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Three New Forms of Movement That Encourage Walkable Urban Designs

ABSTRACT

New movement technology is currently becoming reality around the world. PRT (Personal Rapid Transit) now sometimes called ATN (Automated Transit Network) is currently available at Heathrow airport with systems in various planning stages in South Korea, San Jose, CA -Sam Mineta Airport, and Abu Dhabi, United Arab Emirates - Mazdar City. Technology that allows elevators to move three-dimensionally is currently applied in the Tower of Terror ride at Disneyland, Anaheim, CA. New automobiles are appearing highlighting electric power sources, smaller sizes and even collapsible -- such as the City Mobile car designed at MIT. All of these technologies offer one new important design feature – their ability to interface three-dimensionally both inside and outside of buildings. They can also simultaneously provide freight applications and link multiple transit systems, changing transportations' relationship with urban design and architecture.

These new technologies provide the opportunity to create more walkable transit friendly environments by allowing more compact and interconnected ways to design and move through space. They have the ability to arrive more quickly to their destination – even more time-efficiently than a car and more time-efficient than the standard transit loop or line systems; therefore they can encourage and hopefully increase transit use. New integrated solutions that address multiple overlapping issues such as energy sources, the environment and persons of disability accessibility can also be addressed. Several key issues are involved in encouraging more transit use and the solution lies in their interfaces and overlaps, not in their isolation. The issues are: (1) mode of transportation, (2) energy source/sustainability, (3) human interface, (4) physical location, and (5) actual design.

All of these issues will be explored independently and then with their interfaces and overlaps providing solutions that these new technologies allow. Integrating new forms of movement is a more sustainable solution that allows for stations within easy walking distance encouraging walking. Initially these systems are being implemented in two areas – local existing environments such as airports and entirely new cities. This paper will examine the linkages for the Southern Polytechnic Campus of 2050 using one or all of these new technologies to create a more fully accessible walkable sustainable campus design.

PRT was first implemented in the United States at Morgantown, West Virginia at West Virginia University using small point-to-point driverless vehicles (a system where you go directly from your point of origin to your final destination – no stops in between) called Personal Rapid Transit (PRT) and the system is still functioning today providing unique transportation choices for the university and the town. With the vehicles providing an on demand, point to point service; a small transit vehicle (optimal number is around 4 people) offers many positive benefits along with greater capabilities to move more people more time efficiently. The off-line station concept that is crucial to the efficient functioning of the on demand, point-to-point system presents some new opportunities for station design. This transit system, PRT, has the capabilities to link the 5 key issues mentioned above. The system also allows for expansion of use as needed with only the cost of additional vehicles. The original vehicles upfront costs could be limited to a small

fleet; expansion as appropriate. The other technologies offer similar benefits in unique ways.

These newly emerging movement systems will allow easier access for all ages as station design can now be integrated within buildings at multiple levels. Navigating steep topography as well as connecting multiple other forms of transit to create a seamless system will allow faster and smoother access for all. Linking spaces and places in entirely new ways, the architects' unique spatial training will become essential in allowing these new technologies to be implemented to their full potential.

The students' analysis of existing conditions as well as their unique solutions to connections and interconnections will be presented along with a review of the technologies and their connections to automobiles and other forms of transit.

FULL PAPER

There is a direct relationship in the ability to move around our built environment in a timely, accessible, and sustainable way and to the success of that living environment. Providing choices and options for each user can provide the greatest success in achieving this goal. Finding long term sustainable energy, environmental, planning and financial solutions that can work for all and across our diverse country is difficult especially if depending on one or two forms of movement. Relying on the private car fueled by gasoline also poses the issues of parking and roads that spread out the distances between buildings in villages, towns and cities. Adding transit brings more cost into the equation while frequently extending travel times due to the combination of travel time of car and transit - discouraging transit use. Walking only is a good option if the center is designed within distances that the user will accept and also link to multiple flexible transit options,

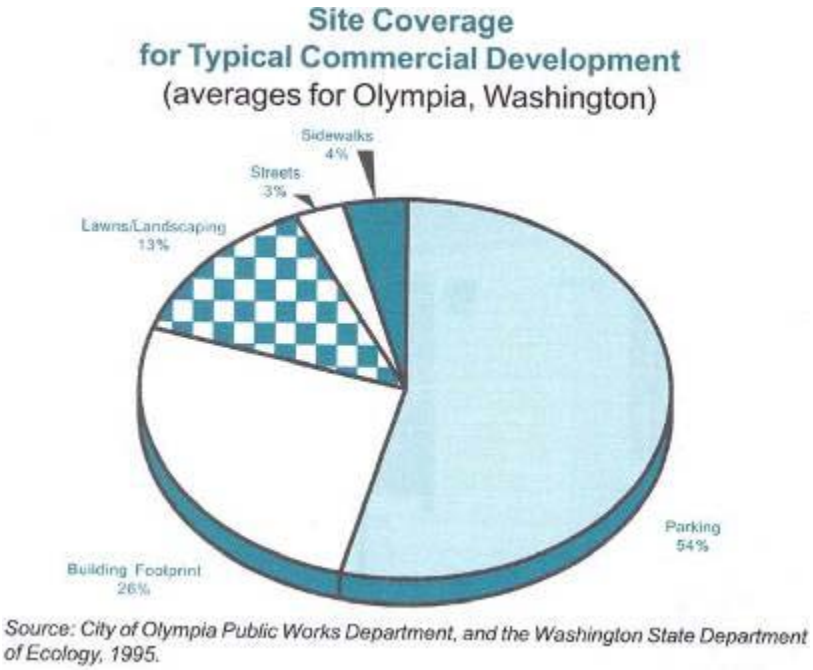

FIGURE 1 Illustration of Site Coverage for Olympia, Washington

however weather, carrying items, persons of disability and aging population concerns can make this approach not feasible for all. Concurrently addressing the full environmental impact adds even more challenges to finding appropriate solutions. Not incidentally the amount of land consumed for parking cars can be at least 54% of the total land area

