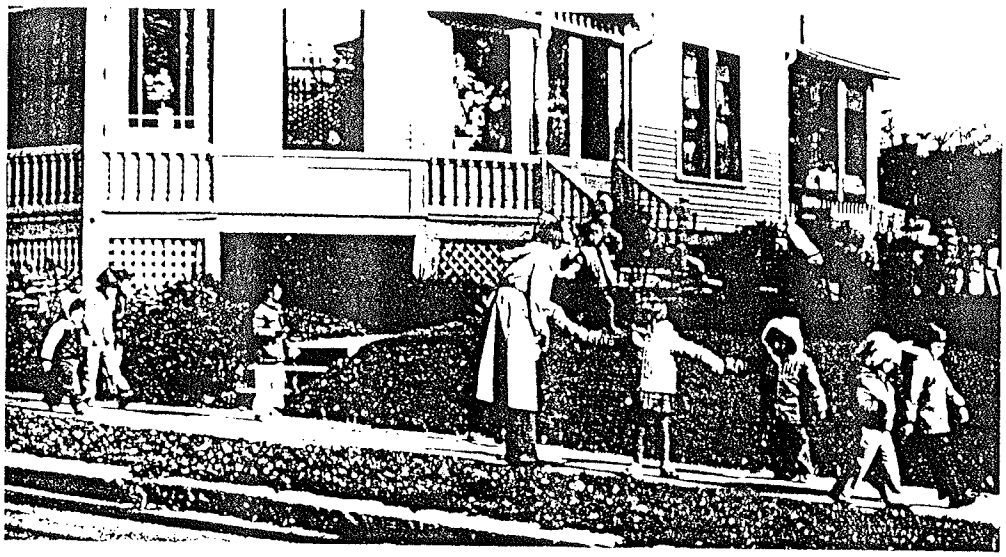
Final

BURLINGTON COMPREHENSIVE PEDESTRIAN ROUTE STUDY



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August, 1993

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The existing pedestrian routes within the City of Burlington have been characterized by traditional sidewalks, several alleyways, and the bikepath along the lake. Presently, there are several areas of conflict that exist on these different routes throughout the city. This study involved identifying these areas of conflict with recommended improvements as well as suggesting additional innerblock connections from the immediate central-business district to the waterfront.

CITY WIDE PEDESTRIAN ROUTES

CURRENT CONDITIONS

An evaluation was conducted to review pedestrian crossing locations with respect to safety conditions at several specified locations throughout the City of Burlington. A total of twenty-three locations have been identified with consultation of the project team, City of Burlington officials and Chittenden County Regional Planning Commission representatives. Each location was visited and photographed with observations of pedestrian activity, making notes of identified problems.

First, a City Wide Circulation Plan was done to identify the major routes and vehicular entry points into the city along with bus routes, bike paths, bike routes/lanes, the railroad, and the ferry route to New York in order to understand the different flows of traffic within the city. (Figure 1) Pedestrians use similar routes to enter the city which either connect with or parallel these major routes of travel. The identified major points of entry into Burlington are:

* Shelburne Road/Route 7 from the south,
* Main Street/Route 2 from the east,
* Colchester Avenue from the northeast,
* Route 127 from the north, and
* the Ferry from New York state.

Destination points within the city were also identified to determine where pedestrians prefer to travel. These points were documented in a City Pedestrian Routes, Nodes, and Destinations Plan. (Figure 2) City and neighborhood parks are major generators of pedestrian traffic, many of them connected with the bikepath and bike routes. Commercial and entertainment areas and the central business district are highlighted as popular destinations. Also identified are the universities, colleges, and neighborhood schools. Many of the major pedestrian routes accessing these different areas correspond with the major vehicular routes. Different user groups have been identified as using these routes: visitors to the city, residents, and commuters working in the city. Each of these groups have different destinations within the city. (see Figure 2)

Several types of problems were noted when inventorying pedestrian routes. Some of the reoccurring problems are as follows:

* Some roads lack pedestrian crosswalks.

* Excessive pavement widths without designated shoulders or crosswalks.

* Traffic lights having a short pedestrian signal, not allowing enough time for people to cross safely.

* Several streets lack sidewalks, limiting any safe pedestrian movement.

Figures 3 and 4 illustrate examples of these situations throughout the city.

IMPROVEMENT ACTIONS

The result of this study is a recommended series of actions which could be implemented to improve the overall city wide pedestrian network and improve safety conditions at these locations.

Based upon our review of the study area locations, and an assessment of the safety conditions, it was determined that five types of improvement alternatives were appropriate for the area and are summarized below.

* Signal Upgrade

Most traffic signals within the City are equipped with pedestrian signal indications, but do not have exclusive pedestrian phases. Most pedestrian phases allow for a 6-8 second advance for pedestrians prior to traffic flow commencing. Safety conditions can be enhanced with exclusive pedestrian phases. In addition, wheel chair ramps are provided at some locations, but should be provided at all locations in accordance with the Americans with Disabilities Act. At locations where a signal upgrade is recommended, the following actions should be assessed:

- Install pedestrian indications and provide exclusive or concurrent pedestrian phases.

- Install wheel chair ramps at all crosswalk/sidewalk areas.

Finally, the impact of exclusive pedestrian phases should be evaluated with respect to traffic operations to insure that satisfactory operating conditions can be maintained. The order of magnitude cost estimate for the signal upgrade can vary from $2,000 to $5,000 depending upon whether existing equipment is present or not and the number of wheel chair ramps required. This estimate is based on utilizing existing controllers.

Flynn Avenue - Sidewalks are Either Non-existant or Very Narrow.

Battery Street/Pearl Street Intersection - Signal for Pedestrian Phase Too Short for Safe Pedestrian Crossing.

Figure 3

Shelburne Road/South Union Street Intersection - Excessive Pavement Widths and No Pedestrian Crosswalks Designated.

Main Street/East Avenue Intersection - No Pedestrian Crosswalks Exist at Either Crossing.

Figure 4

* Geometric Improvements

Certain areas within the city have been identified as having geometry with excessive roadway width and lack of driver channelization which can cause driver confusion. Excessive roadway widths also result in longer pedestrian crossing times, which can be reduced with standard roadway width. The locations identified with the need for geometric improvements warrant further evaluation with the following considerations:

- Travel lanes should be 12 feet wide with appropriate shoulder widths varying from 2-8 feet depending on the locations.

- When feasible, side streets should intersect the main street at a 90 degree angle. This should improve driver sight distance and result in safer conditions. Turning radii should range from 30 feet to 50 feet and should accommodate truck traffic, where appropriate.

- Based upon the improved geometrics, pedestrian crosswalks and advance crossing signals should be installed at appropriate locations.

These improvements can vary in cost depending upon the extent of the geometric improvements required.

* Sidewalk Construction

Some areas in the city have been identified for the construction of new sidewalks. Heavy pedestrian traffic was observed in specific areas, where worn paths are present. The cost for bituminous sidewalk construction is $10 per linear foot excluding granite curbing and $30 per linear foot where granite curbing is required.

* Crosswalks

At certain locations, crosswalks should be installed or existing crosswalks would be restriped.

* Signing

Signs are valuable in communicating important information to the operators of motorized vehicles such as YIELD TO PEDESTRIANS, SCHOOL ZONE, and PEDESTRIAN CROSSING. Signs should be installed adjacent to active pedestrian zones to alert the motorist to accommodate the pedestrian. Signs can be installed permanently along the road edge, on cables above the roadway or installation of advance crossing signs (W11 series) a minimum of 100 feet in advance of the crosswalk. The order of magnitude of this improvement is $400. A temporary solution would be installation of a YIELD TO PEDESTRIANS sign in the center of the roadway which would be placed on a structure or construction barrel.

Table 1 summarizes locations in the city and recommended improvements. These locations are also keyed into the City Pedestrian Route Deficiencies Plan. (Figure 5)

Table 1
Pedestrian Improvement Summary

	Location	Recommendation
1.	Battery Street/King Street	Signal Upgrade, Crosswalk
2.	Battery Street/Maple Street	Crosswalk
3.	Battery Street/Main Street	Signal Upgrade, Crosswalk
4.	Battery Street/College Street	Signal Upgrade, Crosswalk
5.	Battery Street/Cherry Street	Crosswalk
6.	Battery Street/Pearl Street	Signal Upgrade, Crosswalk
7.	Battery Street/Sherman Street	Signal Upgrade, Crosswalk
8.	Pine Street	Sidewalk Construction and Upgrade
9.	Pine Street/Lakeside Avenue	Signal Upgrade, Sidewalk Construction Signing at GE Plant crossing
10.	Shelburne Road/Flynn Avenue	Signal Upgrade, Crosswalk
11.	Flynn Avenue	Sidewalk Reconstruction
12.	St. Paul Street/South Union St.	Geometric Improvements, Crosswalk, Possible Pedestrian Signal
13.	Shelburne Road/South Willard St.	Geometric Improvements, Crosswalks, Sidewalk Construction, Possible Roundabout
14.	South Prospect Street/Fairmont St.	Sidewalk Construction
15.	South Prospect Street/Main St.	Signal Upgrade, Crosswalks, Signing
16.	South Prospect Street/University Housing	Sidewalk Construction
17.	Main Street/University Heights	Sidewalk Construction, Pedestrian Bridge
18.	Main Street/East Avenue	Signal Upgrade, Crosswalks
19.	Riverside Avenue/Intervale Road/ North Prospect Street	Install Crosswalks on Side Streets Only
20.	Riverside Avenue/North Winooski Avenue/Hyde Avenue	Geometric Improvements, Crosswalks
21.	Manhattan Drive/Route 127	Signal Upgrade, Crosswalks
22.	Route 127/North Avenue	Install Crosswalk

Table 1 (continued)
Pedestrian Improvement Summary

23.	North Avenue/Depot Street	Signal Upgrade, Crosswalk
24.	Oak Street/Manhattan Drive	Crosswalks
25.	Manhattan Drive/Spring Street	Crosswalks, Signing
26.	Ethan Allen Parkway/North Avenue	Signal Upgrade
27.	North Avenue/Starr Farm Road	Crosswalks, Signal Upgrade, Signing
28.	North Avenue/Plattsburg Avenue	Crosswalks, Signal Upgrade
29.	North Avenue/Institute Road	Crosswalks, Signal Upgrade, Signing

Several additional routes have been identified which have similar problems. These routes should be studied further for specific recommendations.

* Cliff Street - Lack of sidewalks on either side of street. This street also has steep grades which poses problems meeting ADA/ANSI requirements.

* North Avenue/Plattsburg Avenue Intersection - Difficult pedestrian crossing at a y intersection.

* North Avenue/Ethan Allen Parkway Intersection - Difficult pedestrian crossing at a y intersection.

* Bike Path/Crescent Beach Drive Crossing - Conflict between automobiles and pedestrians.

* Riverside Avenue/Roosevelt Park - Difficult pedestrian crossings because of heavy travelled car route.

* Manhattan Drive/Spring Street - Difficult pedestrian crossings because of heavy travelled car route.

The suggested improvements will increase pedestrian safety by providing exclusive or concurrent pedestrian phases at traffic signals providing better defined pedestrian walkways and increasing the visibility of pedestrian locations throughout the city.

* **Traffic Calming**

Another suggestion for improving pedestrian travel throughout the city is with traffic calming techniques. The concept of traffic calming is to encourage the harmonious coexistence of automobiles and pedestrians by enhancing pedestrian safety and security and an improved street ambiance while maintaining a smooth traffic flow. Traffic calming techniques employ physical changes to streets to reduce vehicular speeds and decrease the dominance of cars. These work by keeping through traffic on arterial streets and controlling traffic on neighborhood and collector streets with the use of traffic control devices.

For these techniques to be effective, there needs to be a larger scheme for extending the selected devices throughout a neighborhood or on several streets. This way traffic can be controlled in a larger area with emphasis on connecting neighborhoods or specific nodes.

There are numerous different traffic calming devices: narrower streets, changes in pavements within the road, speed bumps, devices to move cars from left/right as they travel along a street, roundabouts, bump outs, and gateway treatments are a few. The articles in Appendices A and B give some more examples and definitions of these devices.

Adapting several of these techniques throughout the city of Burlington can achieve the following goals:

- Improve and provide safe, accessible pedestrian travel and street crossings.

- Improve the physical environment by lowering vehicle speeds, pollution and noise.

- Create an inviting and 'green' streetscape for separation of vehicular and pedestrian traffic. These areas can be connected with each other and desired nodes, destinations, and established routes within the city.

- Provide and control additional on-street parking.

Several areas throughout the city can be focused on for implementing traffic calming devices. Presently, the Old North End neighborhoods have several streets with established devices. Some of the techniques used within these neighborhoods are bulb outs, reduced travel lane widths with additional on-street parking, and pedestrian crosswalks with signalized pedestrian lights. There could be a traffic calming plan developed for a larger area with specific elements incorporated into them based on the successes within trial neighborhoods.

