EXECUTIVE SUMMARY

Decision Commons™

Decision Commons provides cutting-edge, seamless 3D visualization of our cities and regions—from street level to the regional scale—connected to powerful analysis and design tools. The result is the ability to sketch alternative futures quickly and compare them side-by-side. Stakeholders in the planning and design process will have easy access to relevant information on environmental, social, land use, transportation, real estate, and economic development issues.

This tool is designed to visualize plausible future conditions in 3D and display high-level information through a graphic dashboard to facilitate conversation and understanding of complex problems. The system is also designed to support decision making through an interactive user experience that allows participants to explore scenarios in real time by adjusting designs or assumptions.

A research project of the University of Washington’s Runstad Center for Real Estate Studies, Decision Commons received funding from the US Department of Housing and Urban Development’s Sustainable Communities Regional Planning Grant Program to support the development of a “proof of concept” test case in the greater Seattle metro region. While it is a robust demonstration of how such a system would be designed, the next major step is to build a working prototype. This requires a more extensive software development process and funding to support this process is currently being sought.

Government Agencies
- Access relevant information to make more informed decisions
- Collect input from stakeholders and the general public
- Sketch and evaluate alternative future scenarios
- Connect community values to metrics + indicators in a variety of categories
- Facilitate communication and decision making around complex issues

Designers + Planners
- Access and explore data-rich 3D models of existing conditions
- Visualize projects in context of the surrounding environment
- Analyze implications of alternative designs
- Rapidly evaluate multiple design scenarios

Community
- Explore realistic 3D views of the community today and how it might look in the future
- Explore the relationships between natural and urban systems locally and regionally
- Understand environmental impacts and benefits of major decisions
- Explore social issues, like affordable housing and access to parks and healthy food options
- Understand opportunities for improving access to jobs, housing + transportation
INTRODUCTION

Decision Commons

The Need is Great

The Puget Sound Region, like most metropolitan regions across the country, is planning for major improvements in public infrastructure over the next couple of decades. In the greater Seattle area, $18 billion will be invested in the light rail system over the next twelve years. Our region is at a critical juncture, presented with an opportunity to create vibrant, accessible, transit-oriented development in station areas, and to connect this development with other key infrastructure improvements. As we work towards these goals and others — addressing climate change, restoring the health of Puget Sound, and ensuring that large and small communities across the region enhance their economic opportunities in the face of ever-increasing global competition — it is critical to engage citizens, present the facts about alternatives being considered, and come to wise decisions supported by a broad and sustainable consensus. The University of Washington Runstad Center for Real Estate Studies Decision Commons project has been working to develop next generation tools to support more efficient and effective decision making around these growing concerns.

In a rapidly changing world where we are increasingly confronted with issues that span multiple geographies and disciplines, it is critical that we work to create solutions that provide access to and communicate information in ways that support better decision making. Urban communities are continuing to grow and that is having significant impacts on both the urban and rural environments where we live and work. Planners and decision makers are increasingly being asked to tackle difficult questions around issues of social equity, public health, climate change, water quality, environmental health and transportation.

The tools being used today to support planning and design exercises are often not up to the substantial task of creating more sustainable and resilient communities. In many cases, millions of dollars are being spent on processes that are not resulting in desirable outcomes. Huge amounts of time and money are being spent on data
collection, analysis and communication with results that are often very linear and don’t provide access to all relevant information in a timely fashion. This can lead to a planning and decision making process that is very siloed and confrontational. Decision Commons provides a venue for asking questions, communicating potential outcomes and engaging diverse stakeholders in the planning and design process. It creates a virtual ‘place’ to interact with and communicate the various opportunities and impacts of potential alternative future development scenarios of our complex urban communities. Decision Commons has the potential to radically change the way people experience, understand and engage with the built environment.

**The Solution**

Decision Commons will provide cutting-edge, seamless 3D visualization of urban and rural environments – from the street level to the regional scale – connected to powerful analysis and design tools. The result is the ability to quickly sketch alternative futures, then compare their pros and cons side-by-side. Stakeholders in the planning and design process will have easy access to relevant information on environmental, social, land use, transportation, real estate, and economic development trends. Decision Commons can visualize plausible future conditions in 3D and display high-level information through a graphic dashboard to promote a better understanding of complex problems and facilitate...
meaningful conversation around important issues. The system supports decision making through an interactive user experience that allows participants to explore scenarios in real time by adjusting designs or assumptions.

Decision Commons is designed to make the planning and design process more holistic and efficient — to save time and money to achieve a better, more integrated outcome. Requiring just a laptop and a projector, it is a revolutionary way for public, private, and non-profit stakeholders and elected officials to make more informed decisions around difficult and complex issues. Decision Commons represents a substantial leap forward in tools to support the planning and design of urban communities.

**Decision Commons - What is it?**

Decision Commons draws on a number of different key advancements in the fields of visualization technology, geospatial analysis, planning support systems and land use and environmental planning. The core technology powering the Decision Commons user experience is transformative on a number of levels. The project leverages tens of millions of dollars invested over the past several years by the entertainment industry in the development of real-time visualization tools to power video games and movies. The game engines that power these systems have robust toolsets to create immersive, real-time, 3D user environments. Decision Commons is harnessing the power of these tools to represent and interact with real-world places. It will use the visualization environment as the main user experience — easy and intuitive to navigate with rich analytics and ‘smart’ urban models. This step alone is unique to the industry and opens up a broad range of potential uses. The rich user experience provided by these tools will be accessible using a variety of interface environments - from portable laptops and projectors to multi-touch tables and portable devices.

