Guidelines for Planning and Implementation of Transit Priority Measures (TPM) in Urban Areas

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Abstract

In recent years there has been an increasing interest in sustainable transportation and surface transit systems. The reliability of transit systems have been a concern with the growing congestion on the roadways. To improve the performance of these systems, Transit Priority Measures (TPM) have been implemented in various jurisdictions across Canada. The overall objective of these TPM is to improve transit travel time, travel time reliability, and/or safety. However, guidelines that governed the selection and implementation of TPM were unavailable. As a result, these Guidelines were developed to create a process that practitioners may use that will aid in:

- Identifying the issues/concerns;
- Assessing the potential transit priority measures; and
- Implementing and monitoring the select TPM (s).

There is a body of TPM applications that can meet these objectives. The TPM can be classified into three broad categories:

- Regulatory Measures;
- Transit Signal Priority;
- Physical Measures.

The selected measure(s) should meet the majority of the principles:

- Safety;
- Delay;
- Disruption to Road Users;
- Consistency/Conspicuity; and
- Pragmatism.

The Guidelines present a six step process for implementing TPM that includes a Decision Support Tool (DST) which guides the practitioner in the selection of the TPM. The results from the DST are preferred TPM that can be implemented on-street.

Introduction

Transit Priority Measures (TPM) have been used to improve transit vehicle performance across Canada. However, guidelines that governed the selection and implementation of TPM were unavailable. As a result, these Guidelines were developed to create a process that practitioners may use that will aid in:

- Identifying the issues/concerns;
- Assessing the potential transit priority measures; and
- Implementing and monitoring the select TPM (s).

In recent years, there has been an increasing interest in sustainable transportation and surface transit systems. The reliability of transit systems have been a concern with the growing roadway congestion. To improve the performance of these systems, TPM have been implemented. The overall objective of these TPM is to improve transit travel time, travel time reliability, and/or safety. These improvements in transit travel time and reliability at individual locations may be relatively small. However, when TPM benefits are aggregated across a corridor or network, the overall benefits can be substantial. Additionally, maintaining exceptional transit services in the longer term can promote modal shifts from personal vehicles to transit. In general, meeting the above objectives can potentially maintain ridership and revenue, while reducing operating costs, even if traffic operations are impacted.

There is a body of applications that can meet these objectives and can be classified into three broad categories:

- Regulatory Measures;
- Transit Signal Priority; and
- Physical Measures.

It is important to note that transit priority measures can often be regarded as a component of larger projects, or a method of achieving different objectives. For example, the direct benefit of implementing TPM is an improvement in transit operations. However, there are indirect benefits such as decreasing greenhouse gas emissions by promoting a modal shift to transit, and reducing congestion.

It is common that practitioners combine multiple TPM at a single location. As an example, queue jump lanes are often accompanied with Transit Signal Displays (TSD).

The primary focus of these Guidelines reflects bus operations with the TPM identified. From a transit priority perspective, these treatments are also applicable to other forms of transit, namely, light rail transit (LRT), and streetcars. However, practitioners must be aware that the application and design of TPM to these other forms of transit may be more rigorous when compared to designing for bus operations.

These Guidelines provide practitioners the necessary tools and framework to follow in selecting TPM. The decision of the most appropriate TPM to implement is left to the practitioner’s discretion.

Purpose of Guidelines

The purpose of this document is to provide stand-alone guidelines for the planning and implementation of TPM. This will provide practitioners with the framework that is required in selecting the appropriate TPM for their needs.

The following are questions that should be considered throughout the process:

- Why implement a TPM?
- When is a TPM triggered?
- Who will be involved?
- What is the goal of the TPM?
- Which TPM is/are most appropriate?
- Where will the TPM be implemented?
- How will the TPM work?

Guiding Principles for TPM

These Guidelines use a set of principles that should be considered during the process of determining the appropriate TPM to use. The selected measure(s) should meet the majority of the principles described below.

