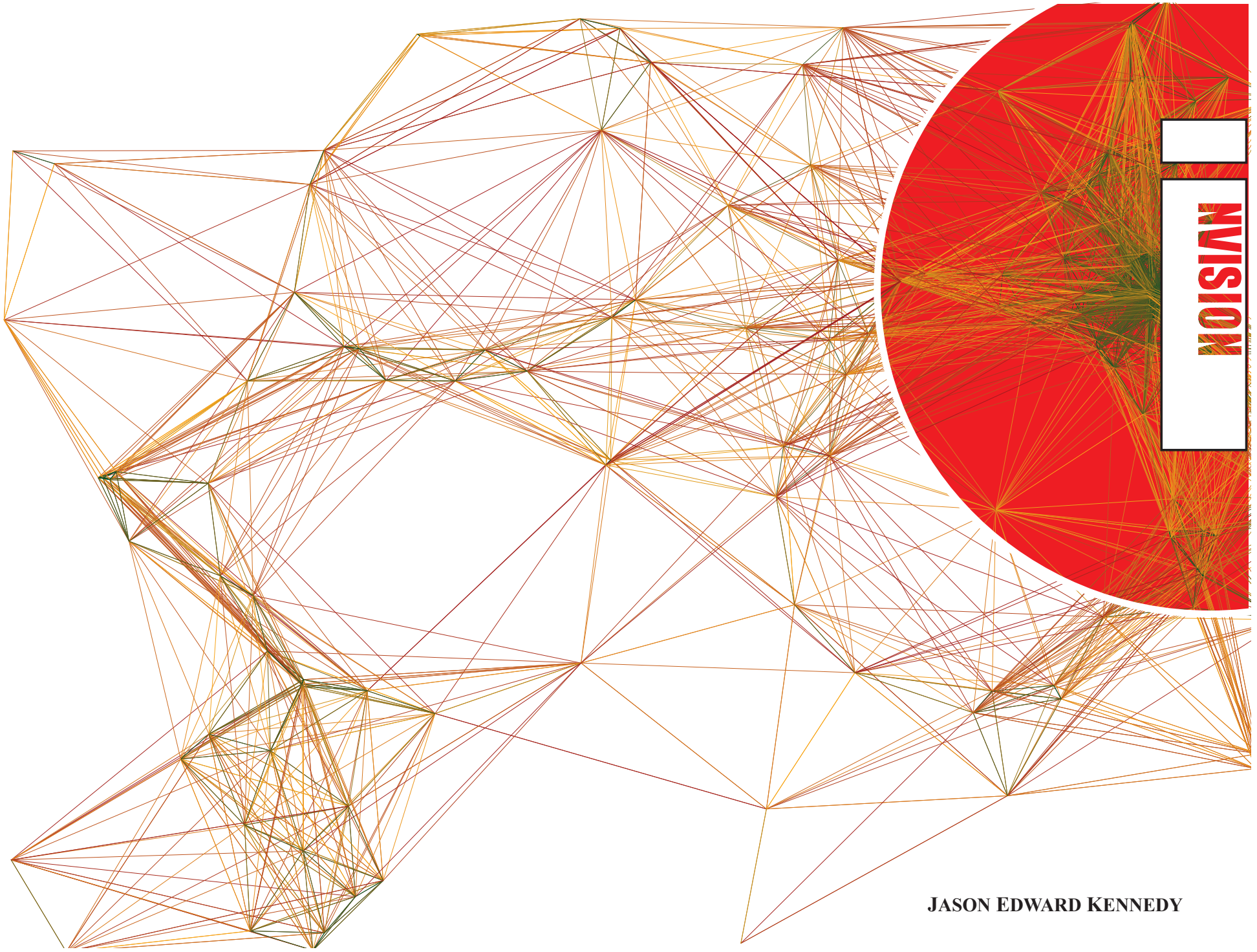
VISION



JASON EDWARD KENNEDY

INVISON: OUR WORLD REDEFINED

by

Jason Edward Kennedy

A thesis submitted in partial fulfillment
of the requirements for the degree

of

Master of Architecture

in

Architecture

MONTANA STATE UNIVERSITY
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JASON EDWARD KENNEDY

April 2010

DEDICATION

To anyone that has the opportunity to dream of the future.

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ABSTRACT

The interstate 70 corridor serves as a gateway to the mountainous region of Colorado for all of Denver's residents, the majority of travelers from the East, and most all visitors flying into the state. The corridor no longer functions efficiently as a connecting tie and the Eisenhower Johnson Memorial Tunnel acts as a centralized hub in the system and under adverse conditions both are susceptable collapse effectively crippling the entire network. As population increases, the number of drivers on the road will increase and inturn traffic congestion will continue to get worse. If the current trend continues the state of Colorado is positioned to loose billions of dollars in lost oppourtunity, not to mention the loss in percieved quality of living to the Denver residents. This project seeks to, through the anaylsis of the exising conditions and the plausible future, describe a solution to the problem.

PREFACE

"To Plato, philosophy was not some abstract subject, divorced from everyday activities, philosophy can gain us access into a realm of truths that lie far beyond what we can either perceive with our senses or even deduce by simple common sense."[1]

In ancient Greece nothing was closer to divinity than mathematics. Mathematics and the ability to quantify the nature of observed phenomena led to a process for, and a philosophy about the predicting of patterns in relationships between nature and man. A grasp of the nature of people, of cultural centers, of public space, and a hierarchy of assumptions about perceived reality is fundamental to exploration and experimentation. It was Plato that through the act of exploring the universal truths of mathematics described the value of philosophic exploration to be that within investigation discovery may be possible.

INTRODUCTION

An interest in discovery, and potential for the realization of solutions that otherwise would be unseen is the conceptual genesis for this thesis. Also, optimism that discovery can be grounds for generating new social norms will be its' goal. The stance taken is such that: sprawling settlements, the physical embodiment of human kind's eradication of the environment, are expanding and transportation systems that connect these settlements are the catalyst for this. Developing a process to describe the condition and evolution of these complex systems will be the target trajectory of this thesis.

All of the following discussions fall under one of three possible topical umbrellas, each is considered to be a tool set with which the process will be constructed, and the aggregate of which forms this thesis.

TOOL SET 1

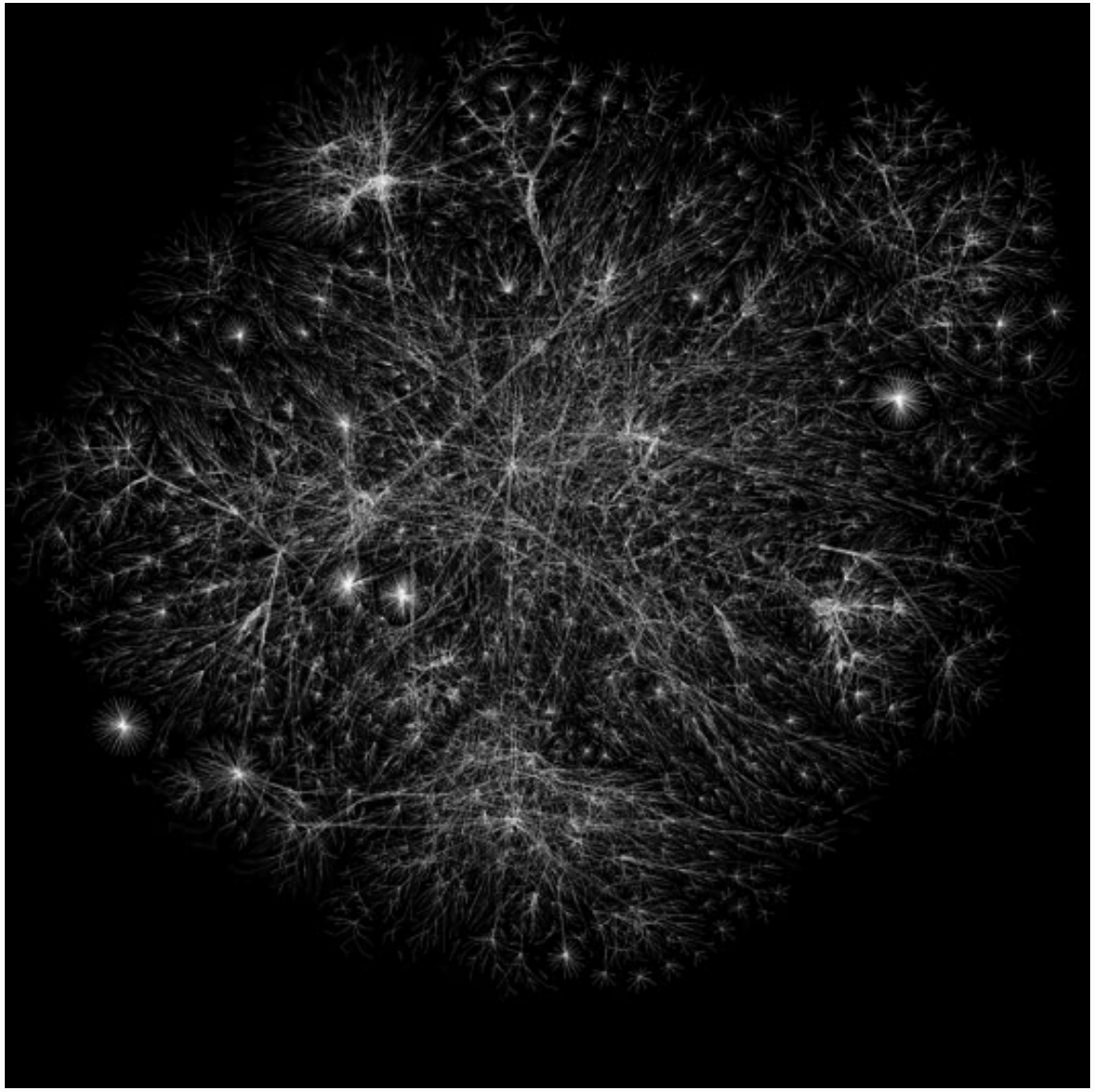
The first of which is a theoretical position. This dialogue forms the momentum with which the project will shape. The purpose of these arguments is to flush out an understanding for the purpose of an architectural investigation and to describe the conceptual interactions between human settlement and the environment. We ask the question, what is the condition of the complex systems that exist in our built environment?

TOOL SET 2

The second is a more pragmatic discussion about how the built environment and the corresponding transportation networks with which they are linked, have developed a relationship with the natural world that has come to be malignant in nature. A dialogue between existing trends and the tools, we as architects are equipped with, will help to describe and shape these complex systems. We ask the question, how do we shape the complex systems with which we interact?

TOOL SET 3

The final discussion combines the previous two, and contrasts goals versus existing trends and the outlined problem. While outlining the specific systems analysis and conceptual momentum as the aggregate for this thesis, we ask the question, what will be the nature of our interaction with the complex systems we are surrounded by, in the future?



TOOL SET 1

PHILOSPHIC STARTING POINT

"Physicists have always been the first to be surprised by when, drawn into uncharted territory by a new physical phenomenon, they have almost invariably found out that mathematicians had already been there, guided not by nature but, rather, by pure thought. This surprising and troubling consonance between mathematics and reality is further evidence of the independent existence of mathematics in the Platonic world of Ideas"[2]

Innovation and discovery have always required a thorough investigation into the unknown, and for any practical application of philosophy or scientific reason to the process of discovery one must examine their agenda alongside the conditions of the past. "Modernus was used for the first time in the late 5th century to distinguish the present which had become officially Christian."[3] The past has always been constantly modern and modernism has always been tied to the classic works even if those icons of the classical world were described as modern in their own time, and we can see that modernism actually imposes its relative nature to the present, so then must postmodernism be a rejection of the present state of things. Postmodernism has brought a way of thinking about things in a very analytical yet imaginative way. "We observe that anarchist intention of blowing up the continuum of history, the force of aesthetic consciousness."[4] This is how the avante garde sought to topple the fortress that was modernist thought. It is important to realize that postmodernism's goal may not to be topple the ideas of modernism just to apply a new way of thinking so much so that they are able to birth a new social norm.

"Modernist sculpture appeared as a kind of black hole in the space of consciousness, something whose positive content was increasingly difficult to define, something that was possible to locate only in terms of what it is not."[5] Historically, within the realm of modernist sculpture we find that only works that are truly site specific and place related, are considered successful or valuable, but once the relationship between sculpture and place was broken the art of sculpture stepped into the realm of the postmodern world where abstraction is more acceptable, this may be one of the real benefits of post-modernist culture. Post-modern art and thought typically encourages creative freedom, this is what allows creative works from all imaginable perspectives to infiltrate the modern consciousness, freeing the world from the constraints of classical form and technique, while opening doors for a countless number of creative individuals. "Under the new post-modernist dispensation, anything goes."[6] This is a subjective view of art but also explains the value inherent in postmodern art, being that anyone can produce art and that through whatever medium their opinions and thoughts can be elaborated.

"The postmodern age is characterized by the coexistence of different cultures."[7] While seeking to birth new cultural norms it is difficult to decipher what is best for the individual and the global community, Habermas explains that, "ever since the beginning of the enlightenment, civilization has been concerned with instrumental reason, while culture has addressed itself to the specifics of expression,"[8] this is the clash between creative minds in different sects



of study, and even in the modern period there was rejection of the state of art and science. In order to promote the growth of specific disciplines the specialists in the study of art, science, and morality saw their spheres of influence segregated from each other in order to more deeply investigate the individual implications of each within society.

The segregation of the sciences and art demeaned the commoners, to them the overall concepts being examined by philosophers, artists, and scientists were not available. "With the birth of surrealism the act conforming to what could be seen as relatable art."[9], would no longer go on, and new individual momentum, "saw the reunification of the different spheres of creative thought"[10] the individual became a valid critic who is inherently informed of art, science, and philosophy through the interactions within their own life. The idea that all opinions are valuable and that all input is important to the whole of society has as illustrated by Owens, "the postmodernist operation is being staged – not in order to transcend representation, but in order to expose that system of power that authorizes certain representation while blocking, prohibiting, and invalidating others."[11] Through these postmodern channels our society as a whole has seen a recent rise in attention paid to the environment and sustainable practices in architecture.

So we see a continued split, re-unification, and split again of elements of both culture and civilization but really these events lend a hand to one another and have become the evolution of our cultural and societal norms. "Nothing conveys more vividly and compellingly the notion of a destiny shaping human ends than do great styles, whose evolutions and transformations seem like long scars that fate has left."[12] What is most important is to realize these patterns and to understand the social and cultural events that shaped these periods of time, and to then realize it isn't the period or specific style to which something adheres but how it responds to the peoples' thoughts and the collective consciousness of the time that is important.

While shifts in norms are constant and unavoidable it is important to realize these shifts as they come. It has recently become ever more obvious that there has been a re-branding of sorts when it comes to architecture, and this trend has infiltrated the main stream in the form of the "green" movement. This is a great thing for practitioners seeking to implement sustainable techniques and curb the wasteful cycle we have become accustomed to. Without the postmodernist style of progression, environmentally responsive architecture may never have become popular, that is not to say that those practicing with high environmental ethos would not have gone the "green" route, just that sustainable architecture is much more powerful as an emerging cultural norm and pop-culture phenomenon.

Concepts that stretch and blur the bounds of both the post-modern and modernist schools of thought emerge to describe properties of our world that may be predictably universal but perceived and experienced at an individual level. It is the foundational philosophy and analytic thought of preceding thinkers, that has established a purpose for investigation into the world around us. With this fundamental understanding the stance of this thesis is to translate the nature of an individual's experience and actions into a quantifiable relationship between the whole of society and some universal strategy for organization, effectively bridging the gap between Modernist thought and our Post-Modern age.


STREET LEVEL VIEW

ARCHITECTURAL STARTING POINT

"Einstein stopped looking for solutions, you can't solve a problem with the same sort of thinking that gave rise to the problem."[13]

An understanding of the structure of the built environment and the networks of components that create urbanism, is key to predicting the future growth of our cities. The proposed forecasting of growth is built on a foundation of atavistic inquiry and knowledge of the evolution of society and the architectural practice over time.

As the world and the architectural practice moved into the 19th century the Industrial Revolution started to affect all aspects of life. "Improvements in agricultural productivity, sanitation, and average income level contributed strongly to the growth and physical well-being of a population increasingly concentrated in the cities."[14] People were becoming liberated. Women were able to get jobs, farmers were able to get a better wage, and society as a whole was seeing the benefit of cheaper goods and improved transportation.

The revolution influenced the realm of architecture as material systems and construction methods were improved. With the advent of iron there was a boom in the utilization of metal as structural components within the architectural organism. Increased span and decreased depth of the member was just one example of how new material properties influenced the architectural practice. The architect could make assumptions about materials that had more uniform properties and thus more freedom to explore new design possibilities. Some argue that the machine had taken over the aesthetics of architecture during this time. It is more accurate to say that the ideology of the time had sought to conform more to the practice of realizing the capacity of this new technology. Architectural exploration itself was in a new position, at the helm of a ship navigated about a course based on the new and exciting characteristics of materials. "The efforts of men such as Eiffel and Jenney evidenced a will to discover a new style based on avant-garde techniques."[15]

These men and these machines were collaborating to push the boundaries of what architecture could do, and all the sudden found themselves at the apex of modernism, a time where new forms and functions were being developed. Le Corbusier, Frank Lloyd Wright, and Mies Van Der Rohe all succeeded in pushing the limits of architecture, redefining what could be done, and redefining what could be imagined.

The Industrial Revolution generated new forms of building materials, and in a way, a new manner of constructing buildings, but they were architects that changed architecture, for the better or worse. From these great pioneers the lessons and strategies that were implemented must be extracted and digested, because today's society is at the threshold of an entirely different revolution, it has been given many names The Green Revolution, The Internet Revolution, The Post-Cold War Era etc., and the Industrial Revolution it has benefited society in countless ways.


RAND
FIVE THOUSAND
RAND

With the collapse of Communism and the fall of the Berlin Wall, the standard of living was boosted around the globe. "The end of Communism and the flattening of the world helped to lift 200 million people out of abject poverty in China and India alone."[16] As the free flow of ideas and technology raced to and from every corner of the world modern civilization became situated at the summit of a mountain of resources. Unfortunately the populace is also at the peak of a mountain of environmental problems with architecture and the built environment being a key contributor to the degradation of the planet.

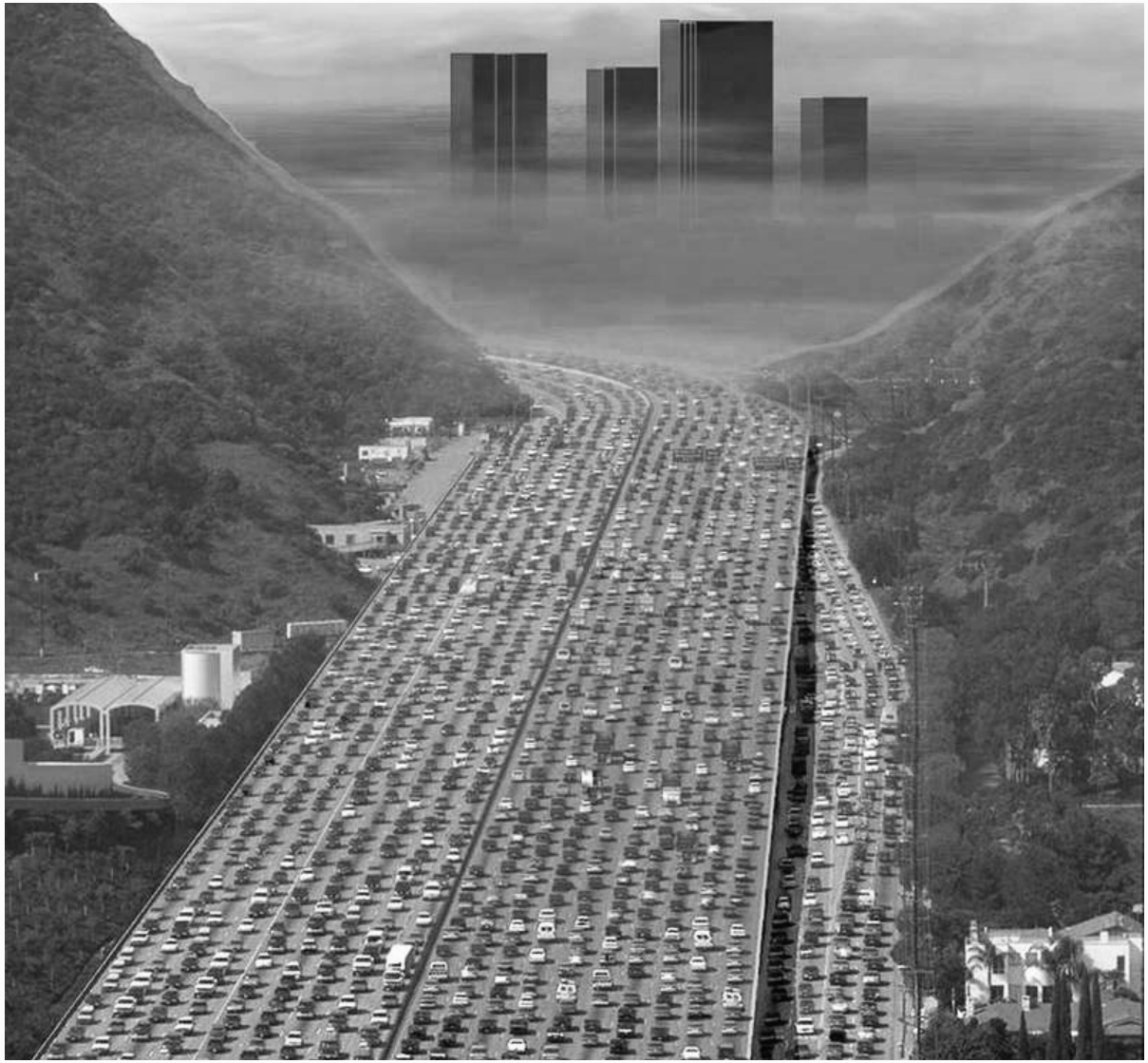
So as the great purveyors of Modernist architecture pushed the limitations of their environment so to must the modern architect promote an architecture of progression. In the 19th century the new technologies of the time were metallurgy and the internal combustion engine. The new technologies of the 21st century are computers, the internet, and countless versions of analytic software. With these tools the face of architecture is bound to change in vastly unimaginable ways. The role of architecture in the environment should be defined by considerations for externalities that may occur, the practice must create new ways of thinking about materials and technology to augment the current systems that are in place.

The increasing emphasis on building performance from the cultural and social context to building physics is influencing building design. By integrating the design and analysis of buildings around digital technologies of modeling and simulation, the architect's and engineer's roles are increasingly being integrated into a relatively seamless digital collaborative enterprise from the earliest, conceptual stages of design.[17]

New processes for collaborative design have lead the industry into new fields of research: micro-biology, synthetic biology, ecology, and network theory, are all just as foreign to the modern architect as steel construction was to architects of 150 years ago, but like their predecessors architects of the post-modern world must utilize the available technology and devise solutions to large problems. Already great strides have been made to adapt new and brilliant strategies for building materials into real world applications in an attempt to create a more environmentally friendly architecture. Experiments into skin systems that borrow from biology have offered solutions to problems like passive climate control and day lighting, "research is promising, and includes smart biological membranes that can interact with their environment based on self-assembling biological structures and polymers."[18] These types of systems are the future of architecture and can only exist when technological innovations are explored to their fullest.

Technological advancements should be utilized in conjunction with more tried and true techniques like photovoltaic arrays, wind power, and passive heating and cooling strategies. Only through the appropriate allocation of these techniques can the carbon footprints of our buildings and their overall negative impact on the environment be minimized. There are also topics of concern related to urbanism that weigh heavily on our environment. Technological advances like urban vertical farming and large scale efficient public transit should be utilized to alleviate the strain caused to the environment by large scale agri-business along with smog generating and street choking commuter automobile traffic. Only through utilization of these techniques and the constant reinvention of the norm can we climb out of the environmental "hole" we find ourselves in today.

When technology, nature, and man meet there has always existed a conflict. What has resulted is the idea of a natural opposition between modern life – evil incarnate – and nature, which is viewed as something serene, immutable, and ever threatened.[19] If care isn't taken to safe guard our environment, and if we don't arrange and expand in a manner that is sustainable the future of the built world is grim. The architectural practice must serve as a sentinel for us all. The stance of this thesis is that through the utilization of new technologies and planning strategies coupled with an understanding of past and current conditions that an urban environment can be created that is sensitive to the needs of society, the environment, and the larger regional and global networks.



TOOL SET 2

A FAILED EXPERIMENT

"Who has anticipated, or adjusted to, the scale of change in Southern California? Stretching now from Santa Barbra, to the edge of the high desert, and the Coachella valley, with a built up surface area the size of Ireland and a larger GNP than the country of India. The urban galaxy dominated by Los Angeles is the fastest growing metropolis in the advanced industrial world. It's current population of 15,000,000 encompassing six counties, and a corner of Baja California, and clustered around 2 super-cores: L.A and San Diego/Tijuana. And a dozen major expanding metro centers, is predicted to increase by another 7 or 8 million over the next generation."[20]

To understand what has happened to what used to be an icon of urbanism and an indicator of social progression for an entire nation; sheds light on the stress placed on entire geographic regions, various ecosystems, and cultures by an implosive scale of expansion. L.A. was one of the first planned cities in the country, planned while it was still part of Spanish territory. Futile attempts to disrupt the engine that is sprawl, and continued rampant abuse of the surrounding environment has been business as usual in this region from the early 1910's when L.A.'s population was 300,000 and sprawl had just reached the new suburb of Hollywood.[21] The eutopic logic of subdivisions in sterilized sites stripped bare of nature and history, master planned for privatized family consumption generated a condition that within the most dense, most urban niches of the Empire there exists artifact of place, a byproduct of the repeated rewiring of the city. Arts and crafts style kits could be purchased and put up on any vacant lot and so by 1930, 94% of all dwelling units were single-family homes.[22] Mayo reworks the notion of L.A., "Here is an artificial city, endeavoring to eat up this too rapid avalanche of anthropoids, the sunshine metropolis heaves and strains, sweats and becomes pop-eyed, like a young boa constrictor trying to swallow a goat. It has never imparted an urban character to its incoming population for the simple reason that it has never had any urban character to impart."[23]

A combination of impetuous development and growth, has spawned a knot-like catacomb created by major interchanges, places that are both charged with energy and drained of value from the commuters of the world's largest metropolis. The city's self-arrangement may be the only metric left with which to process patterns in growth and expansion. The prevailing trend of compartmentalization, market driven over development, and decades of systematic under investment in housing and urban infrastructure has led a population towards the, "apocalyptic awakening of the neighboring San Andreas fault, and it is all too easy to envision L.A. reproducing itself endlessly across the desert with the assistance of…desperate home buyers willing to trade lifetimes on the freeway in exchange for $500,000 dream homes in the middle of Death Valley."[24]

To the dynasty that is "the single largest example of suburban sprawl in the entire world at over 5,000 square miles" excuses for lost ideals about open space for the sake of experienced efficiency in the mechanized realm has created rifts through communities and generated isolated nothing all for the purpose of nurturing a dying technology



and fostering a torturous environment for all people that are unlucky enough to feel the proximity to what could be called the demise of a fallen city. The heart of the city is no longer connected through any channels to the extremities of the empire. This has so choked the city that downtown exists no longer as the city center that it was supposed to be, but now as an artifact of a place that died long ago. The coincidence of this suburban sprawl and the death of the more urban city center is at heart caused by the massive network of highways that have actually isolated the regions of the environment they were supposed to connect. In L.A. the highway system is the manifestation of everything from the metaphysical delusion of the area communities, to an intricate network that connects pollution, and crime to the people. It is the mechanized environment of the automobile culture that has created the duality that has now taken a strangle hold on the empire as a whole.