The South End neighborhoods could benefit from these techniques especially on Flynn Avenue, Birchcliff Parkway, and Home Avenue. These roads have excessive pavement widths and the travel lanes could be narrowed, parallel parking could be added, and major intersections with other roads could be controlled. Also, emphasizing pedestrian crosswalks within the streets will begin to make car drivers aware of other uses on the roads.

* **Roundabouts**

The idea of a roundabout as a traffic controlling device is relatively new in this country and has been implemented in several southern states with great success. A roundabout is a channelized intersection at which all traffic is controlled when entering by reduced speeds and moving clockwise around a central traffic island. Roundabouts can improve traffic safety by simplifying conflicts, reducing vehicular speeds and providing a clear pathway for the driver's right-of-way. They can work very well at a wide range of intersections: local and collector roads, arterial road intersections, rural roads and freeway interchanges. See Figure 6 for an example of a roundabout layout.

One area where a roundabout could be tried within Burlington would be the Shelburne Road/South Willard intersection. Excessive pavement and undefined travel lanes exist here creating hazardous conditions while traveling through this area. Altering the current rotary to a well designed roundabout would help reduce these conflicts, make lane designation clearer, and reduce the speed of cars.

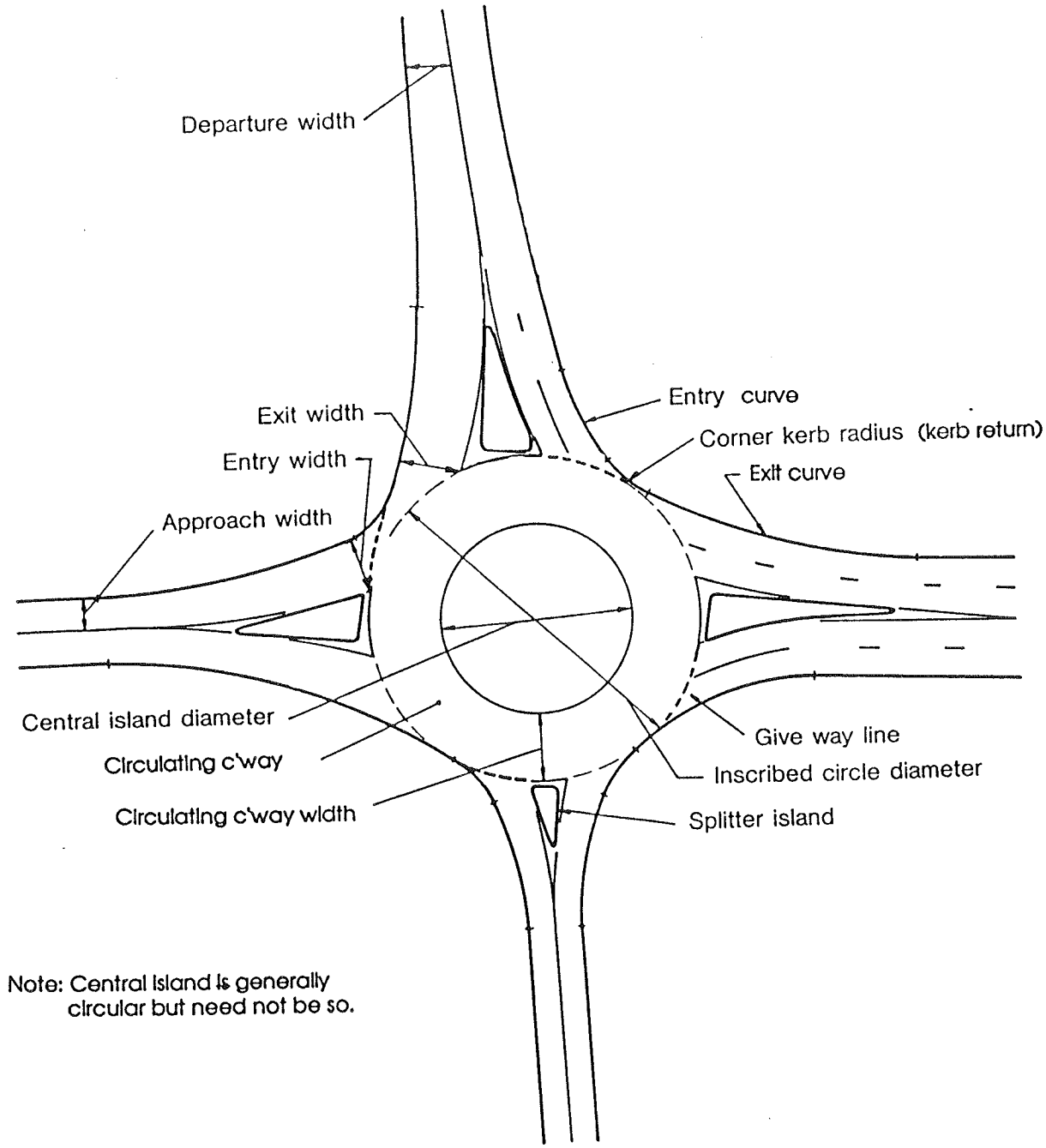


Figure G.1 The Geometric elements of a roundabout

Figure 6

RECOMMENDATIONS

A suggested plan for implementing these improvements is to prioritize the pedestrian route deficiency locations and develop a three or five year master plan. Once a phasing plan is established, a strategy for potential funding for the current and future calendar years should be developed. Some of these projects could be piggy backed with planned road construction projects for the next year by identifying and including pedestrian upgrades within the general vicinity.

INNERBLOCK CONNECTIONS

Existing Conditions

There has been a push to develop alternative pedestrian routes throughout the central business district and down to the waterfront. These routes have been suggested to take on the character of alleyways, small urban plazas and parks, or interior, covered routes protected from the elements. Several such routes presently exist within the city and are inspiration and models for future routes:

* One Lawson Lane Alley - Presently is a pedestrian route with vehicular access, parking, dumpster storage, and balconies for restaurant use.

* Alley between Lower Church Street to City Hall Park - Active pedestrian connection with dumpster storage and temporary vehicular parking.

* Walkway from St. Paul Street to Pine Street beside the Baptist Church - Walk cuts through parking lots and open space.

* Access from South Union Street to South Winooski Street via public parking lots - YMCA users, students, and others use this connection frequently.

* Burlington Square Mall indoor route - Heavily travelled by numerous pedestrians, especially elderly people.

School age children, teenagers, college students, and walking commuters have established other routes to access different areas of the downtown that are somewhat less defined than the ones stated above.

Interior or indoor connections are very important due to the harsh climate in the winter due to strong winds, low temperatures and precipitation. Many pedestrians use the Burlington Square Mall indoor route on a regular basis to access downtown functions and businesses during stormy weather. The covered walkways on the Church Street Marketplace are also used extensively during poorer weather conditions and there has been a push to extend these structures onto the upper block of the marketplace.

These indoor and covered connections are few and only exist in a small section of the city and sometimes limit potential routes that are of interest. For example, the present configuration of the Burlington Square Mall has a very circuitous route for pedestrians trying to go from Bank Street to Cherry Street. Presently, there is no covered or indoor walkway route connecting the waterfront and the Church Street Marketplace. There exists a myriad of possible connections given future expansion of the Burlington Square Mall and other buildings, and grade changes allowing for different levels of linkage.

Conceptual Thoughts

The motivation behind this study is to create a network of pedestrian routes connecting The University of Vermont, the central business district, and the waterfront. Working with the existing alleyways and paths, many additional routes can be established and built upon to strengthen connections to these different areas. The Pedestrian Linkages: UVM to Waterfront Plan illustrates where these routes could occur. (Figure 7) Some of the suggested connections are:

* Connecting Pine Street between Bank Street and Cherry Street. This could be an indoor connection with plazas at either end to greet people along the street.

* Underground connections from the Church Street Marketplace to the Waterfront: Extending and expanding the Burlington Square Mall indoor route west to Battery Street. The interior multi-level routes and underground connections that presently exist in the Mall could be expanded to allow for more public walkways and spaces such as plazas and sitting areas. An underground connection from this point under Battery Street through the hillside to the Main Street Landing property and Lake Street would allow for a climate controlled pedestrian access to the waterfront from the central business district without having to cross the heavily travelled Battery Street at grade.

  The Burlington Square Mall addition could also be linked with the Radisson Hotel and parking garage and the Milot site and continue through under College Street to the Merchants Bank site. The Merchants Bank site, located between Main and College Streets; fronting Battery Street, could provide important connections to the waterfront. This would be an ideal location for a multilevel complex incorporating a parking structure and underground pedestrian connections under College and Battery Streets.

* Develop more connections from Pearl Street to Bank Street. A mid - block connection through the Pearl Street/Battery Street/Cherry Street block could connect with the Burlington Square Mall addition continuing through to Bank Street. A more profound announcement of entry and improved streetscape could enhance these connections.

* Develop an underground link to Lake Street from the Milot site on the east side of Battery Street. This potential connection would provide another underground pedestrian route to the waterfront by crossing beneath Battery Street.

* Extend the existing One Lawson Lane Alley to Lake Street with innerblock walkways and plazas. This has the potential to provide a dynamic and exciting walk from Church Street to the waterfront,

interacting with the Merchants Bank property and the Main Street Landing development.

* Connections from parking structures to Church Street Marketplace and the Burlington Square Mall: The parking garage on St. Paul Street has some connections to neighboring buildings and with a Church Street Marketplace underground pedestrian route, several more connections could be made. The Radisson parking structure can also have more connections as discussed above. The Bank Street/Cherry Street garage by South Winooski Street could also have an underground connection to the Church Street Marketplace.

* Climate controlled connections between Church Street Marketplace and Burlington Square Mall: The below grade floors of Church Street should be connected to each other and the existing parking structures providing shoppers the opportunity to circulate between stores and services within a controlled environment. A 12' wide pedestrian network below grade on each side of Church Street would provide protected access to various shops, increase viable retail space along Church Street and provide a crucial step in linking Burlington's central business district to its waterfront in a climate controlled environment. This solution preserves the architectural and historical character of Church Street.

* Develop stronger connections from the Battery Street south district and Perkins Pier area with the central business district. The Main Street\Battery Street\King Street block has several walkways with wonderful architectural features and special paving which could extend further into the next block east and onto Main Street.

There is the possibility for more routes east of the Church Street Marketplace however, there is considerably more privately owned residential properties which would need to be crossed. Presently, many innerblock routes exist around Edmonds School and Champlain College and there may be a possibility of working with neighbors to make connections that are safe for children.

Recommendations

To continue refining this concept plan, the following steps should be initiated:

- A more detailed survey of existing routes would benefit the identification and utilization of alternate paths. This should include where present routes exist, what are the most important connections, and who are the present users.

- Prioritizing the most important routes based on highest need/most desired connections and develop a timetable for implementation.

- A more specific, detailed design plan showing the character of each route should be completed.

An important aspect for implementing this plan is adoption of these recommendations by the Planning Commission as part of the city wide master plan requiring all future developments or expansions to include these connections. The city planning office should work with several developers whose projects are in the works and inspire them to become part of this project and start the initial phases. Once a few projects are built and are successful routes, there would be more impetus to create more connections. There also may be federal funds available through the Agency of Transportation or ISTEA.

APPENDIX A
TRAFFIC CALMING

TRAFFIC CALMING

Michael Wallwork, P. E.

TRAFFIC CALMING

Traffic calming began in Holland and Australia around 1970 to reduce traffic problems in residential streets. The reasons varied, vehicle speeds, the use of residential streets as a "cut-through", to improve the safety and amenity of the streets. It began because of the reactions by residents to poor planning and road design. To avoid future problems, it is better to plan mixed developments, to reduce trips. Then add a fine-grained street network using short streets that intersect at Tee intersections or at four-way intersections controlled by roundabouts. Often it will also be necessary to build in other devices, including narrow streets.

BACKGROUND

Streets serve many functions. They may provide for on-street parking, circulation, or access to properties for owners, visitors, service and emergency vehicles. Children play there; neighbors meet and socialize there. People use streets as an extension of their yards. Streets are not freeways.

Residents expect their streets to be:

- safe for their children as well as themselves;
- a place where people have freedom of movement;
- a quiet place devoid of through traffic;
- a place where vehicles travel slowly, sharing the space with pedestrians and bicyclists.

Why did the need for traffic calming occur? For more than 5000 years, communities were designed with a fine-grained, grid road network. Development was mixed and based on the quarter mile scale -- the five minute walk. This pattern existed until after the Second World War. Then, in the late 1940's, the motor car became the dominant force in society. Pedestrians and mass transit were excluded from planning and design.

As cars became cheaper and the masses gained untold mobility, a flight to the suburbs occurred. There development was segregated by function into single-use zones, and in many cases by price. In the USA, the trend was probably the most pronounced because of cheap gasoline, low interest federal loans, the interstate highway system, and cheap, readily available land for development. Mass transit was removed, car performance and road standards increased. Sidewalks and visual points of interest were deleted. Open space was replaced with parking lots. With the segregation of developments and a lack of interconnections, driving trips increased dramatically. This was particularly true on residential streets where trips increased to 10 to 14 trips per day per household[1]. The result was an increase in traffic and conflicts.