- **Safety** – The implementation of TPM should provide a safe environment for all road users. Practitioners should be aware of the consequences that a TPM may have on the safety for the intersection/roadway, and the roadway users (pedestrians, cyclists, general traffic);

- **Delay** – The primary purpose of implementing TPM is to reduce the amount of delay experienced by a transit vehicle. By reducing the amount of delay experienced by a transit vehicle, through a TPM or a combination of different TPM, transit system speed, reliability and efficiency may increase;

- **Disruption to Road Users** – Practitioners must ensure that the effects on the other road users are limited with the implementation of any TPM. The degree that the road users are affected is dependent on the TPM selected;

- **Consistency/Conspicuity** – Consistency in the use of a TPM ensures that confusion is minimized for general traffic and transit operators. For example, the usage of lane markings and other treatments to delineate between general purpose lanes and transit lanes should be consistent throughout the system. The use of transit signal displays at signalized intersections should also be consistent to ensure transit operator and general traffic comprehension (refer to TAC “Transit Guidelines for the Application and Display of Transit Signals” for further details); and

- **Pragmatism –** The practitioner should consider practical issues that may arise with the selection of the TPM. For example, the cost of installation may result in the TPM being impractical. Additionally, if installed, the practitioner is required to consider other factors, such as maintenance, and operations.

TPM Types

TPMs can be grouped into the following three general categories:

1. **Regulatory Measures:** These measures include, but are not limited to, vehicular lane use restrictions, time-of-day or part-time reserved transit lanes and on-street parking restrictions.

2. **Transit Signal Priority (TSP):** These include techniques to provide priority for transit vehicles at signalized intersections. They range from passive approaches that prioritize transit movements in standard signal timing plans, actuated TSP that activates a transit signal display when a transit vehicle is physically detected at an intersection, and active TSP where traffic control algorithms are dynamically invoked in response to real-time positioning data provided by transit vehicles.

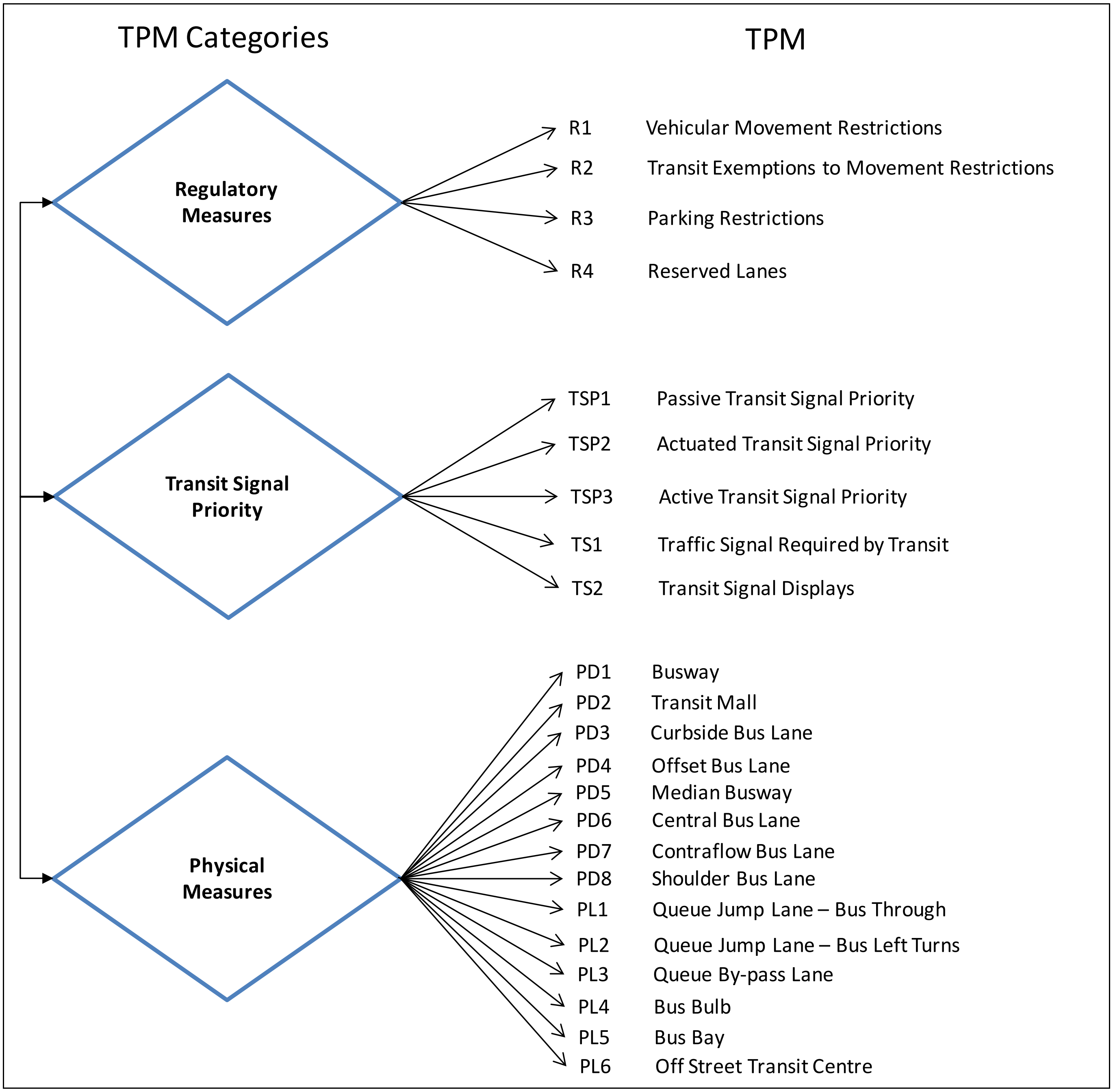
3. **Physical Measures:** Physical improvements may be applied to create an exclusive transit runningway or to change the geometric design of a street segment to improve the operation of transit vehicles. Physical improvements to create an exclusive transit runningway, as defined in the “Guidelines for the Application and Display of Transit Signals” by TAC, may be “dedicated” (the transit lane is continuous from signalized intersection to signalized intersection), or “localized” (a transit lane is provided on the signalized intersection approach). Examples include busways, transit malls, reserved lanes, and queue jump lanes. Physical improvements to the street, such as geometric improvements at intersections, bus bulbs, and bus bays, are designed to improve transit service when operating in general traffic.

