,201	9,136	9,151	9,169	9,076	9,142	9,083	9,083	9,070	9,077	9,084	9,070	9,113	9,091	9,106	9,084	9,074	9,092	9,086	9,095	9,082	9,093	9,084	9,094	9,110
9,219	9,076	9,172	9,248	9,106	9,182	9,170	9,142	9,126	9,123	9,104	9,086	9,091	9,082	9,063	9,068	9,096	9,067	9,086	9,102	9,071	9,078	9,085	9,106	9,086	9,073	9,082	9,076	9,097
9,107	9,089	9,249	9,202	9,163	9,203	9,164	9,204	9,111	9,163	9,126	9,109	9,082	9,090	9,061	9,094	9,076	9,077	9,089	9,095	9,091	9,091	9,095	9,090	9,095	9,087	9,098	9,092	9,106
9,058	9,167	9,219	9,280	9,188	9,172	9,144	9,119	9,192	9,131	9,093	9,070	9,088	9,077	9,097	9,101	9,078	9,078	9,079	9,067	9,080	9,093	9,075	9,081	9,074	9,089	9,091	9,096	9,079
9,112	9,101	9,195	9,248	9,258	9,234	9,186	9,123	9,138	9,132	9,086	9,100	9,099	9,073	9,073	9,085	9,069	9,062	9,085	9,083	9,093	9,084	9,087	9,083	9,082	9,093	9,103	9,104	9,095
9,080	9,243	9,223	9,156	9,156	9,219	9,163	9,163	9,170	9,090	9,124	9,076	9,079	9,079	9,066	9,081	9,073	9,102	9,061	9,105	9,076	9,090	9,092	9,082	9,087	9,093	9,119	9,107	9,083
9,105	9,214	9,211	9,202	9,146	9,185	9,177	9,121	9,138	9,128	9,092	9,082	9,063	9,064	9,078	9,100	9,059	9,094	9,069	9,097	9,092	9,088	9,096	9,075	9,084	9,088	9,093	9,097	9,093
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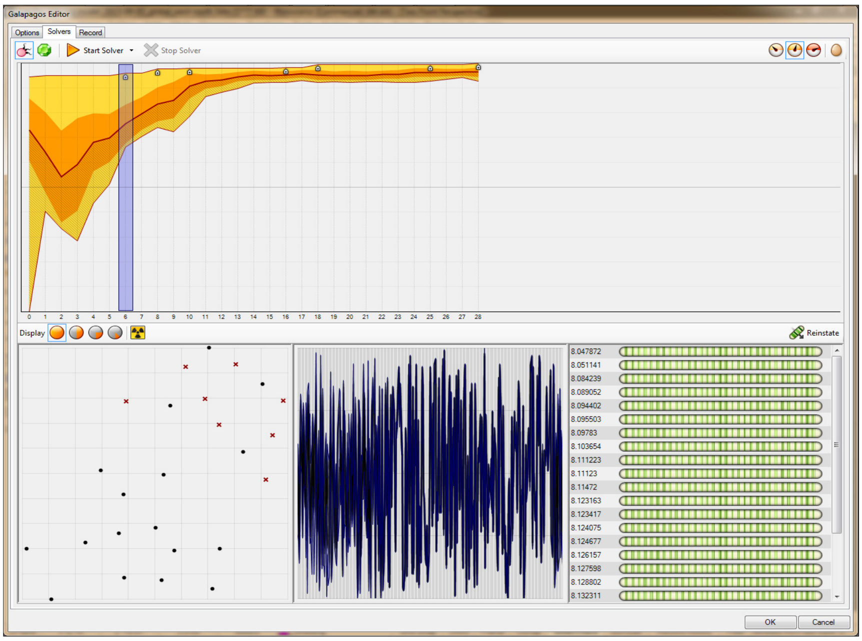

Table C 9 West-north Block Floor3 Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28
9,088	9,398	9,395	9,443	9,354	9,439	9,410	9,462	9,451	9,364	9,301	9,354	9,303	9,306	9,289	9,293	9,319	9,313	9,291	9,320	9,313	9,296	9,309	9,283	9,302	9,287	9,299	9,295	9,288
9,104	9,323	9,441	9,421	9,427	9,369	9,452	9,447	9,344	9,377	9,388	9,290	9,298	9,317	9,313	9,284	9,301	9,330	9,298	9,299	9,321	9,308	9,319	9,283	9,313	9,296	9,307	9,279	9,295
9,074	9,300	9,354	9,371	9,384	9,366	9,421	9,375	9,445	9,283	9,314	9,327	9,337	9,307	9,294	9,305	9,302	9,312	9,280	9,322	9,309	9,300	9,290	9,283	9,312	9,293	9,318	9,301	9,284
9,081	9,307	9,374	9,471	9,392	9,451	9,443	9,434	9,396	9,462	9,371	9,374	9,288	9,329	9,293	9,304	9,286	9,293	9,303	9,306	9,316	9,304	9,311	9,299	9,293	9,300	9,297	9,304	9,300
9,575	9,391	9,405	9,427	9,481	9,445	9,420	9,420	9,286	9,350	9,268	9,308	9,273	9,301	9,284	9,300	9,293	9,284	9,293	9,305	9,304	9,298	9,284	9,284	9,312	9,307	9,314	9,299	9,316
9,372	9,352	9,429	9,487	9,394	9,372	9,456	9,403	9,322	9,377	9,286	9,306	9,298	9,295	9,300	9,288	9,306	9,284	9,293	9,286	9,285	9,314	9,298	9,299	9,289	9,290	9,307	9,308	9,301
9,299	9,331	9,418	9,472	9,412	9,416	9,483	9,380	9,382	9,325	9,320	9,286	9,316	9,295	9,314	9,305	9,292	9,303	9,308	9,309	9,320	9,298	9,292	9,299	9,297	9,298	9,316	9,304	9,275
9,328	9,395	9,438	9,442	9,471	9,459	9,448	9,358	9,409	9,334	9,381	9,297	9,285	9,298	9,293	9,299	9,298	9,293	9,297	9,301	9,306	9,282	9,312	9,306	9,302	9,306	9,287	9,290	9,287
9,296	9,414	9,299	9,379	9,422	9,429	9,394	9,302	9,375	9,357	9,332	9,297	9,316	9,285	9,304	9,285	9,299	9,314	9,316	9,295	9,293	9,290	9,297	9,302	9,292	9,287	9,289	9,312	9,313
9,387	9,342	9,386	9,374	9,422	9,423	9,392	9,364	9,368	9,274	9,261	9,311	9,317	9,292	9,294	9,310	9,320	9,306	9,321	9,312	9,299	9,281	9,270	9,294	9,300	9,305	9,280	9,287	9,287
9,379	9,301	9,422	9,402	9,391	9,394	9,454	9,397	9,389	9,382	9,306	9,282	9,311	9,284	9,311	9,289	9,297	9,290	9,292	9,303	9,298	9,296	9,304	9,297	9,289	9,305	9,296	9,300	9,280
9,342	9,433	9,436	9,428	9,439	9,411	9,397	9,414	9,365	9,390	9,298	9,283	9,324	9,294	9,299	9,300	9,286	9,294	9,299	9,294	9,285	9,305	9,296	9,300	9,297	9,289	9,306	9,296	9,269
9,331	9,326	9,357	9,459	9,421	9,458	9,388	9,386	9,290	9,298	9,314	9,294	9,311	9,303	9,297	9,312	9,292	9,314	9,294	9,290	9,318	9,306	9,299	9,303	9,319	9,301	9,322	9,301	9,300
9,417	9,356	9,398	9,443	9,396	9,369	9,401	9,380	9,331	9,324	9,294	9,282	9,296	9,297	9,296	9,292	9,293	9,326	9,270	9,302	9,308	9,281	9,312	9,286	9,309	9,292	9,313	9,292	9,276
9,346	9,370	9,361	9,446	9,391	9,394	9,390	9,346	9,313	9,329	9,294	9,306	9,304	9,300	9,276	9,298	9,312	9,305	9,294	9,294	9,302	9,272	9,299	9,293	9,290	9,304	9,304	9,288	9,292
9,404	9,293	9,478	9,427	9,401	9,457	9,303	9,348	9,373	9,417	9,286	9,316	9,294	9,293	9,291	9,308	9,307	9,302	9,287	9,312	9,298	9,302	9,309	9,289	9,293	9,301	9,291	9,297	9,307
9,400	9,408	9,400	9,329	9,453	9,430	9,428	9,382	9,346	9,296	9,310	9,301	9,299	9,272	9,308	9,287	9,300	9,289	9,298	9,305	9,290	9,304	9,281	9,287	9,307	9,299	9,299	9,300	9,295
9,292	9,418	9,376	9,391	9,380	9,425	9,347	9,374	9,333	9,298	9,281	9,315	9,304	9,314	9,294	9,290	9,304	9,292	9,307	9,287	9,303	9,313	9,301	9,315	9,306	9,295	9,278	9,301	9,292
9,334	9,313	9,354	9,431	9,384	9,391	9,391	9,365	9,382	9,326	9,302	9,294	9,295	9,320	9,300	9,290	9,289	9,291	9,280	9,296	9,297	9,302	9,278	9,291	9,299	9,314	9,296	9,301	9,312
9,301	9,574	9,411	9,471	9,390	9,457	9,387	9,292	9,387	9,320	9,293	9,295	9,292	9,307	9,310	9,307	9,288	9,295	9,292	9,297	9,291	9,298	9,310	9,302	9,308	9,297	9,291	9,300	9,314
9,355	9,421	9,462	9,504	9,438	9,423	9,365	9,405	9,330	9,342	9,302	9,307	9,298	9,320	9,307	9,304	9,288	9,294	9,283	9,295	9,301	9,291	9,297	9,307	9,283	9,305	9,299	9,311	9,304
9,339	9,286	9,412	9,409	9,381	9,435	9,435	9,396	9,405	9,353	9,303	9,266	9,324	9,285	9,305	9,284	9,302	9,312	9,289	9,292	9,295	9,298	9,294	9,292	9,309	9,296	9,297	9,306	9,294
9,309	9,463	9,430	9,389	9,413	9,420	9,446	9,422	9,383	9,355	9,329	9,331	9,296	9,288	9,295	9,324	9,295	9,302	9,297	9,308	9,313	9,317	9,313	9,321	9,293	9,305	9,301	9,285	9,304
9,373	9,384	9,427	9,498	9,382	9,480	9,475	9,357	9,404	9,367	9,297	9,299	9,311	9,278	9,305	9,306	9,287	9,308	9,285	9,297	9,308	9,273	9,285	9,289	9,302	9,296	9,317	9,307	9,293
9,199	9,391	9,413	9,443	9,401	9,408	9,430	9,383	9,399	9,349	9,274	9,274	9,308	9,287	9,296	9,292	9,321	9,300	9,314	9,307	9,294	9,286	9,297	9,290	9,302	9,287	9,284	9,304	9,292
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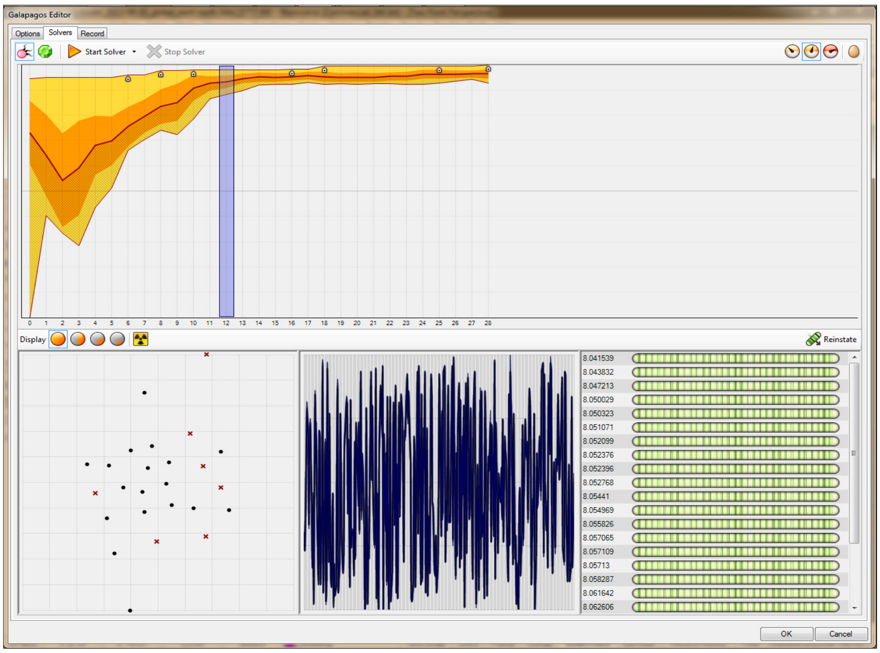

Table C 10 West-north Block Floor4 Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28
9,300	7,704	7,856	7,847	7,858	7,805	7,621	7,606	7,591	7,599	7,625	7,589	7,591	7,553	7,616	7,548	7,576	7,593	7,576	7,543	7,575	7,578	7,586	7,605	7,561	7,576	7,587	7,602	7,557
9,299	7,703	7,627	7,703	7,880	7,741	7,632	7,588	7,608	7,557	7,643	7,625	7,602	7,545	7,603	7,596	7,578	7,589	7,586	7,587	7,567	7,593	7,599	7,590	7,587	7,584	7,561	7,571	7,574
9,308	7,690	7,755	7,839	7,604	7,550	7,720	7,599	7,597	7,619	7,577	7,612	7,586	7,583	7,573	7,581	7,588	7,607	7,583	7,591	7,554	7,604	7,590	7,587	7,598	7,584	7,571	7,547	7,556
9,308	7,692	7,751	7,864	7,848	7,731	7,590	7,605	7,633	7,622	7,578	7,570	7,619	7,545	7,602	7,613	7,603	7,622	7,593	7,610	7,579	7,579	7,600	7,553	7,558	7,568	7,556	7,550	7,565
9,294	7,802	7,652	7,747	7,760	7,768	7,577	7,644	7,602	7,599	7,589	7,541	7,531	7,595	7,593	7,596	7,586	7,576	7,585	7,609	7,577	7,600	7,606	7,584	7,599	7,530	7,567	7,547	7,564
9,312	7,598	7,809	7,821	7,822	7,625	7,786	7,612	7,605	7,610	7,617	7,578	7,603	7,556	7,586	7,562	7,580	7,610	7,618	7,607	7,591	7,567	7,583	7,618	7,588	7,571	7,608	7,568	7,568
7,964	7,819	7,837	7,600	7,886	7,576	7,677	7,642	7,569	7,606	7,578	7,519	7,639	7,569	7,591	7,593	7,608	7,580	7,584	7,614	7,580	7,562	7,564	7,594	7,597	7,565	7,586	7,544	7,561
7,638	7,754	7,906	7,833	7,643	7,593	7,621	7,624	7,583	7,582	7,577	7,598	7,595	7,568	7,605	7,554	7,598	7,587	7,583	7,556	7,572	7,589	7,584	7,573	7,548	7,596	7,518	7,577	7,553
7,736	7,586	7,575	7,693	7,688	7,669	7,602	7,595	7,617	7,616	7,549	7,598	7,607	7,608	7,587	7,583	7,565	7,608	7,576	7,595	7,573	7,600	7,592	7,557	7,544	7,560	7,553	7,561	7,576
7,744	7,734	7,810	7,575	7,596	7,642	7,596	7,604	7,567	7,608	7,619	7,598	7,638	7,572	7,553	7,575	7,569	7,574	7,603	7,564	7,610	7,589	7,585	7,592	7,570	7,566	7,545	7,556	7,590
7,771	7,817	7,613	7,760	7,655	7,669	7,611	7,588	7,601	7,613	7,591	7,562	7,626	7,595	7,589	7,574	7,594	7,615	7,607	7,575	7,594	7,584	7,577	7,564	7,564	7,549	7,553	7,563	7,570
7,725	7,655	7,772	7,672	7,587	7,635	7,654	7,576	7,601	7,600	7,588	7,592	7,547	7,577	7,609	7,603	7,599	7,565	7,581	7,589	7,597	7,579	7,605	7,612	7,586	7,594	7,575	7,562	7,559
7,806	7,848	7,833	7,709	7,716	7,584	7,620	7,589	7,590	7,609	7,568	7,614	7,607	7,580	7,607	7,601	7,616	7,606	7,597	7,602	7,584	7,581	7,593	7,561	7,545	7,566	7,553	7,558	7,573
7,633	7,793	7,818	7,563	7,633	7,618	7,606	7,655	7,623	7,582	7,569	7,563	7,593	7,622	7,623	7,606	7,575	7,602	7,612	7,612	7,606	7,580	7,572	7,576	7,557	7,553	7,548	7,567	7,539
7,773	7,800	7,794	7,594	7,587	7,609	7,582	7,551	7,581	7,567	7,574	7,593	7,601	7,582	7,585	7,597	7,587	7,582	7,583	7,604	7,577	7,593	7,585	7,585	7,577	7,554	7,559	7,577	7,564
7,742	7,796	7,880	7,803	7,589	7,627	7,620	7,646	7,585	7,602	7,544	7,579	7,593	7,609	7,579	7,595	7,599	7,598	7,567	7,621	7,550	7,596	7,565	7,586	7,538	7,572	7,558	7,582	7,571
7,784	7,736	7,724	7,590	7,642	7,736	7,628	7,616	7,581	7,587	7,581	7,540	7,578	7,585	7,609	7,586	7,593	7,590	7,590	7,586	7,559	7,610	7,611	7,584	7,548	7,567	7,554	7,569	7,559
7,669	7,699	7,688	7,676	7,670	7,618	7,571	7,585	7,605	7,582	7,575	7,554	7,587	7,588	7,580	7,599	7,596	7,567	7,571	7,595	7,581	7,598	7,592	7,533	7,588	7,601	7,562	7,566	7,546
7,613	7,782	7,777	7,764	7,607	7,603	7,625	7,577	7,619	7,590	7,588	7,585	7,590	7,627	7,608	7,581	7,578	7,594	7,596	7,590	7,615	7,595	7,571	7,583	7,590	7,579	7,561	7,552	7,550
7,688	7,782	7,747	7,606	7,615	7,605	7,576	7,599	7,593	7,595	7,559	7,587	7,587	7,599	7,589	7,596	7,603	7,583	7,568	7,582	7,575	7,620	7,596	7,551	7,587	7,574	7,590	7,577	7,569
7,574	7,732	7,591	7,853	7,582	7,579	7,598	7,601	7,606	7,550	7,595	7,613	7,584	7,584	7,580	7,577	7,582	7,592	7,571	7,603	7,592	7,592	7,590	7,607	7,558	7,550	7,571	7,576	7,543
7,665	7,969	7,810	7,883	7,752	7,603	7,604	7,598	7,596	7,570	7,581	7,612	7,585	7,556	7,578	7,587	7,582	7,574	7,592	7,586	7,608	7,599	7,601	7,557	7,592	7,561	7,563	7,573	7,568
7,779	7,849	7,870	7,836	7,766	7,611	7,620	7,630	7,550	7,639	7,616	7,551	7,602	7,605	7,600	7,586	7,596	7,587	7,593	7,591	7,598	7,584	7,580	7,596	7,574	7,559	7,551	7,584	7,582
7,571	7,591	7,618	7,743	7,607	7,765	7,616	7,605	7,620	7,606	7,625	7,600	7,551	7,576	7,595	7,592	7,563	7,600	7,589	7,578	7,571	7,583	7,568	7,605	7,588	7,540	7,583	7,547	7,565
7,701	7,722	7,820	7,715	7,669	7,766	7,590	7,633	7,622	7,626	7,618	7,599	7,574	7,558	7,594	7,587	7,603	7,581	7,594	7,592	7,591	7,585	7,572	7,565	7,583	7,552	7,567	7,577	7,547
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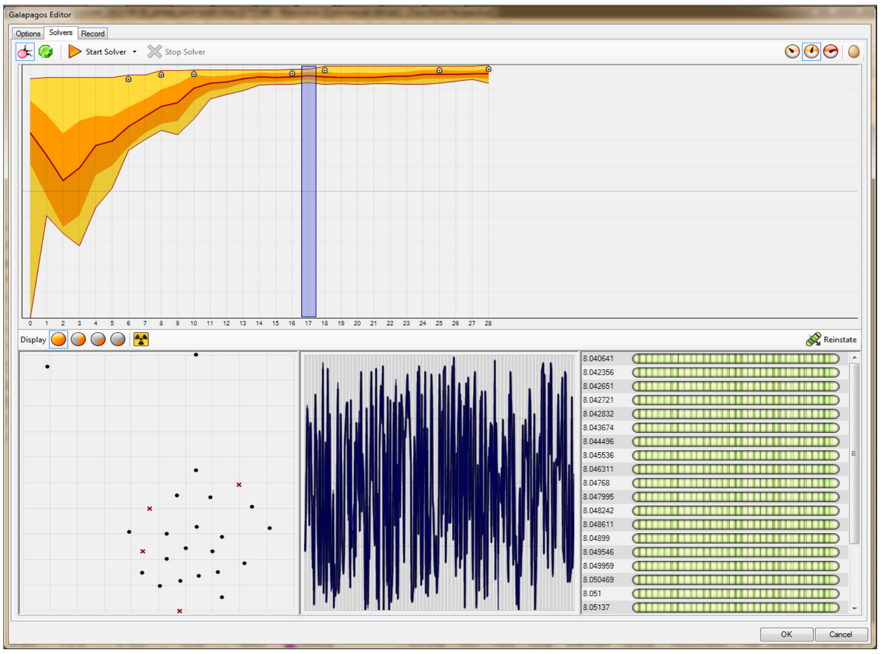

Table C 11 West-north Block Floor5 Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28
7,572	5,438	5,442	5,431	5,739	5,452	5,531	5,436	5,453	5,447	5,459	5,453	5,436	5,462	5,436	5,456	5,454	5,444	5,424	5,447	5,441	5,437	5,444	5,434	5,429	5,436	5,437	5,444	5,436
7,555	5,392	5,570	5,622	5,543	5,496	5,562	5,445	5,495	5,451	5,496	5,453	5,451	5,439	5,468	5,450	5,435	5,453	5,453	5,441	5,444	5,444	5,457	5,428	5,438	5,454	5,444	5,442	5,446
7,571	5,399	5,549	5,618	5,732	5,595	5,467	5,445	5,450	5,449	5,467	5,460	5,474	5,472	5,446	5,461	5,458	5,440	5,430	5,451	5,437	5,432	5,499	5,445	5,435	5,444	5,450	5,433	5,439
7,528	5,354	5,477	5,513	5,641	5,746	5,483	5,450	5,440	5,446	5,452	5,439	5,470	5,494	5,436	5,434	5,441	5,428	5,432	5,451	5,466	5,455	5,455	5,457	5,447	5,443	5,443	5,433	5,439
7,562	5,567	5,544	5,574	5,453	5,434	5,476	5,433	5,453	5,464	5,473	5,470	5,442	5,470	5,475	5,443	5,473	5,429	5,431	5,444	5,452	5,449	5,437	5,448	5,437	5,434	5,464	5,450	5,442
7,552	5,652	5,655	5,531	5,593	5,549	5,441	5,447	5,480	5,457	5,443	5,477	5,433	5,447	5,448	5,439	5,441	5,433	5,444	5,440	5,455	5,432	5,436	5,451	5,439	5,454	5,451	5,447	5,438
7,556	5,387	5,568	5,765	5,538	5,556	5,425	5,474	5,442	5,435	5,439	5,459	5,455	5,477	5,453	5,455	5,435	5,432	5,439	5,438	5,465	5,430	5,439	5,446	5,453	5,465	5,437	5,456	5,445
7,562	5,530	5,496	5,700	5,753	5,468	5,553	5,454	5,466	5,455	5,476	5,491	5,481	5,442	5,460	5,453	5,428	5,452	5,430	5,440	5,458	5,446	5,432	5,464	5,447	5,457	5,448	5,445	5,434
5,806	5,587	5,738	5,444	5,611	5,457	5,530	5,442	5,427	5,463	5,487	5,479	5,444	5,439	5,430	5,444	5,437	5,433	5,463	5,436	5,440	5,445	5,432	5,446	5,444	5,421	5,431	5,430	5,422
5,657	5,531	5,595	5,655	5,486	5,469	5,462	5,447	5,459	5,493	5,435	5,467	5,447	5,439	5,440	5,469	5,450	5,426	5,447	5,427	5,435	5,444	5,441	5,459	5,451	5,458	5,438	5,442	5,450
5,482	5,437	5,456	5,530	5,540	5,514	5,459	5,435	5,432	5,445	5,454	5,478	5,442	5,444	5,430	5,430	5,448	5,441	5,427	5,437	5,437	5,431	5,424	5,459	5,448	5,446	5,444	5,419	5,465
5,677	5,748	5,645	5,438	5,440	5,472	5,470	5,481	5,438	5,439	5,457	5,438	5,434	5,437	5,460	5,450	5,442	5,441	5,461	5,440	5,447	5,431	5,435	5,433	5,436	5,449	5,446	5,438	5,433
5,561	5,607	5,432	5,498	5,469	5,494	5,451	5,464	5,466	5,452	5,446	5,476	5,439	5,431	5,435	5,444	5,453	5,432	5,441	5,442	5,443	5,435	5,440	5,458	5,436	5,420	5,458	5,454	5,442
5,639	5,462	5,578	5,543	5,470	5,445	5,478	5,457	5,448	5,461	5,431	5,442	5,471	5,463	5,439	5,438	5,453	5,433	5,435	5,424	5,450	5,436	5,433	5,443	5,424	5,456	5,442	5,441	5,432
5,334	5,532	5,739	5,541	5,456	5,447	5,470	5,456	5,430	5,483	5,452	5,444	5,437	5,457	5,441	5,470	5,431	5,433	5,456	5,443	5,432	5,448	5,445	5,448	5,441	5,446	5,440	5,438	5,477
5,543	5,692	5,652	5,450	5,480	5,461	5,436	5,447	5,447	5,460	5,458	5,450	5,458	5,438	5,448	5,446	5,435	5,452	5,451	5,445	5,453	5,429	5,441	5,443	5,443	5,442	5,447	5,449	5,434
5,446	5,402	5,550	5,404	5,434	5,446	5,434	5,449	5,470	5,450	5,471	5,472	5,459	5,450	5,428	5,435	5,452	5,440	5,435	5,454	5,449	5,439	5,442	5,452	5,457	5,431	5,446	5,443	5,446
5,501	5,446	5,586	5,509	5,434	5,460	5,471	5,464	5,461	5,434	5,481	5,459	5,439	5,432	5,432	5,442	5,448	5,426	5,434	5,440	5,435	5,437	5,438	5,449	5,436	5,463	5,458	5,440	5,424
5,593	5,491	5,538	5,457	5,495	5,497	5,467	5,469	5,474	5,449	5,436	5,446	5,437	5,462	5,423	5,444	5,451	5,437	5,448	5,410	5,449	5,424	5,450	5,431	5,423	5,434	5,434	5,457	5,449
5,501	5,423	5,537	5,486	5,539	5,437	5,434	5,452	5,442	5,449	5,430	5,469	5,430	5,457	5,428	5,420	5,437	5,433	5,436	5,444	5,459	5,442	5,458	5,460	5,426	5,457	5,437	5,425	5,465
5,564	5,620	5,554	5,523	5,452	5,458	5,474	5,462	5,461	5,489	5,455	5,447	5,465	5,428	5,450	5,453	5,442	5,471	5,438	5,448	5,452	5,459	5,445	5,451	5,443	5,424	5,444	5,442	5,433
5,470	5,638	5,556	5,448	5,475	5,478	5,457	5,446	5,454	5,448	5,449	5,444	5,447	5,442	5,440	5,443	5,437	5,457	5,437	5,452	5,449	5,430	5,446	5,435	5,430	5,423	5,440	5,459	5,420
5,504	5,459	5,475	5,506	5,448	5,443	5,449	5,443	5,465	5,445	5,462	5,451	5,453	5,444	5,449	5,435	5,452	5,460	5,446	5,444	5,454	5,436	5,459	5,445	5,440	5,440	5,439	5,464	5,443
5,590	5,755	5,610	5,659	5,504	5,429	5,432	5,421	5,458	5,455	5,456	5,455	5,448	5,457	5,420	5,441	5,423	5,439	5,432	5,442	5,433	5,431	5,435	5,425	5,452	5,458	5,436	5,431	5,453
5,459	5,676	5,633	5,712	5,510	5,455	5,455	5,502	5,476	5,459	5,441	5,455	5,449	5,437	5,435	5,445	5,449	5,440	5,452	5,454	5,458	5,453	5,442	5,441	5,439	5,441	5,467	5,444	5,446
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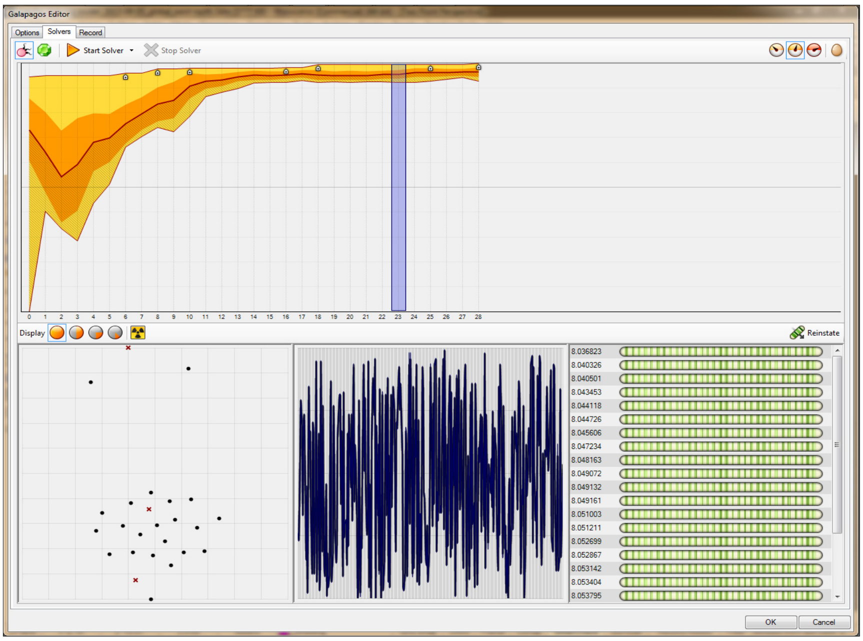