coverage in a typical commercial development as documented in a study by the public works department for the City of Olympia. **(Figure 1)** Parking for business and housing as well as for multiple other needs adds to the complexity for solving full accessibility movement issues. Add into the mix the need for delivery and freight in a timely way so that business can prosper and the complexity is overwhelming and the sustainable solutions hard to find. Many focus their research on one or two aspects; however this is starting to change as it is in the combination of the issues where better solutions can be found. The architect is trained to balance and resolve the multiple complex issues typically also "customizing" for the specific site, owner and location with training in synthesizing this spatial complexity. However, the architect is frequently consulted for the purpose of designing a single building or to focus on what the built environment "looks like". While aesthetics is of key concern to an architect, how that is obtained is by finding solutions that balance ***all*** of the design needs.

Creating walkable transit friendly environments requires more compact and interconnected ways to design and move through space. Currently emerging new movement technologies such as personal rapid transit (PRT) sometimes known as automated transit networks (ATN), three dimensional elevators and some new automobiles are appropriate for creating more interconnected and walkable environments. There are many additional benefits for the application of these technologies in our built world such as accessibility for all, sustainable energy use, more affordable land use patterns, cost effective transit, ability to connect with all current forms of movement, ability to be constructed in existing and historical environements, simultaneously used as a freight application and cost-effective interconnected station design. All of these technologies offer one new important design feature – their ability to interface three-dimensionally both inside and outside of buildings, changing transportations' relationship with urban design and architecture due to their size and energy source.

These new technologies have the ability to arrive more quickly to their destination – even more time-efficiently than a car and more time-efficient than the standard transit loop or line systems; therefore they can encourage and hopefully increase transit use. In the analysis phase of our design project at SPSU, one student timed the one way loop transit system that had just been implemented along with the opening of the new parking garage. At SPSU the time required to go from one point to the next on the bus shuttle was in almost all cases excessive in comparison to the walking time through other campus paths. Rarely was anyone seen on the shuttle as it did not even address the needs of persons with disabilities. **(Figure 2)** This is not an unknown condition for other built

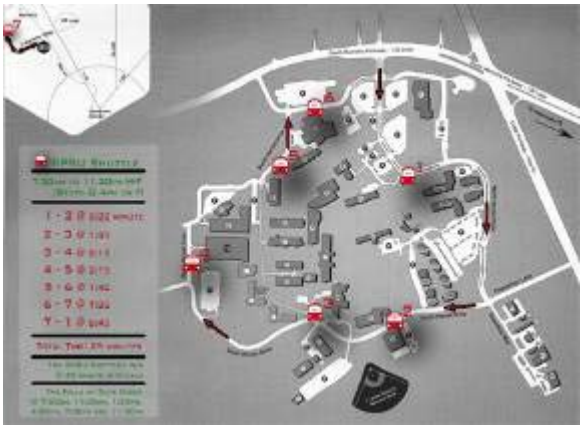

FIGURE 2: Southern Polytechnic State University student, Kira Melville analyzing existing one way loop transit system and travel times.

conditions as adding a shuttle or bus connector system is the first response when enough parking is available but not within walking distance to destinations. While the intent was appropriate the integration with the existing environment was not explored. The weather, topography of the land (hilly versus flat) also contributes to a successful design strategy if a fully accessible environment is to be created. New integrated solutions that address multiple overlapping issues such as energy sources, the environment and persons of disability can be addressed with these new technologies. Several key issues are involved in encouraging more transit use and the solution lies in their interfaces and overlaps, not in their isolation. The issues are: (1) mode of transportation, (2) energy source/sustainability, (3) human interface, (4) physical location and (5) actual design.

All of these issues provide new solutions that these emerging technologies allow due to their synergistic qualities. Integrating new forms of movement that allows for stations within easy walking distance encouraging walking while also providing for those with disabilities is the most sustainable solution. Initially these new movement systems are being implemented in two areas – local existing environments such as airports or other activity centers such as hospitals and Universities and creating entirely new cities. Interweaving or linking paths for humans and paths for transportation is the future, and is quite achievable in many accessible ways, but we must embrace the technologies that can make all of this possible. This paper will examine the linkages for the Southern Polytechnic Campus of 2050 using one or all of these new technologies to create a more fully accessible walkable sustainable campus design.