Exhibit 1 identifies example TPM and groups the TPM using the above three categories.

It is important to note that TPM techniques from various TPM categories can be combined to develop a “layered” TPM solution.

Practitioners should note that the TPM identified in these guidelines are the most commonly used in Canada, and are not a complete list of all TPM that could be used.

Exhibit 1: Examples of TPM



Regulatory Measures

Regulatory measures are transit priority measures that can be applied through existing legislation/regulations, typically through signage and/or pavement markings. Alternatively, new legislation/regulations may be proposed on federal, provincial, and/or municipal levels, if existing legislation does not exist to support the proposed measure. The time required for new legislation to be passed will vary.

Practitioners should note that the “Yield-to-bus” legislation has not been included in **Exhibit 1** because it applies on a global basis and is not a site-specific measure.

Yield-to-bus legislation prioritizes transit movements over general vehicle movements. The yield-to-bus legislation gives transit vehicles priority when merging left into traffic after transit stops or queue jump and queue by-pass lanes. As of the date of preparation of this document, the following provinces have adopted yield-to-bus legislation: Quebec (3), Ontario (2), and British Columbia (1). One should note experience has shown that implementing certain TPM is most effective when implemented in conjunction with the yield-to-bus legislation.

The regulatory measures identified in the Guidelines require the use of signs for enforcement.

Transit Signal Priority

Transit Signal Priority (TSP) refers to the adjustment of the existing phase timings and/or phase sequence to provide preferential treatment to transit vehicles at a signalized intersection. Practitioners should be aware of the differences in providing TSP versus pre-emption. Pre-emption may significantly disrupt traffic flow and requires a significant period of time for the signal control system to recover. TSP typically has a much smaller impact on general traffic and recovery usually occurs within one signal cycle.

Practitioners proposing any form of TSP at an intersection or corridor must take into consideration the effects that providing preferential treatment to transit may have on the other road users. In addition to providing priority to transit vehicles, the use of TSP may also provide benefits for general traffic. For example, general traffic travelling through an intersection concurrently with transit can benefit from generally longer green time as a result of TSP (either passive or active).

Additional benefits in implementing TSP may include, but are not limited to, the following:

- Reduction in delay at the intersection;
- Reduces travel time variability, while increasing reliability;
- Facilitates complex transit movements (i.e., turning left from the curb lane); and
- Improves overall safety of the intersection.