While the visualization environment will be the front-end experience powering Decision Commons, the back-end tools that support it have the potential to be just as transformative. The Decision Commons experience is built on top of another extremely robust and powerful ecosystem — Geographic Information Systems (GIS). The backbone of most urban governments geospatial infrastructure, GIS has become a very mature and data rich environment. Decision Commons will leverage the existing investment jurisdictions have made in GIS data, tools and geospatial analysis.
to power the Decision Commons tool. By providing rich visual and analytical data to support the visually-oriented interface that sits above it, Decision Commons will fit comfortably within existing workflows. It is also designed to harness increasingly powerful rapid urban modeling tools that are beginning to be incorporated into existing GIS workflows. Leveraging the needs of both the game production and GIS communities, rapid urban modeling tools allow for the creating of rich 3D content from simple 2D map features. Rapid urban modeling techniques provide some of the core functionalities powering the real-time generation of alternative future scenarios within the Decision Commons environment.

One of the most important and useful aspects of a tool such as Decision Commons is the ability to sketch alternative futures in an intuitive and data-rich way. Currently, the process for capturing different potential design options is very time consuming and linear. A series of potential analyses are performed up front. These help provide the framework for determining potential design alternatives which, once generated, are sent back for more analysis. Access to the information required to perform much of this analysis usually lie with a few experienced professionals — planners, GIS analysts, transportation experts and so on. Due to the constraints of existing tools and processes, if specific questions arise during a planning and design exercise that were not already identified, it is often time consuming and expensive to explore further. Decision Commons provides a framework for alleviating some of these constraints. By allowing end-users the ability to sketch alternative futures in real-time, impacts and design changes can be explored immediately. This allows for the relevant questions driving the process to be the focus rather than being constrained by the process itself. What happens if we put a rail alignment in one location over
another? What are the potential implications for ridership? How might it impact displacements of business and people? These sorts of questions can be asked and explored in real-time as the process unfolds. The core interface supporting these sketch-based tools is designed to be extremely intuitive to operate allowing both experts and non-experts to interact with the tool. But this intuitive ‘front-end’ is connected to a very robust and data rich 3D GIS allowing for a back and forth dialog between different design scenarios and the associated potential impacts.

Decision Commons, first and foremost, is meant to be a decision support tool. It is designed to be used in a facilitated environment to support diverse groups of stakeholders wrestling with complex planning and design challenges. Of critical importance to this endeavor is the ability to interact and work in a cross-disciplinary environment. Sustainable community planning is inherently complex and requires the integration and iteration of information from a variety of different domains — from economics, social equity, public health, environmental health and others. Decision Commons helps tie these ideas together by creating a venue to share and compare analyses and ideas.

In order to provide an experience that focuses on creating an environment that emphasizes information over process, Decision Commons will provide an ‘end-to-end’ solution that will cut the cost of business as usual dramatically. It will allow end users and participants to focus on asking the most relevant questions at the most appropriate time in the planning process. Less time should be spent collecting, collating and cleaning data and more time should be spent exploring, asking questions and testing alternatives.

The Test Case

In the fall of 2010, the Growing Transit Communities effort led by the Puget Sound Regional Council was awarded funding from the US Department of Housing and Urban Development’s Sustainable Communities Regional
Planning Grant program. PSRC is leading the effort to support sustainable community planning in the region and funding support from HUD is critical to moving much of this work forward.

As part of this regional sustainable community planning effort, the Decision Commons team was awarded a portion of the Growing Transit Communities funds to advance the development of planning support and visualization tools. Specifically, the Decision Commons project was provided funding to support the development of a “proof of concept” test case. This test case demonstration focused on light rail and station area development within the 900-acre Bel-Red/Overlake Area, a subarea of the East LINK light rail corridor between the cities of Bellevue and Redmond, Washington. This location was chosen in part because significant inter-jurisdictional coordination and local station area planning had already occurred providing a unique opportunity to learn from recent work.

Working with the cities of Bellevue and Redmond, PSRC, and Sound Transit, the Decision Commons team developed and tested a demonstration tool that incorporates two parallel aspects of public development decision-making:

(1) the ability for the public and local decision-makers to understand both the visual and analytical aspects of alternative future development scenarios;

(2) the use of neutral, independent analysis in support of local decision-making, applicable to a broad range of
jurisdictions grappling with the complexities of public and private development proposals in response to increased accessibility of public transit.

The Decision Commons tools are being designed to address and incorporate a wide range of land use, environmental, social equity, transportation, economic, and municipal revenue concerns. Over the past twelve months, the University of Washington Decision Commons team has been working to build this proof of concept by creating a mockup of the user experience, dashboard and menu system, identifying the values and indicators that are most important to end users, and connecting all of this with a visualization engine. An integral component to this development has been the active solicitation of end user feedback. One of the key milestones undertaken during this grant process was the convening of multiple focus groups to tease out the most relevant potential uses of the Decision Commons tool. The Decision Commons team worked very closely with the Test Case stakeholders (specifically the Cities of Bellevue and Redmond and Sound Transit) to explore how a tool like Decision Commons could support their particular planning processes and, ultimately, inform and support larger cross-disciplinary planning projects. Much of this work included mapping out and learning from the planning exercises that had recently been undertaken. Utilizing existing data and resources, the Decision Commons team met monthly with Test Case stakeholders to iteratively advance ideas and overall functionality. All of this feedback was critical in shaping both the interface and functionality of the Decision Commons demonstration.

This particular Test Case demonstration is focused on the use of innovative tools to support transit corridor planning. It’s important to note, however, that Decision Commons as a tool is relevant to a broad range of planning and design exercises. Much of the feedback and support accumulated during the development process included examples of how such a tool could support any number of potential end uses in the design and development of healthy communities and the places we live and work. The Decision Commons test case demonstration provides a road-map for leveraging next-generation data and software to accelerate the implementation of sustainable community planning.
THE TOOL
User Experience

Decision Commons combines cutting edge 3D visualization of our cities with powerful analysis and design tools, from the street level to the regional scale.