There are other effects of car dominance which require a change in thinking to calm arterial roads:

- A hierarchical road system developed with many signalized intersections. These intersections quickly became saturated. The cause was dead-end collector roads which provided single entrance/exit to subdivisions. Residents were forced to use a this single exit no matter which direction they went. The result was an overload of the arterial road system with very high turning movements which saturated major intersections. The end result has been a high number of conflicts and crashes.

- With so many trips and so far to go, drivers demanded and received wide, high speed roads with multiple turn lanes. Such roads act as barriers for pedestrians and divide communities.

- Two-way left-turn lanes (TWLTL) were developed to provide unlimited turning ability for cars. They also created a hazard and a barrier for pedestrians. According to recent research, they are now being recognized as a significant hazard for motorists[2]. The 1990 issue of the AASHTO Manual, *Geometric Design of Streets and Highways*, page 826, cautions engineers about using TWLTL's.

REASONS FOR TRAFFIC CALMING

Area-wide traffic calming began as a means of limiting the speed of vehicles and their dominance of the street. It expanded to include safety, security, lifestyle, and street ambiance.

1. Safety: The most compelling reason was the carnage on local streets. An OCED[3] report done in 1983 found that most fatal crashes involving children occurred in residential streets. As an illustration, let's look at Florida's safety record. (You should look at your State's record to see how safe your local streets are.)

   Pedestrian Statistics for Local Streets in Florida in 1991[4].

   Local Streets - Urban Areas

		Total for Year	Percentage of Total
Number Killed	316	914	35
Number Injured	30,337	68,229	44

Local Streets - Rural Areas

		Total	Percentage of Total
Number Killed	77	1,358	35
Number Injured	5,245	51,916	44

A review of the number of vehicle crashes for local streets in Florida in 1991 is worse.

Local Streets - Urban Areas

Number of Crashes	Total Number of Crashes	Percentage of Total Vehicle Crashes
52,387	115,548	45

Local Streets - Rural Areas

Number of crashes	Total Number of crashes	Percentage of Total Vehicle Crashes
7,967	79,772	10

People are killed and injured in supposedly safe residential streets while walking the dog, going to the store, crossing the road, playing on the road, etc. Some of the reasons have little to do with traffic calming. For instance, some people have been hit while walking on the road or in the swale because there are no sidewalks. Other examples involve walking on a sidewalk built without a curb to act as a barrier to errant vehicles, or crossing the road to get to the sidewalk. Children who walk and play on the streets without sidewalks do not develop the respect for the dangers involved in sharing the street with vehicles.

Construction of local streets with curb and gutter and sidewalks will make a significant improvement in pedestrian safety by separating people from cars and giving people and children a safe place to walk.

Overall traffic calming can reduce crashes in residential streets by an average of one-third.[5]

2. Security: Reducing vehicle speeds and/or separating people from vehicles reduces and/or eliminates the vehicle threat. This makes people feel more secure about using a street, or letting their children use the street with little or no supervision.
3. Lifestyle: Traffic calming enables people to reclaim their street. To use it for simple pleasures like walking,

bicycling, social interaction, travel to shops, parks, schools, etc. It allows then to wash the car, to play with and let children play, all in a calm quiet area.

4. Street Ambiance: By designing calm streets or retro-fitting streets with traffic calming devices, many opportunities arise to greatly improve the streetscape so it becomes an extension of people's front yards. Traffic calming can help change the wide open feeling to one of closeness, where colors change as the seasons come and go, and where greenness reduces the impact of black and white of concrete and asphalt.

Even as the use of traffic calming grows, single entrance, single function subdivisions continue to compound existing problems. They reduce the opportunity to make trips by other modes of transportation - walking, bicycling, and mass transit. They increase the number of trips, increase the travel distance to each destination, and the number of trips that have to be made by car, even in a "calmed" street.

CURRENT PRACTICE

Around the world, traffic calming techniques vary. Some communities simply lower the speed limits, which are often seen as being unrealistic by drivers because of the "quality of the street design." As such, they become unenforceable and breed disrespect for speed limits. Other techniques include four-way stop signs -- the use of stop signs to stop the major flow. Both methods violate driver expectation and can be hard to defend.

Research into the effectiveness and safety of stop signs varies. The largest traffic calming scheme in the U.S.A., in Seattle, Washington, has found that in over 400 locations small roundabouts have reduced crashes at intersections controlled by 2-way and 4-way stop controlled intersections by 91% to 96%[6]. Other devices used are speed bumps (short and steep) or humps (wide)[7], which create their own problems of noise and discomfort; street closures, which can create problems by forcing traffic onto other streets; the complete design of streets like the "woornerf"; or a driveway servicing only a few properties.

POSSIBLE SOLUTIONS AND BENEFITS

There are several reasons for traffic calming. They occur when rezoning of a parcel of land makes a local street an access road. Sometimes people move into an area knowing of the traffic problems, then they want someone to make the problems go away. At other times, the composition of a neighborhood changes or the residents seek a better way to manage their street.

CRIME CONSIDERATIONS

There are two schools of thought regarding whether or not increased access to a neighborhood increased the crime rate. Neither has shown a definite correlation.

- Multiple access points increase the crime rate because of easy access. However, even gated communities with 24-hour guards have paid police overtime to reduce crime in their "safe" community. Police chiefs in both the USA and Australia report a lot of crime is done by neighbors.

- A well designed neighborhood with many access points and lots of on-street activity deters crime. On-street activity is a deterrent to crime because criminals do not want to be seen. Also, within a community where there is a lot of interaction, neighbors get to know and look out for each other.

WHAT IS TRAFFIC CALMING?

Traffic calming involves strategic physical changes to streets to reduce vehicle speeds and to decrease the cars' dominance. Traffic control devices are designed and located to keep through traffic on arterial roads. They do so by making the travel time on the residential streets greater than the travel time on the adjacent arterial roads. Traffic calming also seeks to control the behavior of the remaining drivers.

To be effective, traffic calming devices need to be part of a scheme extending along a street, several streets, or throughout a neighborhood. The aims are to control traffic over an area, not at an isolated site, and to be compatible with street activities and adjacent land uses.

Many examples of traffic calming devices exist for retro-fitting: slow points, speed humps and speed bumps, chicanes (devices that cause a driver to move left/right as they travel along the street), and roundabouts (mini-traffic circles that physically force drivers to slow down to 10 to 15 mph). More extreme examples are street closures or restricted access.

During the initial street design, other treatments can be built into the street: narrower streets, brick paving instead of asphalt, and different street designs (woornerf).

When considering a traffic calming scheme, many different concepts and perceptions have to be considered. However, many schemes have the following common aims:

- Improve safety for people, especially children, by controlling conflict points, reducing vehicle speeds and vehicle volumes.

- Improve the physical environment by lowering vehicle generated noise, pollution, and disruption.

- Create a green and inviting streetscape.

TRAFFIC CALMING EXPERIENCE

Many examples of traffic calming schemes exist. In Europe and Australia, traffic calming techniques began in 1970 and are now into their second and third generation. Their effectiveness has been proven and many now appear to be part of the original street design rather than an afterthought. To reach this position, there was a strong desire to change the balance, to experiment, to learn from others, and to do the "right thing" for all people.

Since each location has its own problems and needs, new and improved devices were, and are still, being developed.

THE PLANNING PROCESS

To be successful, a traffic calming program needs a structured planning process, community participation, and consultation with all relevant authorities. The project is undertaken in response to the needs of residents of a street, area, or the community. Residents are the main initiator of traffic calming schemes, although elected representatives or city staff can also initiate schemes.

The planning process for a traffic calming scheme is complex and includes significant resident participation. In the past, skipping or skimming over parts of this process has caused schemes to fail. It is more than simply providing a technical solution to a specific traffic problem. It is an interaction between land use, transportation, resident/community needs, and preferences. It is not, and should not be seen as, traffic management solely for the safe and efficient movement of vehicles. <u>It is a community project where the residents and other affected people must be active participants so they become owners of the project and increase its acceptance.</u>

1. <u>Identify Problems and Issues</u>: Collect and analyze crash data, traffic volumes, streetscape, residential, neighborhood, and community problems.

2. <u>Establish Objectives</u>: Specify and get agreement on the scheme's aim with the residents. This step is essential in evaluating and comparing alternative schemes and their relative success.

3. Alternate Plans: Develop a set of alternate schemes meeting the above aims.

4. Plan Selection: Evaluate the impact of each plan, including achievement of the aims, and undesirable or unavoidable impacts. After consultation with the residents, refine the final plan, design individual traffic control measures, and develop a staged construction plan.

5. Implementation: Undertake any additional before studies, tell the community of the work program, and traffic detours. Often people don't appreciate what a particular device is really like on-the-road. A useful technique is to install cheap, temporary treatments so the residents can try them before proceeding with the final construction.

6. Review: Never assume the scheme achieves the desired effect. Drivers can be very innovative and may find unexpected alternate routes. Conduct after studies to measure their effectiveness, impacts, and resident/community reaction. Change scheme if necessary.

CONSULTATION WITH AUTHORITIES

Contact all involved authorities or organizations at various stages to avoid potential problems. These include the road authority, emergency services, utilities, bicycle clubs, planning organizations, and adjacent communities and municipalities, depending upon the scope and effect of the scheme.

ALTERNATIVES TO TRAFFIC CALMING

Often, preliminary investigations will reveal if the problem is better treated by other programs. If there is poor sight distance at an intersection, clear the sight lines. A large number of crashes at a single intersection can be due to a wide range of items which would require a safety study.

Alternatively, residents unhappy with the streetscape identify trees and shrubs as part of a traffic calming scheme. Instead of landscaping, building a park so children do not have to play on the "unsafe" street may be more appropriate. Poor land zoning that creates traffic problems or truck traffic may be better treated by rezoning or by working with the company managers to reroute their trucks.

TRAFFIC CALMING TECHNIQUES

There ares a range of techniques available, some of which are shown in Table 1. The range is expanding and is only limited by our imagination.

Three simple techniques can prevent the need for retro-fitting of traffic calming devices:

1. Construct mixed developments serviced by a fine-grained road network of narrow streets.

2. Keep the streets to less than 0.5 Km (quarter mile) so drivers have no incentive to speed.

3. Make most roads intersect at tee intersections or control 4-way intersections with roundabouts. This will reduce the number of potential conflicts.

When selecting a device or a series of devices, keep in mind that all devices have a limited range of effectiveness. Place them where the desired speed reduction is needed. Spacings of around 250 feet can keep speeds below 20 mph. A spacing of 400 feet will keep speeds in the 25 mph range. This is because drivers will try to accelerate to make-up time lost by going through any device.

To help devices achieve speed reductions, landscaping can reduce long sight lines and create a closed-in environment. On long, wide, and straight streets, these reductions in sight lines are essential to help change the visual environment.

Roundabouts and slow points, which physically reduce vehicle speeds, are more readily accepted than some other techniques because they do not decrease access.

Use speed reduction devices only on straight sections of roads, not curves, so drivers have a clear line-of-sight. The sideways forces on a vehicle could affect its performance through the device.

Driveways can affect the location of these devices, so special design features have been developed as shown in Table 1.

Bus services in residential areas need careful design. Devices have been developed to slow all vehicles while still allowing bus movements. These devices include roundabouts, chicanes, and slow points. There are slow points designed on bus wheel spacing that allow a flat travel for the bus but force vehicles, with narrower tracks, over a speed hump.

Emergency vehicles require an acceptable level-of-service. Any device must be suitable for the type of emergency vehicle used in the area. In areas near fire stations and hospitals, select a device with care. For instance, vertical displacement devices can create discomfort for spinal patients in ambulances.

Work with truck operators to define preferred truck routes and sign them accordingly.

Bicyclists need attention, as some devices can obstruct bicycles. Many devices can be modified to allow bicyclists to by-pass them. For instance, a street closure can be fitted with a bicycle link through the closure.

People will only drive under constrained conditions for a short time. They will then start accelerating rapidly between treatments to make up for lost time. One option to prevent this behavior is to build subdivisions with short streets and mainly Tee intersections to reduce the opportunity to drive fast.

OFFSET ON CRASH RATES

One device having a well documented safety record throughout Europe and Australia is the roundabout. In general, roundabouts reduce crashes by 50 to 90 percent[8], depending on traffic volumes, compared to other forms of intersection control. In Seattle, mini-roundabouts, although lacking splitter islands so wrong-way left-turns are permitted, have reduced intersection crashes by 91 to 96 percent[5] in comparison to 2 and 4-way stop signs.

EFFECT ON MOBILITY

The effect on mobility is difficult to document because every scheme is different with different problems, people, aims, and effectiveness. Street closures will cause a major reduction in mobility for residents and are only recommended for short streets. Schemes have failed because residents have refused to suffer the inconvenience caused by a street closure. Therefore, only use them when other treatments have failed.