The fate of science in L.A. exemplifies the role reversal between practical reason and the delusional nature of a place so implosive that, ”One would expect the world’s largest scientific and engineering community to cultivate a regional enlightenment, science has consorted instead with pulp fiction, vulgar philosophy and even Satanism to create yet another layer of California cultdom.”[25] There is a decisive lack of cultural rationale for arrangement. The absence of a definitive public functional space, such that would ordinarily serve to illuminate a sense of place, has further fractured the theatre of the city.

L.A. has been the harsh representation of the possible consequences of run-away fragmentation and placeless paranoia caused by a decentralized loss of an urban core, all of which speak to the notion of postmodern urbanism. “Los Angeles is bigger than postmodernism and yet is defined by it.”[26] In the face of uncapped growth and bastardization of open space L.A. shows there does exist vast opportunity for reclamation, re-habilitation, and infill to an urban infrastructure, transportation corridors and hubs, open/green public space, private and civic programming. This wild urban fabric is a new description of our environment, one that is more unpredictable. This can be the only explanation for what could be, “one of the paradoxes of urbanity is its reliance upon its opposite, the condition of coarse activity in un-programmed spaces that approximates Foulcault’s idea of heterotopia. Such are the pleasures of tracking and hunting in a dangerous built domain as if it were raw wilderness.”[27]

Society’s narrative may be, one that is explained as fractured and opportunistic, a story about the nature of man as organic. In a way that is predatory and malignant in nature, enveloping entire regions of our planet. The elements of unchecked development and sprawl will eventually grow, multiply, and feed like all too many “weeds” that eventually infiltrate areas that otherwise would be leftover for more sensitive interactions with society. The challenge is to “grow” the elements of the built environment that facilitate a cohesive efficiency, and a city that, “is understood as an organism that breathes, needs connections green contemplative islands and a busy new central area.”[28] It is the stance of this thesis that this narrative evolves along with the city, guided by tropic chains of employment, transportation, housing, and cultural networks. These are the systems with which the built environment has the most influence.



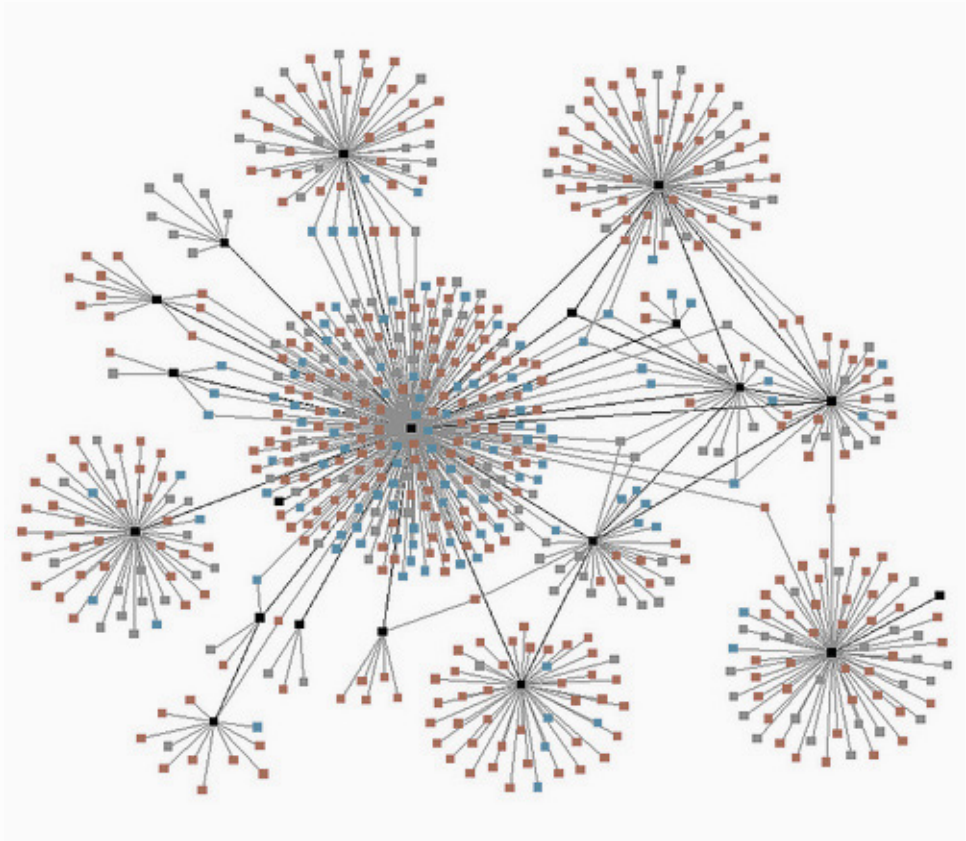
EXAMINING FLOW

"In the 1800's people traveled on average 50 meters a day, today an average of 50 kilometers."[29]

We must treat the built environment and our interactions within it, as inhabitants, as an ecosystem of its own, one that is completely inter-networked with site specific social and ecological networks as well as large scale national and global networks. When we look at how cities have traditionally been arranged we find that transportation methods have laid the ground work for the organizational dynamics of today's modern urban environment. Typically cities have never been more than "one hour wide"[30] and the transportation methods of the time have dictated how wide the city would be. We have come along way from walking cities that were 5 to 8 kilometers wide to get to the automobile dominated cities of today that span up to 50 kilometers wide. We need to re-evaluate the organizational strategies with which cities develop. As Jennings and Newmann explain, "the impact on ecosystem patterns and processes has dramatically increased as urbanization takes up more land, and the demands of urban populations place greater pressure on the ecosystems outside the city."[31]

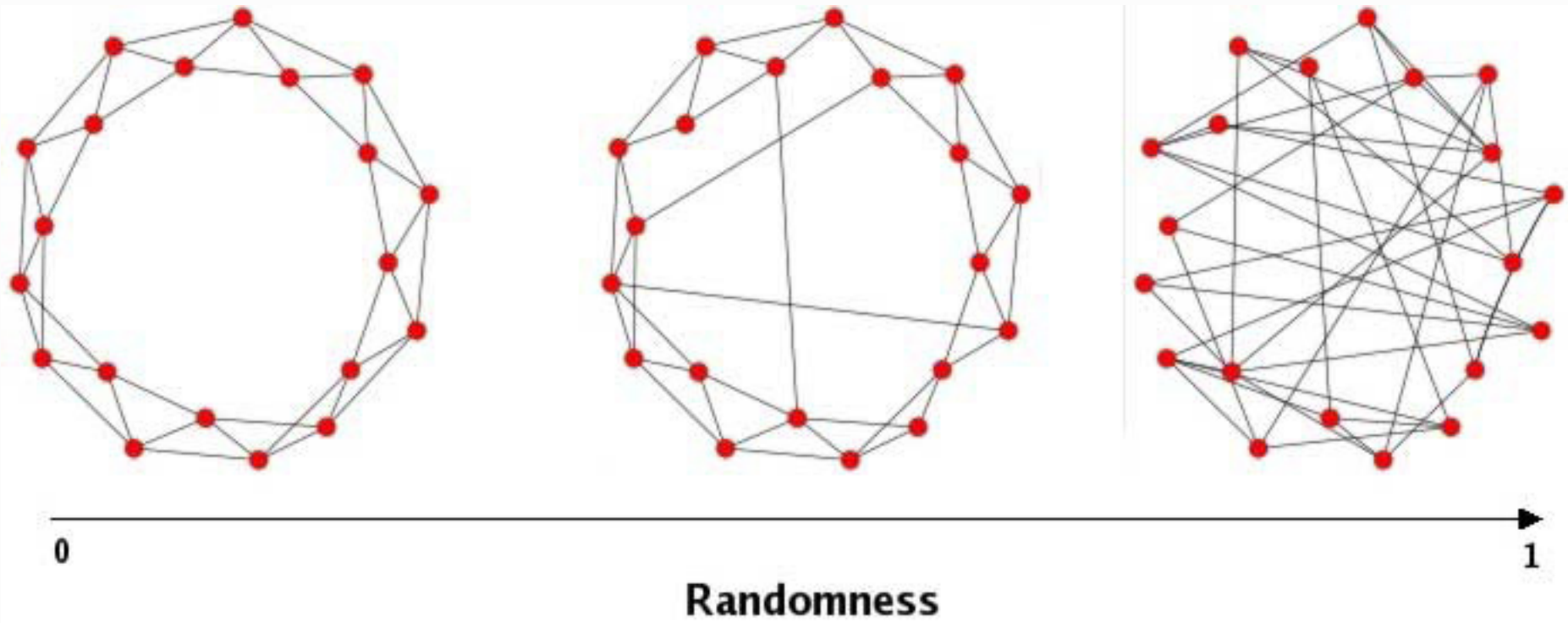
"Cities can be regarded as ecosystems like any other, as they are made up of interacting components such as buildings, transport, sewage infrastructure, formal parks and sporting grounds, and introduced plants and animals."[32] Once this concept is realized it allows for the utilization of strategies of analysis and study that branch out from various sciences and give us a better understanding of how complex systems function both organically and mechanically. "Examining the city as an ecosystem enables flows of energy, materials, and information to be studied together, along with interactions between human and non-human parts of the system."[33] We need to understand how transit, food production, and living spaces interact spatially within the city. Also how inhabitants of these places interact with each other and where those interactions occur. From that analysis we can seek to generate appropriate formal strategies for urbanization in the future.

"Here people could meet in attractive, walk able centers and conduct the transactions that would fire the local, regional, and global economies."[34] This is the vision of a redefined urban district in which the organizational strategy is focused on long term feasibility, increased quality of life, decreased pollution, and a focus on clean transit that is not a detriment to the community but a benefit. In the future the redefining of how we structure the urban environment may rely heavily on the analysis of how we structure all of the networks that surround us. The key to the success of such an investigation relies on our understanding of these networks and there architectural implications. "A sustainable-city model that features mixed-use urban eco-villages, linked across the city by transit, with low and medium density areas around these villages. Compact, mixed development facilitates walking and public transport, thus affording the opportunity to restore vitality to the public realm and a sense of community."[35] Newmann and Jenning's idea for the bundling program and re-establishing mass transit and walking corridors is essential to the new urban development. This bundling of programming essentially creates a hub around which



nodes or program elements all utilizing sustainable building practices can begin to be arranged. These network hubs will serve to promote sustainable practices and in-turn based on the small worlds phenomena should infiltrate the network in calculable and numerous ways. "The compact nodes would be surrounded by parks and integrated support systems – urban agriculture, and storm water and waste water management systems – with links to the wider bio-region. These nodes would serve as the knowledge and service centers of the new economy."[36]

Nature, society, and the built environment should be communicated with as an ecosystem network, and the study of the "small worlds" phenomenon show us that the dense allocation of localized programmatic elements generates ties to the network that are crucial for expansion and efficiency of the whole system. These ties and connections to many nodes are vital for the survival of the ecosystem. The "small worlds" theory suggests that it is through this hub and node structure that most network processes function efficiently.


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Randomness

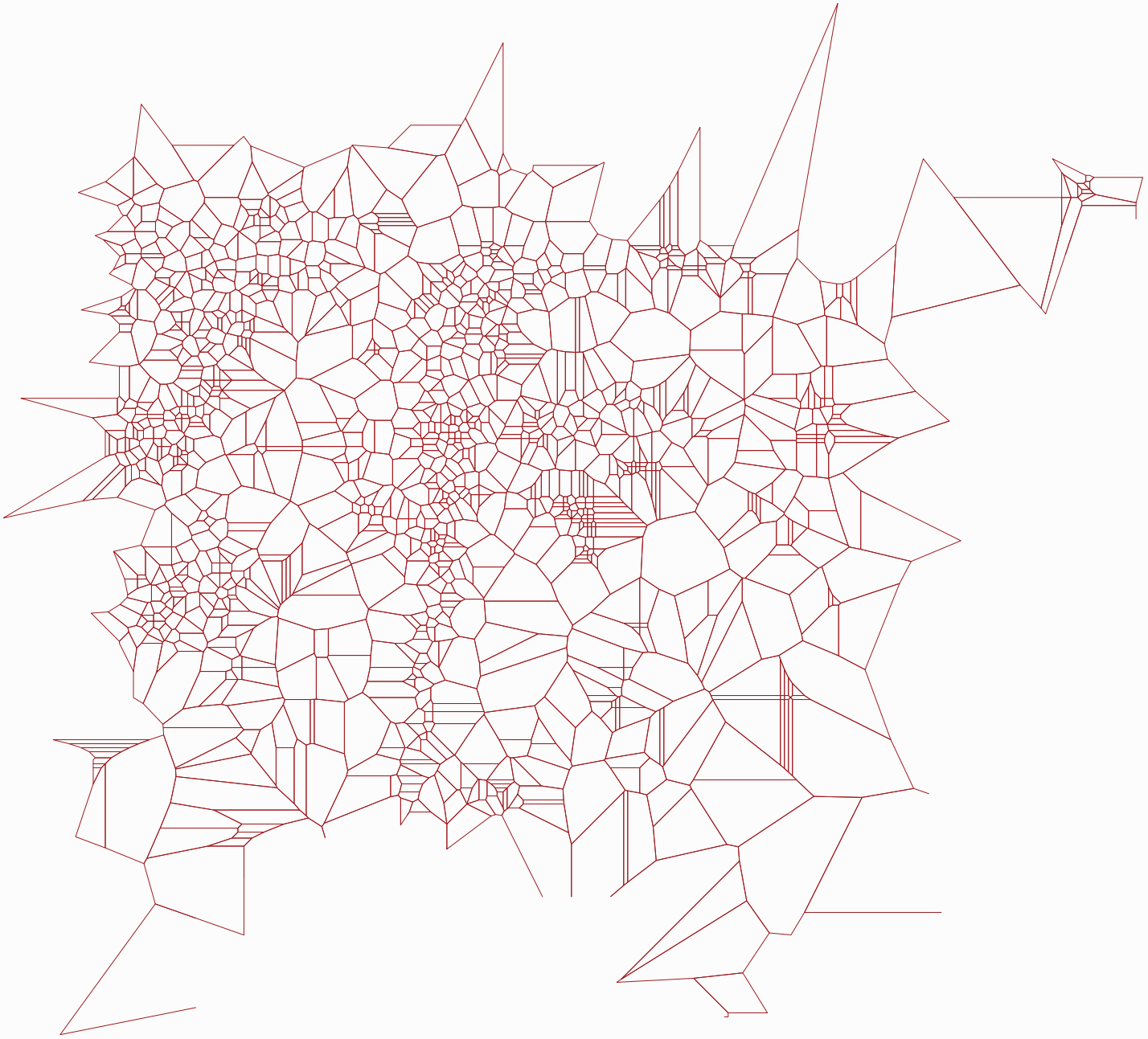
DISCOVERY

"Some of the deepest truths of our world may turn out to be truths about organization, rather than about what kinds of things make up the world and how these things behave as individuals. The small-worlds idea is one of the newest and most important discoveries in this science of forms, a science that has roots stretching into antiquity."[37]

In Nexus Marck Buchan describes the creation of Network Science, "one day during the winter of 1998, mathematicians Duncan Watts and Steve Strogartz of Cornell University in Ithaca, New York, sat down at a table in Strogartz's office and drew a series of dots on a piece of paper. They then connected some of the dots together with lines to produce a simple pattern that mathematicians refer to as a graph, they had stumbled over a graph of an unprecedented and fascinating kind."[38] They had drawn the first diagram of the hub and node architecture that generates the "small worlds" concept within network theory.

The two mathematicians from New York were trying to figure out patterns within the natural phenomena know as synchronicity: specifically how millions of crickets can chirp together as one cohesive organism, when they discovered the foundations for an entirely new realm of science. While studying local crickets, Watts and Strogartz hit a conceptual wall through which they could not break, when, on a whim Watts began contemplating how their "bug" network was connected. Watts became puzzled by the concept of "six degrees". A concept first pioneered by an American psychologist named Stanley Milgram, who in the 1960's was experimenting with the "lost letter" experiment, an experiment where hundreds of letters were given out to random people with the instructions being simply to get the letter to a person with whom they are unfamiliar and have no current address. The trick was utilizing only friends the recipients considered to be "local" or close friends. Milgram found that for the 70 percent of letters that arrived at their destination that typically each letter changed hands no more than 6 times.[39] This experiment served as the foundation for the idea that any one of the more than 6,000,000,000 people that make up the global social network is only six handshakes away from any other. The "small worlds" concept as it has been deemed and its application to a system as large as the entire social network of the planet got the mathematicians thinking about networks more generally and what were the possible applications of such pattern dialogue to their research. The natural next step for the mathematicians was to interpret their problem through these dynamic network parameters. They wondered, who was listening to who, and if anyone was listening at all. The strategy for depicting a hierarchy of communication inside the synchronized system was to try to decipher patterns in the network. At this point their research and it's focus shifted from the specificities of how crickets chirp together to understanding the universal nature of network architecture, the "small worlds" concept.

The "small worlds" phenomenon is being discovered in many real life networks that function everyday throughout the world, some physical, some virtual, and some ecological. Simply a network can be

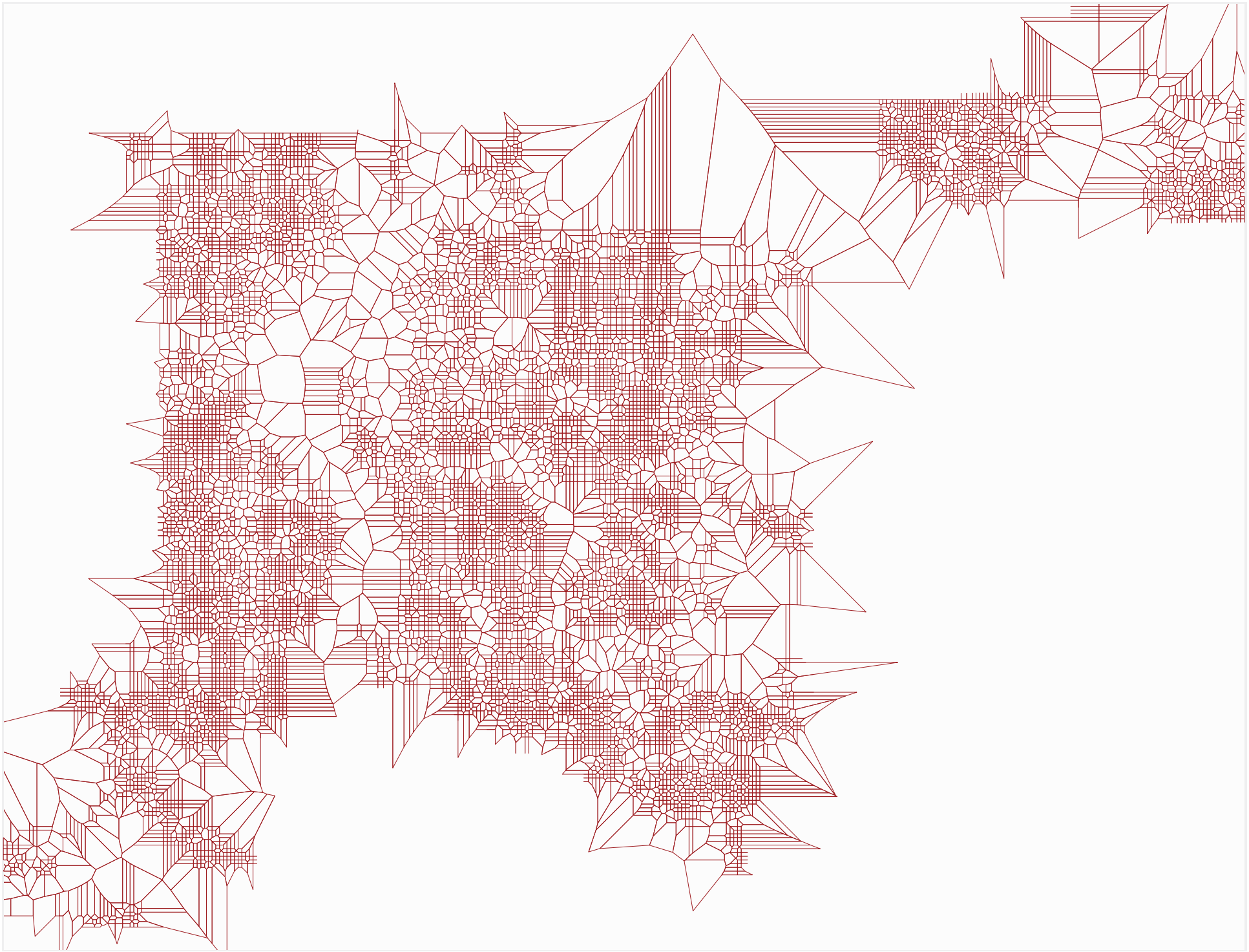


described as the accumulation of a given set of interacting components, and also that there are within each network certain givens and patterns that have been described to be universal. These networks are comprised of a variety of components, and have inherited specific behaviors. Describing a few important elements found to be common through all evaluated networks clarifies the general assumptions conceded when describing the small world architecture of networks. Nodes are a generic member of the network, neither hub nor connecting tie. Nodes are the basic building block for all networks. Central hubs tend to dominate network activity.[40] A hub exists as a main interchange for the linkages within a network they are special nodes, special in the connections they have. Links or ties are the components that connect all nodes and hubs, and have two classifications among them, strong and weak each with differing implications. Strong ties can be described as bonds between family members as they occur in high frequency within the group. [41] Strong ties are the least important structurally, to the architecture that is. Strong ties can be eliminated without much impact on the connectivity of the whole system. Strong links typically do not exist in isolation; rather, they tend to fall within triangles or clusters, a component of their multidimensional connectivity. Weak ties are the crucial means by which otherwise isolated clusters of nodes will receive the most connectivity to a larger network. The removal of such ties would have dramatic implications in that their absence would prevent growth and diversity in the network, also "weak links, the connectors posses so many links that they are infrequently utilized," the redundancy implied in this small world architecture, "provides stability within the system."[42] These networks can exist as one of or any combination of the two classifications of networks: egalitarian and aristocratic. An egalitarian network is one in which all elements have the same number of connections, and intern fairly inefficient connectivity. Within an aristocratic network there is a spectacular disparity in the number connections a given node has. A super connected aristocratic hub connects you to many things, but an egalitarian hub connects you to few, each node is singular.

Watts and Strogartz elaborated on the conditions within which the world is small, as Buchanan explains, "the small worlds phenomenon formalizes the anecdotal notion that, you are only ever six degrees of separation away from anybody on the planet."[43] This insists that the social networks with which we are all familiar are more closely connected than anyone would expect. It is impossible to imagine the system of connections that link the collective planet, this is due to the compartmentalization of the system within which we exist, so all members perceive the network as confined and redundant.

Clustering in the network is caused by the simultaneous overlapping of both random and ordered systems which leads to asymmetric connections, and those corresponding interchanges make some links more important than others. The two arranging strategies function independently yet each is observed to adhere to the same principle, that within the small world architecture of networks there exists a duality between the completely random and the completely ordered, as opposites fundamentally, yet they are observed to assemble in a way that, their local and global architectures expand the same way. Watts and Strogartz found that, "both completely ordered and completely random networks share the same trait, that is that their local structure mirrors their global structure. In essence the capture of data about localized behavior within a network is sufficient to describe the global characteristics."[44] The forms to which these metrics can be applied vary in substance from water molecules and grains of sand to jaywalkers and investment bankers, regardless of what the network is made of, the substance satisfies certain laws of form.[45] This predictability is what is so valuable about the application of network theory to other disciplines of science. Sociology, ecology, economics, and political science have all been greatly impacted by the interpretation of the "small worlds" phenomenon. Only after analyzing the constraints, data, boundaries, and the fundamentals of discovery did the mathematicians attempt to decipher hidden relationships and possibly the universal nature of network organization.