Decision Commons is designed to be an intuitive user experience for exploring, analyzing and making decisions about our cities and regions. It is meant to be interactive and highly visual, allowing for seamless navigation from the street level to the regional scale. The rich 3D visualization allows users to immediately get a sense of what it feels like on the ground, both in terms of what exists today and what could potentially exist in the future. What would it feel like if we increased building heights in a particular location? How might these changes impact critical metrics such as density, walkability and economic displacement? How might the development of a new station area impact the existing sense of place? The Decision Commons tool is being designed to help navigate some of these questions — both analytically and in a highly visual 3D environment. We experience our neighborhoods, cities and regions in three dimensions and our tools should be designed to support this. But they should also be designed to be analytically robust and powerful. By combining rich analysis and design tools, Decision Commons has the potential to dramatically expand our ability to plan for and envision our cities and regions.

The general workflow of how Decision Commons might be implemented on a project is represented through the toolbar, the design of which reflects considerable feedback from end user stakeholders and professionals. At the highest level, a project begins by exploring existing conditions. This process helps participants understand what is on the ground today and informs how they will sketch alternative future possibilities. The next step might be to interactively sketch these potential future scenarios. These could include but would not be limited to, transit alignment options, land use alternatives, right of way and streetscape design options, and environmental and equity planning alternatives. By providing a suite of supportive analysis tools, this process can be very iterative allowing for real-time feedback on design choices. Finally, once a variety of alternatives have been created and agreed upon, it is important to provide high level analytics and communication tools to help inform and facilitate decision making.

© 2012 Decision Commons™ | 13
Support a broad range of planning + design exercises - Process Button

One of the key aspects of Decision Commons as a planning support tool is its ability to adapt to a variety of planning and design processes. Decision Commons is, by design, meant to be flexible and not prescriptive. The Process Button on the far left of the toolbar is how an end user would interact with and define the specific planning process they are working with. By creating a new scenario or option as the process unfolds, users have the ability to let the ideas frame the process rather than having to conform to a specific framework. In this particular example, we are looking back at a transit corridor planning exercise that is in large part complete. Thus this particular menu is populated with snapshots of the process as it unfolded in the Bel-Red / Overlake Corridor. For the purposes of the Test Case demonstration project, this is where end users would access information already created during the planning process.

Explore existing conditions in 3D - Explore Button

The ‘Explore’ button on the toolbar is where a user would first begin to interact with their virtual environment. This section provides access to a broad range of existing conditions data and analysis in both 2D and 3D.

Create new design proposals - Create Button

Decision Commons is also meant to be a first of its kind GeoDesign tool. This is a process by which users can create or sketch new design proposals and get instant feedback on feasibility, opportunity and impact. By using active geographic space to capture design ideas in real-time, it allows end users to focus on the most relevant questions at the most appropriate time. And by providing immediate access to information, these ideas can be iterated upon instantly. The digital ‘sandbox’ provides a venue to test different alternatives and capture official outcomes that move the overall project forward.

What would be the implications, both visually and analytically, of placing new light rail alignments in different locations? What would happen if we increased the height
Compare alternatives + make decisions - Evaluate Button

The steps leading up to this point help inform and shape potential future scenarios. They put end users in the drivers seat by allowing them to ask questions and explore their environment in intuitive and interactive ways. They allow for the sketch-based creation of future possibilities. But ultimately, these tools need to provide a framework for facilitating the decision making process. One of the main goals of providing better access to information is the hope that it will drive more informed decisions. The ‘Evaluate’ button provides tools to help this particular step.

The Test Case demonstration completed as part of the Growing Transit Communities grant program included the development of a software based mock-up of the tool. The toolbar described above is included in this demo mock-up and is combined with a fully navigable 3D environment as the main user experience. This demonstration tool is best experienced in person, but in the absence of a more hands on understanding, the following sections of the report attempt to capture some of the functionality included.

Fast analysis and feedback on design scenarios - Analyze Button

Following this step, it is important to be able to analyze the implications of proposed design ideas and alter them as appropriate. The ‘Analyze’ button provides a limited but robust suite of analysis tools that provide both fast analysis and rapid modeling of the 3D environment.

It is important that the analysis tools captured within Decision Commons be as cross disciplinary and transparent as possible. Ultimately, sustainable community planning requires the distillation of information from a wide variety of expertise. The context of the questions being asked should drive the type of analytics Decision Commons offers. As this is, by design, a cross disciplinary tool, it is critical to incorporate and provide access to a broad suite of analysis options. The analysis tools provided within Decision Commons help aggregate and process complex data sets so that end users can make more informed decisions — based on both hard numbers and analytics and on how it might feel visually on the ground.

limit of buildings in a certain area and how would it feel to be standing on the street? How will this impact the transportation network? What about the implications for greenhouse gas emissions? Providing answers to these kinds of questions first involves the sketching or drawing of new ideas. The ‘Create’ button is the place where this sketching actually happens. This process of designing in geographic space is both iterative and exploratory. It is meant to be flexible but informative such that if new features are sketched by the user, instant quantitative feedback will be communicated. This can happen as many times as might be appropriate in as many instances as necessary.
A critical and time-intensive first step in any planning or design exercise is understanding the existing baseline conditions for a project. Typically this requires a series of steps—from data acquisition and analysis to production of maps and reports—resulting in a very linear and non-iterative process. In an attempt to alleviate much of the effort required in these early steps, Decision Commons will come ‘prepackaged’ with existing condition 3D models of relevant project areas. This step alone is unique to the industry and provides a vastly superior starting point from which to understand the current situation. By providing high-resolution base condition models at low-cost, we can shorten the time and effort required to access relevant information. Combined with being able to navigate and experience these environments in a seamless, three-dimensional visualization tool, Decision Commons represents a significant advancement over the way things are done today.

The overall goal of the Explore section is to provide end users, in whatever capacity they are working, the ability to quickly explore existing conditions in a highly visual and intuitive way. It is meant to allow for the seamless communication of relevant information from the street level to the regional scale. The ‘Explore’ button allows users to access any relevant data and information related to what exists on the ground now and provides an interface for asking questions about the real world in ‘real-time’. It comes ‘pre-populated’ with relevant data supporting specific inquiries in the categories illustrated in the image above.