Diverters/partial street closures will affect the level-of-mobility for fewer residents than street closures.

COSTS AND BENEFITS

Streets designed for people where cars are partners, like the Woornerf, will be less expensive to construct and the savings can be used to beautify the street. Streets serving only a few homes

need only be as wide as a driveway. They may be paved with paving blocks or other materials. They act as driveways with lots of greenery around them, instead of long, wide streets as now built.

Despite the calmed nature of the street, sidewalks are still essential for the elderly, the physically/visually challenged, for mothers with strollers, etc.

Elected officials and the community should be notified of the costs of any scheme. Equally important are the considerable savings, which are often harder to estimate. For instance, the savings from the reduced number of crashes can exceed all other costs. However, as these savings benefit the whole community and not just the area of concern, they are often ignored.

Costs associated with a traffic management scheme include the following:

- Data collection
- Plan preparation
- Street surveys
- Resident surveys
- Final design and documentation
- Construction
- Maintenance
- Subsequent community involvement.

To offset these costs there are substantive cost savings:

- Reduced number of crashes
- Less wear and tear on streets
- Less pollution, noise, etc.
- Property values will increase because of the better streetscape and improved amenity.

A roundabout built as part of the initial construction is almost a zero cost, but to retrofit it can cost from $3,000 to $10,000. In either case, a 90 percent reduction in crashes[7] is a proven benefit providing an extremely high benefit cost ratio in comparison to 2 and 4-way stop signs.[5]

ARTERIAL ROADS

These notes have dealt with the need for traffic calming on local streets. Arterial road design standards have created high volume, high speed, wide roads that are a barrier and a hazard to any pedestrian who dares to cross. Yet the way we have planned and built our communities require people to cross major roads to reach their destinations. These roads are usually devoid of vegetation, lined with poles, advertising signs, and uninteresting buildings.

The addition of right- and left-turn lanes increases the crossing distance for pedestrians.

To further restrict pedestrian movements, super arterial roads with restricted access and barrier walls in the medians are proposed. Yet, as these roads expand to meet future needs, urban sprawl continues, requiring even further increases in capacity. No city has yet built roads fast enough to satisfy ever-increasing demands.

Alternatively, we can build our communities based on the traditional neighborhood. Then the number of trips on local streets and arterial roads will decrease and become safer and less congested. Ten foot wide lanes can be used, street parking can be permitted, with parking bans during the peak period -- one side in the morning, the other in the evening, if necessary.

Bulb-outs at intersections and mid-block reduce pedestrian crossing distance and put them in a position where they are more visible to drivers. Medians with landscaping are an attractive pedestrian refuge. Landscaping is part of the streetscape, which also includes lighting, seats, trash cans, verandas on shops, etc., making walking more attractive. Buildings built at the property line with lots of details also enhance the street environment.

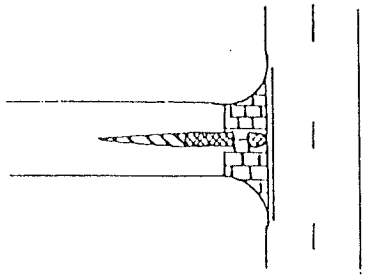
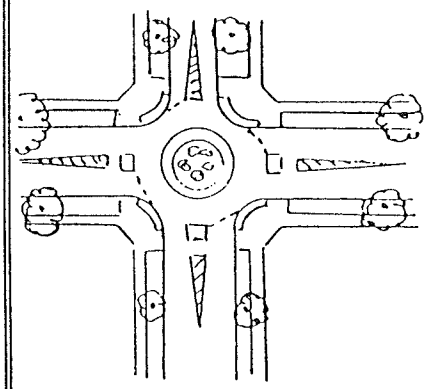
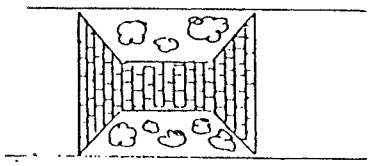
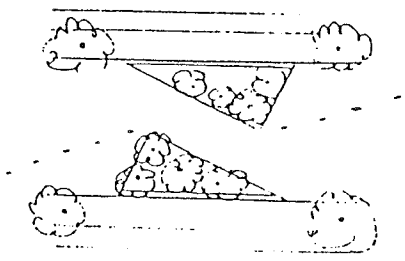
SUMMARY

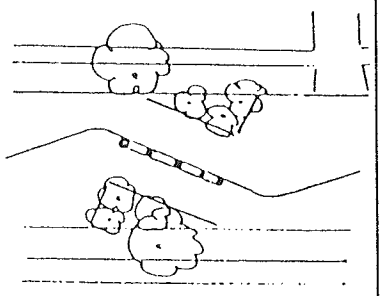
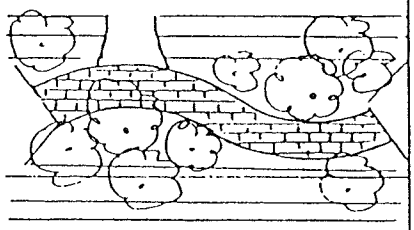
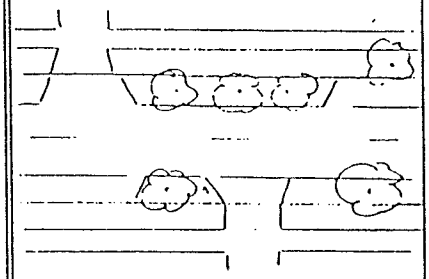
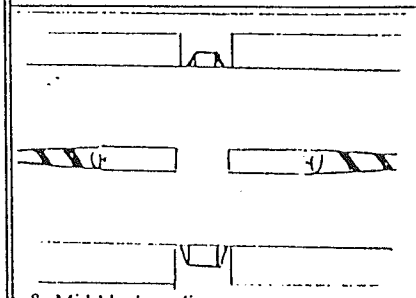
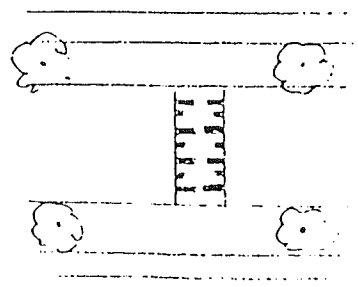
Traffic calming should be an essential part of each authorities' work, as it can have a significant effect on people's lives. If done well with aesthetically pleasing treatments, the street environment is enhanced while the traffic becomes a partner rather that the dominant party in the neighborhood. All people can move more freely and safely around their neighborhood. More children will grow up to be adults, with fewer scars, and others will live longer and more fruitful lives in a more pleasant environment.

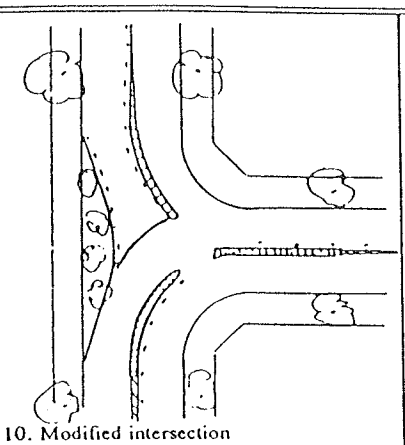
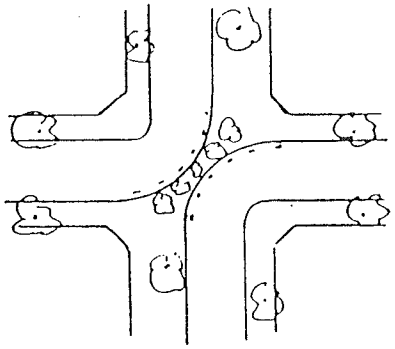
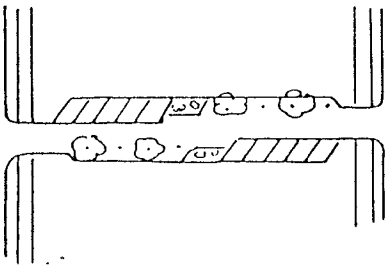
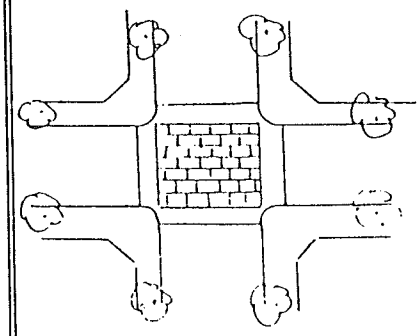
Traffic calming is a negative reaction to a problem caused by bad planning/zoning and/or street design. We need to be proactive in our approach and learn from the past and others. We need to assure our neighborhoods and streets are built for people, not just the motor car. Then traffic calming in local streets or along arterial roads become unnecessary.

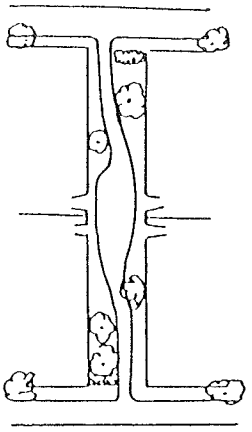
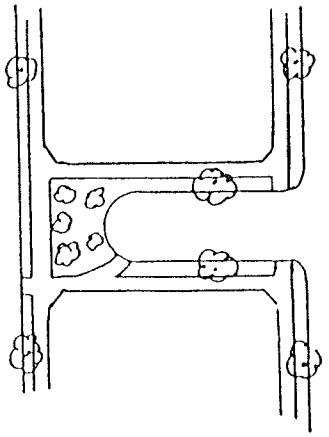
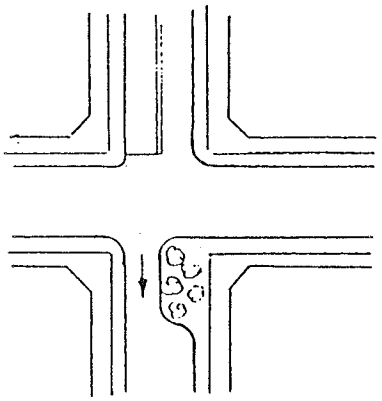
TABLE 1

TRAFFIC CALMING - ADVANTAGES AND DISADVANTAGES

DEVICE	ADVANTAGES	DISADVANTAGES
 1.Gateway treatments.	Positive indication of a change in environment from arterial road to a residential street. Reduces entry speeds. Reduces pedestrian crossing distance. On very wide streets provides space for landscaping in the median.	Low speed of turning vehicles may restrict arterial road flow.
 2. Roundabouts	Reduces crashes by 50 to 90 percent when compared to 2-way, 4-way stop signs and traffic signals by reducing the number of conflict points at intersections. Reduces vehicle speeds . Provides space for landscaping. Cheaper to maintain than traffic signals. Effective at multi-leg intersections. Provides equal access to intersections for all drivers. Provides a good environment for cyclists.	May be restrictive for larger vehicles if designed to too low a speed. Providing a mountable apron this limitation can be minimized. May require additional lighting If left turns by large vehicles are to be accommodated then right-of-way may have to be purchased.
 3 Single-lane slow point.	Reduces vehicle speed. More effective when used in a series. Imposes minimal inconvenience to local traffic. Pedestrians have a reduced crossing distance and so have a safer crossing. Provides space for landscaping. Provides a visual obstruction.	Landscaping needs to be controlled to ensure visibility is reduced. Contrary to driver expectation of unobstructed flow. Can be hazardous for drivers and cyclists if not designed and maintained properly. Confrontation between opposing drivers arriving simultaneously could create problems
 4. Single-lane angled slow point.	As for (3).	As for (3).

 5. Two-lane angled slow point.	As for (3), except that pedestrian safety is less than (3).	As for (3). It is less effective in controlling speeds because drivers can create a straighter through movement by driving over centerline.
 6. Driveway link.	As for (3). Provides a greater visual obstruction. Provides a large area for landscaping. Length of device is limited by cost. A very effective method of changing the initial impression of the street. If done right drivers will not be able to see through. Appears as a road closure yet allows through movements.	Increases the area of landscaping to be maintained by residents. Cost is greater than many other devices. Therefore better to be installed in conjunction with street reconstruction.
 7. Two-lane slow point.	Causes only minor inconvenience to drivers. Regulates parking and serves to protect parked vehicles as the bulb-outs can be installed in no-parking areas to stop illegal parking. Reduces pedestrian crossing areas. Provides space for landscaping.	Not very effective in slowing vehicles or diverting through traffic. Only partially effective as a visual obstruction.
 8. Mid-block median.	Provides a refuge for pedestrians and cyclists. Can improve the streetscape if landscaped.	Will only create a limited reduction in vehicle speeds.
 9. Speed bump.	Reduces vehicle speeds in the vicinity of the bump. Better if used in a series at 300 to 500 feet spacing.	Creates noise particularly if there are lose items in vehicles or trailers. If not well designed drivers will put two wheels in the gutter to reduce impact. A harsh cheap solution. There are more effective and nicer treatments.