Professionals of various scientific disciplines have adopted the strategy of depicting networks about systems of interacting parts with which investigation is necessary. The principles of network theory are appropriately used as a means of deciphering data sets that are large and disparate in nature, i.e. they would not be described as local or common based solely on grounds of physical proximity. To most



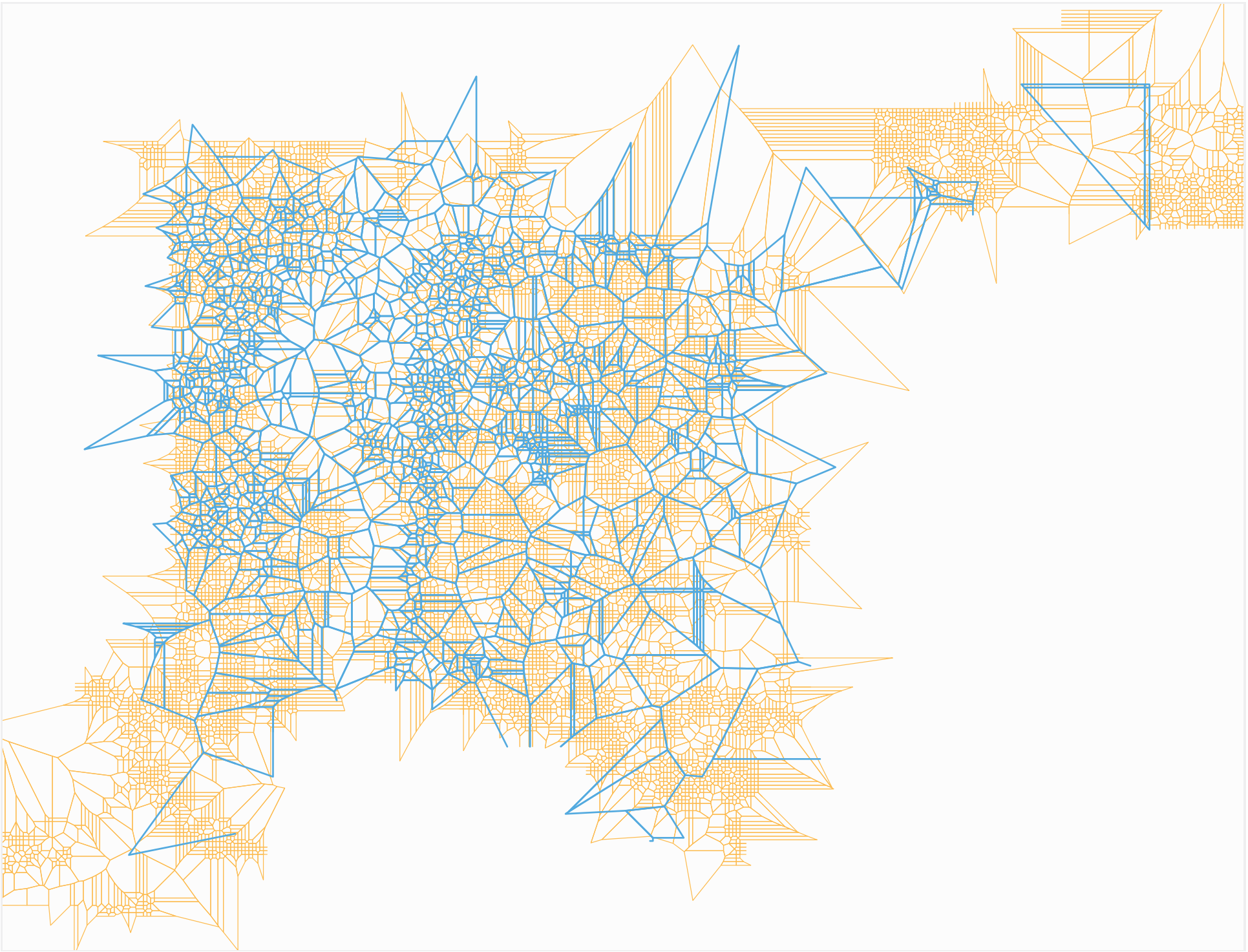
casual observers ecological networks are typically thought of as food webs following the large, who eats who, tropic chains , when in reality, Mark Buchanan explains that, "some of the most informative food webs carry names like 'Wet Stump Hole, Alabama' or 'Dog Carcass, Costa Rica' small thriving ecosystems, that support rich communities of organisms."[46]

Since ecosystems also respond to the hub and node structure that penetrates the deepest, and most compartmentalized clusters of network members we can look at our global network under the same light. Buchanan explains, "small world architecture keeps the biological world sewn tightly together. So not only will the culling of one species affect every species it eats, competes with, or is eaten by, but also will send fingers of influence that in a few steps will touch every last species in the global ecosystem,"[47] this as Buchanan explains, is the risk inherent in networks built on centralized hub structures, such that if the hub fails the system is extremely susceptible to collapse. The network architectures of both the world wide web and the global social network are similar in their structure that each individuals actions are wide reaching and can have a profound impact on the system, as Buchanan goes on to explain, "social networks turn out to be nearly identical in their architecture to the world wide web," and in turn, "each of these networks shares deep structural properties with the food webs of any ecosystem and with the network of business links underlying any nation's economic activity."[48] The architectures of both the world wide web and human social networks illustrates the interconnectivity of the entire global population and demonstrate a profoundly different depiction of an individuals impact on the system than one would expect.

Transportation infrastructure networks, like all other complex systems should adhere to the "small worlds" phenomena and are defined by distances, times, speeds, and interchange points. Typically the transportation methods of the time would dictate how wide a city would be. We have come a long way from the walking cities that were 5 to 8 kilometers wide to get to the automobile dominated cities of today that span up to 50 kilometers wide, because as Mark Buchanan describes in Nexus, "people's travel time budget is and always has been, throughout urban history around an hour a day," the marchetti constant and, "so cities can be no more than one hour wide."[49] Transportation networks have always been dictated by the public's perception of time spent. A faster form of transport would inherently capture less time of a person's day, and since people will likely travel more if it is faster to do so, transportation hubs are established. Arranged like most other aristocratic networks comprised of relatively localized nodes, recurrent clusters of connections at hubs, and strengthened by redundancy and weak ties. This typical structure can cause the hub to collapse under the weight of the entire system. "In 2000 Chicago O'Hare International airport pushed 72,000,000 passengers through its gates," staggering but, "4,600 cancelled flights and 57,000 delays made for O'hare's worst summer in air traffic history."[50]

Transportation systems infrastructure exists in most all urban environments, so when we look at how urban environments have typically been arranged and we find that transportation methods have helped to lay the ground work for the organizational dynamics of today's modern urban environment. Hubs can be seen in the transportation networks of the built environment and within the intricate social networks with which we interact. There is no specific connection between the two, except for the fact that they are each hubs. Hub centers act as interchange points for everything from commuters to ideas, whatever the form or substance maybe, a hub more generally might simply be a way of introducing ritual into the public realm and sense of place functionally appropriate to context. This ritual preserves hierarchy and order, and gives the public an opportunity for this discovery.

Models are being created to understand and predict interactions within complex systems that were previously indistinct, generating a process by which it is possible to discover the patterns that develop around areas of heightened interaction and perception within the urban setting. The structure of these systems is described by the small worlds construct: predictably efficient, yet physically and temporally flexible, defying any spatial quantification whatsoever. There is the need for dialogue between the expressions of the socio-cultural strata and the place defining spatial urban network, within which both completely random and completely ordered networks of the human environment

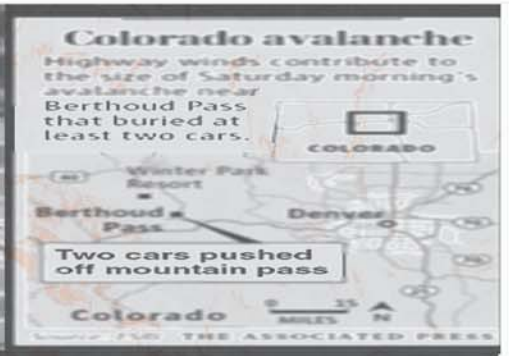


exist. The inherent efficiencies within the structure of the world around us can be de-stilled simply through the attempt to quantify and qualify these various elements and our interactions with them, Duncan Watts explains in his groundbreaking thesis Small Worlds that, “a process designed to reconstruct the space in which a system is presumed to exist, thus will both generate a set of meaningful coordinates, with which to distinguish population members, and provide a visual representation of the data that enables the observer to gain more insight into the relationships between members than would be possible by staring at a large matrix of numbers.”[51] By understanding the circumstances under which these members and their networks function as “small worlds” we will find, the essential strategies for designing a resilient architecture, and the metrics with which the quantification of human interaction is possible. This investigation will hopefully give us the insight into the nature of people, cultural centers, transportation systems, and public space we were looking for. Milgrim’s “lost letters” experiment sought to discover who could connect to anybody, and in the end his strategy later established that possibly anybody could be connected to anybody. These connections may ultimately, “point towards some deep organizing principle of our world.”[52]

30
30

PROJECT




Colorado avalanche
Highway winds contribute to the size of Saturday morning's avalanche near Berthoud Pass that buried at least two cars.
COLORADO
Winter Park Resort
Berthoud Pass
Denver
Two cars pushed off mountain pass
Colorado
THE ASSOCIATED PRESS


Vail Daily
Rock slide closes I-70 for two hours
Car-sized boulders pound Dowd

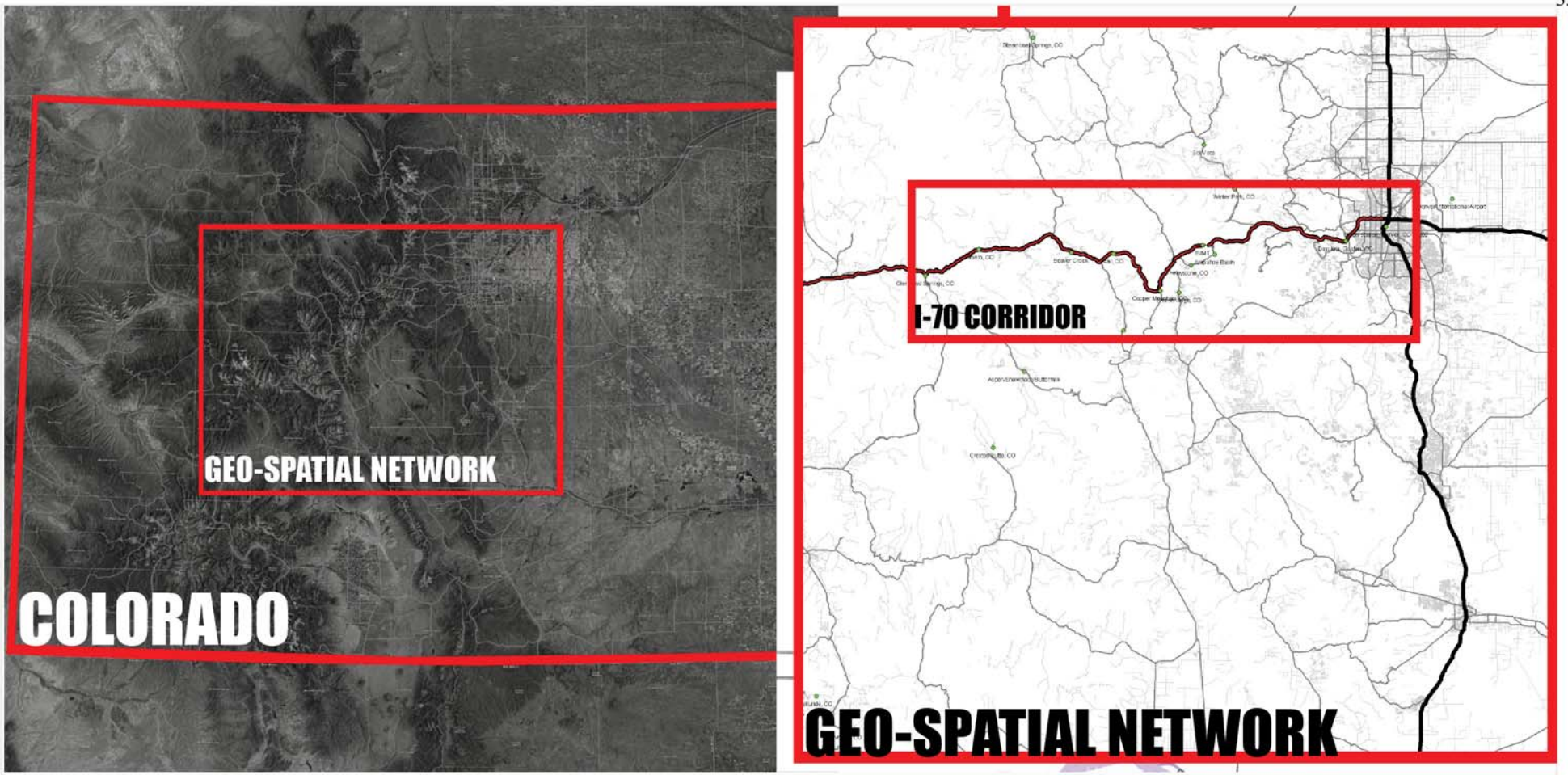



Avalanches
40 - 58
59 - 113


Precarious boulder perched over I-70


Landslide Suscepti

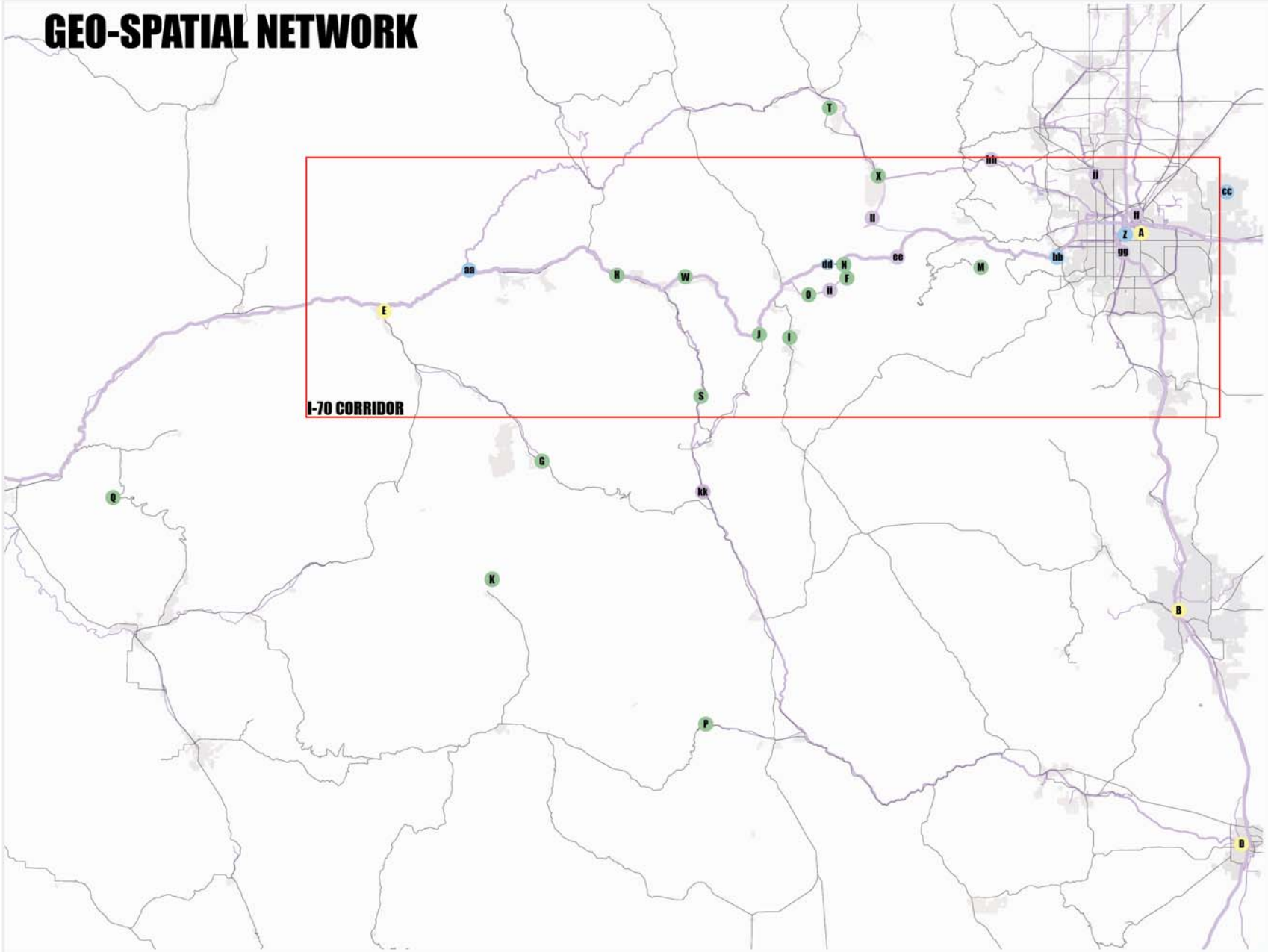

TANKER SPILL CLOSES I-70 FOR 8 HOURS
Traffic halted for 10 miles

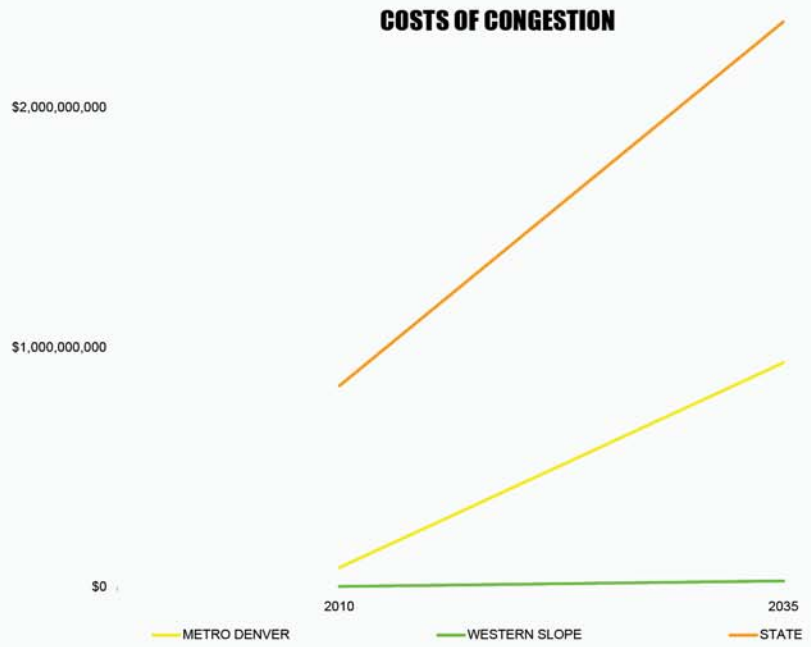


PROJECT

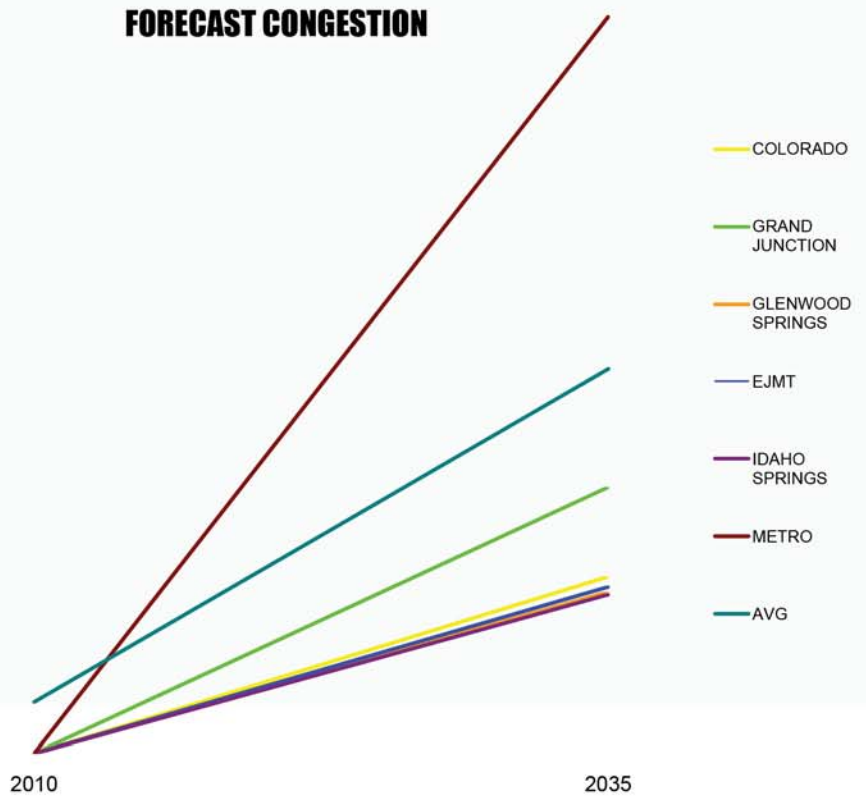
The interstate 70 corridor serves as a gateway to the mountainous region of Colorado for all of Denver's residents, the majority of travelers from the East, and most all visitors flying into the state. The corridor no longer functions efficiently as a connecting tie and the Eisenhower Johnson Memorial Tunnel acts as a centralized hub in the system and under adverse conditions both are susceptable collapse effectively crippling the entire network.

GEO-SPATIAL NETWORK





COST OF CONGESTION		2010	2035
METRO DENVER	ANNUAL COSTS	EXISTING	FORECAST
	CONGESTION HOURS	0.93	2
	CONGESTION DAYS	104	104
	AVERAGE DAILY TRAFFIC	45,122	112895
	NUMBER OF VEHICLES IMPACTED	1,439,022	3600433
	PERSONS IMPACTED	3,881,857	9712406
	COST PER HOUR	$22.34	$41.42
	TOTAL	$80,900,000	$936,000,187
WESTERN SLOPE	ANNUAL COSTS	2010	2035
	CONGESTION HOURS	0.17	0.43
	CONGESTION DAYS	104	104
	AVERAGE DAILY TRAFFIC	20,039	50138
	NUMBER OF VEHICLES IMPACTED	780,671	1953239
	PERSONS IMPACTED	780,671	1953239
	COST PER HOUR	$16.46	$30.52
	TOTAL	$2,100,000	$25,352,284
SUMMARY	ANNUAL COSTS	2010	2035
	TOURISM	$25,000,000	$46,348,500.00
	RESIDENTS	$85,000,000	$961,352,470.77
	BUISNESS	$728,000,000	$1,349,668,320.00
	GOVERNMENT	$1,000,000	$1,853,940.00
	TOTAL	$839,000,000	$2,359,223,231



REGION	2010 EXISTING	2035 FORECAST	ANNUAL
COLORADO	100.00%	169.00%	2.10%
GRAND JUNCTION	100.00%	204.00%	1.02%
GLENWOOD SPRINGS	100.00%	163.00%	1.90%
EJMT	100.00%	165.00%	1.02%
IDAHO SPRINGS	100.00%	162.00%	1.34%
METRO	100.00%	388.00%	5.50%
AVG	120.00%	250.20%	2.15%

PROBLEM

The above diagrams describe the trend that has been occuring, and should continue to ocur if action is not taken. That is that as population increases, the number of drivers on the road will increase and inturn traffic congestion will continue to get worse. If the current trend continues the state of Colorado is positioned to loose billions of dollars in lost oppourtunity, not to mention the loss in percieved quality of living to the Denver residents.

METRICS

$F(x)$ **HAZARD** = RISK * FREQUENCY

$F(x)$ **INSULATION** = $RISK^{-1}$ * FREQUENCY

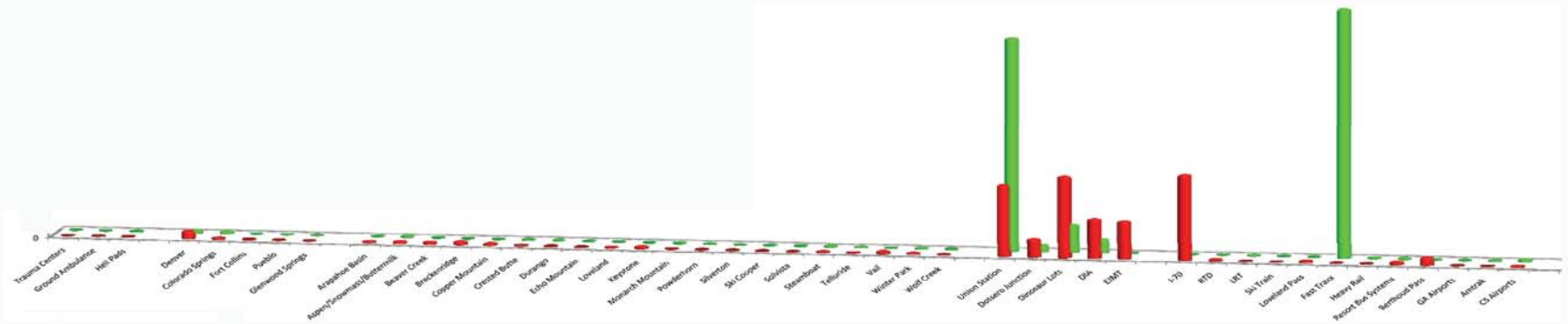
$F(x)$ **VULNERABILITY** = POPULATION * HAZARD

$F(x)$ **RESILLIANCE** = POPULATION * INSULATION

OUTPUTS

HAZARD AND INSULATION DESCRIBE A GIVEN NETWORK COMPONENT'S EXPOSURE TO A PARTICULAR SYSTEM LIABILITY

VULNERABILITY AND RESILIENCE EXPOUND EACH COMPONENTS SYSTEM PEFORMANCE BASED ON USER POPULATION



DESIGNING NETWORKS

"In Nine Chains to the Moon Fuller had been insisting that traditional architecture had to give way to a world wide dwelling services network, Fuller had visualized these global electronic networks long before they arrived."[53]

The following strategies were employed to decode the complex system that is the transportaion corridor conneting the western slope of Colorado to metropolitan Denver.

Data gathering and risk assessment.
Demographic data was gathered about the specific network components of the system. Destination nodes, hub centers, and connecting ties were identified. An assement of risk and hazard was done to identify the network components that were the most vulnerable and those that were most resilient. Some of the identified hazards were natural like incliment weather, landslides, and avalanches. Others were man made like traffic congestion and accidents.