In the case of the Bel-Red / Overlake Corridor project, the first significant design challenge was to propose various alignment options for an extension to Sound Transit’s East Link Light Rail. Having a detailed understanding of what exists on the ground today is a critical first step in understanding the regional and local context. Using a tool like Decision Commons allows users to instantly get a sense of the
community and urban fabric in and around the study area. The experience of exploring existing conditions in Decision Commons is seamless and intuitive so that users can navigate in and out of the study area as needed. At the regional scale, users can see the study area in context to regional population patterns and the regional landscape. At the street level, the existing neighborhood context is represented by 3D buildings and features, allowing for the realistic representation of baseline conditions.

Through this exploration, users can begin to ask questions about the existing context. Because Decision Commons will be built on top of a powerful GIS engine, users will be able to visualize and query existing demographic, environmental and other datasets in real-time. For example, in this particular exercise, users might
want to know how many people currently live in the corridor and what the geographic or income distributions look like. It might also be important to understand the existing regulatory constraints and what the current transportation infrastructure looks like. By providing access to relevant geospatial data Decision Commons allows end users to ask questions and learn about important opportunities and challenges facing their particular design exercise.

The ‘Explore’ button supports a rich diversity of baseline information, but it may not contain all the relevant information a project might require. In an effort to provide the most value to end users, Decision Commons is designed to be flexible. The core of the system is built on top of a geospatial database. This allows for data and information created outside of Decision Commons to be connected to and visualized within the system. Of particular importance to the Decision Commons design team is the ability to compliment existing workflows. Considerable attention has been paid to how the tool would be used to support and add value to current processes.
In this specific example, one of the main goals was to maximize the benefits of new transit infrastructure while providing the most value to current and future residents of the region. This is inherently a complex, cross-disciplinary problem that requires information that spans many different scales and interests.

One of the key constraints of existing tools on the market are the inherent challenges in accessing information. The process for collecting, analyzing, and communicating information is very time-intensive and linear. This was echoed almost universally from all stakeholders the Decision Commons team engaged with — professional planners, elected officials, developers, NGO’s, etc. A large percentage of time on any given project is spent preparing and analyzing data. These are then communicated to various stakeholders in the form of static representations — either via printed materials and/or electronic presentations. Decision Commons has the potential to dramatically impact the efficiency and effectiveness of this process.

One of the critical goals of the Decision Commons and Growing Transit Communities teams is advancing the state of analysis and communication of social equity and environmental issues and challenges. By creating a venue to ask questions and explore a variety of geospatial and demographic data, Decision Commons allows end-users access to information that is often otherwise not accessible.

In this particular example, users can quickly access significant demographic and environmental information simply by navigating the ‘Explore’ button. Census demographic data is easily summarized and communicated in a variety of ways. Population density can be viewed as a heatmap, which clearly highlights potential development opportunities and constraints within the Bel-Red / Overlake Corridor. Because this information is inherently data-driven, it can be represented in any...
number of ways. Demographic data, for example, can be viewed at the block, block group or tract scale both in terms of actual geographies or visualized through the heatmap example shown above. Providing a variety of ways to explore and visualize the same information allows for different interpretations and supports greater transparency and communication.

The built-in power of the visualization engine can be used to explore site or project specific data as well. In the example on the following page, environmental conditions specific to stream water quality and hydrologic conditions can be communicated. In this case, the data was collected by consultants and team members in a separate process but connected to the Decision Commons engine for visualization. Providing direct access to external geospatial data allows end users the ability to analyze and model environmental, social equity, public health and other important issues outside of the tool and use Decision Commons as a venue to share and communicate.
One of the key advancements of Decision Commons is the ability to seamlessly and intuitively design alternative future scenarios and get instant feedback on impacts. While not alone in the desire to support more interactive and informed planning, Decision Commons provides a balance of usability, function, and visualization that is vastly superior to the vast majority of existing Planning Support Systems (PSS) on the market today that often require extensive data collection and manipulation and/or have very limited visualization capabilities. In most cases the visual representation of planning decisions is either added as an afterthought with little visual fidelity or is included using existing off-the-self solutions such as Google Earth. Decision Commons is unique in both capacities.

As with a number of these existing tools, Decision Commons helps further the concept of GeoDesign. While not technically a new idea, GeoDesign has become a nascent and growing field over the past several years. The general idea as defined by Carl Steinitz (Harvard Graduate School of Design), Jack Dangermond (ESRI), Bill Miller (ESRI) and others is that the context of our geographic space conditions what and how we design. By using the existing geographic context as a base from which to explore different design options, we can better inform the potential outcomes. Decision Commons allows for the analysis of contextual information and interactive design to come together creating an ideal tool to support more informed and holistic decision making.

The sketch tools built into Decision Commons allow users to create and capture potential alternative future scenarios directly in the interface. This interactive sketching can be accomplished in a number of ways, including multi-touch tables, pen-based drawing tables or through traditional mouse and keyboard. The ease of
the sketching process is an important aspect of how Decision Commons is used to capture information, whether as professional planners or as part of a larger facilitated session with stakeholders or decision makers. In either case, easy access to information and intuitive, gesture-based sketching creates a rich environment for exploring different ideas and alternatives. By shortening the time and difficulty required to capture potential design scenarios, Decision Commons helps increase the overall effectiveness of the planning process. It also creates an environment that directly supports stronger overall engagement. The more accessible and iterative the tools become, the greater the chance that invested stakeholders will connect with and inform the process.

In the Bel-Red / Overlake Corridor example, different potential rail alignments were sketched using 2D drawing tools. By keeping this process simple and intuitive, users can quickly explore different ideas using a variety of contextual information to inform alignment placement. And because the sketched linework is connected to rapid urban modeling tools, users can zoom into the street level to see 3D representations of light rail infrastructure in real time. This process can then be repeated for the placement of station areas. At any point in time, it is possible to actively query relevant information. For example, once we’ve placed a few
potential station areas, it is possible to see how much developable land, in the City of Bellevue, is within 1/2 and 1/4 mile radii of the station.