FIVE OVERLAPPING ISSUES

1. Modes of Transportation

The "standard" modes of transportation choices are: walking, bicycle, motorcycle, car and transit. Walking and bicycle offers some solutions within certain distances however, will not address the full range of human needs. Bicycling extends this distance and is used in Japan as part of the commuters experience from home to parking/transportation centers. **(Figure 3) (Image 1)** Motorcycle extends this distance

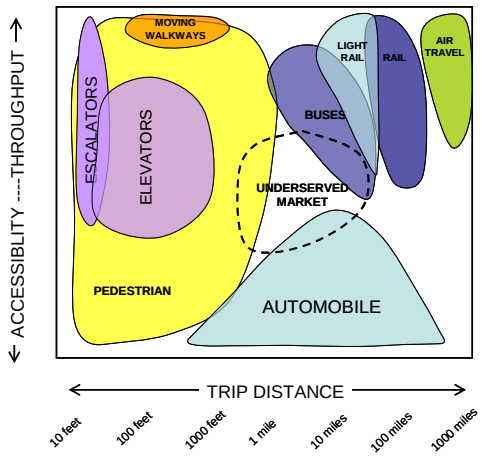

FIGURE 3: Conceptual comparison of modes in the Accessibility – Throughput spectrum from Young, Miller, McDonald. Keys to Innovative Transport Development. Presented at the 87 Annual Meeting of the Transportation Research Board, Washington, D.C., 2007.

even further. The car can now come in various sizes such as the electric cart all the way to the largest delivery vehicle with various ranges in-between, while transit can involve a bus or trolley rather than the more expensive forms of transit such as heavy rail and light rail. Depending upon each situation all forms of transportation can be found to serve

different movement distances and needs. Movement needs are complex and interconnected and the new movement technologies allow for these connections and interconnections to occur.

A form of advanced transportation first developed in the United States at Morgantown, West Virginia, West Virginia University using small point-to-point driverless vehicles (a system where you go directly from your point of origin to your final destination – no stops in between) called Personal Rapid Transit (PRT) is still functioning today offering this University city unique transportation choices. With the vehicles providing an on demand, point to point service; a small transit vehicle (optimal number is 4-6 people) offers many positive benefits along with greater capabilities to move more people more efficiently. The off-line station concept that is crucial to the efficient functioning of the on demand, point-to-point system presents some new opportunities for integrated station design. The ability for point-to-point travel so that each user goes directly to their destination, allows the small scale vehicles to work in a networked interlaced system rather than a ring or multi-pronged linear layout. A networked system provides the opportunity to make connections and linkages that the typical forms of transit cannot, re-defining the planning relationships of parking, transit and their

Image 1: Japanese Bicycle Commuters

destination locations.

A modern application of the technology is currently being installed at Heathrow Airport from parking to airport terminal with many other urban design applications on the way in Europe and Asia. This transit system, PRT, has the capabilities to link the 5 key issues. The system also allows for expansion of use in a cost efficient manner. The original vehicles upfront costs could be limited to a small fleet and the infrastructure required is not as costly as other transit systems starting small but planning for expansion is the ideal.

The original vision of PRT in the United States was as a dual mode vehicle called the Starr Car, designed by William Alden. A dual mode vehicle is one that can travel on the typical highway allowing access into a low density farmland environment and as well become a part of a larger transit system as appropriate, within more urban conditions. The dual mode vehicle is still currently under study at the Texas Transportation Institute and several papers have been presented at the Transportation Research Board on this topic.

Automobiles are now being produced with alternative energy sources as we see the electric vehicle now coming to the public market. A small electric vehicle provides similar synergies with the built world as PRT. Many similar vehicles have been in use around the world providing transit options such as CyberCab in the Netherlands.

Elevators have also been transforming providing destination based services. The technology has been applied in the Tower of Terror ride at Disney. Point-to-point vertical travel within the building along with the technology that allows both a vertical and horizontal movement experience without any transfers can also be used in an outdoor horizontal application. All of these emerging technologies can bring our built world closer together.

2. Sustainability – Energy Sources/ Environmental Issues

Sustainability occurs on many levels in transportation. Energy, time-efficiency, air-quality, land conservation, cost-effectiveness, and reduction of single occupancy vehicle use are the key points to take into consideration in defining transportation sustainability.

New energy sources such as electric, solar and fuel cell are being considered as more viable solutions, although their research has been on-going for over 40 + years, with the electric vehicle popular in the early 1900's. On-street charging stations for electric vehicles are now reappearing. They were found on our streets at the turn of the 20th century for the electric car. Parking facilities have provided charging stations in the past and we will soon see this again. The electric vehicle is an appropriate solution for most commuting needs. These new energy sources can also apply to buildings as well with the potential of transportation interconnecting with architecture; powering each other. A recently constructed parking facility, the Fairfield Multi-Modal Transportation Center, Fairfield, California, 2002, designed by Gordon Chong (the firm is now known as Stantec Architecture) has solar panels on the façade to assist with energy use of the building. This can also provide power to vehicles, creating a totally linked system.

Integrating planned parking and new forms of movement throughout an urban plan or activity center in the early stages of design is the most realistic solution for many living environments' in the United States, as walking can then provide for the remaining needs for most of the users for interconnectivity. SPSU has this opportunity to implement new movement technologies in order to create multiple movement options and a fully accessible campus. However in many existing situations land may not be available nor may the existing plan lend itself easily to this solution for full access. People with disabilities, our older population and freight needs require other solutions for full mobility and human occupation. Combining peripheral parking lots and parking facilities with a sustainable form of transportation such as electric buses (Emory University) is one solution, but not always the timeliest or most accessible for immediate needs of the user. With the size, age and complexity of many of our urban environments this solution does not often provide enough flexibility for many of the multiple short-term daily interactions for the users within the site (inter site movement) that also needs to occur. Parking appropriately sited and then designed throughout the site can provide for many needs however this approach is also not the panacea for creating fully accessible urban designs.