Table C 12 West-north Block All Floors Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28
8,780	8,142	8,176	8,171	8,234	8,157	8,144	8,138	8,104	8,090	8,078	8,071	8,051	8,044	8,054	8,047	8,057	8,056	8,042	8,050	8,054	8,048	8,052	8,048	8,044	8,049	8,049	8,057	8,047
8,724	8,122	8,174	8,205	8,213	8,141	8,171	8,121	8,101	8,098	8,107	8,079	8,060	8,048	8,058	8,057	8,043	8,058	8,057	8,049	8,055	8,052	8,065	8,047	8,051	8,053	8,049	8,042	8,045
8,842	8,105	8,159	8,188	8,185	8,135	8,150	8,096	8,095	8,058	8,066	8,077	8,071	8,058	8,052	8,056	8,052	8,055	8,043	8,058	8,045	8,053	8,067	8,053	8,057	8,048	8,061	8,042	8,045
8,798	8,083	8,166	8,215	8,196	8,211	8,136	8,127	8,104	8,107	8,087	8,065	8,059	8,059	8,059	8,059	8,049	8,057	8,048	8,060	8,057	8,051	8,060	8,048	8,048	8,052	8,049	8,045	8,047
8,890	8,166	8,110	8,165	8,190	8,166	8,118	8,111	8,075	8,093	8,057	8,057	8,050	8,060	8,057	8,052	8,052	8,034	8,048	8,054	8,054	8,051	8,053	8,048	8,058	8,046	8,057	8,041	8,050
8,871	8,142	8,229	8,192	8,174	8,157	8,167	8,104	8,095	8,071	8,069	8,061	8,063	8,040	8,049	8,045	8,048	8,046	8,061	8,050	8,055	8,044	8,043	8,063	8,052	8,049	8,060	8,048	8,048
8,596	8,144	8,184	8,206	8,216	8,138	8,133	8,103	8,089	8,102	8,063	8,037	8,074	8,055	8,054	8,056	8,053	8,051	8,053	8,059	8,061	8,048	8,048	8,051	8,055	8,052	8,055	8,048	8,046
8,481	8,130	8,210	8,206	8,204	8,137	8,133	8,107	8,099	8,070	8,090	8,076	8,057	8,047	8,055	8,044	8,052	8,058	8,044	8,041	8,051	8,048	8,054	8,046	8,047	8,056	8,039	8,051	8,037
8,177	8,127	8,159	8,129	8,167	8,131	8,120	8,076	8,072	8,100	8,062	8,072	8,056	8,049	8,052	8,048	8,048	8,053	8,048	8,055	8,043	8,052	8,052	8,053	8,042	8,042	8,042	8,042	8,054
8,175	8,154	8,217	8,156	8,132	8,134	8,107	8,099	8,098	8,076	8,063	8,063	8,068	8,047	8,038	8,060	8,046	8,045	8,058	8,044	8,053	8,050	8,044	8,055	8,046	8,051	8,043	8,047	8,052
8,126	8,115	8,127	8,153	8,130	8,140	8,118	8,104	8,081	8,087	8,054	8,059	8,058	8,045	8,050	8,040	8,052	8,051	8,048	8,052	8,043	8,052	8,049	8,054	8,049	8,044	8,046	8,040	8,054
8,136	8,190	8,213	8,132	8,118	8,130	8,101	8,115	8,092	8,088	8,054	8,055	8,045	8,043	8,059	8,051	8,055	8,041	8,049	8,047	8,055	8,048	8,054	8,054	8,046	8,045	8,057	8,048	8,036
8,155	8,196	8,152	8,170	8,140	8,138	8,112	8,106	8,083	8,076	8,061	8,064	8,058	8,053	8,056	8,051	8,054	8,056	8,052	8,050	8,058	8,049	8,049	8,050	8,045	8,042	8,051	8,050	8,049
8,153	8,145	8,185	8,116	8,128	8,106	8,101	8,111	8,086	8,066	8,053	8,048	8,057	8,063	8,055	8,047	8,049	8,055	8,046	8,051	8,062	8,043	8,049	8,051	8,036	8,050	8,048	8,044	8,036
8,097	8,146	8,185	8,151	8,108	8,108	8,111	8,088	8,086	8,068	8,055	8,055	8,059	8,051	8,047	8,057	8,049	8,049	8,054	8,054	8,050	8,049	8,045	8,046	8,047	8,041	8,046	8,043	8,053
8,102	8,218	8,234	8,171	8,129	8,131	8,084	8,087	8,077	8,085	8,056	8,054	8,053	8,061	8,047	8,057	8,049	8,058	8,041	8,061	8,045	8,056	8,051	8,049	8,038	8,049	8,046	8,053	8,050
8,095	8,127	8,164	8,109	8,126	8,136	8,115	8,096	8,094	8,079	8,061	8,058	8,054	8,045	8,054	8,048	8,049	8,049	8,052	8,050	8,045	8,057	8,052	8,048	8,050	8,046	8,048	8,048	8,048
8,087	8,154	8,163	8,159	8,116	8,138	8,092	8,082	8,094	8,073	8,077	8,050	8,062	8,047	8,048	8,052	8,054	8,040	8,051	8,048	8,048	8,058	8,054	8,049	8,051	8,061	8,047	8,045	8,039
8,122	8,151	8,186	8,180	8,139	8,126	8,121	8,110	8,092	8,097	8,069	8,070	8,044	8,073	8,047	8,048	8,050	8,049	8,055	8,042	8,060	8,050	8,045	8,050	8,049	8,052	8,043	8,050	8,050
8,101	8,174	8,170	8,165	8,131	8,128	8,106	8,074	8,099	8,090	8,045	8,066	8,060	8,075	8,055	8,046	8,057	8,040	8,044	8,053	8,048	8,057	8,058	8,051	8,047	8,049	8,046	8,043	8,056
8,100	8,144	8,163	8,212	8,113	8,133	8,114	8,114	8,089	8,100	8,065	8,079	8,068	8,053	8,047	8,053	8,046	8,055	8,045	8,056	8,055	8,060	8,051	8,058	8,042	8,039	8,048	8,050	8,043
8,091	8,211	8,209	8,179	8,145	8,141	8,124	8,105	8,117	8,078	8,077	8,050	8,073	8,052	8,053	8,060	8,049	8,053	8,050	8,047	8,058	8,049	8,051	8,043	8,053	8,040	8,042	8,057	8,039
8,114	8,162	8,201	8,200	8,173	8,134	8,128	8,114	8,100	8,107	8,085	8,052	8,068	8,052	8,052	8,056	8,052	8,049	8,052	8,054	8,057	8,052	8,057	8,057	8,045	8,047	8,046	8,054	8,053
8,092	8,183	8,170	8,210	8,123	8,170	8,135	8,102	8,097	8,082	8,079	8,056	8,061	8,045	8,045	8,054	8,037	8,061	8,042	8,050	8,044	8,044	8,045	8,051	8,053	8,045	8,056	8,049	8,050
8,062	8,196	8,213	8,209	8,140	8,162	8,126	8,119	8,120	8,097	8,074	8,064	8,053	8,053	8,062	8,055	8,056	8,047	8,053	8,056	8,054	8,049	8,053	8,047	8,047	8,043	8,052	8,054	8,045
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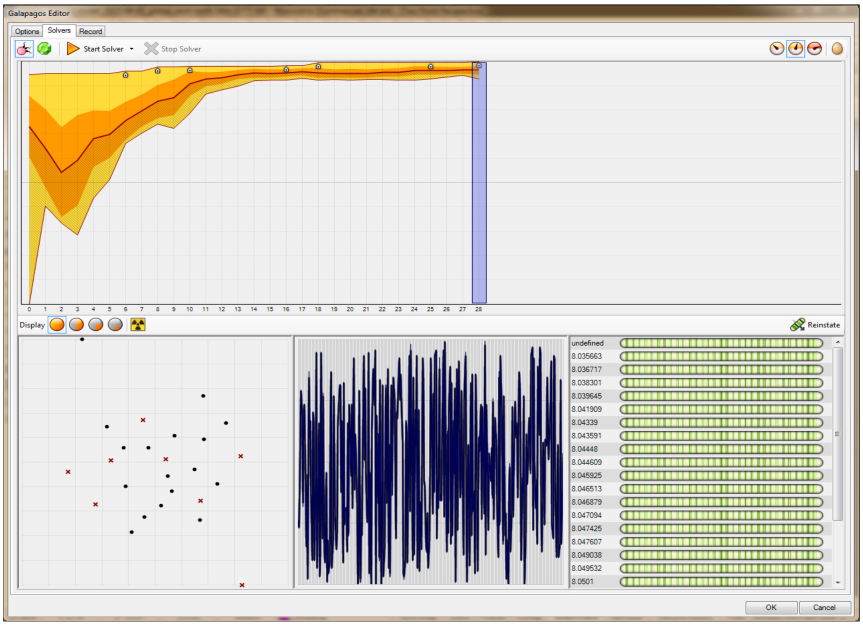

Table C 13 West-south Block Floor1 Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28
2,105	1,943	2,009	1,968	1,987	1,989	1,967	1,984	1,867	1,947	1,916	1,915	1,922	1,911	1,939	1,884	1,902	1,858	1,896	1,891	1,884	1,883	1,896	1,885	1,874	1,899	1,864	1,889	1,884
1,945	2,045	1,955	2,081	2,051	2,014	2,008	1,958	1,917	1,983	1,907	1,861	1,848	1,881	1,873	1,878	1,892	1,885	1,879	1,902	1,877	1,876	1,875	1,869	1,885	1,876	1,890	1,851	1,897
1,894	1,979	1,870	1,926	2,003	1,943	1,999	2,025	1,992	1,911	1,850	1,921	1,892	1,855	1,860	1,892	1,898	1,868	1,851	1,901	1,884	1,870	1,884	1,904	1,884	1,887	1,883	1,869	1,882
1,867	1,949	2,016	1,991	2,018	2,019	1,956	1,983	1,892	1,962	1,873	1,907	1,895	1,912	1,879	1,892	1,908	1,912	1,895	1,876	1,889	1,902	1,853	1,865	1,889	1,881	1,883	1,890	1,870
1,999	2,012	2,044	1,888	1,878	1,992	2,002	1,932	1,998	1,998	1,958	1,909	1,874	1,861	1,865	1,866	1,895	1,901	1,857	1,914	1,860	1,899	1,866	1,883	1,873	1,868	1,875	1,888	1,881
1,810	1,972	2,018	1,945	1,904	1,977	1,910	1,980	2,002	1,870	1,900	1,889	1,890	1,904	1,875	1,896	1,851	1,864	1,891	1,872	1,879	1,867	1,912	1,883	1,869	1,888	1,885	1,869	1,877
1,931	1,952	1,998	2,008	1,986	2,008	1,942	1,904	1,995	1,919	1,910	1,900	1,898	1,915	1,876	1,892	1,887	1,909	1,859	1,892	1,870	1,868	1,867	1,880	1,872	1,863	1,850	1,863	1,807
1,929	1,881	1,950	1,946	1,995	1,928	2,020	1,904	1,908	1,851	1,875	1,856	1,878	1,883	1,876	1,914	1,863	1,857	1,914	1,903	1,875	1,892	1,890	1,892	1,888	1,887	1,873	1,881	1,864
1,883	1,827	1,800	1,942	1,964	1,884	1,967	1,845	1,921	1,844	1,883	1,917	1,841	1,860	1,877	1,895	1,885	1,846	1,902	1,880	1,893	1,877	1,877	1,887	1,874	1,908	1,897	1,886	1,885
1,829	1,954	1,925	1,935	1,963	1,980	1,864	1,916	1,901	1,859	1,859	1,856	1,882	1,873	1,913	1,881	1,892	1,892	1,890	1,896	1,887	1,873	1,889	1,915	1,881	1,879	1,852	1,871	1,875
1,836	1,968	1,976	2,037	1,982	2,010	1,973	1,946	1,904	1,880	1,880	1,887	1,898	1,892	1,880	1,865	1,892	1,904	1,870	1,878	1,892	1,871	1,874	1,871	1,883	1,874	1,878	1,858	1,896
1,859	1,882	1,843	1,855	1,845	1,842	1,950	1,873	1,918	1,927	1,886	1,886	1,848	1,864	1,862	1,871	1,903	1,869	1,868	1,865	1,886	1,887	1,866	1,854	1,872	1,898	1,876	1,879	1,880
1,774	1,908	1,991	1,996	1,998	1,986	1,974	1,982	1,859	1,915	1,870	1,837	1,866	1,913	1,867	1,873	1,888	1,859	1,866	1,873	1,871	1,891	1,851	1,878	1,887	1,861	1,863	1,881	1,874
1,955	1,997	2,004	1,938	1,984	1,872	1,952	1,953	1,938	1,896	1,875	1,930	1,910	1,845	1,877	1,871	1,855	1,875	1,900	1,895	1,885	1,874	1,884	1,887	1,884	1,878	1,878	1,875	1,873
1,973	1,903	1,950	1,994	2,000	2,002	1,971	1,996	1,889	1,933	1,908	1,879	1,861	1,864	1,890	1,886	1,885	1,865	1,860	1,886	1,870	1,897	1,874	1,869	1,876	1,878	1,886	1,866	1,858
1,851	1,877	1,943	2,005	2,021	2,031	1,983	2,007	1,951	1,875	1,889	1,931	1,872	1,853	1,913	1,883	1,852	1,859	1,876	1,878	1,888	1,902	1,888	1,878	1,902	1,889	1,867	1,874	1,871
2,026	1,994	2,007	1,978	2,008	2,004	1,915	1,984	2,023	1,972	1,899	1,923	1,877	1,867	1,881	1,902	1,899	1,882	1,881	1,864	1,877	1,889	1,906	1,876	1,885	1,877	1,872	1,873	1,871
1,805	1,876	1,981	1,968	1,966	1,965	2,011	1,978	1,975	1,956	1,860	1,918	1,902	1,890	1,924	1,903	1,885	1,880	1,873	1,870	1,872	1,869	1,900	1,877	1,882	1,860	1,879	1,887	1,883
1,929	1,988	1,970	2,004	2,003	1,973	1,983	1,997	1,975	1,932	1,868	1,881	1,929	1,928	1,911	1,918	1,894	1,915	1,923	1,896	1,885	1,882	1,878	1,882	1,896	1,864	1,869	1,877	1,863
1,782	1,965	2,015	1,993	1,931	1,928	2,036	2,006	1,988	1,959	1,918	1,914	1,908	1,860	1,902	1,880	1,860	1,863	1,850	1,875	1,897	1,878	1,878	1,871	1,876	1,912	1,879	1,866	1,880
1,842	1,794	1,926	1,941	2,026	2,024	1,855	2,009	1,916	1,940	1,851	1,907	1,865	1,890	1,861	1,892	1,896	1,869	1,862	1,890	1,895	1,861	1,876	1,909	1,872	1,868	1,860	1,889	1,878
1,831	2,110	1,976	1,981	2,029	1,975	1,987	1,961	1,956	1,920	1,877	1,875	1,872	1,903	1,860	1,915	1,853	1,868	1,864	1,872	1,862	1,868	1,880	1,885	1,869	1,901	1,890	1,885	1,867
1,867	1,922	1,906	2,016	2,000	1,946	1,961	2,029	1,958	1,897	1,915	1,899	1,925	1,939	1,896	1,904	1,901	1,916	1,898	1,891	1,868	1,885	1,868	1,883	1,882	1,882	1,890	1,861	1,876
1,720	1,860	1,936	1,992	1,946	2,005	1,990	1,869	1,969	1,991	2,012	1,852	1,894	1,900	1,889	1,870	1,911	1,841	1,899	1,867	1,899	1,881	1,873	1,876	1,846	1,901	1,871	1,875	1,868
1,953	1,914	2,004	2,018	1,980	2,026	2,008	1,969	1,944	2,010	1,901	1,858	1,898	1,914	1,857	1,893	1,916	1,877	1,858	1,880	1,874	1,866	1,875	1,886	1,876	1,884	1,885	1,879	1,870
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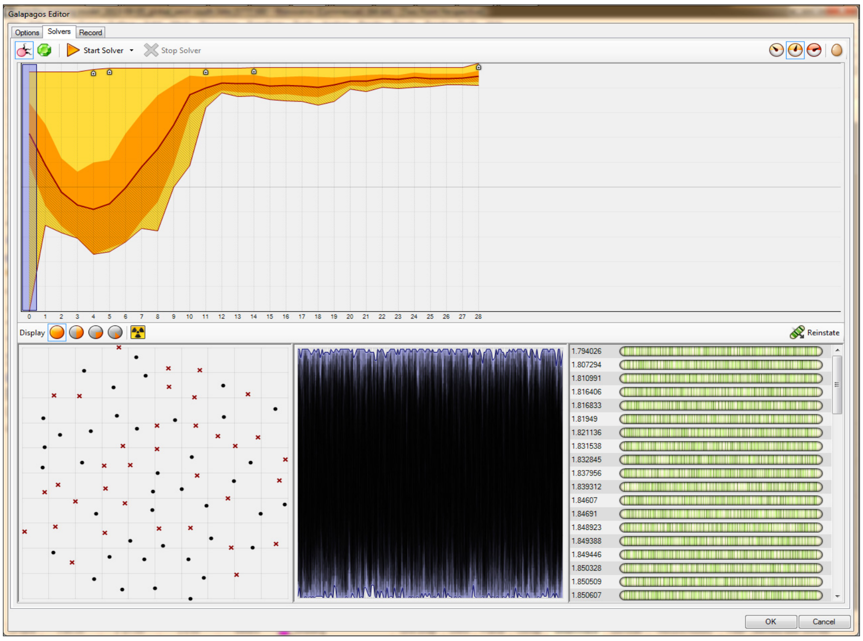

Table C 14 West-south Block Floor2 Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28
2,109	1,927	2,070	2,001	1,995	2,022	1,998	1,955	1,843	1,997	1,824	1,819	1,801	1,801	1,782	1,801	1,780	1,793	1,869	1,791	1,784	1,792	1,806	1,803	1,787	1,809	1,789	1,785	1,780
1,890	1,973	1,953	2,008	2,055	1,944	1,963	2,054	1,832	1,893	1,832	1,788	1,821	1,768	1,800	1,855	1,788	1,853	1,773	1,844	1,783	1,813	1,810	1,805	1,800	1,827	1,811	1,821	1,796
1,936	1,788	1,941	1,945	1,910	2,005	1,958	2,062	1,910	1,823	1,785	1,829	1,836	1,785	1,778	1,794	1,789	1,855	1,796	1,835	1,776	1,809	1,792	1,805	1,784	1,797	1,781	1,805	1,798
1,888	1,898	2,050	2,031	1,950	1,973	2,006	2,021	1,822	1,866	1,819	1,843	1,805	1,840	1,803	1,790	1,807	1,781	1,859	1,799	1,810	1,797	1,813	1,802	1,793	1,816	1,814	1,783	1,798
1,834	2,018	1,979	1,997	1,947	2,066	2,019	1,917	2,003	1,911	1,939	1,837	1,809	1,778	1,837	1,758	1,835	1,845	1,779	1,795	1,843	1,797	1,806	1,801	1,793	1,806	1,796	1,775	1,806
2,038	2,008	1,873	1,998	2,038	1,959	1,846	1,940	1,919	1,845	1,812	1,780	1,815	1,773	1,778	1,824	1,781	1,849	1,861	1,845	1,823	1,800	1,783	1,793	1,785	1,794	1,796	1,811	1,783
1,886	1,981	1,960	1,964	2,048	2,059	2,023	1,825	1,985	1,847	1,809	1,802	1,795	1,782	1,799	1,831	1,855	1,807	1,845	1,861	1,802	1,786	1,802	1,797	1,795	1,796	1,783	1,795	1,780
1,884	1,959	1,986	1,948	2,088	1,963	1,948	1,776	1,825	1,780	1,827	1,775	1,800	1,842	1,787	1,791	1,845	1,853	1,865	1,867	1,800	1,799	1,791	1,807	1,787	1,799	1,809	1,794	1,785
1,880	1,831	1,832	1,934	1,878	2,030	1,971	1,832	1,833	1,825	1,868	1,825	1,782	1,764	1,762	1,778	1,802	1,838	1,796	1,846	1,792	1,806	1,795	1,806	1,788	1,810	1,787	1,785	1,799
1,969	1,949	1,935	2,062	2,035	1,945	1,784	1,820	1,796	1,846	1,847	1,790	1,835	1,838	1,796	1,862	1,795	1,833	1,835	1,851	1,806	1,793	1,792	1,808	1,796	1,780	1,793	1,796	1,812
1,837	1,925	2,011	1,991	1,992	1,996	1,935	1,950	1,796	1,776	1,832	1,777	1,830	1,812	1,844	1,789	1,800	1,863	1,789	1,789	1,795	1,789	1,797	1,782	1,794	1,789	1,803	1,800	1,779
1,823	1,868	1,980	1,954	1,804	1,927	1,836	1,824	1,812	1,820	1,773	1,849	1,799	1,778	1,797	1,780	1,778	1,798	1,788	1,799	1,788	1,792	1,793	1,790	1,772	1,807	1,774	1,782	1,823
1,826	1,884	2,015	2,021	2,031	1,945	1,978	1,959	1,837	1,813	1,828	1,782	1,781	1,775	1,785	1,778	1,848	1,772	1,848	1,804	1,792	1,789	1,807	1,787	1,782	1,787	1,786	1,797	1,796
1,893	1,878	1,995	2,007	2,015	1,780	1,904	2,013	1,901	1,793	1,821	1,841	1,808	1,766	1,768	1,835	1,766	1,844	1,808	1,776	1,817	1,804	1,804	1,794	1,788	1,825	1,795	1,786	1,808
1,850	1,911	1,832	1,875	1,893	1,951	1,951	1,894	1,765	1,844	1,792	1,779	1,803	1,762	1,796	1,873	1,801	1,778	1,847	1,851	1,794	1,794	1,807	1,805	1,795	1,802	1,796	1,795	1,791
1,766	1,966	1,861	1,988	1,956	2,006	1,952	1,985	1,963	1,854	1,774	1,803	1,792	1,831	1,890	1,865	1,778	1,783	1,828	1,805	1,792	1,775	1,770	1,792	1,811	1,800	1,805	1,791	1,801
1,915	1,997	2,051	1,907	1,905	1,982	1,882	2,012	2,032	2,031	1,836	1,842	1,775	1,792	1,792	1,780	1,796	1,798	1,884	1,852	1,799	1,811	1,839	1,790	1,806	1,789	1,798	1,797	1,811
1,881	1,872	1,942	2,005	2,057	1,946	2,076	1,964	2,026	1,937	1,849	1,850	1,796	1,808	1,847	1,796	1,795	1,849	1,845	1,840	1,850	1,798	1,801	1,806	1,799	1,767	1,792	1,800	1,775
1,837	1,930	1,993	2,023	2,035	1,950	1,981	1,965	2,058	1,881	1,791	1,804	1,840	1,843	1,803	1,805	1,787	1,797	1,853	1,802	1,854	1,865	1,782	1,802	1,795	1,784	1,801	1,797	1,772
1,827	1,955	1,919	2,058	2,005	1,962	2,062	1,962	2,026	1,882	1,849	1,794	1,858	1,811	1,775	1,846	1,835	1,844	1,854	1,843	1,863	1,853	1,811	1,794	1,795	1,792	1,792	1,800	1,769
1,785	1,981	1,997	1,933	2,091	2,005	1,788	1,836	1,971	2,013	1,837	1,826	1,843	1,799	1,792	1,807	1,838	1,832	1,845	1,830	1,821	1,797	1,795	1,803	1,765	1,791	1,791	1,799	1,769
1,904	2,077	1,984	1,919	2,029	2,023	2,027	1,968	1,937	1,807	1,800	1,855	1,775	1,858	1,853	1,781	1,837	1,836	1,844	1,828	1,821	1,788	1,809	1,795	1,797	1,782	1,777	1,807	1,782
1,830	1,999	2,043	1,969	2,065	2,022	1,987	1,914	1,976	1,808	1,841	1,852	1,824	1,834	1,819	1,788	1,872	1,841	1,828	1,783	1,850	1,858	1,782	1,799	1,803	1,799	1,808	1,792	1,863
1,930	1,731	1,922	2,061	1,997	2,035	2,004	1,777	1,941	2,003	1,872	1,821	1,797	1,806	1,792	1,776	1,760	1,843	1,849	1,845	1,811	1,787	1,798	1,807	1,807	1,805	1,789	1,788	1,779
1,900	1,976	2,020	2,015	2,002	2,054	2,011	2,019	1,980	1,912	1,830	1,841	1,860	1,833	1,782	1,837	1,809	1,803	1,866	1,774	1,805	1,807	1,797	1,805	1,800	1,816	1,795	1,787	1,792
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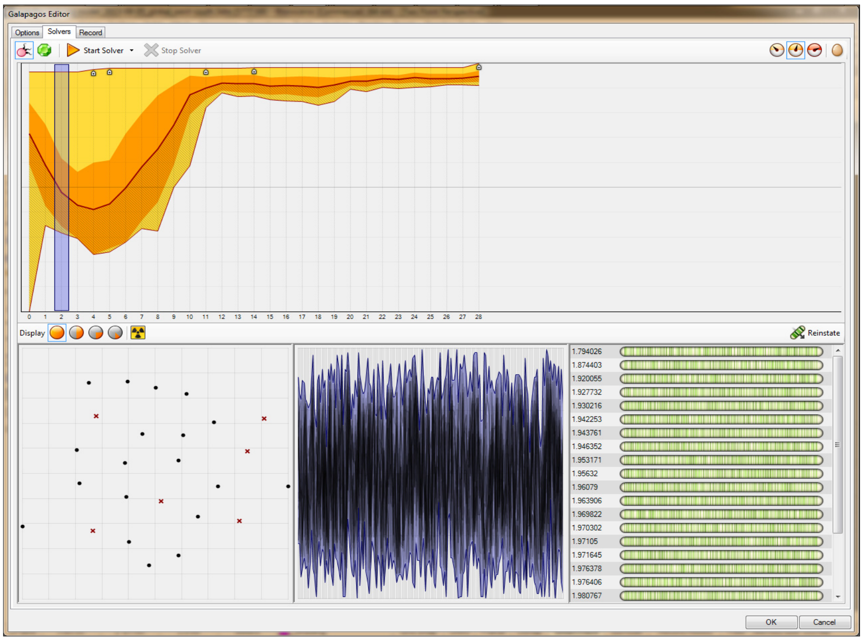