This particular example highlights the sketching of potential light rail alignments, but the structure of the Decision Commons interface is designed to allow for sketching of any number of relevant urban features. For example, this process can be extended to include parks and open space, roads and right of ways, buildings and other amenities. Some of these will be explored in further sections, but the illustrations in this section highlight a brief example of how an end-user might interact with Decision Commons to sketch various design scenarios.
In the previous example, we explored the concept of GeoDesign through the sketching of potential light rail alignments. In this section, we will expand a bit on the idea of GeoDesign to look at ways to ‘paint’ future land use and zoning alternatives. The results of this exercise will ultimately be used to inform and guide the development of procedurally generated 3D content.

To build on our Bel-Red / Overlake example, we’ve now completed our existing conditions exploration and have selected one preferred alignment for the rail extension. The next major step in the planning process is to create land use alternatives that build on the alignment and station area placement and that support the regulatory review process (to be discussed in further detail in a later section). Specifically, the project team needs to generate a few different potential land use alternatives.

This is accomplished through the ‘Create’ button in much the same way as the rail alignments were created in the last example. One specific difference, however, is that in this case users are given the ability to ‘paint’ general geographic areas based on a pre-set list of land use types. As illustrated earlier, the process would be as simple as drawing on the map using traditional mouse and pointer or through some other means such as a multitouch surface. Decision Commons actively captures these sketch-based inputs and provides real-time feedback on metrics and indicators important to the project. The image on the following page illustrates how one of these land use alternatives might look.

Once an individual alternative is complete, it can be saved under the ‘Process’ menu. It can also be used to visually and analytically compare various alternatives. The image on page 27 illustrates four different EIS land use alternatives compared side by side.
The idea of ‘painting’ land use on the map is an aspect of GeoDesign that is used in a variety of existing tools. What sets Decision Commons apart is the ability to rapidly and intuitively connect these ‘sketches’ to 3D forms. A later section will talk in more detail about procedural generation of 3D content, but this process begins with the painting or sketching of simple shapes. These are then converted to 3D forms by connecting the attributes of a given sketch with a template that translates these attributes into a smart three dimensional object.

Creating Right Of Way Alignments

Once we have generated specific land use options, the next major step in the process is to drill down to specific station areas and create new right of way alignments. Given the planned land use identified in the steps above, it is important to think about how the street network will have to change to support the identified land use and project TOD goals. It is apparent looking at the existing conditions of the street network, that the current right of way alignments are not particularly conducive to the land use.
and density required to support a new station. At this point we will need to sketch a new right of way network that supports our new transit oriented development. This is accomplished in much the same way as when we sketched potential light rail alignments — through the simple drawing of two dimensional lines. These lines are automatically stitched into the existing street network (see illustrations on page 28).

It is important to note that these simple two dimensional lines are actively connected to the rapid urban modeling engine built into Decision Commons. This will be discussed in more detail in a later section, but by connecting different right of way alignment options to three dimensional street section templates, users are automatically placing smart 3D objects into the scene. By sketching simple lines based on these templates, we can actively shape potential new right of way alignments and street sections that support the street grid and density goals previously defined for the project.

‘Painting’ of Potential Zoning Options

Finally, once a plausible future right of way alignment is defined, users can begin painting the surrounding land use parcels with zoning characteristics. As we will see in a later section, these zoning parameters will be the key drivers generating plausible 3D building forms.
Build different street ROW profiles…

…and use to sketch new alignments
One of the key existing but underutilized technologies being incorporated into the Decision Commons platform is rapid urban modeling and ‘smart’ 3D data. Currently, the vast majority of 3D modeling tools require significant amounts of time to produce 3D models of buildings and other urban forms. These models are generated in a number of different ways, but each generally follows the same approach. This involves using shapes and forms to create a particular model. A key downtown building, for example, is made by individually ‘pushing and pulling’ geographic forms to achieve the desired shape. It is then ‘painted’ with appropriate building facade images to look as realistic as possible.

Rapid urban modeling takes an entirely different approach. Using what is called a shape grammar, procedural tools follow a complex language to define how buildings and other forms are constructed. Using simple geometric shapes and a handful of relevant attributes, 3D forms can be quickly generated in real-time. The beauty of a system like this is that it is very flexible and can be controlled parametrically by the user. It can also be driven by very simple shapes such as the points, lines and polygons defined in GIS or as sketched directly in Decision Commons using one of the sketch-based Create tools. A street centerline file, for example, can be used to procedurally generate high level of detail 3D models of street rights of way. Because the procedural models are data driven, they can be further refined through the use of information in the GIS data itself. Street width, level of service or pedestrian activity can be modeled on the fly. This creates significant time and cost advantages as the user need only create simple shapes instead of investing large amounts of time in constructing 3D models by hand.

In this particular example, we highlight the rapid, procedural generation of 3D buildings from zoning parameters. In the previous section, we worked through a process of creating future parcels and painting them with different zoning
parameters. Because these zoning parameters are data driven, they can have multiple attributes informing their use, restrictions, etc. These attributes are used by the rapid urban modeling engine to create plausible 3D buildings. Once the user is ready to generate 3D content, all the end user needs to do is to select the ‘Generate’ button. This results in the rapid generation of 3D buildings (see illustrations below and on the next page). Because these are generated based on zoning attribute data and are constructed in real-time, they can easily be changed. If a user isn’t happy with the generated forms, they can easily regenerate them. It is important to understand that these tools are only creating plausible 3D forms based on the input attribute data. It is not an attempt to predict architecturally precise future outcomes.