Creating small strategically placed multi-modal parking facilities can assist in linking sustainable power sources for multiple efficient uses of building and machine. These new technologies are the perfect systems to begin to connect all of the possibilities to create more sustainable power and energy sources due to its new paradigm of smaller vehicles. In addition a technology with point-to-point on demand travel provides a safe and accessible approach that in and of itself has greater safety and accessibility due to the small size of the vehicles (4-6 persons) directly into buildings. The PRT system also provides a level of service to those who cannot walk or drive that cannot be found in any other transit system.

3. Human Interface

The important factor is the physical integration of all of the daily life needs for a person so that walkability and accessibility for all can go hand and hand. Fully integrated parking facilities can be linked with mixed use such as at the University of Pennsylvania, Philadelphia, 2002, were a parking facility/grocery store provides for the multiple needs of walkers, bike riders and car users in a University campus setting. These synergies create greater feasibility for multi-tasking, reducing automobile trips and providing integrated solutions for better time management. Integrating mixed-use to develop fully functioning living environments is a good approach to reduce multiple trips by automobile for daily living. In Des Moines, IA, one peripheral parking facility is connected with the bus system of the city, a day care center, dry cleaning, video rental and other typical daily/weekly living needs. This allows the user to consolidate daily/weekly needs in a time and cost affective way. Allowing these multiple connections can provide easier access for persons of disability and other user groups such as the elderly. Linking transit with these mixed-use centers further expands the ability to serve wider population needs. even without an automobile a person may be able to function independently in a safe and accessible way.

Accessibility is about more than providing for the persons of disability and meeting a set of safety rules; it is about providing mobility for all of us over our lifetime – Universal Design. As at some point in our lives all of us will face challenges in order to be mobile. Transportations' future will be dependant on the ability to provide access for everyone at every stage or point in their lives, especially as our population ages. This comprehensive view of transportation accessibility requires a broad vision for how many different systems can work together in combination with our existing built world to meet this goal, as one specific system can never meet all of our needs. The United States due to its size, breadth and complexity of living environments from urban to rural and everything in between demands that we embrace and support a comprehensive network that interconnects all of us within our living places, from our starting point to our destination -- for every stage in our lives. Interweaving architectural solutions with transportations technological advances can address the full meaning of accessibility even for people that do not physically require it but their existing living environments do – such as traffic congested edge cities. Building upon the existing transportation systems that are now evolving to meet today's sustainable challenges and the varied architectural environments that currently exist; if we embrace emerging viable technological solutions that are called "people movers", then we can learn the meaning of bold ideas to meet big challenges – total accessibility for all.

4. Physical Location

Due to the complex nature of human existence, multi dimensional and interconnected movement can provide the most accessible environment. Also, the need to move many supplies and deliveries is paramount to the success of all movement needs. These three technologies again due to the small size of the vehicles can also provide vehicles for delivery within the same structure and technology as the system for people. Placing all multi modal station on the peripheral of the center does not provide the best planning solution for time and multi-use. Many new planning and architectural opportunities exist for integrating multi-use facilities and vehicles within smaller footprints allowing for greater flexibility and more frequent smaller transportation centers. Flexibility in planning and design while providing greater access is the benefit of integrating systems within the overall planning environment. Movement technologies that we can directly access from within a building can provide a safe and accessible way for certain travelers such as the elderly and children to reach their destination safely. A true

interweaving of man and machine will provide better access and flexibility while creating wonderful new spaces for nature and man to exist at multiple levels and in surprising ways. Providing these options in conjunction with walkable environments can be created optimizing our living solutions.

Downtown Minneapolis is an excellent example of how multi-levels are used for greater pedestrian access to the city. The "second" level of the city interconnected by the skywalk system is directly links parking facilities and the urban fabric of the city. The parking facilities are spaced appropriately for easily access from outside multiple points. Pedestrians can easily, quickly and safely move around the city as there are no traffic and road issues to interact with. A new way of connecting between places, is also created as a more "natural or flexible way to connect is achievable.

A more "natural" approach to pedestrian movement can be established while providing a safe interaction with machines. A more "natural" approach to movement can be described as a networked system. **(Figure 4)** This networked system opens up new locations for retail, parks and people places that were previously not available within the grid or spoke and wheel organizational patterns for such use. If the networked system allows and encourages multiple spatial overlaps between levels even more possibilities and linkages are created.

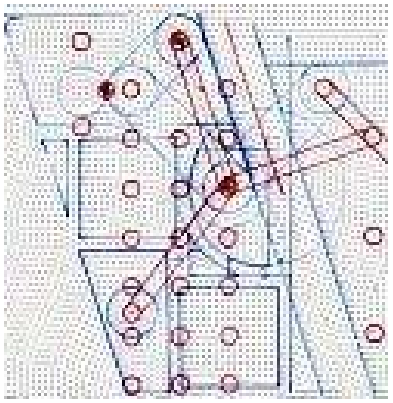

FIGURE 4: Montana State University student, Matthew Killham visualization of new ways to provide linkages with these emerging movement technologies.

When integrating all of the 5 issues discussed above, one form that they could take would expand upon the early visions of Eugene Hennard and Daniel Burnham's Chicago Plan. These plans created multi-levels for different modes of transportation along with full integration into buildings. Every building type was combined along with parking integrated throughout as early as 1920; combined inside of buildings as mixed-use structures along with active pedestrian/commerce friendly streets these living environments were well ahead of their time.