Table C 15 West-south Block Floor3 Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28
2,142	1,930	1,973	2,058	2,011	1,952	2,016	1,894	1,761	1,837	1,743	1,763	1,778	1,798	1,802	1,802	1,814	1,750	1,739	1,769	1,775	1,773	1,763	1,769	1,771	1,758	1,756	1,767	1,756
1,821	2,023	2,000	2,104	2,016	1,911	2,008	2,021	1,805	1,961	1,736	1,694	1,730	1,777	1,810	1,789	1,794	1,818	1,732	1,795	1,778	1,780	1,760	1,768	1,762	1,766	1,739	1,786	1,763
1,887	1,846	2,029	2,022	2,024	1,999	1,998	1,962	1,988	1,774	1,735	1,774	1,759	1,770	1,773	1,769	1,797	1,803	1,754	1,731	1,758	1,772	1,768	1,759	1,763	1,758	1,775	1,756	1,747
1,777	2,039	2,080	1,996	2,105	1,999	2,036	2,008	1,796	1,903	1,732	1,763	1,772	1,702	1,810	1,810	1,814	1,821	1,739	1,784	1,748	1,772	1,765	1,766	1,757	1,753	1,780	1,781	1,743
1,904	2,092	1,910	1,979	2,014	1,943	2,003	1,990	1,918	1,946	1,934	1,755	1,726	1,744	1,725	1,783	1,748	1,793	1,760	1,776	1,762	1,766	1,775	1,759	1,769	1,766	1,765	1,749	1,748
1,821	1,906	1,967	1,954	1,990	2,025	1,815	1,942	1,914	1,770	1,753	1,746	1,748	1,771	1,736	1,764	1,752	1,730	1,754	1,739	1,772	1,779	1,760	1,780	1,752	1,773	1,721	1,785	1,753
1,988	1,999	2,095	2,006	2,036	2,097	2,030	1,781	1,996	1,822	1,760	1,771	1,785	1,757	1,799	1,733	1,797	1,805	1,818	1,818	1,777	1,761	1,764	1,765	1,763	1,761	1,771	1,758	1,751
1,870	2,029	1,989	2,082	2,042	2,003	1,958	1,774	1,778	1,732	1,759	1,756	1,715	1,795	1,787	1,774	1,794	1,812	1,820	1,741	1,764	1,765	1,760	1,765	1,781	1,777	1,768	1,771	1,761
1,791	1,880	1,994	2,016	1,977	2,039	1,959	1,777	1,800	1,751	1,804	1,759	1,741	1,738	1,781	1,820	1,805	1,760	1,756	1,749	1,754	1,788	1,759	1,769	1,753	1,772	1,769	1,771	1,761
1,806	1,889	2,012	2,028	1,971	2,025	1,753	1,776	1,779	1,748	1,710	1,760	1,713	1,747	1,763	1,741	1,766	1,822	1,798	1,752	1,767	1,759	1,772	1,778	1,775	1,769	1,762	1,771	1,785
1,893	1,862	1,992	1,982	2,063	1,991	2,020	1,876	1,755	1,744	1,770	1,786	1,709	1,725	1,771	1,752	1,818	1,786	1,747	1,757	1,747	1,746	1,743	1,753	1,760	1,743	1,771	1,773	1,758
1,850	1,855	1,993	1,962	1,740	2,029	1,776	1,771	1,791	1,787	1,745	1,721	1,751	1,710	1,720	1,716	1,746	1,759	1,751	1,747	1,749	1,769	1,781	1,754	1,756	1,770	1,776	1,753	1,751
1,922	1,933	1,941	2,046	1,975	2,019	2,022	1,906	1,775	1,779	1,797	1,748	1,723	1,773	1,750	1,744	1,809	1,748	1,769	1,762	1,762	1,778	1,750	1,760	1,769	1,772	1,743	1,763	1,765
1,913	1,862	1,991	2,010	2,067	1,739	1,972	1,913	1,922	1,783	1,776	1,769	1,762	1,740	1,720	1,783	1,732	1,763	1,780	1,771	1,774	1,775	1,779	1,756	1,760	1,758	1,789	1,740	1,771
1,825	1,753	1,970	1,946	1,904	1,908	2,016	1,949	1,792	1,802	1,781	1,711	1,784	1,790	1,777	1,804	1,757	1,748	1,807	1,730	1,758	1,765	1,774	1,773	1,761	1,746	1,747	1,761	1,758
1,781	2,053	2,059	1,994	1,974	2,081	2,021	2,012	1,854	1,796	1,713	1,777	1,806	1,745	1,770	1,790	1,752	1,745	1,756	1,770	1,752	1,757	1,761	1,779	1,778	1,769	1,771	1,757	1,768
1,887	2,025	2,052	2,089	2,009	1,992	1,872	2,000	2,065	2,004	1,832	1,724	1,800	1,814	1,826	1,795	1,774	1,805	1,811	1,817	1,754	1,774	1,774	1,771	1,792	1,772	1,766	1,778	1,757
1,920	1,866	2,033	1,997	2,046	2,129	1,966	2,030	2,008	1,878	1,788	1,743	1,774	1,728	1,763	1,768	1,765	1,777	1,704	1,761	1,795	1,762	1,757	1,761	1,755	1,779	1,772	1,765	1,723
2,014	2,027	2,087	2,026	1,987	2,051	2,043	1,976	2,002	1,818	1,769	1,753	1,731	1,728	1,774	1,804	1,795	1,811	1,807	1,763	1,744	1,770	1,775	1,762	1,769	1,765	1,774	1,737	1,754
1,860	2,055	1,968	1,986	2,019	2,034	2,080	1,976	1,994	1,960	1,774	1,726	1,768	1,775	1,750	1,792	1,745	1,793	1,791	1,747	1,791	1,742	1,747	1,766	1,749	1,762	1,757	1,764	1,755
1,779	1,966	2,044	1,965	2,091	2,033	1,739	1,886	1,882	1,947	1,738	1,768	1,744	1,754	1,750	1,771	1,722	1,756	1,771	1,807	1,772	1,769	1,772	1,764	1,753	1,768	1,740	1,792	1,753
1,941	2,160	2,027	2,086	2,069	1,999	2,062	2,019	1,903	1,772	1,768	1,758	1,791	1,769	1,749	1,774	1,799	1,740	1,803	1,804	1,799	1,763	1,767	1,769	1,795	1,758	1,757	1,748	1,747
1,785	1,985	2,037	2,024	2,063	2,074	2,009	1,948	1,992	1,755	1,762	1,805	1,779	1,773	1,799	1,786	1,802	1,756	1,779	1,783	1,765	1,819	1,794	1,808	1,750	1,755	1,766	1,759	1,746
2,017	1,959	2,058	1,963	2,037	1,988	2,031	1,761	1,980	1,928	1,961	1,762	1,734	1,765	1,772	1,770	1,802	1,793	1,728	1,786	1,767	1,760	1,773	1,776	1,776	1,776	1,772	1,786	1,757
2,075	2,021	2,065	2,047	1,993	2,056	2,016	2,015	1,951	2,007	1,717	1,739	1,709	1,800	1,735	1,759	1,784	1,778	1,792	1,783	1,758	1,759	1,750	1,753	1,746	1,745	1,756	1,760	1,754
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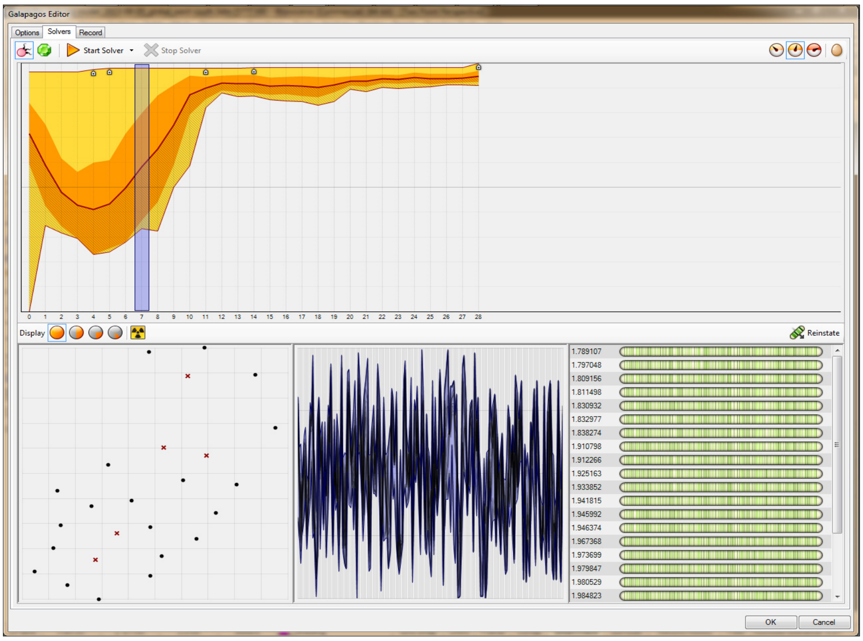

Table C 16 West-south Block Floor4 Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28
2,374	2,224	2,154	2,258	2,290	2,278	2,256	2,221	2,155	2,213	2,158	2,117	2,135	2,145	2,139	2,090	2,124	2,100	2,063	2,094	2,108	2,104	2,092	2,095	2,099	2,121	2,110	2,109	2,094
2,108	2,178	2,226	2,272	2,316	2,198	2,187	2,237	2,140	2,193	2,181	2,111	2,151	2,108	2,087	2,106	2,145	2,122	2,091	2,125	2,098	2,090	2,070	2,079	2,136	2,081	2,099	2,106	2,083
2,045	2,322	2,142	2,255	2,208	2,260	2,264	2,289	2,286	2,187	2,099	2,100	2,126	2,110	2,102	2,147	2,118	2,120	2,157	2,104	2,097	2,110	2,087	2,090	2,112	2,070	2,118	2,098	2,091
2,058	2,237	2,239	2,269	2,264	2,264	2,278	2,273	2,099	2,232	2,130	2,175	2,132	2,113	2,151	2,118	2,130	2,135	2,108	2,107	2,105	2,137	2,097	2,100	2,090	2,109	2,107	2,095	2,104
2,249	2,224	2,226	2,280	2,264	2,269	2,275	2,276	2,221	2,197	2,235	2,131	2,132	2,110	2,120	2,094	2,094	2,140	2,089	2,124	2,079	2,095	2,097	2,066	2,094	2,074	2,109	2,107	2,113
2,158	2,031	2,214	2,185	2,185	2,246	2,153	2,231	2,241	2,155	2,140	2,147	2,146	2,167	2,121	2,155	2,101	2,118	2,128	2,097	2,082	2,100	2,085	2,147	2,087	2,104	2,083	2,104	2,149
2,076	2,169	2,307	2,246	2,268	2,323	2,276	2,163	2,247	2,180	2,188	2,139	2,100	2,108	2,174	2,103	2,136	2,134	2,137	2,142	2,137	2,091	2,119	2,107	2,105	2,105	2,125	2,085	2,097
2,211	2,144	2,304	2,262	2,283	2,249	2,240	2,110	2,180	2,107	2,128	2,086	2,081	2,109	2,110	2,136	2,118	2,122	2,110	2,099	2,106	2,108	2,088	2,099	2,097	2,085	2,115	2,090	2,115
2,116	2,143	2,171	2,251	2,297	2,211	2,276	2,139	2,204	2,174	2,158	2,116	2,130	2,114	2,111	2,132	2,138	2,104	2,083	2,099	2,116	2,121	2,120	2,097	2,108	2,124	2,107	2,115	2,098
2,175	2,190	2,192	2,260	2,287	2,176	2,127	2,175	2,138	2,154	2,163	2,099	2,090	2,138	2,149	2,099	2,133	2,131	2,119	2,090	2,073	2,086	2,114	2,104	2,061	2,101	2,090	2,112	2,086
2,136	2,130	2,235	2,253	2,282	2,266	2,260	2,149	2,114	2,141	2,121	2,107	2,092	2,132	2,139	2,097	2,108	2,171	2,104	2,113	2,112	2,102	2,070	2,101	2,075	2,111	2,101	2,102	2,102
2,068	1,981	2,166	2,165	2,138	2,269	2,155	2,142	2,155	2,098	2,151	2,087	2,103	2,102	2,145	2,115	2,111	2,090	2,094	2,089	2,103	2,120	2,107	2,083	2,092	2,101	2,105	2,091	2,091
2,282	2,207	2,270	2,343	2,251	2,198	2,286	2,218	2,148	2,133	2,204	2,121	2,089	2,181	2,061	2,067	2,106	2,094	2,095	2,114	2,093	2,076	2,077	2,100	2,073	2,092	2,100	2,111	2,093
2,023	2,246	2,235	2,244	2,323	2,107	2,200	2,215	2,155	2,160	2,121	2,148	2,103	2,124	2,105	2,139	2,118	2,060	2,080	2,130	2,091	2,083	2,054	2,094	2,088	2,093	2,086	2,090	2,123
2,115	2,071	2,205	2,279	2,164	2,162	2,268	2,198	2,120	2,178	2,134	2,114	2,104	2,097	2,128	2,127	2,077	2,091	2,133	2,069	2,079	2,085	2,105	2,081	2,102	2,091	2,109	2,084	2,076
2,125	2,198	2,123	2,214	2,241	2,279	2,267	2,256	2,117	2,184	2,086	2,118	2,086	2,119	2,082	2,099	2,100	2,096	2,098	2,097	2,106	2,110	2,082	2,099	2,088	2,115	2,104	2,106	2,089
2,155	2,218	2,224	2,218	2,229	2,256	2,149	2,276	2,302	2,285	2,145	2,167	2,134	2,087	2,136	2,123	2,110	2,122	2,120	2,155	2,105	2,130	2,102	2,094	2,109	2,070	2,102	2,098	2,099
2,069	2,182	2,255	2,251	2,260	2,243	2,237	2,288	2,268	2,159	2,196	2,162	2,122	2,096	2,111	2,124	2,147	2,103	2,108	2,106	2,110	2,091	2,111	2,100	2,088	2,083	2,102	2,109	2,093
2,079	2,262	2,299	2,264	2,279	2,281	2,293	2,271	2,256	2,155	2,130	2,124	2,130	2,146	2,147	2,112	2,131	2,129	2,147	2,116	2,098	2,108	2,078	2,100	2,108	2,085	2,099	2,080	2,096
2,038	2,125	2,143	2,250	2,260	2,278	2,281	2,281	2,281	2,186	2,131	2,173	2,111	2,145	2,140	2,151	2,085	2,155	2,123	2,104	2,144	2,079	2,092	2,083	2,115	2,122	2,094	2,103	2,115
2,141	2,154	2,158	2,221	2,311	2,228	2,135	2,200	2,108	2,141	2,150	2,128	2,123	2,111	2,118	2,137	2,087	2,098	2,107	2,133	2,088	2,096	2,097	2,115	2,062	2,079	2,101	2,100	2,082
2,121	2,366	2,322	2,271	2,309	2,260	2,274	2,273	2,200	2,140	2,120	2,155	2,100	2,128	2,106	2,144	2,138	2,092	2,120	2,073	2,141	2,096	2,099	2,102	2,102	2,100	2,101	2,081	2,113
2,154	2,209	2,189	2,276	2,296	2,321	2,267	2,264	2,252	2,140	2,184	2,167	2,120	2,102	2,111	2,136	2,128	2,110	2,144	2,099	2,086	2,124	2,097	2,090	2,095	2,091	2,109	2,094	2,095
2,194	2,075	2,212	2,123	2,293	2,280	2,249	2,128	2,228	2,194	2,171	2,148	2,127	2,142	2,150	2,072	2,113	2,105	2,101	2,102	2,098	2,089	2,119	2,096	2,093	2,102	2,121	2,075	2,098
2,234	2,137	2,226	2,298	2,246	2,266	2,293	2,224	2,160	2,173	2,135	2,117	2,105	2,100	2,116	2,104	2,143	2,111	2,139	2,105	2,085	2,109	2,102	2,067	2,095	2,096	2,109	2,079	2,077
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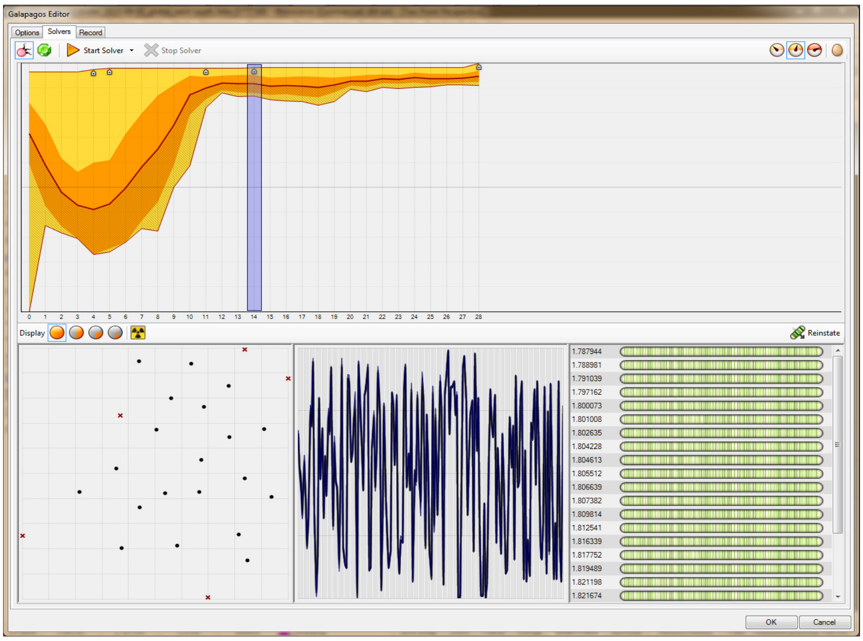

Table C 17 West-south Block Floor5 Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28
1,875	1,699	1,697	1,761	1,778	1,711	1,772	1,614	1,553	1,639	1,509	1,487	1,479	1,484	1,505	1,476	1,478	1,508	1,502	1,497	1,484	1,483	1,476	1,480	1,495	1,482	1,487	1,485	1,489
1,581	1,705	1,686	1,789	1,770	1,572	1,686	1,767	1,495	1,625	1,478	1,490	1,498	1,496	1,493	1,506	1,476	1,482	1,481	1,481	1,494	1,477	1,492	1,478	1,472	1,480	1,474	1,488	1,481
1,623	1,657	1,656	1,657	1,691	1,709	1,697	1,724	1,717	1,512	1,491	1,503	1,493	1,486	1,488	1,486	1,487	1,487	1,464	1,491	1,501	1,495	1,487	1,479	1,493	1,500	1,486	1,494	1,495
1,491	1,705	1,683	1,743	1,727	1,714	1,732	1,740	1,464	1,643	1,495	1,473	1,493	1,478	1,481	1,489	1,482	1,459	1,507	1,482	1,476	1,485	1,468	1,501	1,487	1,482	1,479	1,487	1,478
1,685	1,672	1,607	1,735	1,715	1,679	1,730	1,721	1,658	1,653	1,623	1,513	1,503	1,520	1,486	1,502	1,496	1,482	1,489	1,506	1,497	1,478	1,510	1,475	1,465	1,481	1,505	1,479	1,491
1,610	1,510	1,640	1,658	1,657	1,732	1,583	1,637	1,673	1,556	1,496	1,490	1,482	1,483	1,495	1,481	1,499	1,497	1,519	1,502	1,475	1,495	1,461	1,480	1,479	1,490	1,468	1,487	1,496
1,584	1,803	1,690	1,695	1,742	1,824	1,771	1,493	1,677	1,508	1,474	1,485	1,498	1,482	1,480	1,489	1,494	1,480	1,485	1,489	1,495	1,488	1,495	1,476	1,481	1,484	1,485	1,501	1,475
1,597	1,679	1,621	1,739	1,786	1,738	1,698	1,493	1,499	1,501	1,501	1,501	1,485	1,483	1,490	1,478	1,456	1,495	1,490	1,494	1,470	1,489	1,484	1,465	1,499	1,481	1,484	1,480	1,463
1,667	1,599	1,575	1,652	1,582	1,734	1,732	1,562	1,559	1,491	1,547	1,509	1,478	1,470	1,493	1,490	1,487	1,483	1,482	1,472	1,480	1,481	1,479	1,492	1,493	1,503	1,499	1,490	1,510
1,417	1,717	1,667	1,732	1,733	1,704	1,461	1,504	1,481	1,544	1,484	1,496	1,490	1,495	1,493	1,499	1,472	1,494	1,494	1,486	1,499	1,491	1,471	1,480	1,464	1,494	1,474	1,508	1,493
1,603	1,651	1,668	1,767	1,786	1,724	1,690	1,641	1,446	1,489	1,500	1,478	1,493	1,495	1,480	1,492	1,496	1,478	1,489	1,478	1,493	1,457	1,475	1,483	1,500	1,472	1,494	1,482	1,494
1,865	1,550	1,670	1,653	1,428	1,723	1,486	1,435	1,459	1,514	1,488	1,492	1,474	1,503	1,488	1,505	1,502	1,474	1,489	1,449	1,502	1,483	1,529	1,486	1,489	1,488	1,479	1,489	1,473
1,599	1,675	1,638	1,695	1,819	1,707	1,714	1,644	1,558	1,484	1,557	1,494	1,491	1,477	1,476	1,490	1,467	1,485	1,501	1,478	1,480	1,484	1,510	1,483	1,498	1,473	1,492	1,483	1,483
1,451	1,653	1,724	1,687	1,777	1,447	1,619	1,638	1,615	1,453	1,499	1,480	1,481	1,505	1,484	1,467	1,478	1,489	1,483	1,476	1,476	1,504	1,496	1,474	1,483	1,486	1,495	1,462	1,486
1,682	1,467	1,643	1,585	1,628	1,671	1,751	1,589	1,487	1,568	1,464	1,495	1,482	1,498	1,498	1,467	1,482	1,515	1,482	1,487	1,489	1,476	1,496	1,493	1,456	1,483	1,466	1,500	1,486
1,447	1,599	1,733	1,703	1,707	1,779	1,689	1,664	1,628	1,525	1,488	1,480	1,504	1,508	1,478	1,523	1,491	1,483	1,484	1,487	1,480	1,486	1,480	1,490	1,476	1,491	1,474	1,481	1,478
1,557	1,736	1,792	1,733	1,738	1,738	1,659	1,691	1,764	1,749	1,531	1,483	1,485	1,471	1,474	1,487	1,466	1,482	1,478	1,485	1,490	1,503	1,490	1,484	1,483	1,474	1,495	1,462	1,491
1,572	1,622	1,672	1,652	1,658	1,789	1,706	1,696	1,742	1,605	1,534	1,485	1,476	1,493	1,481	1,499	1,494	1,478	1,499	1,499	1,463	1,483	1,471	1,485	1,498	1,491	1,513	1,473	1,480
1,671	1,632	1,708	1,729	1,725	1,769	1,725	1,689	1,765	1,533	1,496	1,492	1,483	1,480	1,472	1,488	1,488	1,448	1,466	1,468	1,476	1,475	1,490	1,483	1,458	1,488	1,465	1,480	1,496
1,577	1,663	1,737	1,763	1,730	1,746	1,796	1,763	1,767	1,687	1,506	1,539	1,490	1,486	1,471	1,491	1,473	1,476	1,489	1,499	1,472	1,506	1,483	1,517	1,481	1,481	1,491	1,489	1,479
1,489	1,674	1,678	1,673	1,696	1,722	1,449	1,623	1,635	1,714	1,559	1,487	1,496	1,484	1,506	1,488	1,494	1,499	1,512	1,479	1,479	1,485	1,486	1,473	1,494	1,465	1,491	1,489	1,476
1,433	1,852	1,668	1,678	1,805	1,737	1,784	1,748	1,612	1,488	1,466	1,572	1,513	1,491	1,453	1,464	1,490	1,491	1,495	1,488	1,454	1,500	1,486	1,477	1,524	1,448	1,490	1,474	1,478
1,616	1,682	1,677	1,757	1,763	1,767	1,730	1,714	1,693	1,471	1,529	1,553	1,457	1,475	1,457	1,450	1,505	1,488	1,475	1,494	1,490	1,463	1,462	1,468	1,477	1,500	1,460	1,485	1,483
1,618	1,613	1,730	1,770	1,753	1,769	1,754	1,450	1,627	1,642	1,595	1,563	1,478	1,486	1,495	1,483	1,490	1,483	1,488	1,487	1,486	1,479	1,491	1,490	1,487	1,488	1,487	1,472	1,488
1,426	1,773	1,750	1,729	1,756	1,799	1,725	1,676	1,714	1,651	1,506	1,501	1,476	1,472	1,496	1,480	1,471	1,466	1,494	1,486	1,481	1,494	1,478	1,481	1,456	1,492	1,478	1,490	1,459
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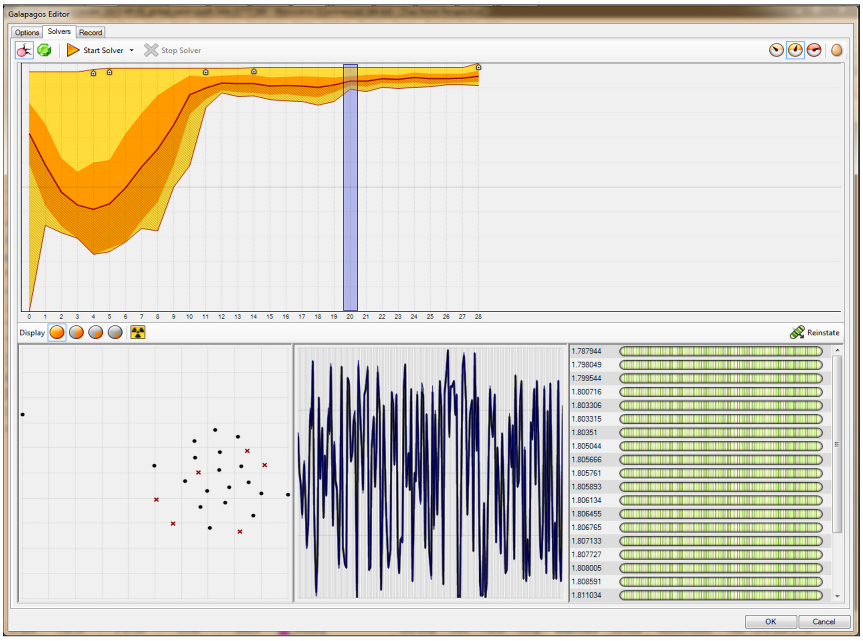