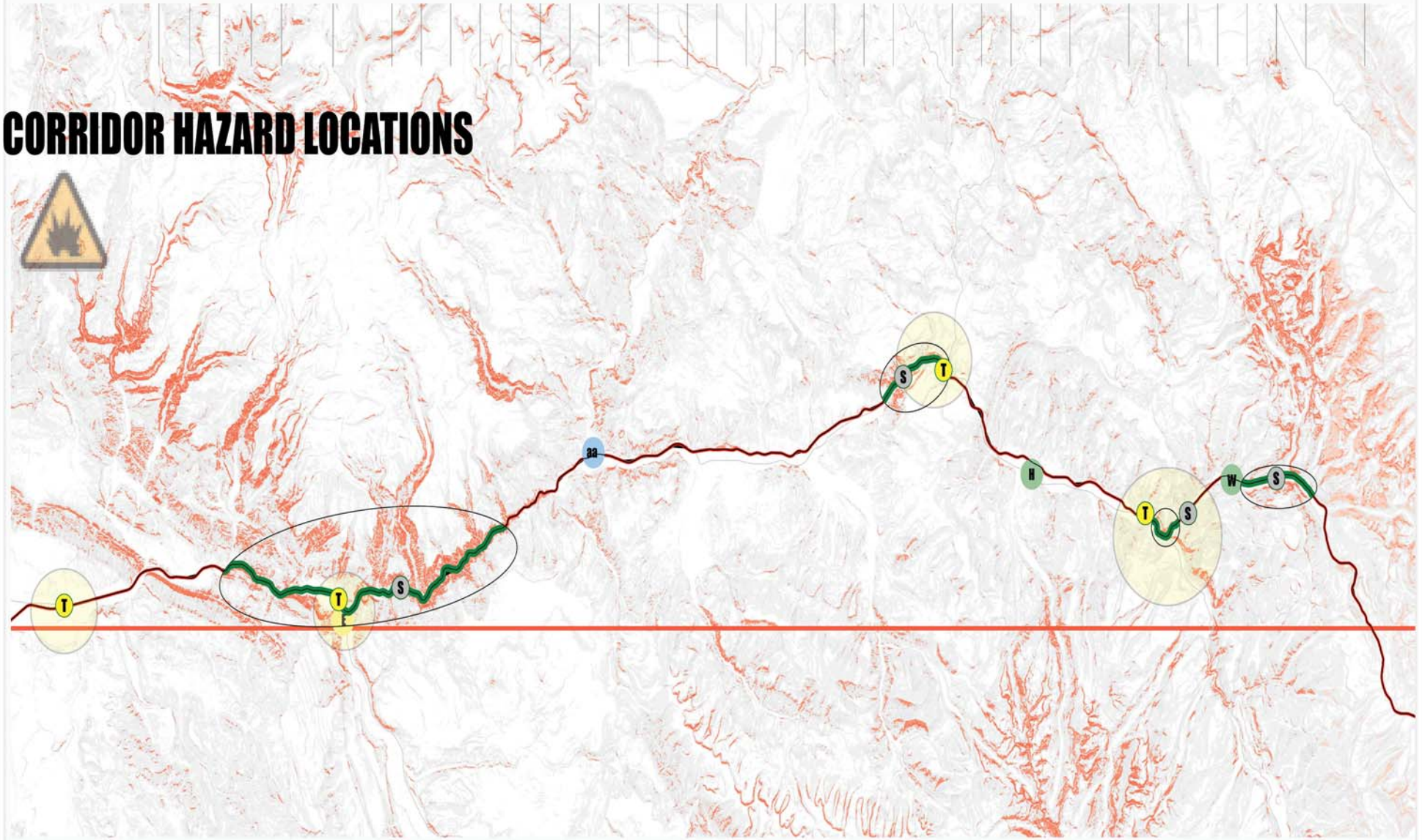
GIS modeling and spatial mapping
It is important to understand the spatial relationships between the network components. All components were mapped interms of there spatial relationship to eachother and the conditions of hazard within the system. Specific steps were taken to insulate the transportaion corridor from the identified hazards.

Non-Euclidian network analysis
It is important to describe the evolution of connectivity in the network in order to expose vulnerability and to predict collapse. In connections, Jasny, Zahn, and Marshall explain, "it is not enough to look at patterns we need to study how they evolve and change."[54] A timline was created to diagram the expansion of the "non-euclidean" transportation network to describe and predict the possible evolution of the system.

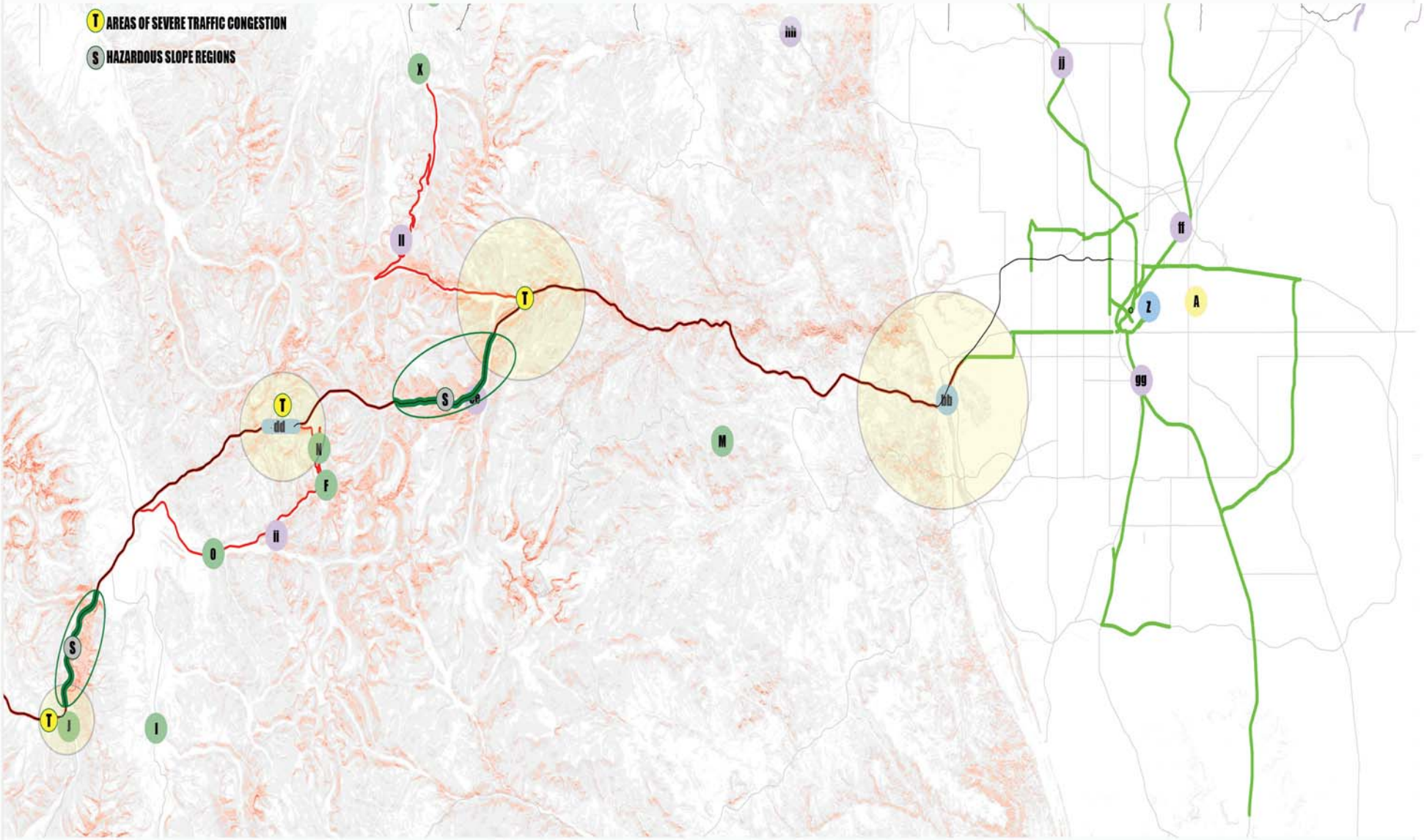
Parametric algorithm
In an attempt to distill the vast amount of data that was gathered, while combining the discoveries made under the previous strategies a parametric algorithm was created to translate the findings into programatic architecture. A boiler plate transportation hub program from the AIAS and American Plastics Council sponsored design competition was incorporated to decipher the implications of population growth, project site, transit mode type, targeted demographics, urban agriculture, shifts in land-use, and population density.

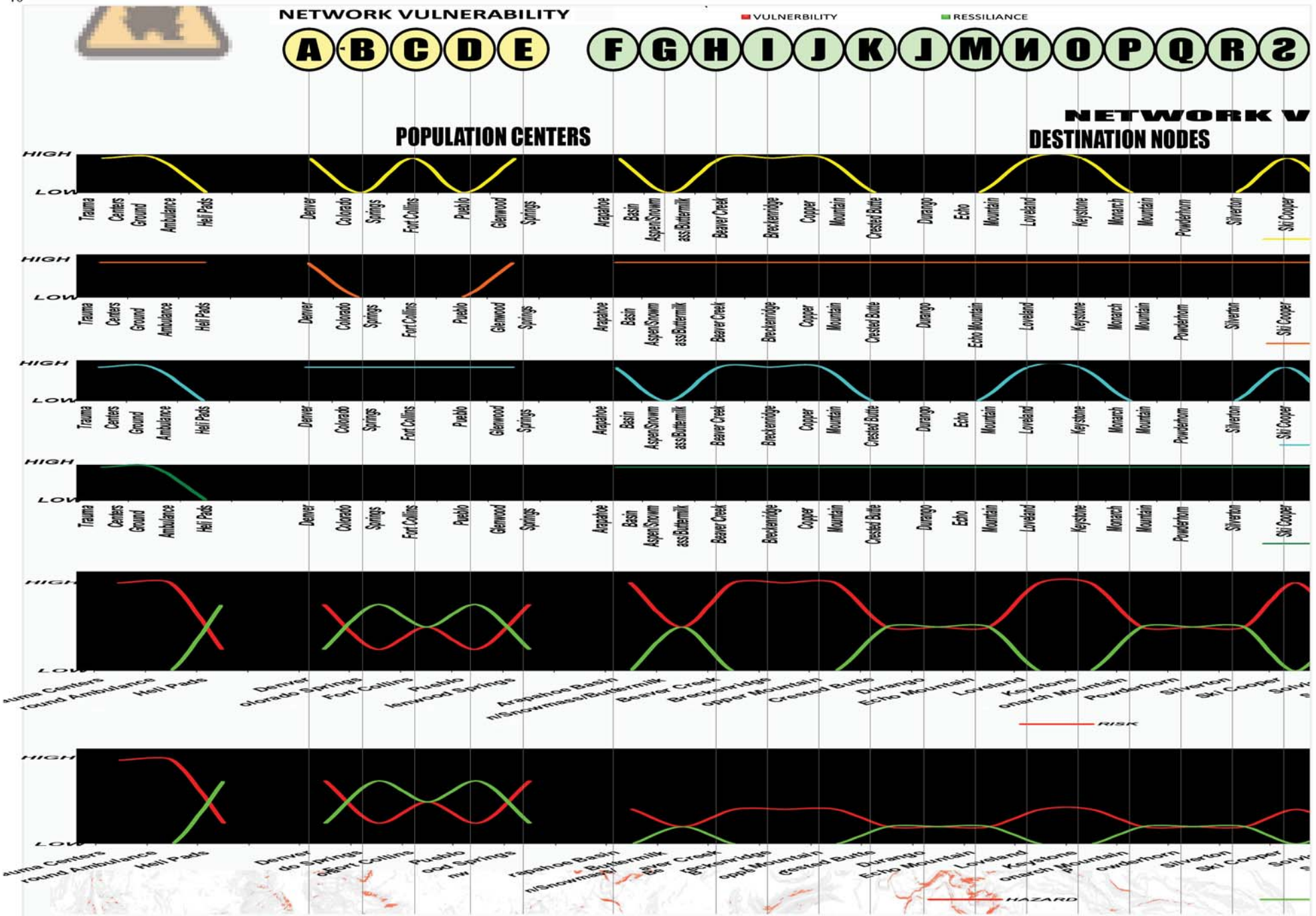
Programatic output
"Default" terminal arrangments were produced based on the specific space adjacencies and clear restrictions present, per transit mode. Those "default" arrangments were placed in their respective sites and were adapted to fit to the existing conditions.

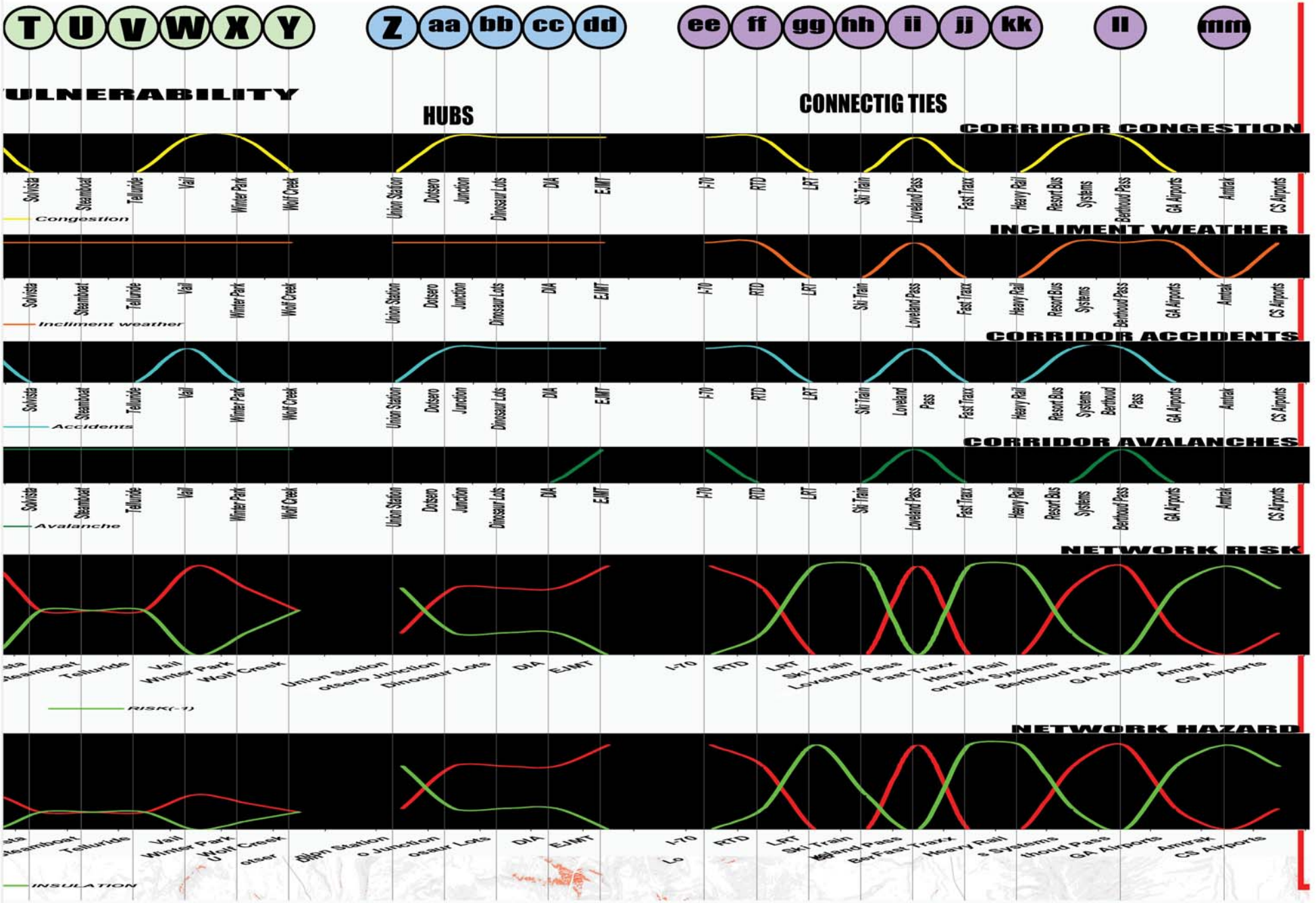
CORRIDOR HAZARD LOCATIONS



HAZARD


T AREAS OF SEVERE TRAFFIC CONGESTION
S HAZARDOUS SLOPE REGIONS
X
iiii
ii
II
T
ff
Z
A
gg
S
T
dd
N
F
M
ii
O
S
T
J
I


NETWORK VULNERABILITY
VULNERBILITY
RESSILIANCE
A B C D E F G H I J K J M N O P Q R S
POPULATION CENTERS
NETWORK V
DESTINATION NODES
HIGH
LOW
Trauma Centers
Ground Ambulance
Heli Pads
Denver
Colorado Springs
Fort Collins
Pueblo
Glenwood Springs
Arapahoe Basin
Aspen/Snowmass/Buttermilk
Beaver Creek
Breckenridge
Copper Mountain
Crested Butte
Durango
Echo Mountain
Loveland
Keystone
Monarch Mountain
Powderhorn
Silverton
Ski Cooper
RISK
HAZARD


T U V W X Y
Z aa bb cc dd
ee ff gg hh ii jj kk
ll
mm
ULNERABILITY
HUBS
CONNECTIG TIES
CORRIDOR CONGESTION
Congestion
INCLIMENT WEATHER
Incliment weather
CORRIDOR ACCIDENTS
Accidents
CORRIDOR AVALANCHES
Avalanche
NETWORK RISK
RISK(-1)
NETWORK HAZARD
INSULATION
Solvista
Steamboat
Telluride
Vail
Winter Park
Wolf Creek
Union Station
Dotsero
Junction
Dinosaur Lots
DIA
EJMT
I-70
RTD
LRT
Ski Train
Loveland Pass
Fast Traxx
Heavy Rail
Resort Bus
Systems
Berthoud Pass
GA Airports
Amtrak
CS Airports

DISCOVERY

Specfic destination nodes are more affected by the collapse of the system do to their spatial proximity to hazards like steep slopes, high mountain passes, high traffic areas, and areas prone to incliment weather.

Those nodes are:

- Winter Park
- Vail
- Aspen
- Breckenridge
- Copper Mountain
- Keystone
- Arapahoe Basin

Certain Hub components are more vulnerable to hazards than others. Those identified hazards create the most risk when the hub is not insulated by supplementary systems.

The most vulnerable hub is:

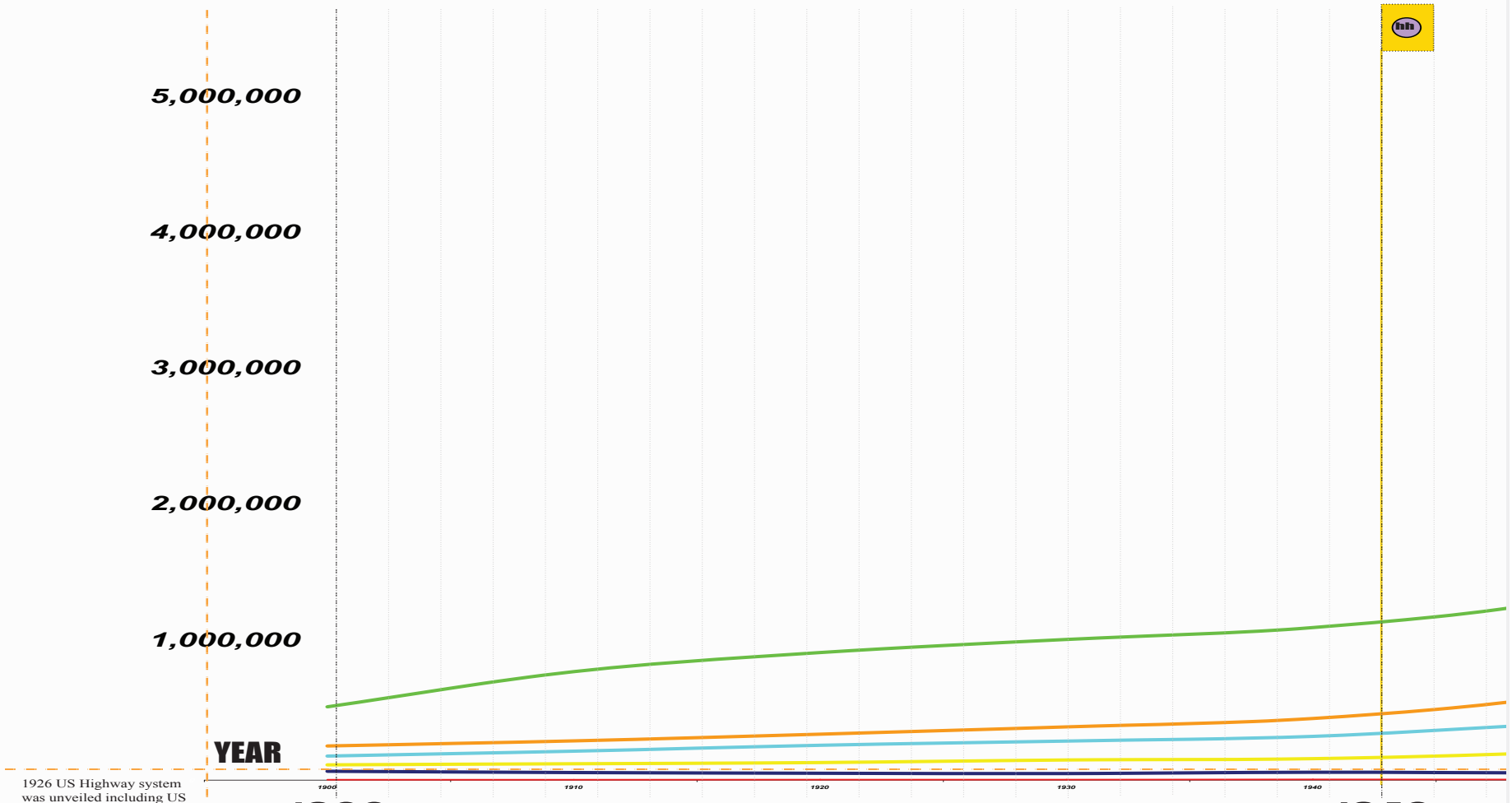
- Eisenhower Johnson Memorial Tunnel

Connecting ties if weak in nature adhere to the same basic principles as hubs do, that is that if un supplemented the collapse will cripple the network.

The most vulnerable tie is:

- Interstate 70 from Golden to Glenwood Springs

NETWORK EVOLUTION

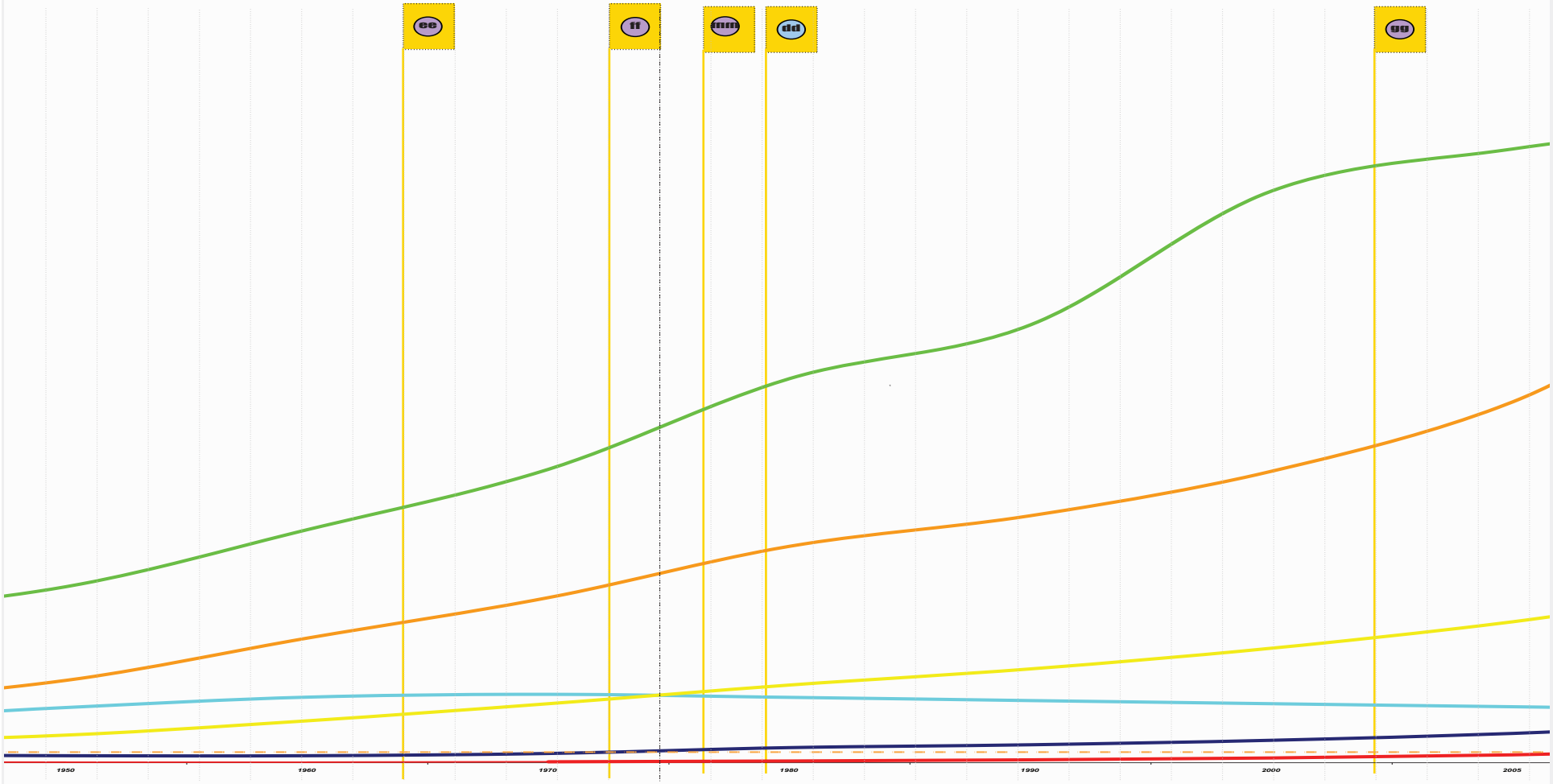


1926 US Highway system was unveiled including US highway 6 west of Denver to Grand Junction, later extended to the pacific coast in 1937. For these mountain roads to remain competitive with alternatives in other states the Colorado Department of Highways had to rely on ingenuity to keep the roads safe, by developing snow machines to clear the roads and various bridge and culvert designs to keep the roads from flooding. This ushered in a new era of transporataion development and connectivity in the region.