Because these 3D models are generated through the input of attribute data, the parameters driving the shapes can be changed at any time. This in effect makes them ‘smart’ 3D models. Existing tools used to create 3D models use simple 3D shapes and forms and cannot be controlled by model data and parameters. This advancement is significant in that it allows for active control of how future scenarios are being constructed. With real-time design and feedback, it is much easier to engage planners and decision makers.
Paint zoning parameters...

... to generate 3D buildings.
One of the main advantages of a tool like Decision Commons is the ability to quickly analyze new alternatives using a variety of geospatial tools. In this example, we will expand on the alignment and station area exercise to explore some of the more complicated geospatial analysis options included with Decision Commons.

In the previous example, we explored the sketch-based creation of different light rail alignments, the painting of new land use and zoning options and the procedural generation of 3D content. Much of this work was done in various capacities by the Cities of Bellevue and Redmond, Sound Transit and various other community stakeholders during the planning process. Decision Commons provides a common venue for capturing and communicating this information. But it also provides an environment for performing real-time geospatial analysis.

In the Bel-Red / Overlake example, the preferred light rail alignment was selected to follow the SR520 highway for much of the area within the City of Redmond (see example on the following page). This posed particular equity and accessibility concerns as the placing of the Overlake Village station adjacent to the highway resulted in significant potential impacts to movement of people. Decision Commons can analyze the impacts of these decisions in real-time. Specifically, planners and decision makers wanted a better idea how many people could access the station given the current alignment decision. The most common approach for quickly accessing this question is to use a visually effective but crude method of placing two concentric rings at distances of 1/4 and 1/2 mile around the station. A more accurate and data-rich approach would be to use geospatial analysis tools to calculate a network-based 1/4 and 1/2 mile walk distance. These tools are much better at predicting actual routes people can travel to reach a particular destination. By connecting these analyses to underlying geospatial data, relevant information on such things as total population, employment, future predicted population and
Sketch new pedestrian bridge...

... and visualize walkshed impacts.
number of housing units can be calculated.

In this particular example, the City of Redmond was interested in ways to mediate the barrier-like effect of the highway. What would happen if they were to create a pedestrian bridge over SR520? What impact would this have on potential access to the light rail station? The figure on the previous page highlights the potential implication of connecting the light rail station with the north side of the highway. The results are, not surprisingly, dramatic. In this specific example, the area to the north of the highway includes both a large portion of the Microsoft campus as well as some significant residential housing. Connecting these areas with a pedestrian bridge would have a significant impact on the potential future number of employees and residents able to access the new station.

This is one specific example of using geospatial analysis tools to help answer questions and inform decision making. Decision Commons would provide this kind of rich geospatial analysis and comparison in real-time, allowing for end users to literally sketch their ideas and get data rich, informed results immediately. With tools such as this, it will be much easier to explore many different ideas that relate to urban space and have real, meaningful discussions about the potential impacts. It will provide a framework for asking place specific and contextually appropriate questions as part of the planning and design process while also allowing for the seamless visualization of this information across scales. In this particular example, we were looking at one station area. But this analysis can be calculated at a variety of scales and the data results compiled accordingly.
Select various amenity types...

... and analyze walkability access.
Decision Commons is designed to rapidly analyze various scenarios — both as sketching is taking place and side by side once various alternative scenarios are created. Design specific feedback is critical during this sketching process. Providing relevant, contextual feedback during the design process supports the overall goal of making more informed decisions. One of the key advantages of a tool such as Decision Commons is that it allows users to see — both visually as a sense of place and analytically — the impacts of design choices. This can happen on a number of different levels. Once a user has placed a potential station area, for example, they have the ability to display relevant data on the screen in an iterative, real-time manner. But they also have the ability to compare different completed scenarios side by side.

This access to information extends to the tracking of project indicators and metrics (which will be discussed more in later sections). Through the use of tools that connect project values and goals to specific measurements on the ground, Decision Commons can help link design choices to information that supports more informed decision making.

It is also important to provide an open framework for connecting to external analysis and modeling. Decision Commons will be packaged with a number of useful analytics, but is by no means meant to be comprehensive. By allowing end users to perform analyses outside Decision Commons and providing the ability to communicate and visualize these results within the tool, end users have a much broader toolkit from which to inform decision making. These types of analyses and models include, but are not limited to, greenhouse gas models (upper image on the following page), transportation models, environmental analyses and models, analyses of social equity (lower image on the following page) and public health issues.
VISUALIZE GHG Models

ANALYZE Social Equity Issues
One of the key challenges facing urban design and planning professionals is the ability to clearly communicate and understand development options that are inherently three-dimensional in nature. One of the least understood and most controversial metrics of modern urban planning is the concept of density. Generally defined as the number of people inhabiting a specified urban area, it is usually represented as a number — dwelling units per acre or people per square mile for example. But this abstract notion does not tell the whole story. The nature and scale of urban form is critical in shaping the places we live and work. Density has a direct impact on the type and character of the space around us. But it is also easily misunderstood. It is difficult for professionals, elected officials and the general public, to clearly understand the place-based context of different development densities.

Decision Commons, as a three-dimensional, place-based tool is an ideal medium to explore the potential impacts of changes in density. What would happen if we were to increase the building heights of a particular neighborhood? What would that look like and how might it feel on the ground? Decision Commons would not only allow for the real-time calculation of associated metrics pertaining to such a change, but would also let the user zoom down to street level to ‘experience’ what this might look and feel like.

This ability to interactively mix the analytical with the experiential to explore urban form questions can be extended to a broad range of examples. In the following case study, we will explore the concept using a procedurally generated, realistic model of a future condition. In this particular example, we are looking at potential future build-out of a new station area being planned in the Bel-Red / Overlake Corridor. Using the zoning parameters developed earlier in the process, we can procedurally generate plausible 3D urban forms that represent future conditions. We also might have a Building Information Modeling (BIM) model provided to us by a
developer or architect that helps anchor the neighborhood and needs to be integrated into the future urban fabric. From here we can work in an iterative fashion to explore different building height and use mix combinations. At the most basic level, what would it feel like if we changed the overall building height to 60 feet? What about 120? What if we changed the use mix from 100% commercial to 50% commercial and 50% residential and put more retail on the ground floor? Using a tool like Decision Commons would allow these kinds of questions to be asked and represented easily whether used as a simple communication tool, as part of a visual preference survey or as part of a more robust real estate analysis.