Practitioners should also consider the location of transit stations/stops in conjunction with the type of TSP selected. The location of the station/stop may have an impact on transit reliability, performance, and how effective TSP operations will be. Optimizing the location of the transit station/stop can minimize exposure to vehicular conflicts, and/or improve TSP efficiency.

The variability in passenger service time can make it difficult to accommodate TSP effectively at locations with near-side stops. However, at stops with low passenger service time variability and a high level of priority granted, TSP can be very effective in reducing the amount and variability of delay. At stops with low passenger service time variability, passengers can often be served during the red display (unlike at far-side stops). Near-side stops facilitate transit vehicle insertion into traffic, as the transit vehicles can use the width of the cross street to merge into the traffic lane.

Generally, far-side stops can accommodate TSP more easily than near-side stops. At these locations, transit vehicles do not stop before the signal. As a result, the transit vehicle's estimated time of arrival at the intersection is easier to predict. However, it is more difficult for transit vehicles to pull out if the transit stop is located in a bus bay.

Transit priority requests can be activated by (applicable to actuated or active TSP):

- Manual command by transit vehicle operator;
- Automatic detection upon door closing; and
- Automatic detection of the transit vehicle approaching the intersection.

Physical Measures

The physical measures are divided into two categories: Dedicated (PD) and Local (PL) measures. Dedicated physical measures are defined as physical measures that are continuous from one intersection to the next along a defined transit corridor. In contrast, localized measures only exist at a single isolated intersection. The implementation of physical TPM is intended to minimize the amount of interactions between transit vehicles and other vehicles, and increase the efficiency of the transit system.

TPM Triggers

Triggers are events or objectives that initiate the process to select the appropriate TPM to implement on a local or corridor-wide scale. Triggers are either proactive or reactive. The following categorizes some of the more common triggers, as proactive or reactive. These triggers can be identified by a single group or multiple groups. As described in the on-line survey, many agencies have identified multiple groups that identify the need for TPM. Based on the survey results, 20 of the 24 respondents indicated that there were multiple agencies involved in identifying the need for TPM. The more prominent groups that were identified in this survey were:

- Public;
- Transit Planning;
- Transit Operators;
- Transit Agency/Operations;
- City Transportation Planning;
- Public Works/Traffic Operations;
- Provincial/Regional Transportation Planning.

Cooperation between these groups is essential to ensure that all issues are identified and agreed upon. This can be accomplished through initial meetings attended by the stakeholders. In addition, potential locations for TPM implementation can also be determined through stakeholder meetings.

Proactive

The TPM selection process is initiated through future transit demand and/or opportunities/objectives. A situational example, which may trigger proactive assessment of the need for a TPM, is when a jurisdiction develops local strategic planning documents such as transportation master plans. These documents should be consulted to identify the priorities of key stakeholders (city, region, transit operator, provincial transportation agency, etc.).

The following describes several proactive TPM triggers.

Transportation Master Plan / Official Plan

A transportation master plan highlights the objectives of a jurisdiction with respect to their transportation system. Examples of the type of objectives that are in a master plan include promoting sustainable modes of transportation (i.e., walking, cycling, and/or transit), over the use of private vehicles. These objectives are often environmentally, and/or practically driven (i.e., construction of additional roadways may not be feasible). The TPM objectives can help in selecting the most appropriate TPM. Practitioners should be aware that it is important that the provision of priority to transit vehicles should be considered in high-level planning, and official documents such as a transportation master plan, or master plan.

Transit Oriented Development (Existing/Proposed)

Opportunities to provide better transit service may arise with the development of adjacent lands that have the ability to support the transit service. In conjunction with the development of the adjacent lands, TPM can also be implemented for the routes that will service the area. This will help ensure transit service to the area will be reliable.

Competition between Modes of Travel

Justification that public transit is the desired form of travel may be difficult if the transit service is slow and unreliable. Therefore, to increase the benefits of transit and ensure that transit operations are comparable to general vehicle operations, TPM can be selected.

Projected Transportation Needs

Through modeling exercises, it may be determined that the existing transportation services may not be adequate to accommodate future demands. To help ensure that these demands are met, practitioners may begin to determine feasible solutions to the potential inadequacies of transit services.

Cost Saving Opportunities

A faster and more reliable transit system can provide cost saving opportunities. For example, if schedule adherence increases with the implemented TPM, the number of transit vehicles can be reduced because the demand can be accommodated with fewer vehicles. As a result, maintenance and operating costs can be reduced.