CITY OF DENVER
IS INCORPORATED

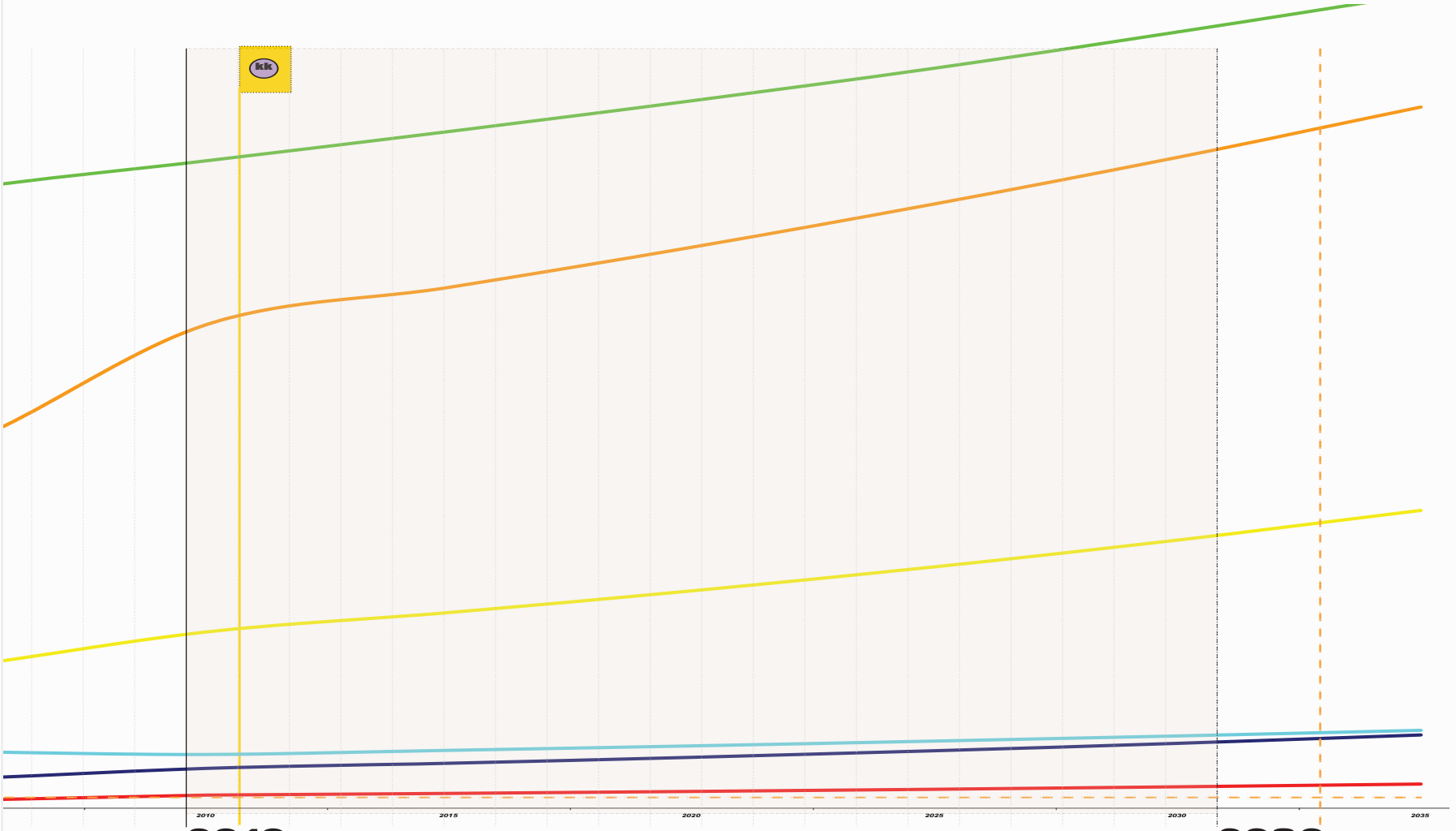
TIMLELINE

AREA POPULATION GROWTH



1970

t = 112

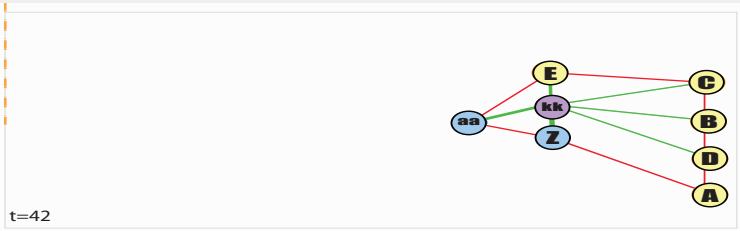


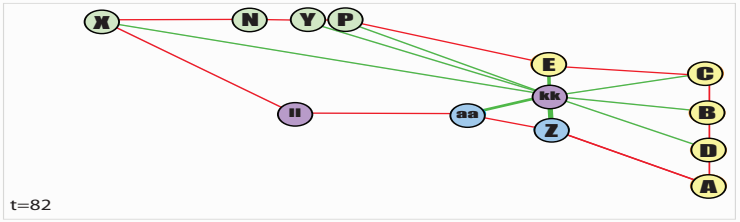
2010

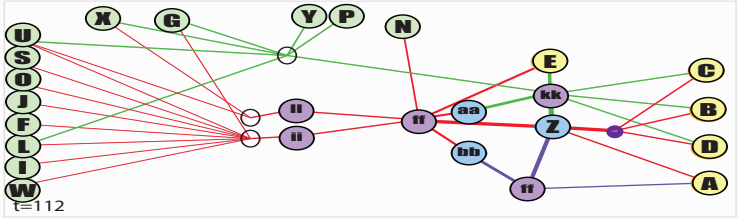
t = 152

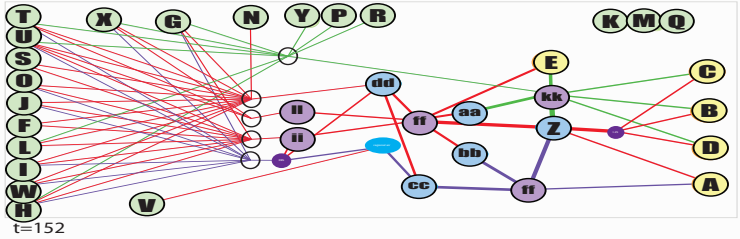
2030

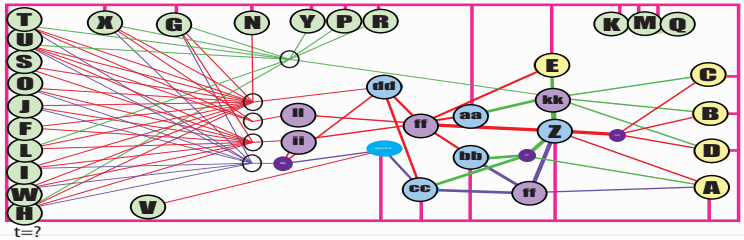
t = 192











hh RIO GRANDE RAILROAD COMPANY BEGINS RUNNING REGULAR SKI TRAINS FROM UNION STATION TO WINTERPARK COLORADO. CONNECTING PEOPLE FROM ALL CORNERS OF THE COUNRTRY DIRECTLY TO THE SKI AREA DOOR TO DOOR.

ee CDOT COMPLETES CONSTRUCTION OF INTERSTATE 70 BOOSTING EAST TO WEST CONNECTIVITY OF THE REGION PROVIDING A MORE DIRECT AND RELIABEL ROUTE FROM DENVER TO GRAND JUNCTION.

ff DENVER'S REGIONAL TRANSPORTATION DEPARTMENT OR RTD BEGINS OPERATION OF THE REGIONAL BUS SYSTEM, WHICH PROVIDED GREATER CONECTIVITY TO THE METRO REGION

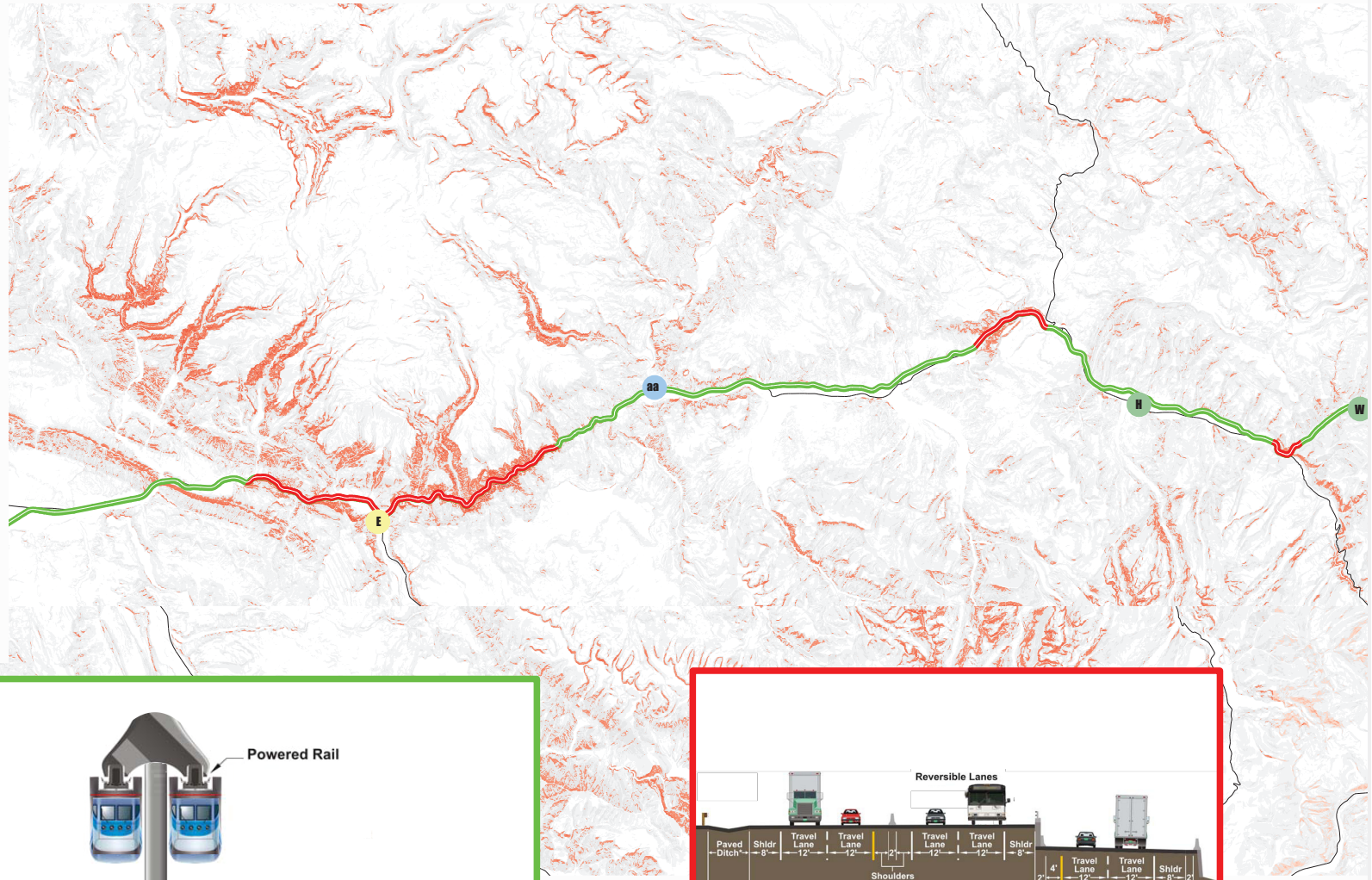
mm AMTRACK IS FORMED AND BEGINS OPERATING INTERSTATE RAIL LINES INTO AND OUT OF COLORADO. TRAINS STOPPED AT UNION STATION AND DOTSERO JUNCTION ON THEIR WAY TO GRAND JUNCTION AND THE WEST COAST.

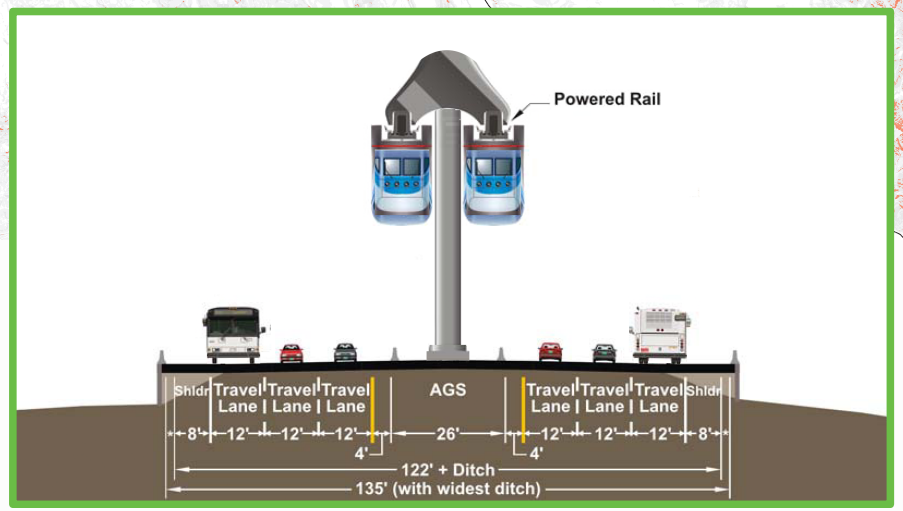
dd THE EISENHOWER JOHSON MEMORIAL TUNNEL IS OPENED, ALLOWING PEOPLE TO DRIVE EAST TO WEST THROUGH THE MOUNTAIN REGION WITHOUT HAVING TO TAKE THE MORE DANDEROUS MOUNTAIN PASSES.

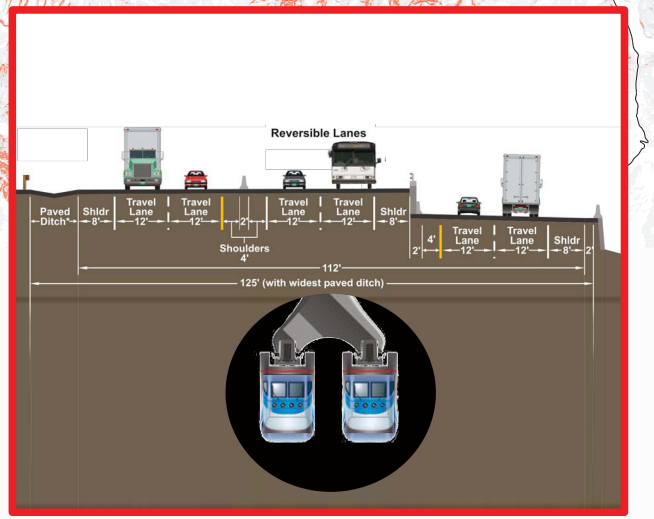
gg DENVER'S REGIONAL TRANSPORTATION DEPARTMENT BEGINS OPERATION OF THIER LIGHT RAIL NETWORK, PROVIDING, MAINLY, ADDED CONNECTIVITY WITHIN THE THE DOWNTOWN DENVER AREA.

kk DENVER'S NEW EXPANSION OF THEIR EXISTING MASS TRANSPORTATION SYSTEM WILL BE COMPLETED BOOSTING THE CONNECTIVITY OF MASS TRANSIT TO THE GREATER METRO REGION.

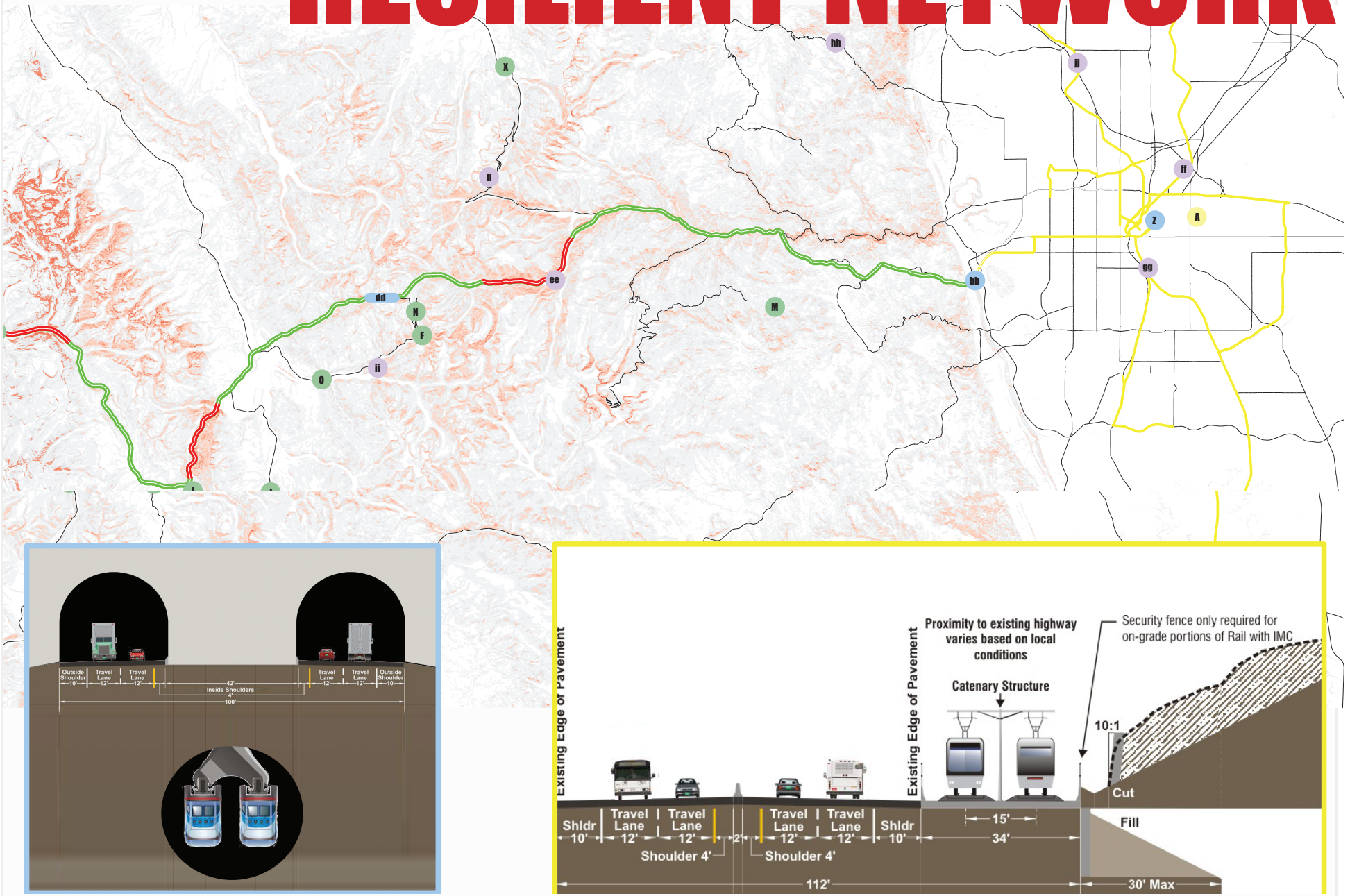
INSULATED SYSTEM





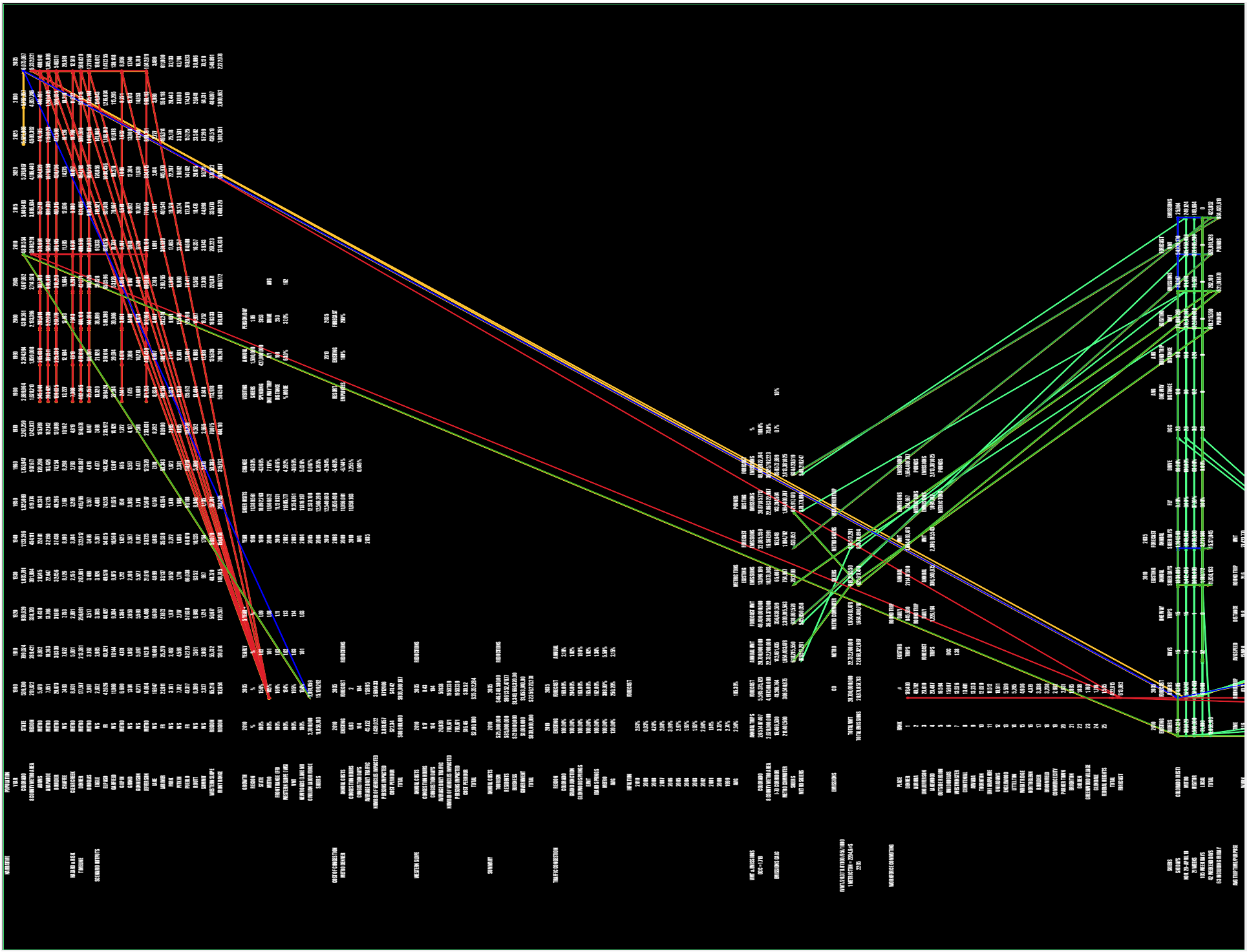


RESILIENT NETWORK

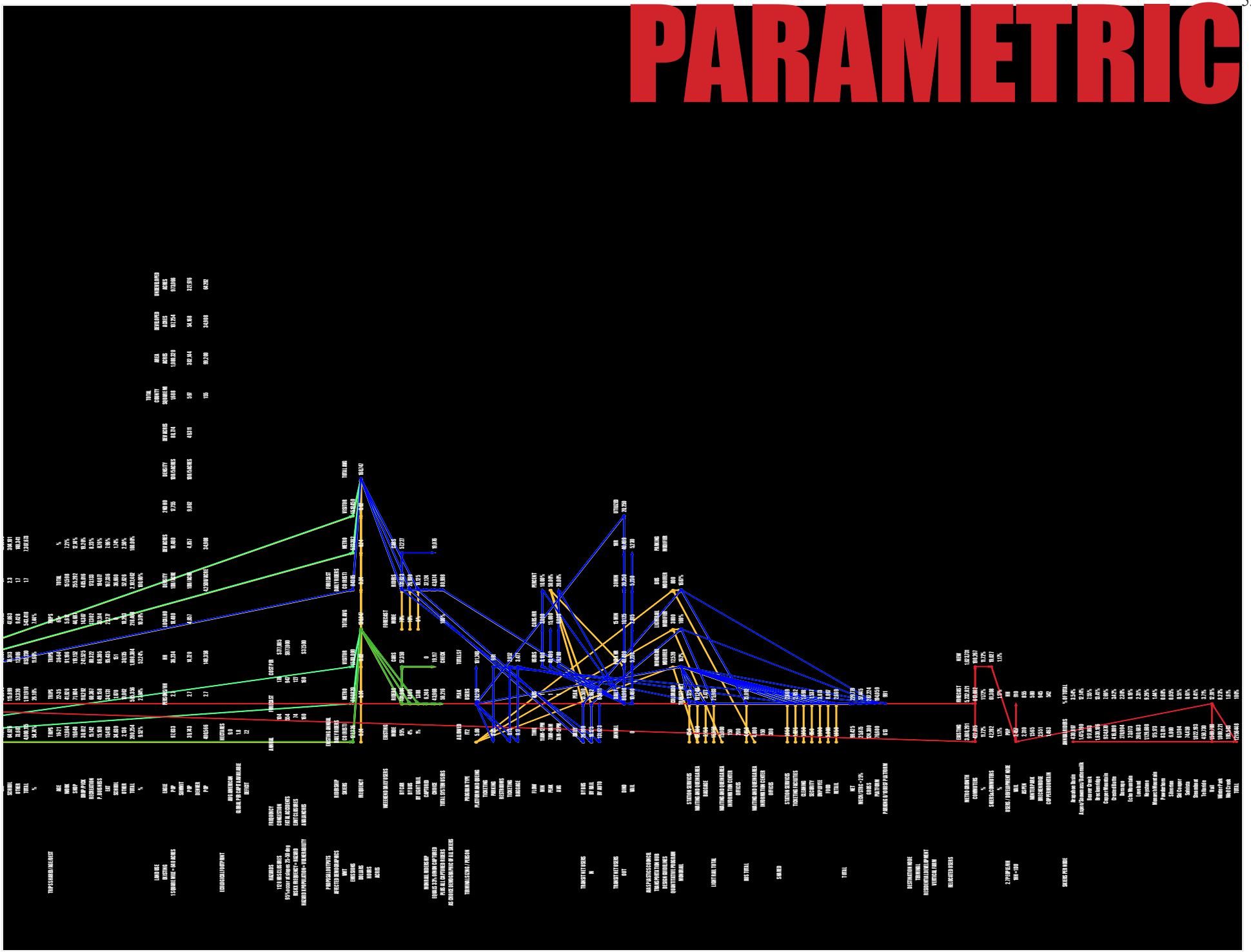


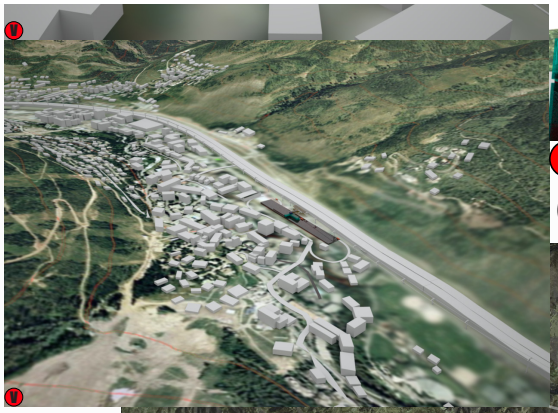
DISCOVERY

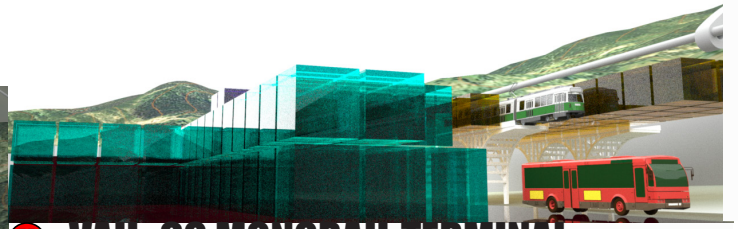
Certain modes of transprotation are more generally insulated or resilient to system collapse than others. Both heavy and light rail are insulated from traffic congestion and incliment weather, but to run a new infrastructure through the corridor it must be resilent to specific hazards of the corridor. The steep slopes and heavy precipitation in the region create a high risk for avalanches and landslides. To be a resilient system the new rail line must be specifically insulated to those hazards identified in the corridor. Areas of extreme risk dictate that the rail line should be sub-grade, and since access to the system must occur frequently the line will have to be both above and below grade depending on the existing hazard This coniguration coupled with suplementary resort bus systems should provide complete connectivity.