Interactively exploring different building height ideas helps planners, developers and various stakeholders to connect more directly with potential land use decisions. But it also allows for real time, question based analysis that extends to individual buildings.

**ANALYZE Building Level Control**
Because Decision Commons is built using a smart 3D data framework, building data can be viewed from individual, sub-floor levels up to and including multi-scalar aggregation of building communities. We could, for example, change the use mix of an individual building from 100% office to a 50-50% mix of office and residential. This would in turn change the three-dimensional representation of the building in the visualization, but it would also adjust the parameters for individual floor plates in the model. It would also provide numbers for a corridor or district-scale analysis of total residential units or jobs. Both scales of inquiry could be accessed by fluidly zooming in and out of the interface with appropriate data views being communicated in the most compelling format available.

We could extend these sorts of real-time analysis iterations even further by exploring relationships to other urban form metrics. Another often misunderstood but important measure of development potential is the concept of floor area ratio (FAR) and development incentives. While a relatively straightforward calculation to perform, FAR is arguably a metric best understood by visualizing in three-dimensional space. It is also a metric that is commonly used by jurisdictions to promote various development incentives. By providing certain FAR 'rights' based on achieving particular development milestones or programmatic needs, jurisdictions can help inform the shape and mix of uses of urban space.

Decision Commons is an ideal tool for exploring the implications of potential FAR-based incentives. In this particular case, we worked with the Cities of Bellevue and Redmond to understand how each jurisdiction structured their FAR incentive program. This allowed the Decision Commons team to shape a toolset that would directly benefit potential end users.

One of the major advantages of using a tool such as Decision Commons is this ability to interact with geographic and three-dimensional urban forms at a variety of scales. Vary few existing tools allow for the ability to seamlessly navigate between sub-building level analytics all the way up to regional scale analysis.
Interactively control building height...

... and visualize alternatives.
One of the key components of a successful planning and design exercise is providing timely and accurate environmental and regulatory review. This process, while critically important, is often cumbersome and costly. Huge amounts of time and money are being spent to collect, analyze and communicate different environmental review options throughout the analysis, outreach and submittal stages of development projects. Professional services to support these kinds of environmental and regulatory review exercises are currently a multi-billion dollar industry nationwide. If Decision Commons could recoup a small fraction of these costs, it could have a huge impact on the planning and development communities.

The structure of the Decision Commons platform is also an ideal tool for exploring these kinds of regulatory review challenges. Utilizing the core GIS capabilities combined with the sketch-based geodesign tools of Decision Commons, various alternative scenarios could be analyzed in an iterative and informed way. Specific environmental review metrics, for example, could be defined upfront and calculated in real time or near real time as various alternatives are developed. In this way, the design exercise can focus on the specific questions driving the process rather than the steps required to complete regulatory documentation. Due to the inherent geographic nature of the data necessary to analyze most of these regulatory studies, Decision Commons would make it relatively easy to output the results of the various alternatives into a format suitable for regulatory submittal. This step alone would offer substantial cost savings to jurisdictions and project proponents.
### Dashboard - Compare Scenarios

<table>
<thead>
<tr>
<th>Metric</th>
<th>No Action</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walkability</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household Density</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pedestrian Density</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Property Appreciation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Jobs Added</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Build Out Capacity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jobs / Housing Balance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access to Parks + Open Space</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access to Schools</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bicycle Infrastructure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transit Mix + Total Trips</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access to Transit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impervious Surfaces</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ANALYZE EIS Alternatives**
A key component of any planning process is the identification of important project values and goals. Specific to every project, they are a critical part of how decisions about alternative futures will be made. Decision Commons includes a variety of tools to facilitate this process and help map critical indicators and metrics to these goals. Using a brainstorm capture tool, end users can, through the support of a facilitator, collectively identify values and goals specific to the project at hand. This is accomplished using a “virtual whiteboard” that allows users to list, rank and weight various values and goals that can be used to drive overall project direction.

Once the key stakeholders have agreed on the values and goals specific to moving the project forward, it is important to connect them to information that can ultimately be used to support comparative decision making. This is accomplished by ‘mapping’ various indicators and metrics to individual values and goals. The figures on the opposite page provide a snapshot of how this might be realized. In each case, there may be multiple indicators and metrics supporting a specific project value or goal. In this example, you can see that the project goal ‘Create Walkable + Connected Community’ has been associated with three different indicators — walkability, household density, and pedestrian intensity. These indicators are then further divided into metrics to support each individual indicator. For example, in this particular exercise, the indicator for walkability is comprised of three individual metrics — average block size, intersection density and walkability score. These various indicators and metrics can then be aggregated up using multi-criteria analysis methods to inform and compare individual design scenarios. While these particular examples were relevant to the test case demonstration project, the concept of Decision Commons is to provide a flexible framework of indicators and metrics to support a broad variety of different planning and design processes.

By providing various ways to capture, record and evaluate various design scenarios, Decision Commons supports decision making by putting information first.
Identify project values and goals...

... and map to indicators + metrics.
An important component of any successful planning or design process is the ability to engage stakeholders and to provide transparency on the methods used to evaluate scenarios. This is critical for end user buy-in and support. Decision Commons, by design, allows for a variety of ways to access relevant information. In terms of indicators and metrics used to inform the process, they can be accessed at various levels of detail. At the highest level, the information used to support project values and goals can be summarized in a corporate style dashboard interface. This allows for quick review of how changes in the design impact the relative value of each alternative. Does the scenario that was just sketched move the needle up or down when compared with the other alternatives? What is the overall impact of the current design on the values and goals driving the process? This information is communicated and visualized in real-time providing critical feedback on scenario generation.