Increase Transit Capacity

Increasing transit speed through TPM can improve service frequency and capacity on a route (without additional resources).

Roadway Reconstruction

Roadway reconstruction provides the opportunity for the construction of physical TPM without incurring significant construction costs, in comparison to installing the measure(s) independently.

Re-development Opportunities

Local developments may provide opportunities to implement TPM. For example, lengthening an existing right turn lane can be completed in conjunction with the construction of local developments.

Reactive

The selection of a TPM is initiated based on existing concerns, complaints, etc. In other words, the TPM selection process is in reaction to different events. Example situations which may trigger reactive assessment of the need for a TPM are:

- Request by the transit agency to reduce delay at a particular signalized intersection, or a group of signalized intersections;
- Request by the transit operator to provide features to help the transit vehicle exit a transit terminal;
- Request by the transit agency to reduce the travel time on a particular transit route;
- Request by a resident to improve the on-time performance of a particular transit route (improve schedule reliability).

The following describes several reactive TPM triggers.

Political Demand

The decision to promote transit services may not always be based on existing or public concerns. At times, the TPM selection process may begin due to political demand. It is important to take into consideration the political demands. This will be essential for successfully implementing TPM.

Transit Travel Time Savings

Practitioners may find that the transit travel times have drastically increased over a period of time in their jurisdiction. As discussed, the primary objective to implementing any TPM is to improve transit operations. A measurable factor is the transit travel time. Ideally, implementing TPM decreases the travel time for transit vehicles. As a result, there will also be an overall decrease in the delays experienced by passengers.

Transit Service Reliability

Transit service reliability refers to how well a transit vehicle adheres to a predetermined schedule (or headway). For example, transit vehicle reliability in mixed traffic may be significantly worse, when compared to transit vehicles operating in a dedicated lane. The implementation of TPM would ideally decrease the variations in travel time, headways, and delay that a transit vehicle encounters.

Practitioners may decide that the variation in travel time, headways, and delays are unacceptable. Therefore, the selection of TPM may be necessary to provide a more efficient system.

Existing Deficiencies

One of the more prominent triggers that will initiate the TPM selection process is that there are known existing deficiencies that are affecting the transit service. For example, there could be lengthy or highly variable delays on a particular left turn.