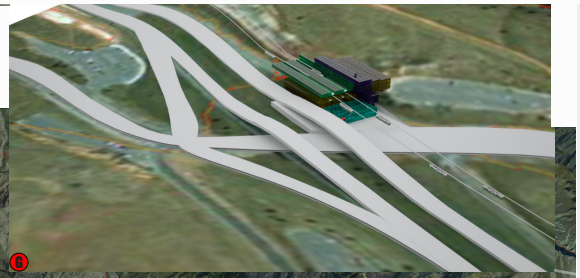
PARAMETRIC



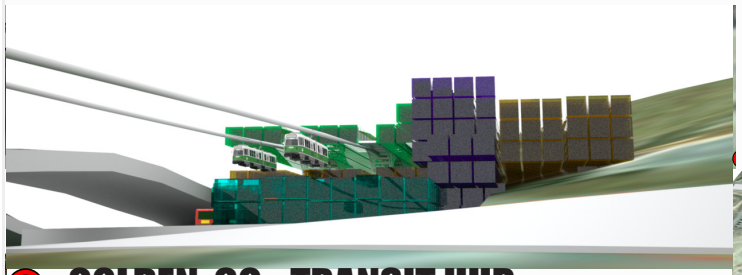




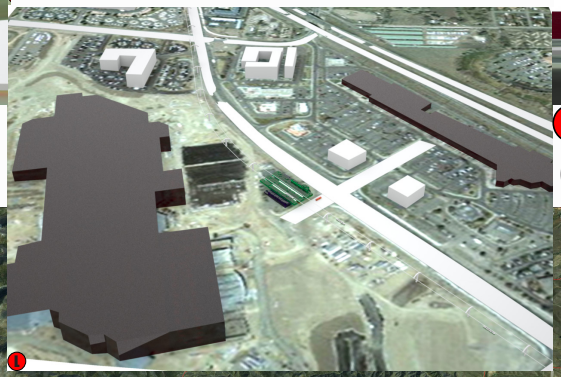
V- VAIL, CO MONORAIL TERMINAL @ EXISTING BUS TERMINAL



TERMINALS

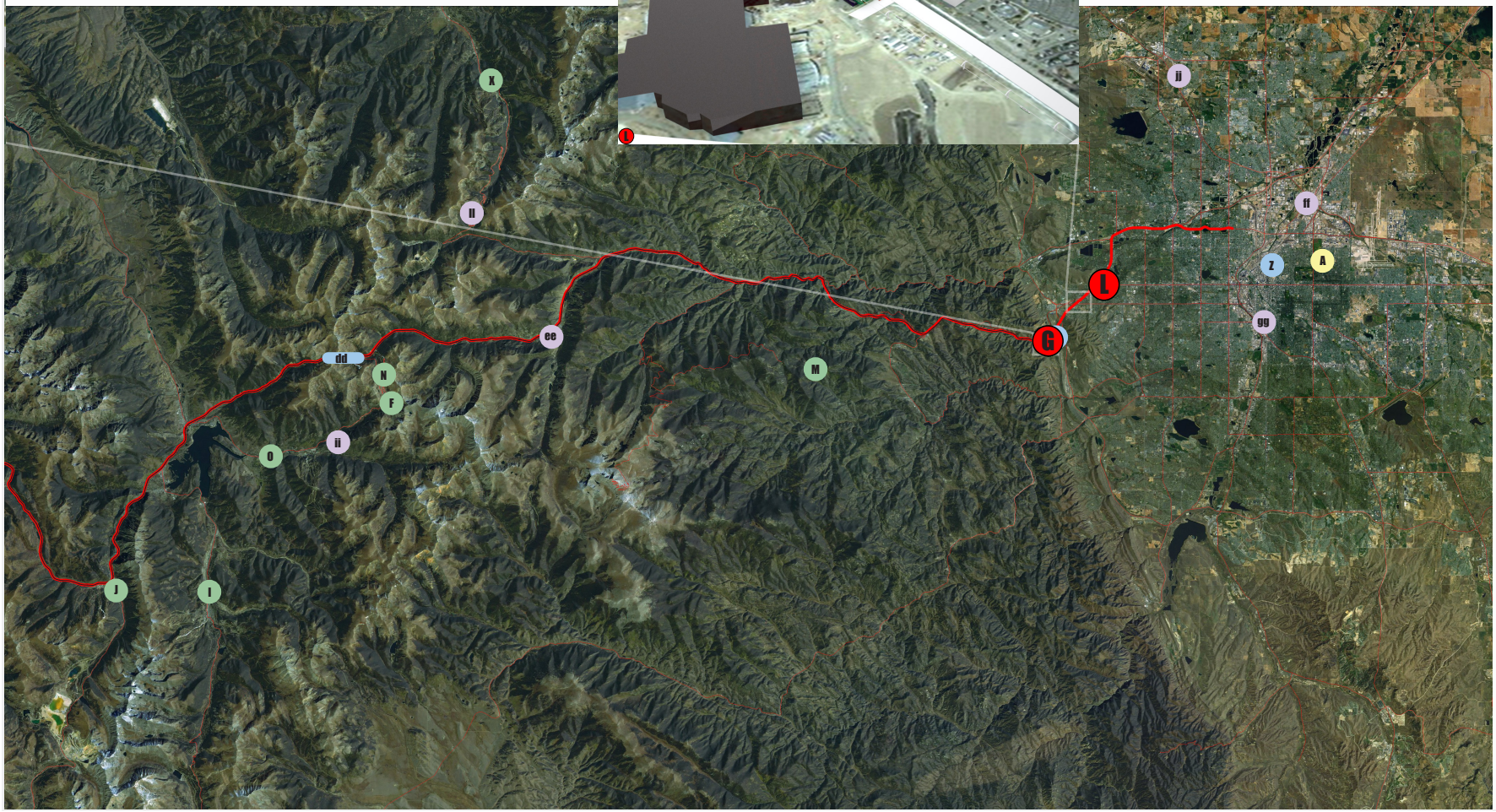


G - GOLDEN, CO - TRANSIT HUB



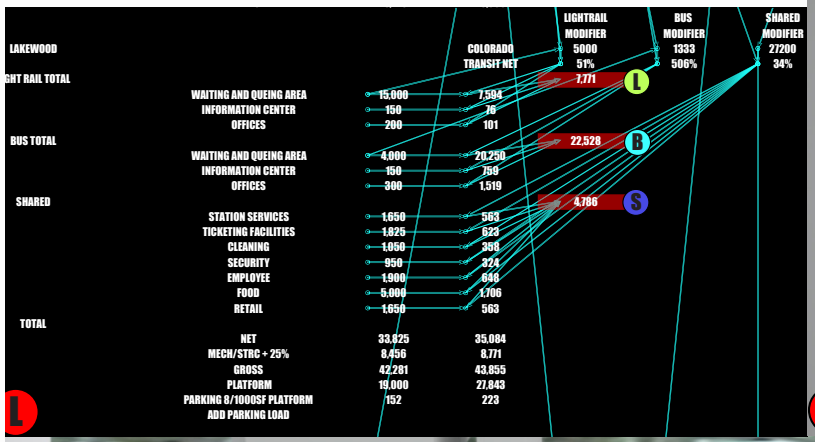


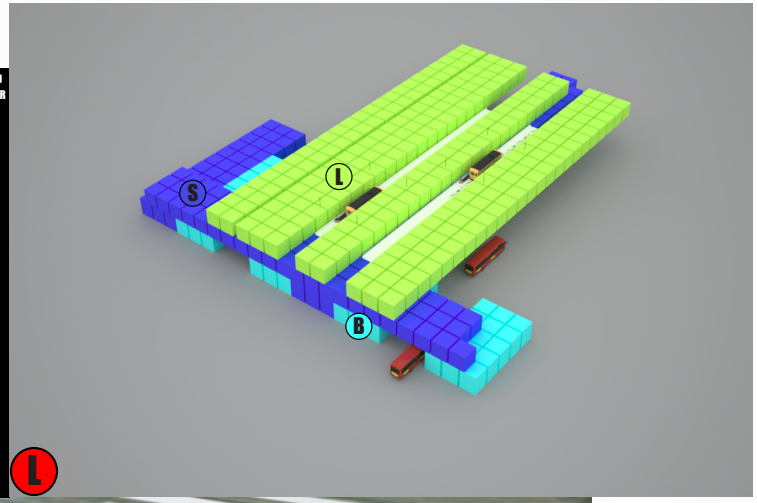
L - LAKEWOOD, CO PARK 'N RI
@ COLORADO MILLS SHOPPIN

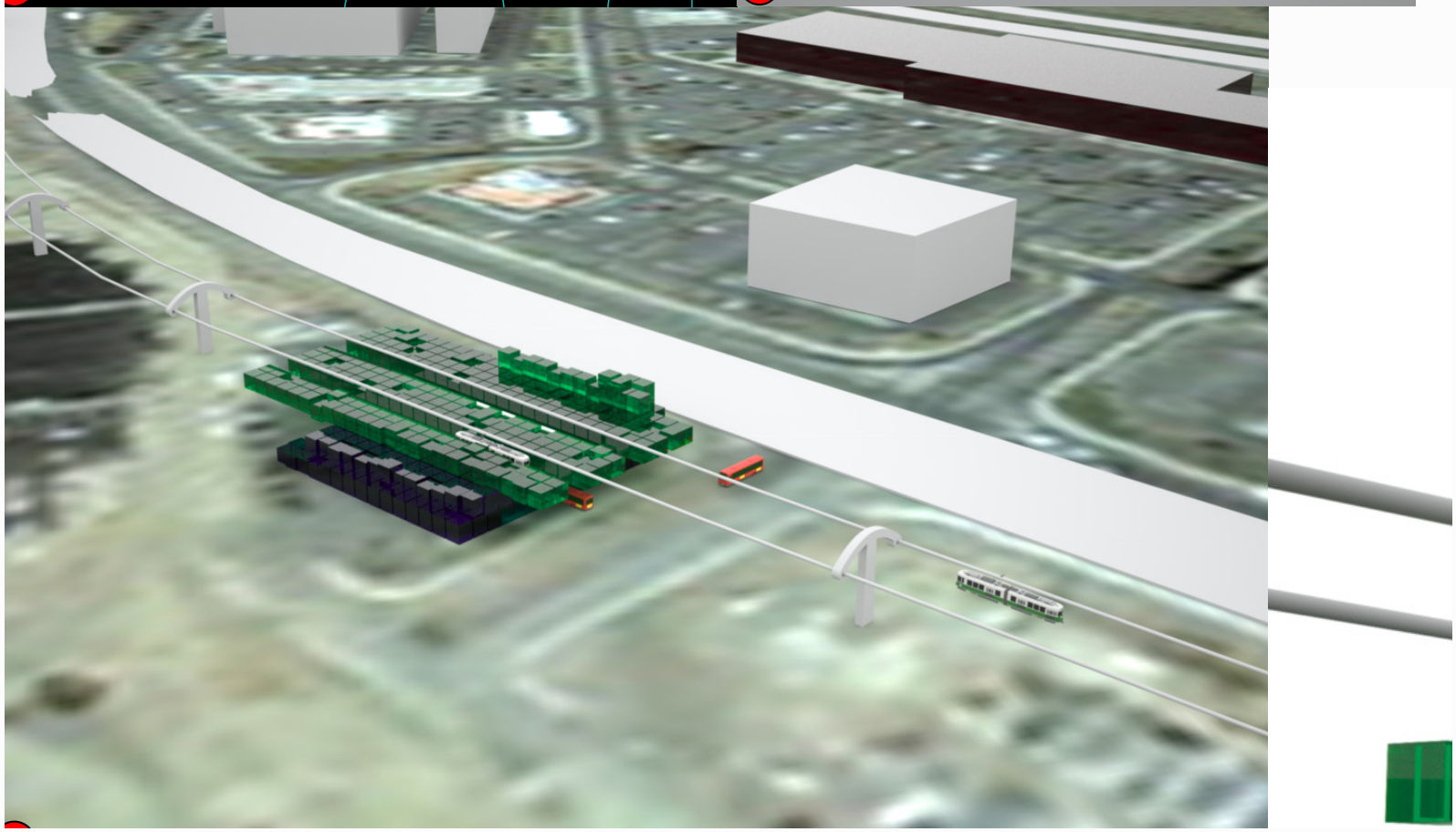


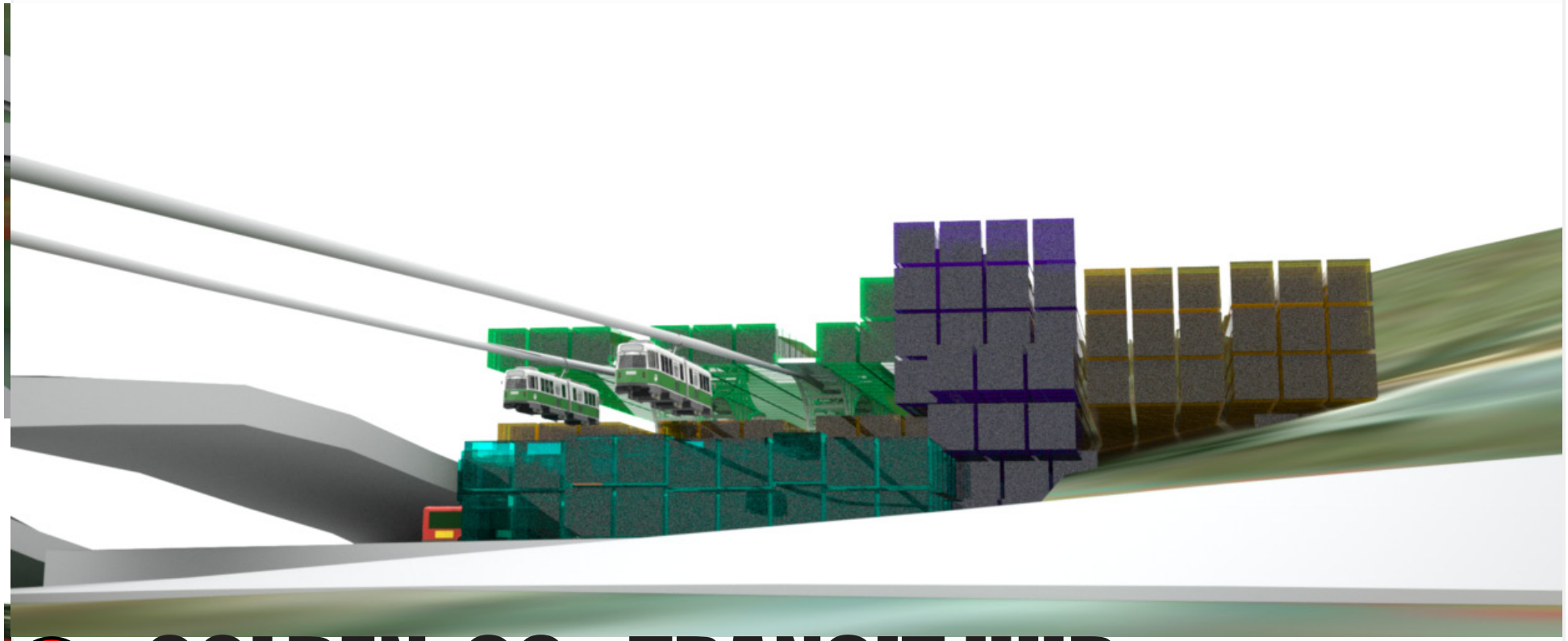


L - LAKEWOOD, CO PARK 'N RIDE @ COLORADO MILLS SHOPPING MALL

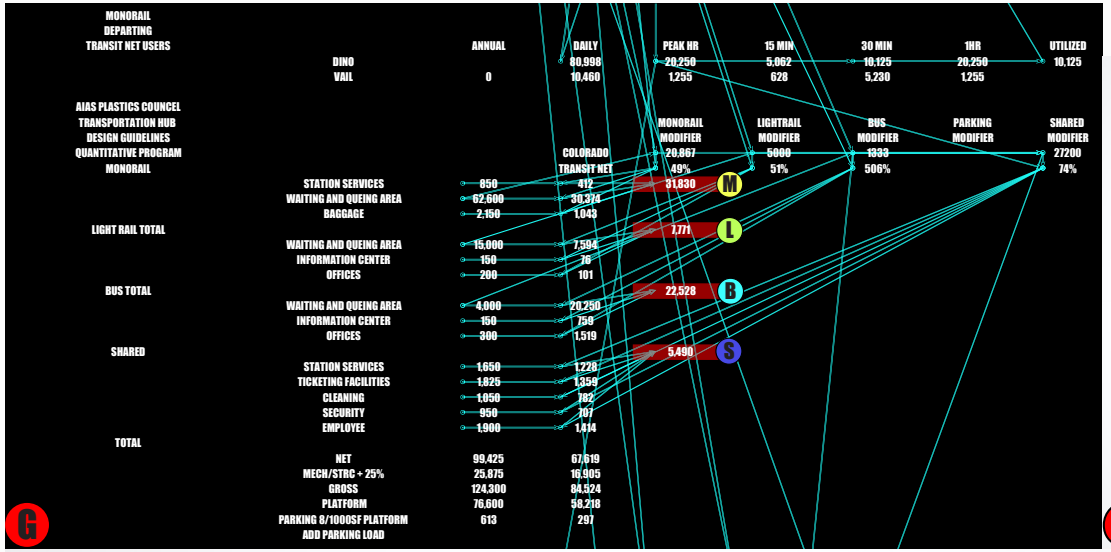

LAKEWOOD
COLORADO TRANSIT NET
LIGHTRAIL MODIFIER 5000 51%
BUS MODIFIER 1333 506%
SHARED MODIFIER 27200 34%
GHT RAIL TOTAL
7,771
WAITING AND QUEING AREA 15,000 7,594
INFORMATION CENTER 150 76
OFFICES 200 101
BUS TOTAL
22,528
WAITING AND QUEING AREA 4,000 20,250
INFORMATION CENTER 150 759
OFFICES 300 1,519
SHARED
4,786
STATION SERVICES 1,650 563
TICKETING FACILITIES 1,825 623
CLEANING 1,050 358
SECURITY 950 324
EMPLOYEE 1,900 648
FOOD 5,000 1,706
RETAIL 1,650 563
TOTAL
NET 33,825 35,084
MECH/STRC + 25% 8,456 8,771
GROSS 42,281 43,855
PLATFORM 19,000 27,843
PARKING 8/1000SF PLATFORM 152 223
ADD PARKING LOAD
L

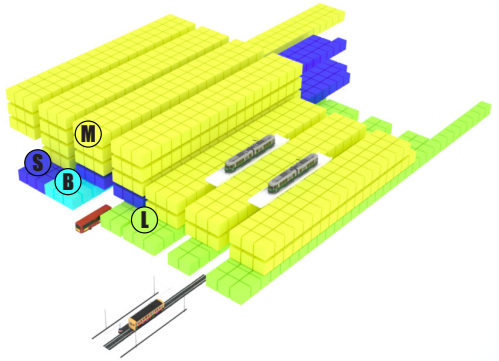

S
L
B
L

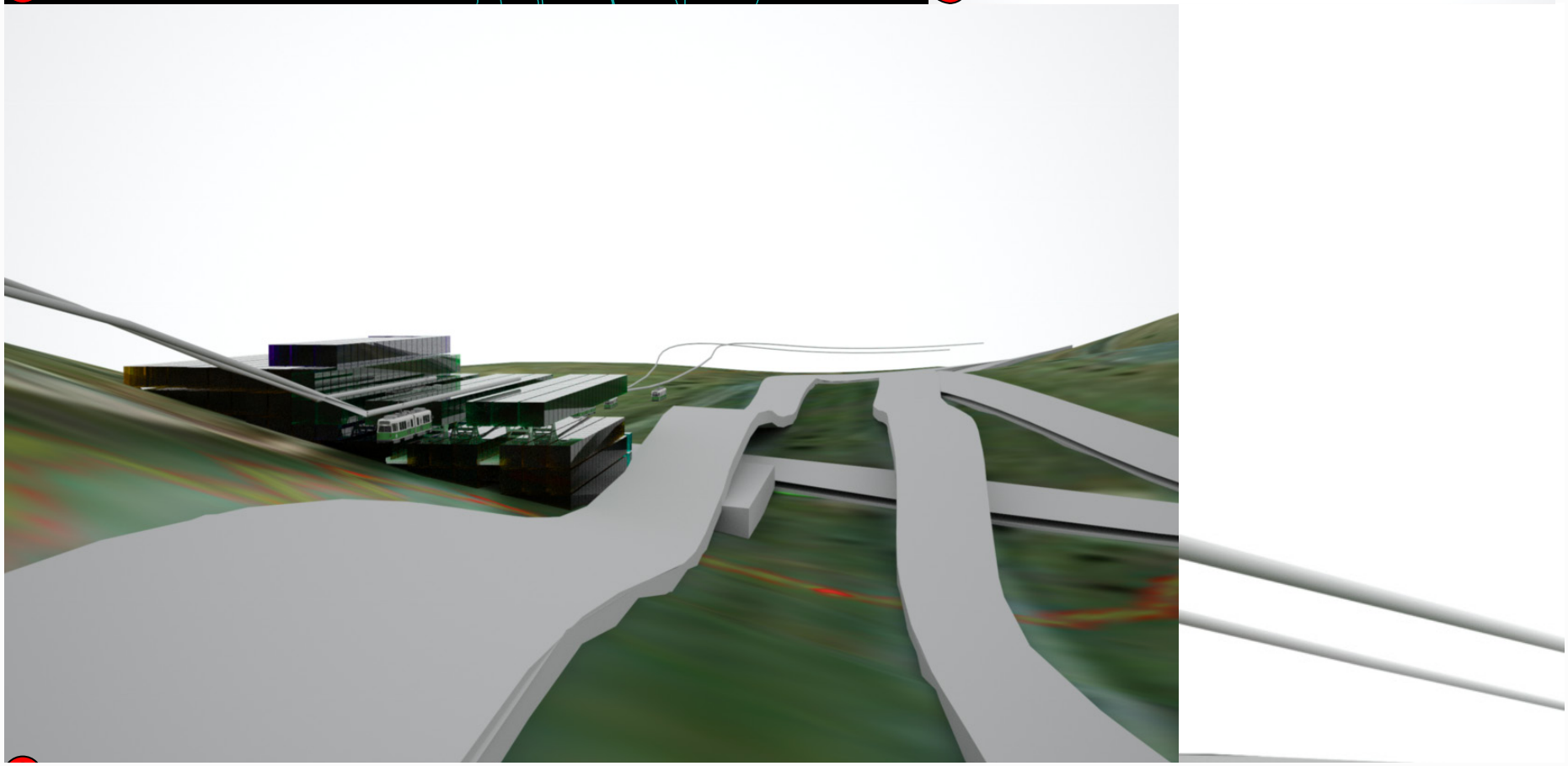


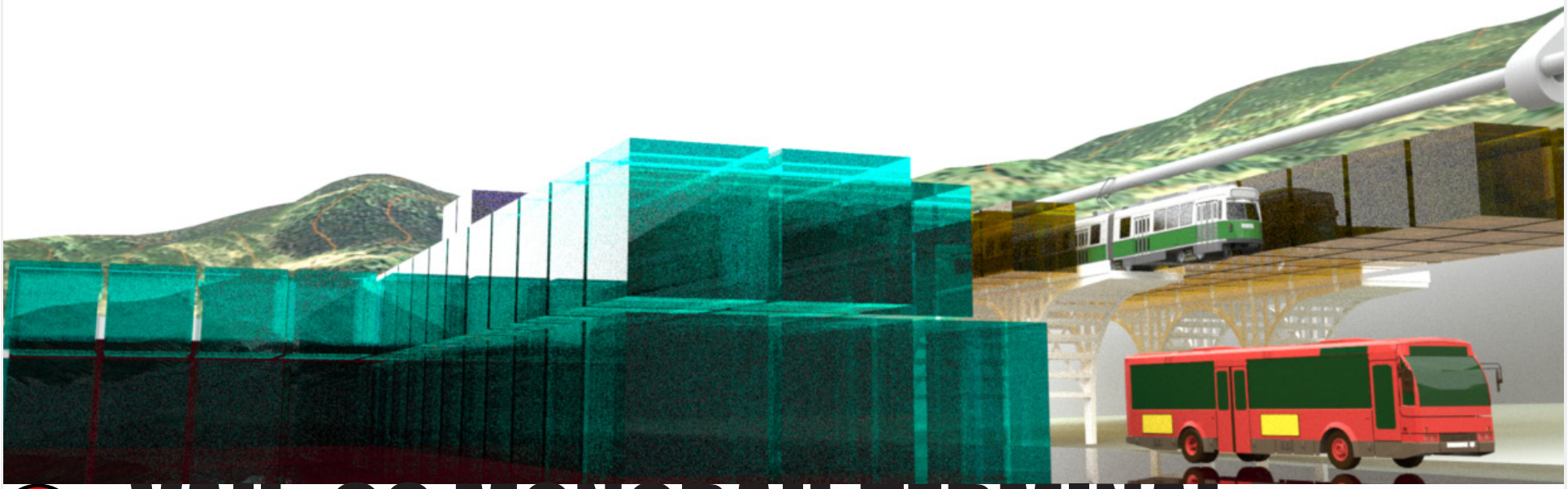


G - GOLDEN, CO - TRANSIT HUB

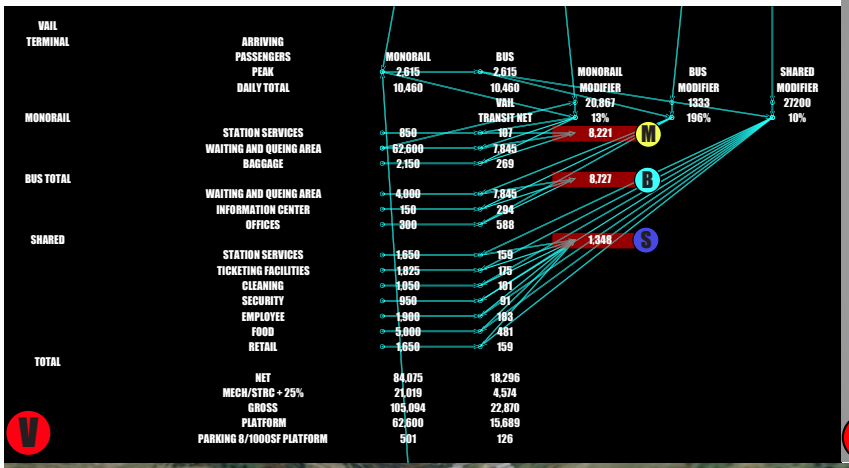

MONORAIL
DEPARTING
TRANSIT NET USERS
ANNUAL
DAILY
PEAK HR
15 MIN
30 MIN
1HR
UTILIZED
DINO
80,998
20,250
5,062
10,125
20,250
10,125
VAIL
0
10,460
1,255
628
5,230
1,255
AIAS PLASTICS COUNCEL
TRANSPORTATION HUB
DESIGN GUIDELINES
QUANTITATIVE PROGRAM
MONORAIL
MONORAIL MODIFIER
LIGHTRAIL MODIFIER
BUS MODIFIER
PARKING MODIFIER
SHARED MODIFIER
COLORADO TRANSIT NET
20,867
5000
1333
27200
49%
51%
506%
74%
STATION SERVICES
850
412
31,830
M
WAITING AND QUEING AREA
62,600
30,374
BAGGAGE
2,150
1,043
LIGHT RAIL TOTAL
1,771
L
WAITING AND QUEING AREA
15,000
7,594
INFORMATION CENTER
150
76
OFFICES
200
101
BUS TOTAL
22,528
B
WAITING AND QUEING AREA
4,000
20,250
INFORMATION CENTER
150
759
OFFICES
300
1,519
SHARED
5,490
S
STATION SERVICES
1,650
1,228
TICKETING FACILITIES
1,825
1,359
CLEANING
1,050
782
SECURITY
950
707
EMPLOYEE
1,900
1,414
TOTAL
NET
99,425
67,619
MECH/STRC + 25%
25,875
16,905
GROSS
124,300
84,524
PLATFORM
76,600
58,218
PARKING 8/1000SF PLATFORM
613
297
ADD PARKING LOAD