This kind of access to information is essential for engaging end user stakeholders and making them feel more connected to the project. But it is not enough to simply display this information without appropriate context. It may be helpful to have a general idea of how various alternatives are impacting overall project values and goals, but being able to drill down into more detail is essential. By providing access to the data and analytics that are powering the needles, end users can better understand specifically what is driving the differences in the overall dashboard results. It also a helpful way to quickly compare different alternative scenarios against each other. This can be accomplished in any number of ways — spatially through map comparisons, analytically through metrics and indicators and at the highest level through the project dashboard.

It is important to note that the evaluation component of Decision Commons is not intended to be a linear process — design, compare, decide — but more of an iterative one — design, compare, design, compare, etc. The Evaluate tools are accessible at all times during the planning process and provide a snapshot of how things have progressed. Individual process milestones can be captured and
recorded for the record so that they can be referred to and accessed at a later date.

Finally, the ‘Evaluate’ button has a number of features useful to the facilitator and to support the facilitation process. In particular, it provides some tools specific to enhancing collaboration and capturing stakeholder ideas and comments. An important component of any outreach strategy is the ability to capture user input and feedback. Decision Commons provides a venue to collect and store this information in a way that can be georeferenced and geolocated. If an end user has a particular comment about a specific idea on the map, their comment can be stored with a location stamp. This allows for later retrieval of all comments and feedback by relevant parties as both a tabulated list but also based on specific locations in geographic space.

---

**Dashboard - Scenario Evaluation**

- **Create walkable / connected community**: 3.0
- **Increase economic vitality**: 2.1
- **Promote creation of living wage jobs**: -0.6
- **Increase diversity + community activity**: 0.6
- **Improve mobility + variety of transportation options**: 3.0
- **Protect and enhance natural resources and community amenities**: -1.2

**EVALUATE Using Project Dashboard**
The examples presented in this document have only been a brief introduction to the potential power of Decision Commons. Based on the feedback the team has received through this process, there is unanimous support that a tool such as this would be a huge leap forward for the fields of sustainable urban design and planning. The Decision Commons team has spent the past year moving the project forward in significant ways and setting up the framework for how Decision Commons could be realized. It is a substantial piece of work that has been vetted by a diverse community of potential end users. The project team now has a good sense of what people want and how they might use a tools such as Decision Commons to advance their work. And while the Test Case demonstration has been focused on a specific corridor planning exercise in the Seattle metro region, the tool itself is designed to be used at a national scale.

The framework developed during the Test Case process has been focused on how potential end users in the design and planning communities — environmental, economic, public health, social equity, transportation and economic development — could best utilize a next-generation tool. While it is a robust demonstration of how such a system would be designed, the next major step is to build a working prototype. This requires a more extensive software development process. The Test Case work completed to this point has defined a clear strategy forward with robust end user requirements and clear technical development pathway. This process is currently moving forward but is seeking further resources to advance this development.

Further development of Decision Commons also requires continued support and feedback from end user communities. Over the coming months, the Decision Commons team will be seeking strategically aligned partners to help advance overall functionality. Early supporters of the Decision Commons project would work directly with the team to advance specific end user needs. In exchange, the Decision Commons team would engage with jurisdictions to share data and experiences and build on the work completed thus far to support the specific needs of end users. These potential partnerships present a unique opportunity for jurisdictions and municipalities to help shape the future of the Decision Commons tool.
For more information, contact:

Runstad Center for Real Estate Studies
College of Built Environments
University of Washington
424 Gould Hall, Box 355740
Seattle, WA 98195
(206) 616-9042
www.decisioncommons.org

Decision Commons Team Members:

George Rolfe
Suzanne Cartwright
Robert Matthews, AICP
Critter Thompson
Jason Oliveira, AIA

Edited by Critter Thompson
APPENDIX A:

Decision Commons is designed to leverage existing tools and workflows. The vast majority of the data required to get a system up and running are available in most metro regions. These data include, but are not limited to GIS data, 3D modeling data and general assessor and land use data. This section describes, at a high level, what sorts of datasets are required to connect a project to the Decision Commons framework.

The data needs listed to the right highlight some of the basic building blocks to creating a successful Decision Commons implementation. Each individual partnership or project will have data needs and desires that are specific to that project.

<table>
<thead>
<tr>
<th>Category</th>
<th>Dataset</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Built</td>
<td>Parcels</td>
<td>vector</td>
</tr>
<tr>
<td>Built</td>
<td>Building Footprints</td>
<td>vector</td>
</tr>
<tr>
<td>Built</td>
<td>Zoning/Land Use</td>
<td>vector, data</td>
</tr>
<tr>
<td>Built</td>
<td>SketchUp Models</td>
<td>3D</td>
</tr>
<tr>
<td>Built</td>
<td>Revit Models, BIM</td>
<td>3D</td>
</tr>
<tr>
<td>Built</td>
<td>Park/Open Space</td>
<td>vector</td>
</tr>
<tr>
<td>Built</td>
<td>Geographic Boundaries</td>
<td>vector</td>
</tr>
<tr>
<td>Terrain</td>
<td>Lidar, DEM</td>
<td>raster</td>
</tr>
<tr>
<td>Natural</td>
<td>Topography</td>
<td>raster, vector</td>
</tr>
<tr>
<td>Natural</td>
<td>Hydrology</td>
<td>vector</td>
</tr>
<tr>
<td>Natural</td>
<td>Critical Areas</td>
<td>vector, data</td>
</tr>
<tr>
<td>Human</td>
<td>Demographics</td>
<td>vector, data</td>
</tr>
<tr>
<td>Transportation</td>
<td>Street centerlines</td>
<td>vector</td>
</tr>
<tr>
<td>Transportation</td>
<td>Transit networks</td>
<td>vector</td>
</tr>
</tbody>
</table>