Table C 18 West-south Block All Floor Fitness Function

Gen_0	Gen_1	Gen_2	Gen_3	Gen_4	Gen_5	Gen_6	Gen_7	Gen_8	Gen_9	Gen_10	Gen_11	Gen_12	Gen_13	Gen_14	Gen_15	Gen_16	Gen_17	Gen_18	Gen_19	Gen_20	Gen_21	Gen_22	Gen_23	Gen_24	Gen_25	Gen_26	Gen_27	Gen_28
2,121	1,945	1,981	2,009	2,012	1,990	2,002	1,934	1,836	1,927	1,830	1,820	1,823	1,828	1,833	1,811	1,819	1,802	1,814	1,808	1,807	1,807	1,807	1,806	1,805	1,814	1,801	1,807	1,801
1,869	1,985	1,964	2,051	2,042	1,928	1,970	2,008	1,838	1,931	1,827	1,789	1,810	1,806	1,813	1,827	1,819	1,832	1,791	1,829	1,806	1,807	1,801	1,800	1,811	1,806	1,802	1,810	1,804
1,877	1,918	1,928	1,961	1,967	1,983	1,983	2,013	1,979	1,841	1,792	1,826	1,821	1,801	1,800	1,818	1,818	1,826	1,805	1,813	1,803	1,811	1,804	1,807	1,807	1,803	1,809	1,804	1,803
1,816	1,966	2,014	2,006	2,013	1,994	2,002	2,005	1,814	1,922	1,810	1,832	1,819	1,809	1,825	1,820	1,828	1,822	1,822	1,809	1,806	1,819	1,799	1,807	1,803	1,808	1,813	1,807	1,799
1,934	2,004	1,953	1,976	1,964	1,990	2,006	1,967	1,960	1,941	1,938	1,829	1,809	1,802	1,807	1,800	1,813	1,832	1,795	1,823	1,808	1,807	1,811	1,797	1,799	1,799	1,810	1,800	1,808
1,887	1,886	1,942	1,948	1,955	1,988	1,861	1,946	1,950	1,839	1,820	1,811	1,816	1,820	1,801	1,824	1,797	1,811	1,831	1,811	1,806	1,808	1,800	1,817	1,794	1,810	1,791	1,811	1,812
1,893	1,981	2,010	1,984	2,016	2,062	2,009	1,833	1,980	1,855	1,828	1,819	1,815	1,809	1,826	1,810	1,834	1,827	1,829	1,840	1,816	1,799	1,809	1,805	1,803	1,802	1,803	1,800	1,782
1,898	1,938	1,970	1,995	2,039	1,976	1,973	1,811	1,838	1,794	1,818	1,795	1,792	1,822	1,810	1,818	1,815	1,828	1,840	1,821	1,803	1,811	1,803	1,806	1,810	1,806	1,810	1,803	1,798
1,867	1,856	1,874	1,959	1,940	1,980	1,981	1,831	1,863	1,817	1,852	1,825	1,794	1,789	1,805	1,823	1,823	1,806	1,804	1,809	1,807	1,815	1,806	1,810	1,803	1,823	1,812	1,809	1,811
1,839	1,940	1,946	2,003	1,998	1,966	1,798	1,838	1,819	1,830	1,813	1,800	1,802	1,818	1,823	1,817	1,812	1,834	1,827	1,815	1,806	1,800	1,808	1,817	1,795	1,805	1,794	1,812	1,810
1,861	1,907	1,976	2,006	2,021	1,997	1,975	1,912	1,803	1,806	1,820	1,807	1,804	1,811	1,823	1,799	1,823	1,840	1,800	1,803	1,808	1,793	1,792	1,798	1,802	1,798	1,809	1,803	1,806
1,893	1,827	1,930	1,918	1,791	1,958	1,841	1,809	1,827	1,829	1,809	1,807	1,795	1,791	1,803	1,797	1,808	1,798	1,798	1,790	1,806	1,810	1,815	1,794	1,796	1,813	1,802	1,799	1,804
1,881	1,921	1,971	2,020	2,015	1,971	1,995	1,942	1,835	1,825	1,851	1,796	1,790	1,824	1,788	1,790	1,824	1,792	1,816	1,806	1,800	1,803	1,799	1,802	1,802	1,797	1,797	1,807	1,802
1,847	1,927	1,990	1,977	2,033	1,789	1,929	1,946	1,906	1,817	1,818	1,834	1,813	1,796	1,791	1,819	1,790	1,806	1,810	1,810	1,809	1,808	1,803	1,801	1,801	1,808	1,808	1,791	1,813
1,889	1,821	1,920	1,936	1,918	1,939	1,991	1,925	1,811	1,865	1,816	1,796	1,807	1,802	1,818	1,831	1,800	1,799	1,826	1,805	1,798	1,803	1,811	1,804	1,798	1,800	1,801	1,801	1,794
1,794	1,939	1,944	1,981	1,980	2,035	1,982	1,985	1,903	1,847	1,790	1,822	1,812	1,811	1,827	1,832	1,795	1,793	1,808	1,807	1,804	1,806	1,796	1,808	1,811	1,813	1,804	1,802	1,802
1,908	1,994	2,025	1,985	1,978	1,994	1,895	1,992	2,037	2,008	1,849	1,828	1,814	1,806	1,822	1,817	1,809	1,818	1,835	1,835	1,805	1,821	1,822	1,803	1,815	1,796	1,807	1,802	1,806
1,849	1,884	1,976	1,975	1,997	2,014	1,999	1,991	2,004	1,907	1,845	1,832	1,814	1,803	1,825	1,818	1,817	1,817	1,806	1,815	1,818	1,801	1,808	1,806	1,805	1,796	1,812	1,807	1,791
1,906	1,968	2,011	2,009	2,006	2,005	2,005	1,980	2,011	1,863	1,811	1,811	1,823	1,825	1,821	1,825	1,819	1,820	1,839	1,809	1,811	1,820	1,801	1,806	1,805	1,797	1,802	1,794	1,796
1,817	1,953	1,956	2,010	1,989	1,990	2,051	1,998	2,011	1,935	1,836	1,829	1,827	1,816	1,807	1,832	1,800	1,826	1,821	1,814	1,833	1,812	1,802	1,806	1,803	1,814	1,803	1,805	1,800
1,807	1,914	1,961	1,946	2,043	2,003	1,793	1,911	1,903	1,951	1,827	1,823	1,814	1,808	1,806	1,819	1,807	1,811	1,819	1,828	1,811	1,802	1,805	1,813	1,789	1,794	1,797	1,814	1,792
1,846	2,113	1,995	1,987	2,048	1,999	2,027	1,994	1,921	1,825	1,806	1,843	1,810	1,830	1,804	1,816	1,823	1,805	1,825	1,813	1,815	1,803	1,808	1,806	1,817	1,798	1,803	1,799	1,797
1,850	1,959	1,970	2,009	2,037	2,026	1,991	1,974	1,974	1,814	1,846	1,855	1,821	1,824	1,816	1,813	1,842	1,822	1,825	1,810	1,812	1,830	1,801	1,810	1,802	1,806	1,806	1,798	1,813
1,896	1,848	1,972	1,982	2,005	2,015	2,006	1,797	1,949	1,952	1,922	1,829	1,806	1,820	1,819	1,794	1,815	1,813	1,813	1,818	1,812	1,799	1,811	1,809	1,802	1,814	1,808	1,799	1,798
1,917	1,964	2,013	2,021	1,996	2,040	2,010	1,981	1,950	1,951	1,818	1,811	1,809	1,824	1,797	1,815	1,825	1,807	1,830	1,806	1,801	1,807	1,800	1,799	1,795	1,806	1,804	1,799	1,790
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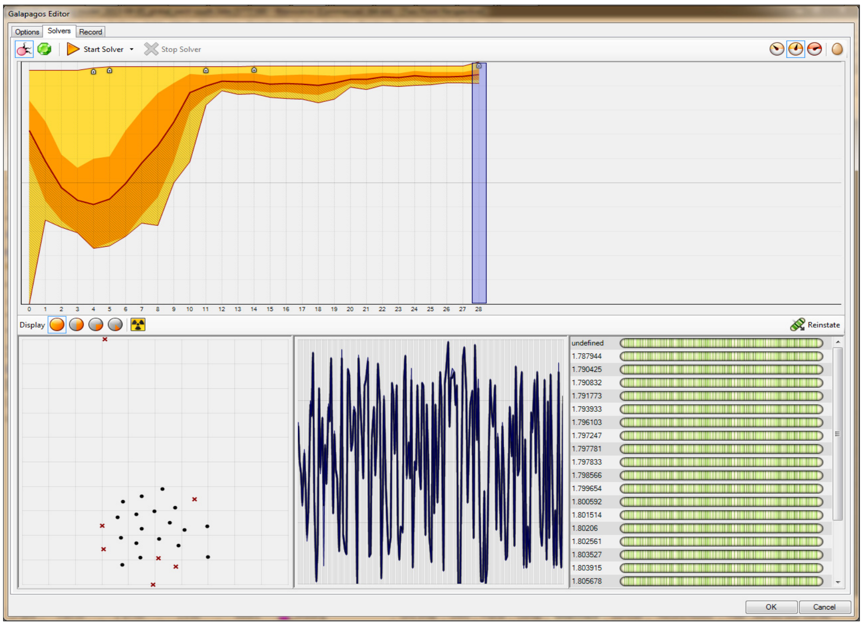