 10. Modified intersection	Reduces vehicle speeds. Reduces through traffic along the top of the Tee. Necessary to enforce changes in priority from one street to another.	Can be hazardous for vehicles and cause confusion regarding priority if incorrectly or inadequately designed.
 11. Diagonal road closure.	Eliminates through traffic. Provides area for landscaping. Reduces conflicts. Increases pedestrian safety. Can include a bicycle pathway connection.	Will inconvenience residents in gaining access to their properties. May inhibit access by emergency vehicles unless the street names are changed. Will move through traffic to other streets if not back to the arterial.
 12. Shared zone.	Provides a low speed shared environment that is safe for all users. Improves amenity without restricting access. Provides flexibility for on-street parking.	High cost unless part of original design.
 13. Intersection hump.	Slows vehicles in the most critical area and so helps to make conflict avoidance easier. Highlights intersection a	Increases difficulty of making a turn.

 14. Modified street design.	Reduces vehicle speeds without reducing access. Enhances amenity. Provides a large area for landscaping. Reduces the visual sight line.	High cost of retro-fitting. Better as part of street reconstruction or initial construction.
 15. Street closure.	Eliminates through traffic. Reduces the speed of the remaining vehicles. Improves safety for all other street users.	Reduces emergency vehicle access unless street is renamed. Reduces access to properties for residents.
 16. Partial street closure.	Reduces through traffic in one direction and partially in the other. Allows two-way traffic in the remainder of the street.	Reduces access for residents. Emergency vehicles only partially affected as they have to drive around partial closure with some care.

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[5] Selecting Roadway Design Elements to Accommodate Bicycles, Draft Report, Federal Highway Administration, Washington, D.C., November 1992.

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E. Deakin, P.C. Bosselmann, D.T.Smith,Jr., W.S. Homburger, and B. Beukers. Residential Street Design, ITE/Prentice-Hill, 1989.

APPENDIX B
MEASURES FOR TRAFFIC CALMING IN RESIDENTIAL AREAS

MEASURES FOR TRAFFIC CALMING IN RESIDENTIAL AREAS

Hideo Yamanaka
Michiyasu Odani

The concept of traffic calming in residential areas, which may be defined as fostering the harmonious coexistence of automobiles and people by restraining vehicle speed and traffic volume, was first put into practice in *woonerf* projects in the Netherlands. The Dutch approach was later developed and implemented elsewhere, mainly in West Germany, Denmark, and other West European countries. A variety of techniques grew out of this work.

In Japan, traffic calming has been widely adopted in "community streets" and in new residential areas. The techniques of traffic calming have drawn considerable attention as a means of physically reinforcing the conventional, statutory traffic control measures.

Here, we discuss some of the specific techniques used for traffic calming in the following sections.

1. Objectives of Traffic Control Measures in Residential Areas

Figure 1 summarizes the objectives of most road improvement and traffic control measures in residential areas. These objectives are interrelated and, depending on the stratagem used, some can be simultaneously achieved, while others, by their very nature, are mutually exclusive.

The immediate aims of implementing traffic calming are threefold: to reduce the speed of vehicles, to decrease the volume of through traffic, and to control on-street parking. The benefits of introducing such measures include more spacious and safer areas for pedestrians, cyclists, and residents as well as more attractive roads. Through these direct and indirect effects, the ultimate goal of traffic-calming schemes is achieved — enhanced safety, a pleasanter environment, and greater convenience on residential streets.

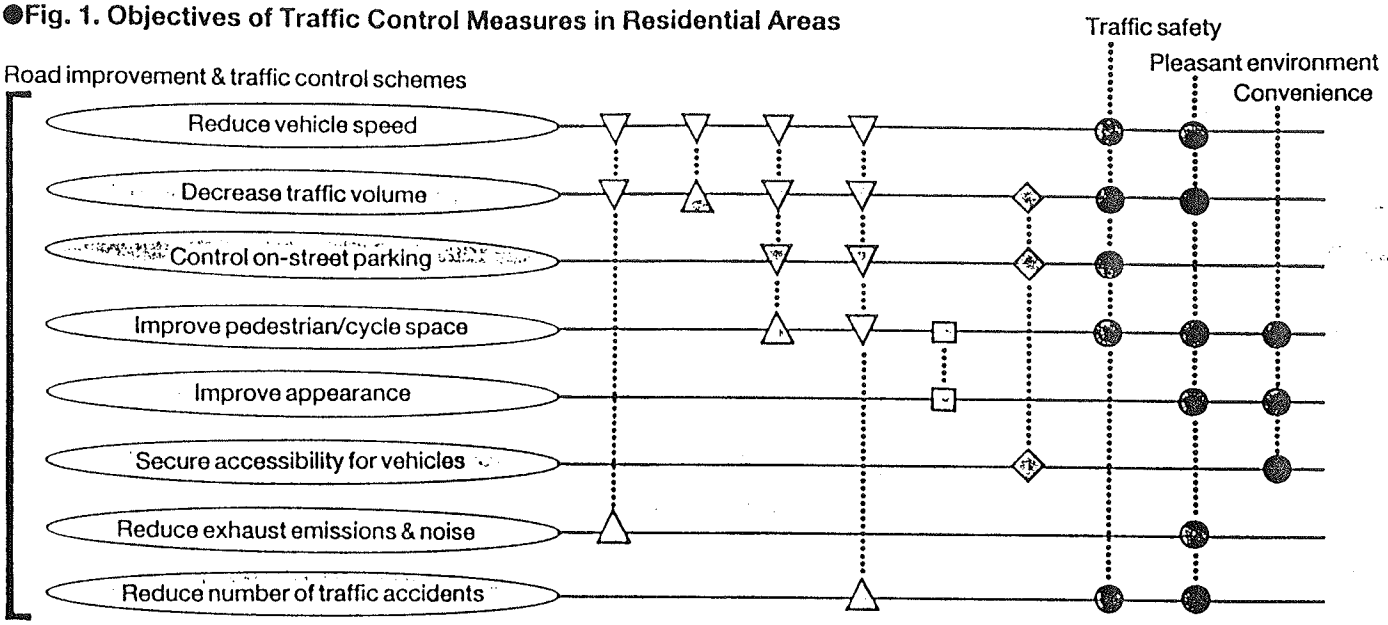
2. Techniques

There are three ways in which these traffic-control measures can be applied — to sections of roadway, to intersections, and to whole road networks.

Traffic-control measures for a road network are applied over a wide area, and measures for specific sections of roadway and intersections within the area form an integrated part of them. Their primary target is to control through traffic.

Separate measures for intersections are justified because most traffic accidents in residential areas occur at or around intersections (according to one survey, such accidents account for almost two-thirds of all accidents in residential areas). Thus, intersections should be given the greatest emphasis in traffic safety policy. The specific measures adopted at intersections mainly aim to encourage cautious driving, such as by requiring drivers to come to a complete stop before entering the intersection itself.

●Fig. 1. Objectives of Traffic Control Measures in Residential Areas



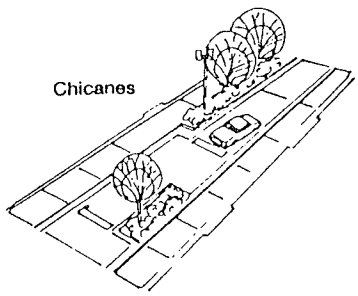
indicates measures which facilitate the implementation of measures
indicates measures that have complementary features
indicates measures that have conflicting features

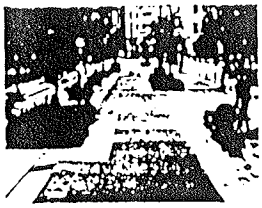
●Table 1. Traffic-Calming Techniques in Residential Areas

Objective	Approach	Techniques
Reduce vehicle speed (sections of road)	Statutory restrictions Winding roadway Shock/vibration Visual inducements Guidance	Speed limits: 30, 20, 10km/h Chicanes, forts, varied pavement surfaces Humps, undulations, rumble strips Chokers, narrowed roadway, illusionary humps and forts Bollards, colored pavement, signal control, warning signals, zone signs
Encourage cautious driving (intersections)	Statutory restrictions Road humps, eye-catching Prevent easy passage Define right-of-way	Complete stops, signals Raised intersections, varied pavement at intersections Forced channeling, mini-roundabouts, diagonal diverters, median barriers Humps at entrance/exit of non-priority roads, chokers, undulations in pavement, warning signs
Control on-street parking (sections of road)	Statutory restrictions Reduce parking space Delineate parking space Vehicles and time restrictions	Prohibit parking, stopping Narrowed roadway, devices to prevent parking on sidewalk (high curbs, guard rails, bollards) Staggered parking areas, delineated parking spaces Stopping-only areas, time-limit parking, residents permit parking, spaces reserved for the handicapped
Decrease traffic volume	Statutory restrictions Detours and diverters Increase time of passage Entry treatment (*Shikii*)	Prohibit passage by large vehicles, time restrictions on through traffic, closure to vehicular traffic Alternating one-way streets, strategic diagonal diverters Techniques for reducing vehicle speed Humps, chokers, other devices for restricting entry to areas

●Fig. 2. Techniques for Controlling Speed

Winding roadways, shift line of passage from side to side

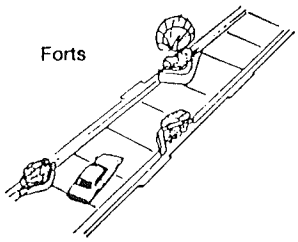




Sharp bends, Community Street, Osaka
(photo by Hideo Yamanaka)

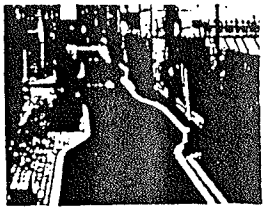
Staggered parking, Delft, the Netherlands
(photo by Michiyasu Odani)

S-shaped roadway, Minami Azabu Community Street, Tokyo
(photo by Hideo Yamanaka)

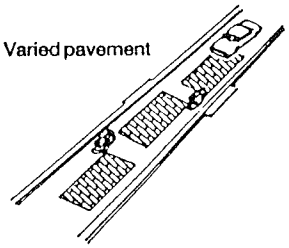


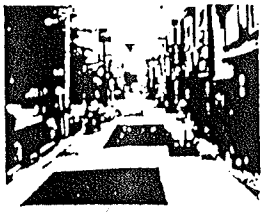
Protruding planters, Katsurazaka New Town, Kyoto
(photo by Hideo Yamanaka)

Random placing of tress, Kohoku New Town, Yokohama
(photo by Tadashi Fujitsuka)



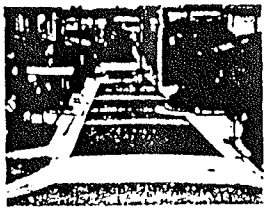
S-shaped roadway, Koraku Road-Pia, Nagoya, Aichi
(photo by Hideo Yamanaka)





Staggered patchwork, Sekime Road-Pia, Osaka
(photo by Hideo Yamanaka)

Patchwork, Kashima-dai New Town, Hino, Tokyo
(photo by Tadashi Fujitsuka)



Forts and illusionary humps, Shichigahama-machi Shiomi-dai New Town, Miyagi
(photo by Hideo Yamanaka)

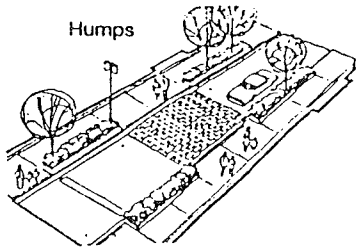
Table 1 shows the techniques used for traffic control classified according to where they are used and their objectives. The table indicates the approach used to achieve each objective and the techniques used to implement them. The table includes physical traffic calming as well as conventional statutory techniques for traffic control.

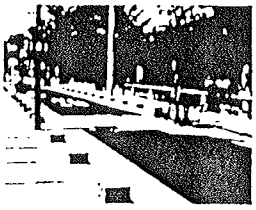
In practice, the manner in which these techniques are combined is very important; however, before going into the way they are integrated, we will consider first the major techniques of traffic calming according to type.

3. Techniques for Controlling Speed

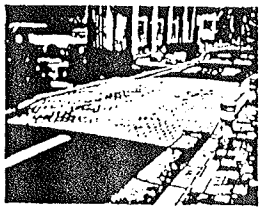
Figure 2 shows structural devices designed to force drivers to slow down and proceed at low speeds. Most physical traffic-calming devices are of this type.