These three new movement technologies can integrate wonderfully into this type of spatial complexity further expanding and developing new movement possibilities and ways to interact in our built world. This is an approach to movement and spatial design that allows for more efficient land use while combining the best of living environments for man. A complete synthesis of needs and uses that while demanding good initial planning offers far more flexibility for growth and change than the typical organizational patterns.

5. Actual Built Design

Integrating with existing historic structures is now feasible due to the size, scale and technologies that can be applied to the mode of transportation. New movement technologies have been historically integrated in beautiful ways as in the Country Club Plaza community in downtown Kansas City. Country Club Plaza began as a new development by Mr. Nichols that was structured upon and expanded the older street grid of Kansas City. The existing street grid expanded creating a new area that was newly designed to accommodate the automobile and transit. The approach that was taken in the mid 1920's when this area was started has proven its longevity as it is still a viable community today allowing further growth and development to meet modern needs and demands. However is reaching a current maximum movement density that may limit more growth. Parking facilities and transit were considered an integral part of the community design and given full aesthetic attention in keeping with all of the buildings in the community. As the area continued to expand over the last century this approach was sustained. Active street fronts are found and parking is integrated fully with other building types throughout the community. However, even with this great "historical example" to sustainable community design that is now becoming the "standard" for development today; the level and density of parking is quite amazing and traffic issues are beginning to emerge at country Club Plaza.

The next level of integration would be to provide a way to move throughout the activity center in a timely way. This is where the integration of these new technologies could assist in the further viability of the community. Most people park close to their intended destination; however in a downtown activity center such as Country Club Plaza the goal is to encourage visitors to walk throughout the entire area. Walking of this more non-directed type is discouraged if the user finds themselves further from their end use vehicle and also carrying many packages or if they are persons of disability, with children or elderly. Strategically what occurs is that people plan where to park, where they can have optimum access to their intended destinations and this goal may not always be attainable or even desirable. So, in order to further expand the usability as well as create easier accessibility, these new technologies can provide the flexibility as well as the time and accessibility aspects. Designing the activity area and parking facilities to maximize the potential interfaces and linkages is of paramount importance.

The placement of the parking as surrounding feeder areas similar to Louis Kahn's proposal for downtown Philadelphia in the 1950's where he called the parking facility the defenders of the city was not the chosen solution by the city planner Edmond Bacon. However, these parking facilities were imagined as mixed-use residential structures with public parking and placed around the perimeter of the city within walking distances to the center city. However, this plan did not addresses the issues mentioned above and it could be imagined would move their car as to meet their needs appropriately. Wisely, Edmond Bacon took the opposite approach and integrated parking fully into buildings and all around the city; however the issues of easy accessibility to all areas of the city became challenged by the shear numbers of automobiles – grid-lock! It was during this same time that Victor Gruen, Paul Rudolph and Ulrich Franzen began to imagine and design with parking integrated throughout the community along with small vehicles underground that could take people all around quickly and easily. It was from Victor Gruen's background in shopping center design that he understood the "walkability" dilemma.

Now more than ever as we want to limit the amount of driving we do and consolidate our shopping and work trips. Today we can further expand upon Victor Gruen's idea and use elevators, people movers, PRT and automated parking technology allowing transit or vehicles to move within buildings allowing these connections to be even more interconnected. This can provide more flexibility and synergy for multiple

overlaps and connections Human living spaces can now be developed on multiple levels similar to Des Moines, IA and Minneapolis, MN and as envisioned by Victor Gruen. Other environmentally sustainable solutions such as green roofs and integrated water and food production solutions can also be integrated within multi-levels. A fully networked livable environment can be created.

SOUTHERN POLYTECHNIC CAMPUS DESIGN 2050

Analysis of SPSU Existing 2009 Conditions

The architecture students at Southern Polytechnic State University were excited about the idea of designing the SPSU campus of 2050. They proposed how the University could expand in academics and student enrollment, proposing new courses of study and an expanded campus, while contemplating how education might be delivered. They were given one requirement: to integrate newly emerging movement technologies into the campus plan. They began by analyzing the history, evolution and existing campus conditions.

University History

As part of the design process it is important to understand the history of the site and area as the past always holds seeds for the future. As SPSU was founded as a technical institute and continues to day to emphasize technology education this University appeared the appropriate place to embrace and utilize these new movement technologies. Upon further research the University also has historic and current research with movement technologies such as automobiles, submarines, and aircraft. Currently research with electric vehicles, Formula One cars, and submarines provided the core for embracing a 2050 vision. Solar power and nuclear plant technology are the core energy research areas for the campus. The University also had an unusual activity – the bathtub races, where bathtubs were converted into vehicles and then raced on the campus ring road. A great campus to think about new movement technologies! A very brief history:

1948 - SPSU was founded as the Technical Institute
1958 - SPSU became the Southern Technical Institute
1961 - Hoyt McClure/ Acting Director led to the movement of building 8 buildings on 120 acres of land.
2009 - Southern Polytechnic State University expanded and now encompasses more than 230 acres and 35 buildings.

SPSU figure/ground

The campus is a “typical” ring road campus with the original buildings constructed with the typography in mind. The first buildings were nestled into the hillside and oriented for passive heating and cooling - a very environmental approach. Over the years the development has expanded the ring round and the buildings have not been oriented with either the typography or environment as part of the design strategy.

The campus is located with highway access to downtown Atlanta and Chattanooga TN. The students were very interested in the connectivity between their campus and these locations as well as to both Georgia Tech and Georgia State in downtown Atlanta and The University of Georgia in Athens, GA.