APPENDIX D

ANALYSIS MESHES

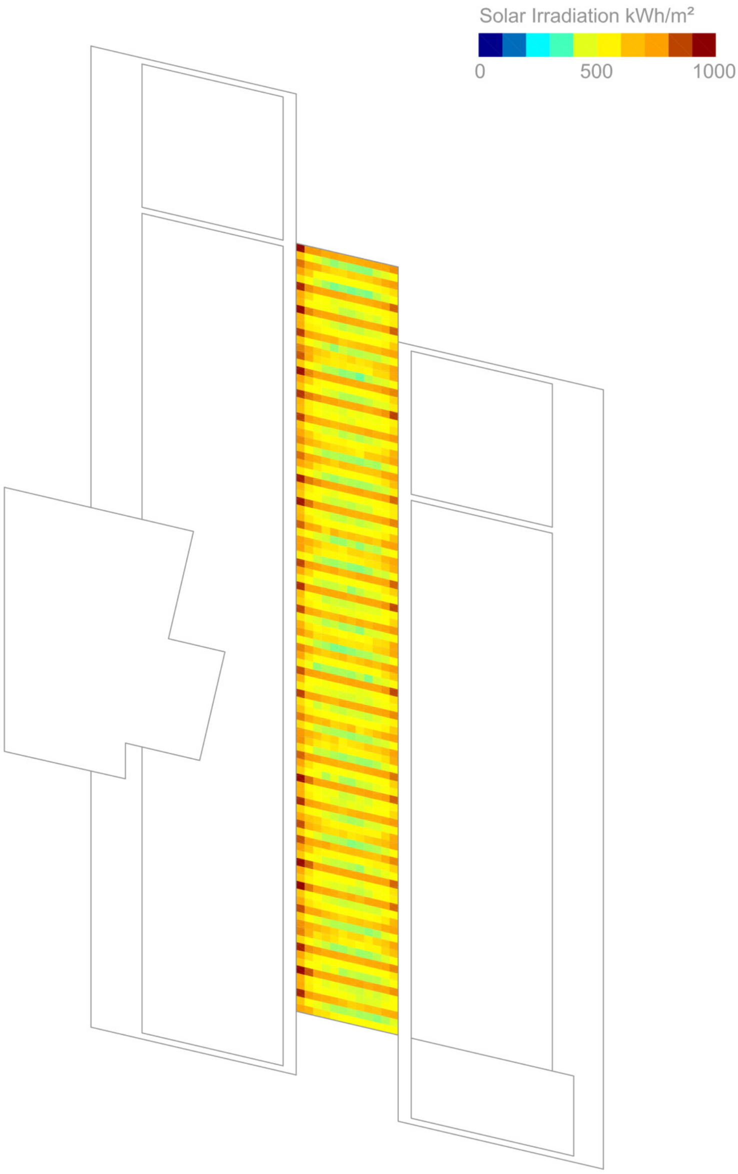

Figure D 1 Atrium Roof Initial Design SI Analysis Mesh

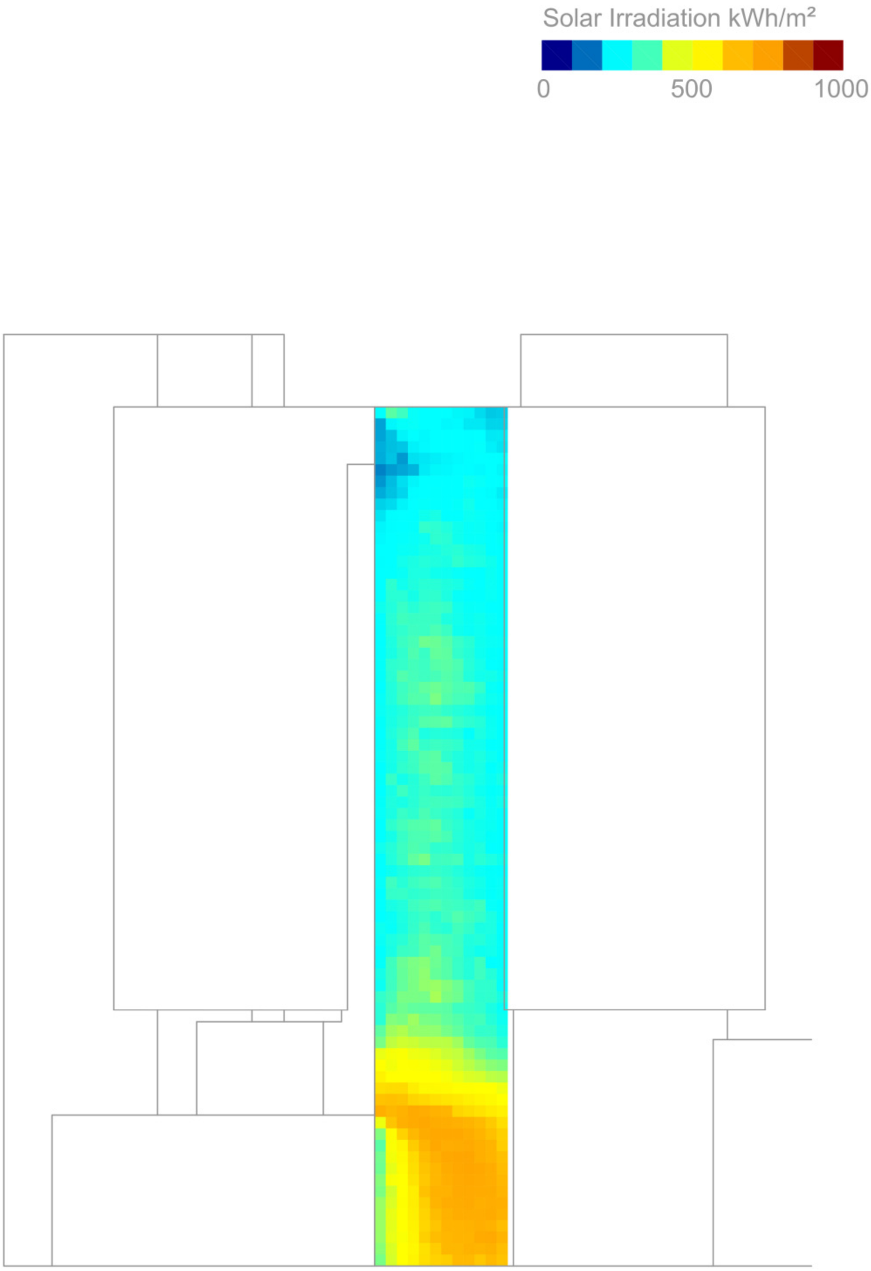

Figure D 2 Atrium South Facade Initial Design SI Analysis Mesh

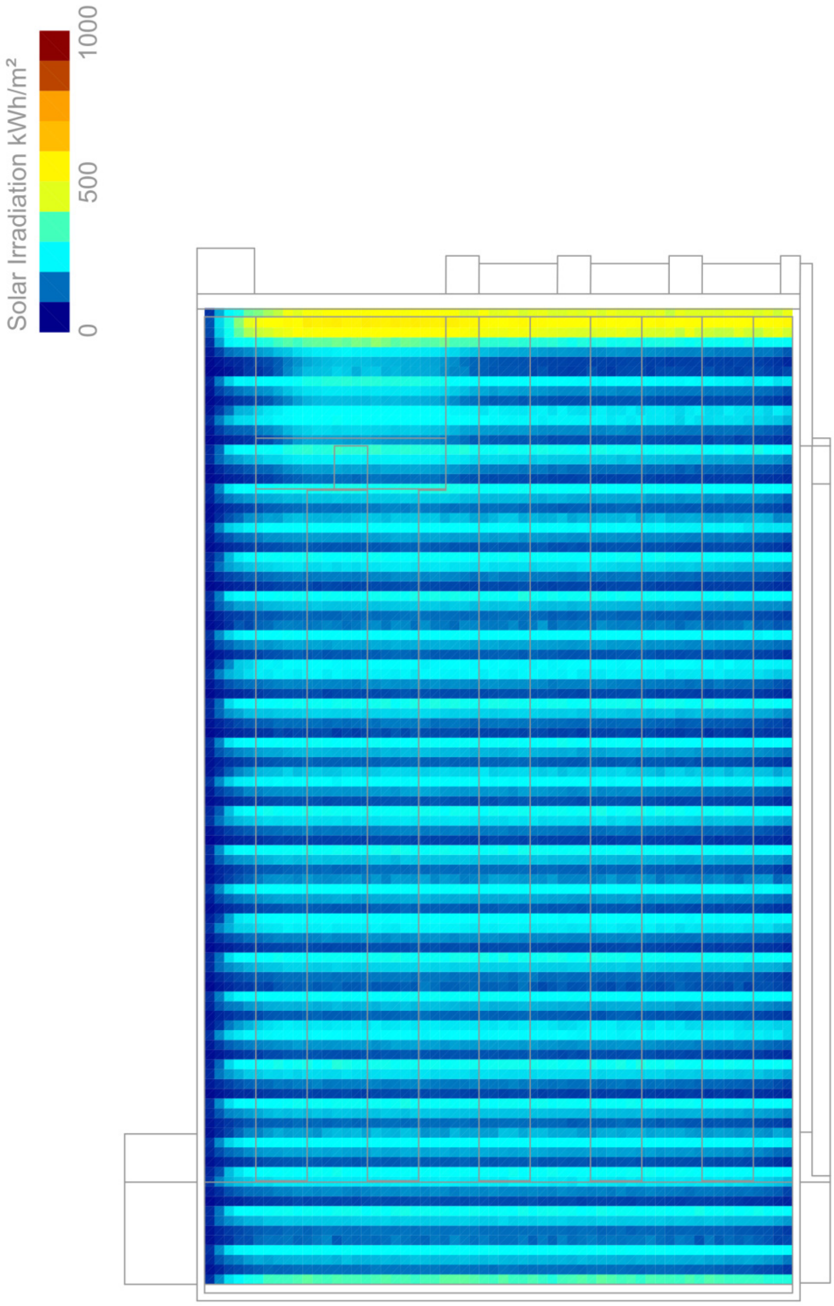

Figure D 3 East Facade Initial Design SI Analysis Mesh

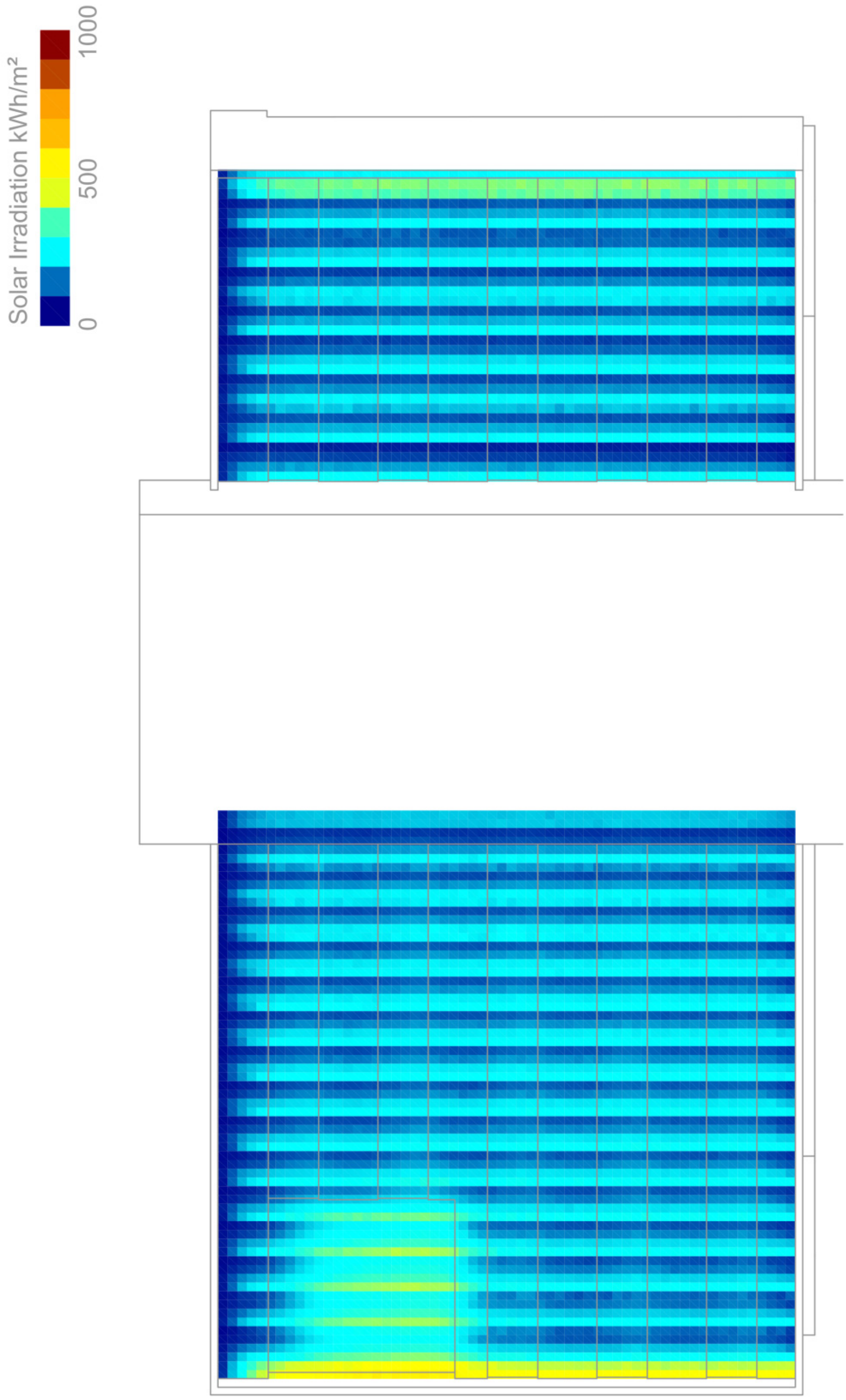

Figure D 4 West Facade Initial Design SI Analysis Mesh

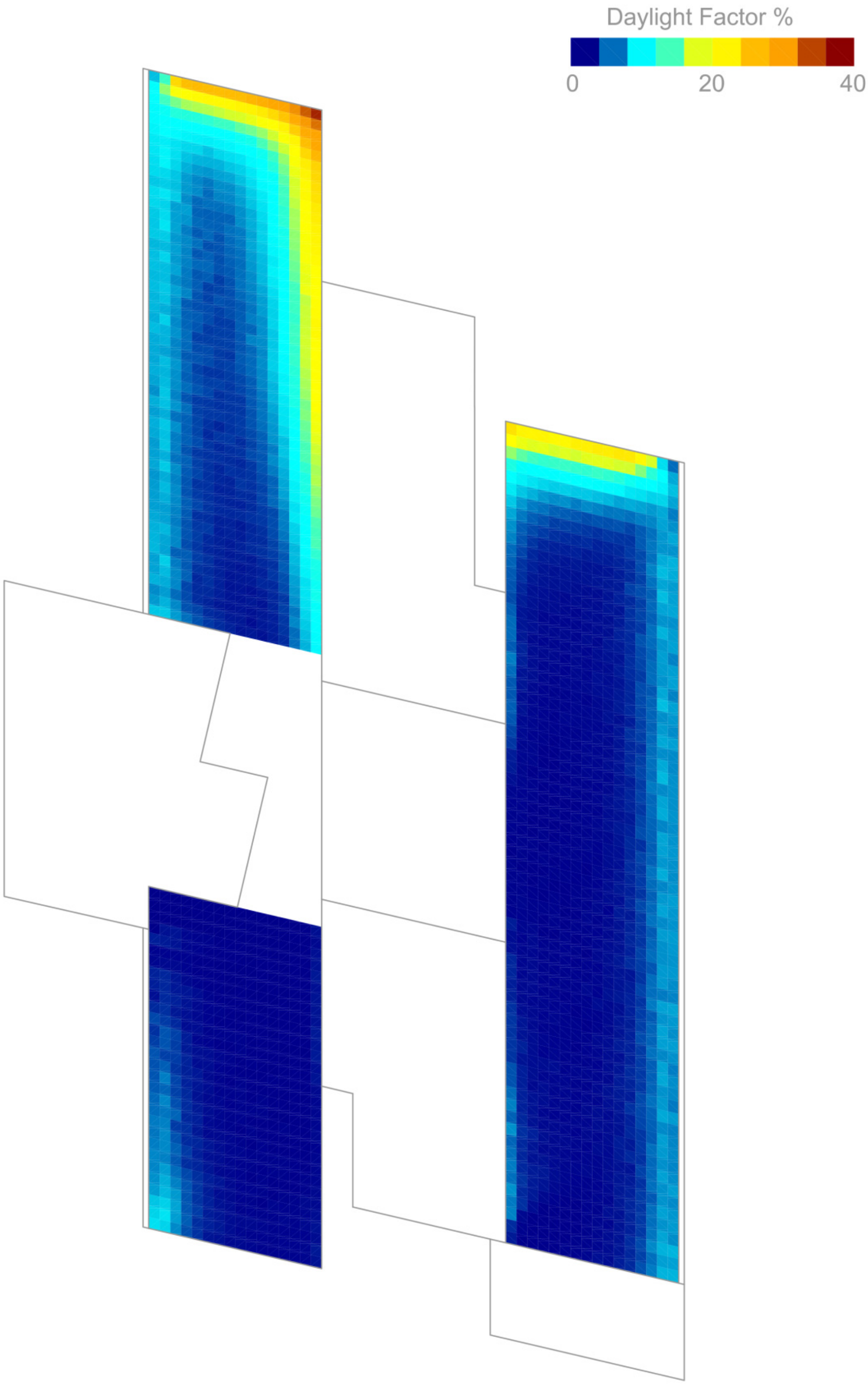

Figure D 5 Floor1 Initial Design DF Analysis Mesh

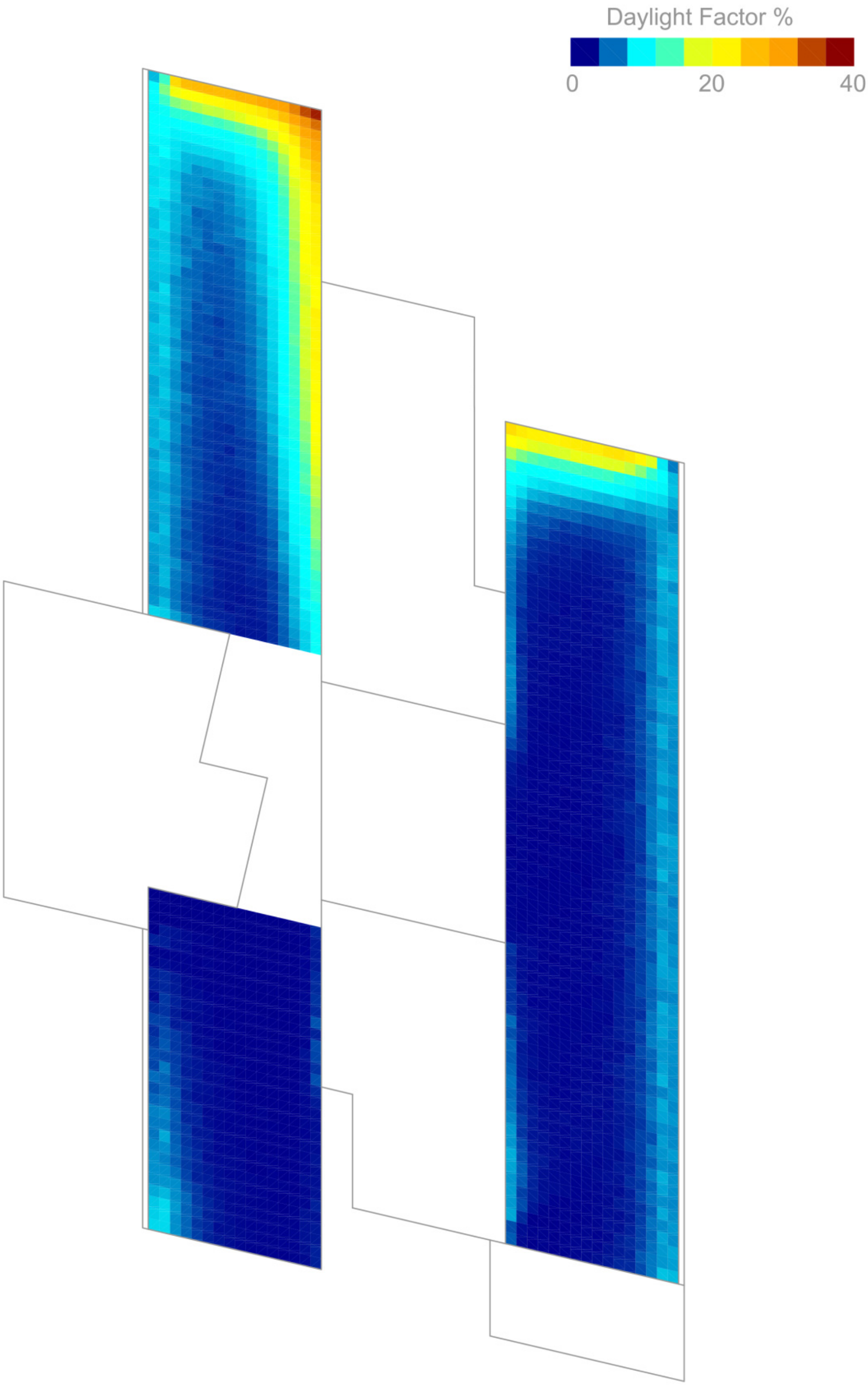

Figure D 6 Floor2 Initial Design DF Analysis Mesh

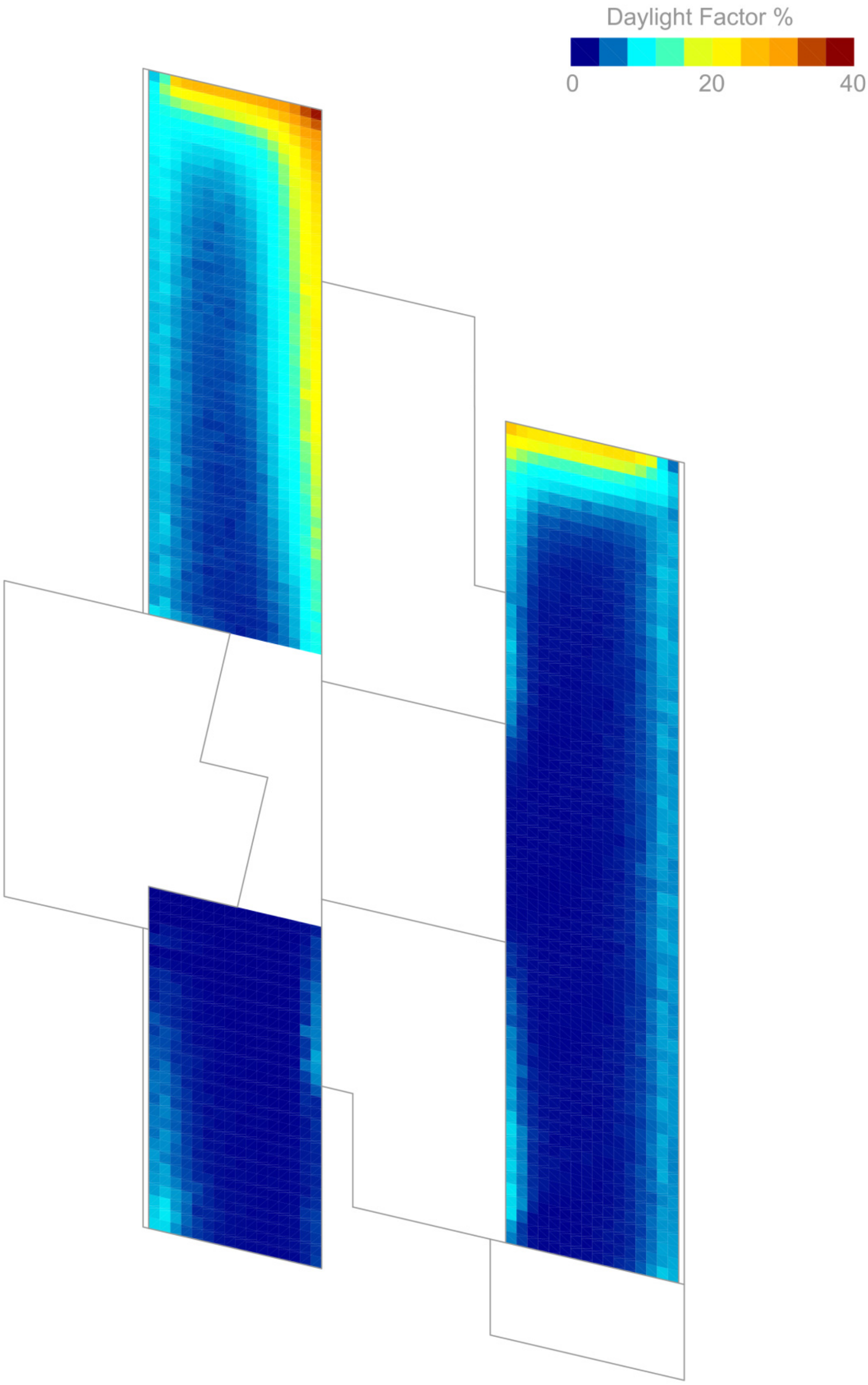

Figure D 7 Floor3 Initial Design DF Analysis Mesh

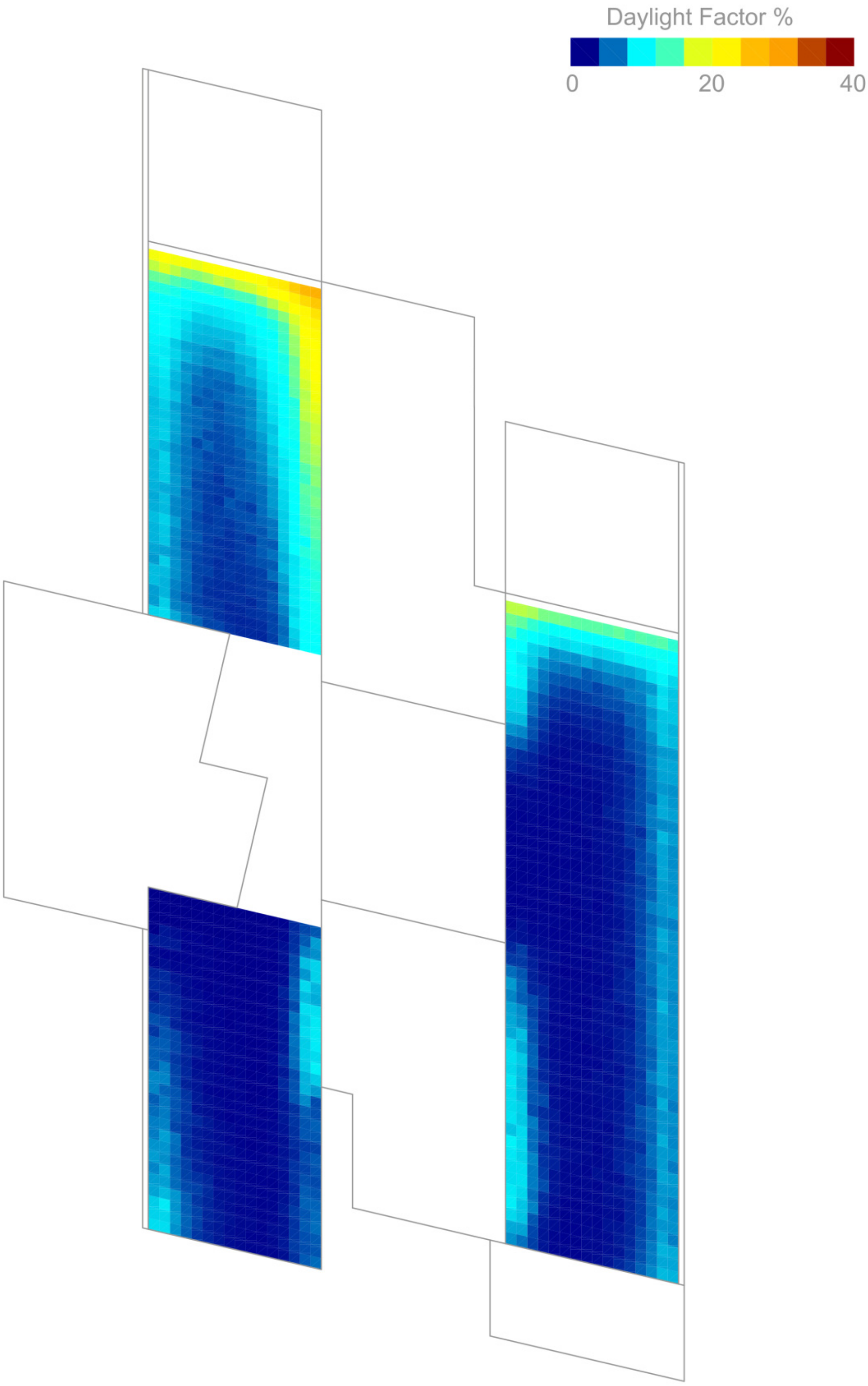