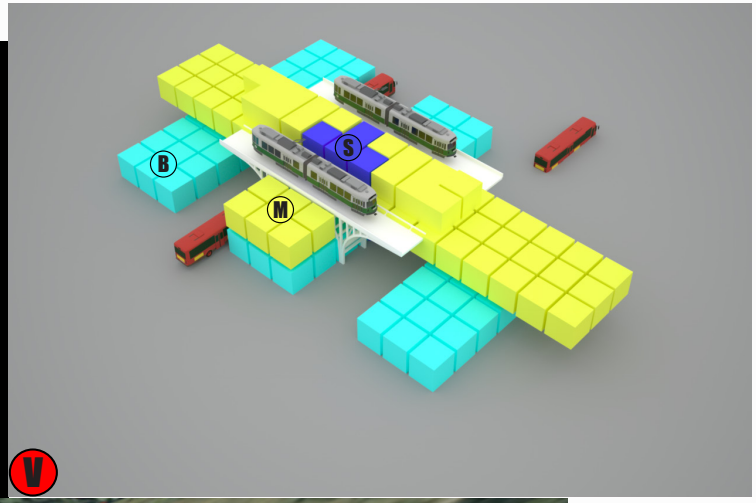

M
S
B
L

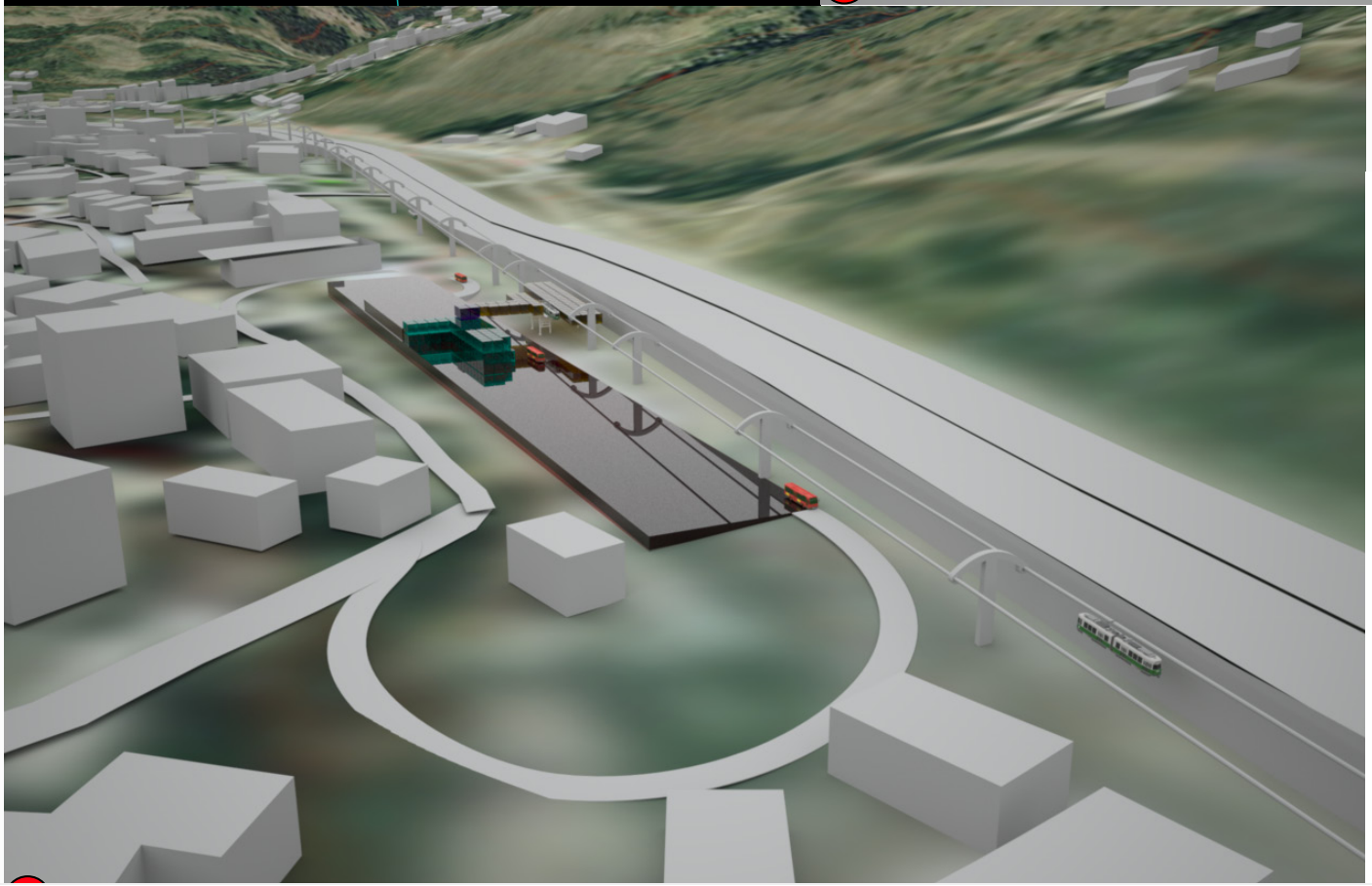




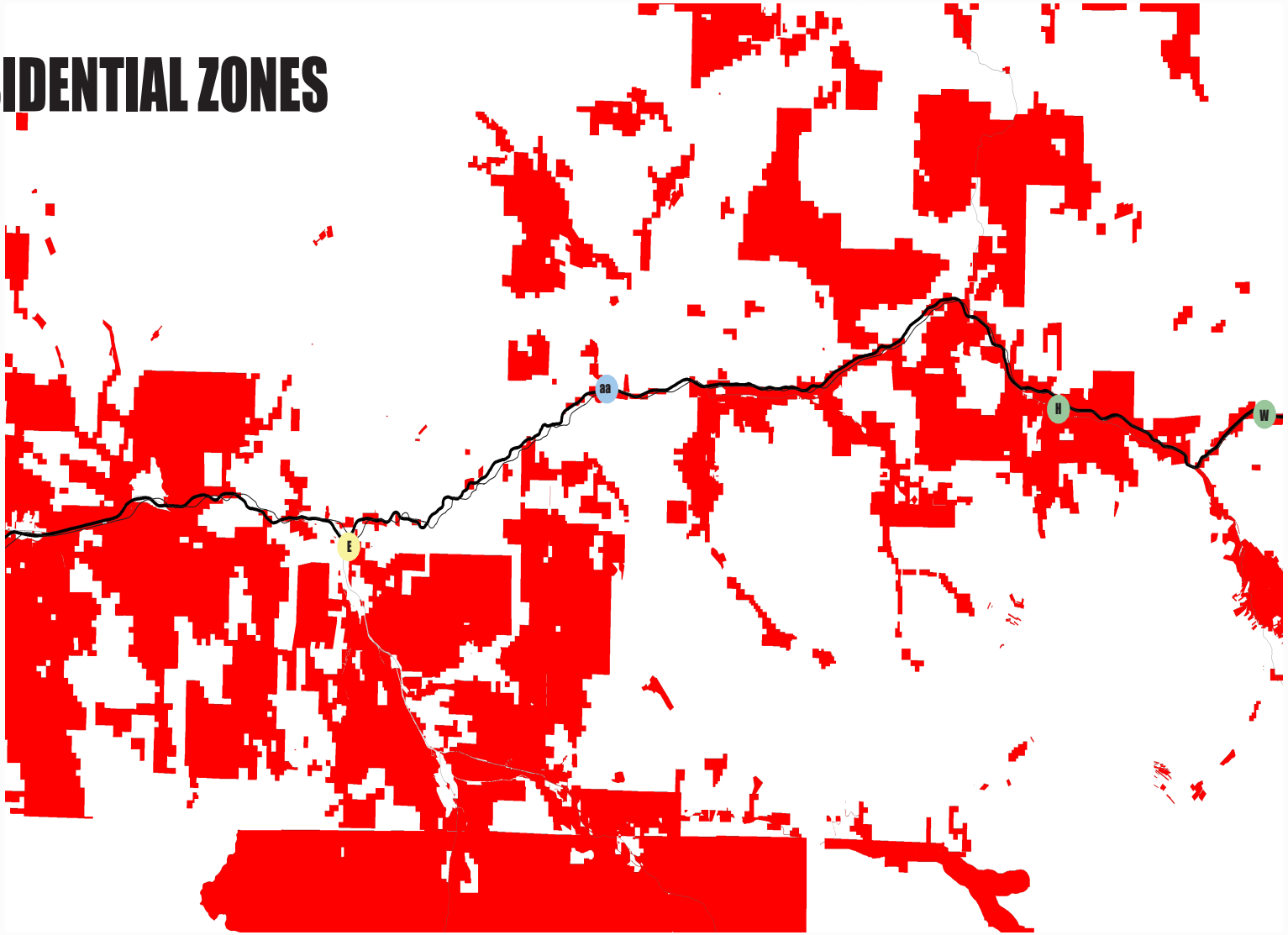
V - VAIL, CO MONORAIL TERMINAL @ EXISTING BUS TERMINAL


VAIL
TERMINAL
ARRIVING
PASSENGERS
PEAK
DAILY TOTAL
MONORAIL
STATION SERVICES
WAITING AND QUEING AREA
BAGGAGE
BUS TOTAL
WAITING AND QUEING AREA
INFORMATION CENTER
OFFICES
SHARED
STATION SERVICES
TICKETING FACILITIES
CLEANING
SECURITY
EMPLOYEE
FOOD
RETAIL
TOTAL
NET
MECH/STRC + 25%
GROSS
PLATFORM
PARKING 8/1000SF PLATFORM
MONORAIL
BUS
2,615
10,460
850
62,600
2,150
4,000
150
300
1,650
1,825
1,050
950
1,900
5,000
1,650
84,075
21,019
105,094
62,600
501
2,615
10,460
107
7,845
269
7,845
294
588
159
175
101
97
193
481
159
18,296
4,574
22,870
15,689
126
MONORAIL
MODIFIER
20,867
13%
8,221
8,727
1,348
BUS
MODIFIER
1333
196%
SHARED
MODIFIER
27200
10%
TRANSIT NET
M
B
S

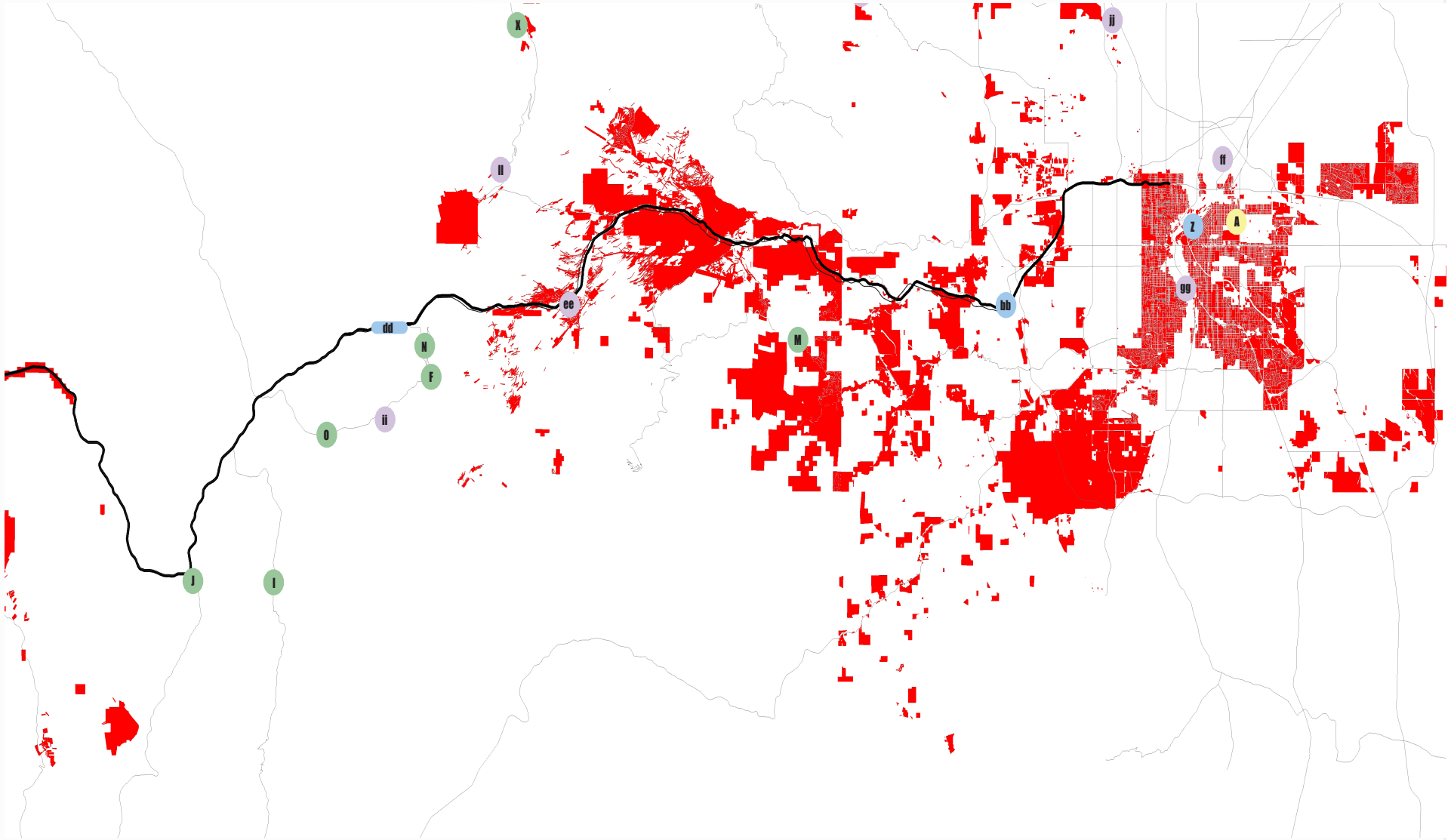

B
S
M



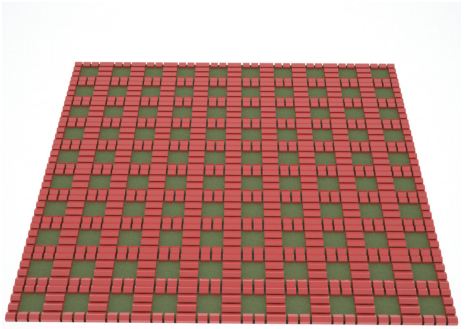
CORRIDOR RESIDENTIAL ZONES



DEVELOPMENT



RESIDENTIAL DEVELOPMENT NETWORK

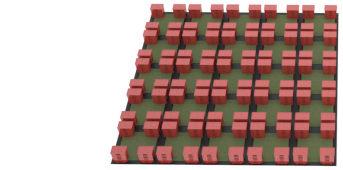


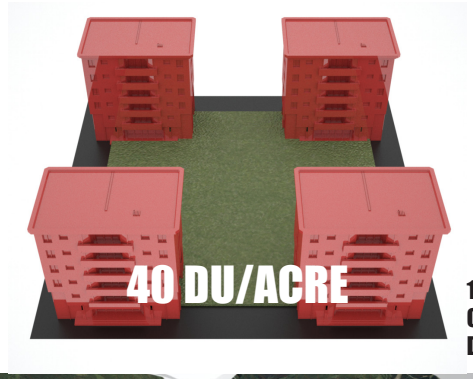


1,228 HOUSEHOLDS ON 102 ACRES OF DEVELOPED LAND.

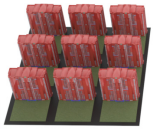


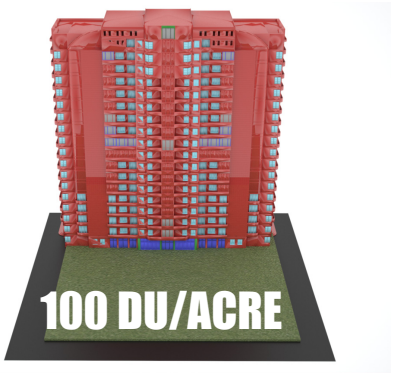
TRANSPORTATION ORIENTED RESIDENTIAL DEVELOPMENT IN THE MOUNTAIN REGION BECOMES MORE REALISTIC AS MASS TRANSIT OPPOURTUNITIES ARE CREATED. ALSO, AS AVERAGE COMMUTE TIMES IN THE DENVER METRO REGION ARE EXPECTED TO RISE BY 113% BY 2035 UTILIZATION OF A PUBLIC TRANSIT NET SHOULD ALSO RISE.





1,228 HOUSEHOLDS ON 31 ACRES OF DEVELOPED LAND.





1,228 HOUSEHOLDS ON 12 ACRES OF DEVELOPED LAND.





The insulated transportaion network will provide complete, resilient connectivity between the mountain region and the Denver metro area. This connectivity provides the oppourtunity to shape development in these regions. When we look at the possible build out scenario of the land sonned for residential development in the mountain region we see that there is a great deal of open land that can and will be developed. By developing the areas around these new transportation nodes, valuable undeveloped forest land will be conserved. Also the carbon emissions for region will be greatly reduced. These factors coupled with the allocation of localized small scale urban agriculture will further reduce the impact society has on the larger global community. At full build out of the resilient transportation system and transportation oriented developments the following will be conserved.

$120,000,000.00 ANNUALLY

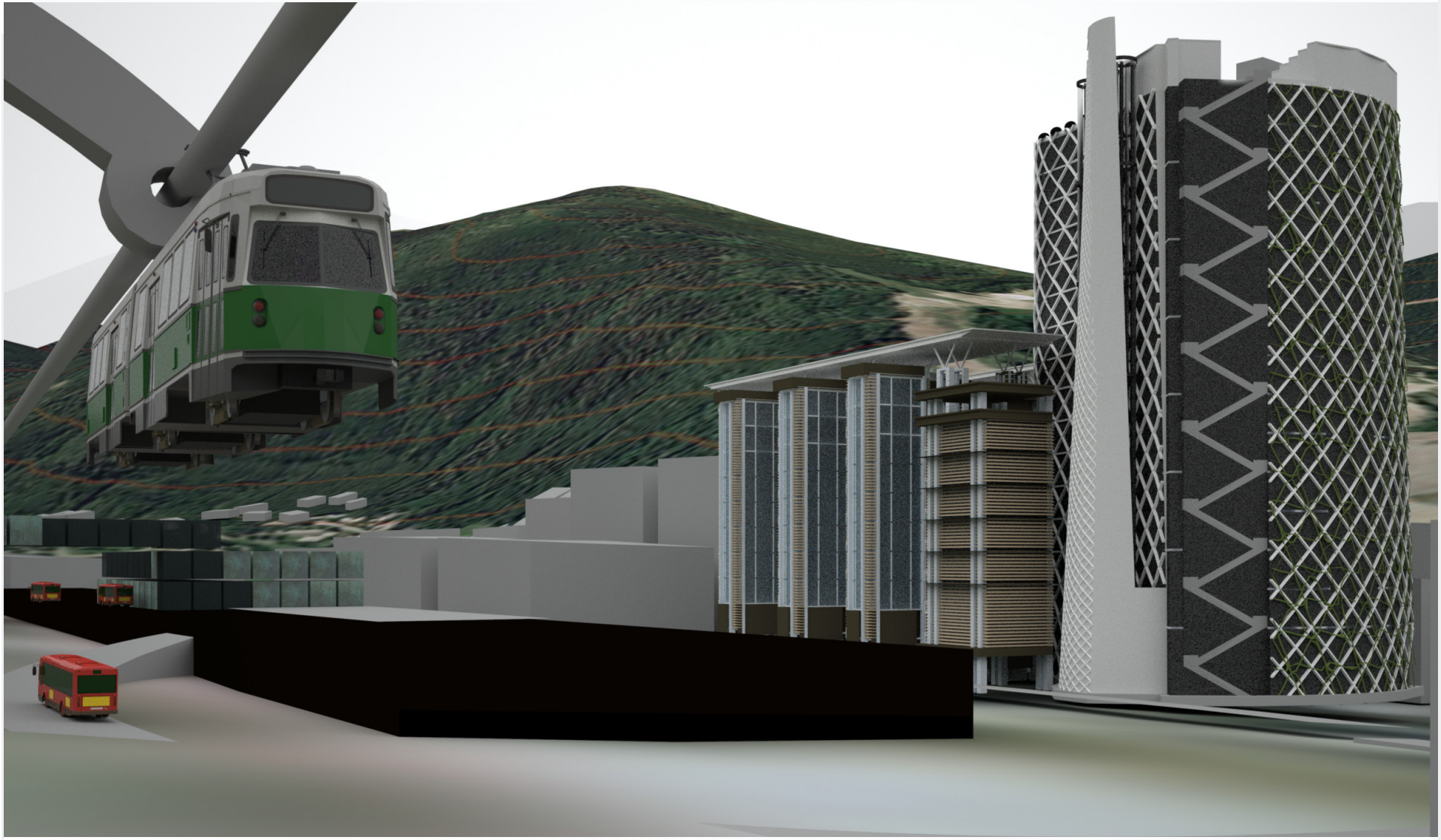
67,000,000 LBS CO_2

1,500 ACRES OF FOREST

97,000 HECTARES OF ARABLE LAND

DISCOVER

ARCHITECTURE



THESIS

As architects, those who have the power to shape settlements and our built world we have the responsibility to implement change where needed and sculpt our environment in a way that is beneficial to our global community. The goal of this project is to do just that, and through a process of analysis and interpretation of the complex systems that surround us we will discover solutions and a resilient architectural future that will curb the business as usual trend of increasingly congested transit corridors and sprawling regional settlements that are swallowing up our world as we speak.

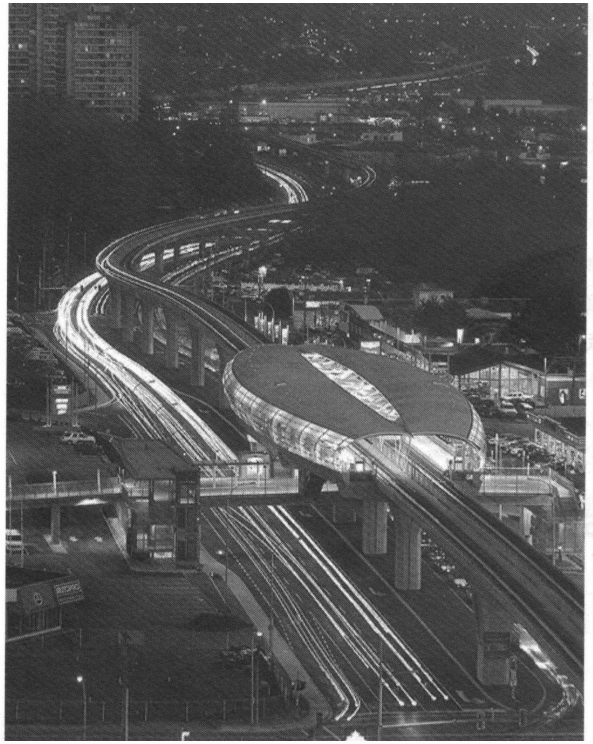
PRECEDENT

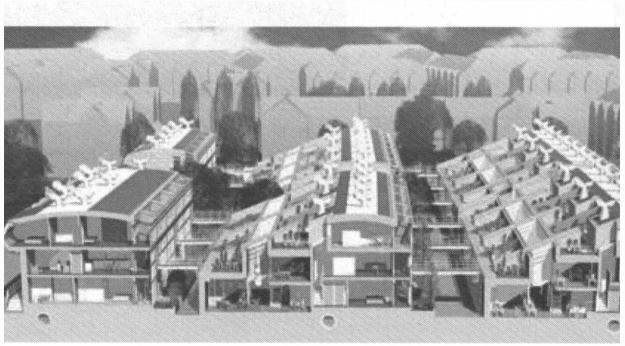
Vancouver SkyTrain extension

In seeking to improve efficiency and expand the user base of their public transportation system the Canadian province of Vancouver has upgraded its existing Sky-Train network by installing new high speed trains and developiing more interchange points.

The stations are elevated and minimize their ground level intrusion by lifting the infrastructure to an over head strata. This may be a fundamental component of maintaining a sense of place to an urban environment.

The increased efficiency and breadth of the transit system as spurred compact development in areas linked by proximity to these interchange points, “which can be seen in the mixed-use districts of Metrotown and Burnaby. This may be a fundamental component of growth in the system and the architecture of expansion.





Beddington Zero-Energy Development

This high density mixed-use urban village in rural London was created to remediate a pre-existing sewage treatment site, composed of multiple housing types located wihtin relative proximity to eachother, localized retail, and commercial programming. This arrangment facilitates walking and a definitive sense of comunity.