University Planning and Goals

This is a commuter campus although housing is expanding as more traditional students attend. The campus also provides training and continuing education programs mainly at night. Parking therefore is required as part of the mix for the suburban Marietta, GA campus of Southern Polytechnic State University. The campus recently constructed its first parking structure. The majority of the small lots close to existing buildings, the historic pattern, remain, however the plan moving forward is to construct more parking facilities on the ring road. One student documented the congested area of traffic and they were located at the entry points to the campus- not where any parking structures have been built or are planned. This actually decreases the walkabilty due to this strategy due to the topography and the needs of the users and no attempt was made to address handicap accessibility within these plans. This is a common development strategy, however often implemented without any overall planning looking at the total movement and structure of the campus.

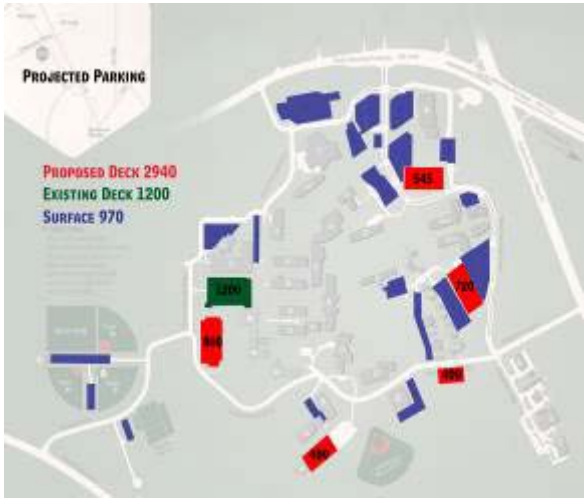

FIGURE 5: Southern Polytechnic State University student, Katie McCulloch analyzing projected parking.

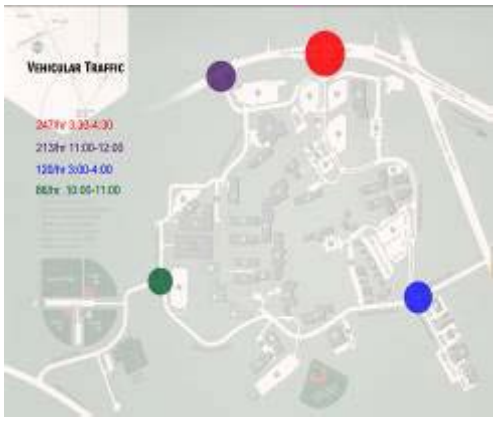

FIGURE 6: Southern Polytechnic State University student, Katie McCulloch analyzing vehicular traffic.

The University has joined the American College and University Presidents Climate Commitment to sustainability and implementing one of these movement systems would be another way to addresses these goals. One student documented all of the natural existing conditions, sunlight, orientation, weather among others so that the original approach to sustainability could be understood and new buildings could address these concerns.

Others students documented the potential student growth of the campus and every student suggested new areas of study that would fit with a technology campus.

Handicap Accessibility

One student thoroughly studied accessibility on campus; mapping and photographing the entire campus. This campus is basically not accessible and had many needs in meeting these goals. If one of these new movement technologies were to be implemented all of the issues related to solving this complex problem could be addressed.

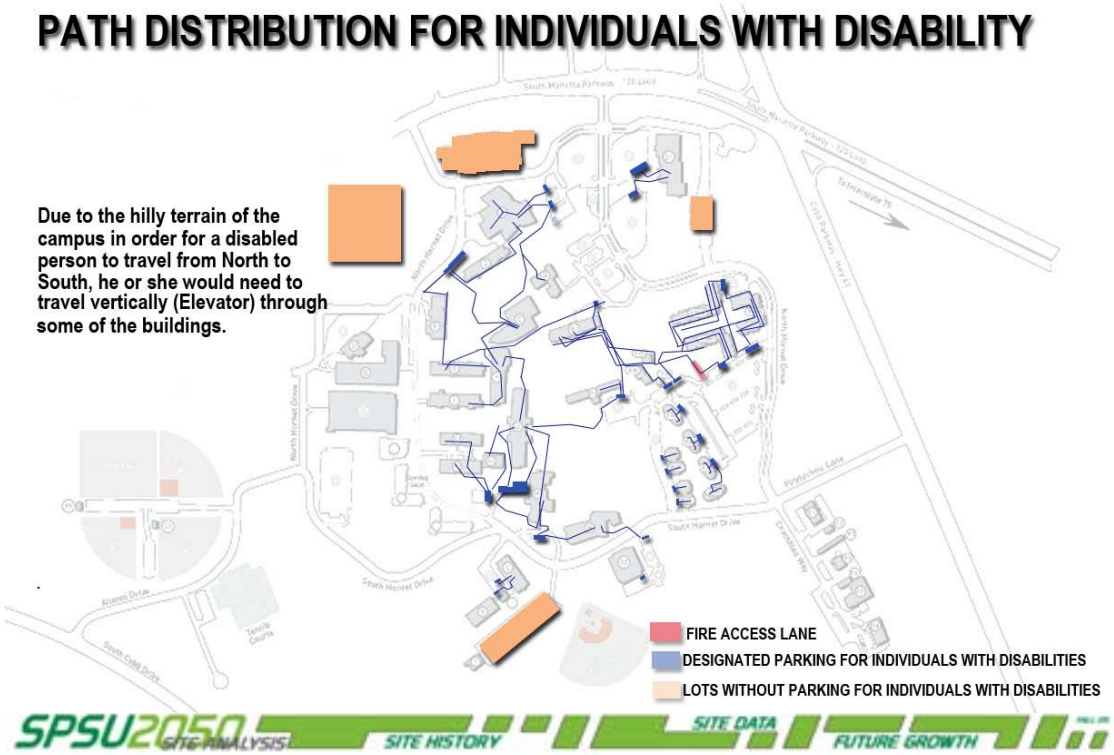

FIGURE 7: Southern Polytechnic State University student, Omar Foster analyzing path distribution for individuals with disabilities.