Figure D 8 Floor4 Initial Design DF Analysis Mesh

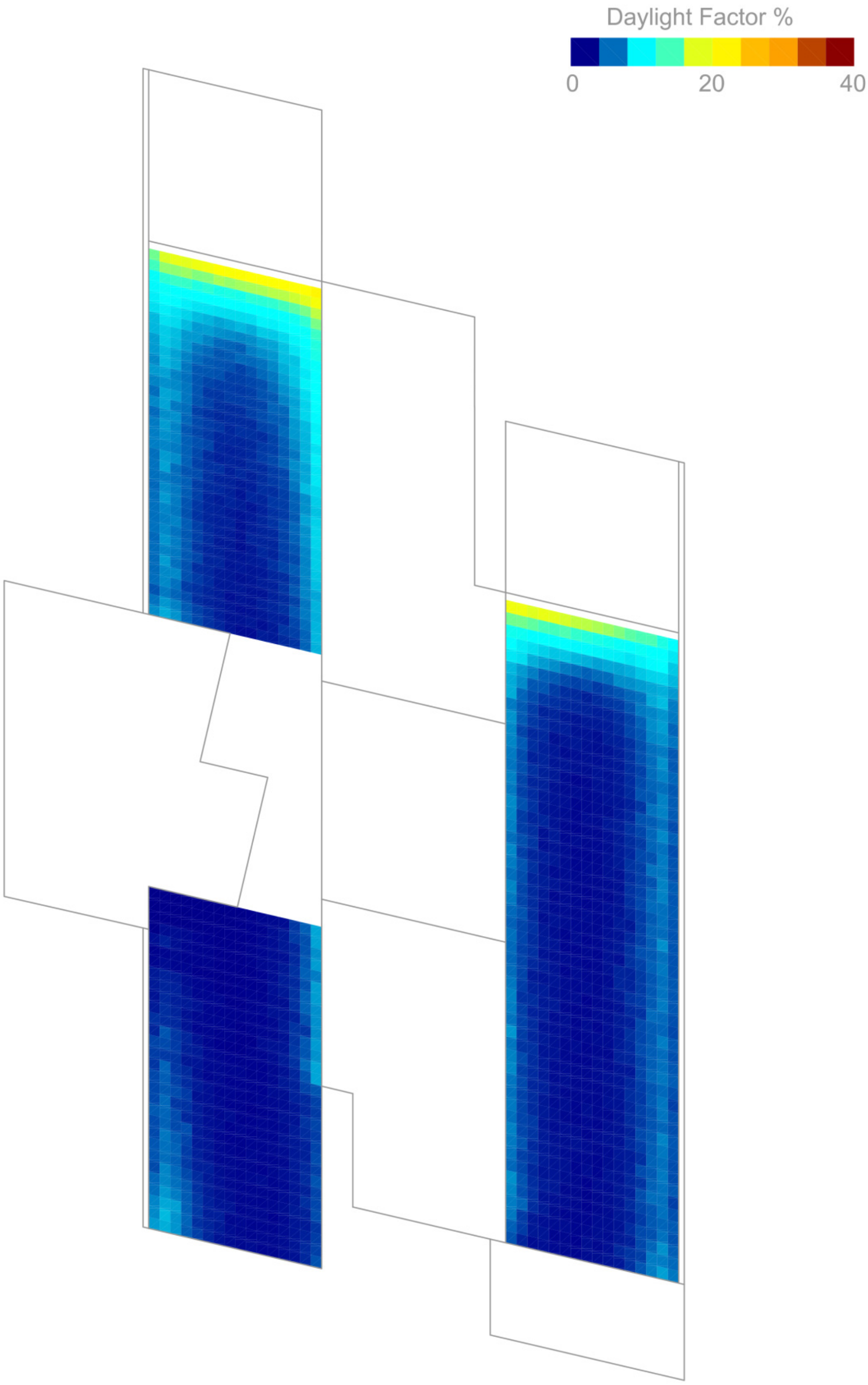

Figure D 9 Floor5 Initial Design DF Analysis Mesh

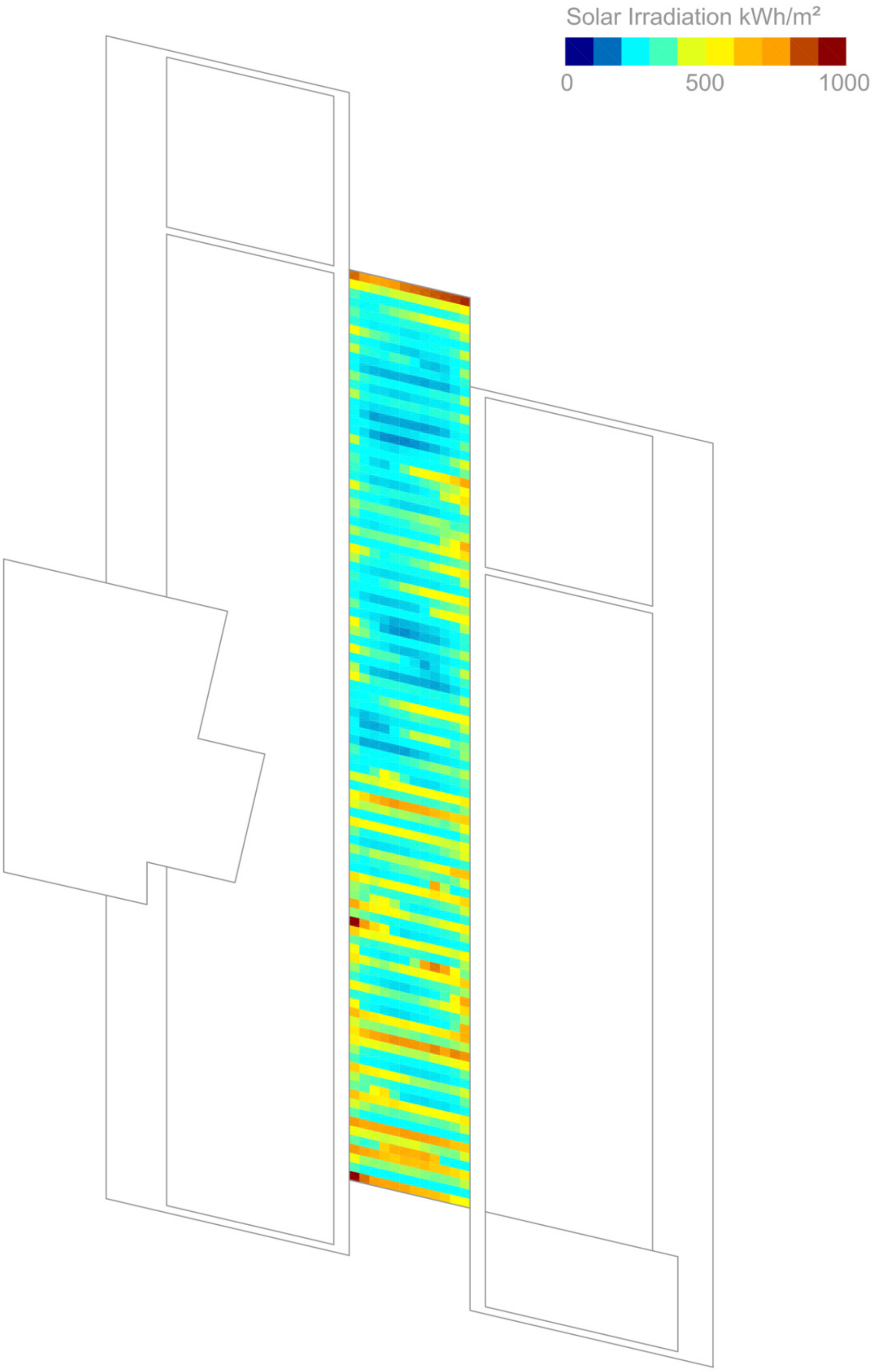

Figure D 10 Atrium Roof Alternative Design SI Analysis Mesh

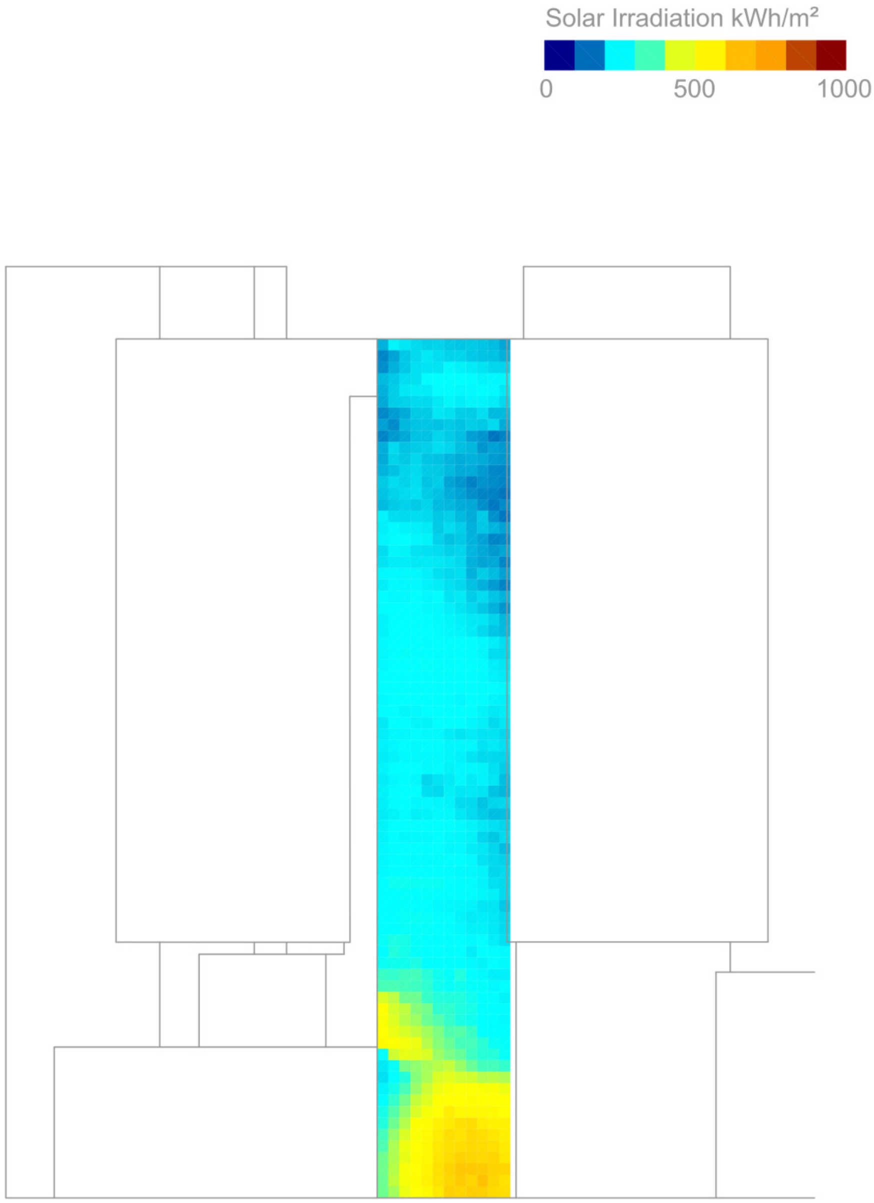

Figure D 11 Atrium South Facade Alternative Design SI Analysis Mesh

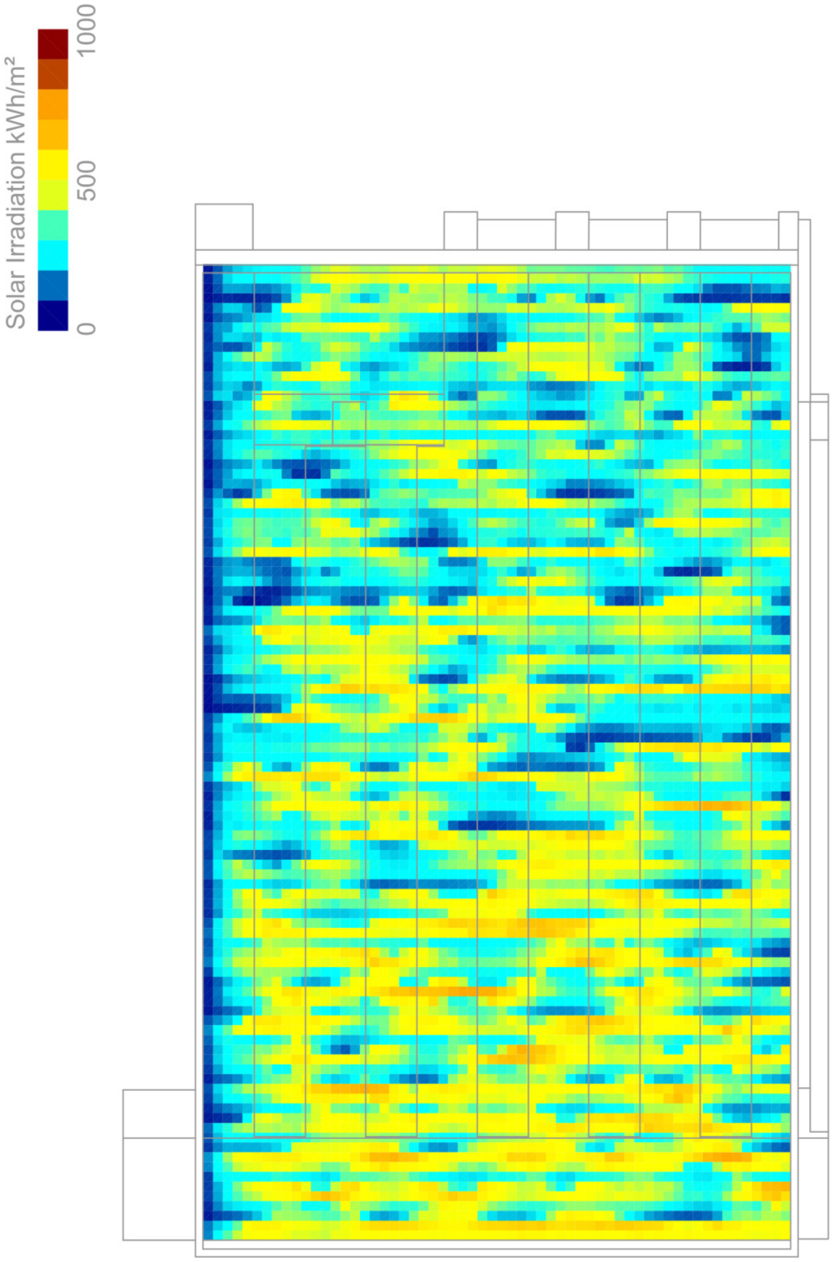

Figure D 12 East Facade Alternative1 SI Analysis Mesh

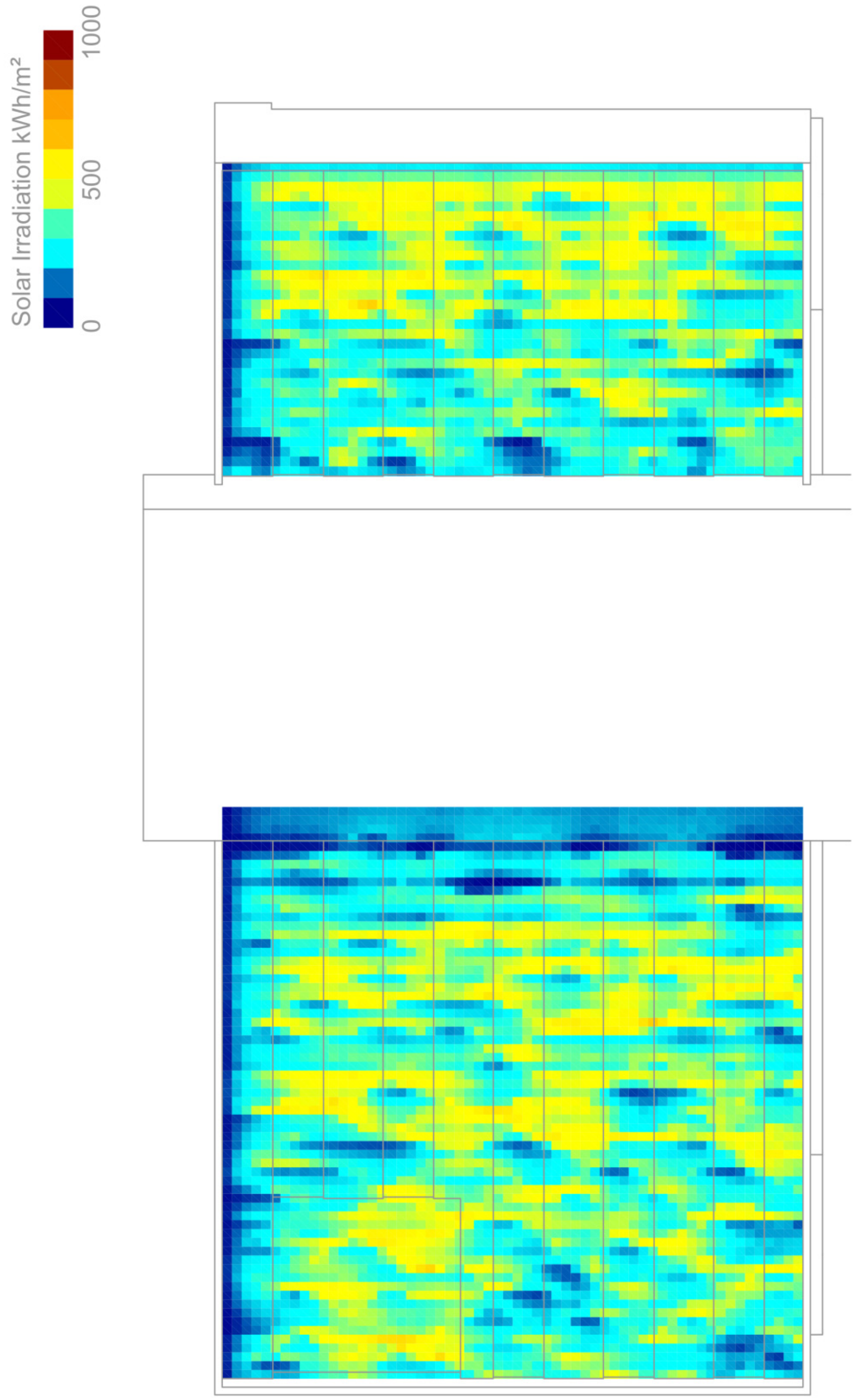

Figure D 13 West Facade Alternative1 SI Analysis Mesh

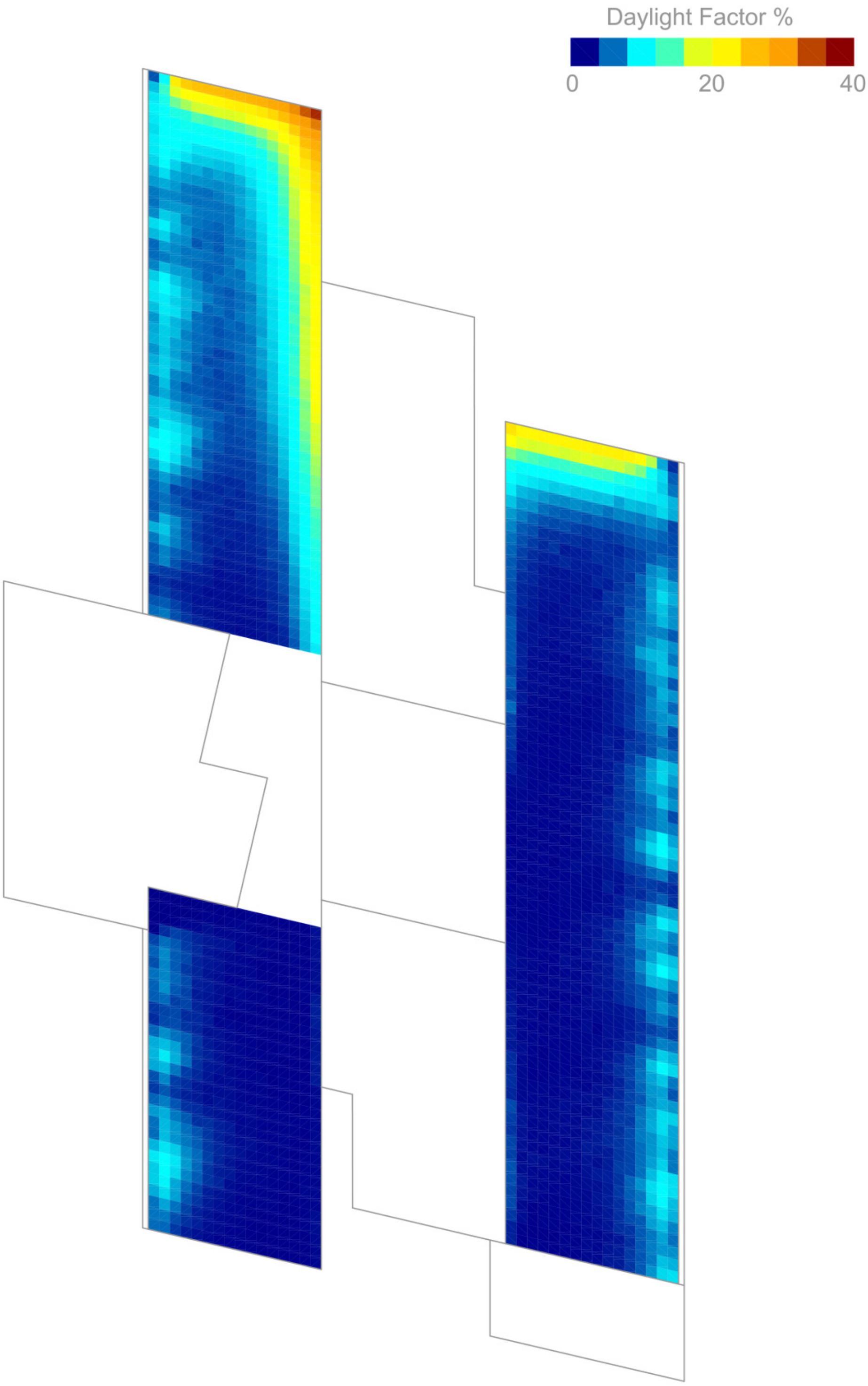

Figure D 14 Floor1 Alternative1 DF Analysis Mesh

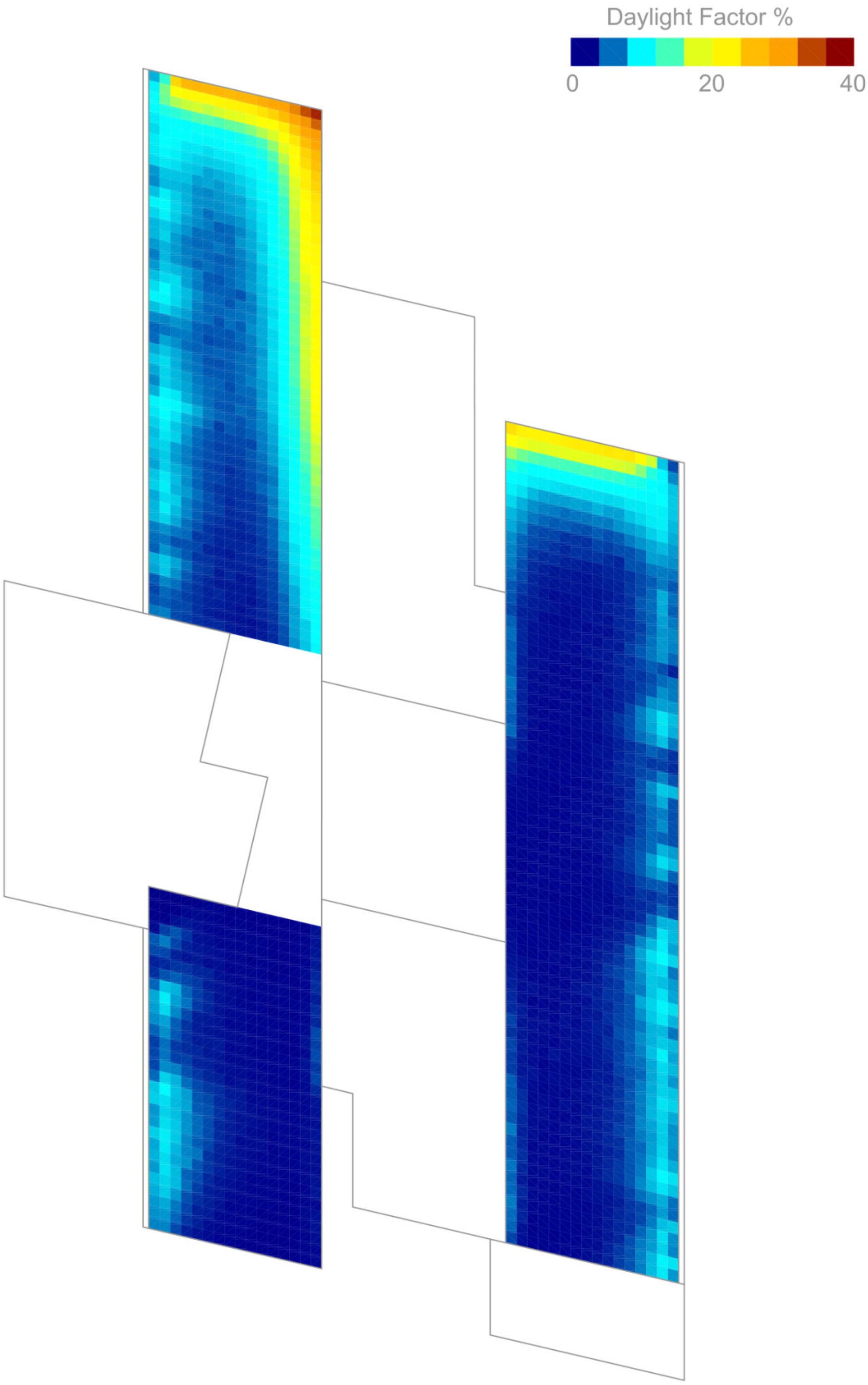

Figure D 15 Floor2 Alternative1 DF Analysis Mesh

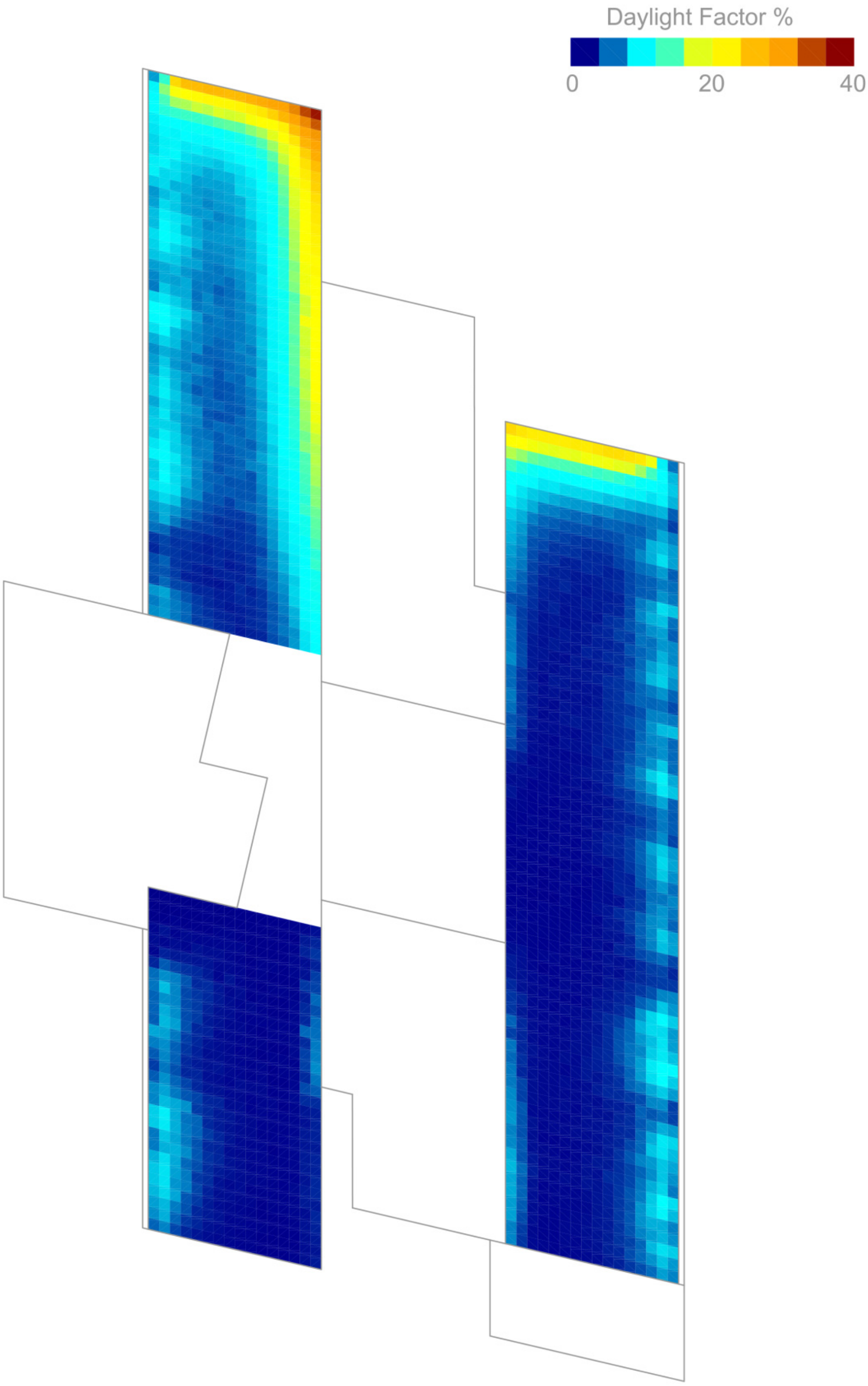