Rough Road Surfaces: place undulations in road surface

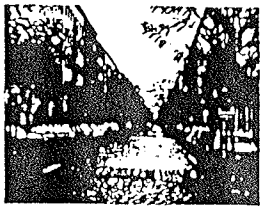




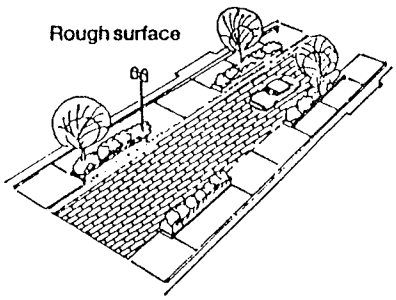
Hump with arc cross section, Sekime Road-Pia, Osaka (photo by Hideo Yamanaka)



Flat-topped hump, Koraku Road-Pia, Nagoya, Aichi (photo by Tadashi Fujitsuka)



Hump that does not impede buses and two-wheel riders, Berlin, Fed. Rep. Germany (photo by Michiyasu Odani)

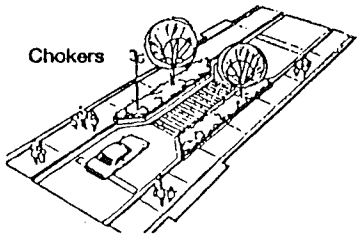


Concrete-panel pavement, Bonsai-cho Community Street, Omiya, Saitama (photo by Tadashi Fujitsuka)

Interlocking block (ILB) pavement, Nishi-shin New Town, Kobe, Hyogo (photo by Tadashi Fujitsuka)

Cobblestone tile pavement, Sanjo-Shirakawa, Kyoto (photo by Hideo Yamanaka)

Narrowed roadway: reduce roadway to one-car width



Choker and block pavement, Koraku Road-Pia, Nagoya, Aichi (photo by Hideo Yamanaka)

Planted chokers, Buxtehude, Fed. Rep. Germany (photo by Michiyasu Odani)

Choker on a two-way street, Helsingør, Denmark (photo by Michiyasu Odani)

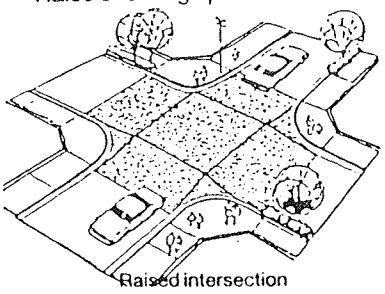
Such structures can be divided into three basic designs: (1) winding roadway, (2) introducing undulations in the roadway surface, and (3) the narrowing of the roadway at certain points. In addition, there are other techniques that act psychologically to give drivers the impression of these structures.

Most of these methods involve a design element. Chicanes, for instance, are highly effective when they make the narrowest section of a road appear to be no more than 1m wide. It is difficult to adopt such a design, however, because chicanes must be installed on roads used by large emergency vehicles, such as fire engines.

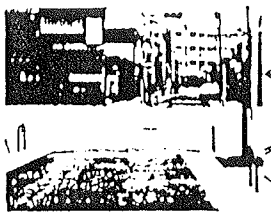
As a result of research into the ideal cross section for speed humps, the Transport Road Research Laboratory (TRRL) recommends humps that are about 3.6m across and 10cm in peak height. In Japan, however, humps with a wider cross sec-

●Fig. 3. Techniques to Encourage Cautious Driving at Intersections

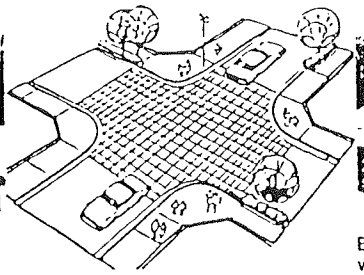
Raise or change pavement



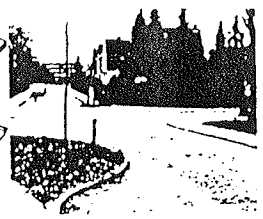
Raised intersection



Raised intersection with ILB pavement, Koraku Road-Pia, Nagoya, Aichi
(photo by Hideo Yamanaka)

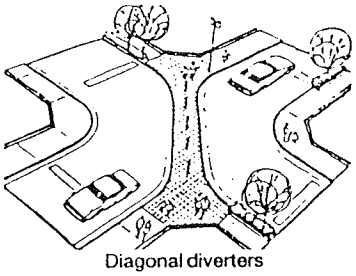


Block pavement



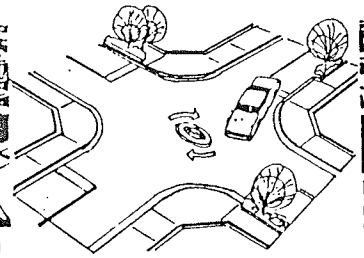
Block pavement combined with chokers at entrance, Buxtehude, Fed. Rep. Germany
(photo by Michiyasu Odani)

Prevent easy passage

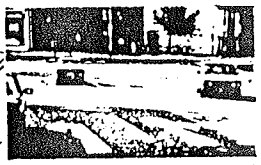


Diagonal diverters

Diagonal diverter connecting pedestrian paths, Minami-Tsukaguchi, Amagasaki, Hyogo
(photo by Hideo Yamanaka)

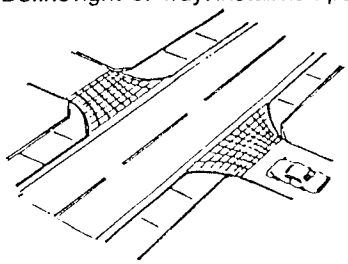


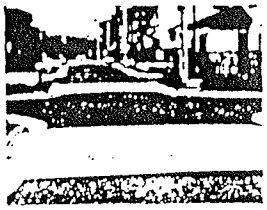
Mini-roundabouts



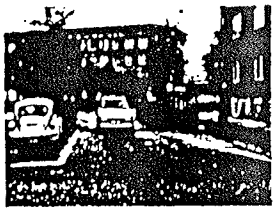
Roundabout defined by road markings, U.K.
[photo courtesy of the Transport Operation Research Group (TORG), University of Newcastle-upon-Tyne]

Define right-of-way: install humps, chokers, or pavement variations on non-priority road





Humps, Shichigahama-machi, Shiomi-dai New Town, Miyagi
(photo by Hideo Yamanaka)



Chokers, near Copenhagen, Denmark
(photo by Michiyasu Odani)

Block pavement, Minami-Azabu Community Street, Tokyo
(photo by Hideo Yamanaka)

tion and gentler arc are used because those conforming to TRRL specifications are considered to have too great a speed-restraining effect.

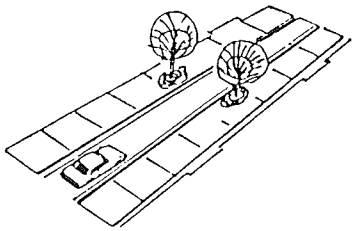
4. Techniques for Intersections

Figure 3 shows several techniques that can be used to encourage cautious driving at intersections. They include measures to make intersections more noticeable, those that physically restrict the ability to drive straight through, and others that clearly define who has the right of way. Of these, diagonal diverters are adopted mainly to discourage through traffic rather than to improve traffic safety. Mini-roundabouts require a relatively large amount of space at the intersection.

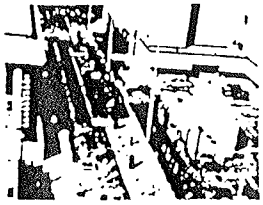
At intersections where traffic in one direction has priority over that coming the other way, humps and chokers on the non-priority road are effective. This tech-

●Fig. 4. Techniques for Controlling On-street Parking

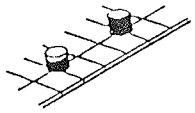
Reduce parking space: eliminate excess space



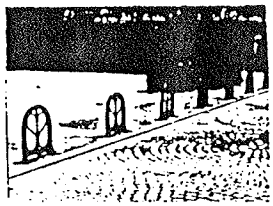
Narrowed roadway



Kokura Community Street, Kita-Kyushu, Fukuoka (photo by Hideo Yamanaka)

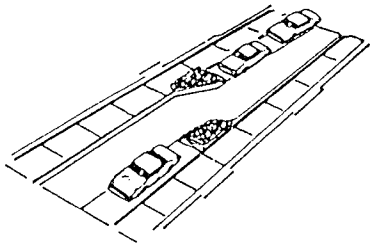


Devices to prevent sidewalk parking



Bollards, Nakiriyama Community Street, Amagasaki, Hyogo (photo by Hideo Yamanaka)

Delineate parking space: provide defined parking areas



Staggered parking areas

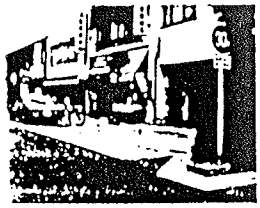
Diagonal parking slots, Düsseldorf, Fed. Rep. Germany (photo by Hideo Yamanaka)

Parallel parking slots, Cologne, Fed. Rep. Germany (photo by Hideo Yamanaka)

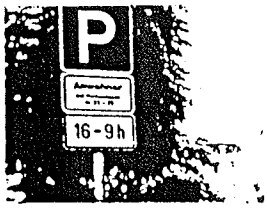
Parking slots indented into sidewalk, Rijswijk, the Netherlands (photo by Michiyasu Odani)

Vehicles and time restrictions

Stopping only, Miyuki-cho Community Street, Numazu, Shizuoka (photo by Hideo Yamanaka)



30-minute parking, Hotta Community Street, Nagoya, Aichi (photo by Hideo Yamanaka)



Resident-only parking, Bonn, Fed. Rep. Germany (photo by Hideo Yamanaka)

Handicapped-only parking, Bonn, Fed. Rep. Germany (photo by Hideo Yamanaka)

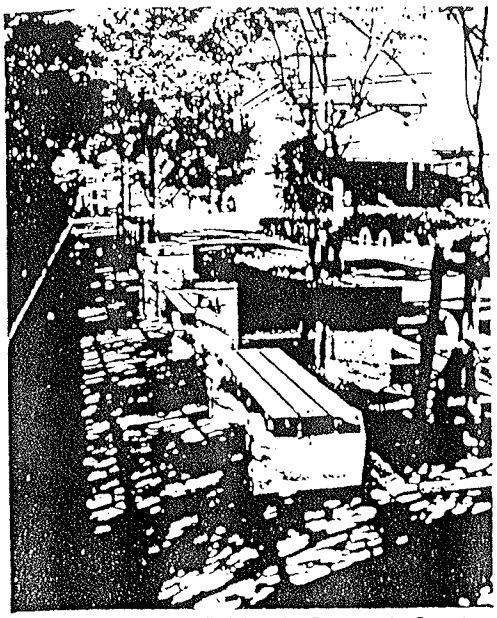
nique is quite an effective way of discouraging the entry of unwanted vehicular traffic into residential areas via minor streets.

In Japan, devices placed in this manner are referred to as *shikii*, a *shikii* being the threshold along which the entrance door slides in a traditional Japanese house. The analogy derives from the perception of the residential area as a home, meaning that one crosses the *shikii* to enter it.

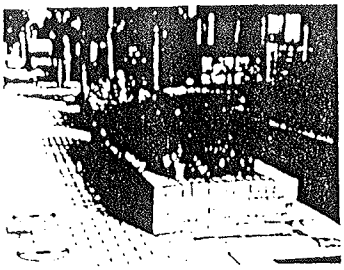
5. Techniques for Controlling On-Street Parking

One problem in residential areas is on-street parking for extended periods by nonresidents. On-street parking is prohibited along most residential streets in Japan; enforcement, however, is difficult, so restrictions are often ignored. The techniques used to limit such parking include providing well-defined parking

BENCHES

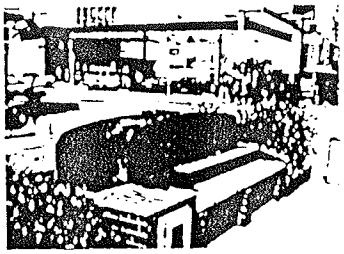


Benches in the shade, Taisho-cho Community Street, Ashikaga, Tochigi (photo by Hideo Yamanaka)

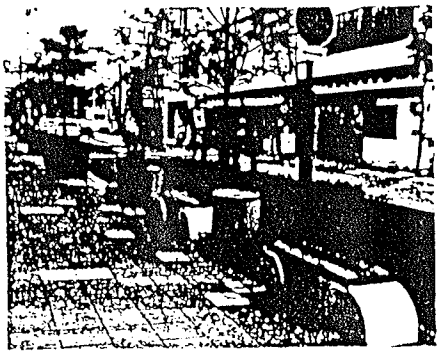


Benches built into planters, Tenjin Community Street, Kita-Kyushu, Fukuoka (photo by Hideo Yamanaka)

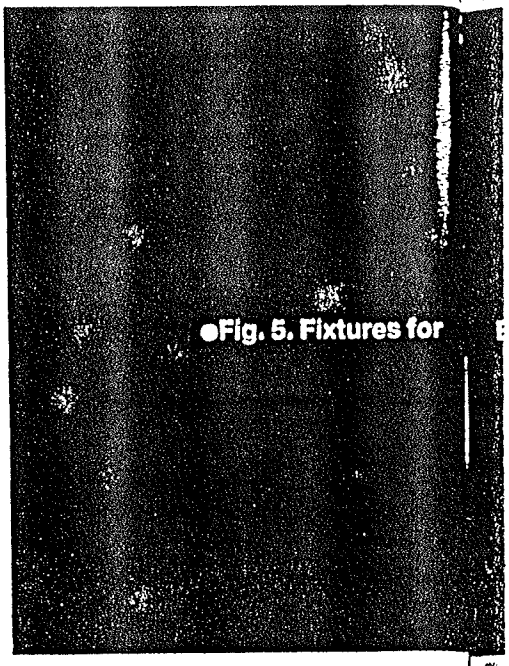
Benches built into forts, Ote-machi Community Street, Numazu, Shizuoka (photo by Hideo Yamanaka)