Walking and Inter-Site Movement

The campus is however quite walkable for the mobile, except if you are carrying many items, walking late at night or dealing with bad weather. The students documented these times as well as the areas of campus that received the most foot traffic. The students also documented the vegetation and walking paths. The new bus circulator was also tracked for the arrival and destination times to compare this to walking.

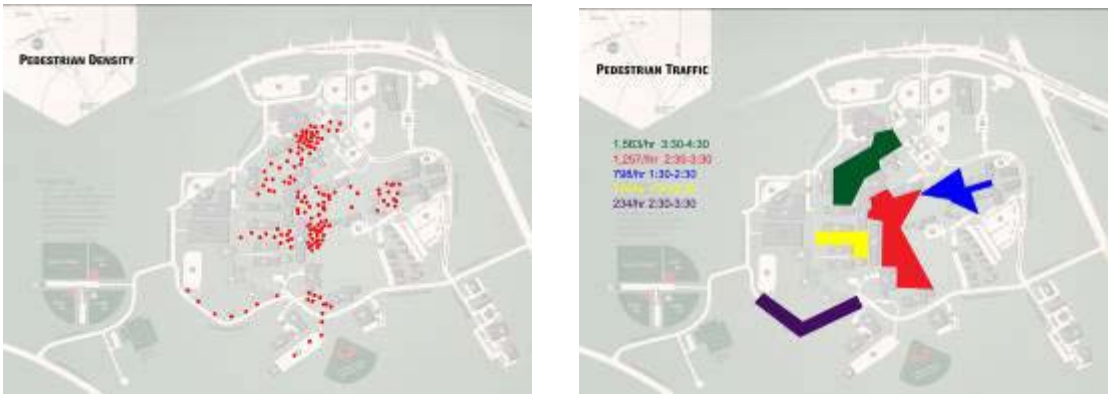

FIGURE 8: Southern Polytechnic State University student, Katie McCulloch analyzing existing pedestrian density and pedestrian traffic areas.

FIGURE 9: Southern Polytechnic State University student, Kira Melville analyzing walking times.

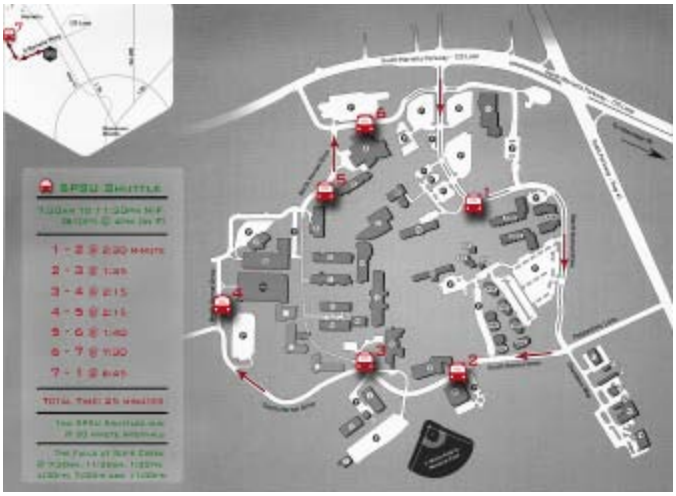

FIGURE 10: Southern Polytechnic State University student, Katie McCulloch analyzing shuttle times.

Final Analysis Review

Each architecture students' analysis resulted in a full power point presentation showing in full detail the results of their work – all of this cannot be presented in this paper.

Final Designs

When working within the existing campus the existing infrastructure of the road systems may handle a PRT type transit but typically would not allow the full development of its potential as a networked system. However, by starting with the existing road infrastructure, a base for the new PRT transit system can be established. PRT can function on the road based system reducing upfront costs, provide less congestion by eliminating individual drivers, and provide easy access to existing connection points while allowing for multiple destination points. This will provide for the user reduced travel time and therefore encourage transit use. Also due to the size of the vehicle and its on-demand capabilities, it can also reduce overall fleet size or at minimum allow for better management based upon demand.

Retrofitting the existing parking facility with charging stations can provide another energy source for these new technologies. Off-line vehicles can be charging as other vehicles are in use. This is the way that early electric car fleets operated. So integrating a small fleet of vehicles can provide the more cost-effective option for transit applications. When walking is not an option for connectivity between buildings and for the user, starting with existing conditions and providing a level of service that will encourage transit ridership within an activity center with minimum up front expense would be a great place to begin to implement new movement system and encourage transit use. The advantage is its ability to expand slowly and its ability due to its size to and to then expand to a multi-level system as needs and demand require.

Each student took different approaches to how all of these issues were combined. Here are just a few visual examples of solutions. Each students unique solution could be developed into a full paper of its own, but the underlying consensus was that these small flexible new movement technologies can allow a new way to move around campus that complements walking, can resolve issues for persons with disabilities, provide a way for freight or delivery to occur on campus and provide options when needed for all of us. Therefore it was viewed as a complementary system that would encourage walking.