Figure D 16 Floor3 Alternative1 DF Analysis Mesh

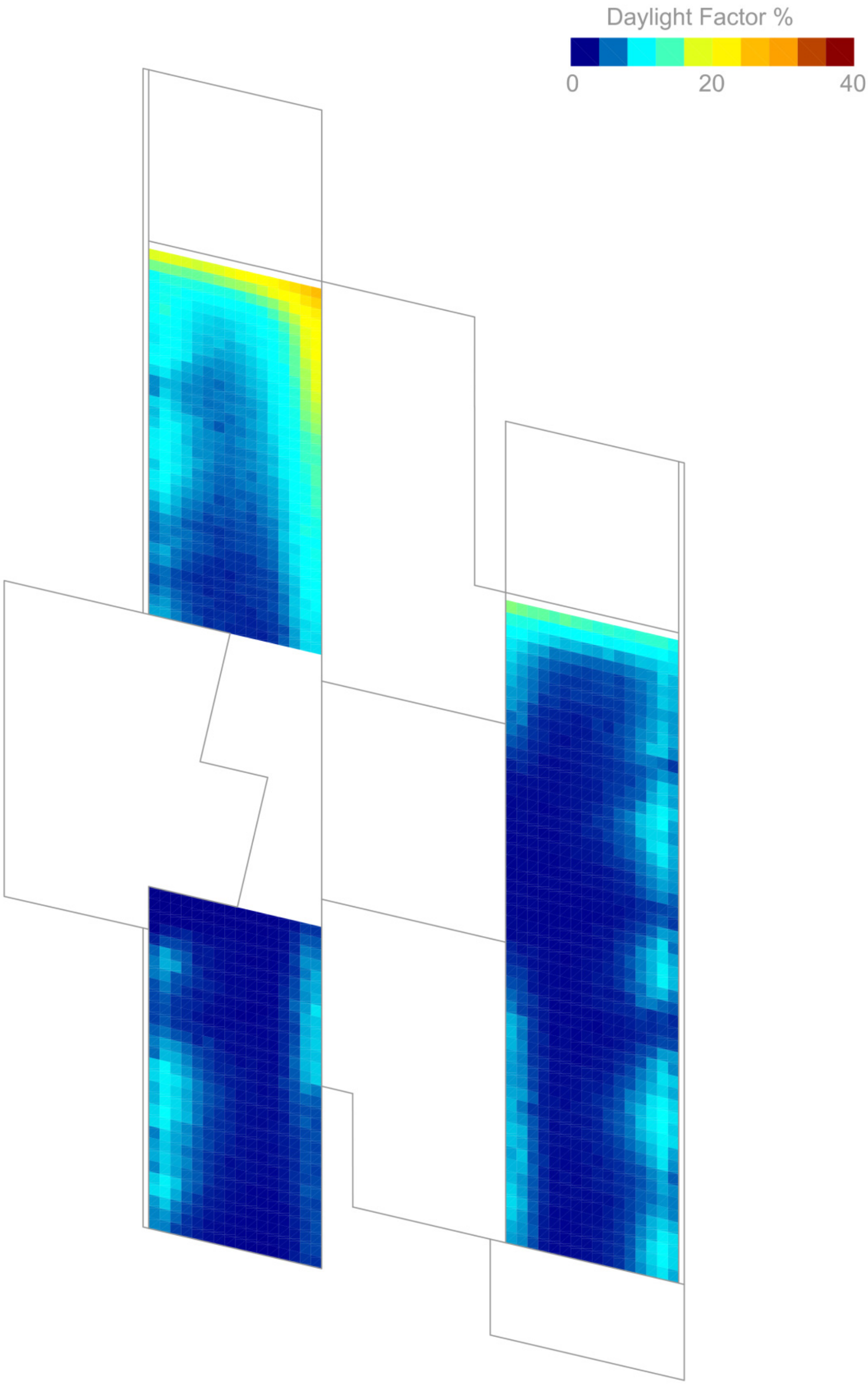

Figure D 17 Floor4 Alternative1 DF Analysis Mesh

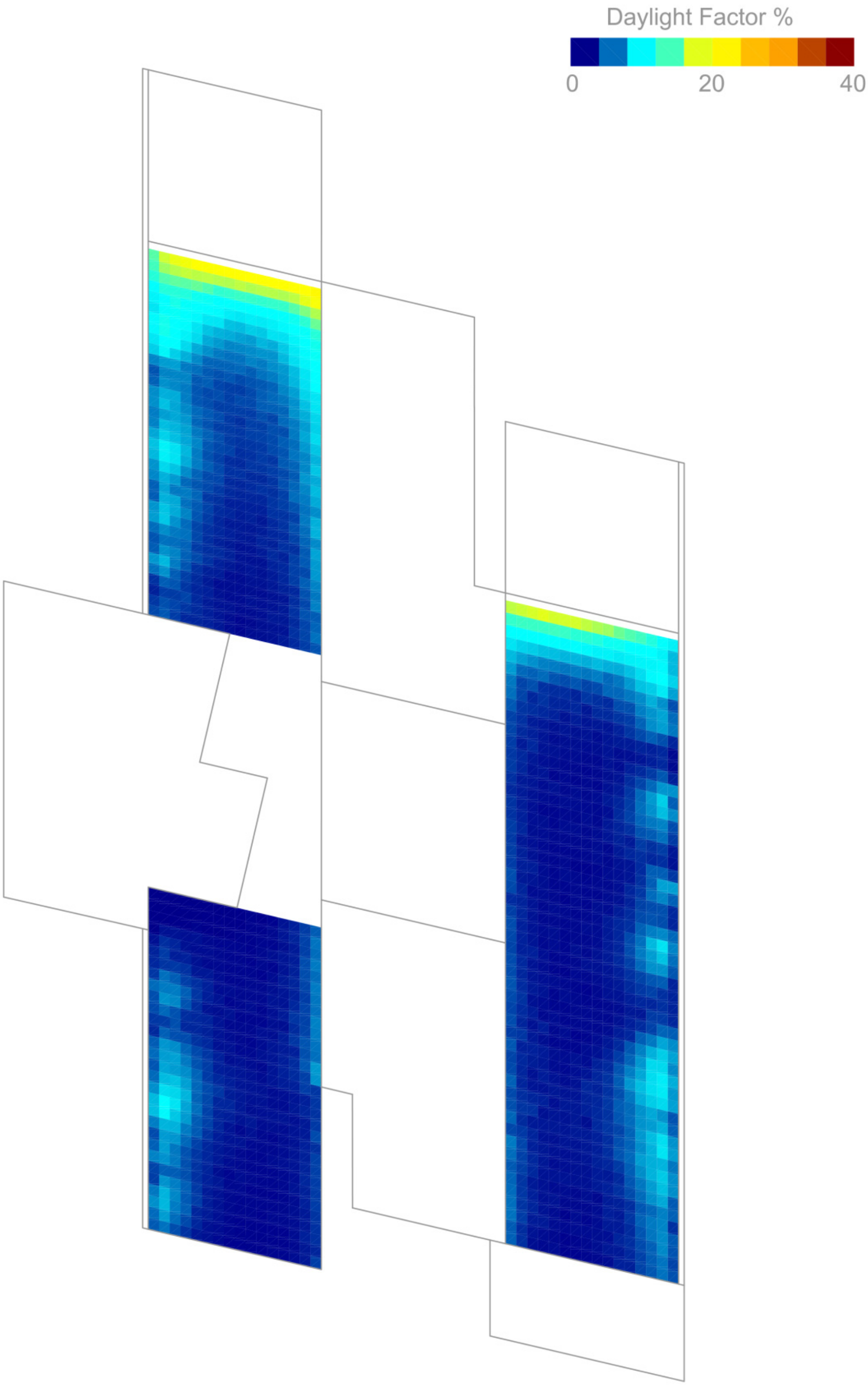

Figure D 18 Floor5 Alternative1 DF Analysis Mesh

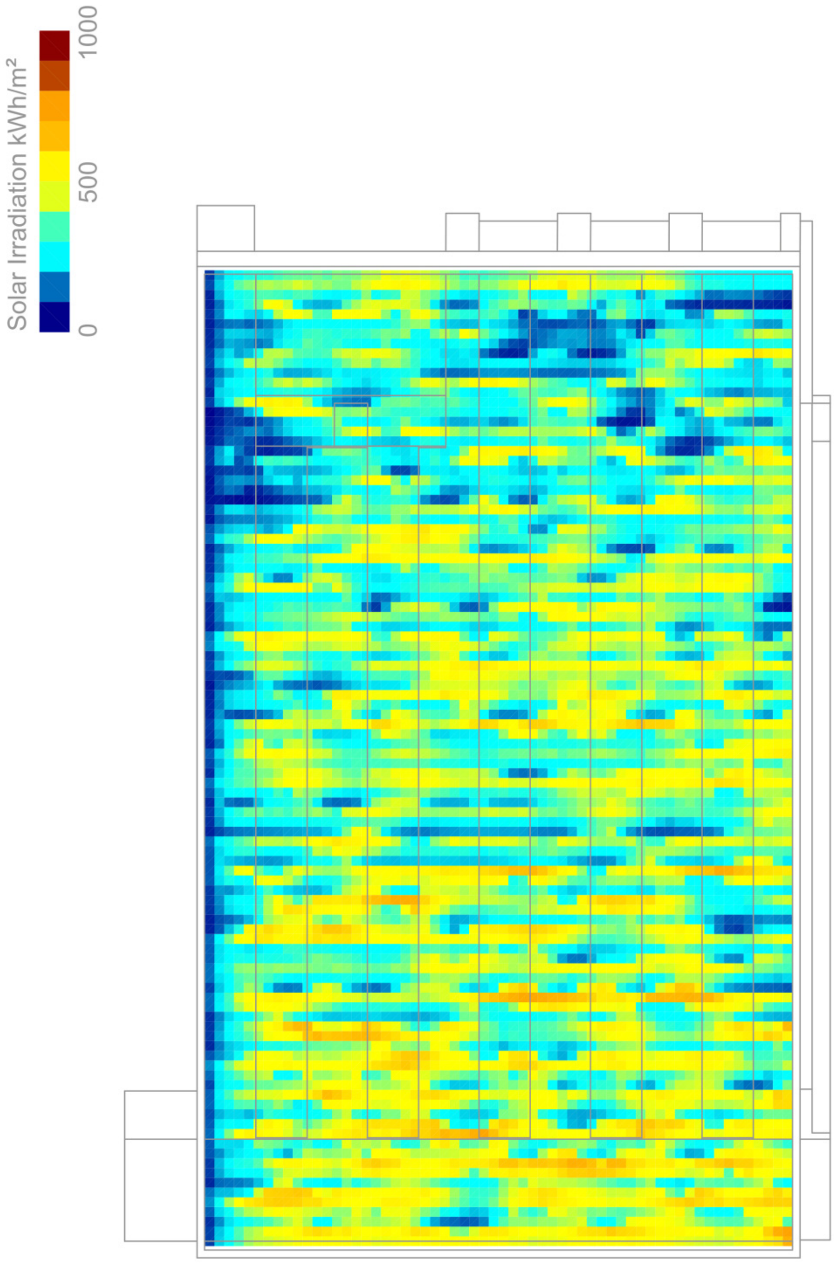

Figure D 19 East Facade Alternative2 SI Analysis Mesh

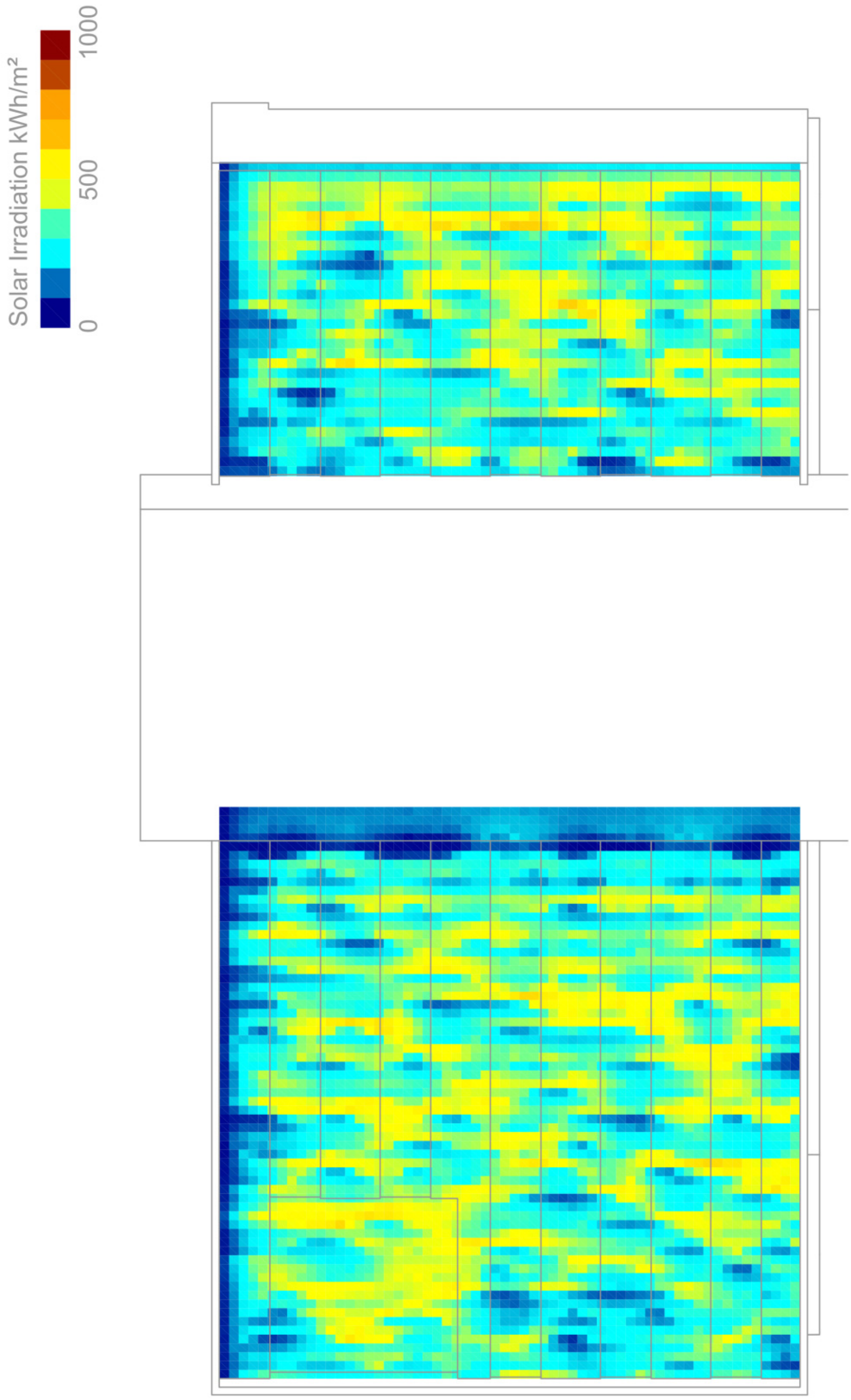

Figure D 20 West Facade Alternative2 SI Analysis Mesh

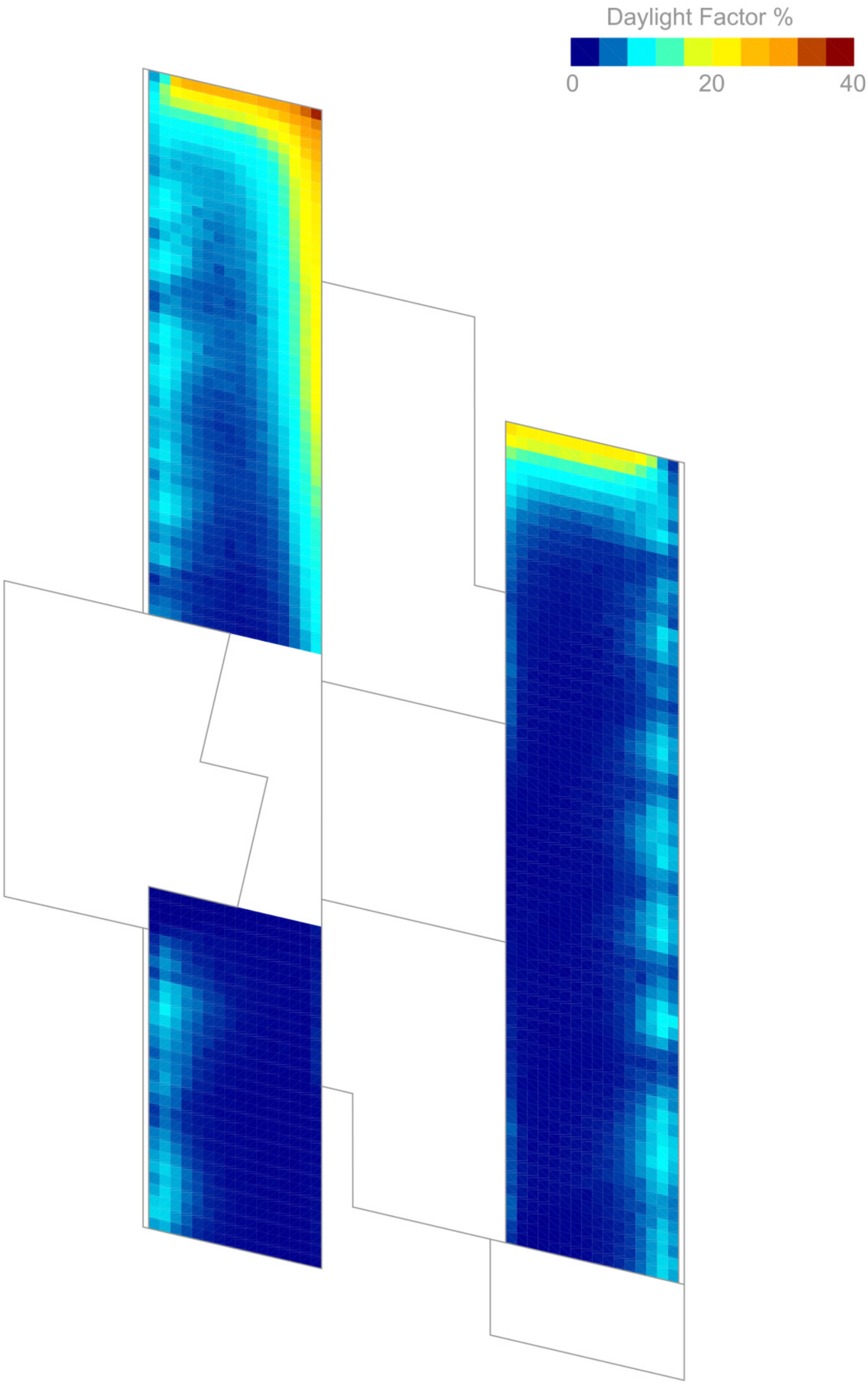

Figure D 21 Floor1 Alternative2 DF Analysis Mesh

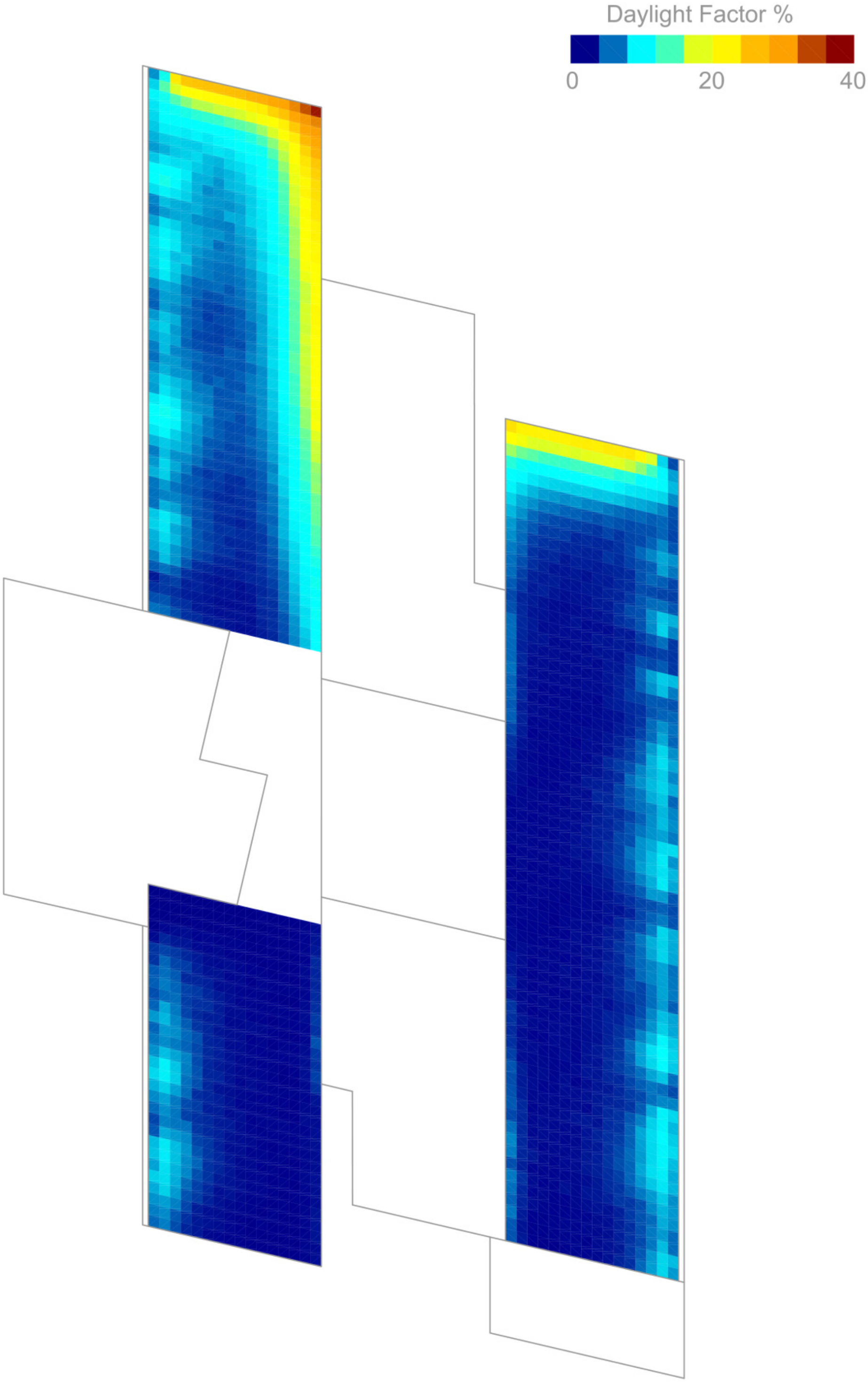

Figure D 22 Floor2 Alternative2 DF Analysis Mesh

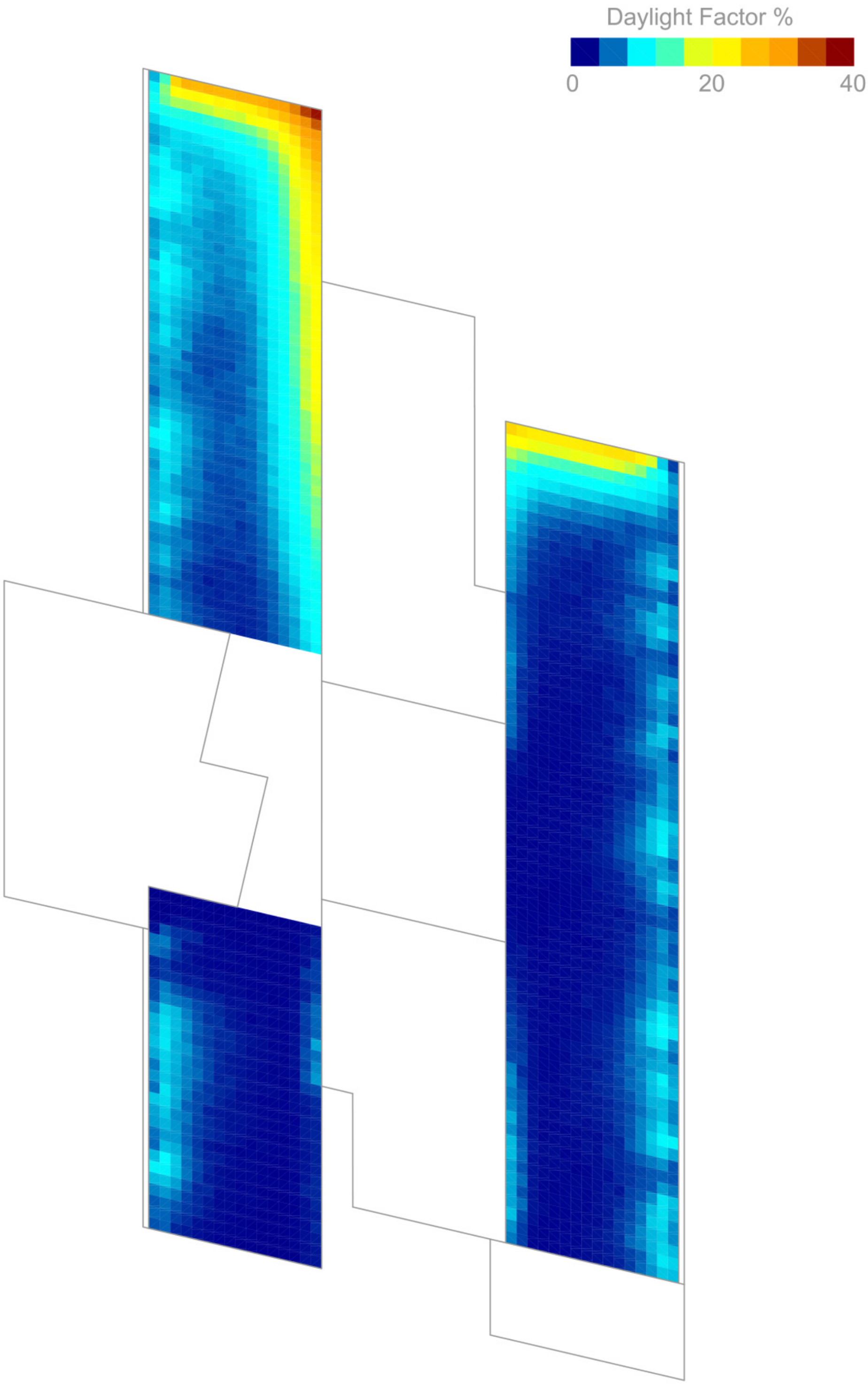

Figure D 23 Floor3 Alternative2 DF Analysis Mesh

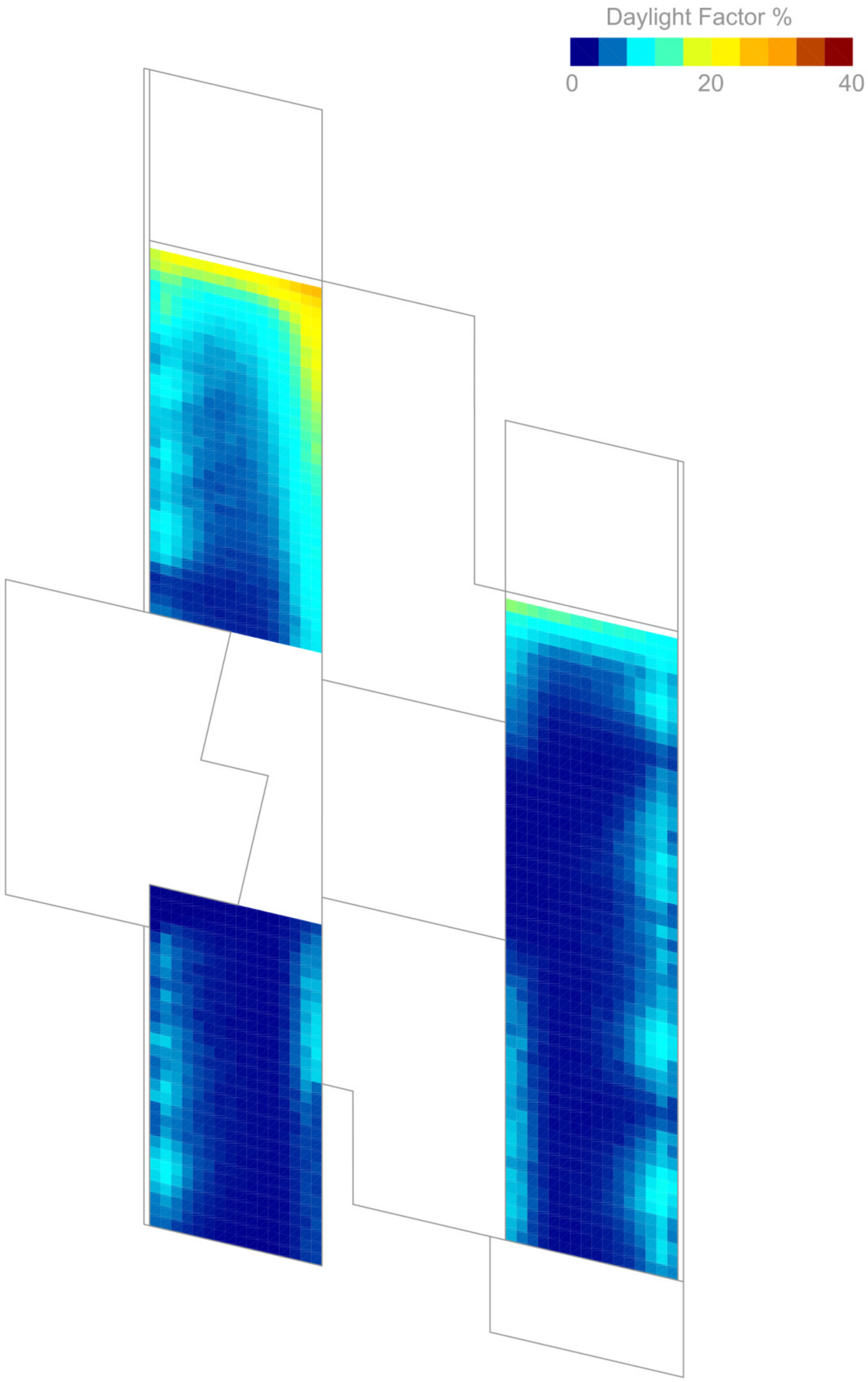

Figure D 24 Floor4 Alternative2 DF Analysis Mesh