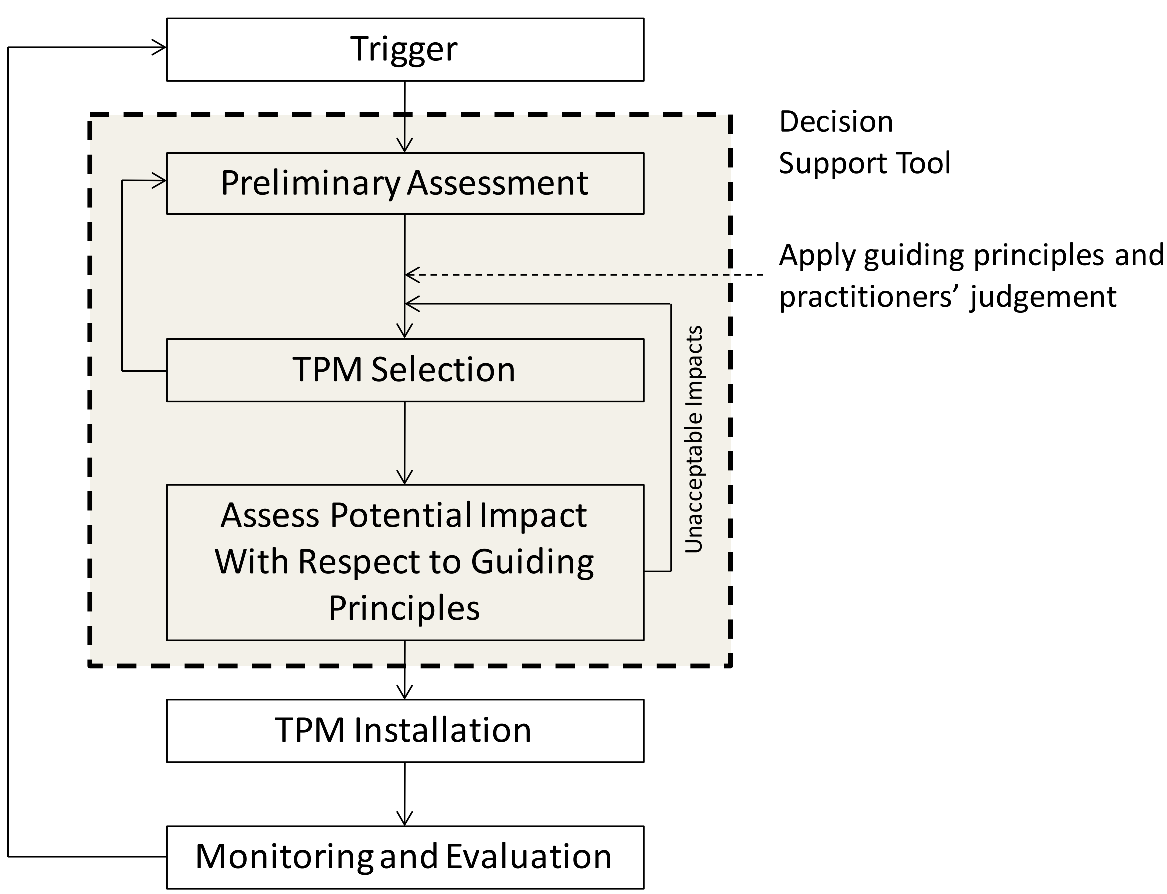
Public Complaint

The process of implementing TPM may be initiated by a public complaint. For example, in one jurisdiction surveyed, transit service reliability is a more common complaint than frequency and speed.

Approach for the Implementation of TPM

Implementing TPM requires a systematic approach involving six elements: (1) a trigger; (2) preliminary assessment; (3) TPM treatment selection; (4) assessment of potential impact with respect to guiding principles; (5) TPM treatment installation; and (6) monitoring and evaluation. **Exhibit 2** illustrates the sequential nature of these elements.

Exhibit 2: Approach for Implementing TPM



Trigger: Refer to the earlier **TPM Triggers Section** for detailed description.

Preliminary Assessment: Once a trigger has identified the need for assessment of a site, the next step is to determine whether there is a need for any TPM at the given location. This requires understanding the existing problem or future transportation master plans. Understanding the problem includes: identifying the problem, quantifying the problem, stating the objectives, generating alternative solutions, analyzing the solutions, and selecting a range of potential alternatives. For example, the TPM objective might be the reduction of signal delay at signalized intersections to reduce the running time on a route, thereby reducing the number of vehicles required to operate on a route.

An initial screening should be performed to identify the physical impact of the TPM at the given location. It should determine whether the TPM can be implemented within the existing right-of-way, or if additional right-of-way is required. An initial assessment of the capital and operating cost of the candidate TPM will help focus on the treatments that can be implemented with available resources. In addition, factors such as public acceptance, organizational acceptance, the different needs and priorities for each jurisdiction should be considered.

TPM Selection: When a site is a candidate for TPM, it is necessary to identify the type of TPM that would best meet the needs of the given situation. It is important to consider that each type of TPM has advantages and disadvantages. Furthermore, it might be advantageous to layer the TPM, combining strategies from different solutions. An example is the implementation of a queue jump lane with active TSP.

Assessment of Potential Impact of Selected TPM: After a TPM has been selected for potential implementation, the next step is to assess the impact of this selection with respect to the Guiding Principles. The Guiding Principles provide a holistic platform for practitioners to address the specific conditions that arise when making a decision about whether to TPM. This step promotes the integration of the Guiding Principles within the context of local site conditions, and the priorities, values, and specific goals of the local jurisdiction.

Some of the issues that should be considered at this step in the process are as follows:

- Impact to transit operations;
- Impact to other road users;
- Impact to adjacent properties;
- Cost (capital and maintenance costs); and
- Required enforcement activities.

TPM Installation: Treatments are installed following standard guidelines.

Monitoring and Post Evaluation: Once the TPM has been installed, it is necessary to monitor and evaluate its performance. Some measures that can be monitored are:

- Transit travel time (average and variability);
- Transit delays;
- Delay to other road users; and
- Collisions.

These measures can be evaluated from studies. For example travel time studies, collision studies, and field investigations can be conducted. The results from these studies can be used to compare to the initial results obtained prior to implementation.