Various groverning principles were utilized to design many elemennts of the development from building orientation to maximize solar gain to infrastructure arrangment to support grey water recycling and water treatment.

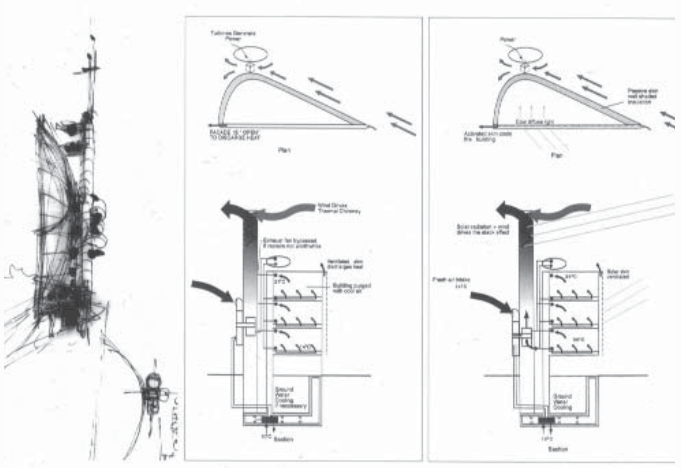
This is a great example of the advantages of densification and the one process by which strategies or principles for development can generate on a large scale a near zero footprint.

Turbine Tower

The turbine tower project by Richard Rogers was developed to prove a mixed-use tower that was capable of capturing nough energy that it would need no supplemental power and actually had capacity to produce extra could be accomplished.

The tower utilizes wind energy to both, spin turbines that create energy and power the tower, and vent and flush the entire structure.

This project exemplifies the intricate role that the built environment has with the “natural” and how analysis and proper harnessing of this dialouge can become the genesis for a project that is rooted in place and minimizes the externalities of development.



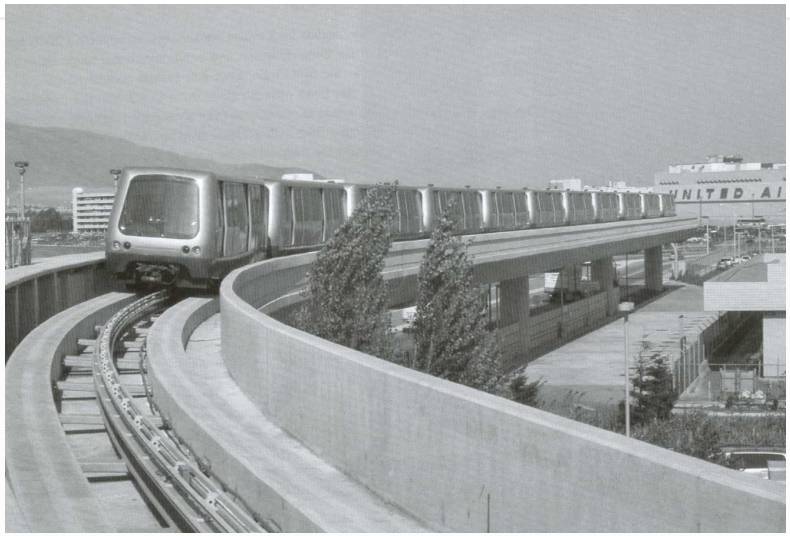


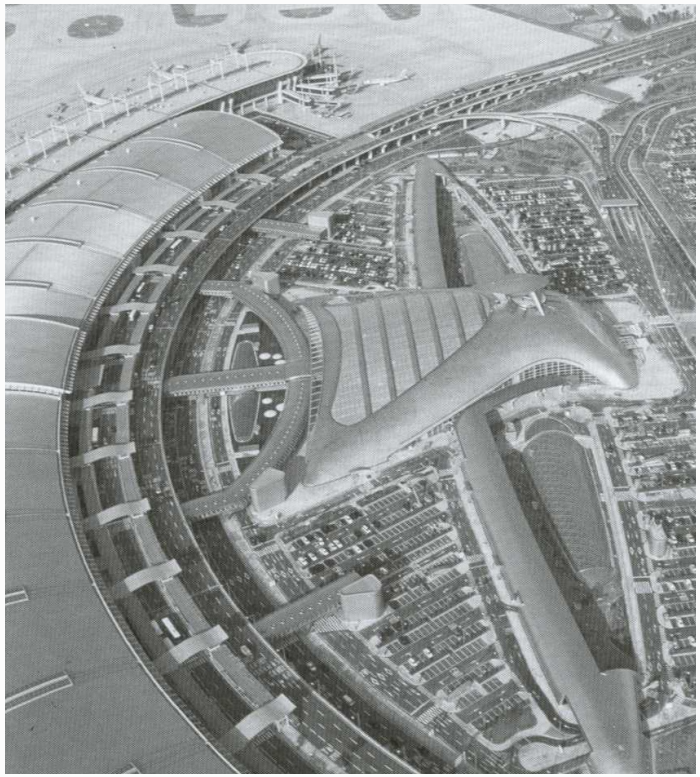
Slateford Green: Car-free housing

A 120-unit housing development built on a 2 hectares of former railway goods site in west Edinburgh, Scotland has created an environment where residents have nearly no reliance on automobiles.

The segregation of cars from the site along with close proximity to bus stations and access to a car club has created a residential population of which less than 25% own automobiles.

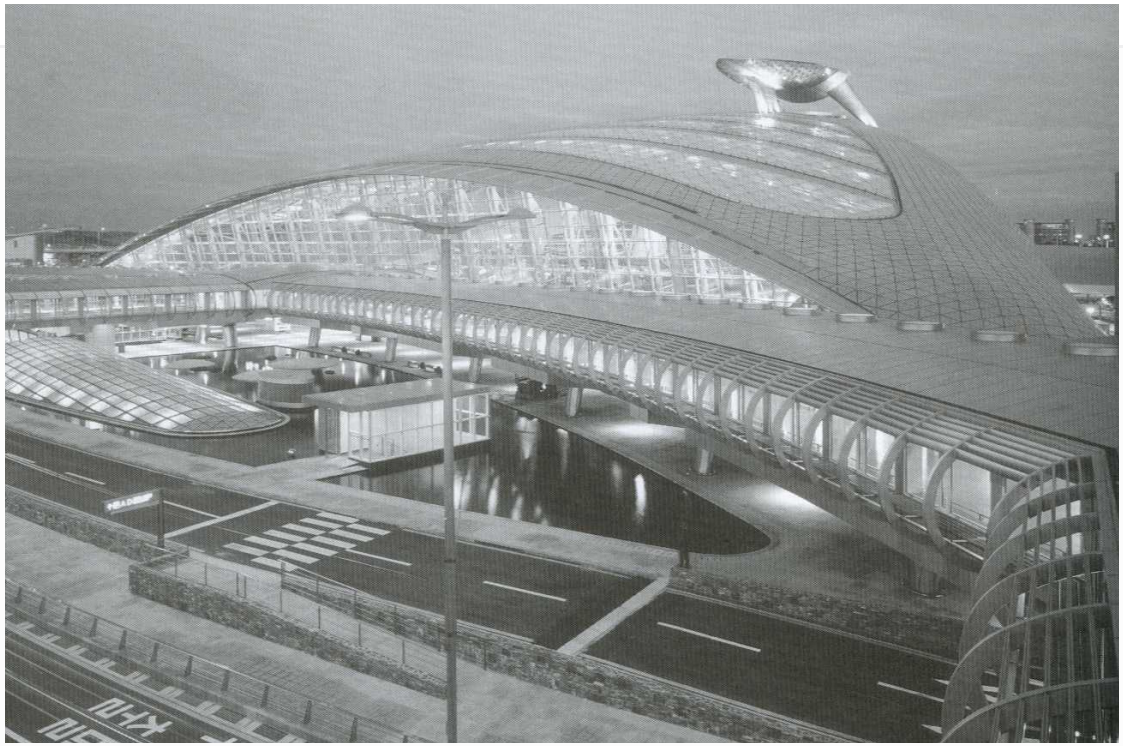
Here multiple the modes with which the residents mobilize is augmented by a localized network of people and program that tread lightly on the environment and promote densification within a multi-use urban district.

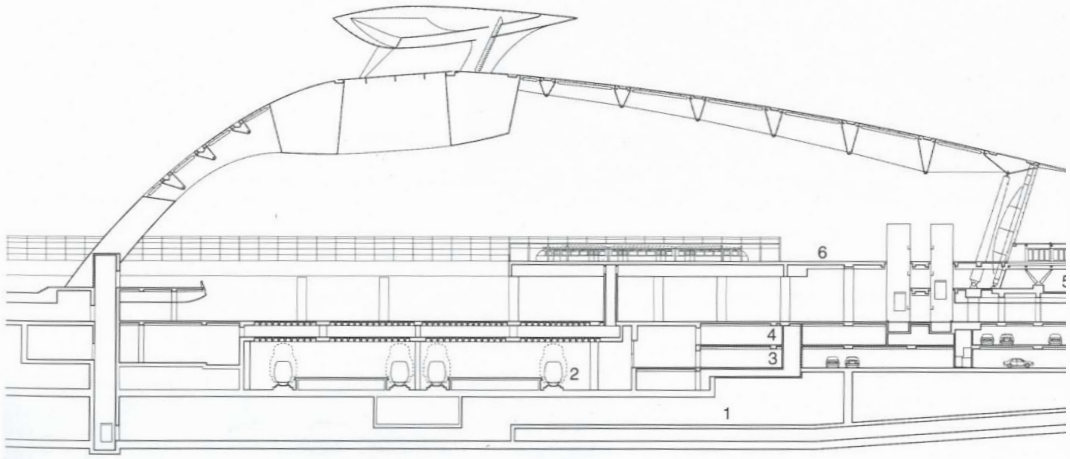




Inchon Airport, Seoul, South Korea

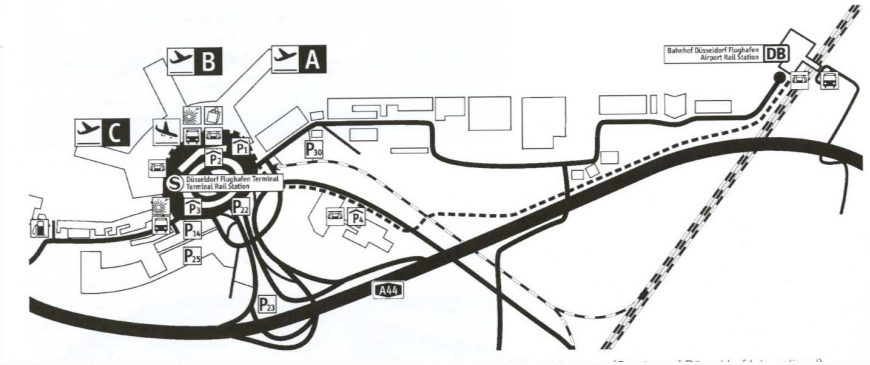
The airport has an annual passenger capacity of 100 million, comperable to DIA. The fan shaped platform center incorporates five rail systems. Several localized networks connect the airport to the neighboring city of Kimpo and one greater regional system connects the airport to Seoul an hour away. This interchange shows the value of stratification of transit typologies and the necesity of clustering to promote efficiency. This terminal allows people from a large service area to interact and move around the country without the dependence on automobiles.

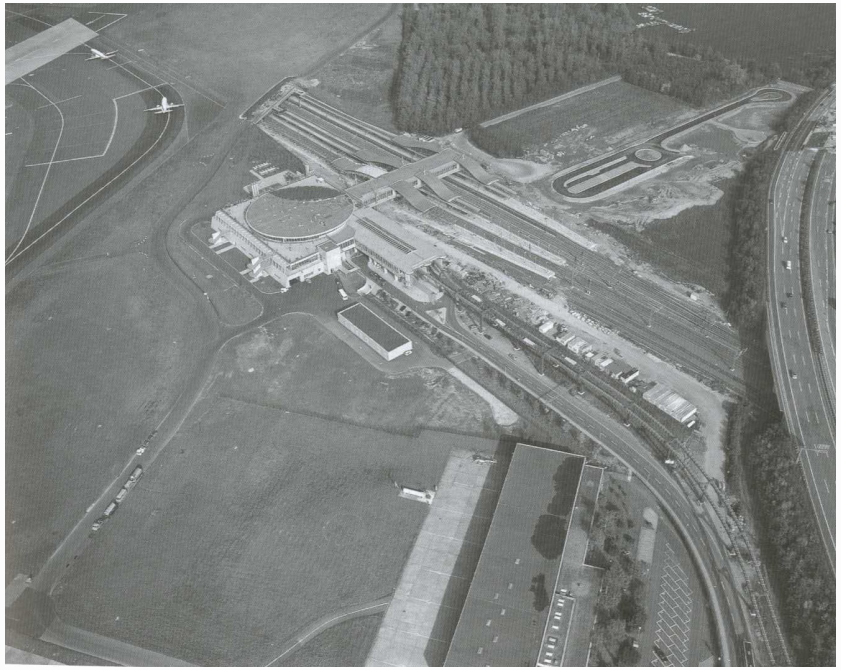


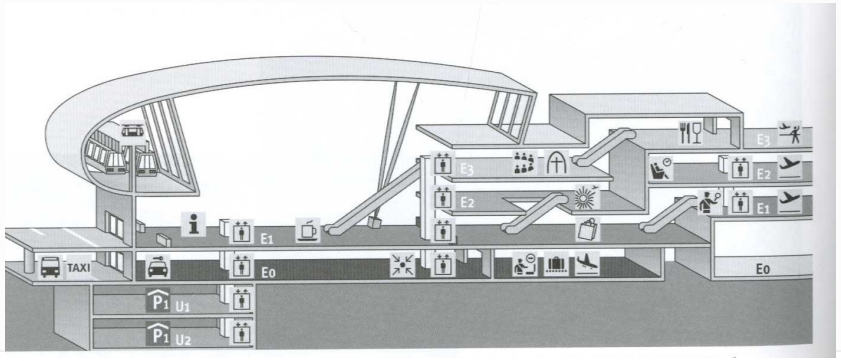


Key
1 Baggage handling
2 Platform and car park level 1
3 Car park level 2
4 Great Hall concourse, airport arrivals level and car park level 3
5 Ground level and links to buses, coaches and taxis
6 Light rail link to new city and airport departures

10 m


B
A
C
Bahnhof Düsseldorf Flughafen
Airport Rail Station
DB
P1
P2
P30
S
Düsseldorf Flughafen Terminal
Terminal Rail Station
P3
P22
P4
P14
P25
P23
A44

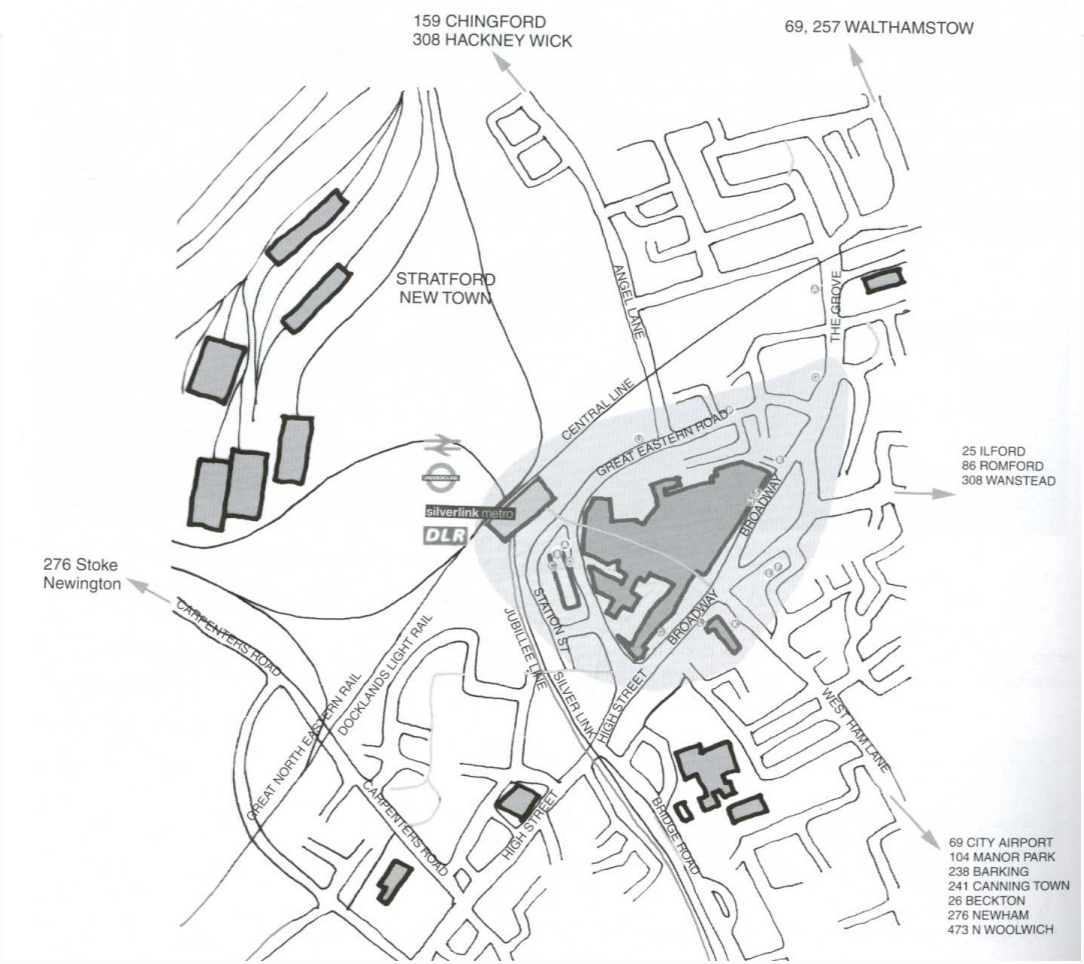



E3
E2
E1
E0
TAXI
P1 U1
P1 U2



Dusseldorf Airport, Germany

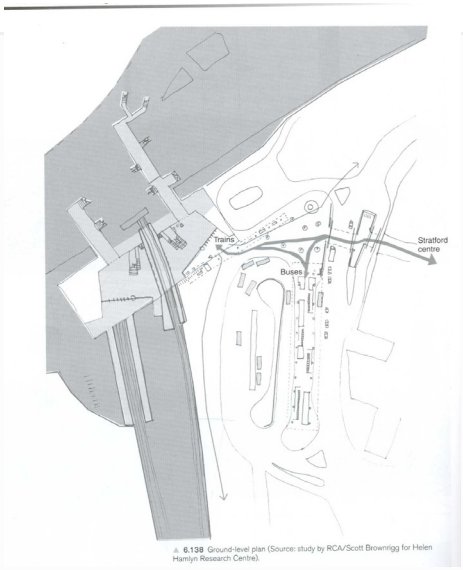
This airport had an annual passenger capacity of 15 million in 1996, and after expansion was capable of handling 22 million in 2002. The success of this expansion was helped along by the main component of this airport, which is a 2.5 kilometer suspended mono-rail people-mover which runs literally through the terminal. Providing an obvious datum for expansion. This planning strategy is based on utilizing sytems that are determined to be expandable while understanding that different modes of transport need to be cohe-sively connected.


159 CHINGFORD
308 HACKNEY WICK
69, 257 WALTHAMSTOW
STRATFORD
NEW TOWN
ANGEL LANE
THE GROVE
CENTRAL LINE
GREAT EASTERN ROAD
BROADWAY
25 ILFORD
86 ROMFORD
308 WANSTEAD
silverlink metro
DLR
276 Stoke
Newington
CARPENTERS ROAD
DOCKLANDS LIGHT RAIL
GREAT NORTH EASTERN RAIL
JUBILEE LINE
STATION ST
SILVER LINK
HIGH STREET
BROADWAY
WEST HAM LANE
BRIDGE ROAD
69 CITY AIRPORT
104 MANOR PARK
238 BARKING
241 CANNING TOWN
26 BECKTON
276 NEWHAM
473 N WOOLWICH

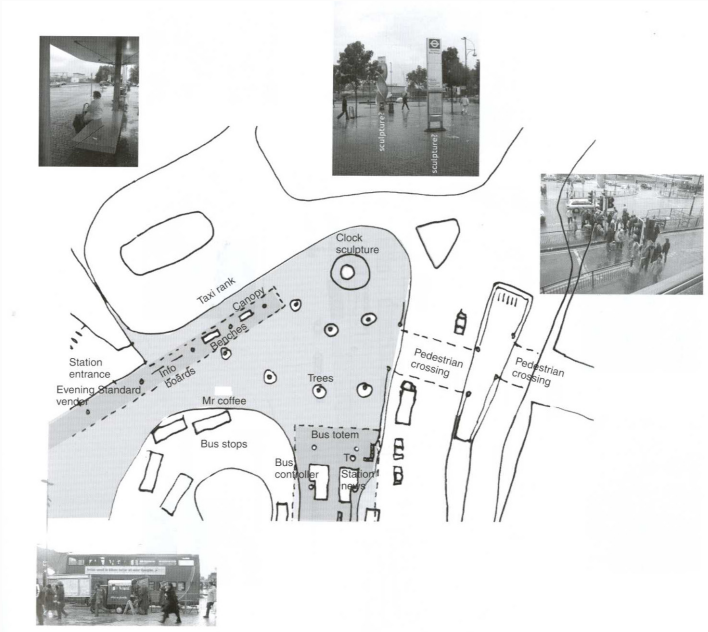

STRATFORD STATION

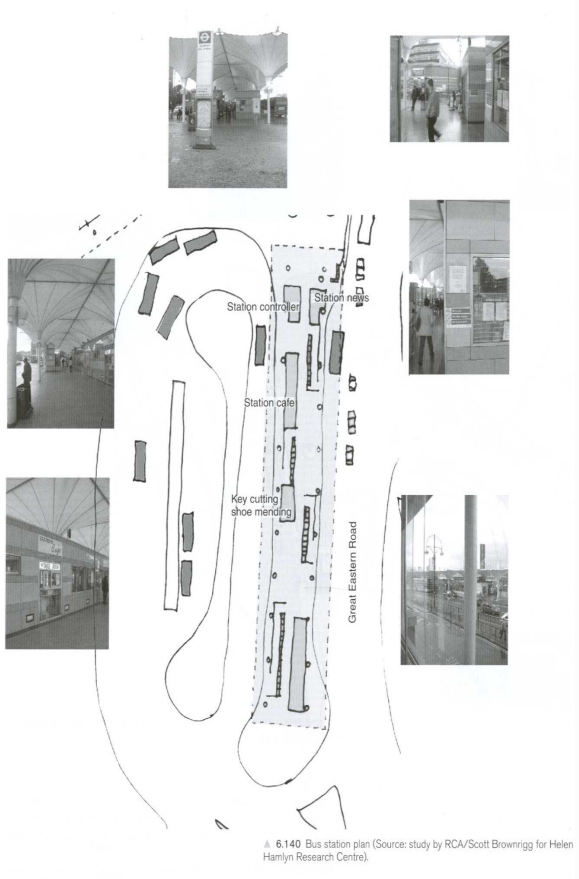
Channel Tunnel Terminal, Cheriton, Kent, UK

Once it was decided to build an rail connection under the English Channel betweeen the UK and France, a proposal that supplements existing ifrastructure; that being ferry and air travel, a major interchange point had to be created. The “Chunnel” terminal now averages 3.5 m illion passenger departures yearly. The channel tunnel is a example of a hybrid transit type that dealt with problems foriegn to most planners and architects. The shown site schematics make an attempt to rectify the collisions between different spatial strata consistent with the different modes of travel. Connecting the rail network of greater Europe to the UK allows for more flexiblity for users and allows the system to function more effieciently.



▲ 6.138 Ground-level plan (Source: study by RCA/Scott Brownrigg for Helen Hamlyn Research Centre).





▲ 6.140 Bus station plan (Source: study by RCA/Scott Brownrigg for Helen Hamlyn Research Centre).

80
80

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4 Habermas, Jurgen. “Modernity – An Incomplete Project” The Anti-Aesthetic. Pg. 3

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6 Crimp, Douglas. “On The Museum’s Ruins.” The Anti-Aesthetic. Pg. 50

7 Owens, Craig. “The Discourse of Others.” The Anti-Aesthetic. Pg. 66

8 Frampton, Kenneth. “Towards Critical Regionalism.” The Anti-Aesthetic. Pg. 19

9 Habermas, Jurgen. “Modernity – An Incomplete Project.” The Anti-Aesthetic. Pg. 4

10 Habermas, Jurgen. “Modernity – An Incomplete Project.” The Anti-Aesthetic. Pg. 4

11 Owens, Craig. “The Discourse of Others.” The Anti-Aesthetic. Pg. 68

12 Crimp, Douglas. “On The Museum’s Ruins.” The Anti-Aesthetic. Pg. 59

13 Habermas, Jurgen. “Modernity – An Incomplete Project.” The Anti-Aesthetic. Pg. 4

14 Trachtenburg, Marvin. Architecture. Pg. .375

15 Francastel, Pierre. Art and Technology. Pg. 194

16 Friedman, Thomas L. Hot, Flat, and Crowded. Pg. 30

17 Kolarevic, Branko. Performative Architecture. Pg. 3

18 Hensel, Michael. Morpho-Ecologies. Pg. 68

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20 Davis, Mike, City of quartz. Pg. 6-7

21 Davis, Mike, City of quartz. Pg.7

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26 El-Khoury, Rodolphe. Shaping the city : studies in history, theory and urban design. Pg. 99

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29 Buchanan, Mark. Nexus. Pg. 192

30 Jennings, and Peter Newman. Cities as sustainable ecosystems. Pg. 125

31 Jennings, and Peter Newman. Cities as sustainable ecosystems. Pg. 129

32 Jennings, and Peter Newman. Cities as sustainable ecosystems. Pg. 93

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37 Buchanan, Mark. Nexus. Pg. 19

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41 Buchanan, Mark. Nexus. Pg. 41

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43 Watts, Duncan J., 1971- Small worlds : the dynamics of networks between order and randomness. Pg. 4

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45 Buchanan, Mark. Nexus. Pg. 18

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47 Buchanan, Mark. Nexus. Pg. 151

48 Watts, Duncan J., 1971- Small worlds : the dynamics of networks between order and randomness. Pg. 15-16

49 Jennings, and Peter Newman. Cities as sustainable ecosystems. Pg. 125

50 Buchanan, Mark. Nexus. Pg. 121

51 Watts, Duncan J., 1971- Small worlds : the dynamics of networks between order and randomness. Pg. 17

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53 Network Fever (4)

54 Connections (1)

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