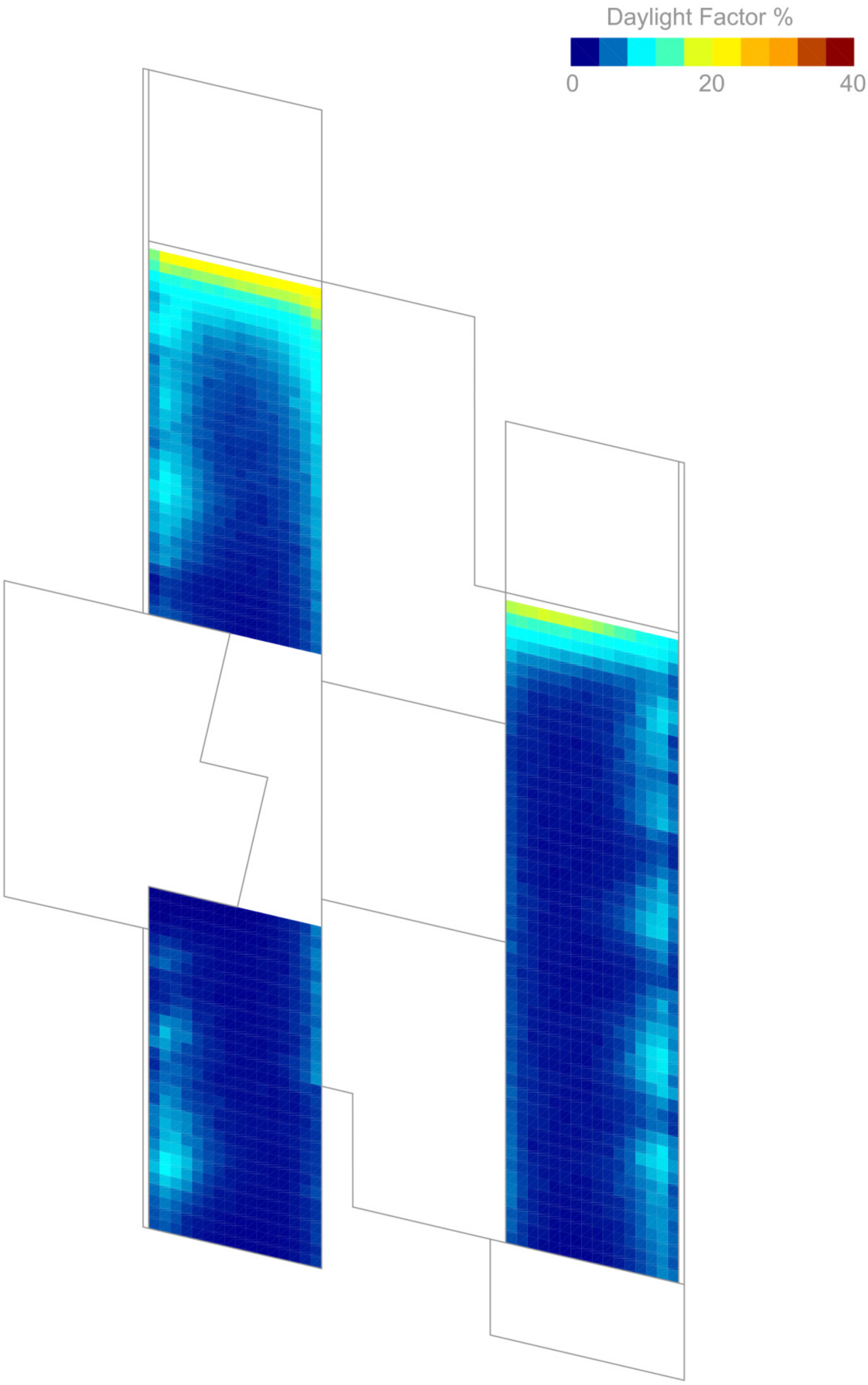

Figure D 25 Floor5 Alternative2 DF Analysis Mesh

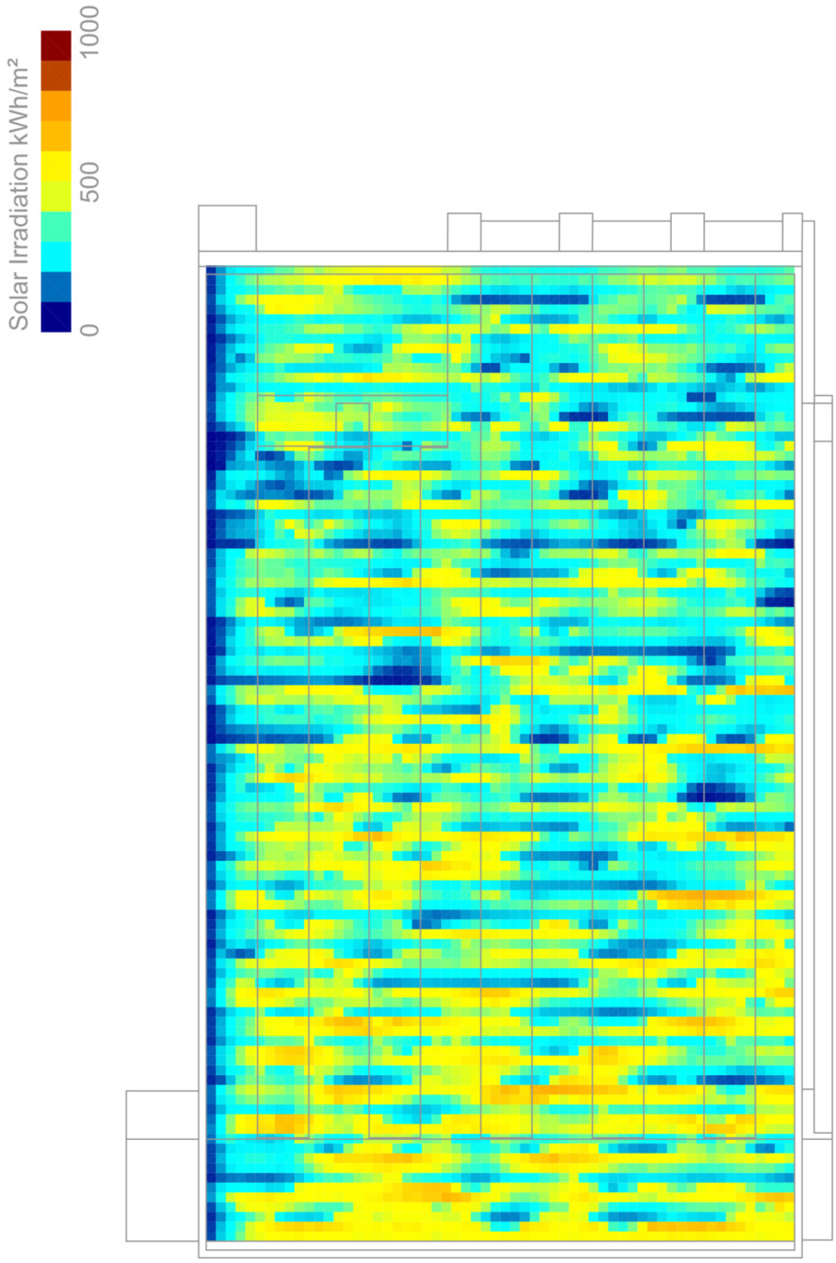

Figure D 26 East Facade Alternative3 SI Analysis Mesh

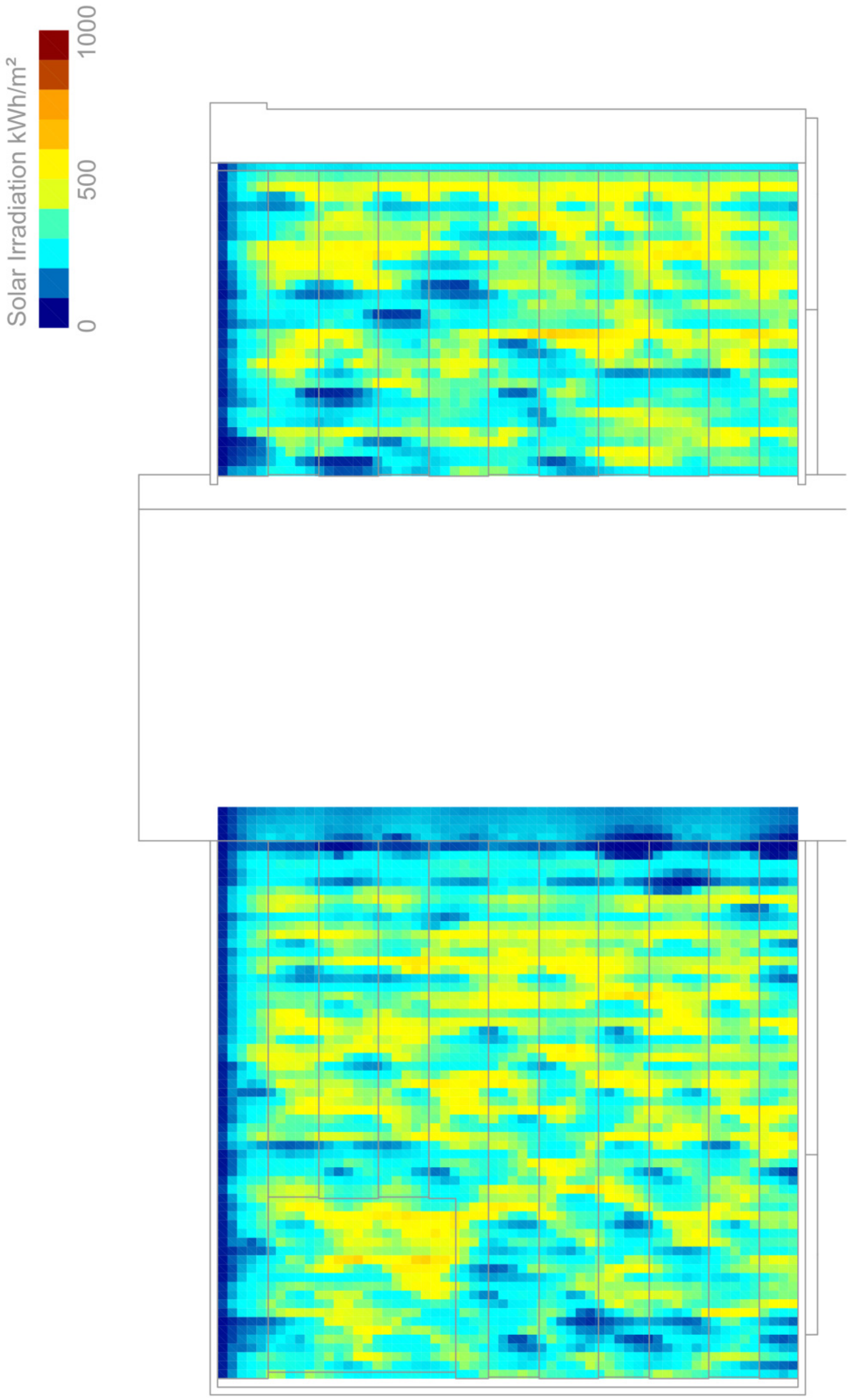

Figure D 27 West Facade Alternative3 SI Analysis Mesh

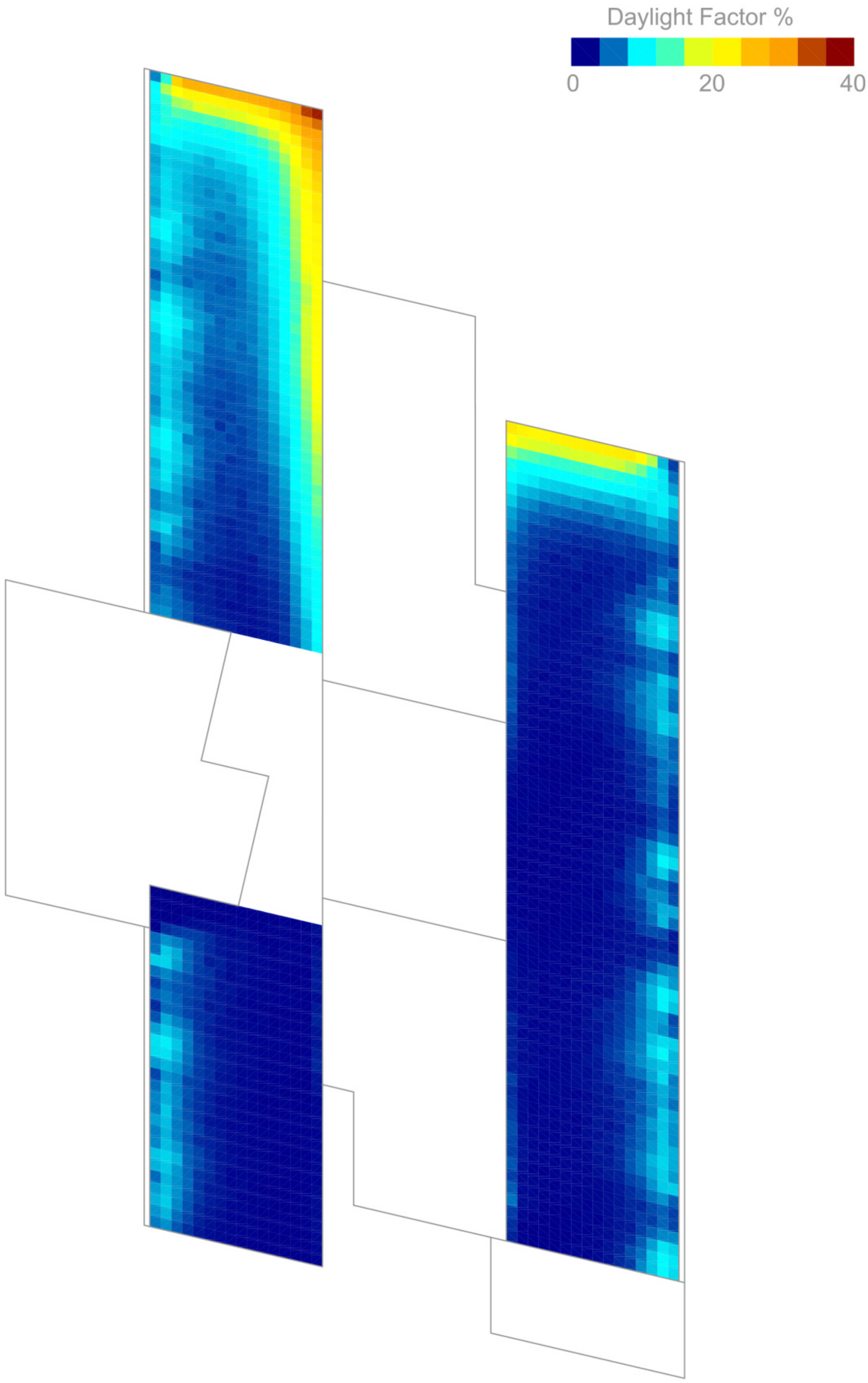

Figure D 28 Floor1 Alternative3 DF Analysis Mesh

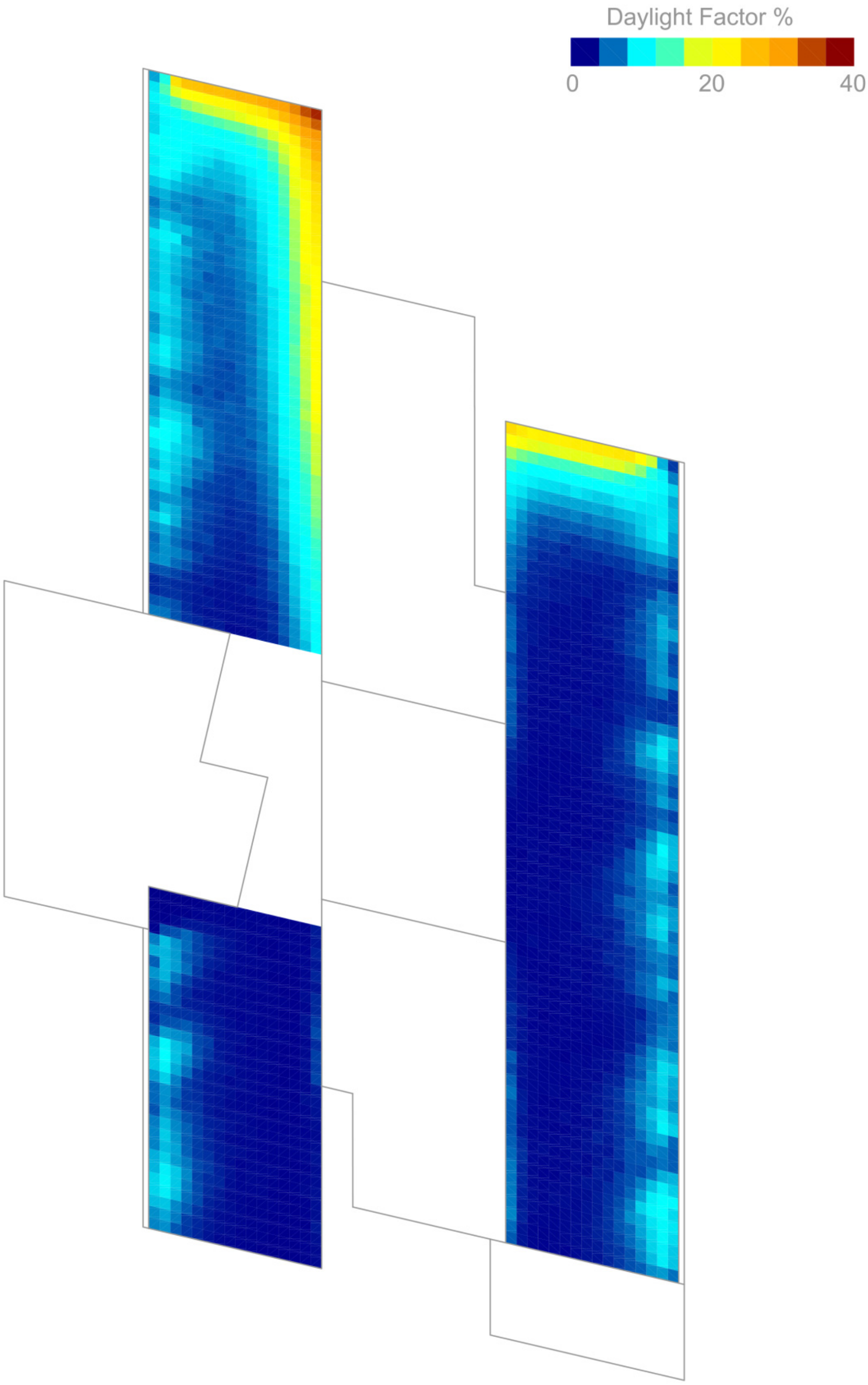

Figure D 29 Floor2 Alternative3 DF Analysis Mesh

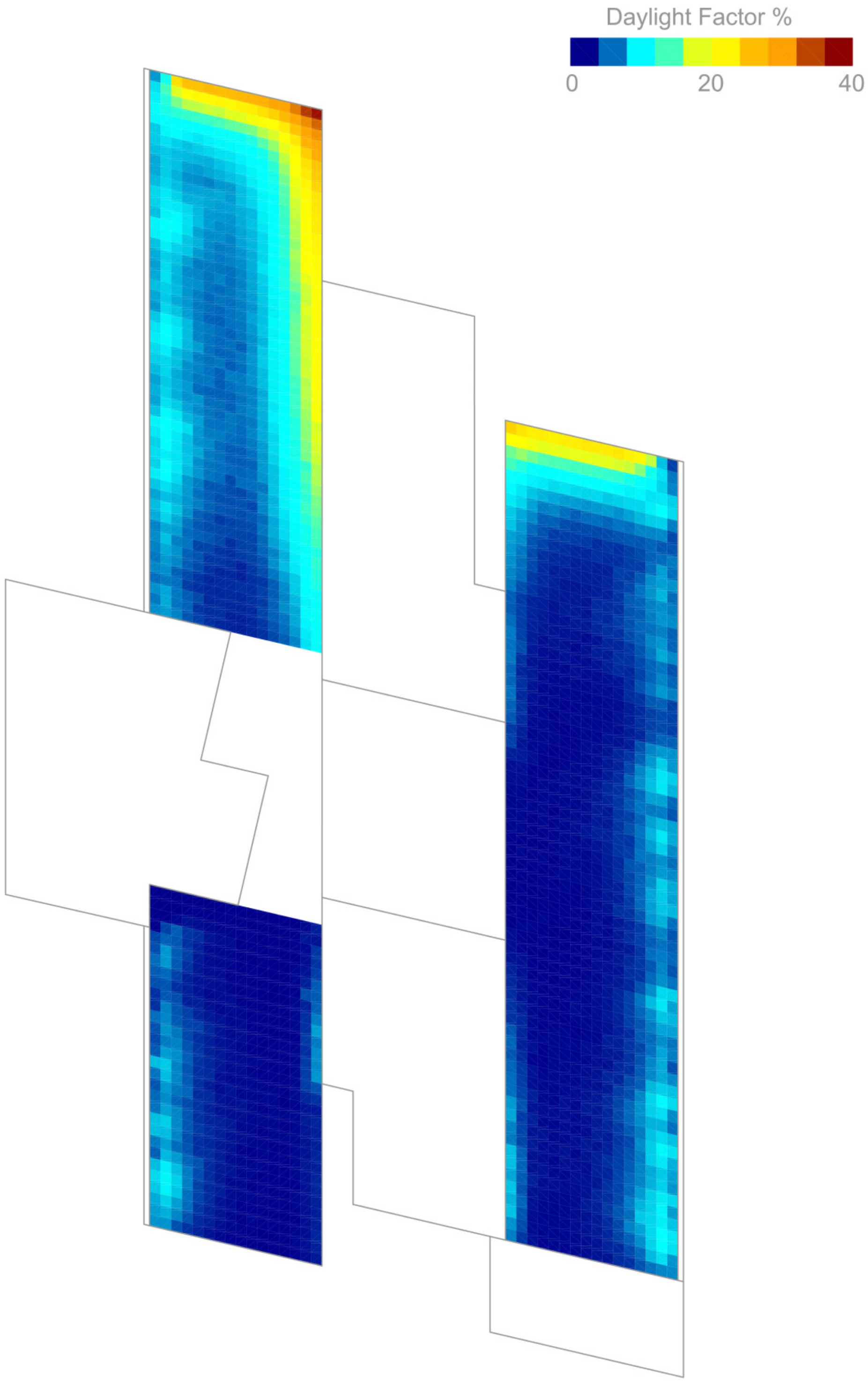

Figure D 30 Floor3 Alternative3 DF Analysis Mesh

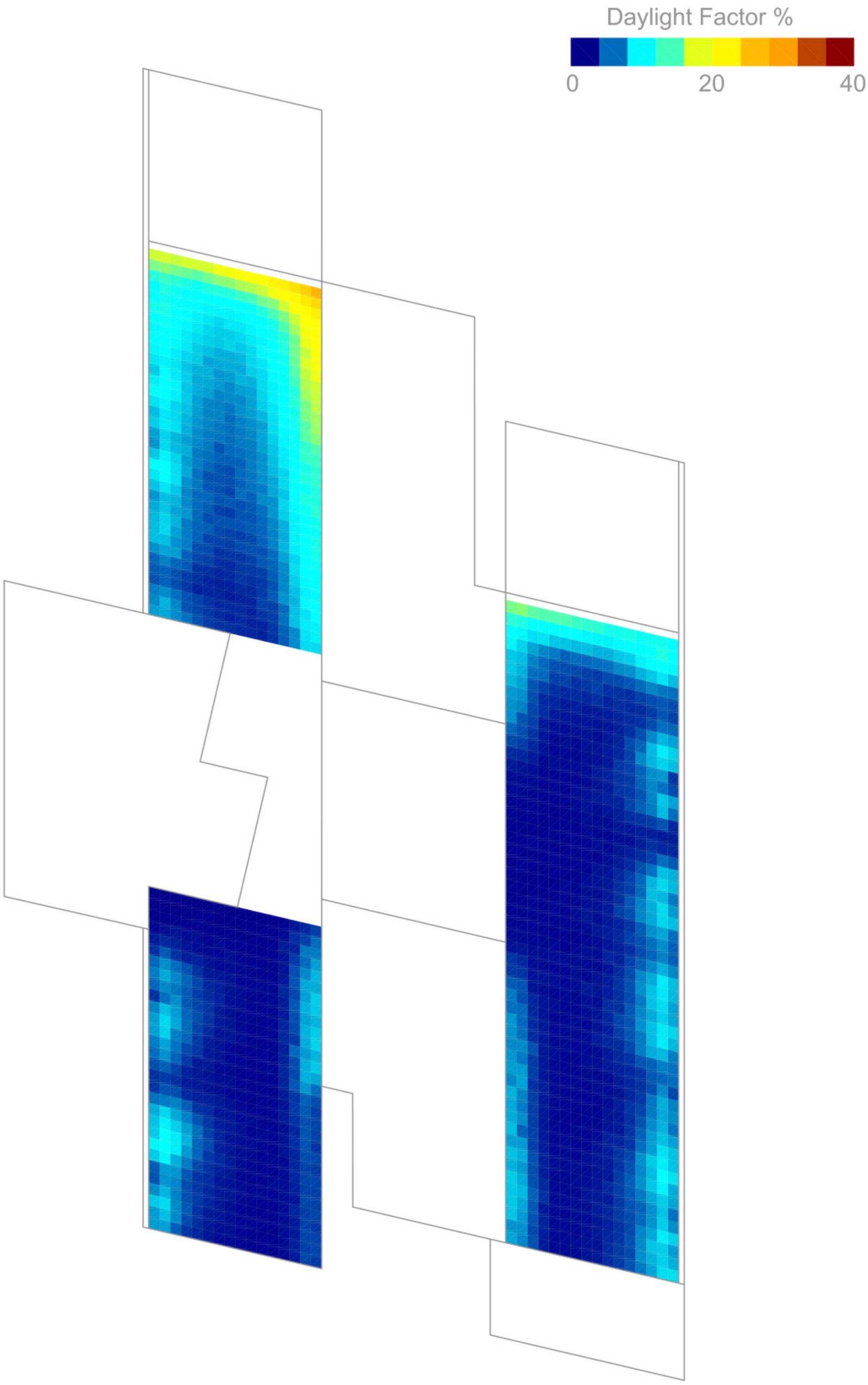

Figure D 31 Floor4 Alternative3 DF Analysis Mesh

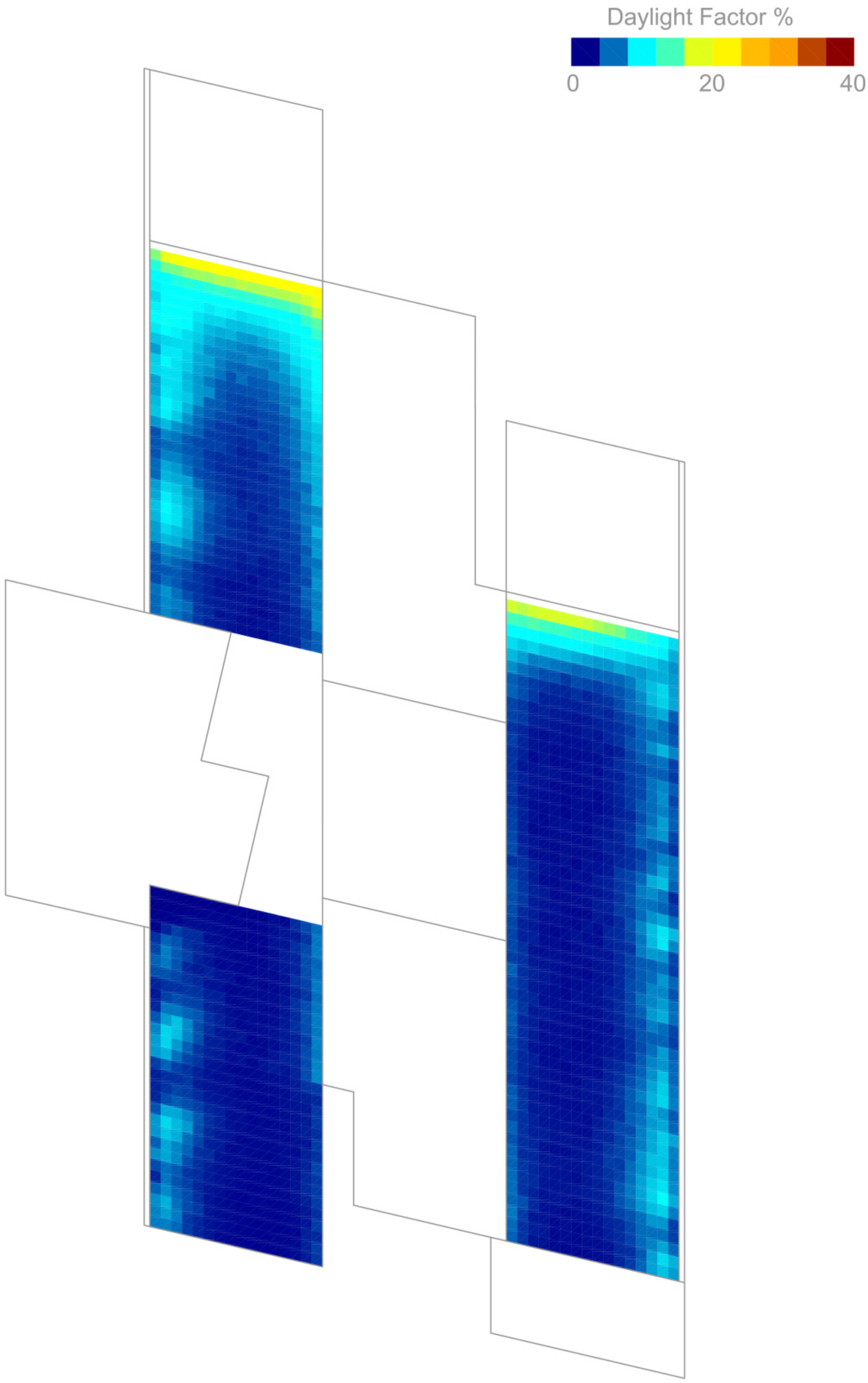

Figure D 32 Floor5 Alternative3 DF Analysis Mesh