Decision Support Tool for TPM

The TPM Decision Support Tool (DST) is a three step process that consists of: Preliminary Assessment, TPM Selection, and assessment of the Potential Impact to Guiding Principles. The following describes the process used in the TPM decision support tool to arrive at the preferred TPM solution(s).

Preliminary Assessment

The preliminary assessment portion of the process may be divided into two categories, namely, problem definition, and assessment.

Problem Definition

The entire decision process is initiated by a trigger (either proactive or reactive). This provides the primary steps in guiding the practitioner into a more detailed analysis of the actual problem that requires mitigation or opportunities. Conducting studies to further assess the issues that have been identified by the previous stage is essential. Studies that can be completed by the practitioner are, as follows:

- Travel Time Studies;
- Field investigations; and
- Simulation.

Independently of the method used (field investigation, or travel time study), the problem should be adequately defined prior to proceeding to the assessment stage. By defining the problem, the practitioner can determine the severity of the issue, and extent (i.e., local intersection problem, or corridor problem).

Travel Time Studies

Collaboration with the local transit agency is necessary to complete a travel time study. This study permits the user to determine the total travel time of the affected bus route, and where bottlenecks occur. Data collection is dependent on the availability of a CAD/AVL system on the bus. If a CAD/AVL system is available, the practitioner can coordinate with the local transit agency to extract the required data from the affected route. If the system is unavailable or the necessary information cannot be extracted from the system, the practitioner can use other methods, such as manual data collection in the field, or portable GPS units, to collect GPS data to determine where the delays occur, and the magnitude of the delay.

Using the extracted data, the practitioner can determine the types of delay: queue delay (delays caused by congestion), control delay (delay caused by waiting at a signal), and the frequency of delay (day of week, time of day).

Field Investigations

Field investigations can be used to further investigate the problematic areas as defined by the trigger. Conducting field investigations can provide practitioners a visual understanding of the problem. For example, it may be difficult to determine whether dwell times at a transit stop/platform can be a contributing factor to the poor travel time through the travel time study. Visual inspection can provide definitive knowledge that dwell times may be a factor.

Modeling/Simulation

If field investigations, and travel time studies cannot be completed, a traffic model can be developed for the desired network. Popular simulation software includes Synchro for traffic analysis and VISSIM for microscopic simulation. The approach and detail for the model will be dependent on the cost required to develop the model.

Assessment

A preliminary assessment of the TPM is performed using eight evaluation categories. The objective is to screen out TPM that may not feasible given the constraints and objectives established by the trigger. The eight categories are:

Local versus Corridor –The determination of whether the issue is local or a corridor wide issue will influence the decision of which TPM to select.

Physical Impacts – The Physical TPM are used to create an exclusive transit runningway, which may be either localized or dedicated as previously described. The exclusive transit runningway can either be accommodated within the existing right-of-way, or may require additional right-of-way for implementation. Physical measures may also include changing the geometrics of the roadway to benefit transit operations.

Operations – In general, the objective of TPM is to reduce delay to transit (increase transit reliability). The TPM improvement to transit should be assessed within the context of the impacts on other roadway users (motorists, cyclists and pedestrians).

Public Acceptance – Public acceptance evaluation of the TPM by transit users, as well as other competing roadway users such as motorists, cyclists, pedestrians, and adjacent property owners/businesses.

Safety – Safety of the various roadway users (pedestrians, cyclists, motorists, transit) is an objective that practitioners should keep in mind when implementing and operating a TPM.

Enforcement – To ensure compliance by the other road users, the enforceability of TPM should also be assessed prior to installation. The level of enforcement required is dependent on the proposed TPM. For example, dedicated right-of-ways will require little enforcement. In contrast, parking and lane restrictions will require more enforcement. The selection of certain TPM may not be feasible without proper enforcement, which may require prior agreement with the enforcement agency. Also, appropriate by-laws may be required to support the TPM. These by-laws will need to be in place prior to TPM operation.

Organizational – A common institutional challenge is inter-agency coordination and communication. Inter-agency coordination is particularly important with the design, implementation and operation of TPM since it often requires cooperation between planning, traffic, transit, and enforcement agencies. In large-scale TPM deployment (such as dedicated transit lanes), inter-agency coordination is particularly important since these projects often require the cooperation of the local municipality, regional government and provincial government.