FIGURE 11: Southern Polytechnic State University student, Kira Melville station locations.

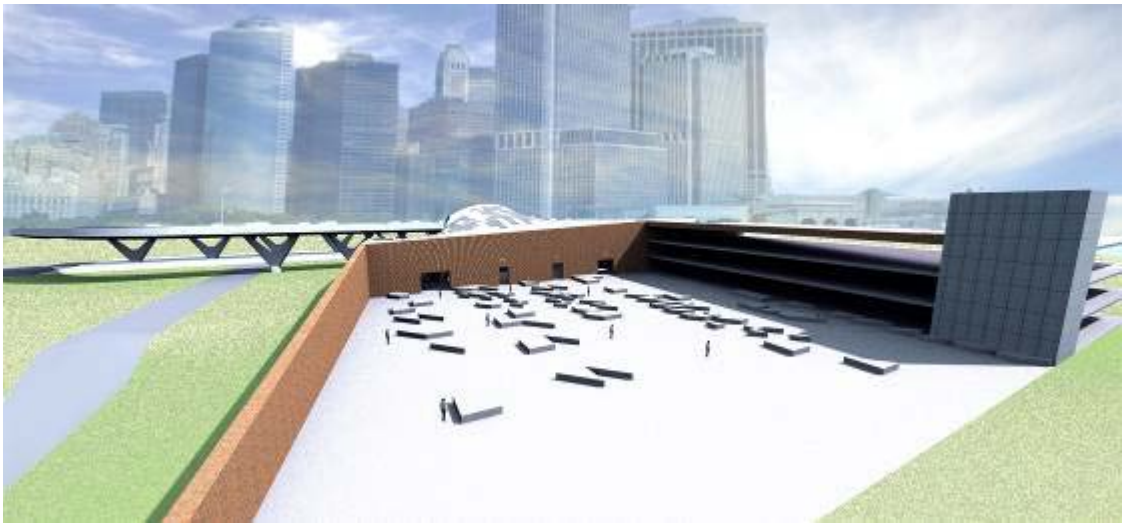

FIGURE 12: Southern Polytechnic State University student, Scott Hardin showing connections to multiple modes.

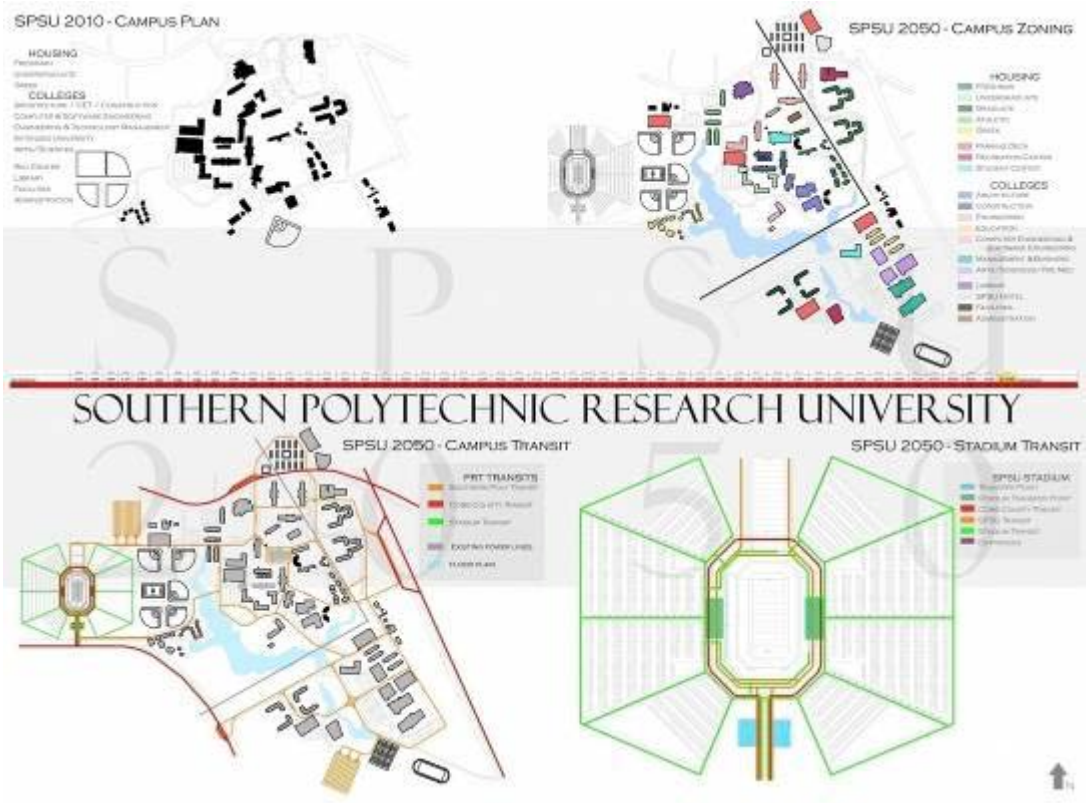

FIGURE 13: Southern Polytechnic State University student, Ryan Tolle – Campus Expansion with new movement system connectivity.

Sources:

McDonald, Shannon. *The Parking Garage – Design and Evolution of a Modern Urban Form.* Urban Land Institute, Washington, D.C., 2007.

Young, Miller, McDonald. Keys to Innovative Transport Development. Presented at the 87 Annual Meeting of the Transportation Research Board, Washington, D.C., 2007.