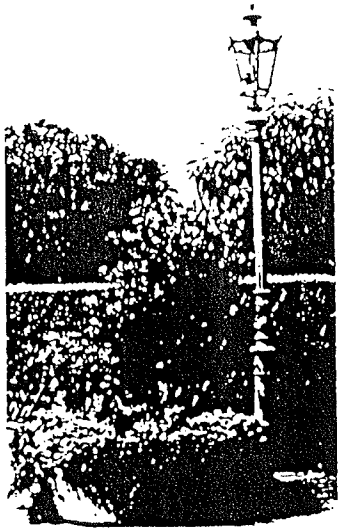
Benches and fountain, Hotta Community Street, Nagoya, Aichi (photo by Hideo Yamanaka)



Benches along a shopping street, Hotta Community Street, Nagoya, Aichi (photo by Hideo Yamanaka)

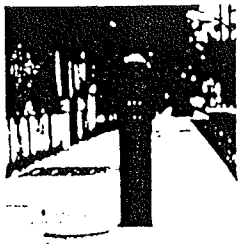


●Fig. 5. Fixtures for



Street lamp, Düsseldorf, Fed. Rep. Germany (photo by Hideo Yamanaka)

LIGHTS



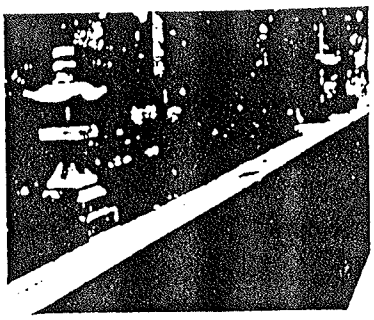
Footlight, Mifune Community Street, Kobe, Hyogo (photo by Michiyasu Odani)

Foot path lamp, Bonsai-cho Community Street, Omiya, Saitama (photo by Tadashi Fujitsuka)

Specially designed street lamp, Minami-Azabu Community Street, Tokyo (photo by Hideo Yamanaka)

LANDMARKS

Stone statue, Sumiyoshi-Miyacho Community Street, Kobe, Hyogo
(photo by Michiyasu Odani)



Stone lantern, Mifune Community Street, Kobe, Hyogo
(photo by Michiyasu Odani)

SIGNS

Sign indicating Community Street, Shinjuku Community Street, Tokyo (photo by Hideo Yamanaka)

Sign indicating Community Street, Higashi-Namba Community Street, Amagasaki, Hyogo
(photo by Hideo Yamanaka)

"Priority to Pedestrians," Onozaki Danchi, Tsukuba, Ibaragi
(photo by Hideo Yamanaka)

Enhancing Pedestrian Spaces

areas and reducing the space available for parking, as Figure 4 shows. The latter is achieved by such means as narrowing the roadway or installing bollards to prevent drivers parking on the sidewalk.

However, such physical structures alone do not suffice to effectively prevent parking, and it would be impractical to make it completely impossible for residents and visitors to park in residential areas.

Some areas have adopted schemes that allow parking for a limited time, but resident parking and permit parking schemes are not permitted on public streets in Japan. But making effective use of such schemes would require the institutionalization of parking patrols, the setting up of a means for local residents to control parking, or the development of some sort of automatic monitoring system.

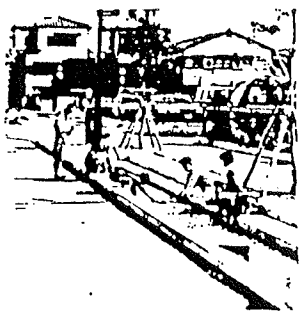
6. Providing Pleasant Spaces for Pedestrians

In addition to traffic-oriented measures, there are a number of ways to improve the function of spaces exclusively designed for pedestrians, as seen in Figure 5: benches along shopping streets and streets bordering parks; small streams along community streets that also serve as play areas for children; and decorative lighting for the benefit of pedestrians.

7. Integration with Statutory Techniques

In Japan, it is often pointed out that the proper integration of statutory measures and physical means of traffic control is critical if the desired results are to be achieved. One reason this needs to be considered is that these two approaches come under the jurisdiction of different administrative agencies in Japan (the

RUNNING WATER



Children and an artificial stream, Minami-Tsukaguchi, Amagasaki, Hyogo
(photo by Hideo Yamanaka)

national and prefectural police agencies are responsible for enforcing traffic laws, while the Ministry of Construction and local governments are responsible for the construction and maintenance of roads). Another factor is that statutory restrictions designed to slow traffic have been instituted and taken root in residential areas under the "Living Zone" project, which began in the 1970s. Almost none of them involved planning that coordinated use of statutory and physical means.

There are two ways of integrating statutory and physical traffic-calming techniques.

One is to use physical structures to augment and complement those traffic regulations that are not easily enforced just by placing signs. Such physical means appear to be particularly effective in reinforcing low speed limits and parking restrictions.

Physical traffic-calming techniques are also useful when enactment of statutory restrictions is difficult because of local conditions. A classic example of this is when a one-way system to reduce traffic volume cannot be introduced because of local opposition. In cases like this, entry treatment (*shikii*) techniques, such as installing humps at the entry points into an area, are effective. Traffic-calming techniques like this have other attractions that make them acceptable to local residents, for example, they have the double effect of improving the appearance of the street and reducing traffic volume.

The other way of integrating statutory and physical traffic-calming techniques is to institute traffic regulations that augment the physical techniques. This may involve legal reinforcement of the "priority for pedestrians" concept, which underpins the remodeling of streets for traffic-calming purposes. In the Netherlands and West Germany, the concept of *woonerf* street design has been completely incorporated into traffic law, and signs have been set up accordingly.

Unfortunately, however, hardly any progress has been made toward introducing such a statutory infrastructure in Japan. This means that, even among the methods mentioned here, most are ineligible for Japanese government subsidies. When the methods have been used, it has been in unusual situations in which progressive local governments or developers have taken it upon themselves to do the work.

It is important to improve statutory infrastructure while at the same time pinpointing effective traffic control measures. In this way, it will be possible to break out of the present situation in which work is restricted to demonstrative projects. □

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(1) Amano, K., Fujitsuka, T., Odani, M., and Yamanaka, H. *Hosha Kyôzon Dôro no Keikaku & Shuhô* (Planning and techniques for traffic calming on residential streets). Toshi Bunkasha, 1986.
(2) Osaka Municipal Government Public Works Bureau. *Kôtsû Yokusei no Tame no Dôro Kôzô* (Street design for traffic restraint). Osaka Public Works Bureau, 1984.
(3) Study Group of Planning Residential Streets. *Hito to Kuruma "Oriai" no Michizukuri: Jûkunai Gairo Keikaku Kô* (On street planning in residential areas: harmonious integration of people and automobiles). Kashima Institute Publishing Co., Ltd., 1989.

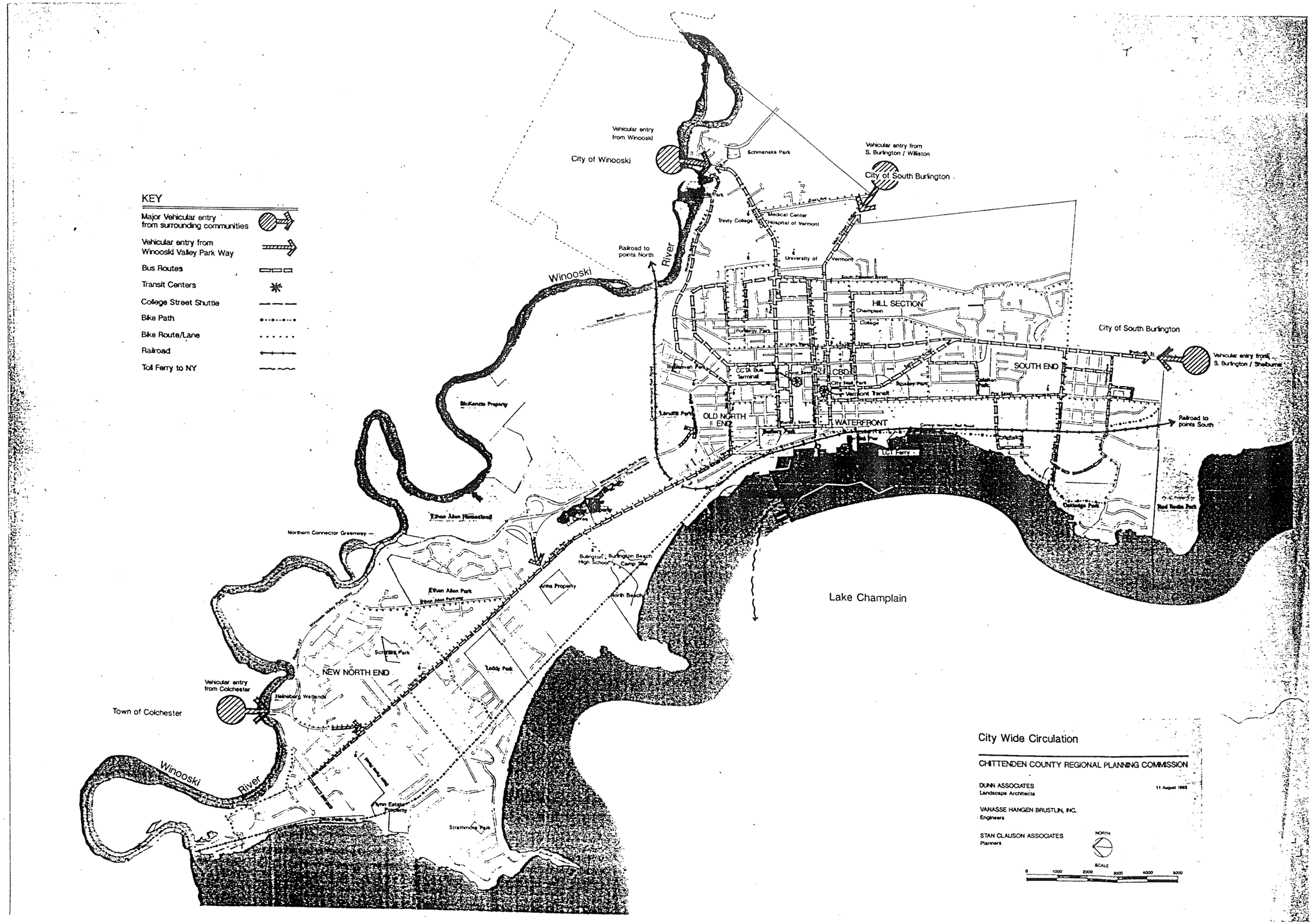
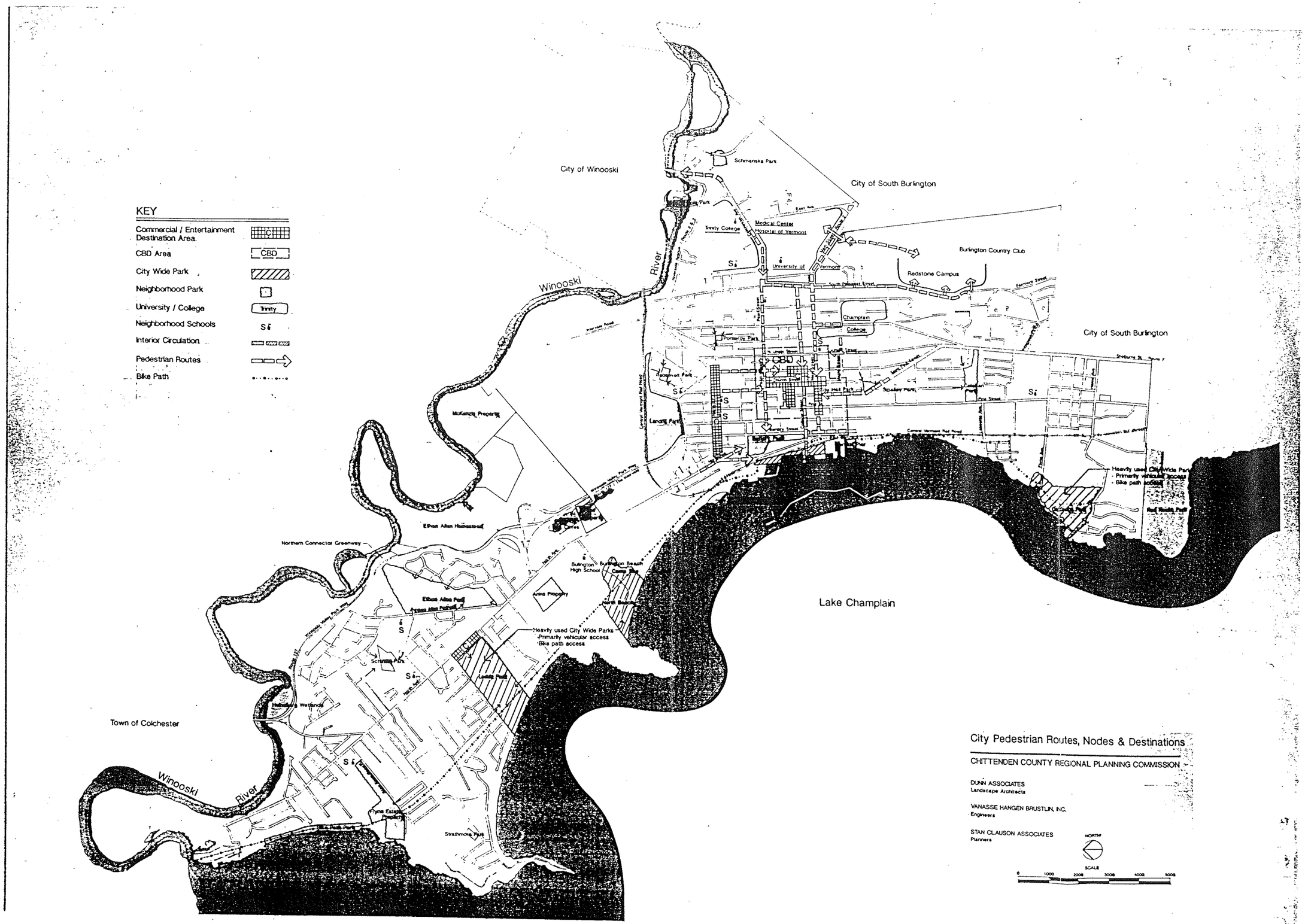