Financial – Financial constraints should consider the transit operating cost with, and without, the TPM, the increased (or reduced) operating cost due to the TPM, and the capital cost required to construct the TPM. Trade-offs between capital and operating costs may need to be considered in the selection of a TPM. Practitioners should also consider the cost savings that a TPM can provide. For example, future operating cost increases can be mitigated with a TPM when congestion on the roadway increases.

TPM Selection

Each TPM design alternative can be analyzed based on defined criteria. The criteria selected is based on the categories that were developed in the preliminary assessment section.

Potential Impact to Guiding Principles

The impacts to the Guiding Principles will be dependent on the selected TPM. Therefore, when a potential TPM is selected, it is important for the practitioner to evaluate the impact that the measure will have on the Guiding Principles. The selected TPM should comply with the majority of the Guiding Principles.

Evaluation of the potential impacts on the Guiding Principles can be accomplished through various methods. Additionally, evaluation methods specific to each TPM are provided. The more prominent types of studies that are applicable to all TPM are as follows:

- Travel time studies;
- Service reliability studies;
- Queue studies;
- Pilot projects; and
- Other field observations.

It should be noted that the implementation of a pilot project can be used to determine the potential impacts on a smaller area. For example, intermittent bus lanes in Lisbon, Portugal were installed on 800 meters of a roadway (4). Based on this small scaled installation, it was determined that installation of the intermittent bus lane had a positive effect on transit operations and it was perceived well with the public.

Monitoring and Post Evaluation

Once a TPM is implemented, it is important to monitor and assess the effectiveness of the installed measure. The criteria to evaluate TPM vary depending on the measure selected. However, the more prominent measures that are evaluated post installation are the transit running times (as measured by the mean and standard deviation), transit delay at intersections, transit operating speeds, and schedule adherence.

The travel time studies, field investigations, and traffic modeling may be used to determine these times. Once sufficient data has been collected for the post implementation runs, it can then be compared to the before runs. The differences in the results would be the impacts that the installation of the proposed TPM has on the intersection or corridor.

Cost savings can also be evaluated to determine the effectiveness of a TPM installation. Implementing TPM can potentially reduce the number of transit vehicles required to service a transit route. As a result, the overall cost to operate the transit service is reduced.

Furthermore, the effects to the other road users should also be evaluated. As previously stated, the intent of installing a TPM is to provide priority for transit vehicles, while limiting the impacts that the measure will have on other users.

Additionally, the data collected post installation could be beneficial for TSP measures (passive, actuated, and active). The data could be used to determine if the initial programming of the signalized intersection was sufficient. If the data has shown that TSP operations were not as expected, the data can be used for further analysis to determine the appropriate adjustments to make. This is generally an on-going process to ensure that TSP operations are functioning correctly.

Conclusions

Transit Priority Measures (TPM) have been used to improve transit vehicle performance across Canada. However, guidelines that governed the selection and implementation of TPM were unavailable. As a result, these Guidelines were developed to create a process that practitioners may use that will aid in:

- Identifying the issues/concerns;
- Assessing the potential transit priority measures; and
- Implementing and monitoring the select TPM (s).

These Guidelines provide practitioners the necessary tools and framework to follow in selecting TPM. The selected TPM should meet the majority of the Guiding Principles:

- Safety
- Delay;
- Disruption to Road Users;
- Consistency/Conspicuity; and
- Pragmatism.

Other useful guidelines that can be used in conjunction with this document include:

- Guidelines for Transit Lane Conspicuity (Transportation Association of Canada, 2010); and
- Guidelines for the Application and Display of Transit Signals (Transportation Association of Canada, 2011).

List of References

1. British Columbia
   Motor Vehicle Act, R.S.B.C. 1979, c.318, s.169.1

2. Ontario
   Highway Traffic Act, R.S.O. 1990, c.H.8, s.142.1(1)

3. Quebec
   Highway Safety Code, R.S.Q. 1986, c. C-24.2. s.407

4. Viegas, Jose Manuel, Roque Ricardo, Lu, Baichuan, and Vieira, Joao "*The Intermittent Bus Lane System: Demonstration in Lisbon.*" In TRB 86th Annual Meeting, 2007.