KEY
Major Vehicular entry from surrounding communities
Vehicular entry from Winooski Valley Park Way
Bus Routes
Transit Centers
College Street Shuttle
Bike Path
Bike Route/Lane
Railroad
Toll Ferry to NY
Vehicular entry from Winooski
City of Winooski
Schmanska Park
Vehicular entry from S. Burlington / Williston
City of South Burlington
Trinity College
Medical Center Hospital of Vermont
Railroad to points North
Winooski River
University of Vermont
HILL SECTION
Champlain College
City of South Burlington
Vehicular entry from S. Burlington / Shelburne
CCTA Bus Terminal
CBD
SOUTH END
Vermont Transit
OLD NORTH END
WATERFRONT
Railroad to points South
Toll Ferry
McKenzie Property
Ethan Allen Homestead
Northern Connector Greenway
Burlington / Burlington Beach High School / Camp Site
Ethan Allen Park
Arms Property
North Beach
Lake Champlain
NEW NORTH END
Vehicular entry from Colchester
Heineberg Wetlands
Town of Colchester
Winooski River
Lynn Estate Property
Strathmore Park
City Wide Circulation
CHITTENDEN COUNTY REGIONAL PLANNING COMMISSION
DUNN ASSOCIATES
Landscape Architects
11 August 1993
VANASSE HANGEN BRUSTLIN, INC.
Engineers
STAN CLAUSON ASSOCIATES
Planners
NORTH
SCALE
0 1000 2000 3000 4000 5000

Figure 1



City Pedestrian Routes, Nodes & Destinations

CHITTENDEN COUNTY REGIONAL PLANNING COMMISSION

DUNN ASSOCIATES
Landscape Architects

VANASSE HANGEN BRUSTLIN, INC.
Engineers

STAN CLAUSON ASSOCIATES
Planners

NORTH

SCALE
0 1000 2000 3000 4000 5000

Figure 2

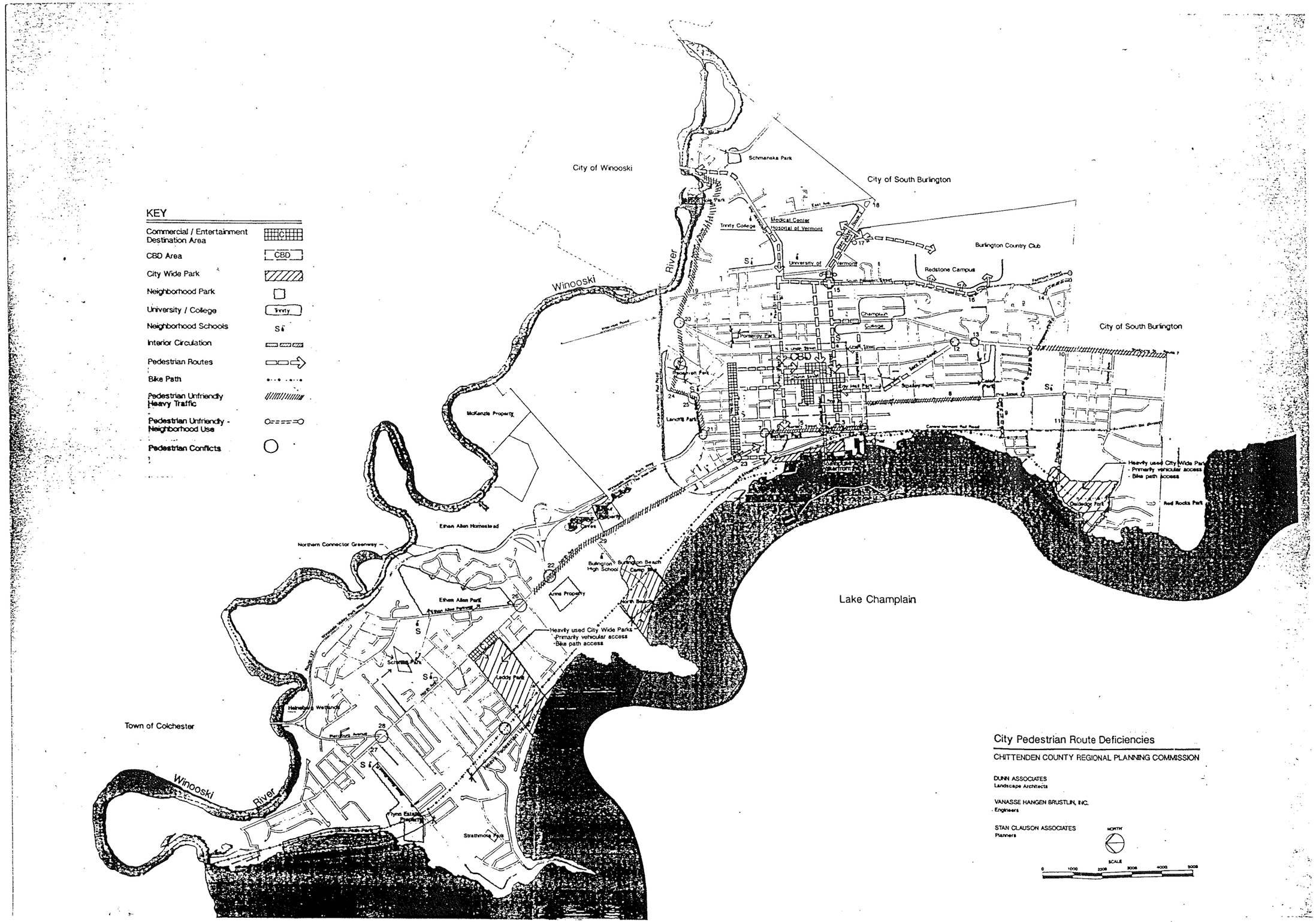
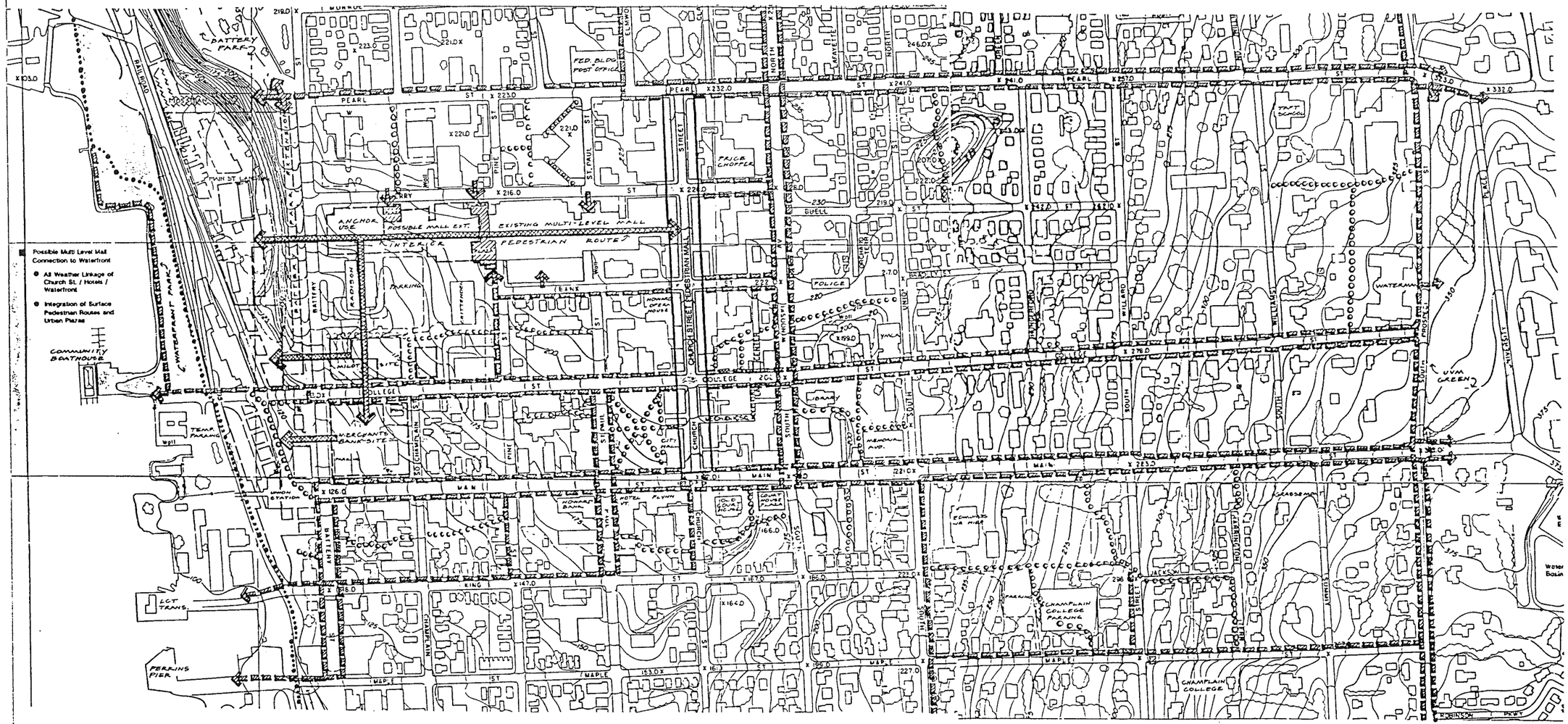

KEY
Commercial / Entertainment Destination Area
CBD Area
City Wide Park
Neighborhood Park
University / College
Neighborhood Schools
Interior Circulation
Pedestrian Routes
Bike Path
Pedestrian Unfriendly Heavy Traffic
Pedestrian Unfriendly - Neighborhood Use
Pedestrian Conflicts
City of Winooski
City of South Burlington
Town of Colchester
Lake Champlain
Winooski River
Schmanska Park
Trinity College
Medical Center Hospital of Vermont
University of Vermont
Redstone Campus
Burlington Country Club
Champlain College
Pomeroy Park
Battery Park
Lakeside Park
Leddy Park
Red Rocks Park
McKenzie Property
Ethan Allen Homestead
Northern Connector Greenway
Burlington High School
Burlington Beach Camp
Ethan Allen Park
Arms Property
Heavily used City Wide Parks
-Primarily vehicular access
-Bike path access
Scrimsha Park
Hathaway Wetlands
Flynn Estate Property
Strathmore Park
City Pedestrian Route Deficiencies
CHITTENDEN COUNTY REGIONAL PLANNING COMMISSION
DUNN ASSOCIATES
Landscape Architects
VANASSE HANGEN BRUSTLIN, INC.
Engineers
STAN CLAUSON ASSOCIATES
Planners
NORTH
SCALE
0
1000
2000
3000
4000
5000

Figure 5



KEY

	Existing	Potential
Outdoor Pedestrian Connection		
Sidewalks		
Alternate Routes		
Indoor Connections		
Plazas		

Pedestrian Linkages: UVM to Waterfront

CHITTENDEN COUNTY REGIONAL PLANNING COMMISSION

DUNN ASSOCIATES
Burlington, VT
Landscape Architects

VANASSE HANGEN BRUSTLIN, INC.
Bedford, NH
Engineers

STAN CLAUSON ASSOCIATES
Montpelier, VT
Planners

25 August 1983

north

Figure 7